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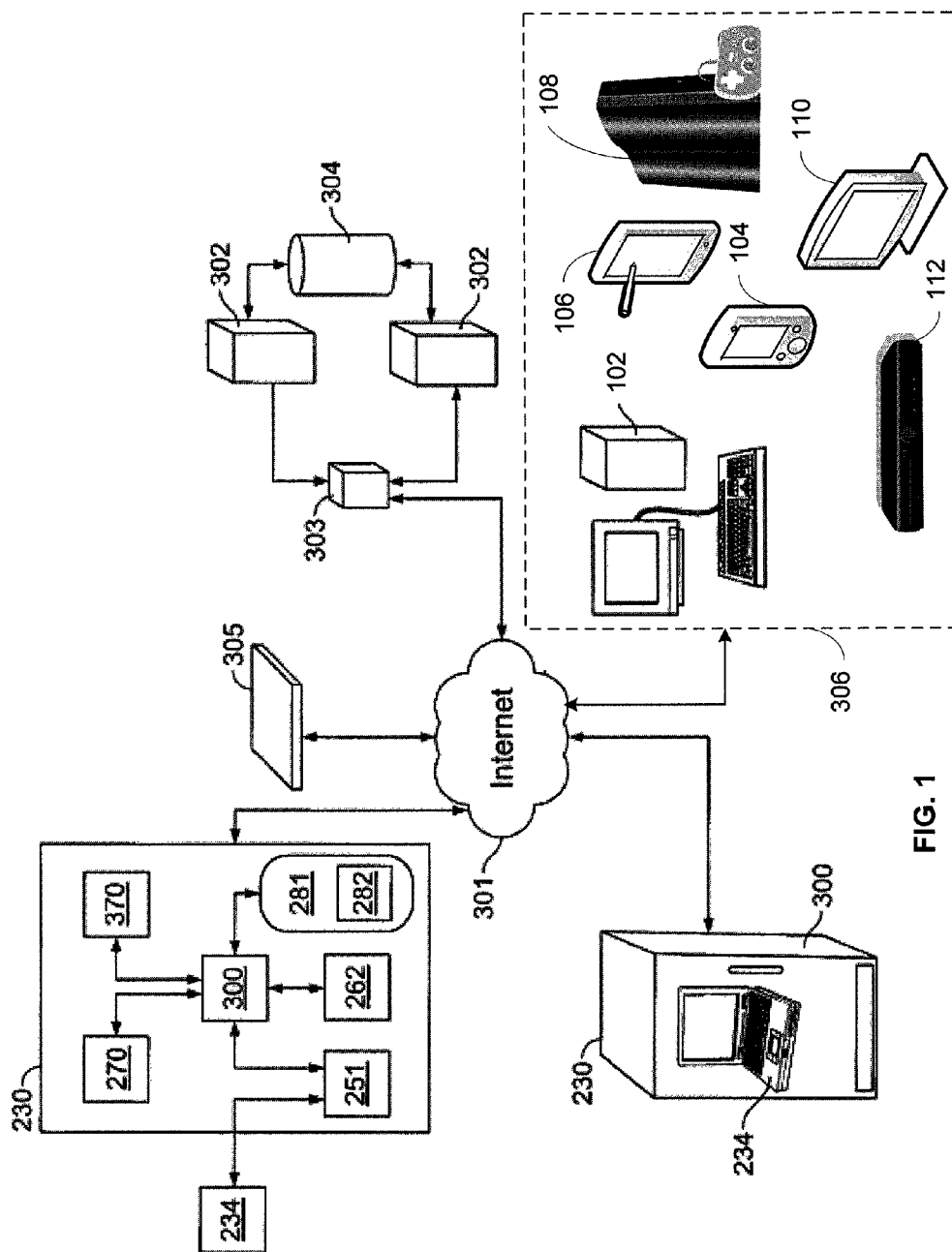
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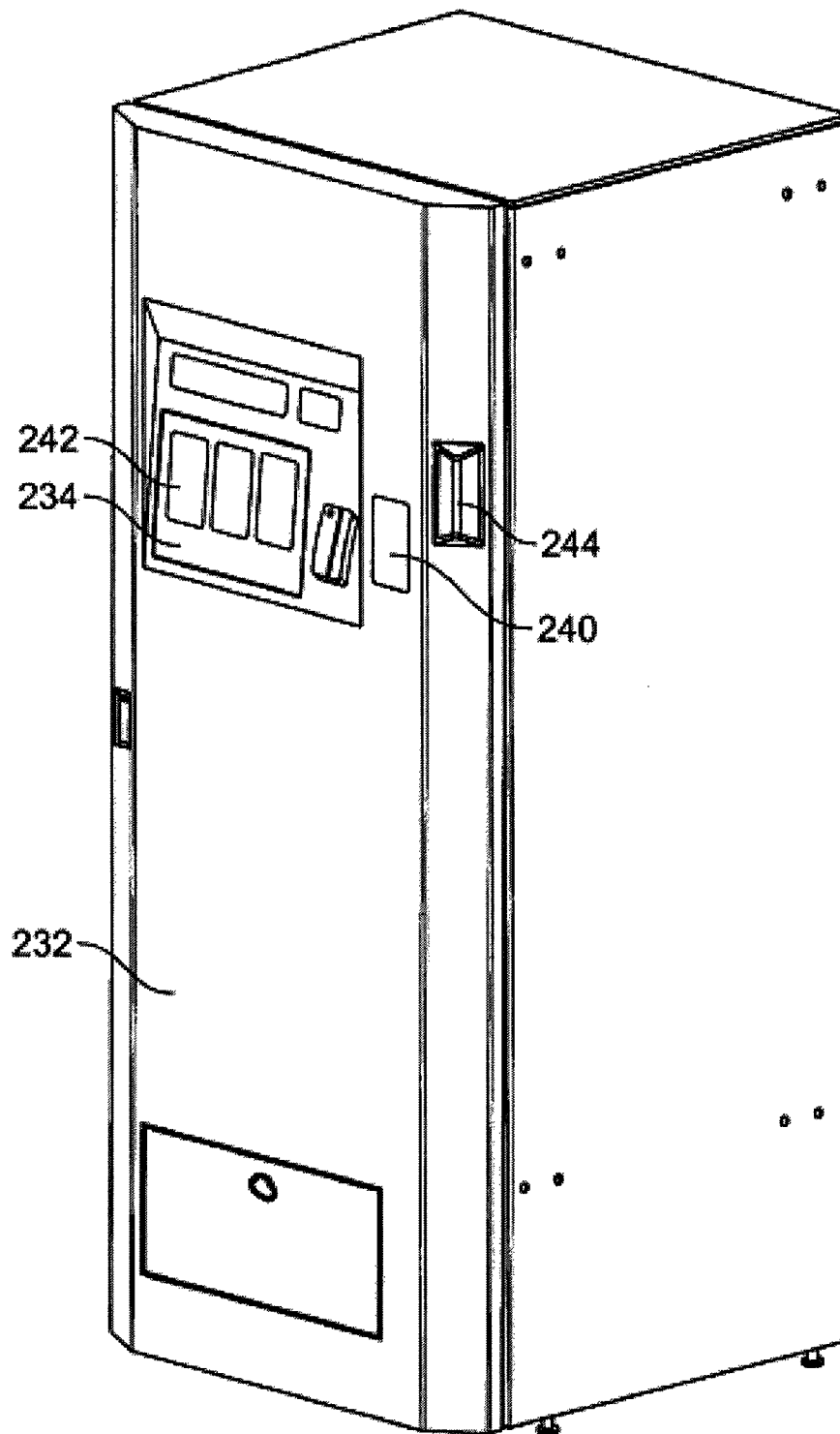


FIG. 2



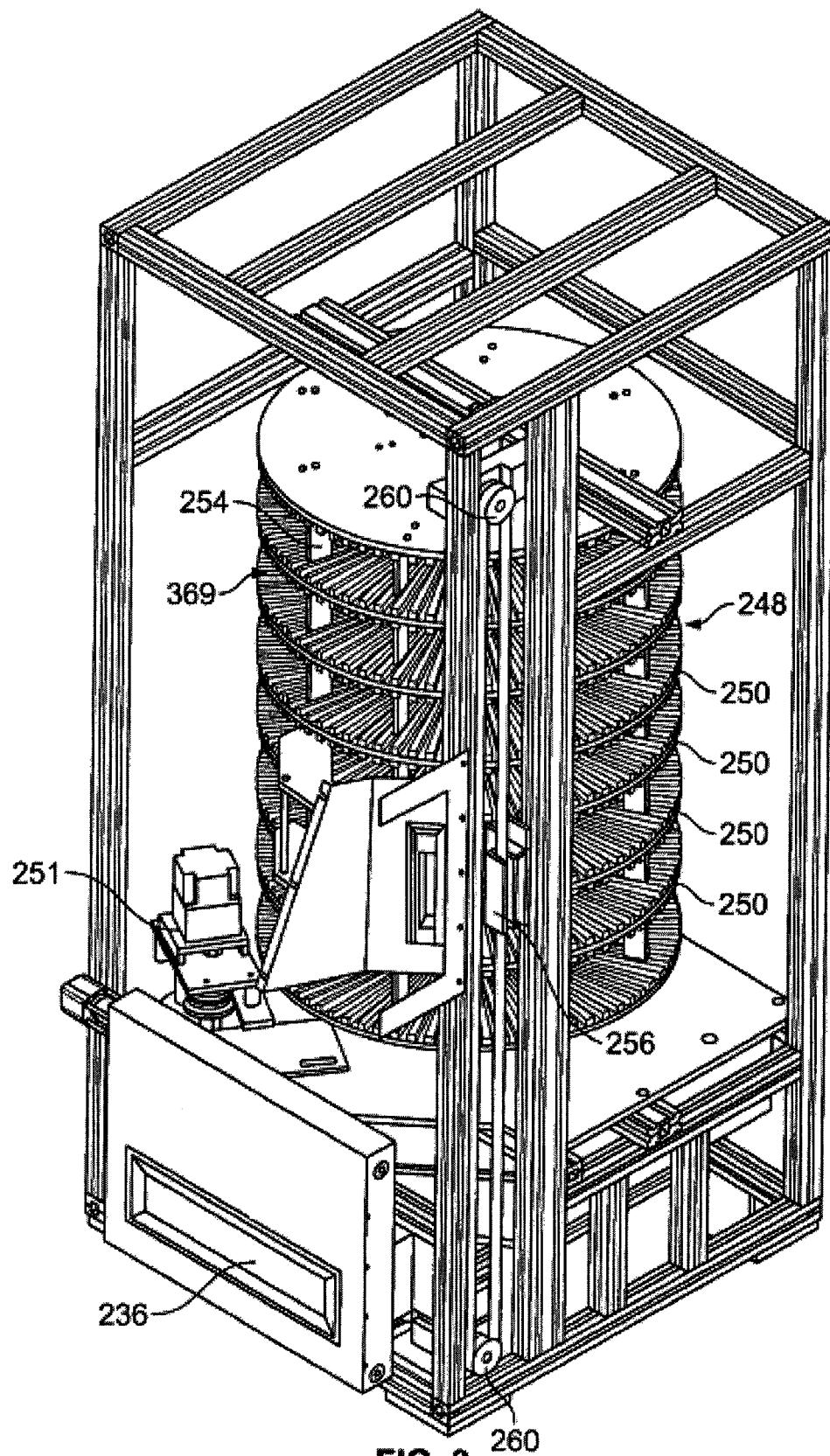


FIG. 3

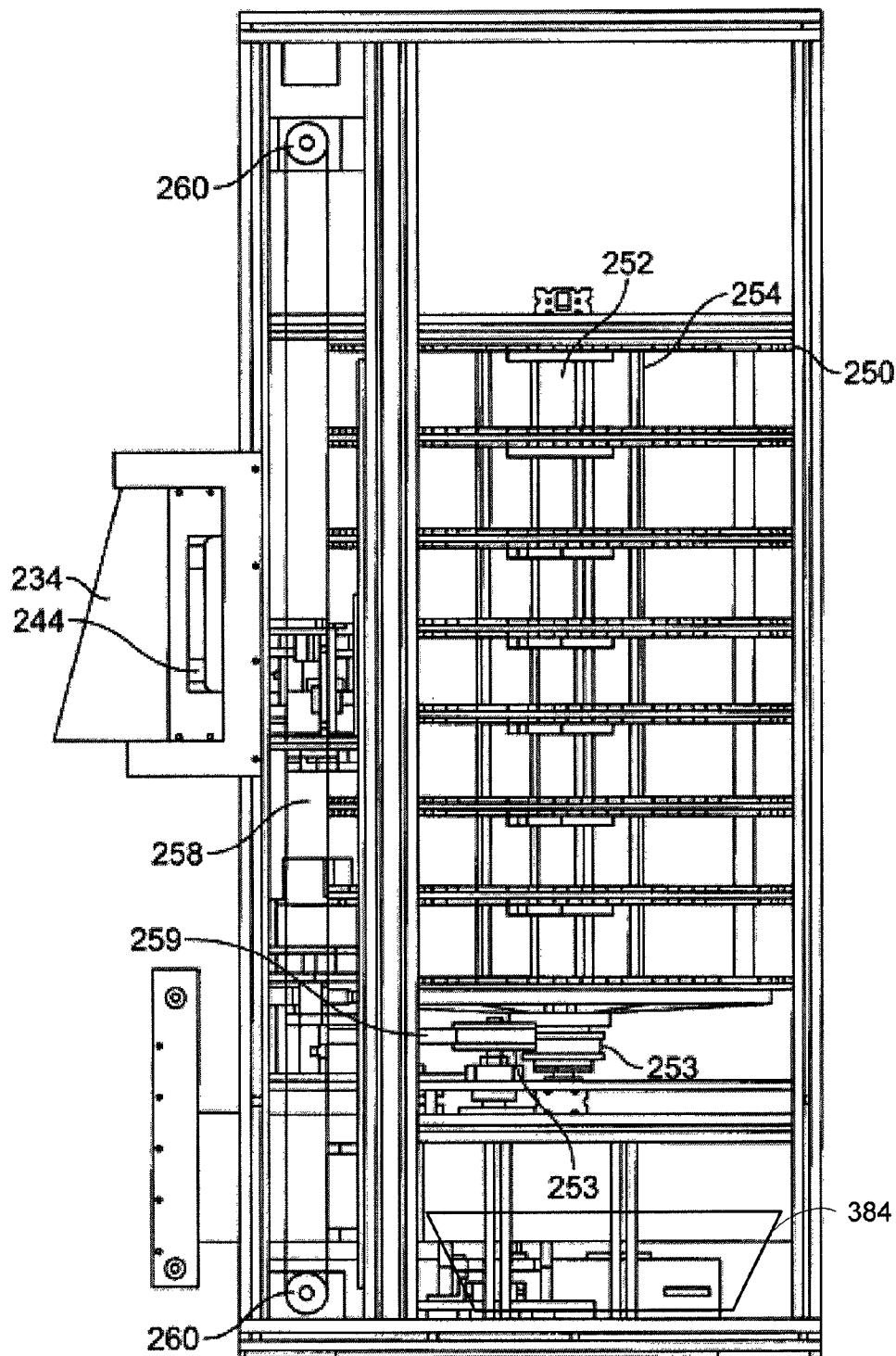


FIG. 4

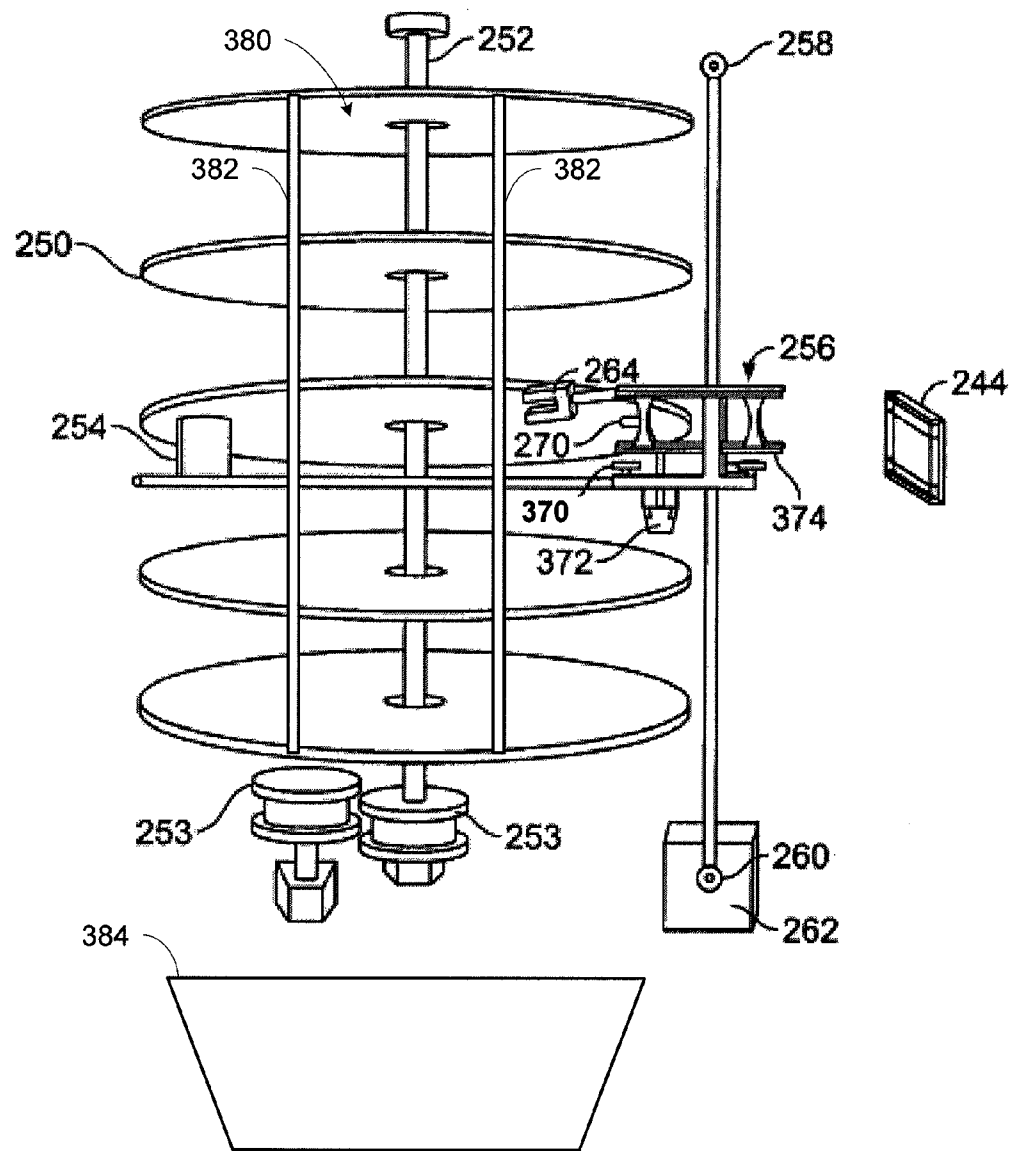
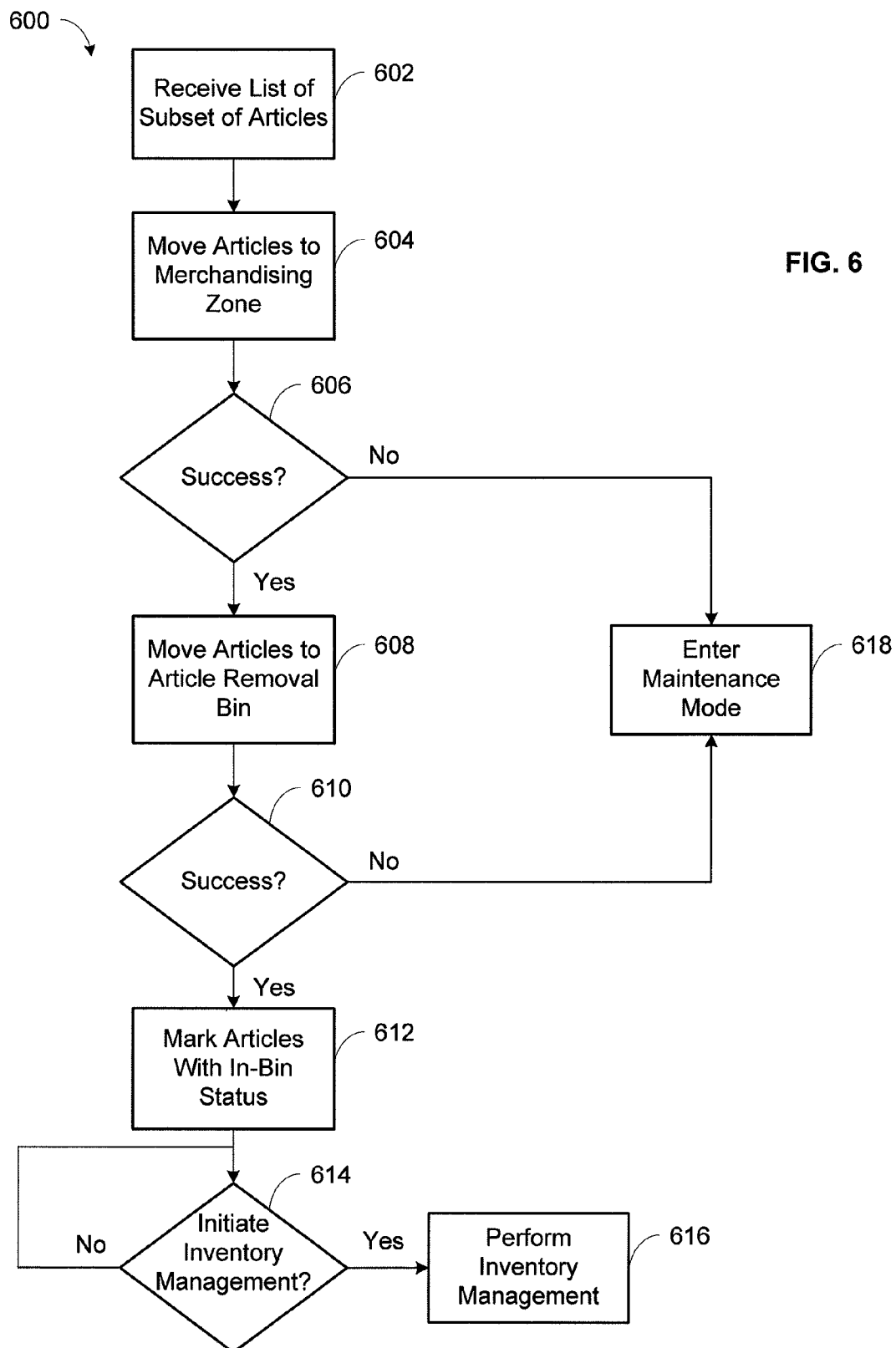
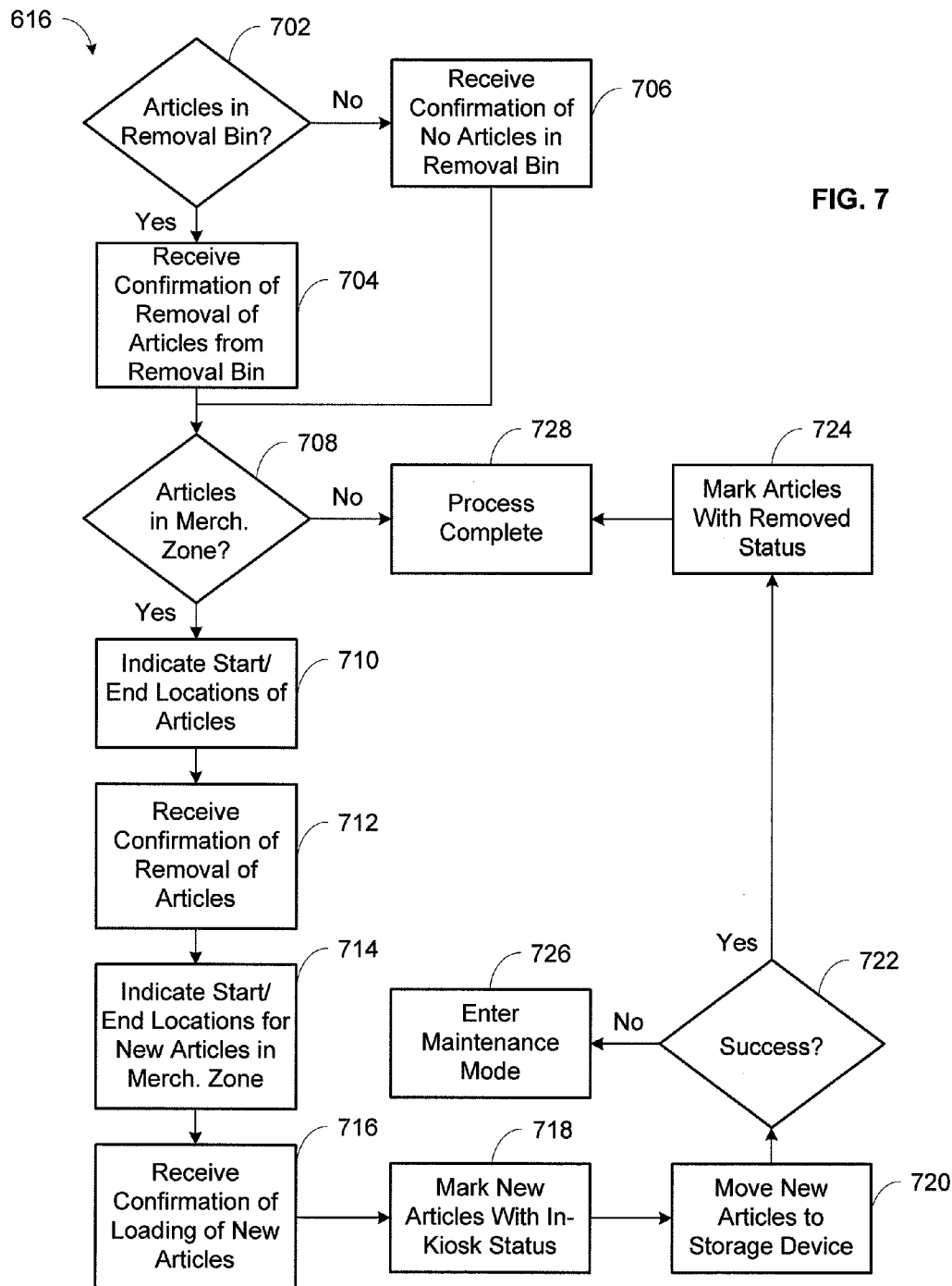


FIG. 5





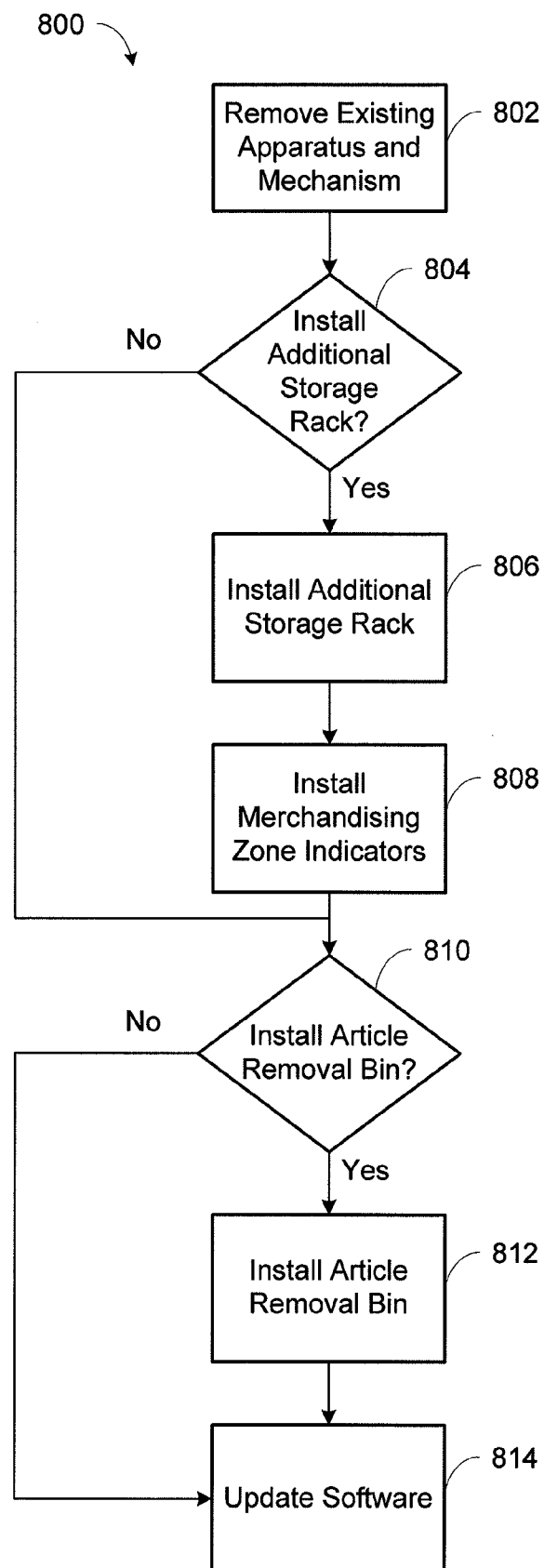


FIG. 8

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# SYSTEM AND METHOD FOR OPTIMIZING UTILIZATION OF INVENTORY SPACE FOR DISPENSABLE ARTICLES

## CROSS-REFERENCE TO RELATED APPLICATION

This application is being filed simultaneously with U.S. patent application Ser. No. 13/414,597, entitled "SYSTEM AND METHOD FOR OPTIMIZING UTILIZATION OF INVENTORY SPACE FOR DISPENSABLE ARTICLES", which is incorporated herein by reference.

## TECHNICAL FIELD

This invention relates to a system and method for optimizing utilization of inventory space for articles dispensable from an article dispensing machine. More particularly, the invention provides a system and method for managing the removal and loading of articles to a storage unit, a merchandising zone, and/or an article removal bin of the article dispensing machine.

## BACKGROUND AND SUMMARY OF THE INVENTION

While the invention is often described herein with reference to a digital video disc, Blu-Ray disc, and video game distribution system, an application to which the invention is advantageously suited, it will be readily apparent that the invention is not limited to that application and can be employed in article dispensing systems used to distribute a wide variety of dispensable articles.

The digital video disc (DVD) player has been one of the most successful consumer electronics product launches in history. The market for DVD movie video, Blu-Ray movie video, and video game rentals is enormous and growing. Millions of households have acquired video, and video game rentals is enormous and growing. Millions of households have acquired DVDs since they were introduced in 1997. In the first quarter of 2003 alone, it was estimated that well over three million DVD players were shipped to U.S. retailers.

In 2003, brick-and-mortar stores dominated the movie video and video game rental landscape in the U.S. Statistics showed that two brick-and-mortar companies controlled nearly sixty-five percent of the home video rental business. One element repeatedly cited for success of certain brick-and-mortar store video rental franchises was perceived high availability of new video releases. Consumers want entertainment on demand, and through stocking multiple units of each new release, successful brick-and-mortar companies meet this consumer demand.

The foregoing indicates that there is a significant market potential for aligning regular routines of consumers (e.g., shopping, getting coffee or gas or going to a convenience store) with their DVD, Blu-Ray, and video game rental activities.

One improved article dispensing machine is disclosed in commonly owned U.S. Pat. No. 7,234,609, which is herein incorporated by reference in its entirety. The invention of the U.S. Pat. No. 7,234,609 and the invention can function as an article dispensing machine-based distribution system that will typically have multiple units of each new release per article dispensing machine. The dispensing machines of the U.S. Pat. No. 7,234,609 and the invention can stock up to two thousand DVDs, Blu-Ray, video games, or other discs (mov-

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ies, games or other entertainment content), making the system competitive with existing brick-and-mortar video rental superstores.

The dispensing machine and system of the U.S. Pat. No. 7,234,609 and the invention distinguishes itself from such stores by offering major benefits not conventionally offered by such stores, including additional cross-marketing programs (e.g., promotional rentals for a certain amount of dollars spent at the retail location) and convenience (e.g., open always).

The dispensing machine of the U.S. Pat. No. 7,234,609 and the invention yields a competitive advantage in the DVD, Blu-Ray disc, and video game rental marketplace by offering consumers cross-marketing/promotional programs, convenience of selection (e.g., computer-based searches for movies and recommendations based on consumer profiles), and potentially extended hours (e.g., 24 hours a day, 7 days a week). The invention employs a more cost-effective, convenient platform than brick-and-mortar stores. In addition, with the invention, dispensing machines can be situated in retail locations having high foot traffic, such as at a popular grocery store, restaurant, drug store, and/or other popular retail location.

The dispensing machine of the U.S. Pat. No. 7,234,609 and the invention can be operated at a substantial savings over the costs associated with traditional brick-and-mortar video rental stores. For example, the invention does not require hourly employees to continuously man the dispensing machines or restock them with inventories.

Unlike brick-and-mortar stores, the dispensing machine of the U.S. Pat. No. 7,234,609 and the invention does not require an on-site store manager because all operational decisions can be made at a centralized location by a management team officed remote from the retail locations. Unlike brick-and-mortar stores, the dispensing machine of the U.S. Pat. No. 7,234,609 and the invention does not require significant physical space. Unlike brick-and-mortar stores, the dispensing machine of the U.S. Pat. No. 7,234,609 and the invention has low operating costs because heating or air conditioning is not necessarily required for the dispensing machines and they consume a relatively low level of electrical energy. In addition, the dispensing machine of the U.S. Pat. No. 7,234,609 has low maintenance costs and downtime.

The dispensing machine of the U.S. Pat. No. 7,234,609 and the invention addresses the shortcomings of traditional brick-and-mortar stores in a convenient and cost-effective delivery vehicle having the added bonus of serving as an effective promotional platform that drives incremental sales to retail locations. In addition, the dispensing machine of the U.S. Pat. No. 7,234,609 and the invention overcomes these disadvantages by at least offering more new releases and older selections for any given time period, and lower cost per viewing with significantly more convenience than Internet-based and pay-per-view services.

The dispensing machine of the U.S. Pat. No. 7,234,609 and the invention is a fully automated, integrated DVD, Blu-Ray, and video game rental and/or purchase systems. It preferably incorporates robust, secure, scalable software that provides a fully personalized user experience and real-time feedback to retail locations and advertisers, scalable hardware that leverages existing technologies such as touch screen, focused audio speakers and video monitors, technology utilizing the Internet through a system website or mobile/consumer electronics device application. These technologies and others fill long-felt needs in the art and give advantages over conventional video distribution options. The dispensing machine of

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the U.S. Pat. No. 7,234,609 and the invention functions as much as a promotional platform as it does a rental kiosk.

By utilizing the dispensing machines and the fully-interactive, real-time, linked Internet website or mobile/consumer electronics device applications, consumers can rent one or more DVDs, Blu-Ray discs, video games, or other entertainment content directly from dispensing machines as well as indirectly by making a rental reservation through the website or application for later pickup at a conveniently located machine. These dispensing machines are preferably networked with each other, with the inventory control and/or supply office and with the system website or application by phone-line, DSL, wireless network, or other Internet connection at each retail location. Through this linked network, the rental experience for each consumer can be customized based on a profile for each consumer, such as via personalized home pages and rental screens.

The invention allows for optimizing the utilization of inventory space for articles dispensable from an article dispensing machine by improving the sorting, removal, and loading of the inventory of articles. A list identifying a subset of articles targeted for removal from the article dispensing machine may be received. The subset of articles may include at least thinned articles, damaged articles, fraudulent articles, do not rent (DNR) articles, rebalancing articles, and/or a combination of these subsets that are to be removed from the article dispensing machine. Further refined subsets of a subset of articles may also be defined. The subset of articles may be moved from a non-removable storage unit in the article dispensing machine to a predetermined area. The predetermined area may include a merchandising zone of the storage unit and/or a separate article removal bin. Inventory management may then be initiated through the receipt of a command from a field service representative. The field service representative may remove each subset of articles from the predetermined area(s) and confirm that the subset of articles was removed. New articles may be loaded into the predetermined area by the field service representative, followed by confirmation that the new articles have been loaded. The article dispensing machine may move the new articles from the predetermined area to the storage unit. The status of each of the articles may be tracked in an inventory database.

The invention has the advantage of quicker and more efficient removal from and loading of articles to an article dispensing machine because the articles may be removed from and loaded to the same predetermined area. Moreover, the wear and tear on mechanics of the article dispensing machine and downtime due to mechanical breakdowns may be reduced through use of the invention. Cost savings due to less downtime, maintenance, and time for removing and loading articles may also result. Other features and advantages are provided by the following description and drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an illustration of a system for communicating and processing information in a network of article dispensing machines and dispensing apparatus.

FIG. 2 is a perspective view of an article dispensing machine constructed in accordance with the principles of the invention.

FIG. 3 is a partially open perspective view of the article dispensing machine of FIG. 2.

FIG. 4 is a partially open side elevational view of the article dispensing machine of FIG. 2.

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FIG. 5 is a partially open side elevational view of the view of the article dispensing machine of FIG. 2 with certain components removed for clarity.

FIG. 6 is a flowchart illustrating operations for optimizing utilization of inventory space in an article dispensing machine.

FIG. 7 is a flowchart illustrating operations for removing and loading articles into inventory space in an article dispensing machine.

FIG. 8 is a flowchart illustrating operations for installing additional inventory space in an article dispensing machine.

#### DETAILED DESCRIPTION OF THE INVENTION

While this invention is susceptible of embodiments in many different forms, there is shown in the drawings and will herein be described in detail preferred embodiments of the invention with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the broad aspect of the invention to the embodiments illustrated.

FIGS. 1-5 illustrate an article dispensing machine designated 230. Article dispensing machine 230 is one of a plurality of article dispensing machines included within an article distribution system having a plurality of such machines situated at a plurality of retail locations. The article dispensing machines of a particular article distribution system preferably form a network. As such, those machines are preferably in electrical communication with each other and with a central server or central controller.

As shown in FIG. 1, each article dispensing machine 230 includes a dispensing machine processor 300, also referred to herein as a vending controller, which is connected to a first sensor 270 and a second sensor 370, a first motor 251 and a second motor 262 and a user interface control system 234, collectively referred to as "the peripheral devices." The processor is capable of executing various programs to provide input to and/or receive outputs from the peripheral devices. Suitable processors for such use are known to those of skill in the art. In addition, the processor is operably connected to at least one memory storage device 281, such as a hard-drive or flash-drive or other suitable memory storage device.

Article dispensing machine memory storage device 281 can include any one or a combination of volatile memory elements (e.g., random access memory (RAM, such as DRAM, SRAM, SDRAM, etc.)) and nonvolatile memory elements (e.g., ROM, hard drive, tape, CDROM, etc.). Moreover, article dispensing machine memory storage device 281 may incorporate electronic, magnetic, optical, and/or other types of storage media. Article dispensing machine memory storage device 281 can have a distributed architecture where various components are situated remote from one another, but are still accessed by processor. Article dispensing machine memory storage device includes an article dispensing machine database 282.

The article dispensing machines 230 preferably comprise a network of machines in communication with one another. As shown in FIG. 1, in the preferred configuration, the article dispensing machines 230 are networked with one another via a central server or central controller 302 in a hub-and-spoke system. However, optionally, the article dispensing machines may be connected and communicate directly with one another, and/or subsets of article dispensing machines may communicate with one another directly as well as with the central server 302.

Generally, in terms of hardware architecture, the central server 302 includes a central processor and/or controller,



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central memory, and one or more input and/or output (I/O) devices (or peripherals) that are communicatively coupled via a local interface. The architecture of the central server **302** is set forth in greater detail in U.S. Pat. No. 7,234,609, the contents of which are incorporated herein by reference. Numerous variations of the architecture of the central server **302** and the content provider backend **308** would be understood by one of skill in the art and are encompassed within the scope of the invention.

The processor/controller is a hardware device for executing software, particularly software stored in memory. The processor can be any custom made or commercially available processor, a central processing unit (CPU), an auxiliary processor among several processors associated with the server **302**, a semiconductor based microprocessor (in the form of a microchip or chip set), a macroprocessor, or generally any device for executing software instructions. Examples of suitable commercially available microprocessors are as follows: a PA-RISC series microprocessor from Hewlett-Packard Company, an 80x86 or Pentium series microprocessor from Intel Corporation, a PowerPC microprocessor from IBM, a Sparc microprocessor from Sun Microsystems, Inc., or a 68xxx series microprocessor from Motorola Corporation. The processor may also represent a distributed processing architecture such as, but not limited to, SQL, Smalltalk, APL, KLIsp, Snobol, Developer 200, MUMPS/Magic.

The software in memory may include one or more separate programs. The separate programs comprise ordered listings of executable instructions for implementing logical functions. The software in memory includes a suitable operating system (O/S). A non-exhaustive list of examples of suitable commercially available operating systems is as follows: (a) a Windows operating system available from Microsoft Corporation; (b) a Netware operating system available from Novell, Inc.; (c) a Macintosh operating system available from Apple Inc.; (d) a UNIX operating system, which is available for purchase from many vendors, such as the Hewlett-Packard Company, Sun Microsystems, Inc., and AT&T Corporation; (e) a LINUX operating system, which is freeware that is readily available on the Internet; (f) a run time Vxworks operating system from WindRiver Systems, Inc.; or (g) an appliance-based operating system, such as that implemented in handheld computers, smartphones, or personal digital assistants (PDAs) (e.g., PalmOS available from Palm Computing, Inc., Windows CE or Windows Phone available from Microsoft Corporation, iOS available from Apple Inc., Android available from Google Inc., BlackBerry OS available from Research In Motion Limited, Symbian available from Nokia Corp.). The operating system essentially controls the execution of other computer programs and provides scheduling, input-output control, file and data management, memory management, and communication control and related services.

Steps and/or elements, and/or portions thereof of the invention may be implemented using a source program, executable program (object code), script, or any other entity comprising a set of instructions to be performed. When a source program, the program needs to be translated via a compiler, assembler, interpreter, or the like, which may or may not be included within the memory, so as to operate properly in connection with the operating system (O/S). Furthermore, the software embodying the invention can be written as (a) an object oriented programming language, which has classes of data and methods, or (b) a procedural programming language, which has routines, subroutines, and/or functions, for example but not limited to, C, C++, Pascal, Basic, Fortran, Cobol, Perl, Java, Ada, and Lua.

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When article dispensing machine **230** is in operation, the article dispensing machine processor is configured to execute software stored within article dispensing machine memory, to communicate data to and from the dispensing machine memory, and to generally control operations of article dispensing machine pursuant to the software. The software aspects of the invention and the O/S, in whole or in part, but typically the latter, are read by processor, perhaps buffered within the processor, and then executed.

When the invention or aspects thereof are implemented in software, it should, be noted that the software can be stored on any computer readable medium for use by or in connection with any computer related system or method. In the context of this document, a computer readable medium is an electronic, magnetic, optical, or other physical device or means that can contain or store a computer program for use by or in connection with a computer related system or method. The invention can be embodied in any computer-readable medium for use by or in connection with an instruction execution system, apparatus, or device, such as a computer-based system, processor-containing system, or other system that can fetch the instructions from the instruction execution system, apparatus, or device and execute the instructions. In the context of this document, a "computer-readable medium" can be any means that can store, communicate, propagate, or transport the program for use by or in connection with the instruction execution system, apparatus, or device. The computer readable medium can be for example, but not limited to, an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, device, or propagation medium. More specific examples (a non-exhaustive list) of the computer-readable medium would include the following: an electrical connection (electronic) having one or more wires, a portable computer diskette (magnetic), a random access memory (RAM) (electronic), a read-only memory (ROM) (electronic), an erasable programmable read-only memory (EPROM, EEPROM, or Flash memory) (electronic), an optical fiber (optical), and a portable compact disc read-only memory (CDROM) (optical). Note that the computer-readable medium could even be paper or another suitable medium upon which the program is printed, as the program can be electronically captured, via, for instance, optical scanning of the paper or other medium, then compiled, interpreted or otherwise processed in a suitable manner if necessary, and then stored in a computer memory.

For communication with the central server **302**, article dispensing machine **230** is equipped with network communication equipment and circuitry. In a preferred embodiment, the network communication equipment includes a network card such as an Ethernet card. In a preferred network environment, each of the plurality of article dispensing machines **230** on the network is configured to use the TCP/IP protocol to communicate via the network **301**. It will be understood, however, that a variety of network protocols could also be employed, such as IPX/SPX, Netware, PPP and others. It will also be understood that while a preferred embodiment of the invention is for article dispensing machine **230** to have a "broadband" connection to the network **301**, the principles of the invention are also practicable with a dialup connection using a standard modem. Wireless network connections are also contemplated, such as wireless Ethernet, satellite, infrared, radio frequency, Bluetooth, near field communication, and cellular networks.

The central controller **302** communicates with the article dispensing machine controllers **300** via the network **301**. The central controller **302** is preferably located at a central station or office that is remote from the plurality of article dispensing

machines 230. The central controller 302 can operate as the server for communicating over the network 301 between the plurality of article dispensing machines 230. The central controller 302 receives communications and information from the article dispensing machines 230, and also transmits communications and information to the machines 230. For example, when a rental transaction is performed at the article dispensing machine 230, transaction data such as the rented title is then transmitted from the machine 230 to the central controller 302 via the network 301. It will be understood that central servers in general, such as the central controller 302, are often distributed. A plurality of central servers/controllers 302 may optionally be arranged in "load balanced" architecture to improve the speed and efficiency of the network. To accomplish the implementation of multiple controllers 302, the controllers 302 may be in communication with a router/distributor 303.

The central controller 302 is also in communication with a central database 304. The central database 304 stores information regarding the transaction network. For example, the central database 304 stores data regarding the vending inventory at each of the plurality of article dispensing machines 230. The central database 304 also stores sales information regarding the sales quantities of the vending merchandise stored in the machines 230. For example, the central database 304 stores information regarding the sales totals for each title and for each machine 230 vending location. Central database 304 also stores user information and rental transaction information, such as user IDs, the date on which discs are due to be returned, the date on which discs were rented from the machines 230 and a list of valid coupon codes and restrictions associated with those codes. In certain embodiments, central database 304 also may be configured to store user PINs. Some of this information is also preferably stored in article dispensing machine database 282.

Central database 304 is preferably a relational database, although other types of database architectures may be used without departing from the principles of the invention. For example, the database 304 may be a SQL database, an Access database or an Oracle database, and in any such embodiment have the functionality stored herein. Central database 304 is also preferably capable of being shared, as illustrated, between a plurality of central controllers 302 and its information is also preferably capable of being transmitted via network 301. It will be understood that a variety of methods exist for serving the information stored in central database 304. In one embodiment, .net and Microsoft Reporting Services are employed, however, other technologies such as ODBC, MySQL, CFML and the like may be used.

The central controller 302 and central database 304 are also accessible by an electronic device 306, which may include a personal computer 102, mobile device 104 (e.g., smartphone, personal digital assistant, etc.), tablet computer 106, video game console 108, television 110, and Blu-Ray player 112. The electronic device 306 may be in direct or indirect communication with the central controller 302 and/or the central database 304 through a wired and/or wireless network connection, such as Ethernet, Wi-Fi, cellular (3G, 4G, etc.), or other type of connection. As a personal computer 102, the electronic device 306 will be understood as comprising hardware and software consistent with marketable personal and laptop computers, such as a display monitor, a keyboard, and a microprocessor. The electronic device 306 may also comprise Internet browser software such as Firefox, Internet Explorer, Chrome, or Safari. Using the browser software, a user of the electronic device 306 can access a web interface through the central controller 302. An application may also

execute on the electronic device 306 that accesses the central controller 302. To that end, central controller 302 preferably comprises web server software such as IIS or Apache. It will be understood that a variety of web server software and web browser software exists to implement the principles of the invention without departing therefrom. Through the web browser software or application, the electronic device 306 communicates with the central controller 302 and allows the user to login to a central command functionality of the central controller 302 and to view and modify data stored in the central database 304. The browser interface or application also allows the user to perform certain system functions, which will affect the inventory and behavior of the article dispensing machines 230. The electronic device 306 may communicate with the central controller 302 and the central database 304 using rules and specifications of an application programming interface (API).

In a preferred embodiment, a financial server 305 is also in communication with the network 301. It will be understood that a variety of financial services exist for processing financial information via the Internet and other networks 301. Those services allow for the processing of credit card and debit card information, so that users of the services do not have to interface directly with credit and debit card companies. In FIG. 1, the financial server 305 is illustrated as a single server, although the financial server 305 may comprise an entire sub-network of financial servers 305 responsible for processing financial information.

As shown in FIG. 2, article dispensing machine 230 includes a machine housing 232 with front, rear, top, bottom and side panels. The machine housing 232 is preferably a combination molded fiberglass and sheet metal cabinet. However, those skilled in the art will appreciate that the housing can be constructed from a variety of other suitable materials and with a variety of other suitable manufacturing techniques.

As shown most clearly in FIG. 2, a user interface portion 234 of housing 232 includes a card reader 240, a keypad and/or touch screen 242 and an article transfer opening 244. The card reader 240 is preferably designed in known fashion to read magnetically encoded membership and/or credit/debit cards for authorizing the distribution of articles of inventory through the article transfer opening 244. Keypad and/or touch screen 242 permits consumers and/or inventory stocking personnel to communicate with the dispensing machine 230 and/or a central office linked in electrical communication with the dispensing machine. Keypad and/or touch screen 242 also permits consumers and/or inventory stocking personnel to enter appropriate commands directed to carrying out specific machine tasks. It will be appreciated that the optional touch screen includes a monitor made with known technologies making it capable of being utilized as a user interface for entry of commands designed to carry out machine tasks. The touch screen 242 may also be capable of displaying a QR (Quick Response) code to a customer. The customer may read the QR code with a camera on a mobile device or with a dedicated QR code reader. The QR code can represent a universal resource locator (URL) to access a digital media selection or can represent a reference number for use by the customer when contacting customer service, for example.

Furthermore, it will be appreciated that additional user interface portions having additional or even identical user interface components could be incorporated within article dispensing machine 230. For example, these components could be incorporated on other panels of the housing 232 of machine 230 so that the machine can be used simultaneously by multiple consumers, translating into more efficient distri-

bution of articles in high traffic areas. Dispensing machine **230** also preferably includes speaker units. Known audio technology may be incorporated within dispensing machine **230** to broadcast focused audio directed to relatively small (e.g., three square feet) locations in front of the machines from speaker units and/or in other designated locations at a retail site.

Referring now to FIG. **3** which shows the components positioned in the interior of dispensing machine **230**, the article dispensing machine includes a non-removable storage unit **248** which may be a carousel-style, cylindrical storage facility having a plurality of compartmentalized rows **249** defined by circular-shaped storage racks **250** sharing a common central axis. Each of the rows **249** has a plurality of receiving slots or compartments **369**. Each storage rack **250** includes radially extending, angularly separated compartment panels defining article storage compartments **369** which are designed to receive and retain flat-type pack articles, such as DVD, Blu-Ray disc, and video game disc cases, as desired. The compartment panels are preferably axially aligned to retain the opposing sides of DVD, Blu-Ray disc, and video game disc cases at the top and bottom ends thereof. In that regard, the DVD, Blu-Ray disc, and video game disc cases are preferably retained between successive vertical pairs of storage racks **250**. The storage racks **250** are vertically spaced by axially extending support members **254**.

A first motor **251**, hereinafter referred to as the rotational motor, rotates the storage unit **248** about a vertical axis formed by the driven shaft **252**. As shown in FIG. **4**, rotational motor **251** drives a belt **259**, which in turn rotates wheels **253** and shaft **252** to which the storage racks **250** are attached.

As shown in FIGS. **3** and **5**, a selector arm **256** is adjacent the storage unit **248**. The selector arm **256** is connected to a conveying belt **258** carried by rollers **260**, which are preferably positioned proximate to the top and the bottom of the article dispensing machine housing. At least one of the rollers **260** may be driven by a second motor **262**, hereinafter referred to as the selector arm motor, to provide for vertical movement of selector arm **256** along a vertical axis generally parallel to the vertical axis of the storage device. Alternatively, the selector arm motor **262** may be positioned on the selector arm **256**. In a preferred embodiment, the motors **251**, **262** are stepper motors that are capable of accurately controlling the movement and position of the compartmentalized storage unit **248** and the selector arm **256**, respectively.

Referring now to FIG. **5**, the vending apparatus **230** is equipped with a first sensor **270** for sensing objects stored in the inventory of the apparatus. The first sensor is preferably mounted on the selector arm **256**. A variety of forms of sensors are practicable with the invention for use as the first sensor without departing from the principles thereof, including proximity sensors, proximity sensors, an optical laser scanner, a magnetic scanner, an optical bar code reader, an ultraviolet optical scanner, a radio frequency sensor and an infrared optical scanner. The vending apparatus **230** is further equipped with a second sensor **370** capable of reading information attached to the objects stored in the inventory of the apparatus. The second sensor **370** is preferably, as illustrated, mounted on the selector arm **256**. A variety of forms of sensors are practicable with the invention for use as the second sensor without departing from the principles thereof, including an optical laser scanner, a magnetic scanner, an optical bar code reader, an ultraviolet optical scanner, a radio frequency sensor and an infrared optical scanner.

The selector arm **256** comprises a picker device **264** which is capable of removing a DVD, Blu-Ray disc, or video game disc from the compartments **369**. The selector arm **256** may

further comprise a conveyor belt **374**, which contacts one of the media products in one of the compartments **369** and conveys the product to the article transfer opening **244** whereby it is delivered to a user on the exterior of the article dispensing machine **230**. The conveyor **374** is driven by a conveyor motor **372**.

A system and method for calibrating the selector arm controller is disclosed in commonly owned U.S. Patent Application, Publication No. 2006/0254832, which is herein incorporated by reference in its entirety.

Generally, during the normal operation of the article dispensing machine, each article of inventory dispensed from a dispensing machine is preferably scanned by the second sensor **370** and an electronic record is created indicating the consumer who rented and/or purchased the media. In addition, articles of inventory returned to a dispensing machine by a customer and inserted into the article transfer opening **244** thereof are preferably scanned by the second sensor **370** and identified by the dispensing machine (for example with a bar code reader or scanner in electronic communication with the dispensing machine controller, positioned proximate the media dispensing/return opening) along with an identification of its later stored position on the storage device.

These electronic records can be shared among dispensing machines within a network thereof, and can also be shared with a centralized office via the Internet or any other electronic data communication link. These electronic records can be used to ensure that the inventory process is carried out efficiently and accurately.

Part of the storage unit **248** may be designated as a merchandising zone **380** for implementing the invention related to optimizing utilization of inventory space of the article dispensing machine **230**, as described below. A predetermined number of article storage compartments **369** in each of the storage racks **250** that make up the storage unit **248** may be part of the merchandising zone **380**. Color-coded rods **382**, in one embodiment, may delineate the merchandising zone **380** so that inventory stocking personnel and/or field service representatives can quickly and easily identify the merchandising zone **380**. Other locators and/or indicators may be utilized to identify and define the merchandising zone **380**. The merchandising zone **380** may hold articles that have been targeted for removal prior to the physical removal of the articles from the article dispensing machine **230**. New articles may also be loaded into the merchandising zone **380**. In one embodiment, the merchandising zone **380** may consist of a quadrant of each of the storage racks **250**. The merchandising zone **380** may be included as any portion or all of the storage unit **248** and/or one or more storage racks **250**. The number of compartments **369** included in the merchandising zone **380** may vary. In some embodiments, some or all of one or more of the storage racks **250** of the storage unit **248** may be designated as the merchandising zone **380**. If the entirety of one or more storage racks **250** is designated as the merchandising zone **380**, these designated storage rack(s) **250** may be located at an optimal height of the storage unit **248** to facilitate easier access for field service representatives. For example, the merchandising zone **380** may be the top-most storage rack **250** so that the field service representative, instead of a storage rack **250** located lower in the storage unit **248** so that the field service representative would not have to bend or crouch down to access the merchandising zone **380**.

Furthermore, an article removal bin **384** may be located at the bottom of the article dispensing machine **230** for collecting media articles for removal. Media articles moved into the article removal bin **384** may include damaged articles, fraudulent articles, or DNR articles that are no longer eligible

for rental or sale. In one embodiment, thinned articles may be moved into the article removal bin **384**. Damaged articles, fraudulent articles, DNR articles, thinned articles, and other statuses of media articles are detailed below. The inventory stocking personnel or field service representatives may physically remove the media articles from the article removal bin **384** when inventory management of the article dispensing machine **230** is performed, as described below. In one embodiment, the article removal bin **384** may be an open bin that articles being removed may be dropped into. In other embodiments, the article removal bin **384** may include slots and/or compartments for the articles being removed. The article removal bin **384** may include an incline to improve and optimize the loading of articles into the article removal bin **384**.

The article removal bin **384** and/or the use of additional storage racks **250** of the storage unit **248** can significantly increase the inventory capacity of the article dispensing machine **230**. A previous version of an article dispensing machine may have an inventory capacity of 710 media articles, of which 80 media articles are unavailable for rental or sale to a customer. Accordingly, 630 media articles would be available for rental or sale to a customer in this previous version. The invention allows for installation and use of the article removal bin **384** and/or one or more additional storage racks **250** in place of the inventory space previously used for the 80 media articles that are unavailable for rental or sale.

In one embodiment, an additional storage rack **250** of the storage unit **248** may allow storage of 87 additional media articles that are available for rental or sale to a customer, and an article removal bin **384** may allow storage of 60-100 additional media articles that are not available for rental or sale to the customer. The overall inventory capacity of the article dispensing machine **230** in this embodiment may therefore be increased from 710 to 777-817 media articles, an increase of 9.4-15%. In this embodiment, the number of media articles available for rental or sale may be increased from 630 to 717 media articles, an increase of 13.8%.

In another embodiment, an article removal bin **384** may allow storage of up to 150 media articles that are not available for rental or sale to the customer. The overall inventory capacity of the article dispensing machine **230** in this embodiment may be increased from 710 to 780 media articles, an increase of nearly 9.9%, with the 150 additional media articles not available for rental or sale.

The article dispensing machine **230** may include an automated self-healer job that optimizes and maximizes the availability of article inventory. For example, if an article has an unknown identity due to errors or other reasons, the self-healer job may attempt to determine the identity of the unknown articles. Unknown articles may initially be unidentifiable if the article dispensing machine **230** is unable to capture identifier information on the article due to problems with the sensor **370**, a missing identifier, a misaligned identifier, etc. These unknown articles may be placed in the article removal bin **384** and/or the merchandising zone **380**, if the unknown articles can be identified and if it is determined that the unknown articles are to be removed from the article dispensing machine **230**.

The physical media article in an article dispensing machine **230** may include at least a DVD, Blu-Ray disc, video game disc, or other media article. Each of the article dispensing machines **230** may operate without requiring continuous connectivity and communication with the central controller **302**. In one embodiment, the central controller **302** only transmits data in response to communication from an article dispensing machine **230**. For example, an article dispensing machine **230**

may attempt to communicate with the central controller **302** following completion of one or more rental transactions or one or more media article return transactions. In another embodiment, the article dispensing machine **230** continues normal operations and transactions even if communication is interrupted or cannot be established with the central controller **302**. Communication with the central controller **302** may be interrupted if the load at the central controller **302** is above a certain threshold. For example, the central controller **302** may direct the article dispensing machine **230** to only transmit certain types of messages and/or transactions, e.g., financial authorizations, until the load has decreased. In these cases, transaction data can be stored locally in the article dispensing machine **230**, such as in the article dispensing machine memory storage device **281**, until a predetermined time interval elapses, when a predetermined number of transactions is reached, until communication with the central controller **302** can be reestablished, or the load at the central controller **302** has decreased. Once communication is established with the central controller **302**, financial and inventory information can be uploaded and the appropriate servers and databases can be updated.

In one embodiment, the article dispensing machine **230** can display only media articles which are physically located at the article dispensing machine **230**. In this way, a customer may browse on the user interface **234** only the media articles which are in-stock and available to rent at that article dispensing machine **230**. Typically, the article dispensing machine **230** possesses media information for the media articles that are currently located in the article dispensing machine **230**. The media information for a media article includes title, actor, director, studio, publisher, plot synopsis, format, description, parental rating, individualized ratings and reviews, popularity, article type, running time, genre, cover artwork, or other information. The article dispensing machine **230** can also store in memory the media information for recently-rented media articles that are no longer physically stored in the article dispensing machine **230**. The article dispensing machine **230** can communicate with the central controller **302** when media information about a particular media article is needed. For example, when a particular media article is returned to an article dispensing machine **230** that does not have the corresponding media information for that particular media article, the article dispensing machine **230** can query the central controller **302** and central database **304** for the media information. Once the media information is obtained, the article dispensing machine **230** may display that particular media article on the user interface **234** as in-stock and available to rent.

In another embodiment, the article dispensing machine **230** can display media articles that are both physically located and not physically located at the article dispensing machine **230**. In this embodiment, media articles which are both available and unavailable to rent can be displayed. A media article may be unavailable to rent if it is not in-stock or is in-stock but has been reserved for rental. In one example, the entire catalog of media articles stored in an inventory database can be displayed on the article dispensing machine **230**. In another example, a subset of the entire catalog of media articles can be displayed on the article dispensing machine **230**. The subset of media articles that can be displayed on the article dispensing machine **230** may be determined, for example, based on geographic location, retailer agreements, contractual obligations, customer rental habits, and other criteria. The media articles that can be displayed on the article dispensing machine **230** may include recently-rented media articles that are no longer physically stored in the article dispensing

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machine 230 or media articles that have never been physically in the article dispensing machine 230. For example, media articles that have never been physically in the article dispensing machine 230 may be displayed because those media articles may be available at a nearby article dispensing machine. In this case, those media articles may be displayed to the customer so that the customer has an option to obtain those media articles from the nearby article dispensing machine 230. In this embodiment, if a customer attempts to rent a media article that is out-of-stock, reserved for another customer, or otherwise cannot be vended at the particular article dispensing machine 230, then that media article can be deemed an unavailable media article.

An embodiment of a process 600 for optimizing the utilization of inventory space for media articles is shown in FIG. 6. The process 600 can result in the management, removal, and loading of media articles into space designated for storage of inventory in an article dispensing machine 230. In some embodiments, the space in the article dispensing machine 230 may have been previously empty, unused, or otherwise unavailable for storing article inventory, for example, and the invention allows for optimal usage of this space. Increased capacity to store media articles that are rentable or sellable to customers from the article dispensing machine 230 may result, as described above. A customer may rent and/or purchase one or more media articles from an article dispensing machine 230 during a transaction. Multiple copies of the same media article may be present in an article dispensing machine 230 so that the media article is available to multiple customers. For example, a new release of a DVD or Blu-Ray disc of a recent movie may have a higher demand than a DVD or Blu-Ray disc for an older movie. In this case, more copies of the new release may be stocked in the article dispensing machine 230 in anticipation of the higher demand.

The operator of the article dispensing machine 230 may have agreements with the producers, manufacturers, distributors, and/or developers of the media articles that dictate the manner, location, pricing, duration, disposal, and/or other parameters related to the rental and sale of the media articles. Some agreements may include a transaction eligibility cutoff date that specifies the last date that a media article may be rented or sold. For example, the operator may have an agreement with a movie studio that allows DVDs and Blu-Ray discs from that movie studio to be rented for a certain time period, after which the DVDs and Blu-Ray discs must be returned or destroyed. As another example, the operator may have an agreement with a video game developer that allows a certain number of video game discs from that developer to be stocked for rental or sale in an article dispensing machine 230 for a certain time period, after which a lower number of video game discs may be stocked. Some agreements may specify that the removal of media articles from article dispensing machines 230 at certain dates prior to the transaction eligibility cutoff date may result in reduced costs. The process 600 may therefore be used in cases where an agreement dictates the removal of media articles from the article dispensing machine 230, e.g., if media articles must be returned, destroyed, reduced, or otherwise removed.

Media articles may also be removed from the article dispensing machine 230 using the process 600 if the operator makes a business decision to reduce or eliminate the availability of a media article for rent or purchase, such as if a media article has rentals or sales that are below expectations, or if a media article is an older title. For example, analysis of sales and rental data stored in the database 304 may determine how long a media article has been stored in inventory. As another example, a profitability analysis of sales and rental

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data may determine which media articles are selling well and which are not. Other media articles may be removed from the article dispensing machine 230 using the process 600 if the media articles are damaged, fraudulent, or for other reasons. Through use of the process 600, some or all of the media articles stored in the article dispensing machine 230 can be automatically sorted into one or more predetermined areas prior to any manual interaction with a field service representative.

Media articles that may be removed from an article dispensing machine 230 may fall into various categories, including thinned articles, damaged articles, fraudulent articles, rebalancing articles, and do not rent (DNR) articles. A particular media article may be designated as a thinned article if the operator of the article dispensing machine 230 wishes to reduce the stocked number of the particular media article, such as when the transaction eligibility cutoff date is upcoming or as a result of the operator's business decision, e.g., rentals or sales are below projections. A subset of thinned articles may be designated as rebalancing articles if the operator of the article dispensing machine 230 wishes to place particular media articles in another article dispensing machine 230. Accordingly, thinned articles may be removed from the article dispensing machine 230 prior to the expiration of the transaction eligibility cutoff date or other specified date using the process 600.

If a particular media article becomes damaged or otherwise unplayable, the media article may be designated as a damaged article may be removed from the article dispensing machine 230 so that a customer cannot rent or purchase it. Media articles that have been reported as being fraudulent can be designed as fraudulent articles that may also be removed from the article dispensing machine 230 so that a customer cannot rent or purchase it.

Furthermore, a particular media article may be designated as a do not rent (DNR) article if the transaction eligibility cutoff date for the particular media article has passed so that the particular media article is not eligible to be rented or sold. In some cases, an agreement may specify penalties if a DNR article is not removed from an article dispensing machine 230 by the cutoff date. The agreement or contract may specify that DNR articles must be destroyed or returned to a distributor, studio, etc. There may be one or more categories of DNR articles that specify the relative urgency of whether a particular media article needs to be removed from the article dispensing machine 230.

New media articles may also be loaded into the article dispensing machine 230 to replace the media articles which have been removed. The new media articles may include, for example, new releases of DVDs, Blu-Ray discs, and video game discs for rental or sale to customers. Media articles of previously released media content, such as older movies or video games, may also be loaded into the article dispensing machine as new media articles. One or more copies of a particular media article may be loaded as new media articles. Inventory space for these new media articles that can be rented or sold to customers may be increased by moving media articles to the merchandising zone 380 and/or article removal bin 384, which are ultimately physically removed from the article dispensing machine 230.

At step 602, a list that identifies a subset of media articles targeted for removal may be received at an article dispensing machine 230. The list may include thinned articles (including rebalancing articles), damaged articles, fraudulent articles, and/or DNR articles that are specified by the operator of the article dispensing machine 230. As described above, these media articles may be targeted for removal based on agree-

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ments and/or business decisions related to the reduction of stock for the particular media articles. The list of the subset of media articles may be in an XML format or other appropriate format. The article dispensing machine 230 may receive the list from the central controller 302. The subset of media articles may have been manually or automatically selected for the list based on analysis of sales and rental data, for example. The subset of media articles identified in the list may be moved from the storage unit 248 to the merchandising zone 380 and/or the article removal bin 384, depending on various factors. These factors may include how the media articles have been designated, the available space in the merchandising zone 380, and the available space in the article removal bin 384.

Media articles may be moved to the merchandising zone 380 from other areas of the storage unit 248 at step 604. In one embodiment, thinned articles (including rebalancing articles) may be moved to the merchandising zone 380 at step 604. In another embodiment, any media article targeted for removal, including thinned articles, damaged articles, fraudulent articles, and/or DNR articles may be moved at step 604 from the other areas of the storage unit 248 to the merchandising zone 380. The picker device 264 may move a media article from a compartment 369 in a non-merchandising zone area of the storage unit 248 to a compartment 369 in the merchandising zone 380. In one embodiment, media articles that are placed in the merchandising zone 380 may be placed from top to bottom and left to right, starting with a first storage rack 250. The media articles moved at step 604 may be based on the list of the subset of media articles received at step 602. The moving of thinned articles and/or other media articles at step 604 may be known as a thin job that can be executed on a periodic basis. For example, the thin job may be executed on a daily basis following a scheduled reboot of the article dispensing machine 230. If the thin job is successfully executed at step 606, then the process 600 continues to step 608.

However, if the thin job is not successfully executed at step 606, such as if an error code is detected due to a mechanical or software issue, then the article dispensing machine 230 may enter a maintenance mode at step 618. In this case, the article dispensing machine 230 may remain in the maintenance mode and not allow any customer transactions until serviced by a field service representative. At step 606, a message may be transmitted to the central controller 302 that the thin job either successfully executed or did not successfully execute. A thin job may not successfully execute due to an error code or if the article dispensing machine 230 is loaded with new media articles before the thin job has completed. In this case, the media articles that did not get moved to the merchandising zone 380 by the initial thin job may be moved to the merchandising zone 380 by a later-executed thin job.

If a media article that is targeted for removal is not present in the article dispensing machine 230 when the thin job is executed at step 604 but is later returned by a customer, that media article may be placed in a non-merchandising zone area of the storage unit 248 upon return. The media article may then be moved to the merchandising zone 380 when the next thin job is executed. Furthermore, thinned and other media articles in the merchandising zone 380 may be rented or purchased by a customer from the article dispensing machine 230.

At step 608, media articles may be moved to the article removal bin 384 from the storage unit 248. In one embodiment, DNR articles, damaged articles, and/or fraudulent articles may be moved from a non-merchandising zone portion of the storage unit 248 and/or to the article removal bin 384 at step 608. In another embodiment, thinned articles may

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be moved from a non-merchandising zone portion of the storage unit 248 to the article removal bin 384 at step 608. In a further embodiment, media articles that had previously been moved to the merchandising zone 380 at step 604 may be moved from the merchandising zone 380 to the article removal bin 384 at step 608. The media articles placed in the article removal bin 384 may be based on the list of the subset of media articles received at step 602.

The picker device 264 may retrieve the media article from a compartment 369 in the storage unit 248 to the article removal bin 384. The moving media articles may be known as a load bin job that can be executed on a periodic basis. For example, the load bin job may be executed on a daily basis following execution of the thin job at step 604. If the load bin job is successfully executed at step 610, then the process 600 continues to step 612. However, if the load bin job is not successfully executed at step 610, such as if an error code is detected due to a mechanical or software issue, then the article dispensing machine 230 may enter a maintenance mode at step 618. In this case, the article dispensing machine 230 may remain in the maintenance mode and not allow any customer transactions until serviced by a field service representative. A maximum number of media articles that are allowed to be moved into the article removal bin 384 may be defined. Accordingly, the number of media articles loaded into the article removal bin 384 may be tracked so that the article removal bin 384 is not overloaded.

The media articles moved into the article removal bin 384 may be marked in a database with an in-bin status at step 612. The database may include an inventory database within the article dispensing machine database 282, central database 304, or other database. Marking the status of the articles in the database assists in keeping track of the location of each piece of inventory. Each article may have a unique identifier, such as a barcode, serial number, radio frequency identification (RFID) tag, or other identifier, that identifies characteristics of the article, such as a title, type, and other information. When the media articles are moved into the article removal bin 384, their unique identifiers may have been read by the sensor 370, for example.

As discussed above, media articles may be categorized with a variety of statuses, including in-bin, thinned, damaged, fraudulent, DNR, and unknown. Media articles may also be categorized with other statuses, whether they are physically located in the article dispensing machine 230 or located elsewhere. These other statuses include in-kiosk, removed, missing, rented, wrong title, received, sold, and destroyed. The in-kiosk and removed statuses are discussed further below. A media article designated as a missing article is a particular media article that was expected to be one location or slot in the storage unit 248 but is not actually located there. The location or slot in the storage unit 248, in this case, may be empty or contain another media article. A rented article is a media article that has been rented to a customer. A media article that is designated as a wrong title article is a particular media article that has been reported to have the wrong title associated with it in the inventory database. Wrong title articles in the article dispensing machine 230, if present, may also be targeted for removal. A received article is a media article that has been reported as being received by the warehouse or distribution center following removal from the article dispensing machine 230. A sold article is a media article that has been sold out of the inventory of the article dispensing machine 230. A media article designated as a destroyed article is a particular media article that has been destroyed, including those destroyed pursuant to an agreement.

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At step 614, it is determined whether a command for initiating inventory management of the article dispensing machine 230 has been received. In one embodiment, inventory management may be initiated by a field service representative who logs into the article dispensing machine 230 using the user interface 234 for the purpose of removal and loading of media articles. If inventory management has not been initiated at step 614, then the process 600 returns to step 614 to await the initiation of inventory management. In one embodiment, the process 600 can return to step 602 to receive another list of a subset of media articles that are targeted for removal, as described above. However, if inventory management has been initiated at step 614, then inventory management can be performed at step 616. During inventory management, the user interface 234 may display instructions, graphics, and/or other information to assist the field service representative in the removal and loading of media articles from the article dispensing machine 230. For example, the user interface 234 may display and/or indicate a particular storage rack 250 and/or compartment 369 corresponding to a media article that is to be removed or where a media article is to be loaded.

An embodiment of step 616 for performing inventory management is shown in more detail with reference to FIG. 7. At step 702 of FIG. 7, it is determined whether any media articles have been moved into the article removal bin 384. Thinned articles, DNR articles, damaged articles, and/or fraudulent articles may have been placed in the article removal bin 384 at step 608, as described above. If no media articles have been moved into the article removal bin 384, then at step 706, the article dispensing machine 230 awaits receipt of confirmation that there are no media articles in the article removal bin 384. The field service representative may interact with the user interface 234 to confirm that there are no media articles in the article removal bin 384 at step 706. However, if media articles have been moved into the article removal bin 384, then at step 704, the article dispensing machine 230 awaits receipt of confirmation that the media articles have been removed from the article removal bin 384. The field service representative may remove the media articles from the article removal bin 384 then interact with the user interface 234 to confirm that the media articles have been removed from the article removal bin 384 at step 704.

Next, it is determined at step 708 whether media articles have been moved into the merchandising zone 380. Thinned articles and/or other articles targeted for removal may have been moved into the merchandising zone 380 from other areas of the storage unit 248 at step 604, as described above. If no media articles have been moved into the merchandising zone 380, then the process 616 is complete at step 728. However, if media articles have been moved into the merchandising zone 380, then the process 616 continues to step 710. At step 710, the starting and/or ending locations of the thinned and other media articles in the merchandising zone 380 may be indicated on the user interface 234 so that the field service representative is informed of which media articles to remove from the article dispensing machine 230. Other visual, audio, and/or tactile indicators may be used to inform the field service representative of the locations of the media articles to be removed. In one embodiment, the picker device 264 may remove some of the initial media articles from the merchandising zone 380 so that the field service representative knows the beginning portion of which media articles to remove. The remainder of the media articles may subsequently be removed from the merchandising zone 380 by the field service representative. In some embodiments, there may be media articles targeted for removal that are stored outside of the merchan-

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dising zone 380 because the merchandising zone 380 is full. In this case, the article dispensing machine 230 may automatically dispense these media articles through the article transfer opening 244. In other embodiments, the motors 251 and 262 may be turned off at step 710 so that the field service representative may manually and freely rotate the storage unit 248 to access the merchandising zone 380.

The article dispensing machine 230 awaits receipt of confirmation that the media articles in the merchandising zone 380 have been removed at step 712. The field service representative may interact with the user interface 234 to confirm that the media articles have been removed from the merchandising zone 380 at step 712. In one embodiment, the article dispensing machine 230 may automatically determine whether the media articles have been removed from the merchandising zone 380 by using the sensor 270, for example. Once the media articles have been removed from the merchandising zone 380, new media articles may be loaded into the merchandising zone 380 by the field service representative. The starting and/or ending locations for where to load the new media articles may be indicated on the user interface 234 at step 714. Other visual, audio, and/or tactile indicators may be used to inform the field service representative of the locations where to load the new media articles. In one embodiment, new media articles may be loaded into the merchandising zone 380 from bottom to top and right to left, starting with a last storage rack 250. New media articles may include multiple copies of new releases and/or other media articles that will be available for rental or purchase by customers.

It is possible that there may be more new media articles to load into the merchandising zone 380 than available slots in the merchandising zone 380. In this case, the field service representative may enter a maintenance mode of the article dispensing machine 230. In one embodiment, the remaining new media articles that need to be loaded into the article dispensing machine 230 may be individually loaded through the article transfer opening 244 so that these media articles can be stored in other portions of the storage unit 248. In another embodiment, another thin job may be manually executed to remove further media articles from the inventory of the article dispensing machine 230 to make room for the new media articles.

After the new media articles are loaded into the merchandising zone 380, the article dispensing machine 230 awaits receipt of confirmation that the new media articles have been loaded at step 716. The field service representative may interact with the user interface 234 to confirm that the new media articles have been loaded into the merchandising zone 380 at step 716. In one embodiment, the dispensing machine 230 may automatically determine whether the new media articles have been loaded into the merchandising zone 380 by using the sensor 270, for example. The new media articles that have been loaded may be marked in a database with an in-kiosk status at step 718. The database may include an inventory database within the article dispensing machine database 282, central database 304, or other database.

The new media articles may be moved from the merchandising zone 380 to other areas of the storage unit 248 at step 720. The moving of new media articles at step 720 may be known as a merchandising zone synchronization job. The field service representative may initiate or schedule the merchandising zone synchronization job. In one embodiment, the merchandising zone synchronization job may be remotely initiated from the central controller 302. In another embodiment, the motors 251 and 262 may be activated so that the merchandising zone synchronization job can be executed, if the motors 251 and 262 had been turned off at step 710. New



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media articles may be rented or purchased by customers when the new media articles are in the merchandising zone 380, prior to or during execution of the merchandising zone synchronization job. A customer may also rent or purchase the new media articles after execution of the merchandising zone synchronization job when the new media articles have been moved to the non-merchandising zone area of the storage unit 248.

In some embodiments, the merchandising zone synchronization job may move some or all of the new media articles to optimized receiving slots 369 and/or optimized storage racks 250 that are nearest to the location of the picker device 264. In this way, the picker device 264 may have not have to travel as far to access a particular new media article when a customer rents or buys that new media article. The new media articles may include new releases or other titles with rental or sales volumes that are anticipated to be higher than for other media articles, for example. There may be less wear and tear on the picker device 264 and associated machinery because the picker device 264 would not have to travel as far to access these more popular media articles. In addition, a customer transaction may be completed more quickly. For example, the picker device 264 may typically be located near the article transfer opening 244, particularly following a customer transaction. In this case, placing new media articles that are likely to be rented or bought in the optimized receiving slots 369 and/or the optimized storage racks 250 that are nearest to the location of the picker device 264 will speed customer transactions involving these media articles.

If the merchandising zone synchronization job is not successful at step 722, such as if an error code is detected due to a mechanical or software issue, then the article dispensing machine 230 may enter a maintenance mode at step 726. The article dispensing machine 230 may remain in the maintenance mode and not allow any customer transactions until serviced by a field service representative. However, if the merchandising zone synchronization job is successful at step 722, then the process 616 continues to step 724. At step 724, the thinned articles and/or other media articles that had been removed from the merchandising zone 380 may be marked in a database with a removed status. In some embodiments, the thinned articles and/or other media articles may be marked with a removed status at step 712 when the field service representative has confirmed the removal of the thinned articles from the merchandising zone 380. A media article with a removed status has been physically removed from the article dispensing machine 230. An inventory report may be transmitted from the article dispensing machine 230 to the central controller 302 after a successful execution of the merchandising zone synchronization job. Following step 724, the process 616 is complete at step 728.

In one embodiment, a merchandising zone unload job may be executed on a periodic basis to unload thinned and/or other media articles from the merchandising zone 380. The merchandising zone unload job may be executed in parallel with a thin job so that a media article may be moved from the merchandising zone 380 to a non-merchandising zone of the storage unit 248, then another media article may be moved into the merchandising zone 380 to replace the previously moved media article. Some or all of the merchandising zone 380 may be reserved for thinned or non-removed articles unless that space is needed for other purposes.

The thin job, load bin job, merchandising zone synchronization job, merchandising zone unload job, self healer job, and other jobs that are periodically and/or automatically executed by the article dispensing machine 230 may each have a priority assigned to them. The priority may determine

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whether or not the job is executed at a scheduled time, based on whether the article dispensing machine 230 is performing other tasks. For example, if a customer is involved in a transaction at the article dispensing machine 230 at the time when a thin job is scheduled to be executed, the transaction can be allowed to continue and the thin job will execute after the transaction is completed. Jobs may also be interruptible and resumable so that other jobs or actions with higher priorities may be executed. In this way, jobs with longer durations may be interrupted and/or not started to allow higher priority jobs with shorter durations to execute, such as rental or return transactions involving a customer.

A process 800 for retrofitting a previous version of an article dispensing machine to incorporate the invention described above is shown in FIG. 8. The process 800 may result in the installation and addition of an article removal bin 384 to the article dispensing machine 230 and/or one or more additional storage racks 250 to the storage unit 248 to increase the overall inventory capacity of the article dispensing machine 230. As seen in FIG. 4, the article removal bin 384 may be installed in the bottom portion of the article dispensing machine 230 so that the selector arm 256 and the picker device 264 may deposit media articles targeted for removal in the article removal bin 384. An additional storage rack 250 may be installed in the storage unit 248 and be rotated along with the other storage racks 250 by the driven shaft 252. The additional storage rack(s) 250 (not shown) may be installed at the top or the bottom of the existing storage racks 250, for example.

At step 802, any existing apparatus and/or mechanisms in the article dispensing machine 230 may be removed or cleared from the area(s) where the article removal bin 384 and/or the additional storage rack 250 are to be installed. For example, obsolete or unused storage apparatuses, wiring, and/or other mechanisms may be removed or cleared from the bottom interior of the article dispensing machine 230. The existing apparatus and/or mechanisms may also be secured so that they do not interfere with installation of the article removal bin 384 and/or additional storage rack 250, e.g., bundling wires together and securing the bundle to a rail. At step 804, it may be determined whether one or more additional storage rack(s) 250 are to be installed in the article dispensing machine 230. An additional storage rack 250 may not be installed if there is insufficient space in the article dispensing machine 230 or if a business decision has been made to not install an additional storage rack 250, for example. If additional storage racks 250 are not to be installed at step 804, then the process 800 continues to step 810, detailed below.

However, if additional storage racks 250 are to be installed at step 804, then at step 806, the additional storage rack(s) 250 may be installed. The additional storage rack(s) 250 may be substantially similar to an existing storage rack 250 in the storage unit 248, and may be connected to the driven shaft 252 so that the entire storage unit 248 rotates together. In one embodiment, the additional storage rack(s) 250 and the existing storage racks 250 may rotate independently of one another. At step 808, indicators identifying the merchandising zone 380 may be installed on some or all of the storage racks 250, including the newly-installed additional storage rack(s) 250. The indicators may include color-coded rods 382, for example, as shown in FIG. 5. The indicators may delineate the merchandising zone 380 so that inventory stocking personnel and/or field service representatives can quickly and easily identify the merchandising zone 380.

At step 810, it may be determined whether one or more article removal bins 384 are to be installed in the article



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dispensing machine **230**. An article removal bin **384** may not be installed if there is insufficient space in the article dispensing machine **230** or if a business decision has been made to not install an article removal bin **384**, for example. If an article removal bin **384** is not to be installed at step **810**, then the process **800** continues to step **814**, detailed below. However, if an article removal bin **384** is to be installed at step **810**, then at step **812**, the article removal bin **384** may be installed. The article removal bin **384** may be placed in the bottom interior of the article dispensing machine **230** and may be secured to the article dispensing machine **230** so that it is stationary but removable. More than one article removal bin **384** may be installed so that media articles in different categories can be segregated, for example. At step **814**, the software and/or firmware of the article dispensing machine **230** may be updated so that the newly-installed article removal bin(s) **384** and/or additional storage rack(s) **250** may be utilized as additional inventory capacity. The update software and/or firmware may enable the selector arm **256** and the picker device **264** to deposit media articles targeted for removal in the article removal bin **384** and merchandising zone **380**, for example.

Any process descriptions or blocks in figures should be understood as representing modules, segments, or portions of code which include one or more executable instructions for implementing specific logical functions or steps in the process, and alternate implementations are included within the scope of the embodiments of the invention in which functions may be executed out of order from that shown or discussed, including substantially concurrently or in reverse order, depending on the functionality involved, as would be understood by those having ordinary skill in the art.

It should be emphasized that the above-described embodiments of the invention, particularly, any “preferred” embodiments, are possible examples of implementations, merely set forth for a clear understanding of the principles of the invention. Many variations and modifications may be made to the above-described embodiment(s) of the invention without substantially departing from the spirit and principles of the invention. All such modifications are intended to be included herein within the scope of this disclosure and the invention and protected by the following claims.

The invention claimed is:

**1.** A method of utilization of inventory space for a plurality of articles in an article dispensing machine, the article dispensing machine comprising a user interface, a processor in communication with the user interface, and a non-removable storage unit for holding the plurality of articles in a plurality of slots, the method comprising:

receiving, at the processor, a list identifying a subset of the plurality of articles, the subset targeted for removal from the article dispensing machine, wherein the plurality of articles comprise consumer goods articles and wherein the subset of the plurality of articles targeted for removal comprises one or more of a thinned article, a damaged article, a fraudulent article, a wrong title article, or a do not rent (DNR) article;

using the processor, causing the article dispensing machine to automatically move the subset of the plurality of articles to a non-consumer inventory management section of the article dispensing machine from a consumer inventory management section of the non-removable storage unit, wherein the non-consumer inventory management section is reserved for non-consumer inventory management and is configured to hold the subset of the plurality of articles;

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receiving a command signal at the processor through the user interface adapted to be initiated by a field service representative, the command signal for initiating the non-consumer inventory management of the article dispensing machine to manually remove the subset of the plurality of articles from the non-consumer inventory management section of the article dispensing machine to outside of the article dispensing machine and to manually load at least one article from outside of the article dispensing machine into the non-consumer inventory management section;

receiving a load confirmation signal at the processor through the user interface adapted to be initiated by the field service representative, the load confirmation signal indicating that the at least one article has been loaded into the non-consumer inventory management section; and

subsequent to receiving the load confirmation signal, using the processor, causing the article dispensing machine to automatically move the at least one article from the non-consumer inventory management section to the consumer inventory management section of the non-removable storage unit, wherein the non-consumer inventory management section is configured to hold the at least one article.

**2.** The method of claim **1**, wherein:

the thinned article comprises a first article of the plurality of articles that is targeted for removal based on one or more of an upcoming expiration of a transaction eligibility cutoff date or a business decision; and

the DNR article comprises a second article of the plurality of articles that is targeted for removal based on an expiration of the transaction eligibility cutoff date.

**3.** The method of claim **1**, further comprising receiving a removal confirmation signal at the processor through the user interface adapted to be initiated by the field service representative, the removal confirmation signal indicating that the subset of the plurality of articles has been removed from the non-consumer inventory management section.

**4.** The method of claim **1**, wherein causing the article dispensing machine to automatically move the subset of the plurality of articles comprises:

using the processor, causing the article dispensing machine to automatically move the thinned article to the non-consumer inventory management section; and

using the processor, causing the article dispensing machine to automatically move one or more of the damaged article, the fraudulent article, the wrong title article, or the DNR article to an article removal bin.

**5.** The method of claim **1**, wherein causing the article dispensing machine to automatically move the subset of the plurality of articles comprises using the processor, causing the article dispensing machine to automatically move one or more of the thinned article, the damaged article, the fraudulent article, the wrong title article, or the DNR article to an article removal bin.

**6.** The method of claim **1**, wherein causing the article dispensing machine to automatically move the subset of the plurality of articles comprises using the processor, causing the article dispensing machine to automatically move one or more of the thinned article, the damaged article, the fraudulent article, the wrong title article, or the DNR article to the non-consumer inventory management section.

**7.** The method of claim **1**, further comprising using the processor, causing the article dispensing machine to automatically move one or more of the thinned article, the dam-

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aged article, the fraudulent article, the wrong title article, or the DNR article from the merchandising zone to an article removal bin.

8. The method of claim 1, wherein the non-consumer inventory management section comprises a subset of the plurality of slots on one or more levels of the non-removable storage unit, and further comprising transmitting, from the processor to the user interface, one or more locations of the subset of the plurality of slots where the subset of the plurality of articles should be removed from, in response to receiving the command signal.

9. The method of claim 1, wherein the non-consumer inventory management section comprises a subset of the plurality of slots on one or more levels of the non-removable storage unit, and further comprising using the processor, causing the article dispensing machine to automatically indicate, using a picker device, one or more locations of the subset of the plurality of slots where the subset of the plurality of articles should be removed from, in response to receiving the command signal.

10. A method of utilization of inventory space for a plurality of articles in an article dispensing machine, the article dispensing machine comprising a user interface, a processor in communication with the user interface, and a non-removable storage unit for holding the plurality of articles in a plurality of slots on one or more levels, wherein the plurality of articles comprises consumer goods articles, the method comprising:

using the processor, causing the article dispensing machine to automatically move a subset of the plurality of articles from a consumer inventory management section of the non-removable storage unit to a predetermined area of the article dispensing machine, the subset targeted for removal from the article dispensing machine, wherein the predetermined area is reserved for non-consumer inventory management and the predetermined area is configured to hold the subset of the plurality of articles; receiving a removal confirmation signal at the processor through the user interface adapted to be initiated by a field service representative, the removal confirmation signal indicating that the subset of the plurality of articles has been removed from the predetermined area; receiving a load confirmation signal at the processor through the user interface adapted to be initiated by the field service representative, the load confirmation signal indicating that at least one article has been loaded into the predetermined area; and

subsequent to receiving the load confirmation signal, using the processor, causing the article dispensing machine to automatically move the at least one article from the

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predetermined area to an optimized level of the non-removable storage unit, the optimized level selected from the one or more levels such that the optimized level is nearest to a picker device of the article dispensing machine.

11. The method of claim 10, wherein the at least one article has a higher transaction volume as compared to other articles of the plurality of articles.

12. The method of claim 10, wherein:

the optimized level comprises an optimized slot of the plurality of slots, the optimized slot nearest to the picker device; and

causing the article dispensing machine to automatically move the at least one article comprises using the processor, causing the article dispensing machine to automatically move the at least one new article from the predetermined area to the optimized slot.

13. The method of claim 10, wherein:

the subset of the plurality of articles targeted for removal comprises one or more of a thinned article, a damaged article, a fraudulent article, a wrong title article, or a do not rent (DNR) article;

the thinned article comprises a first article of the plurality of articles that is targeted for removal based on one or more of an upcoming expiration of a transaction eligibility cutoff date or a business decision; and

the DNR article comprises a second article of the plurality of articles that is targeted for removal based on an expiration of the transaction eligibility cutoff date.

14. The method of claim 13, wherein the predetermined area further comprises an article removal bin, and wherein causing the article dispensing machine to automatically move the subset of the plurality of articles comprises:

using the processor, causing the article dispensing machine to automatically move the thinned article to the predetermined area; and

using the processor, causing the article dispensing machine to automatically move one or more of the damaged article, the fraudulent article, the wrong title article, or the DNR article to the article removal bin.

15. The method of claim 10, further comprising receiving a command signal at the processor through the user interface adapted to be initiated by the field service representative, the command signal for initiating the non-consumer inventory management of the article dispensing machine to manually remove the subset of the plurality of articles from the predetermined area to outside of the article dispensing machine and to manually load the at least one article from outside of the article dispensing machine into the predetermined area.

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