

(51) International Patent Classification:

A01K 5/02 (2006.01) A01K 5/00 (2006.01)  
A01K 1/10 (2006.01) B65G 53/36 (2006.01)

(21) International Application Number:

PCT/US2017/031233

(22) International Filing Date:

05 May 2017 (05.05.2017)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/333,149 06 May 2016 (06.05.2016) US

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(81) Designated States (unless otherwise indicated, for every

kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN, KP, KR,

KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(54) Title: MOBILE MODULAR DEVICE FOR DISPENSING ITEMS TO PETS

(57) Abstract: A mobile modular device for dispensing items such as treats, food, toys, etc., to pets for use in, for example, pet training, pet play, etc.. The device has an electronic and mechanical core module, an item dispensing module, and optionally a dispensed item receiving module. An outer protective shell may be used to enclose the electronic and mechanical core module, the pet item dispensing module, and the dispensed pet item receiving module, as well as be configured and/or weighted to keep the device moderately upright when the device is at rest, and/or when in use.

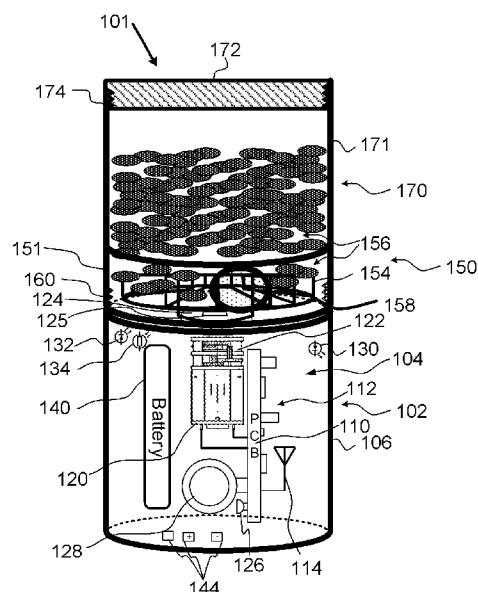


FIG. 1

# A MOBILE MODULAR DEVICE FOR DISPENSING ITEMS TO PETS

## CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application makes reference to and claims the benefit of the following co-pending U.S. Provisional Patent Application No. 62/333,149 filed May 6, 2016. The entire disclosure and contents of the foregoing U.S. Provisional Patent Application is hereby incorporated by reference.

### *Field of the Invention*

[0002] The present invention broadly relates to a mobile modular device for dispensing items such as treats, food, toys, *etc.*, to pets for use in, for example, pet training, pet play, *etc.*

## BACKGROUND

[0003] Conventionally, there have been mechanical devices for hiding and dispensing treats, food, *etc.*, to pets, *e.g.*, dogs, cats, *etc.* These prior devices may have the limitations in giving only very crude control over the rate at which the treats, food, *etc.*, may be accessed by a pet. There have also been computer controlled feeding devices that either based on a computer controlled timer or WiFi control to dispense treats, food, *etc.*, to pets, but these devices may be generally large and bulky, have wires going to power supplies, and may not be suitable for a pet to play with. There may also be devices which may combine a camera with a treat, food, *etc.*, dispensing mechanism so that a user may dispense a treat, food, *etc.*, to their pet remotely, for example, via the Internet, but these devices may not be meant to be played with by the pet, and may be mounted to a wall or other fixed location.

## SUMMARY

[0004] According to a first broad aspect of the present invention, there is provided a device for dispensing items which is mobile and which comprises:

- a hopper for storing a plurality of items;

- an electronic and mechanical core module having;

- an electronic wireless communications component;

- an item dispenser drive component;

- a computer component for controlling the item dispenser drive component; and

a power source for supplying power to the computer component, the electronic wireless communications component, and the item dispenser drive component;

an item dispensing module having an item dispenser component which is responsive to the item dispenser drive component to cause items to be dispensed; and

a dispensed item receiving module for receiving the items dispensed from the hopper;

wherein the electronic and mechanical core module is configured to receive electronic data instructions for controlling the dispensing of the items from the hopper and wherein the electronic and mechanical core module causes items to be dispensed by the item dispenser component.

**[0005]** According to a second broad aspect of the present invention, there is provided a device for dispensing pet items which is movable by a pet and which comprises:

an electronic and mechanical core module having;

a computer component;

an electronic wireless communications component;

a pet item dispenser drive component controlled by the computer component; and

a power source for supplying power to the computer component, the electronic wireless communications component, and the item dispenser drive component;

a pet item dispensing module having a hopper for storing pet items and a pet item dispenser component which is responsive to the pet item dispenser drive component to cause pet items to be dispensed; and

a dispensed pet item receiving module for receiving the items dispensed by the item dispenser component; and

an outer shell which encloses the electronic and mechanical core module, and the pet item dispensing module, and which protects the electronic and

mechanical core module and the pet item dispensing module from actions of the pet that cause movement of the device.

wherein the electronic and mechanical core module is configured to receive electronic data instructions for controlling the dispensing of the pet items by the pet item dispenser component and wherein the electronic and mechanical core module causes pet items to be dispensed by the pet item dispenser component in response to the pet moving the device.

**[0006]** According to a third broad aspect of the present invention, there is provided a device for dispensing items which is mobile and which comprises:

an electronic and mechanical core module having;

an agitator drive component for imparting movement to an agitator;

a computer component for controlling the agitator drive component;  
and

a power source for supplying power to the computer component, the electronic wireless communications component, and the agitator drive component; and

an item dispensing module having:

a hopper for storing items to be dispensed and having an opening through which the items are dispensed; and

an agitator having one or more item receiving receptacles, the agitator being configured to be moved within the hopper by the agitator drive component so that an item in any one of the one or more item receiving receptacles, when adjacent to the opening, can be dispensed therethrough;

wherein the electronic and mechanical core module is configured to receive electronic data instructions for controlling the agitator drive component in rotating the agitator, and wherein the electronic and mechanical core module causes the agitator drive component to impart movement to the agitator in response to interactions by an animal with the device.

**[0007]** According to a fourth broad aspect of the present invention, there is provided a device for dispensing items which is mobile and which comprises:

a hopper for storing a plurality of items;

an electronic and mechanical core module having;

an item dispenser drive component which dispense items when the device is moderately upright;

a computer component for controlling the item dispenser drive component; and

a power source for supplying power to the computer component, and the item dispenser drive component;

an item dispensing module having an item dispenser component which is responsive to the item dispenser drive component to cause the items to be dispensed from the hopper; and

an outer shell which encloses the hopper, the electronic and mechanical core module, and the pet item dispensing module, and which keeps the item dispensing module moderately upright when the device is at rest;

wherein the electronic and mechanical core module controls the dispensing of the items from the hopper by the item dispenser component, and wherein the electronic and mechanical core module causes items to be dispensed by the item dispenser component.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

**[0008]** The invention will be described in conjunction with the accompanying drawings, in which:

**[0009]** FIG. 1 is a side perspective view showing an embodiment of the device, including interior components, according to the present invention;

**[0010]** FIG. 2 is an exploded side view showing the main modules of the device shown in FIG. 1;

**[0011]** FIG. 3 is a schematic block diagram illustrating the various components of the device shown in FIG. 1;

[0012] FIG. 4 is a side perspective view of the device of FIG. 1 showing the assembled modules enclosed within a protective outer shell;

[0013] FIG. 5 is side perspective view similar to FIG. 4A, but showing an alternative embodiment of the protective outer shell;

[0014] FIG. 6 is an exploded view of the electrical and mechanical core module of the device of FIG. 1;

[0015] FIG. 7 is an exploded view of an alternative embodiment of the item dispensing module of the device of FIG. 1;

[0016] FIG. 8 is an exploded view of the device having the outer protective shell of FIG. 4;

[0017] FIG. 9 is an embodiment of a charging base for use with the electrical and mechanical core module;

[0018] FIG. 10 shows an embodiment of the device having the outer protective shell of FIG. 4 and being used as a pet play system;

[0019] FIG. 11 shows the electrical and mechanical core module of the device detecting the approach of a pet;

[0020] FIG. 12 shows the device being used in combination with a pet activated remote;

[0021] FIG. 13 illustrates the electrical and mechanical core module being used with and coupled to a separate food feed system having a larger case or shell;

[0022] FIG. 14 illustrates the device being used modularly to operate a separate ball thrower system;

[0023] FIG. 15 shows a top plan view of the device illustrating the use of IR LEDs and sensor;

[0024] FIG. 16 illustrates a side view of the top of electrical and mechanical core module of FIG. 15, along with the inside of the item dispenser module and the item receiving module;

[0025] FIG. 17 is an exploded side perspective view of an alternative embodiment of the device of FIG. 1;

[0026] FIG. 18 is a similar side view of the device of FIG. 17, but with the agitator drive component, as well as the agitator rotated approximately 90° about their common rotational axis with respect the view shown in FIG. 17;

[0027] FIG. 19 is a perspective view of the hopper of the device of FIG. 17 showing the inside of the hopper component with a wiper;

[0028] FIG. 20 is a top plan view of an alternative embodiment of the wiper of FIG. 19;

[0029] FIG. 21 is a perspective view of the agitator for the embodiment of FIG. 17;

[0030] FIG. 22 is a top plan view of the agitator of FIG. 21;

[0031] FIG. 23 is a perspective view of the underside of the agitator of FIG. 21 having a female lock connector with a D-shaped recess for receiving a D-shaped male key connector;

[0032] FIG. 24 is a perspective view of an alternative embodiment of the agitator of FIG. 21 having a female lock connector with a generally triangular-shaped recess providing 3-way symmetry for receiving a generally D-shaped key connector in 3-different orientations;

[0033] FIG. 25 is a perspective view of the device of FIG. 17 in a tilted configuration to illustrate how treats may be dispensed;

[0034] FIG. 26 is a perspective view of an alternative embodiment of the protective shell of FIG. 8 with internal components visible;

[0035] FIG. 27 is a perspective view of the top portion of the protective shell of FIG. 26;

[0036] FIG. 28 is a perspective view of the electrical and mechanical core module of FIG. 17 being used with and coupled to an alternative embodiment of a separate food feed system having a larger case or shell; and

[0037] FIG. 29 is an exploded perspective view of the some of the internal components of the embodiment shown in FIG. 28.

## DETAILED DESCRIPTION

[0038] It is advantageous to define several terms before describing the invention. It should be appreciated that the following definitions are used throughout this application.

### *Definitions*

[0039] Where the definition of terms departs from the commonly used meaning of the term, applicant intends to utilize the definitions provided below, unless specifically indicated.

[0040] For the purposes of the present invention, directional terms such as “top,” “bottom,” “side,” “front,” “frontal,” “forward,” “rear,” “rearward,” “back,” “trailing,” “above,” “below,” “left,” “right,” “horizontal,” “vertical,” “upward,” “downward,” *etc.* are merely used for convenience in describing the various embodiments of the present invention. The embodiments shown in FIGS. 1 through 29 may be flipped over, rotated by 90° in any direction, *etc.*

[0041] For the purposes of the present invention, the term “mobile” refers to a device which is relatively movable spatially from one position to another by a human and/or animal.

[0042] For the purposes of the present invention, the term “module,” as well as the associated term “modular,” refer to an isolatable element, component, *etc.*, or combination of such elements, components, *etc.* that perform a defined function and has a defined interface to other elements, components, *etc.* Modules may be implemented in hardware, a combination of hardware and software, firmware, or a combination thereof, all of which are considered to be functionally (*e.g.*, behaviorally) equivalent.

[0043] For the purposes of the present invention, the term “item” refers to any materials, foods, treats, toys, *etc.*, which may be dispensed by embodiments of the device of the present invention.

[0044] For the purposes of the present invention, the term “animal” refers to a dog, cat, horse, pig, bird, *etc.*

[0045] For the purposes of the present invention, the term “pet” refers to domesticated animals, such as dogs, cats, *etc.*

[0046] For the purpose of the present invention, the term “computer” refers to any type of computer system that may implement software including an individual computer such as a personal computer, mainframe computer, mini-computer, *etc.* In addition, computer system refers to any type of network of computers, such as a network of computers in a business, the Internet, personal data assistant (PDA), devices such as a cell phone, a television, a videogame console, a compressed audio or video player such as an MP3 player, a DVD player, *etc.* A personal computer is one type of computer system that may include the following components: a case or chassis in a tower shape (desktop) and the following parts: motherboard, CPU, RAM, firmware, internal buses (PIC, PCI-E, USB, HyperTransport, CSI, AGP, VLB), external bus controllers (parallel port, serial port, USB, Firewire, SCSI, PS/2, ISA, EISA, MCA), power supply, case control with cooling fan, storage controllers (CD-

ROM, DVD, DVD-ROM, DVD Writer, DVD RAM Drive, Blu-ray, BD-ROM, BD Writer, floppy disk, USB Flash, tape drives, SATA, SAS), video controller, sound card, network controllers (modem, NIC), and peripherals, including mice, keyboards, pointing devices, gaming devices, scanner, webcam, audio devices, printers, monitors, *etc.*

**[0047]** For the purpose of the present invention, the term “in electronic communication” refers to two or more devices which are able to transmit electronic signals, data, *etc.*, by a wired connection, wireless connection, or a combination of wired and wireless connections.

**[0048]** For the purpose of the present invention, the term “display device” refers to a device (*e.g.*, a monitor) which presents visual images from a computer for viewing. The display device may be incorporated as a component of the computer, or may be a separate device which is in electronic communication with the computer.

**[0049]** For the purpose of the present invention, the term “data” refers to any information, signal, *etc.*, which quantifies, describes, identifies, *etc.*, an attribute, characteristic, property, *etc.*, of a device, machine, equipment, component, parameter, variable, set of variables, *etc.*

**[0050]** For the purposes of the present invention, the term “electronic database” refers to a database on which data, software, *etc.*, is electronically stored on a computer, and which may be electronically accessed, for example, to input data, to retrieve data, *etc.*

**[0051]** For the purpose of the present invention, the term “software” refers to a general term used to describe any form of programmed machine-readable language or instructions (*e.g.*, object code) that, when loaded or otherwise installed, provides operating instructions to a machine capable of reading those instructions, such as a computer or other type of computer program reader. The term software may include applications such as word processors which perform productive tasks for users, system software such as operating systems which interface with hardware to provide the necessary services for application software, device controllers (*e.g.*, printer controllers such as printer drivers) which control the operation of devices such as display devices (*e.g.*, monitors), printers, *etc.*, and middleware which controls and co-ordinates distributed systems. Software may include programs, *etc.*, that are coded by programming languages like C, C++, Java, *etc.* Software is usually regarded as anything but hardware, meaning the “hard” are the parts that are tangible (able to hold) while the “soft” part is the intangible objects inside the computer. Software is so called to distinguish it from computer hardware, which encompasses the physical interconnections and devices required to store and execute (or run) the software. At the lowest level, software may comprise a

machine language specific to an individual processor. A machine language comprises groups of binary values signifying processor instructions which change the state of the computer from its preceding state. Software may be stored or reside on, as well as be loaded or installed from, one or more floppy disks, CD ROM disks, hard disks (internal or external), or any other form of suitable non-volatile electronic storage medium. Software may also be installed by downloading or by any other form of remote transmission.

**[0052]** For the purpose of the present invention, the term “transmission” refers to any type of transmission that may be carried out electronically by wired methods, wireless methods or combinations thereof. Illustrative electronic transmissions may be carried out by a variety of remote electronic transmission methods, such as by using Local or Wide Area Network (LAN or WAN)-based, Internet-based, or web-based transmission methods, cable television or wireless telecommunications networks, other suitable remote transmission method, *etc.*

**[0053]** For the purpose of the present invention, the term “computer hardware” (hereafter referred to as “hardware”) refers to digital circuitry and physical devices of a computer system, as opposed to software, which may be stored on a hardware device such as a hard disk. Illustrative examples of hardware may include the motherboard, CPU, RAM, firmware, internal buses (PIC, PCI-E, USB, HyperTransport, CSI, AGP, VLB), external bus controllers (parallel port, serial port, USB, Firewire, SCSI, PS/2, ISA, EISA, MCA), the power supply, case control with cooling fan, storage controllers (CD-ROM, DVD, DVD-ROM, DVD Writer, DVD RAM Drive, Blu-ray, BD-ROM, BD Writer, floppy disks, USB Flash, tape drives, SATA, SAS), video controllers, sound cards, network controllers (modem, NIC), and other peripherals, including mice, keyboards, pointing devices, scanners, audio devices, printers, display devices (*e.g.*, monitors), *etc.*

**[0054]** For the purpose of the present invention, the term “user” refers to an individual (or group of individuals) who are using embodiments of the present invention. The term user may also refer to a computer which inputs instructions to a computer system.

**[0055]** For the purposes of the present invention, the term “machine-readable medium” refers to any tangible or non-transitory medium or media on which may be read, for example, by a computer, or any other device capable of reading programmed machine-readable language or instructions. Examples of machine-readable media may include floppy disks, Zip<sup>TM</sup> disks, CD-ROM, CD-R, CD-RW, DVD, DVD-R, memory sticks, flash memory, hard disks (internal or external), optical disks, *etc.*

**[0056]** For purposes of the present invention, the term “non-transient storage medium” refers to a storage medium that is non-transitory, tangible and computer readable. Non-transient storage medium may refer generally to any durable medium known in the art upon which data can be stored and later retrieved by data processing circuitry operably coupled with the medium. A non-limiting non-exclusive list of exemplary non-transitory data storage media may include magnetic data storage media (*e.g.*, hard disc, data tape, *etc.*), solid state semiconductor data storage media (*e.g.*, SDRAM, flash memory, ROM, *etc.*), and optical data storage media (*e.g.*, compact optical disc, DVD, *etc.*).

**[0057]** For purposes of the present invention, the term “processor” refers to a device that performs the basic operations in a computer. A microprocessor is one example of a processor.

**[0058]** For the purposes of the present invention, the term “random-access memory (RAM)” refers to a type of computer data storage. RAM may take the form of integrated circuits that allow the stored data to be accessed in any order, *i.e.*, at random. The word random thus refers to the fact that any piece of data can be returned in a constant time, regardless of its physical location and whether or not it is related to the previous piece of data. This contrasts with storage mechanisms such as tapes, magnetic discs and optical discs, which rely on the physical movement of the recording medium or a reading head. In these devices, the movement takes longer than the data transfer, and the retrieval time varies depending on the physical location of the next item. The word RAM is mostly associated with volatile types of memory (such as DRAM memory modules), where the information is lost after the power is switched off. However, many other types of memory are RAM as well, including most types of ROM and a kind of flash memory called NOR-Flash.

**[0059]** For the purposes of the present invention, the term “read-only memory (ROM)” refers to a class of storage media used in computers and other electronic devices. Because data stored in ROM cannot be modified (at least not very quickly or easily), it is mainly used to distribute firmware (software that is very closely tied to specific hardware, and unlikely to require frequent updates). In its strictest sense, ROM refers only to mask ROM (the oldest type of solid state ROM), which is fabricated with the desired data permanently stored in it, and thus can never be modified. However, more modern types such as EPROM and flash EEPROM can be erased and re-programmed multiple times; they are still described as “read-only memory” because the reprogramming process is generally infrequent, comparatively slow, and often does not permit random access writes to individual memory locations.

**[0060]** For the purposes of the present invention, the term “Internet” refers to a global system of interconnected computer networks that interchange data by packet switching using the standardized Internet Protocol Suite (TCP/IP). The Internet may carry various information resources and services, such as electronic mail, online chat, file transfer and file sharing, online gaming, and the inter-linked hypertext documents and other resources of the World Wide Web (WWW).

**[0061]** For the purposes of the present invention, the term “solid-state electronics” refers to those circuits or devices built entirely from solid materials and in which the electrons, or other charge carriers, are confined entirely within the solid material. The term is often used to contrast with the earlier technologies of vacuum and gas-discharge tube devices and it is also conventional to exclude electro-mechanical devices (relays, switches, hard drives and other devices with moving parts) from the term solid state. While solid-state can include crystalline, polycrystalline and amorphous solids and refer to electrical conductors, insulators and semiconductors, the building material is most often a crystalline semiconductor. Common solid-state devices include transistors, microprocessor chips, and RAM. A specialized type of RAM called flash RAM is used in flash drives and more recently, solid state drives to replace mechanically rotating magnetic disc hard drives. More recently, the integrated circuit (IC), the light-emitting diode (LED), and the liquid-crystal display (LCD) have evolved as further examples of solid-state devices. In a solid-state component, the current is confined to solid elements and compounds engineered specifically to switch and amplify it.

**[0062]** For the purposes of the present invention, the term “solid state sensor” refers to sensor built entirely from a solid-phase material such that the electrons or other charge carriers produced in response to the measured quantity stay entirely within the solid volume of the detector, as opposed to gas-discharge or electro-mechanical sensors. Pure solid-state sensors have no mobile parts and are distinct from electro-mechanical transducers or actuators in which mechanical motion is created proportional to the measured quantity.

**[0063]** For the purposes of the present invention, the term “computer network” refers to a group of interconnected computers. Networks may be classified according to a wide variety of characteristics. The most common types of computer networks in order of scale include: Personal Area Network (PAN), Local Area Network (LAN), Campus Area Network (CAN), Metropolitan Area Network (MAN), Wide Area Network (WAN), Global Area Network (GAN), Internetwork (intranet, extranet, Internet), and various types of wireless networks.

All networks are made up of basic hardware building blocks to interconnect network nodes, such as Network Interface Cards (NICs), Bridges, Hubs, Switches, and Routers. In addition, some method of connecting these building blocks is required, usually in the form of galvanic cable (most commonly category 5 cable). Less common are microwave links (as in IEEE 802.11) or optical cable (“optical fiber”).

**[0064]** For the purposes of the present invention, the term “local area network (LAN)” refers to a network covering a small geographic area, such as a home, office, building, office site, *etc.* The defining characteristics of LANs, in contrast to WANs (wide area networks), include their higher data transfer rates, smaller geographic range, lack of a need for leased telecommunication lines, *etc.*

**[0065]** For the purposes of the present invention, the term “data storage medium” or “data storage device” refers to any medium or media on which a electronic data may be stored for use by a computer system. Examples of data storage media include floppy disks, Zip<sup>TM</sup> disks, CD-ROM, CD-R, CD-RW, DVD, DVD-R, memory sticks, flash memory, hard disks, solid state disks, optical disks, *etc.* Two or more data storage media acting similarly to a single data storage medium may be referred to as a “data storage medium” for the purposes of the present invention. A data storage medium may be part of a computer.

**[0066]** For purposes of the present invention, the term “hardware and/or software” refers to functions that may be performed by digital software, digital hardware, or a combination of both digital hardware and digital software. Various features of the present invention may be performed by hardware and/or software.

**[0067]** For the purposes of the present invention, the term “Bluetooth<sup>®</sup>” refers to a wireless technology standard for exchanging data over short distances (using short-wavelength radio transmissions in the ISM band from 2400–2480 MHz) from fixed and mobile devices, creating personal area networks (PANs) with high levels of security. Created by telecom vendor Ericsson in 1994, it was originally conceived as a wireless alternative to RS-232 data cables. It may connect several devices, overcoming problems of synchronization. Bluetooth<sup>®</sup> is managed by the Bluetooth<sup>®</sup> Special Interest Group, which has more than 18,000 member companies in the areas of telecommunication, computing, networking, and consumer electronics. Bluetooth<sup>®</sup> was standardized as IEEE 802.15.1, but the standard is no longer maintained. The SIG oversees the development of the specification, manages the qualification program, and protects the trademarks. To be marketed as a

Bluetooth<sup>®</sup> device, it must be qualified to standards defined by the SIG. It will be understood by one skilled in the art that Bluetooth<sup>®</sup> is only one of many wireless communication technologies and that other technologies may be substituted therefore and perform the same or similar function.

**[0068]** For the purposes of the present invention, the term “cloud computing” is synonymous with computing performed by computers that are located remotely and accessed via the Internet (the “Cloud”). In this style of computing, the computing resources may be provided “as a service”, allowing users to access technology-enabled services “in the cloud” without knowledge of, expertise with, or control over the technology infrastructure that supports them. According to the IEEE Computer Society it “is a paradigm in which information is permanently stored in servers on the Internet and cached temporarily on clients that include desktops, entertainment centers, table computers, notebooks, wall computers, handhelds, *etc.*” Cloud computing is a general concept that may incorporate virtualized storage, computing and web services and, often, software as a service (SaaS), where the common theme is reliance on the Internet for satisfying the computing needs of the users. For example, Google Apps provides common business applications online that are accessed from a web browser, while the software and data are stored on the servers. Some successful cloud architectures may have little or no established infrastructure or billing systems whatsoever including Peer-to-peer networks like BitTorrent and Skype and volunteer computing like SETI@home. The majority of cloud computing infrastructure currently consists of reliable services delivered through next-generation data centers that are built on computer and storage virtualization technologies. The services may be accessible anywhere in the world, with the Cloud appearing as a single point of access for all the computing needs of data consumers. Commercial offerings may need to meet the quality of service requirements of customers and may offer service level agreements. Open standards and open source software are also critical to the growth of cloud computing. As customers generally do not own the infrastructure, they are merely accessing or renting, they may forego capital expenditure and consume resources as a service, paying instead for what they use. Many cloud computing offerings have adopted the utility computing model which is analogous to how traditional utilities like electricity are consumed, while others are billed on a subscription basis. By sharing “perishable and intangible” computing power between multiple tenants, utilization rates may be improved (as servers are not left idle) which can reduce costs significantly while increasing the speed of application development. A side effect of this

approach is that “computer capacity rises dramatically” as customers may not have to engineer for peak loads. Adoption has been enabled by “increased high-speed bandwidth” which makes it possible to receive the same response times from centralized infrastructure at other sites.

**[0069]** For the purposes of the present invention, the term “smartphone” (also known as a “smart phone”) refers to a hand-held mobile device with more advanced computing capability and connectivity than basic feature phones, and which may use mobile operating systems such as iOS, Android, BlackBerry (mobile) operating systems (OS), Windows Phone (mobile) operating systems (OS), *etc.* Smartphones may provide, in addition to digital cameras, various other features such as keyboards, touchscreens, personal digital assistants (PDAs), media players, web browsing, wireless connectivity (Wi-Fi), GPS navigation units, *etc.*

**[0070]** For the purposes of the present invention, the term “electronic tablet” (also known as a “tablet computer” or “tablet”) refers to a mobile computer having, for example, a touchscreen display, circuitry, battery, *etc.* Electronic tablets may also be equipped with sensors, digital cameras, a microphone, an accelerometer, *etc.*, wherein the touchscreen display uses finger gestures, stylus gestures, *etc.*, in place of a physical computer mouse and/or keyboard for moving the cursor, inputting data, *etc.*, on-screen, pop-up virtual keyboards for typing, physical buttons for basic features such as speaker volume, power, *etc.*, ports for network communications, battery charging, *etc.*

**[0071]** For the purposes of the present invention, the term “light emitting diode (LED)” refers to an electronic device, complement, element, *etc.*, that generates light from two-lead semiconductor light source.

**[0072]** For the purposes of the present invention, the term “sensor” refers to an electronic device, complement, element, *etc.*, that detects light, motion, *etc.*

**[0073]** For the purposes of the present invention, the term “agitator” refers to a component that causes items such as pet treats, other small objects, *etc.*, to be moved about. The agitator may be smooth, have brushes, grooves, holes, other surface features, *etc.*, that will cause the items, treats, other objects, *etc.*, to move when the agitator moves (*e.g.*, rotates) either by friction with the surface of the agitator, by a projections, dents, holes, *etc.*, in the surface that mechanically engage the items, treats, objects, *etc.* The agitator’s motion may include moving (*e.g.*, rotating) circularly, linearly in any direction, or any combination of movement,

motions, *etc.* The agitator's movement may in large increments, smaller increments, *e.g.*, a series of smaller vibrations, *etc.*

**[0074]** For the purposes of the present invention, the term “item receiving receptacle” refers to a cavity, dent, guide, depression, recess, groove, *etc.*, formed in, attached to, *etc.*, the agitator which is designed to receive, hold, *etc.*, roughly a measured number of one or more treats. In the case of a powder, finely ground treat, *etc.*, the receptacle may define a rough volume thereof. The receptacle may be designed to receive a particular shape or size of treat such that other treats would not be readily accepted by the receptacle. The receptacle may have a surface with no openings, or may have a surface with openings, holes, gaps, *etc.*, such as a basket comprising interwoven elements, sections, parts, *etc.*, to allow small particles to fall through. A function of the receptacle may be to guide the, item(s), treat(s), *etc.*, to as the agitator moves so that it may be eventually dispensed.

**[0075]** For the purposes of the present invention, the term “treat” refers to an item, group of items, *etc.*, that may be dispensed. The treat(s) may be a form of food such as a pet food kibble, medicine, non-food item, *etc.* The treat(s) may be any shape, any size, *etc.*, including being a powder, finely ground, a food kibble, a medicine in a capsule, *etc.*

**[0076]** For the purposes of the present invention, the term “electrical and mechanical core” (referred to also interchangeably as “core”), refers to one or more components that contain the electronic control and the motors or other electro-mechanical movement devices (referred to interchangeably as “motor”) that cause the device to work. It will be understood by those skilled in the art that the electronics and/or motor may be in a single housing/casing, be split between various sub-modules/housing, *etc.*

**[0077]** For the purposes of the present invention, the term “wiper refers to a component that acts, for example, to restrict the number of treats that may be dispensed in each dispense cycle, and which may be flexible, ridged, brush-like, *etc.*, or any combination thereof.

**[0078]** For the purposes of the present invention, the term “keyed coupler” refers to a mechanical component for transferring motion rotationally, laterally, as well as other forces from one member (*e.g.*, the male member) to another member (*e.g.*, the female member). The keyed part portion, *etc.*, of the coupler may, for example, allow connection in one orientation relative to the keyed part, portion, *etc.*, in two or more orientations, *etc.* The various ways the coupler may be engaged, connected to, *etc.*, to other components, devices, *etc.*, may be controlled by the shape of the keyed part, portion, *etc.*, of the coupler and/or the

device, component, *etc.*, that coupler engages, is connected to, *etc.*, would be understood and may be determined by those skilled in the art. The keyed part, portion, *etc.*, of the keyed coupler may be recessed, may be protruding, may be a combination of recess(es) and/or protrusion(s), *etc.*

**[0079]** For the purposes of the present invention, the term “lock coupler” refers to the part, portion, *etc.*, of a component, element, *etc.*, that mates with, engages with, *etc.*, the key coupler. The lock coupler may support one or more orientations in engaging, connecting, *etc.*, the key coupler to the lock coupler.

**[0080]** For purposes of the present invention, the term “moderately upright” refers to an object, such as embodiment of a device of the present invention, being oriented within 45 degrees of vertical in more than one direction.

**[0081]** For purposes of the present invention, the term “resting position” refers to a position wherein an object, such as embodiment of a device of the present invention, is quiescent, substantially quiescent, motionless, substantially motionless, *etc.*

**[0082]** For the purposes of the present invention, the term “comprising” means various devices, components, elements, capabilities, steps, *etc.*, may be conjointly employed in embodiments of the present invention. Accordingly, the term “comprising” encompasses the more restrictive terms “consisting essentially of” and “consisting of.”

**[0083]** For the purposes of the present invention, the terms “a” and “an” and similar phrases are to be interpreted as “at least one” and “one or more.” References to “an” embodiment in this disclosure are not necessarily to the same embodiment.

**[0084]** For the purposes of the present invention, the term “and/or” means that one or more of the various devices, components, elements, capabilities, steps, *etc.*, may be employed in embodiments of the present invention.

### ***Description***

**[0085]** Conventional pet treat, food, *etc.*, dispensing devices may be meant to have a single or very limited different functions/uses. In particular, if these conventional pet treat, food, *etc.*, dispensing devices include a computer system, that system may not be modular so that it may be easily removed and thus used to drive different mechanical device mechanisms.

[0086] Embodiments of the present invention provide a mobile and movable modular device which may be designed to be used with various electrical and/or mechanical component modules to provide a variety of functions that may be useful in the care, training, and play with pets. The mobile and movable modular device comprises: a hopper for storing a plurality of items; an electronic and mechanical core module having a computer component (*e.g.*, CPU, volatile and non-volatile memory, volatile memory (*e.g.*, RAM) and/or non-volatile memory (*e.g.*, hard disk), *etc.*) for controlling an item dispenser drive component; an electronic wireless communications component (*e.g.*, Bluetooth and/or WiFi wireless communications components, other RF communications components, *etc.*); an item dispenser drive component (*e.g.*, motor, gears, *etc.*); and a portable power source (*e.g.*, a battery, including a rechargeable battery, capacitors, *etc.*) for supplying power to the computer component, the electronic wireless communications component, and the item dispenser drive component. The mobile and movable modular device also comprises an item dispensing module having an item dispenser component which is responsive to the item dispenser drive component to cause items (*e.g.*, pet items, *etc.*) to be dispensed from the hopper. The mobile and movable modular device may further and optionally comprise a dispensed item receiving module (*e.g.*, a container, holder, *etc.*) for receiving the items to be dispensed by the item dispenser component. The electronic and mechanical core module (which may be referred to hereafter interchangeably as “core”) is configured to receive electronic data instructions for controlling the dispensing of the items from the hopper when the electronic and mechanical core module causes items to be dispensed by the item dispenser component. For mobile, movable modular devices for dispensing pet items which are movable in response to actions of a pet, the device may further comprise an outer protective shell which encloses the electronic and mechanical core module, the pet item dispensing module, and optionally the dispensed pet item receiving module and which protects the electronic and mechanical core module, the pet item dispensing module, and optionally the dispensed pet item receiving module from the actions of, for example, the pet. In some embodiments, the outer shell In some embodiments, the item dispensing module may be configured to dispense pet items from the hopper into the outer shell with the outer shell including one or more openings through which one or more of the pet items may exit the outer shell. In some embodiments, the item dispenser drive component may be configured to dispense items when the device is moderately upright. In some embodiments, the outer shell may be configured, for example, by shape and/or weighting to keep the item dispensing module moderately upright when the device is at rest. It will be understood by those skilled in the art that the electronic and

mechanical core module could be physically housed/contained in a single case, one or more physically and/or electrically connected cases, *etc.*

**[0087]** In some embodiments of the present invention, the electronic and mechanical core module may also include light emitting diodes (LEDs) that may emit visible or invisible light such as infrared (IR), optic sensors (IR and/or visible), motion sensors, GPS receiver, *etc.* In other embodiments of device of the present invention, the device may used with other exterior peripheral components, *etc.*, for holding and dispensing items with the electronic and mechanical core module providing the motive power to drive, run, control, *etc.*, for example, an exterior item dispensing component, *etc.* These exterior peripherals may be such that the electronic and mechanical core module fits within the exterior peripheral component such that these exterior peripheral components may add, for example, additional protection, shielding, security, resistance, *etc.*, against a pet chewing or otherwise damaging the electronic and mechanical core module. Any sensors within the electronic and mechanical core module may include, for example, optical sensors (including, for example, infrared sensors), motion/acceleration detection, a compass, proximity detection, *etc.* In some embodiments, the electronic and mechanical core module may be made reasonably waterproof with, for example, seals to prevent water or other fluid leakage around mechanical linkages, *etc.* In some embodiments, the modular core the electronic and mechanical core module may be made waterproof and may use, for example, an electromagnetic field to couple the motive power outside the electronic and mechanical core module. In some embodiments, the electronic and mechanical core module may cause the item dispensing module to dispense one item in response to, for example, at least one sensor detecting a movement by the pet of the device, the proximity of the pet to the device, *etc.* In some embodiments, the infrared sensor(s) may be configured to sense the proximity of the pet to the device through an RFID signature, while in other embodiments, the infrared sensor(s) may be configured to sense different RFID signatures (*e.g.*, different RFID signatures for different pets, *etc.*)

**[0088]** Embodiments of the mobile and movable device of the present invention are further illustrated by **FIGS. 1** through **29**, one of which is indicated generally as **101** in **FIG. 1**. **FIG. 1** illustrates an embodiment of dispensing device **101**, including the various component modules that together may comprise a dispensing system. The electronic and mechanical core module (“core”) **102** may include various different electrical and mechanical components **104** contained within a core module case **106**. Electrical and mechanical

components **104** may include one or more printed circuit boards **110** along with various other electronic components **112**, plus various other input and output components that may be electrically connected (all such connections not being shown **FIG. 1** for purposes of clarity) including one or more radio antennas **114**, one or more electric motor(s) **120** with corresponding gears **122**, a keyed coupler **124** with a recessed key **125**, a microphone **126**, a speaker **128**, one or more visible light LED(s) **130**, one or more infrared LEDs **132**, one or more infrared light sensors **134**, and a power source such as battery **140** which may be a rechargeable lithium ion battery. Module core case **106** may include contacts **144** that may permit power and/or data signals to reach the electrical components in device **101**. In some embodiments, charging of battery **140** is achieved, via contacts **144**, but may also be provided by an inductive coupling with all electronic data communication also being wireless.

[0089] An item dispensing module **150** for device **101** may also include a dispensing module case **151** in addition to a dispensing mechanism, such as a vertically rotating agitator **154** that is connected to coupler **124** so it can be driven by one or more motors **120** via gears **122**. Coupler **124** may have gaskets and/or grease associated with it in order to prevent water from getting into core module case **106**. The rotational movement of agitator **152** causes one or more of items **156** (*e.g.*, pet treats, pet food, pet toys, *etc.*) to move (*i.e.*, be dispensed) to and through exit hole **158**. The dispensing module case **151** may be coupled to the electrical and mechanical core module case **106** mechanically through, for example, screw-type threads such as **160**, some another mechanical locking mechanism and/or by magnets (not shown).

[0090] A dispensed item receiving component in the form of hopper **170** may be enclosed or housed within a hopper module case **171** to hold items **156** that have been dispensed (feed) through exit hole **158** from dispensing module case **151**. Hopper module case **171** and dispensing module case **151** may be either separate cases or may be integrated into a single physical case. A lid **172** keeps dispensed items **156** from falling out of hopper module case **171**. Lid **172** may also have screw-type thread, such as **174**, another mechanical mechanism, or a magnetic mechanism to keep lid **172** from being disconnected from or falling off of hopper module case **171**. In some embodiments, lid **172** may not be necessary and therefore optional for hopper module case **171**.

[0091] In the embodiment of device **101** shown in **FIG. 1**, all of the electrical and mechanical components for core module **102** may be contained within core module case **106**. In alternative embodiments, one or more of these components for core module **102** may be present in separate cases that are then coupled together to form a composite core module case

**106.** In addition, other possible electrical and mechanical components not shown in **FIG 1** may included in core module case **106**, or may be separate from core module case **106**, yet coupled to one or more of the components in core module **102**.

[0092] **FIG. 2** shows an external view of dispensing device **101** with the hopper module case **171**, dispensing module case **151** with hole **158** and separated from the core module case **106** to reveal the agitator **154**. Core module **102** has keyed coupler **124** with a key connector **125** that is driven by the motor **120** to in turn drive the agitator **154**. Shown in core module case **106** are audio speaker holes **229**. There may also be a waterproof membrane positioned over speaker holes **229** to allow for sound to be heard from speaker **128** by passing through holes **229** but without allowing water or other liquids to enter the core module case **106**. Additional features shown in **FIG. 2** may include a light coupler **231** that allows light from LED(s) **130** inside core module case **106** to pass outwardly. Depending upon the optical properties of core module case **106**, light coupler **231** may not be necessary, and therefore optional. There may also be provided an optical window **233** to permit infrared light to be transmitted into and out of the core module case **106**; this optical window **233** may or may not be required based upon the optical properties of core module case **106**.

[0093] **FIG. 3** shows schematic block diagram **300** for the various electronic components of core module **102**, including components not shown in **FIG. 1**. Block diagram **300** only shows some approximate grouping of functions and should not be construed or interpreted to necessarily show individual electronic components, elements, *etc.*, as well as any other components, elements, *etc.*, necessary drive these electronics components, elements, *etc.*, such as, for example, voltage converters. Block diagram **300** shows a “system on a chip” **302** that may include a CPU, non-volatile memory (*e.g.*, disk storage), volatile memory (*e.g.*, RAM), as well as other functional features which may be integrated on device. An example of such a chip **302** may be a Nordic Semiconductor nRF52832 chip, as described in its manual at: [http://infocenter.nordicsemi.com/pdf/nRF52832\\_PS\\_v1.0.pdf](http://infocenter.nordicsemi.com/pdf/nRF52832_PS_v1.0.pdf), of which the entire disclosure and contents are hereby incorporated by reference.

[0094] As shown in block diagram **300**, these components may include motor (or other similar electrical to mechanical movement component) **120** which may include, for example, electromagnetic coils, piezo-electric effects, *etc.* Antenna(s) **114** may support one way or two way radio frequency (RF) communication between the components in core module **102**, as well as an external computer system such as a personal computer (PC), mobile or smartphone phone, computer tablet, *etc.* These RF communications may include various

Bluetooth standards, WiFi such as Ethernet WiFi, simpler RF communication as may be used with remote control devices, or any other RF communication signaling. As further shown in block diagram **300**, there may be necessary physical, electrical, and/or codec devices **315** to convert the RF signal into a form that may be used by the CPU of chip **302**. There may also be driver devices **321** to support the current and/or voltage requirements of motor **120**, microphone **126** for picking up audible sounds, and speaker or other audible output device(s) **128** to output sounds that may be heard by an animal or human and/or may output sounds in frequency ranges that may only be heard by animals, or some subset of animals. Speaker **128** may be driven directly by the CPU subsystem on a chip **302** or may be driven by an audio code **329** that may have additional memory **331** for holding data for various sounds, including human voices. Human and/or animal visible light LEDs **130** may also give visible indication to a human or animal. These LEDs **130** may also exhibit colored light and/or white light. Infrared LEDs **132** may also be used in combination with infrared sensors **134** to sense various actions such as the movement of agitator **154**, or whether or not items **156** have been dispensed. The combination of IR LEDs **132** and sensors **134** may also be used to sense the proximity of various devices or animals.

[0095] Chip **302** may need various voltages and may need to manage the recharging of a battery **140**, which may be provided by power management device(s) **341**. Chip **302** may also support a wired interface such as a Universal Serial Bus (USB) or other wired communication standard, including, for example, to an Ethernet with interface electronics **345**. Various sensors and/or compass, gyroscope or other motion sensing/location devices **346** may also be used to detect location or movement. This data/information may be used by software running on the CPU of chip **302** to change the behavior of device **101** and/or communicate such movement to an external computing device. A camera **381** may also provide visual information that can be sent via the CPU of chip **302** and RF circuitry **315** back to an external computing device. Beyond the basic communication functions, it may be useful to have antenna **384** for a Global Positions System (GPS) or other radio receiver **385** for knowing, establishing, *etc.*, the location of device **101**.

[0096] FIG. 4 shows an embodiment of a smart pet play system **400** using dispensing device **101** with core module **102**, dispensing module **150**, and hopper module **170** enclosed within outer shell **410**. This outer shell **410** may totally enclose and surround the dispensing system **101**, and thus protect it from an animal using device **101**. Outer shell **410** may also be split into a lower half **412** and upper half **414** to allow the dispensing module **150** to be

inserted and removed from the inside of shell **410**. The two halves **412** and **414** may be joined together at or by a seam **420**, seam **420** also including, for example, screw-type threads built into halves **412** and/or **414**, a bayonet type joining mechanism that may require less than a full rotation to join/unjoin the two halves/parts **412/414**, other conventional mechanical connections for joining two halves/parts **412/414**, *etc.* Separating two halves **412/414** will permit adding items/treats/food **156** to hopper module **170** and/or removal of core module **102**, dispensing module **150**, and hopper module **170**.

[0097] As shown in **FIG. 4**, there may be one or more holes **426** that may be formed in the bottom half **412** or top half **414** of outer shell **410** that may permit dispensed item **156** to exit shell **410**. In use, a dispensed item **156** may pass through hole **158**, with that dispensed item **156** falling into a ball. The pet may, in turn, push/knock device **101** around to cause dispensed item **156** to move around within outer shell **410** until that dispensed item **156** falls out of shell hole(s) **426**.

[0098] In some embodiments, and/or how the dispensing device **101** is installed in the ball, output hole **158** of the dispensing device **101** may line up and/or connect directly with hole **426** so that the treat immediately exits the ball-shaped outer shell **410**. This allows the treat to be dispensed without the pet having to knock the ball-shaped outer shell **410** around. This might be particularly useful when introducing the system to a pet.

[0099] Built into the lower shell **412** is a support **430** that may help hold device **101** in place. As shown in **FIG. 4**, the support **430** may be in the form of a ring. Similarly, a corresponding support **432** is shown in the top **414** part of outer shell **410**. This support **432** is also shown in the form of a ring. When there is no lid **172** as shown in **FIG. 1**, support **432** may be in the form of a ring going around the top of the hopper module case **171** combined with the top **414** may act as a lid to contain dispensed items **156** within hopper module case **171**.

[0100] In some embodiments for dispensing module **150** to work, device **101** may need to be reasonably (*e.g.*, moderately) upright. The shape of outer shell **410** and the weight of core module **102** may aid in keeping device **101** moderately upright when in, for example, a resting position. Additional weight indicated as **440** may also be added to bottom half **412** to further aid in keeping device **101** moderately upright when in such a resting position.

[0101] In the embodiment shown in **FIG. 4**, outer shell **410** has a generally ellipsoid or oval egg-shaped configuration, but may be formed in many other shapes, configurations, *etc.*,

including, for example, those that are more spherically-shaped, square-shaped, rectangularly-shaped, *etc.* For example, **FIG 4B** shows an alternative configuration **450** providing an outer shell **452** which is generally cylindrical-shaped for enclosing and protecting core module **102**, dispensing module **150** and hopper module **170**. As shown in **FIG. 5**, outer shell **452** may be split into a lower part **454** and upper part **456** to enable the core module **102**, dispensing module **150**, and hopper module **170** to be inserted therein. The joint **458** between lower part **454** and upper part **456** may include a mechanism for securing part **454** to part **456** so that those parts may remain joined together, such as screw threads or a bayonet mount. A hole **460** may also be provided in outer shell **452** to enable dispensed items **156** dispensed (through and from hole **158**) to exit from outer shell **452**.

[0102] **FIG. 6** shows additional details of one embodiment of core module **102**. The core module case **106** has been split into a bottom half **507** and top half **509** which may be held together with screws **512**. Also shown in **FIG. 6** is PCB board **110**, motor **120**, gears **122**, coupler **124**, and battery **140** of core module **102**.

[0103] **FIG. 7** shows an alternative embodiment of dispenser module **150** having dispenser module case **610** to hold dispenser module **150**. Dispenser module case **610** may have formed therein a hole (see hole **632**) for dispensing an item from dispenser module **150**. There may also be slots **616** in dispenser module case **610** to act as a guide the agitator **620**. In this embodiment, agitator **620** has a back and forth reciprocating action caused by eccentric wheel **624** pushing/pulling the agitator **620**. A top cover **630** with hole **632** permits the item within dispenser module case **610** to fall into the dispenser module exit **614** and be pushed out by agitator **620** while the agitator **620** also blocks further items from falling through hole **632** if agitator **620** stops in the “out” position. Eccentric wheel **624** may be driven by coupler **124**. An optional stirring mechanism **632** may also be coupled to the wheel **624** or other parts of mechanism **632** to stir the items and aid in those items falling through hole **633**.

[0104] **FIG. 8** shows an exploded view of device **101** along with outer protective shell **410**. In **FIG. 8**, core module **102** has halves **507** and **509** with coupler **124** connected to a drive mechanism inside the core module **102**. Coupler **124** operates via eccentric wheel **624** (not shown in **FIG. 8**) to drive agitator **620** push items out through exit hole **614** while alternately opening and closing off hole **633** in top cover **730**. Top cover **730** has a sloped set of channels **731** to help guide the treats to the hole **633**. Also shown in **FIG. 7** is shell bottom **412** with a ring-shaped support **430** and shell top **414**, as well as hole **426** for permitting

items to exit outer shell **410**. Shell bottom **412** may also be provided with one or more optional weights **440**. The slots **772** form part of a bayonet type connection for the bottom half **412** and a mating set of slots **774** are in top half **414** to support connecting the bottom **412** to the top half **414**.

[0105] FIG. 9 shows one embodiment of a charging base **810**. This base **810** may have no active components and may simply wire power and signals from, for example, a standard connector **820** such as a USB A port through to pogo pins **830**. Base **810** may also have protection circuits and/or voltage changing circuits in it. Connection or pogo pins **830** may have some springiness to urge contact with simple flat connectors on the bottom of core module **102**. In addition to providing power, one or more of pins **830** may have one or two way signals for communicating with the electronics in core **102**.

[0106] FIG. 10 shows a potential use for system **400** which may be in a smart pet play system. The play system may have software that runs on it to provide some level of functionality and to communicate with other devices wirelessly. The human user with a computer system **910** such as a smart-phone, tablet, personal computer, *etc.*, may wirelessly communicate through, for example, a Bluetooth and/or WiFi device, instructions which may include anything from a few parameters to entire software routine(s) to system **400**. These parameters and/or routines may then be stored in one or more of the memories in system **400**, including, for example, CPU of chip **302** with nonvolatile memory **303**, and/or audio memory **331**. In this way the computer system **910** may act as the display for core module **102**. Additionally, core module **102** may communicate back to computer system **910** to send alerts, audio, or other information back to the human user.

[0107] Once programs and/or parameters have been loaded into system **400**, human computing device **910** may then wirelessly instruct system **400** to begin operation. For example, a simple operation might be to dispense an item (*e.g.*, pet treat) every “n” seconds where “n” is programmed by the human. The dispense operation may optionally be programmed to also make a noise or talk to the pet via audio codec **329** and speaker **128** to signal that a treat has been dispensed. By, for example, noise generated during the dispensing of the treat, pet **920** may then be attracted to system **400** by the treat being dispensed inside outer shell **410** of system **400** and may then knock system **400** around to get the treat to come out of hole(s) **426** in shell **410**.

[0108] What causes the treat to be dispensed by system 400 may be programmed to become more difficult and/or in reaction to the pet's behavior. For example, initially it may be desirable to dispense a treat frequently as pet 920 is become accustom to system 400, but as pet 920 learns how system 400 works, it may be desirable to stretch out the time between treats to make them last longer reduce the caloric intake.

[0109] System 400 may also be programmed to react to the pet's behavior. For example, the motion and/or position sensing device(s) 346 could detect that pet 920 is hitting System 400 around and could either slow down or speed up the rate at which the treat may be dispensed. The capability of system 400 may also be expanded by adding a radio frequency tag 930 attached via a collar to pet 920. This tag 930 may be, for example, a passive RF transmitter tag but may also be an active (battery powered tag) which typically may have more or greater range. RF tag 930 may be a standard RF signal such as Bluetooth, some other signal format for RFID, *etc.* The receiver for system 400 may then detect which pet 920 is near system 400. Additionally, the strength and/or other RF information may act to tell about how far away pet 920 is from system 400, *i.e.*, to provide proximity detection.

[0110] Tag 930 in combination with software loaded onto system 400 can further vary the behavior of the system 400. Some example may include signaling back to the human user on their device 910 if pet 920 has approached system 400. Tag 930 may uniquely identify one of a multiple of pets 920 such that system 400 may only dispense items (*e.g.*, treats) to a specific pet 920. In this way a pet owner with more than one pet 920 may have multiple systems 400, each programmed to only work with a specific pet 920 to enable each pet 920 to have their own interaction with their own system 400.

[0111] FIG. 11 shows using the infrared LEDs 132 and sensors 134 it can detect if something has approached it. Alternatively in combination with tag 930, RF circuits 315 in combination with CPU of chip 302 may detect the proximity of pet 920 to identify the specific pet. For example, if the core module 102 is left on a countertop, core module 102 may detect that a pet 920 has jumped up onto the countertop and optionally outputs a flash of light from visible LEDs 130 and/or an audible deterrent via speaker 128, and/or signals a human on their device 910. Similarly, the core module 102 may be used to teach boundaries to a pet 920 in terms of, for example, by placing core module 102 at the entrance to a room.

[0112] The combination of the core module 102, dispensing module 150, and hopper module 170 with lid 172 but without any outer shell 410 for system 400 might be used as part

of a training program by acting as a remote treat dispenser. For example, the human with their device **910** could tell the core module **102** via a software “button” on human device **910** to dispense a treat if pet **920** exhibits the proper behavior. Another option would be to have system **400** dispense a series of treats over a period of time to encourage, for example, a “down – stay” behavior. With the ability of system **400** to proximity sense pet **920**, the human may automatically decide whether to keep rewarding pet **920** if say the human leaves the room in order to help teach pet **920** to follow commands even if the human is not in sight. Furthermore, the speaker **128** in core module **102** may be used to issue voice or audible signal commands remotely.

[0113] Figure **12** shows another use for the combination of the electrical and mechanical core module **102**, dispenser module **150** and hopper module **170** with a pet activated remote **1020** that may electronically communicate wirelessly with RF signals back to the core module **102**. When pet **920** touches remote **1020**, remote **1020** may send an RF signal to core module **102**. Based upon the software the loaded in core module **102**, core module **102** may then issue a treat and/or a positive re-enforcing sound. In this way pet **920** can run back and forth between remote **1020** and device **101**.

[0114] FIG. **13** shows how core module **102** may be used with and coupled as part of a separate item (food) feeder system **1100** having a larger case or shell **1110**. In this embodiment, a larger item dispense mechanism **1150** dispenses measured amounts of food items into a bowl (not shown) from a larger hopper **1170**. In this way, the electronics of the core module **102** may be used modularly. Software used in core module **102** in combination with other software on the human computer device **910** may be used to track information such as how many calories a pet has consumed in a given period of time.

[0115] FIG. **14** illustrates how device **101** may be used modularly as part of a separate ball thrower system **1200** having a case or shell **1210**. In this embodiment, the core module **102**, item dispenser module **150**, and hopper module **170** may be used as part of a ball thrower and treat system **1200**. In this embodiment, motor **120** of core module **102**, when operating in one mode, may be used to wind up a throwing mechanism inside ball hopper **1230** with hole **1232** for dispensing the ball. When operating in a different mode, motor **120** may be used to dispense pet items (*e.g.*, treats). In other words, and as illustrated in FIG. **14**, only one set of mechanical hardware (*e.g.*, ball thrower and treat system **1200**) needs to be combined with and coupled to device **101** when using the electrical and mechanical components of core module **102**.

[0116] FIG. 15 shows a top view with details on the application of the IR LEDs 132 and IR sensors 134. The top of the core module case 106 is shown as having various “windows” in it, these windows being either physical or may just be an IR optically transparent material that covers the various LEDs 132 and sensors 134. Windows for LEDs 132 are numbered 1332-1 through 1332-3, while windows for sensors 134 are numbered 1334-1 through 1334-2. These windows may be arranged to allow IR light to pass around the outside of agitator 154.

[0117] FIG 16 illustrates a side view of the top of the core module 102, along with the inside of dispenser module 150 and hopper module 170. FIG. 16 shows IR LEDs 132-1 through 132-3 and IR sensors 134-1 through 134-2. Light from IR LED 132-1 passes through window 1332-1 through the top of the core module case 106. As shown in FIG. 16, hopper module 170/dispenser module 150 have a light pipe 1350 that enables light to pass through and treat items in hopper 170 and then exit due to the angled surface 1352 such that the light passes through the hopper module 170 toward light pipe 1360 which has an angled surface 1362 to route light through light pipe 1360 toward window 1334-1 and then towards light sensor 134-1. If the level of the dispensed items 156 is high enough, light path 1370 crossing through hopper module 170 may thus be blocked to indicate that there is at least a certain level of dispensed items 156 in hopper module 170. The CPU of chip 302 of core module 102 may control the turning on and off of the various IR LEDs 132-1 through 132-3 and when to read IR sensors 134-1 through 134-2. As pet 920 may be knocking device 101 (within system 400) around into various orientations, the motion and compass sensing devices 346 of FIG. 3 may be used by the CPU of chip 302 under control of software to determine a time to measure the contents of hopper module 170 when hopper module 170 is reasonably upright and stationary, and/or to make adjustments for when the device is tilted.

[0118] FIG 16 also shows a mechanism for detecting if a treat has been dispensed. IR LED 132-2 emits light through window 1332-2 that then proceeds to a mirror 1370 which reflects that light back through window 1334-2 to sensor 134-2. In this way if an item 156 is dispensed, that dispensed item 156 will interrupt the path of the light beam and may then be detected by CPU 302 and via software. In this instance, LED 132-3 is not being used, but as would be understood by those skilled in the art, by having multiple LEDs and multiple sensors, various light paths may be sensed by sequencing the LEDs and/or when those light paths are detected.

[0119] FIGS. 17 through 25 show an alternative embodiment of the dispensing device, indicated as 1600, which may perform functions similar to that of dispensing device 101. Dispensing device 1600 has a core module 1602 that contains the mechanical and electronic components for controlling the rotation of an agitator drive component in the form of a keyed coupler, such as male key connector 1624. Male key connector 1624 is shown as having a protruding generally-D shaped key, but may have any of a number of other shapes. Any or all of the electronics and sensing features shown in dispensing device 101 (see FIGS. 1 through 16 described above) may be incorporated into core module 1602. Among the capabilities of core module 1602 which may be included is producing sound through optional speaker holes 1629. Device 1600 may also include charging base 1640 having optionally signal pins 1642 to enable charging and/or communicating with core module 1602. This embodiment of charging base 1640 may have a connector input 1644 for a cord such as well-known USB micro-B although it will be understood by those skilled in the art that other connectors and cables may be substituted in place of the USB micro-B. Charging base 1640 may also be considered separate from dispensing device 1600 in that device 1600 may be used independent of base 1640. As shown in FIGS. 17 and 18, device 1600 also has an item dispensing module that includes agitator 1654 which rotates about a rotational axis (agitator 1654 being shown in FIGS. 17 and 18 as rotating about a generally vertical axis when in an upright configuration), and is shown as having a top surface 1655 (which may be, for example, generally conically shaped as shown or may have other shapes), and one or more item receiving receptacles in the form of, for example, as a plurality of cavities 1656, and which are shown as being spaced apart around or along the perimeter of agitator 1654. See also FIGS. 21 and 22 which show other views of agitator 1654. In some embodiments, cavities 1656 may be roughly be the size of a single treat to be dispensed. Cavities 1656 are big enough to at least allow an individual pet treat 156 to be received and dispensed, as described below. To receive and dispense a single treat, cavities 1656 may be large enough to dispense all or most of one treat but smaller than two treats. In some embodiments of agitator 1654, conically-shaped top surface 1655, which helps in guiding treats 156 into the cavit(ies) 1656, may be omitted. In some embodiments of device 1600, agitator 1654 may have different and interchangeable variants having different sizes, shapes, configurations, *etc.*, to, for example, to dispense different size treats, different amounts of treats, *etc.*

[0120] In device 1600, the item dispensing module also has a hopper 1670 which includes an opening in the form of hole 1672 positioned so as to align which each of cavities 1656 as

agitator **1654** is rotated so that the respective cavity **1656** is adjacent thereto and facing hole **1672**, as well as sized so that hole **1672** allows treat(s) within a respective cavity **1656**, when adjacent to and facing hole **1672** to come out, thus performing generally the same function as hole **158** for device **101**, as described above. See **FIG. 18** which shows a view of device **1600** with male key connector **1624** and agitator **1654** rotated approximately 90° (relative to the orientation shown in **FIG. 17**) about their common rotational axis wherein one of cavities **1656** is now positioned adjacent to and facing hole **1672** for dispensing any treat within this cavity **1656** therethrough. In device **1600**, hopper **1670** is also configured so as to mate with, connect with, *etc.*, core **1602** to enable rotation of agitator **1654** about its rotational axis. This mating may be achieved, for example, by using any type of fastener, which may include screws, a bayonet-like or dimple type connection, *etc.*, as would be well known those skilled in the art. Hopper **1670** may also include wiper **1676** which has at least a portion thereof which follows and conforms at or near to top surface **1655** of agitator **1654**. See also **FIG. 19** where wiper **1676** is also shown as being as wide as hole **1672** and having a width the same or similar as cavity **1656** of agitator **1654**, as well as partially protruding through hole **1672** and outside of hopper **1670**. Wiper **1676** may have ridges, may be held at an angle, may be flexible and bend to brush along the top surface top **1655** of agitator **1654**. Wiper **1676** may have a spring mechanism to flexibly hold it in place or there may be enough flexibility in the material comprising wiper **1676** that a separate spring may not be required. An optional lid **1678** may also be included to close off hopper **1670** when device **1600** is used as a standalone dispenser. For example, lid **1678** may not be required with device **1600** when installed in, for example, a ball-shaped or egg-shaped system **400** where the top of outer shell **410** also acts as a lid to keep the treats in hopper **1670**.

[0121] **FIG. 20** shows an alternate embodiment of wiper **1670**, indicated as **1677**. Wiper **1677** comprises a plurality of smaller brush-like elements to provide a wiper which may be more flexible, with this added flexibility of wiper **1677** potentially preventing jamming of dispensed items **156** (*e.g.*, especially if items **156** are irregularly sized) against wiper **1676** or **1677** as agitator **1654** rotates. Other variants of wiper **1670** besides wiper **1677** shown in **FIG. 20** may also be used. Wipers **1676** or **1677** need not be as wide as is shown in **FIGS. 17** through **20**. Instead, the minimum width of wiper **1676** or **1677** is a function of the size of treats **156** to be dispensed, the size of hole **1672**, the size of each cavity **1656**, *etc.* Wiper **1676** or **1677** should be wide enough to prevent treats **156** from falling through hole **1672** if a cavity **1656** is turned so as to be adjacent to and facing hole **1672**. As will be explained in

more detail below, without wiper **1676** or **1677**, multiple/many treats **156** in hopper **1670** may fall out uncontrollably when cavity **1656** rotates past hole **1672**.

[0122] **FIG. 23** is a bottom view of agitator **1654** which shows one embodiment of a female locking connector, indicated as **1685**. Female locking connector **1685** is generally D-shaped and may fit or mate only in one way, orientation, configuration, *etc.*, with a male generally reciprocal D-shaped key connector **1624** (see **FIGS. 17** and **18**). Although not shown, male key connector **1624** and female lock connector **1685** may be provided with detents, magnets, other mating connections, *etc.*, to hold them together in a mated configuration. Because female lock connector **1685** may only mate in one way, orientation, configuration, *etc.*, with male key connector **1624**, the rotational orientation configuration, *etc.*, of agitator **1654** will be restricted and the same for the drive electronics. With some agitators **1654** and in some applications, it may be desirable to know exactly how agitator **1654** is rotationally oriented configured, *etc.*, about its rotational axis, which is provided by agitator **1654** having female lock connector **1685** oriented configured, *etc.*, exactly due to corresponding shape of male keyed lock connector **1624**.

[0123] With other agitators **1654** and in other applications, it may be desirable to provide some flexibility in how agitator **1654** is rotationally oriented, configured, *etc.*, about its vertical rotational axis. **FIG. 24** illustrates an alternative embodiment of the agitator, indicated as **2354**, having a generally and somewhat triangularly-shaped female lock connector with three rounded corners connected by three relatively straight edges, indicated as **2385**, which provides a locking configuration with 3-way symmetry such that female lock connector **2385** may mate in 3 different orientations, configurations *etc.*, with male keyed connector **1624**. In other words, with female lock connector **2385**, agitator **1654** may be connected, mated, *etc.*, in any of 3 different orientations, configurations, *etc.*, by male keyed connector **1624**.

[0124] **FIG. 25** illustrates dispensing device **1600** in operation when in a tilted configuration. Hopper **1670** and core **1602** are shown in **FIG. 25** connected together with agitator **1654** being within or inside hopper **1670** and driven by keyed connector **1624** of core **1602**. (Wiper **1676** is shown as being somewhat visible behind treats **2456**.) As especially shown in **FIG. 25**, the entire assembly of device **1600** may be in a somewhat tilted configuration, relative to the vertical axis, indicated by dashed line **2410**, when device **1600** when in an upright (non-tilted) configuration. The rotational axis of device **1600** in this tilted configuration is indicated by dashed line **2420** (also referred to herein interchangeably as the

“tilt axis”). The rotation of device **1600** about tilt axis **2420** (in either the clockwise or counterclockwise direction) is indicated by double headed arrow **2422**. The degree of tilt (also referred to herein interchangeably as the “tilt angle”) of device **1600** from vertical axis **2410** to tilt axis **2420** is further indicated by curved arrow **2424**. **FIG. 25** thus shows that device **1600** may operate satisfactorily to dispense treats, even if the entire assembly of device **1600** is tilted (for example, to the extent of tilt angle **2424**) such as might occur with, for example, a bottom weighted system **400** sitting on the carpet, leaning against an object (*e.g.*, table, chair, sofa, *etc.*), *etc.* For example, **FIG. 25** shows a treat **2496** that fits within cavity **1656** and which is adjacent to and facing hole **1672** so that treat **2496** may pass therethrough. Cavities **1656** may be shaped such that when agitator **1654** is rotated about its rotational axis, the treat fits within cavity **1656** and may be lightly pressed against the side of hopper **1670** for a wide range of semi-upright orientations, but when cavity **1656** is adjacent to and facing hole **1672** (as shown in **FIG. 25**), the treat may still fall out through hole **1672**. When cavity **1656** is in the orientation, configuration, *etc.*, shown in **FIG. 25**, one of the functions of wiper **1676** (or wiper **1677** in other embodiments) may be to keep the rest of treats **2456** from then filling cavity **1656** and subsequently falling out uncontrollably through hole **1672**. Instead, only the one treat **2496** in cavity **1656** may fall out as cavity **1656** rotated adjacent to and facing hole **1672**. In this orientation, configuration, *etc.*, other cavities **1656** (not shown) may be filling with treats **2456** and cavity **1656** may be filled with a **2456** treat after cavity **1656** rotates past wiper **1676**.

[0125] As agitator **1654** rotates, another function of wiper **1676** is to keep a fixed amount of treats (for example, a single treat) from filling a cavity **1656**. As cavity **1656** with a treat rotates prior to being the position shown in **FIG. 25**, gravity may cause multiple treats to stack up on top of each cavity **1656**. As each cavity **1656** with its treats rotates near or proximate hole **1672**, wiper **1676** may scrape/wipe off the additional treats from the top of cavity **1656** such that these treats may tend to flow on top of wiper **1676** and be blocked. Thus, wiper **1676** may control how much each cavity **1656** fills before it reaches a position adjacent to and facing hole **1672**. Accordingly, in some instances, a single treat might be the desired result, but if cavity **1656** is bigger and/or if treats **2456** are smaller, a measured “dose” of treats, food, other items, *etc.*, may be dispensed through hole **1672** from hopper **1670**.

[0126] A flexible wiper **1676** may also help prevent jamming in the case of irregular shaped treats. In some uses, it may be better that occasionally a little too much treat is

dispensed rather than cause device **1600** to jamb up which may cause all dispensing of treats to stop until cleared by the human operator. If agitator **1654** rotates continuously, one treat after another may fall into a cavity **1656** and then be rotated around past wiper **1676** and then adjacent to and facing hole **1672** where it may fall out. Dispensing of treats may also occur whether agitator **1654** rotates clockwise or counterclockwise about its rotational axis. It may also be possible for dispensing device **1600** to work by alternately being rotated in one direction and then being reversed to rotate in the other direction. Even if agitator **1654** rotates primarily in one direction for dispensing treats, it may help to prevent jamming by slightly reversing the direction of rotation occasionally or before or after each treat is dispensed. The dispensing may be somewhat more reliable if the electronics in core **1602** make a cavity **1656** stop adjacent to and facing hole **1672** to let the treats fall out rather than having the treats fall out as cavity **1656** passes by hole **1672**. Having agitator **1654** with a bottom keyed (for example, as shown in **FIGS. 23** and **24**) relative to the cavities **1656** will allow the electronics to know the position of agitator **1654**.

[0127] While not required for all embodiments, the conically shaped top surface **1655** of agitator **1654** may help direct treats **2456** into cavities **1656** whether device **1600** is upright or tilted. Top surface **1655** of agitator **1654** may also be relatively smooth, may have bumps and/or grooves, *etc.*, in it to help stir/agitate the treats and to help keep them flowing into cavities **1656** as agitator **1654** spins or otherwise rotates about. Dispensing device **1600** may also work whether or not core **1602** keeps exact control over the orientation of agitator **1654**. An uncontrolled (“dumber”) core **1602**, for example, may just spin or rotate for a fixed amount of time and have one or two treats come out hole **1672**. Conversely, a more precise dispensing of treats may occur if the amount and rotation/orientation of agitator **1654** is more precisely controlled.

[0128] **FIG. 26** shows an alternative embodiment of the ball-shaped outer protective shell of **FIG. 8**, indicated as **2500**, which encloses the core module **1602** and hopper **1670** of dispensing device **1600**, and which has a hemispherical top portion **2502** and a hemispherical bottom portion **2504**. Shown inside protective shell **2500** is dispensing device **1600**. Top portion **2502** has a coupling element for securing top portion **2502** to bottom portion **2504** in the form of, for example, a bayonet mount slot **2510** with locking dents **2512**, as shown in **FIGS. 26** and **27**. Top portion **2502** also has an upper inner hemispherical hard shell **2522** while bottom portion **2504** has a lower inner hemispherical hard shell **2524**. Top portion **2502** also includes a plurality of outer upper soft ribs **2526** attached to the outer surface of

inner hard shell **2522**, while bottom portion **2504** also has a plurality of outer lower soft ribs **2528** attached to the surface of hard shell **2524**. Hard shells **2522** and **2524** maintain the shape of protective shell **2500** and keep the pet from being able to get to the dispensing device **1600**. Soft ribs **2526** and **2528** are configured and attached, respectively, to hard shells **2522** and **2524** so as to act as more gentle bumpers when protective shell **2500** is contacting floor, furniture and similar hard objects and to soften the effects on protective shell **2500** and objects protective shell **2500** comes into contact with. Top portion **2502** and bottom portion **2504** of protective shell **2500** may be fabricated, for example, by a molding process known as “double-shot” molding that allows two or more dissimilar materials (for example, a harder material such as that used to form shells **2522** and **2524**, and a softer material such as that used to form ribs **2526** and **2528**) to be molded together.

[0129] FIG. 27 provides another view of top portion **2502** which shows in greater detail the bayonet mount slot **2510** with locking dents **2512**. Support ring **2550** which is similar to the support ring **432** of FIG. 4 described above is also provided. Ring **2550** both holds dispensing device **1600** in place and keeps treats **2456** from falling out. Further shown in FIG. 27 is an optional lid **2554** that also acts to restrict the motion of dispensing device **1600** as protective shell **2500** is moved. Instead of lid **2554**, dispensing device **1600** and treats **2456** may be held in place by the inside or inner surface of top portion **2502**.

[0130] FIG. 28 illustrates an alternative embodiment of feeder **1100** and which is indicated as **2700**. Feeder **2700** has a food hopper **2702** with a hopper bottom **2704**, a base support **2706** with spout **2720**, and a lid **2710**. Feeder **2700** also has a feeding agitator **2750** and a feeding wiper **2754**. The same core **1602** as shown in FIG. 17 may also be used to drive and rotate feeding agitator **2750** about its rotational axis, provided that the bottom of feeding agitator **2750** has a female locking connector such as **1685** (shown in FIG. 23) or **2385** (shown in FIG. 24) which may be mated to a male keyed coupler **1624** (not shown in FIG. 28). Many of the components of feeder **2700** may scaled up versions of similar components of dispensing device **1600** to provide more capacity and/or to dispense more food/treats and/or at a faster rate. The food (not shown) that goes into hopper **2702** may be kibbles or other food shapes that are larger or smaller than those used in dispensing device **1600**. In operation, feeder **2700** works similarly to dispensing device **1600**, as described with respect to FIG. 25.

[0131] FIG. 29 illustrates some of the internal components of feeder **2700** in more detail. In particular, feeder **2700** is shown as having a hopper bottom **2704** with a neck **2760**

provided with hole 2764 and a wiper 2754 that fits into neck 2760 above hole 2764. Also shown is core 1602 with male keyed coupler 1624 for connection to a female lock coupler (not shown) in the bottom of feed agitator 2750.

[0132] The feed cavities 2752 in feed agitator 2750 may be bigger to enable larger and/or more treats/food to be dispensed each time a feed cavity 2752 passes by opening 2764. In other embodiments, cavities 2752 in agitator 2750 may be of a different shape that would aid in dispensing different shapes or amounts of food/treats or other items. For example, the treats/food may be of a shape that would fit certain shaped cavities better than others. A benefit of this dispensing system is that it is flexible enough to permit changing out various components such as hoppers and/or agitators, but with the same core being adapted to support dispensing differently.

[0133] One or more embodiments of the device described herein may be implemented as a mobile modular pet system for use with variety of animals, including pets, which may include, for example including dogs, cats, horses, pigs, *etc.* One or more embodiments described herein may also be contemplated for other uses unrelated to pet animals.

[0134] All documents, patents, journal articles and other materials cited in the present application are hereby incorporated by reference.

[0135] Although the present invention has been fully described in conjunction with several embodiments thereof with reference to the accompanying drawings, it is to be understood that various changes and modifications may be apparent to those skilled in the art. Such changes and modifications are to be understood as included within the scope of the present invention as defined by the appended claims, unless they depart therefrom.

[0136] In addition, the purpose of the Abstract of the Disclosure in this application is to enable the U.S. Patent and Trademark Office, as well as the public generally, including any scientists, engineers and practitioners in the art who may not be familiar with patent or other legal terms or phraseology to determine the what the technical disclosure of the application describes. Accordingly, while the Abstract of the Disclosure may be used to provide enablement for the following claims, it is not intended to be limiting as to the scope of those claims in any way.

[0137] Finally, only claims including the express language “means for” or “step for” should be interpreted according to 35 U.S.C. § 112, paragraph 6.

**WHAT IS CLAIMED IS:**

1. A device for dispensing items which is mobile and which comprises:
  - a hopper for storing a plurality of items;
  - an electronic and mechanical core module having;
    - an electronic wireless communications component;
    - an item dispenser drive component;
    - a computer component for controlling the item dispenser drive component; and
    - a power source for supplying power to the computer component, the electronic wireless communications component, and the item dispenser drive component;
  - an item dispensing module having an item dispenser component which is responsive to the item dispenser drive component to cause the items to be dispensed; and
  - a dispensed item receiving module for receiving the items dispensed from the hopper;

wherein the electronic and mechanical core module is configured to receive electronic data instructions for controlling the dispensing of the items from the hopper, and wherein the electronic and mechanical core module causes items to be dispensed by the item dispenser component.
2. The device of claim 1, wherein the electronic and mechanical core module further comprises at least one sensor for detecting motion and/or orientation of the device.
3. The device of claim 2, wherein the electronic and mechanical core module dispenses items in response to sensing that the device has been moved.
4. The device of claim 1, wherein the electronic and mechanical core module further comprises at least one sensor for detecting the proximity of an animal to the device and wherein the electronic and mechanical core module dispense items in response to sensing the proximity of the animal.

5. The device of claim 4, wherein the at least one sensor is an infrared sensor for sensing that the animal is in proximity to the device.
6. The device of claim 5, wherein the infrared sensor senses the proximity of the animal through an RFID signature.
7. The device of claim 6, wherein the infrared sensor is configured to sense different RFID signatures.
8. The device of claim 5, which the electronic and mechanical core module further comprises at least one infrared LED to detect, in combination with the infrared sensor, when the item is dispensed by the item dispensing module.
9. The device of claim 1, wherein the electronic and mechanical core module further includes a speaker.
10. The device of claim 1 wherein the electronic and mechanical core module further comprises a microphone.
11. The device of claim 1, wherein the item dispensing module further comprises a hopper for storing the items to be dispensed.
12. The device of claim 1, where in the electronic and mechanical core module causes the item dispensing module to dispense one item in response to an interaction by the animal with the device.
13. The device of claim 1, wherein the device is shaped and weighted so that in a resting position the device is moderately upright.
14. The device of claim 1, wherein item dispenser component comprises an agitator which moves in response to the item dispenser drive component.
15. A device for dispensing pet items which is movable by a pet and which comprises:

an electronic and mechanical core module having;

a computer component;

an electronic wireless communications component;

a pet item dispenser drive component controlled by the computer component; and

a power source for supplying power to the computer component, the electronic wireless communications component, and the item dispenser drive component;

a pet item dispensing module having a hopper for storing pet items and a pet item dispenser component which is responsive to the pet item dispenser drive component to cause pet items to be dispensed from the hopper; and

a dispensed pet item receiving module for receiving the items dispensed by the item dispenser component; and

an outer shell which encloses the electronic and mechanical core module, and the pet item dispensing module, and which protects the electronic and mechanical core module and the pet item dispensing module from actions of the pet that cause movement of the device.

wherein the electronic and mechanical core module is configured to receive electronic data instructions for controlling the dispensing of the pet items by the pet item dispenser component and wherein the electronic and mechanical core module causes pet items to be dispensed by the pet item dispenser component in response to the pet moving the device.

16. The device of claim 15, wherein the electronic and mechanical core module further comprises at least one sensor for detecting the motion and/or orientation of the device.

17. The device of claim 16, where in the electronic and mechanical core module causes the pet item dispensing module to dispense one item in response to the at least one sensor detecting a movement by the pet of the device.

18. The device of claim 15, wherein the power source comprises a rechargeable battery.

19. The device of claim 15, wherein the outer shell has an oval egg-shaped configuration.
20. The device of claim 15, wherein the pet item dispensing module is configured to dispense the pet items from the hopper into the outer shell and wherein the outer shell includes one or more openings through which one or more of the pet items may exit the outer shell.
21. The device of claim 15, wherein the device is shaped and weighted so that in a resting position the device is moderately upright.
22. A device for dispensing items which is mobile and which comprises:
- an electronic and mechanical core module having;
    - an agitator drive component for imparting movement to an agitator;
    - a computer component for controlling the agitator drive component;
    - and
    - a power source for supplying power to the computer component and the agitator drive component; and
  - an item dispensing module having:
    - a hopper for storing items to be dispensed and having an opening through which the items are dispensed; and
    - an agitator having one or more item receiving receptacles, the agitator being configured to be moved within the hopper by the agitator drive component so that an item in any one of the one or more item receiving receptacles, when adjacent to the opening, is dispensed therethrough;
- wherein the electronic and mechanical core module is configured to receive electronic data instructions for controlling the agitator drive component in rotating the agitator, and wherein the electronic and mechanical core module causes the agitator drive component to impart movement to the agitator in response to interactions by an animal with the device.

23. The device of claim 22, having a rotational axis and wherein the agitator rotates about the rotational axis.
24. The device of claim 23, wherein the agitator has a top surface and wherein the hopper further comprises a wiper having at least a portion thereof which follows and conforms at or near the top surface.
25. The device of claim 24, wherein the top surface is conically shaped to guide the items from the hopper to the item receiving receptacles.
26. The device of claim 24, wherein item receiving receptacles comprise a plurality of cavities, wherein the agitator has a perimeter, and wherein the cavities are spaced apart around the perimeter.
27. The device of claim 26, wherein the cavities are aligned with the opening such that, when the agitator is rotated so that the cavity is adjacent to and facing the opening, any item received by the cavity may be dispensed through the opening.
28. The device of claim 23, wherein the agitator drive component comprises a male key connector and wherein the agitator has a bottom side with a female lock connector for mating with the male key connector.
29. The device of claim 28, wherein the female lock connector is generally D-shaped and where the male key connector has a reciprocal generally D-shape.
30. The device of claim 28, wherein the female lock connector is generally triangular in shape and has three rounded corners connected respectively by one of three straight edges.
31. The device of claim 23, which further comprises a charging base to enable charging and/or communicating with the electronic and mechanical core module.
32. The device of claim 23, which further comprises a ball-shaped outer protective shell having a hemispherical top portion, a hemispherical bottom portion and a coupling element for securing the hemispherical top portion to the hemispherical bottom portion, the ball-

shaped outer protective shell enclosing the electronic and mechanical core module and the item dispensing module.

33. The device of claim 32, wherein top portion includes an upper inner hemispherical hard shell having an outer surface and a plurality of upper soft ribs attached to the outer surface of the upper inner hemispherical hard shell, wherein the hemispherical bottom portion has a lower inner hemispherical hard shell having an outer surface and a plurality of lower soft ribs attached to the outer surface of the lower inner hemispherical hard shell, the upper soft ribs and lower soft ribs being configured to act as bumpers for the ball-shaped outer protective shell.

34. The device of claim 22, wherein the electronic and mechanical core module comprises an electronic wireless communications component and wherein the power source supplies power to the electronic wireless communications component.

35. The device of claim 22, wherein the device is shaped and weighted so that in a resting position the device is moderately upright.

36. A device for dispensing items which is mobile and which comprises:

a hopper for storing a plurality of items;

an electronic and mechanical core module having;

an item dispenser drive component which dispense items when the device is moderately upright;

a computer component for controlling the item dispenser drive component;  
and

a power source for supplying power to the computer component, and the item dispenser drive component;

an item dispensing module having an item dispenser component which is responsive to the item dispenser drive component to cause the items to be dispensed from the hopper; and

an outer shell which encloses the hopper, the electronic and mechanical core module, and the item dispensing module, and which keeps the item dispensing module moderately upright when the device is at rest;

wherein the electronic and mechanical core module controls the dispensing of the items from the hopper by the item dispenser component, and wherein the electronic and mechanical core module causes items to be dispensed by the item dispenser component.

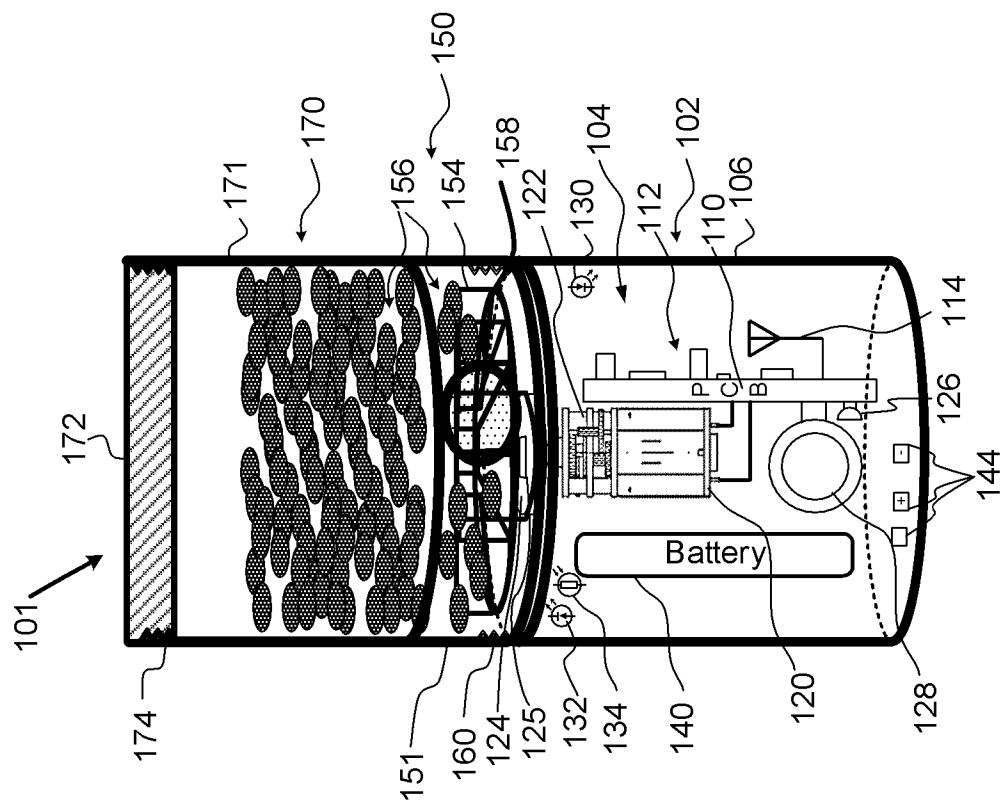
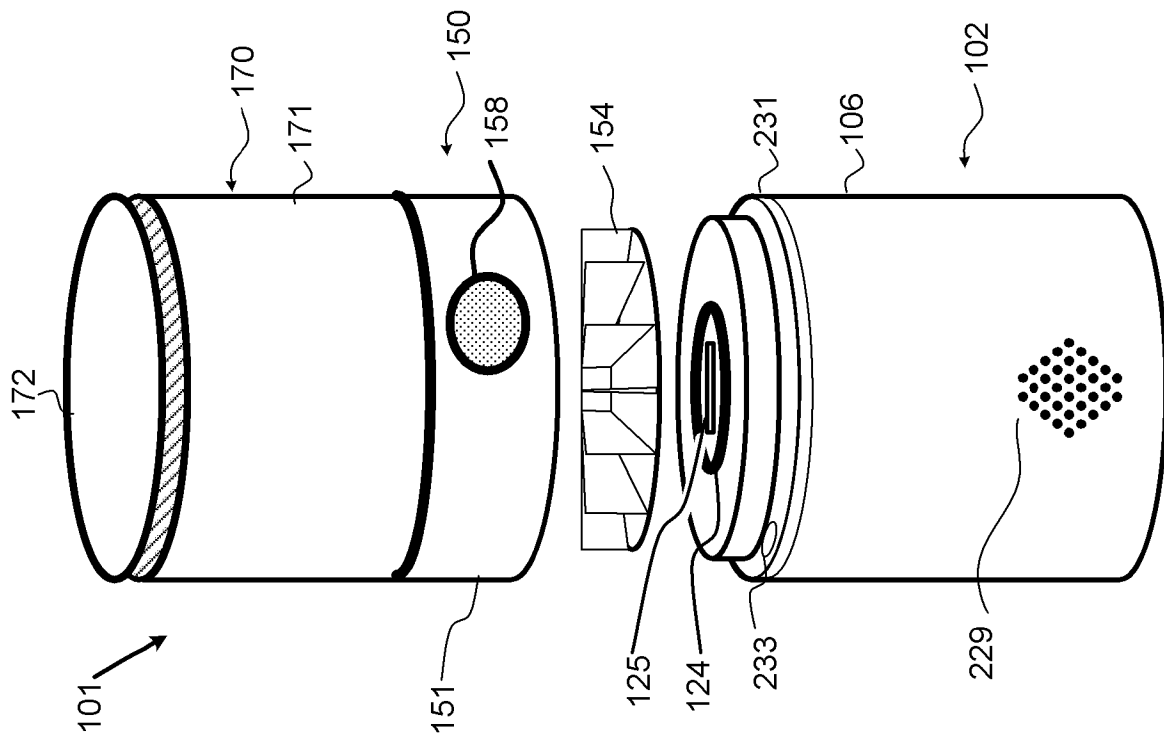
37. The device of claim 36, wherein the outer shell forms a lid for the hopper to keep the items within the hopper.

38. The device of claim 36, wherein the outer shell has an opening formed therein to enable the items dispensed from the hopper to exit therethrough.

39. The device of claim 36, wherein the electronic and mechanical core module causes the item dispenser component to dispense a single item in response to a pet interacting with the device.

40. The device of claim 36, wherein the electronic and mechanical core module controls the rate at which items are dispensed by the item dispenser component.

41. The device of claim 36, wherein the outer shell has a shape and weighting which is configured to keep the device in a moderately upright configuration.



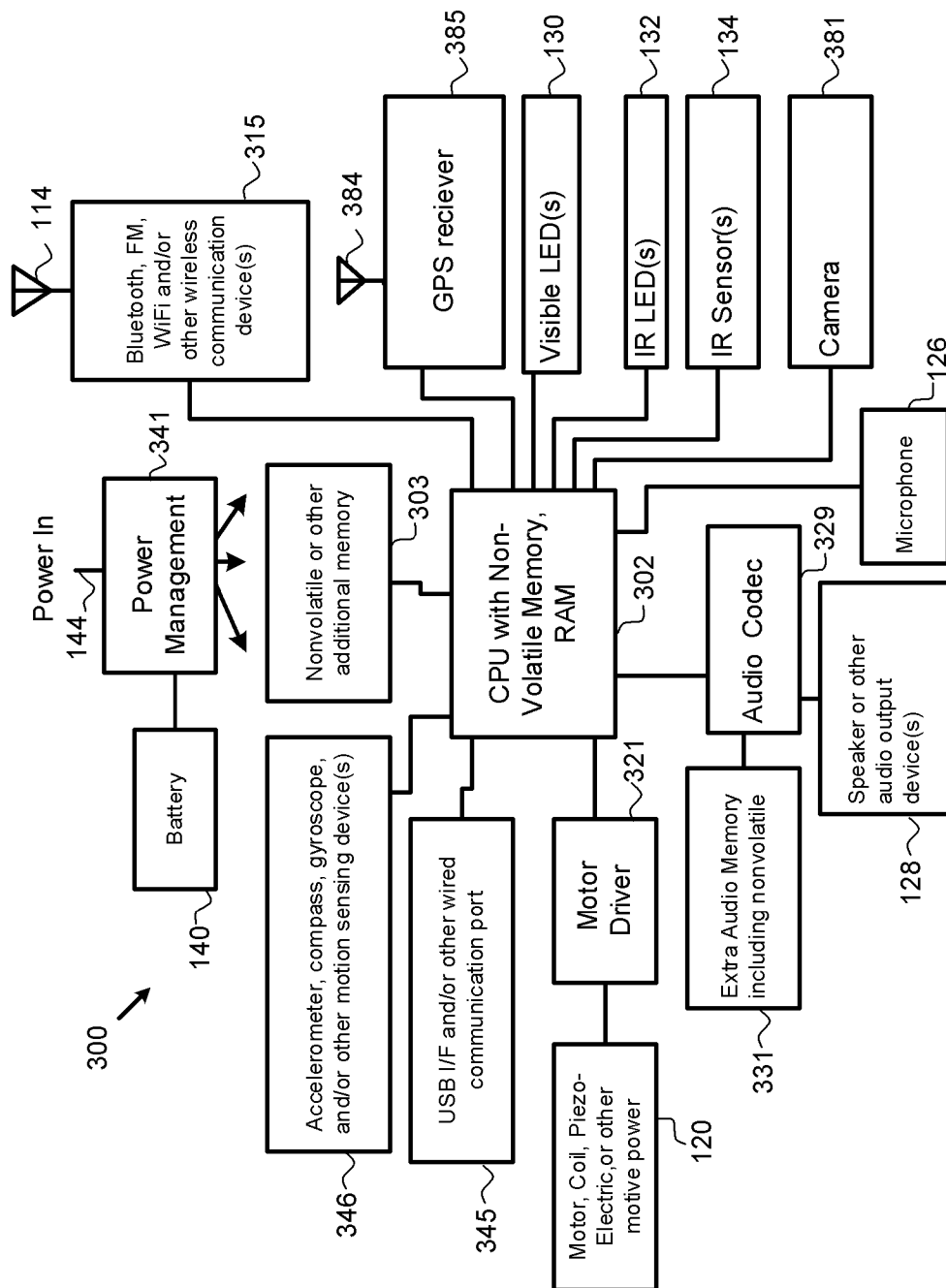


FIG 3

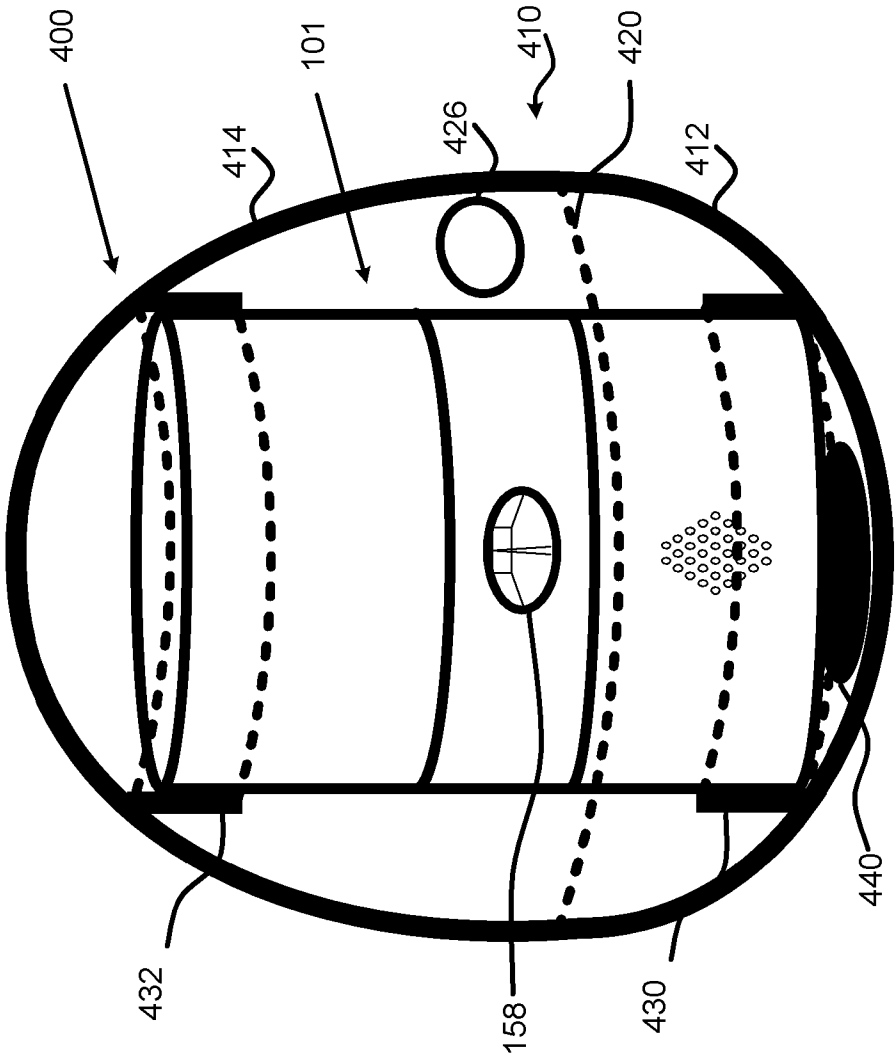


FIG. 4

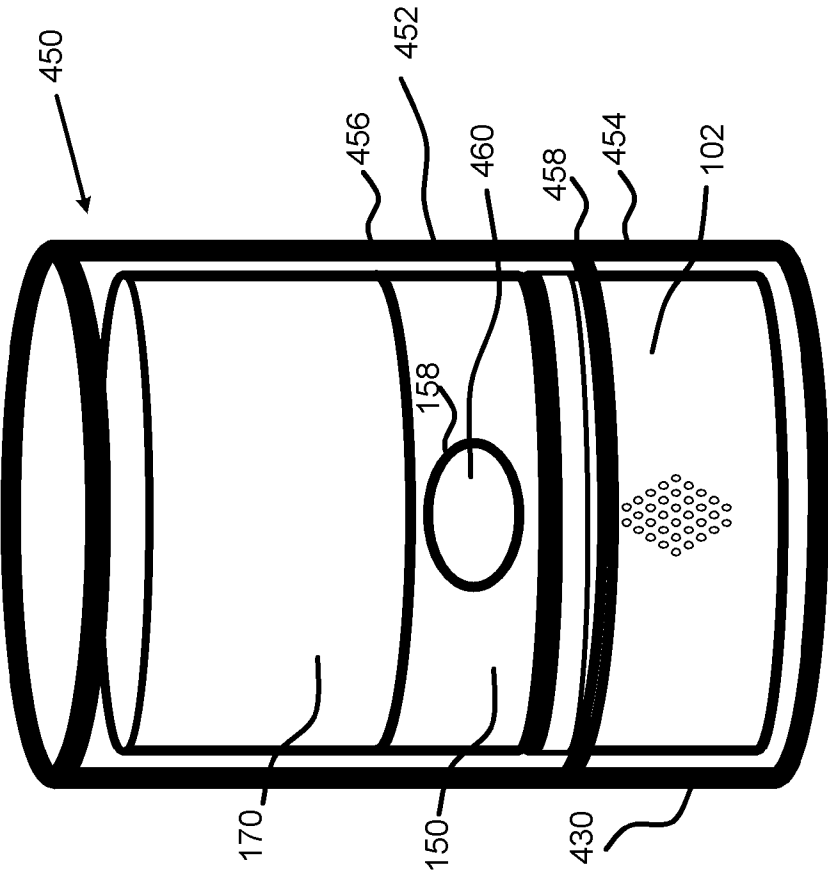


FIG. 5

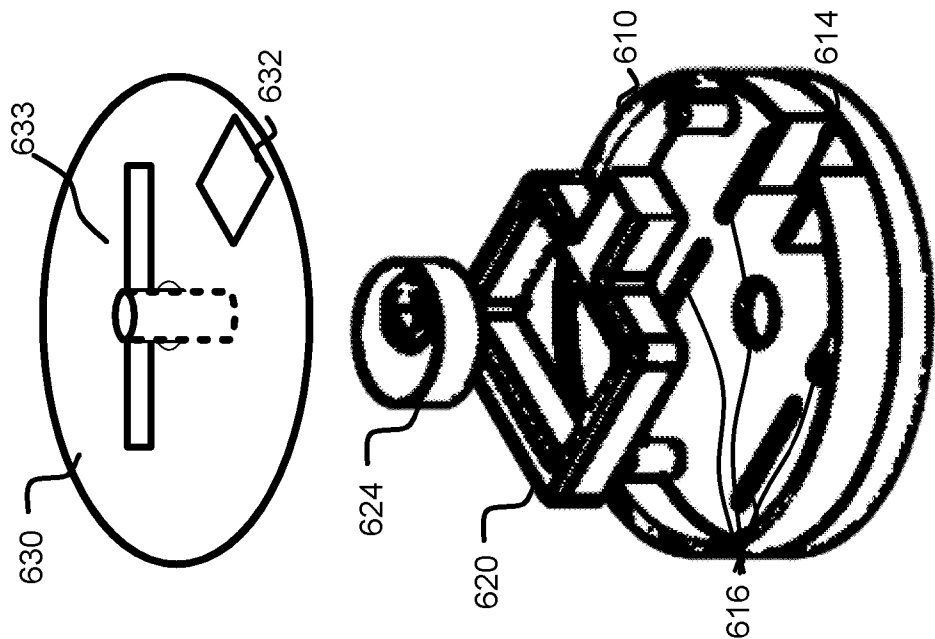


FIG. 7

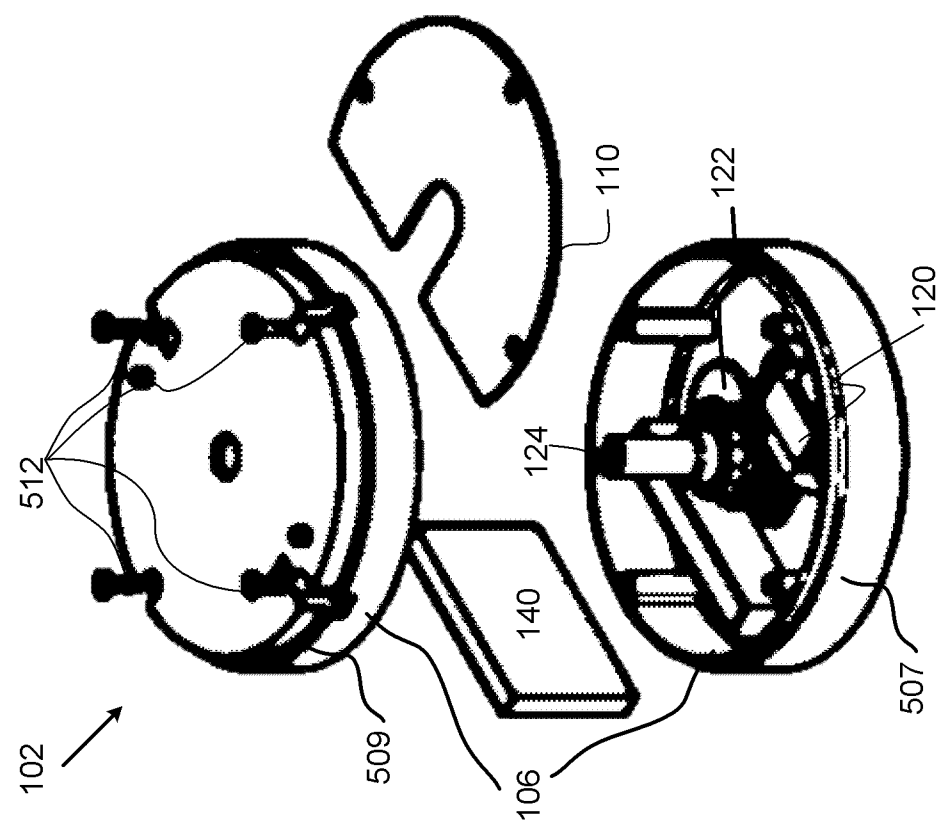


FIG. 6

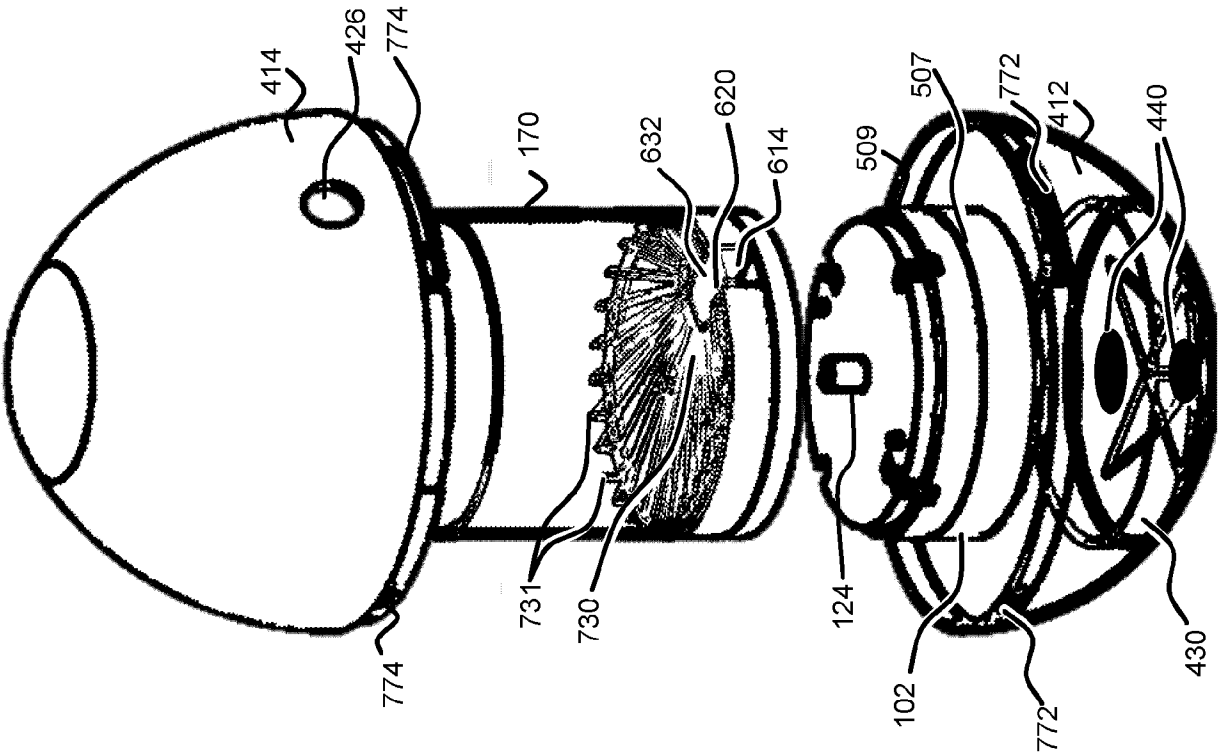


FIG. 8

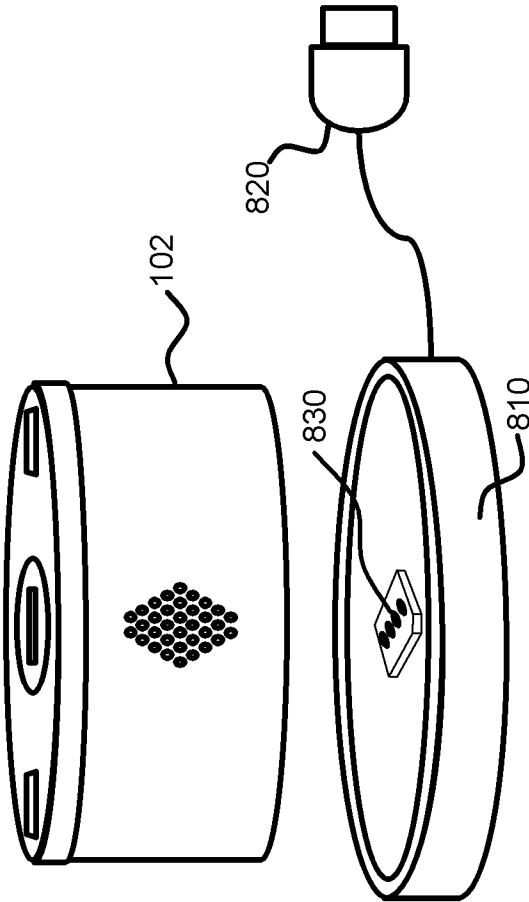


FIG. 9

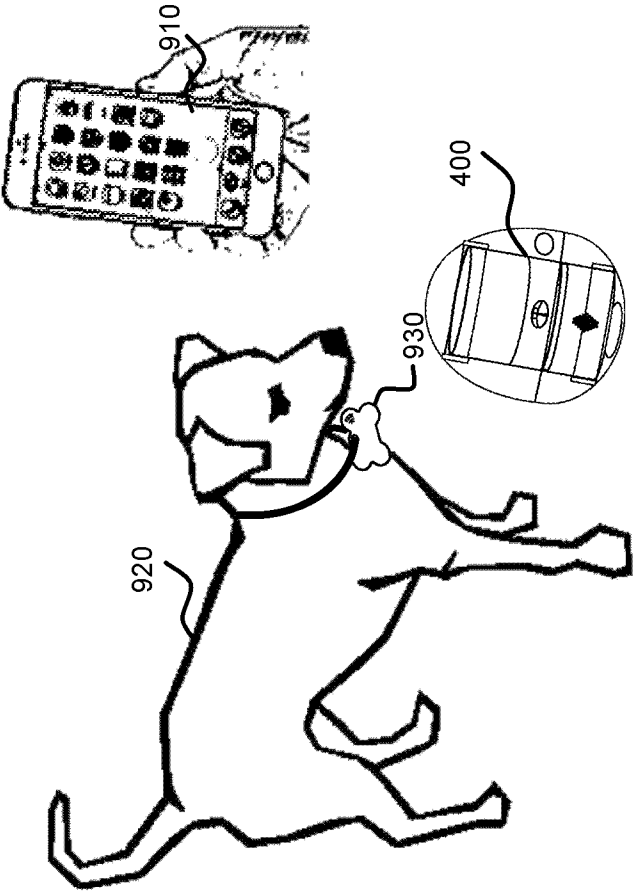


FIG. 10

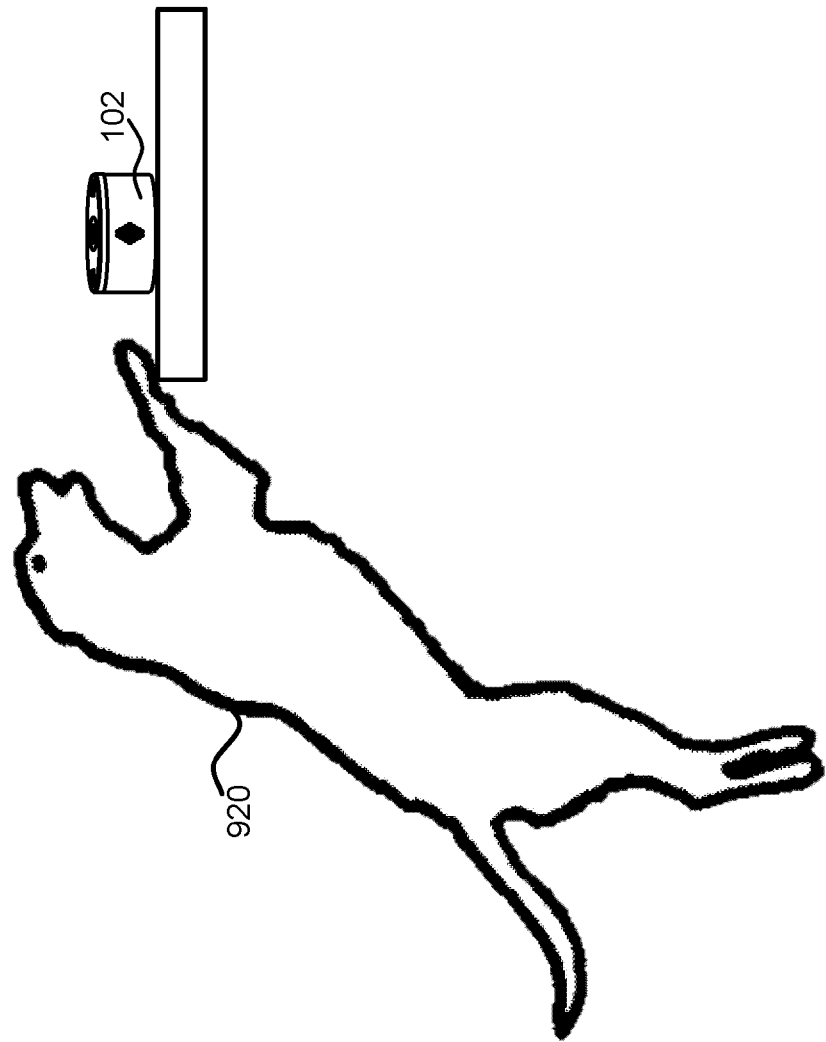


FIG. 11

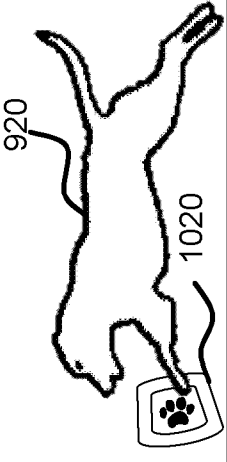


FIG. 12

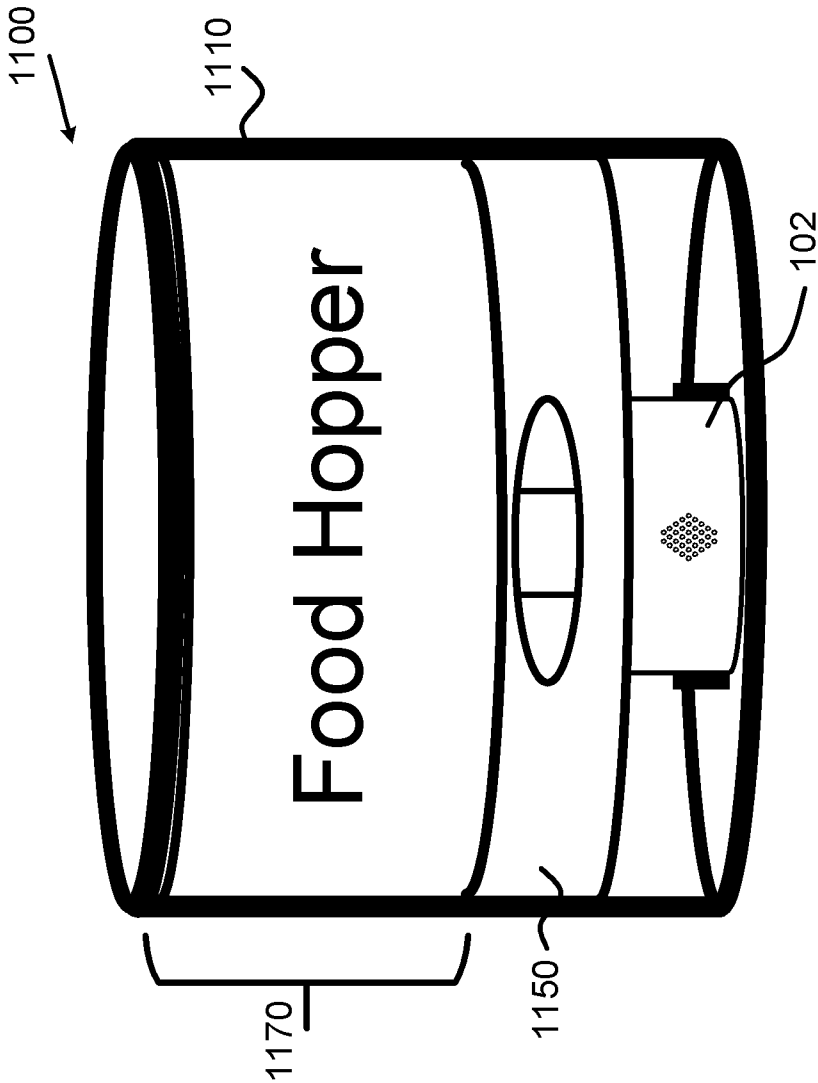


FIG. 13

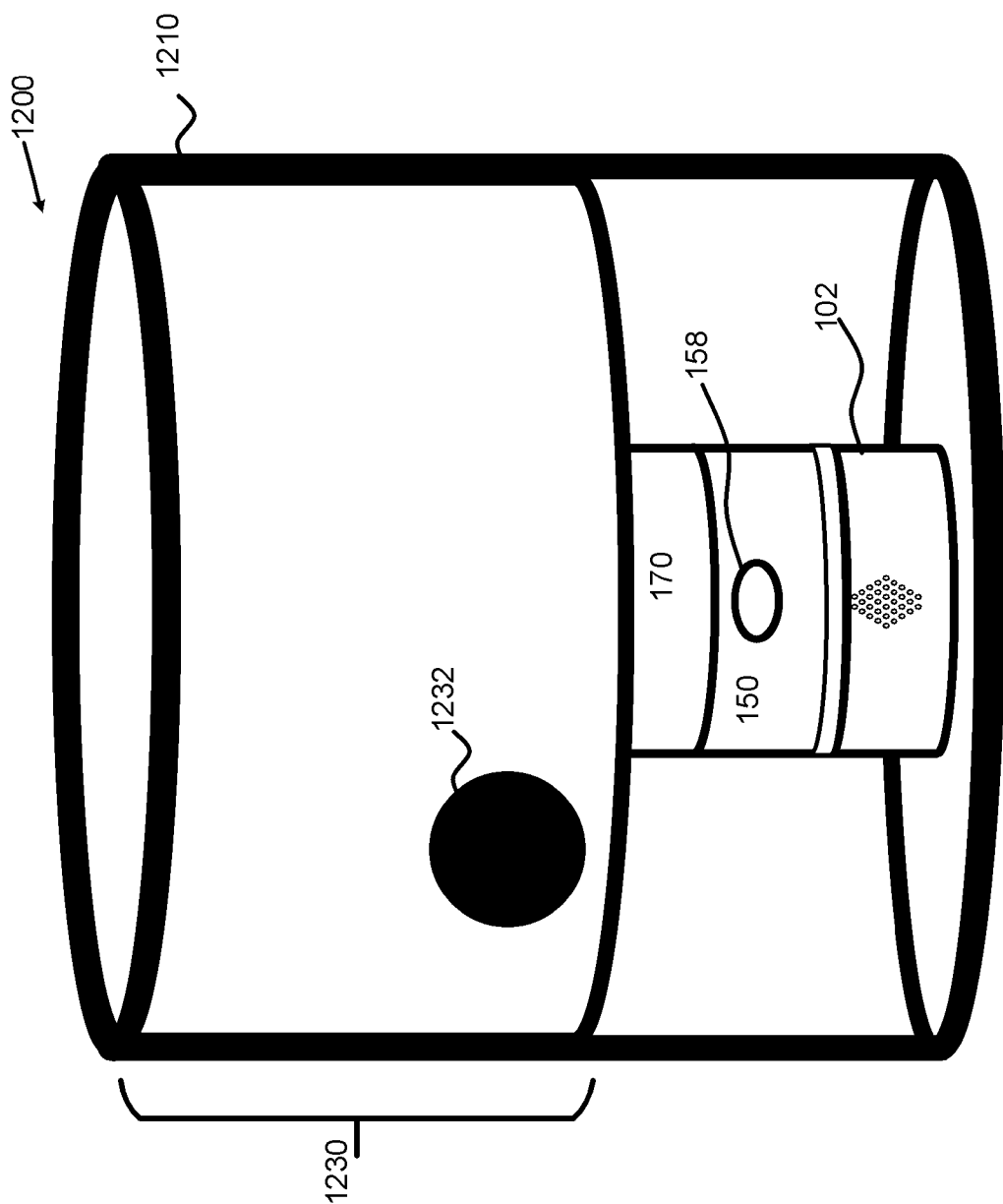


FIG. 14

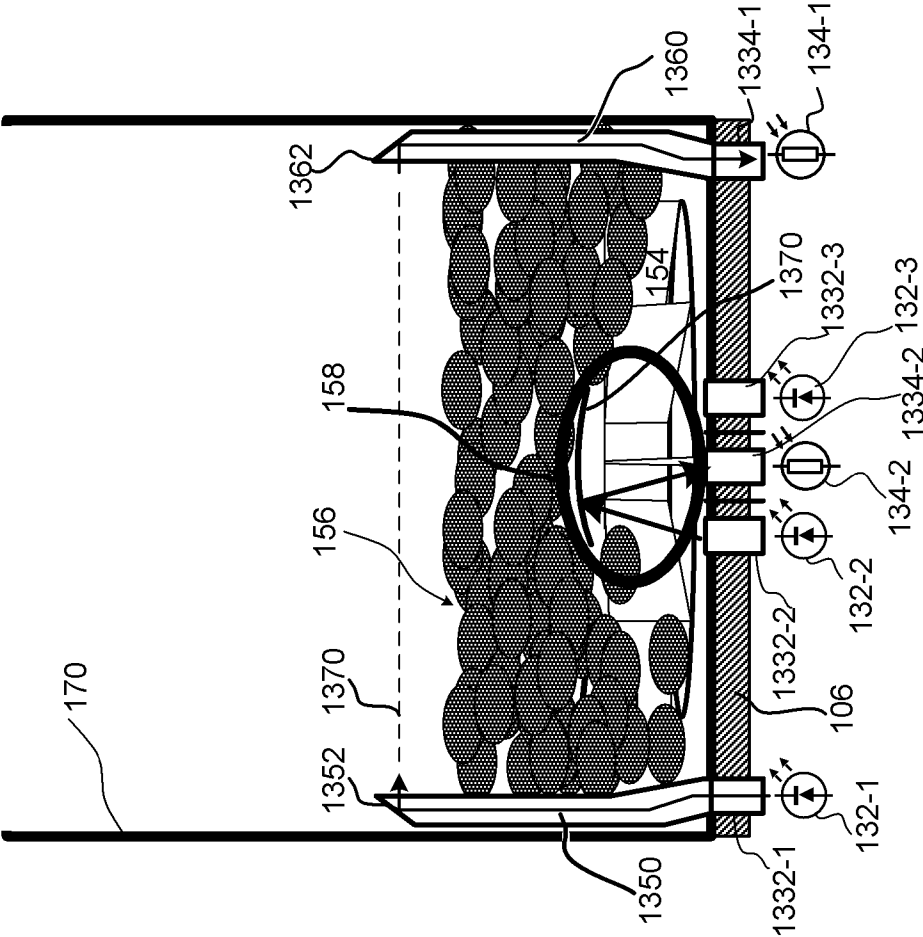


FIG. 16

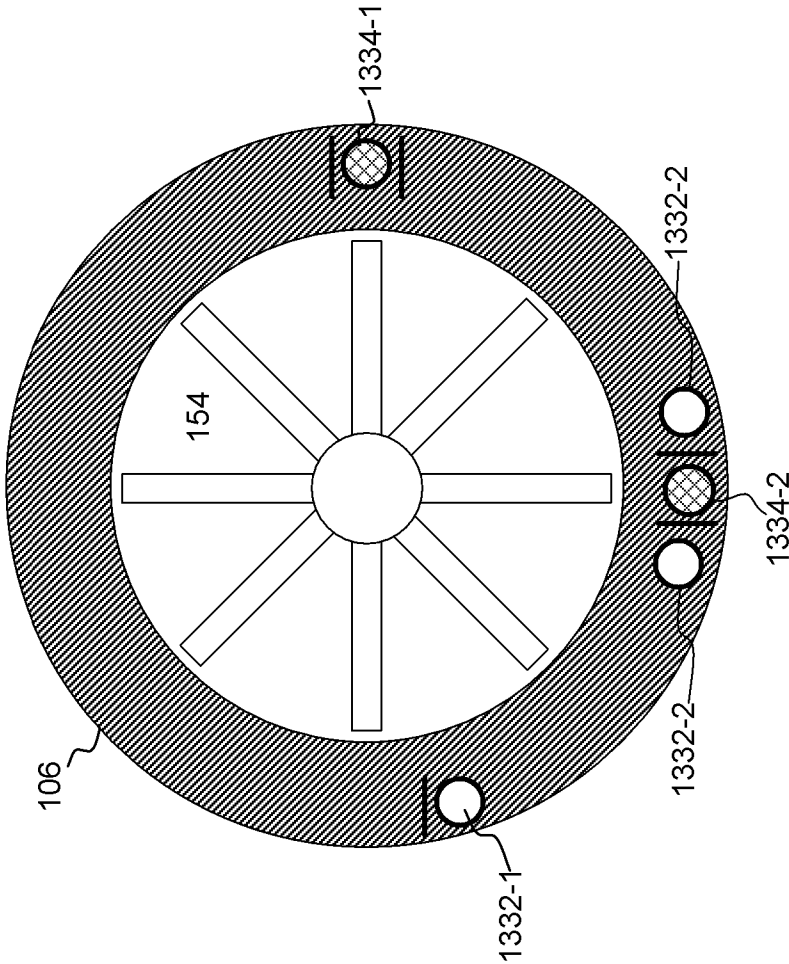


FIG. 15

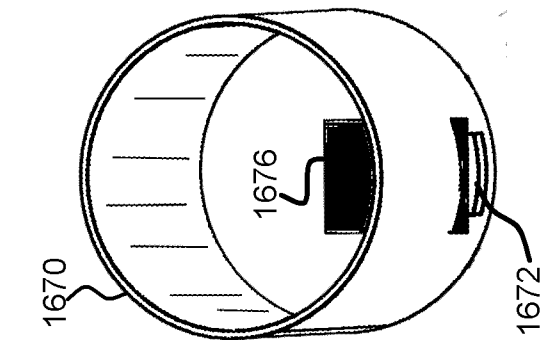


FIG. 19

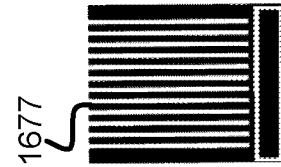


FIG. 20

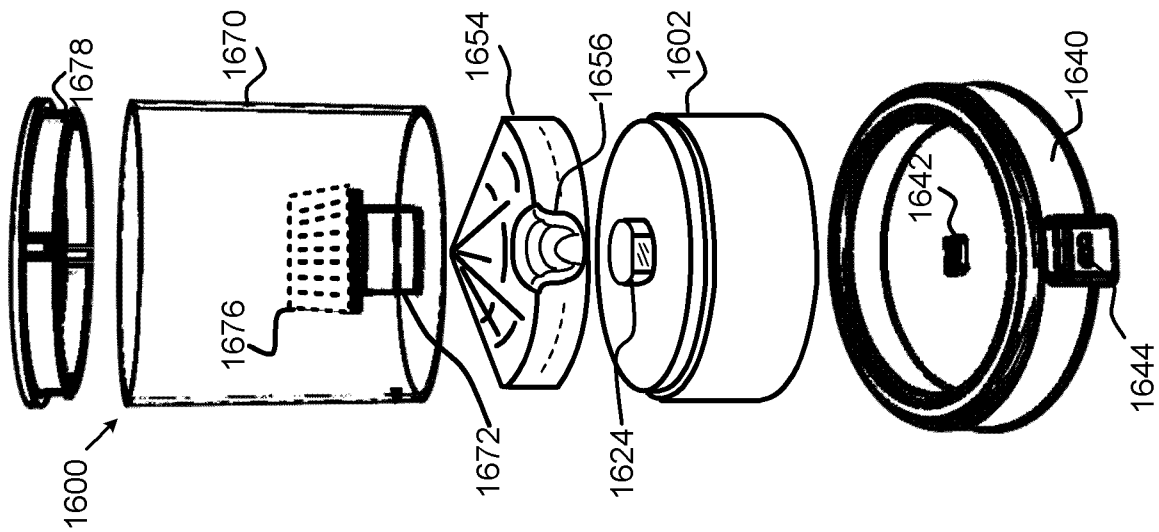


FIG. 18

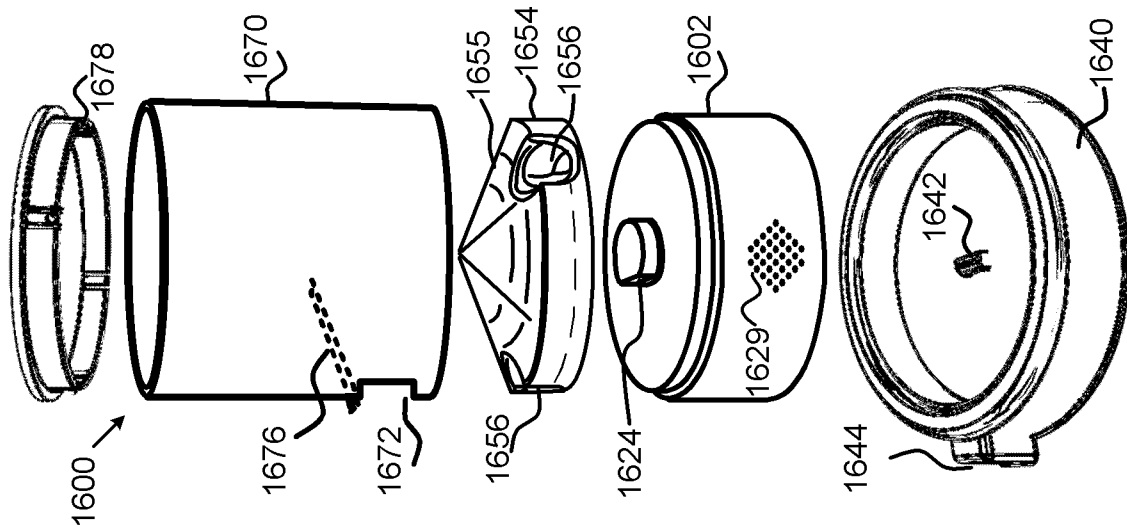


FIG. 17

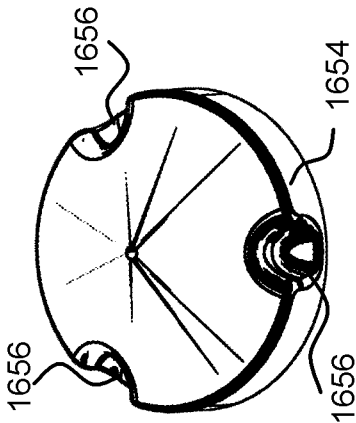


FIG. 21

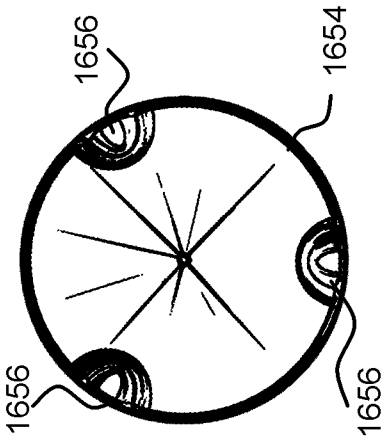


FIG. 22

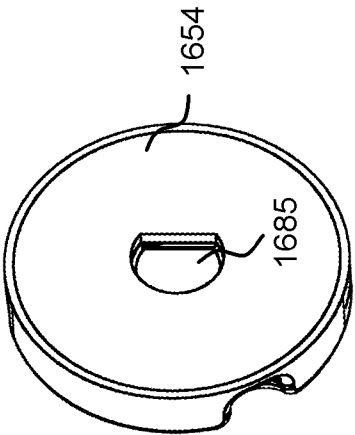


FIG. 23

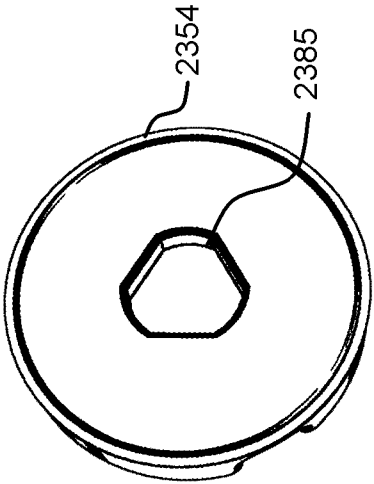


FIG. 24

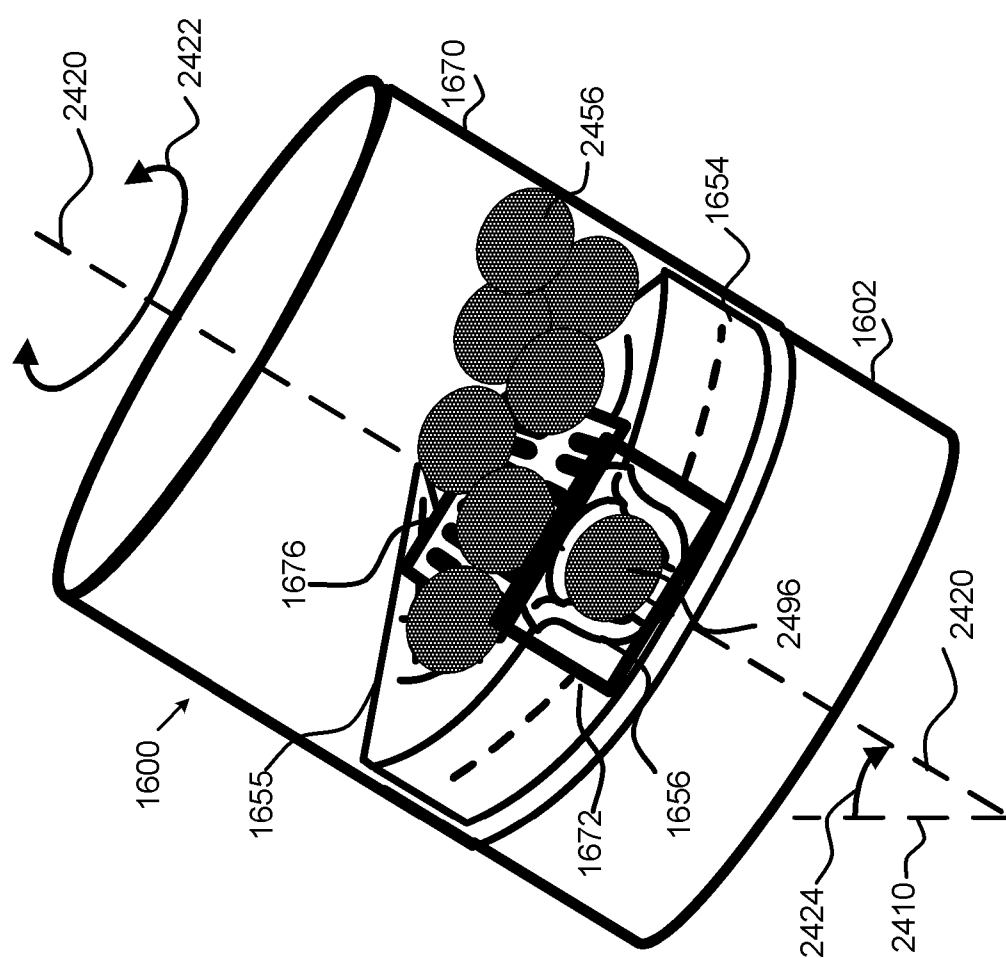


**FIG. 25**

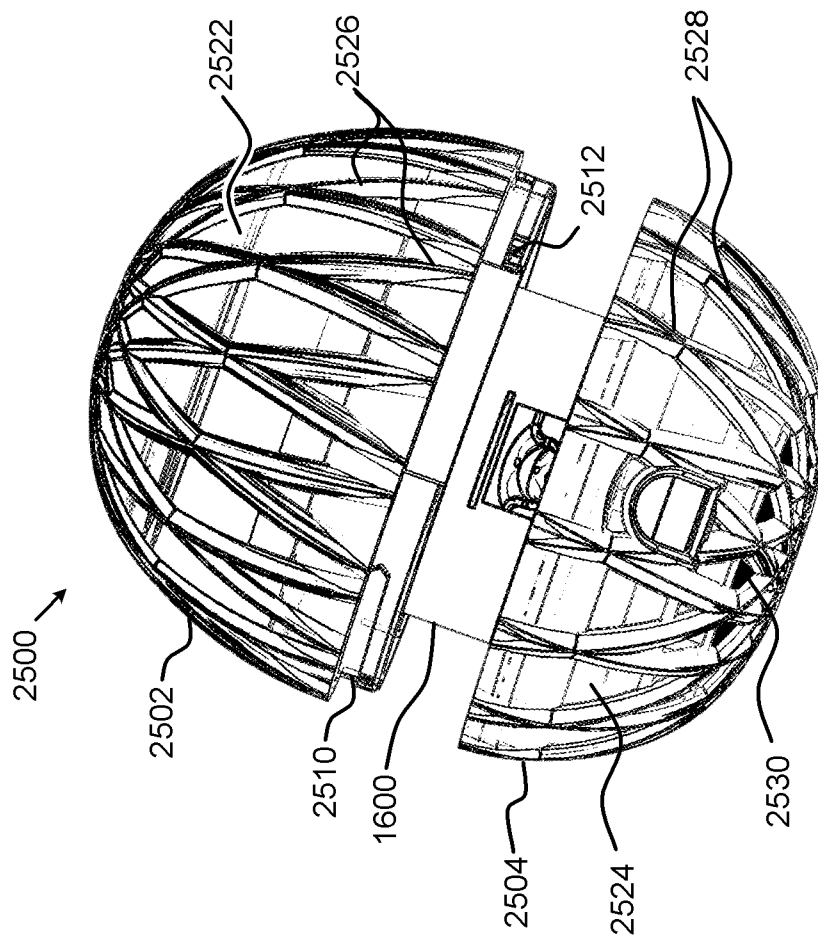


**FIG. 26**

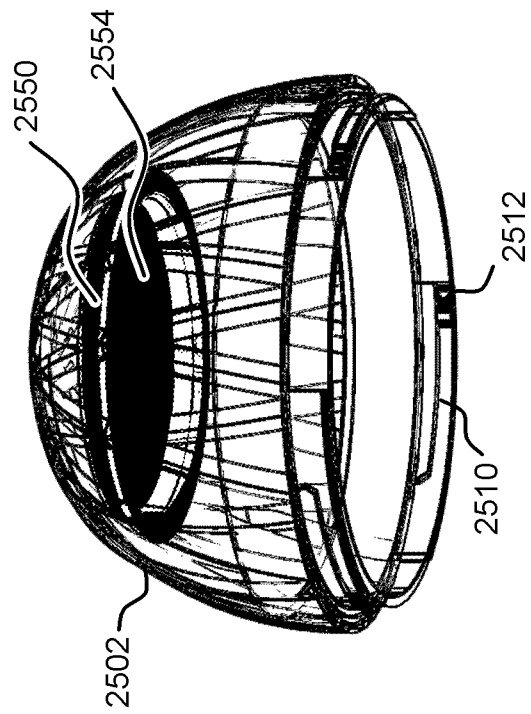


**FIG. 27**

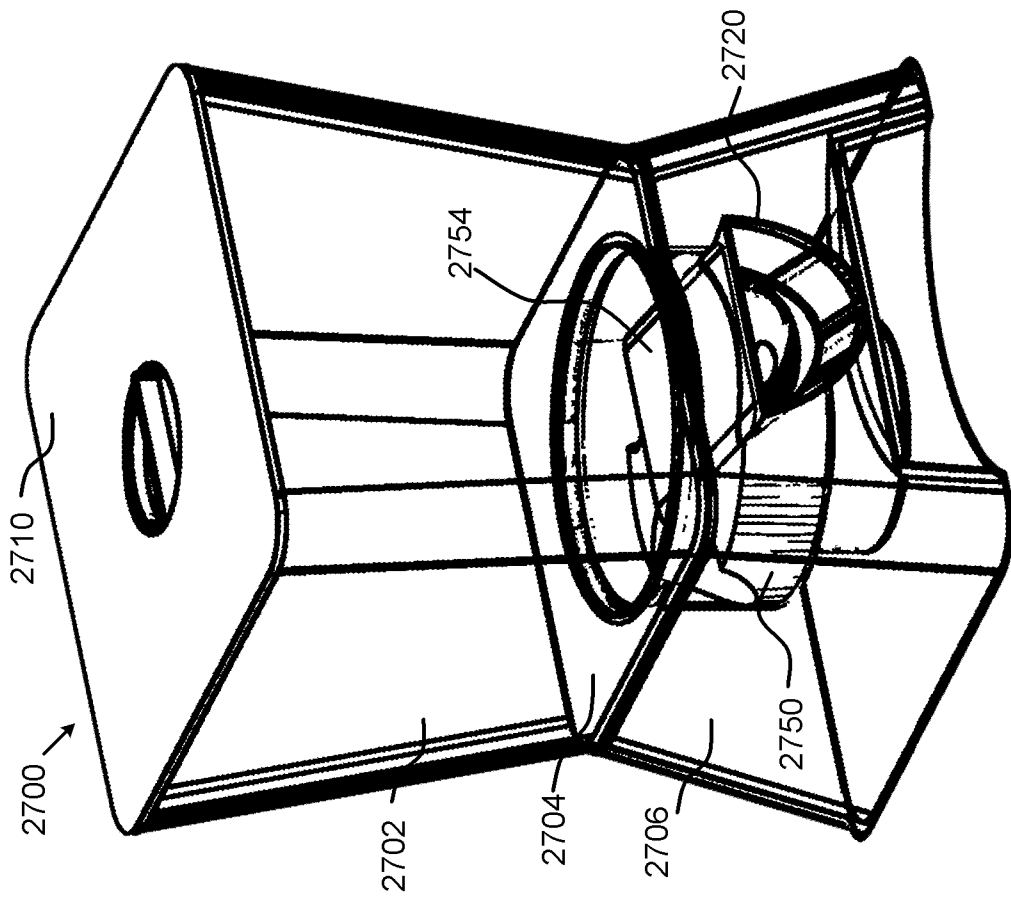


FIG. 28

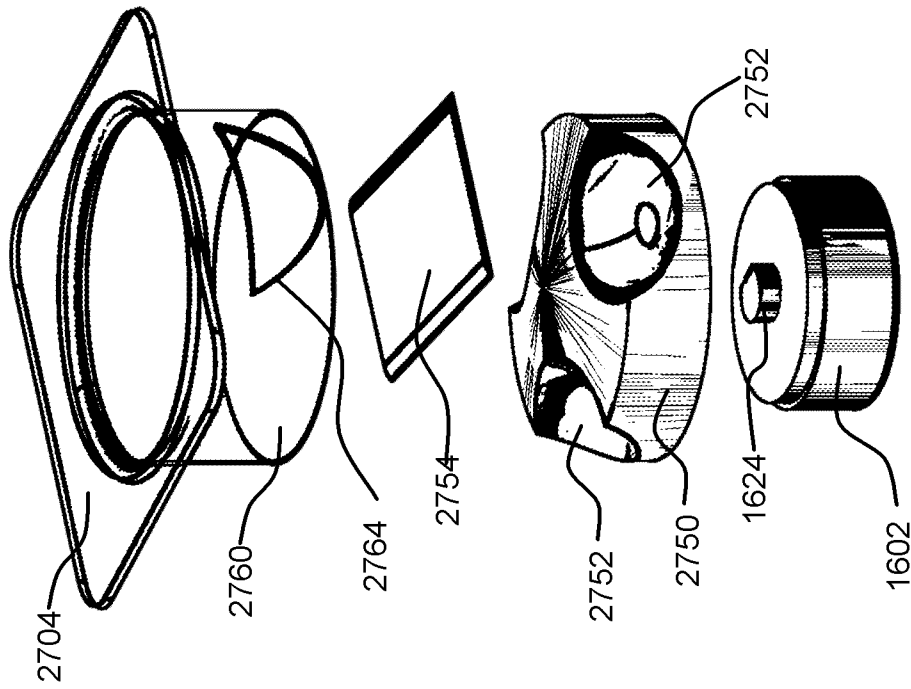


FIG. 29

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2017/031233

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:  
See extra sheet(s).

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:  
1-21, 36-41

### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2017/031233

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A01K 5/02; A01K 1/10; A01K 5/00; B65G 53/36 (2017.01)

CPC - A01K 5/0225; A01K 1/10; A01K 5/00; A01K 5/0114; A01K 5/02; A01K 5/0233; A01K 5/025; A01K 5/0275; A01K 5/0291; B65G 53/36 (2017.02)

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

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See Search History document

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

USPC - 119/51.02; 119/51.01; 119/52.4; 119/52.1; 119/56.1; 119/57.92; 222/55; 222/144.5; 222/144; 222/344 (keyword delimited)

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

See Search History document

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages       | Relevant to claim No.    |
|-----------|------------------------------------------------------------------------------------------|--------------------------|
| X         | WO 2016/000081 A1 (WISELEAP SOLUTIONS INC.) 07 January 2016 (07.01.2016) entire document | 1-8, 11-17, 19-21, 36-41 |
| ---       |                                                                                          | ---                      |
| Y         |                                                                                          | 9, 10, 18                |
| Y         | US 2004/0059466 A1 (BLOCK et al) 25 March 2004 (25.03.2004) entire document              | 9, 10, 18                |
| A         | US 2015/0040832 A1 (KLEIN) 12 February 2015 (12.02.2015) entire document                 | 1-21, 36-41              |
| A         | US 2015/0068462 A1 (PET MATE LDT.) 12 March 2015 (12.03.2015) entire document            | 1-21, 36-41              |
| A         | US 2015/0342143 A1 (PETTRAX, INC.) 03 December 2015 (03.12.2015) entire document         | 1-21, 36-41              |
| A         | US 6,481,180 B1 (TAKAHASHI et al) 19 November 2002 (19.11.2002) entire document          | 1-21, 36-41              |
| A         | US 8,833,304 B2 (WHITSETT) 16 September 2014 (16.09.2014) entire document                | 1-21, 36-41              |



Further documents are listed in the continuation of Box C.



See patent family annex.

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Special categories of cited documents:

“A”

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

“E”

earlier application or patent but published on or after the international filing date

“L”

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

“O”

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

“P”

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

“T”

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

“X”

document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y”

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

“&amp;”

document member of the same patent family

Date of the actual completion of the international search

30 August 2017

Date of mailing of the international search report

12 SEP 2017

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents

P.O. Box 1450, Alexandria, VA 22313-1450

Facsimile No. 571-273-8300

Authorized officer

Blaine R. Copenheaver

PCT Helpdesk: 571-272-4300

PCT OSP: 571-272-7774

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2017/031233

Continued from Box No. III Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-21, 36-41, drawn to a device for dispensing pet items which is movable by a pet and which comprises an outer shell.  
Group II, claims 22-35, drawn to a device for dispensing pet items which is movable by a pet and which comprises an agitator drive component for imparting movement to an agitator.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention: an electronic wireless communications component; a pet item dispenser drive component controlled by the computer component; and an outer shell which encloses the electronic and mechanical core module, and the pet item dispensing module, and which protects the electronic and mechanical core module and the pet item dispensing module from actions of the pet that cause movement of the device as claimed therein is not present in the invention of Group II. The special technical feature of the Group II invention: an agitator drive component for imparting movement to an agitator; and an agitator having one or more item receiving receptacles, the agitator being configured to be moved within the hopper by the agitator drive component so that an item in any one of the one or more item receiving receptacles, when adjacent to the opening, is dispensed therethrough as claimed therein is not present in the invention of Group I.

Groups I and II lack unity of invention because even though the inventions of these groups require the technical feature of a device for dispensing items which is mobile and which comprises: an electronic and mechanical core module having; a computer component; and a power source for supplying power to the computer component; and an item dispensing module having: a hopper for storing items to be dispensed and having an opening through which the items are dispensed; and wherein the electronic and mechanical core module is configured to receive electronic data instructions, this technical feature is not a special technical feature as it does not make a contribution over the prior art.

Specifically, US 6,481,180 B1 (TAKAHASHI et al) 19 November 2002 (19.11.2002) teaches a device for dispensing items which is mobile and which comprises: an electronic and mechanical core module having; a computer component; and a power source for supplying power to the computer component; and an item dispensing module having: a hopper for storing items to be dispensed and having an opening through which the items are dispensed; and wherein the electronic and mechanical core module is configured to receive electronic data instructions (the microcomputer 45 detects opening of the upper door 4 or the lower door 5 by the upper door sensor 117 or the lower door sensor 118, it interrupts the dispensing operation. The dispensing operation is continued from the moment of closure. When the microcomputer 45 detects from the micro switch 76 that any one of the hoppers 51 to 54 is not attached, it prohibits the dispensing operation and displays a warning of prohibition on the display device 47. Moreover, when cell opening sensor 101 cannot detect the movement of the movable cell 89 in the dispensing operation, when the shutter opening sensor 102 cannot detect the opening of the shutter 17, or when the shutter closing sensor 103 cannot detect the closure of the shutter 17 (no light reflection), the dispensing operation is prohibited and a warning of prohibition is displayed on the display device 47, col. 14, lines 55-67, col. 15, lines 1-4).

Since none of the special technical features of the Group I or II inventions are found in more than one of the inventions, unity of invention is lacking.