(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 150 757 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
05.04.2017 Bulletin 2017/14

(51) Int Cl.:
D06F 39/02 *(2006.01)* ***A47L 15/44*** *(2006.01)*

(21) Application number: **16190574.0**

(22) Date of filing: **26.09.2016**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(30) Priority: **02.10.2015 IT UB20154180**

(71) Applicant: **Candy S.p.A.**
20900 Monza (MB) (IT)

(72) Inventor: **ROSSI, Pierluigi**
I-20900 Monza, MONZA E BRIANZA (IT)

(74) Representative: **Leihkauf, Steffen Falk**
Jacobacci & Partners S.p.A.
Via Senato, 8
20121 Milano (IT)

(54) **AUTOMATIC DISPENSER**

(57) Device (10) for automatically dispensing at least a solid or fluid substance (S) within a container (C), wherein the device (10) is insertable into the container (C) and extractable from the same, characterized by comprising at least a compartment (12) for containing said substance (S) having a dispensing surface (14) for dispensing the substance (S) outward the compartment (12) into the container (C), at least access means (16) coupled to said dispensing surface (14) able to achieve at least a configuration of total opening in order to allow a dispensing of the substance (S) through the entire dispensing surface (14) and of total closure in order to prevent the dispensing of the substance (S) through the dispensing surface (14), at least an actuator (18) connected to the access means (16) for activating said access means (16),
controlling means (20) connected to the actuator (18) and programmable for automatically managing the dispensing of said substance (S) within the container (C), by varying the configurations of said access means (16) and power supply means (22) connected to said controlling means (20) for supplying the device (10), wherein said device (10) is movable with respect to the container (C) and the dispensing of the substance (S) within the container (C) occurs based on the relative movement of the device (10) with respect to the container (C).

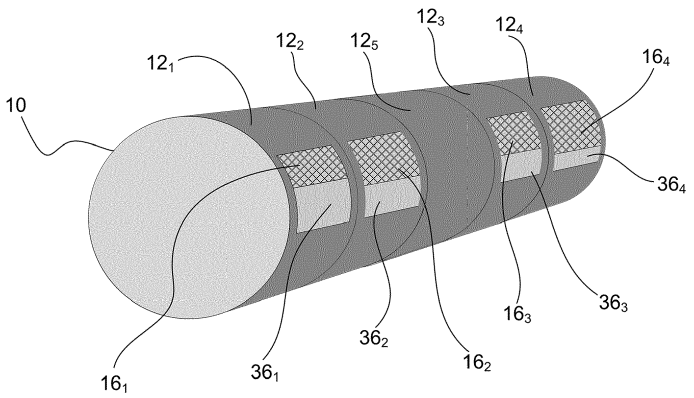


FIG. 4

EP 3 150 757 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a device for automatically dispensing at least a solid or fluid substance within a container. Moreover, the invention relates to a system comprising said device and a programming apparatus in remote communication with the device. In addition, the invention relates to a washing system comprising an apparatus for the wash cycle, such as a washing machine, said device being insertable inside the washing apparatus so as to be used during the washing steps and a programming apparatus integrated in the washing apparatus and in remote communication with said device.

BACKGROUND ART

[0002] In current washing systems, in particular for systems that employ washing machines to treat various kinds of fabrics, the dispensing of the detergent for the wash cycle usually takes place using a dispenser integrated into the washing machine in the form of a drawer with multiple compartments inside which is added the detergent or other substances useful for the wash, such as fabric softener, whitener, scale preventer, etc. The technological development in this sector has also allowed to control the dispensing of substances during the different washing steps based on controlling the access to the dispenser compartments. However, although such a system is very practical, in this case the dispensing of the detergent is not fully efficient. Indeed, in order to use the detergent present in the drawer, it is necessary that, based on a circuit with inner conduits, the water for the wash cycle is introduced inside the corresponding compartment and after being mixed with the detergent, it exits again from the same to end up in the washing drum and contact the fabrics to be treated. It is evident that such a system requires a complex circuit of water conducts which also occupies space in the washing machine. In addition, it is worth noting that in this manner, part of the detergent, which can be solid, liquid or gel, necessarily remains inside the compartments or in the water flowing conducts, thus causing a waste of the detergent itself and a deterioration of some parts of the washing machine.

[0003] For this reason, movable dispensers have been designed, to be inserted directly in the drum of the washing machine. These detergent dispensers have the advantage of being able to apply the detergent directly on the fabric during the washing step without there being any waste or that part of the detergent remains in conducts of the washing machine at the end of the wash cycle. Usually, these types of dispensers consist of a container with open compartments in which inserting the detergent, for example a spherical dispenser, or of granular tablets or gel which dissolve in contact with water. However, a disadvantage of these dispensers is that, for example in the case of a container with open compartments, the detergent contained inside is released immediately at the beginning of the wash cycle, when the spinning drum places the container upside down, making it impossible to program the release of the detergent. Also considering the detergent tablets that dissolve slowly during the wash cycle, it is inconceivable to directly control the release of detergent during the different steps of the wash cycle. A further disadvantage of these types of dispensers is the inability to coordinate the different washing programs with the dispensing of detergent or other substances (scale preventer, fabric softener,...).

[0004] It is the purpose of the present invention to overcome the above mentioned drawbacks of the known dispensers and to provide a device for dispensing in automatic manner a solid or fluid substance within a container which is more efficient and functional.

DESCRIPTION OF THE INVENTION

[0005] A device and system for dispensing at least a solid or fluid substance within a container and a corresponding washing system according to the independent claims are disclosed herein. The device according to the present invention is configured to be able to be inserted inside the container and to be able to be extracted from the same. In particular, the device comprises at least one compartment for containing the substance to be dispensed, having a dispensing surface for dispensing the substance towards outside of the compartment into the container. Furthermore, the device comprises at least an access means coupled to said dispensing surface and able to achieve at least one configuration of total opening in order to allow a dispensing of the substance through the entire dispensing surface, and of total closure in order to prevent the dispensing of the substance through the dispensing surface and at least one actuator connected to the access means for activating said access means. In addition, the device according to the present invention includes controlling means connected to the actuator and programmable for automatically managing the dispensing of said substance into the container by varying the configurations of said access means, and power supply means connected to the controlling means for power supplying the device. In particular, the device of the present invention is movable with respect to the container and the dispensing of the substance into the container occurs based on the movement of the device with respect to the container.

[0006] In particular, the device according to the present invention can be used in a washing process of the washing device as a device not belonging to the washing machine, insertable, and extractable, inside the washing drum, and that can dispense the contained substances, in times, and/or conditions, established by the washing program or following the guidance of an external device/user. In particular, the device can be applied to a washing process, as a specific and non-limiting example, a wash cycle of fabrics carried out by means of a basket/drum washing machine.

[0007] Furthermore, the device can be applied to other processes, different from the washing process of the washing machine, that can benefit from the use thereof. As non-limiting examples, the device is applicable for the release of substances within a reservoir, a tank or any other container, during the course of a process inside them. As another non-limiting example, the device is applicable for the release of substances in agriculture, such as fertilizers, pesticides or other.

[0008] In addition, the present device is applicable for the release of substances in medicine, such as for example the dispensing of a drug during surgery or a therapy.

[0009] According to the present invention, it is possible, once the container has been filled with the substance to be dispensed, to directly insert the device inside the container and, once the dispensing process is completed, to extract the device from the container and reuse it for a new process. The shape and the size of the device must be such as to ensure a simple and fast insertion inside (and extraction out of) the container where the process of dispensing the substance takes place, for example in a drum of a washing machine for a washing process. Furthermore, the shape and the size of the device must be such as to avoid a possible obstruction or damage of other objects present in the container, for example the fabrics to be treated in a washing machine, and of other devices and objects that contact the device, including the washing machine drum/basket and the user who handles the device. Clearly, the shape and the size of the device may be subject to changes depending on the shape and the size of the container inside which it is inserted. The device can have for example a cylindrical, spherical, ellipsoidal shape, etc.

[0010] The compartment is hollow and completely delimited by containment surfaces for the substances which it is adapted to contain. The compartment may also be adapted to contain circuit components such as for example the controlling means, the power feeding means or any other components present, in order to protect them from the external environment. This can be done by deviding the compartment at least in two regions separated by a hermetic wall, in which a region is adapted to contain the substance to be dispensed and has a dispensing surface and the other, totally hermetic, is adapted to contain the above mentioned circuit components. In an alternative embodiment, it is conceivable to dedicate a whole compartment only to contain the circuit components.

[0011] The compartments can be of any shape and size, also different from one another, provided that the condition relating to shape and the size of the device is met. The compartments may be made in plastic or metal material or in other material, depending on the convenience.

[0012] The dispensing surface is represented at least by an outward compartment opening to allow the dispensing of the substance in the container. In other words, this represents the portion of a compartment surface dedicated to the passage of the substance to be dispensed from the inside of the compartment outwards, in particular outward the device, into the container. At the same time, this opening allows the transit in an opposite direction from the container into the compartment.

[0013] The access means are coupled to the dispensing surface so as to achieve at least two configurations: total closure and total opening. In the configuration of total closure, the substance is prevented from being dispensed through the entire dispensing surface. This can be obtained by covering and thus totally closing the dispensing surface in dependency of a displacement of said access means on the surface. The same result can be obtained by varying the permeability of the access means - or of a part thereof - positioned at the dispensing surface, i.e. making such access totally impermeable. In the total opening configuration instead, the substance is able to be dispensed through the entire dispensing surface. This can be obtained by uncovering and thus totally opening the dispensing surface in dependency of a distancing of the aforesaid access means from the surface. As previously noted, the same result can be obtained by varying the permeability of the access means - or of a part thereof - positioned at the dispensing surface, i.e. making such access totally permeable.

[0014] Preferably, the access means are movable with respect to the dispensing surface so that the opening and closure configurations are determined by a relative translatory displacement or by a rotation. However, access means fixed at the dispensing surface are also conceivable, so as to cover it completely. In this case, the opening and closure configurations may be obtained by varying the chemical and physical properties of the access means so as to make them permeable or impermeable, depending on the case.

[0015] In order to activate the access means to obtain the configurations described above, these are connected to an actuator. The actuator can be any mechanism able to convert an input command, for example, electric, coming from the controlling means in mechanical action on the access means, for example a displacement or a rotation, or in a chemical or physical action, by varying for example the permeability properties of the access means. The actuator may be an electromechanical or electromagnetic actuator, consisting of a motor, a piezoelectric, an electroactive polymer, etc.

[0016] The device is equipped with controlling means connected to the actuator and hence to the access means for

automatic managing the same. The controlling means is also adapted for managing any other electronic component present inside the device. Such controlling means may be directly programmed by a user so as to follow for example a time schedule. It is conceivable that the device includes a system for integrated programming arranged on the external surface. For example, the device can have a display with setting buttons for manually programming the time management of the opening and closure of the dispensing surface through the activation of the access means. The user can then program the controlling means and decide, according to criteria established by the dispensing process to be implemented, after how much time the access means can be activated and brought in a total opening configuration so as to dispense the substance into the container. The controlling means can also be programmed to repeatedly activate the access means so as to open and close in established times the dispensing surface, for example for not dispensing the substance only once.

[0017] The controlling means can also be programmed so as to follow a preset program and supplied by an external apparatus to the device. In other words, the controlling means can be in turn controlled by another apparatus via a communication system, so that the management of the access means is controlled from the outside of the device. The controlling means can then run a program, even single instructions, by interacting with the integrated electronic components (for example sensors) and/or signals coming from other external apparatuses.

[0018] Through the automatic control by the controlling means a dispensing can be done without needing to stop for example the washing process. In other words, it is not necessary to manually intervene on the access means to allow the dispensing of the substance into the compartment.

[0019] The device is also equipped with power supply means that provide the energy supply for the various features of the device and in particular for the controlling means and for other electronic components present in the device.

[0020] The power supply means may be equipped with an energy accumulation element, such as for example a rechargeable battery or an electrical capacitor. Furthermore, the power supply means can be wired and/or not wired with reference to external energy sources to the device. For example, the device can be equipped with a connector to be connected to a power supply cable coming from an external electrical source. Alternatively or in combination, the energy transmission may occur by contact with a separated platform for the energy recovery in the accumulation system. Alternately or in addition, the device can be equipped with an antenna, for example RFID, or winding to receive the energy by means of electromagnetic waves of appropriate wavelength.

[0021] According to the configuration in which a platform is used which is external to the device and connected to network, or to another electrical source, from which the platform receives electricity, this converts the electrical energy in electromagnetic waves and transmits them to the device via an antenna or winding.

[0022] The power supply means of the device convert the electromagnetic waves received from the platform in electrical energy to restore the energy in the rechargeable batteries. The antenna and the power supply means of the device may be located inside a compartment - or in a portion thereof - adapted to contain electronic components, such as for example the controlling means.

[0023] Such power supply means, adapted to provide power to the device, do not require contact between the electrical system of the device and the external electrical system. To facilitate the energy exchange between the platform and the device, the external platform can be structured with an accommodation for the device which allows an optimal distance between the antennas, or windings/coils. The device will be recharged when not in use in the washing process.

[0024] The charging state of the device rechargeable batteries can be displayed on a device display or communicated via a communication system to the control unit of the washing machine during the wash cycle, to the external electric system platform while charging and/or to other external apparatuses in communication with the device.

[0025] All the electrical components present in the device can be made, and work, so as to optimize the total electric energy saving.

[0026] Alternatively, the external power supply means can consist of another type of platform external to the device, connected to the grid network, or to another electrical source, from which the platform receives electrical energy.

[0027] The platform can be provided with a cable, terminating with a connector, by which it is possible to transmit, via a connection, energy to the device.

[0028] This configuration provides that the device is equipped with a connector to which connecting the connector of the external electric system, so as to receive the energy through a wiring. This energy will load the rechargeable batteries.

[0029] The connector of the device can be placed on the compartment adapted to the containment of electrical components. The connector placed on the device must be, to the extent permitted by the component functionality, water resistant, and resistant to the other substances present in the process and to the physical and chemical conditions of the process itself. This condition can also be obtained by a protective element acting on the connector.

[0030] Advantageously, the device according to the present invention is movable with respect to the container. This means that in addition to being insertable in and extractable from the container, said device is independent from the container i.e. is not fixed at any point within the container and is free to move within the same. In particular, the device can be totally separated from the container or connected to it by an intermediate flexible element to which the device is attachable and detachable. Such an element may contain in the inside thereof a cable for the power supply of the device

electrical components. The flexibility of the intermediate element makes the device in any case movable with respect to the container in the sense that although the movement of the one is affected by the possible movement of the other, the device can move in decoupled manner from the container.

[0031] Furthermore, the substance present in the compartment is dispensed into the container based on the relative movement of the device with respect to the container. In other words, the dispensing does not occur in "one-way" manner from the inside outward the compartment simply using the force of gravity, for example placing the dosing compartment at a certain distance from the bottom of the container, instead it occurs based on a compartment "two-way" access using an exchange by diffusion facilitated by the relative movement of the device with respect to the container. It should be noted that relative movement between device and container means any configuration in which these two elements move one relatively to the other. This can take place for example if the container has a motor allowing for example a rotation of the container about an axis, if the same device comprises movement means (small motor) or if none between the container and the device has a motor but the device is put into movement for example by an air or water jet that circulates within the container. Alternatively, the dispensing of the substance can take place due to the mutual movement between the device and a fluid present within the container. For example, the device can be fixed with respect to the container, and the fluid contained therein (liquid or gas), moving inside the compartment device, may be the cause of dispensing or diffusion of the substance.

[0032] In an embodiment of the present invention, the access means are such as to achieve also a partial opening configuration, comprised between the total opening and the total closure configurations, to allow the dispensing of the substance only through a portion of said dispensing surface. In this manner, it is possible to modulate the dispensing relatively to the amount of substance released in a determined time. During the steps of a washing machine wash cycle, the device can dispense for example a small amount of substance in the initial part of the process to run a prewash and then, in a second time, dispense the remaining substance for the central part of the wash cycle.

[0033] The partial opening configuration may include in turn a plurality of configurations of partial opening, all of which are comprised by different degrees between the total opening and the total closure configurations. In other words, the controlling means can manage through the actuator the access means so that the substance is dispensed through a portion representing 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90% - or any other percentage - of the total dispensing surface.

[0034] In a further embodiment of the invention, the device comprises communication means, for receiving and transmitting data, that are connected to the power supply means and to the controlling means.

[0035] In this manner, it is possible to exchange information between the device and another external apparatus or system, for example, the electronic control unit of the washing machine, a smartphone or a remote control. The information include commands or instructions necessary to the functionality of the device within the limits of the application process, and in particular of the device components, namely the controlling means, including any sensors, the communication means themselves, the power supply means and every other electronic component.

[0036] Communication can be done using either a wiring or a wireless system. The communication signals can be of various type: electromagnetic and/or optical and/or mechanical signals and/or sound pressures and/or voice commands.

[0037] The communication means may comprise an antenna for exchanging, sending and receiving electromagnetic waves whose frequency may be chosen, as a non-limiting example, in the interval ranging from hundreds of MHz to the order of GHz, circuits to convert the signals coming from the antenna into suitable signals for the device electrical components, including any sensors and any other electronic part, and circuits to convert the signals coming from the device electrical components into suitable signals for being transmitted by the antenna.

[0038] The transmission power is such as to allow the communication between the device and an external communication system and at the same time to optimize energy saving of the electrical energy accumulated in the device.

[0039] In an embodiment of the invention, the actuator is an electromechanical actuator. In this manner, it is possible to convert an electric signal coming from the controlling means in a mechanical action such as for example the displacement or the rotation of the access means so as to put this access means in one of the possible configurations (total opening, total closure or partial opening).

[0040] In a further embodiment of the invention, the device comprises at least one sensor connected to the controlling means for detecting a physical or chemical quantity inside the container.

[0041] In particular, the device may have one or more sensors to detect for example the temperature inside the container, the hardness and pH of water possibly present inside the container or any other parameter useful for the process that accompanies the dispensing of the substance into the container, for example during the washing steps of a washing machine. The sensors can also include integrated position sensors (accelerometers or compasses). The information collected by the sensors can be directly analyzed and managed by the controlling means or transmitted outside the device through the communication means.

[0042] The device may also include in a variant thereof also monitoring means connected to the controlling means, to the power supply means, to the possible communication means, to the possible sensors and to any other electronic component present in the device in order to collect information on the state of components connected to it.

[0043] In an embodiment of the device according to the present invention, the controlling means include an actuator control circuitry and a control and management logic for monitoring said circuitry, said actuator and all the various components of the device, such as the power supply means, the possible communication means, the possible sensors and any other electronic component in order to collect information on the state of these components. The control and management logic includes in particular at least one programmable element, such as for example a microcontroller and at least one memory. The programmable element can be programmed remotely, for example from the washing machine control unit, from a smartphone, from a personal computer or from a remote control or directly on the device itself.

[0044] The control and management logic can for example be programmed to run a time schedule releasing or dispensing the substance. This could be implemented by the use of timers of different kind present in the microcontroller or other timers, synchronized with a clock signal and with signals coming from remote.

[0045] Control and management logic can also be programmed to allow a remote control of access means, for example from the washing machine control unit, from a smartphone, from a personal computer or from a remote controller.

[0046] In this manner, in the case where the device is used inside a washing machine, the steps of the washing program could be monitored and timed by the washing machine control unit itself, which will manage directly, by communication and control means, the device access means.

[0047] Advantageously, the control and management logic can run the monitoring of the microcontroller state, for example by reading "on-port" signals on the microcontroller and/or on the internal registers thereof, and comparing them with reference values and/or communicating them to the washing machine control unit.

[0048] In addition, the control and management logic can run the monitoring of the battery charge state, for example by reading the battery or capacitor charge value, provided by a chip, or other circuit, of the power system, and comparing it with the reference values and/or communicating it to the washing machine control unit. If the charge is below a certain value it is possible to ask the control unit to alert the user - through a sound, light signal or other, about the charge state so as to proceed to a possible charging.

[0049] In addition, the control and management logic can run a verification of the program received. The verification can take place for example by means of a comparison with the control unit by sending to the control unit the program, stored by the device after having been received from the control unit itself.

[0050] In a similar way, the control and management logic can run a verification of the received order. This verification can take place for example by means of a comparison with the control unit by sending to the control unit the received order, stored by the device after having been received from the control unit itself.

[0051] The control and management logic can also run the switching on and off processes of device. For example, in the case where the antenna, or reel/winding, of the device power supply means receives an appropriate frequency, power and energy signal, this could supply a specific part of the circuits of control and management logic, activating the power supply on all device components. The power supply can be turned off by the control and management logic by intervening on the switching of power supply of the dispenser components. For example, when the device must be switched off in the normal execution of the washing program, the washing machine control unit can send to the device a switch-off signal. In another example, the management and control logic circuits receive, or produce, an interrupt and/or "watchdog" signal that requires the switching-off of the device. In other words, through a suitable signal received by the antenna it is possible to activate power supply and through another suitable signal it can be disabled. The power supply remains disabled until the antenna receives another signal capable of re-enabling it.

[0052] In a preferred embodiment of the invention, the device comprises a plurality of compartments at least two of which are mutually contiguous, each compartment containing a solid or fluid substance to be dispensed within the container through a dispensing surface, wherein the controlling means are programmable to manage the substance dispensing from each compartment, according to different times.

[0053] In this manner, it is possible to independently and simultaneously manage the dispensing of various substances within the same process according to different dispensing times. In the case of application of the device inside a washing machine, the single compartments can for example contain substances that can be dispensed into the container in successive times during the washing step. In a non-limiting example, a device compartment may contain the detergent useful for a prewash initial part, a second compartment may contain the detergent useful for the wash cycle central part, a third compartment may contain the fabric softener and the fourth compartment the scale preventer. Through the automatic and programmed management of the controlling means, the detergent present in the first compartment may be dispensed in a wash cycle initial step, the detergent of the second compartment can be dispensed later in a wash cycle central step, the softener can be dispensed in a final step together with the scale preventer. In this manner, a more targeted use of the substances to be dispensed in optimal times for the washing program selected is obtained.

[0054] The plurality of compartments can consist of different portions of a single compartment separated by shared internal walls. For example, in the case where the device has a cylindrical shape, the portions can be obtained through cross-sections so that the plurality of compartments is represented by contiguous cylinders having shared circular walls. Alternatively, the portions may be obtained by means of longitudinal sections of the cylindrical device so that the plurality of compartments is represented by cylinder segments having shared rectangular walls. Obviously, it is conceivable to

make the compartments of any shape and size based on the initial shape of the device.

[0055] In a further embodiment of the present invention, at least one portion of the wall that separates two contiguous compartments is openable to allow mixing of the substances present in the two contiguous compartments within the device.

[0056] In this case, the shared wall may be provided with own access means associated to an actuator manageable and controllable by the controlling means. In this manner, it is possible that there is contact of the substances present in the contiguous compartments before dispensing them outwards, and then during successive instants dispensing the combined substances outward the device, namely into the container. In particular, through the management of the controlling means, it is possible that two or more substances mutually interact, getting in contact, combine before being dispensed into the container but not before a determined moment in the process.

[0057] As an example, two substances may be considered, from which combination a detergent is produced the effectiveness of which is maximum one minute after the combination of the substances. In this case, the substances may be inserted in two adjacent compartments provided with access means on the wall separating them. One minute before the expected dispensing of detergent, it is possible to act on the access means placed between compartments and allow the combination of the substances.

[0058] Then, after a minute, at the time of maximum effectiveness of the detergent, dispensing them outwards, by acting on the compartment access means that allow the dispensing of the substance into the container, for example into the washing machine washing drum. Such an approach may be used also in the medical field when the combination of two medicines is desired, prior to the final dispensing of the substance.

[0059] In an embodiment of the invention, in the case of a configuration comprising a plurality of compartments, the device comprises a plurality of access means each coupled to the dispensing surface of each compartment, in which the controlling means are programmable to manage the configurations of the access means of each compartment in mutually independent manner.

[0060] In this way, it is possible to independently manage the dispensing of the substances contained in the various compartments by acting directly on one single access means. For example, this allows the simultaneous dispensing of two or more substances, when this becomes necessary, for example in the case in which two substances must act together or must be combined once dispensed into the container.

[0061] In an embodiment of the invention, the access means include a sliding door along the dispensing surface thereby determining an initial position start of stroke and a final position of end of stroke. In the initial position of start of stroke, the actuator acts on the door so that the latter totally covers the dispensing surface in order to prevent the transit of the substance from the compartment to the outside thereof, i.e. into the container. In the final position of end of stroke, the actuator acts on the door so that the latter totally uncovers the dispensing surface in order to allow the transit of the substance from the compartment to the outside thereof, i.e. into the container. Passing from the initial position of start of stroke to the final one of end of stroke, the door can slide parallel along an internal or external surface of the compartment. In this manner, any impediment to the dispensing of the substance is avoided, as well as any possibility of grip or contact between the door and any object in the container. Obviously, alternative configurations are conceivable for the door movement relative to the dispensing surface, provided that all requirements described above are met, with respect to a possible substance dispensing impediment and to a possible contact with other objects.

[0062] In a preferred embodiment, the actuator is of electromagnetic type and comprises at least one induction reel/winding and magnetized elements, such that the induction reel is positioned at the sides of the sliding door and the magnetized elements are positioned inside the door and at the start and end of stroke positions thereof.

[0063] In particular, the actuator also includes an internal magnetized element, called "core", in the access means surface, i.e. of the door. Alternatively, it is conceivable to permanently magnetize the entire surface or just a portion of the access means. The magnetized element may have the same geometric shape of the access means, with slightly smaller dimensions, such as to permit an insertion thereof inside the access means.

[0064] The magnetized elements placed in proximity to the end point and to the starting point perform the anchoring function in absence of excitation on the induction reel. These elements exert on the internal magnetized element of the access means a minimal, but sufficient, force within the limits of chemical and physical conditions of the washing process, so that, in absence of excitation of the induction reel, if the access means are in the starting point state, or in the end point state, they remain in that state.

[0065] In this manner, the access means are maintained in the total opening or total closure configurations.

[0066] The induction reel can be excited by an electrical circuit in order to generate on the internal magnetized element such a force as to overcome the anchoring force exerted by the lateral magnetized elements so as to move the access means from the starting point to the end point, or vice versa, from the end point to the starting point.

[0067] To move the access means in two different directions, it is necessary that the reel is coupled to an electric circuit such as to ensure an excitation thereof by means of opposite direction electric currents.

[0068] The duration of the reel excitation is relative to the time necessary to bring the access means from the starting point to the end point, or vice versa, from the end point to the starting point.

[0069] Obviously, the concept of using a coupling between induction reels and magnetized elements can be extended to any other type of configuration both regarding the geometry of the involved elements and regarding the number or arrangement thereof.

[0070] In an alternative embodiment of the invention, the access means comprise a plurality of membranes having a partially impermeable surface. In particular, the access means are rotatable relative to the dispensing surface.

[0071] The membranes are advantageously arranged one above the other so as to constitute a single superimposed structure. The membranes can be of different nature in terms of permeability, and achieve different shapes. Based on a particular superimposing configuration, it is possible to create on the superimposed structure both permeable and impermeable portions with respect to the substance to be dispensed. Furthermore, the rotation of the access means relatively to the dispensing surface allows a variation of the position of the permeable portion of the structure of superimposed membranes relative to the dispensing surface so as to vary the configuration from total opening to total closure. In the total opening configuration, the permeable portion achieves the same size as the dispensing surface. In the total closure configuration, the impermeable portion achieves the same size as the dispensing surface.

[0072] The membranes that constitute the superimposed structure can move coupled or independently of one another. For example, the coupled or common movement of some membranes together while the others remain fixed is conceivable.

[0073] The superimposed surface of the membranes may be coupled to a single dispensing surface so as to dynamically vary the surface through which the substance is dispensed. The superimposed structure can for example comprise a plurality of permeable portions of different size so that, based on the movement of the access means on the dispensing surface, it is possible to gradually modulate the dispensing of the substance from a total closure to a total opening configuration. However, it is also conceivable to couple the same surface of superimposed membranes to different dispensing surfaces for different compartments. In this manner, it is possible to use one single access means for more compartments. The movement of the access means, for example the rotation of the structure of superimposed membranes, can determine the displacement of the permeable/impermeable portion of said structure from a dispensing surface of one compartment to the dispensing surface of an adjacent compartment. Clearly, in order for such a configuration to work, it is necessary that the size of the permeable portion is equal or less than the compartment dispensing surface for which a dispensing of the substance contained therein is desired, and the impermeable portion is equal or greater than the compartment dispensing surface for which the preventing of dispensing the substance contained therein is desired.

[0074] In an embodiment of the invention, the membranes have a shape of discs and are rotatable relative to an axis passing through their center, based on the driving action of a motor coupled thereto. The motor can be an electric motor, provided with a suitable shaft mechanical system which allows the mechanical transmission to the discs. In this manner, it is possible to activate the access means avoiding any possible impediment in dispensing the substance and any possible contact with other objects in the container.

[0075] In a further embodiment of the invention, the access means comprise a plurality of membranes with circular shape, one of which having sectors rotatable relative to their own median axis. Based on the rotation of the sector, it is possible to open the dispensing surface of the corresponding compartment and determine a transit for the substance to be dispensed. In order to determine the rotational movement of the sectors, each sector can be coupled to an electric motor or similar.

[0076] As previously mentioned, the present invention finds application in the field of washing fabrics inside a washing machine. In this manner, the container inside of which the device is insertable and from which it is extractable may be the drum/basket of a washing machine. In the specific case of a washing machine, the device therefore is immersed in an aqueous environment in which chemical substances dispensed during the wash cycle are present. As a consequence, the device must be able to work properly even if totally immersed for example in water where chemical agents of various nature can also be present. Furthermore, the device must be able to withstand the typical stresses of a washing machine drum moving in all the washing steps, also during the maximum movement steps, as the spinning program.

[0077] Advantageously, in the total closure configuration, the compartment is hermetic relative to the external environment. In this manner, the substance inside the compartment can be, according to the limits required by the process, isolated from the external environment up to the dispensing instant. This prevents the substance from escaping from the compartment before the time established or an external substance, for example water, from penetrating into the compartment.

[0078] The device and system according to the present invention is entirely insertable and fixable inside a protective, hollow means having at least one opening for the transit of substances from the device toward the container and from the container toward the device.

[0079] The protective means, or shell, serves to avoid excessive stresses, or disturbing elements, to the extent permitted by the process and by the component functionality, on compartments, on access means, on any sensors and on other components that could be damaged in the implementation of the process.

[0080] The protective means must be resistant, to the extent permitted by washing process, or other application

process, to water, to other substances and objects in the process and to physical and chemical conditions of the process itself. Furthermore, this protective element must not interfere with any functionality of the device. For example, it must enable the insertion of substances in the compartments in an easy way, in the same way in which it would be possible to proceed if the protective element were not present. For example, the protective element can be equipped with a manual opening system, such as a door, for direct access to compartments.

[0081] The protective means can be made of any shape so as to meet the same requirements for the device shape, as listed above. In a preferential way, the protective means is of cylindrical, spherical or ellipsoidal shape. This can be made in plastic material so as to resist to the centrifugal forces present, for example, inside a washing machine drum.

[0082] The size of the opening present on the protective means must be such as to ensure an efficient dispensing of the substance outwards but at the same time prevent that small size objects present in the container can penetrate into the protective means and somehow damage the device.

[0083] The protective element may have a plurality of openings distributed on the walls thereof, having equal or different sizes.

[0084] To facilitate the extraction operation of the device from the protective means, the latter can be dismountable in various parts. In particular, the protective means can be dismounted and hence opened to allow access to the compartments and to the access means. This is useful, for example, for inserting the substances into the compartments, for emptying the compartments, for cleaning, for control and maintenance of the compartments and access means.

[0085] The system for delivering at least a solid or fluid substance within a container according to the present invention comprises a device as the one described so far and a programming apparatus for remote controlling and programming of the controlling means of said device. In particular, the programming apparatus is in communication with the device through communication means present within the device.

[0086] In particular, the programming apparatus can be a smartphone, a tablet, a laptop, a remote control or any other apparatus able to communicate with the device by transferring information and commands. Communication may take place in remote mode or via a cable connection.

[0087] In other words, the device can be remotely programmed by an apparatus external to it for applying all the features described above. Furthermore, the device itself may send information to the apparatus about for example the values detected by any sensors, relative to the battery charge, relative to the status of the dispensing process, etc. All this information can be viewed on a display present on the programming apparatus.

[0088] In one embodiment, the apparatus can connect to the Internet network and download useful information for the dispensing process that can be sent directly to the device. For example, the device can be inserted inside a washing machine of a certain brand. The apparatus is able to download the information relating to washing programs of that particular washing machine and to program the device, specifically the controlling means, based on such programs. In other words, the programming apparatus serves as washing machine electronic control unit and is able to directly manage the functionality of the device. For this type of functionality, it is conceivable to design a computer application to be downloaded directly on the programming apparatus.

[0089] The washing system according to the present invention comprises a washing apparatus comprising at least one support structure having a container into which inserting at least one object to be washed, wherein said container is adapted to move relative to the support structure. Furthermore, the washing apparatus comprises at least one washing unit for inserting and extracting water from the container and at least one container movement managing unit for managing the movement thereof. In addition, the system comprises a device such as the one described so far to be inserted inside the container, in which the substance to be dispensed is used during the wash cycle of the object and a programming apparatus for the control and remote programming of the controlling means of said device, in which the programming apparatus is integrated in the support structure of the washing apparatus and in communication with the device through the communication means thereof. In one embodiment, the washing apparatus is made in the configuration of a washing machine in which, instead of using the traditional drawer with compartments, the detergent and/or the other substances useful for the wash cycle are inserted into the device/dispenser as described above, which in turn is inserted into the drum before the washing process. By acting directly on the programming apparatus which is integrated in the washing machine it is possible to directly programing, or controlling, the device, namely the controlling means, so that the dispensing of the substances useful for the wash cycle occurs following a certain sequence determined by the washing program selected. The device may send information to the programming apparatus about, for example, values detected by possible sensors, relative to the battery charge, relative to the dispensing process status, etc. All this information can be viewed on a display present on the programming apparatus. Also in this case, the programming apparatus can connect to the Internet to download information or updates, for example about new washing programs.

[0090] It is apparent that such a washing system, namely a washing machine, will no longer need the traditional detergent drawer. Therefore, the washing system according to the present invention can be designed and made without this drawer and without all the water conducts from and to the drawer as well as the associated electronics. This leads to substantial savings in terms of manufacture of the final system and elimination of components that may cause possible faults.

[0091] These and other aspects of the present invention will become more apparent in the light of the following description of some preferred embodiments described below.

Figure 1	shows a schematic representation of the device components according to the present invention;
Figure 2	shows a schematic representation of a device according to an embodiment of the present invention;
Figures 3a, 3b, 3c, 3d, 3e and 3f	show a schematic representation of the device in the total opening (a, b), total closure (c, d) and partial opening (e, f) configurations;
Figures 3Aa and 3Ab	show a schematic representation of an actuator according to an embodiment of the present invention;
Figures 3Ba, 3Bb and 3Bc	show a diagrammatic representation of a device in which the actuator of figure 3a is applied;
Figure 4	shows a schematic representation of the device comprising a plurality of adjacent compartments;
Figures 5A and 5B	show a schematic representation of protective means according to the present invention;
Figures 6a, 6b, 6c and 6d	show a schematic representation of a device inserted inside protective means according to the present invention;
Figures 7a, 7b and 7c	show a schematic representation of a device according to another embodiment of the present invention;
Figures 8A and 8B	schematically show the access means according to the embodiment of figure 7;
Figures 8Aa, 8Ab and 8Ac	schematically show the access means according to an alternative embodiment;
Figure 9	shows a schematic representation of a system comprising the device according to the present invention, inserted in the washing machine drum and remotely controlled by a programming apparatus via a remote connection;
Figure 10	shows a schematic representation of a system comprising the device according to the present invention, inserted in the washing machine drum and remotely controlled by a programming apparatus via a cable connection; and
Figure 11	shows a schematic representation of a washing system comprising the device according to the present invention, inserted in the washing machine drum and remotely controlled by a programming apparatus integrated into the washing machine via a remote connection.

[0092] Figure 1 shows, in a block diagram, a device 10 for automatically dispensing at least a solid or fluid substance S within a container C.

[0093] The device comprises a compartment 12 to contain the substance S to be dispensed. The compartment 12 is provided with a dispensing surface, or opening 14, that determines a transit for the substance S from within the compartment 12 outwards, i.e. into container C. Coupled to the dispensing surface 14, access means 16 are present that can achieve different configurations so as to close or open outwards the transit made by the dispensing surface 14. The access means 16 can be activated by an actuator 18 connected thereto. The device also includes controlling means 20 connected to the actuator 18 and programmable for automatically managing the dispensing of the substance S into the container C by varying the configurations of the access means 16. To power supply the entire device 10, the latter is finally provided with power supply means 22 connected to the controlling means 20.

[0094] In addition, the device 10 comprises communication means 24 having an antenna 25 for receiving and transmitting information to the outside and a sensor 26 for detecting a physical quantity internal or external to the device 10. Both the communication means 24 and the sensor 26 are directly connected to the controlling means 20. Furthermore, the communication means 24 and also the sensor 26 may comprise a direct connection to the power supply means 22. In a base configuration, device 10 does not include communication means 24 with antenna 25 or sensor 26. For this reason, these elements are depicted in Figure 1 with dashed lines. In a more elaborate configuration, the device comprises the communication means 24 with antenna 25 and/or sensor 26.

[0095] The controlling means 20 comprise in turn a control logic 28 which provides a programmable element, such as a microcontroller 30 and a memory 32 to store data received from components internal or external of the device 10. Furthermore, the controlling means 20 comprise a control circuitry 34 for controlling and managing various components of the device 10, such as the actuator 18, the access means 16, the power supply means 22, the possible communication means 24 and the possible sensor 26.

[0096] Figure 2 shows device 10 seen from the outside. Device 10 has the shape of a capsule, i.e. a cylindrical structure in which the regions corresponding to the bases are bevelled, which well suites a smooth insertion inside the container

C. In the particular case in which container C is represented by a washing machine drum/basket, the capsule shape allows a free movement of the device 10 within the drum during the various washing steps and in particular facilitates rotation of the device 10 as a function of the rotation of the drum itself. Furthermore, the presence of bevelled corners avoids any damage of possible objects present in container C as well as of the internal walls of container C itself. The figure shows the presence of a dispensing surface 14 having a roughly rectangular shape from which substance S is dispensed. The access means 16 has the form of a door which partially closes the dispensing surface 14.

[0097] Figures 3a, 3c, and 3e each show a cross section of device 10 as shown in figure 2 and describe three different configurations of the access means 16. In particular, the access means 16 consist of a impermeable surface (door), which can slide inside a side surface of a compartment 12 so as to fully open (figure 3a, 3b), completely close (figure 3c, 3d) or partially open (figure 3e, 3f) the dispensing surface 14 and consequently vary the size of the transit surface 36 of the substance S. In particular, the access means 16 inserts itself in a cavity 38 provided in the thickness of a wall of compartment 12.

[0098] The dispensing surface 14 comprises four sides. Two of the four sides are two different rectilinear segments parallel to the orthogonal passing through the center of the compartment 12 bases. These two sides are at the same height relative to the bases. The other two sides are two arches, which connect the upper and the lower extremes of the two above-mentioned sides. From a point of view orthogonal to the capsule side surface, frontally to the dispensing surface 14, this is similar to a rectangle. Instead, from a point of view orthogonal to the bases, the dispensing surface 14 is visible as a crown arc.

[0099] The dispensing surface 14 is indicated in figure 3a with dashed lines. In particular, in figure 3a this is shown by a point of view orthogonal to the bases while in figure 3b, from a point of view orthogonal to the side surface of the device.

[0100] The access means 16 can move, with appropriate tolerance, in direction tangent to one, or more than one, circumferences whose center passes through the orthogonal to the bases of the cylinder structure that forms the capsule, parallel and concentric to the cylinder bases, on which the circular crown part that constitutes the opening on which the access means 16 move and with a radius given by the distance between the access means 16 and the orthogonal to the bases of the cylinder passing through the center of such bases. Assuming that the median (central) axis of the access means 16 is part of a concentric circumference arc and parallel to the cylinder base, hence it is possible to take the tangents to such an arc as displacement directions of the access means 16.

[0101] When the access means 16 is found in a total opening configuration (figures 3a and 3b), the transit surface 36 of the substance S is greatest. In this case, the dispensing surface 14 coincides with the transit surface 36. When instead the access means 16 is found in a total closure configuration (figures 3c and 3d), the access means 16 completely covers the dispensing surface 14. In this case, the transit 36 is completely closed and the substance S cannot leave the compartment 12.

[0102] When the access means 16 is found in a partial opening configuration (figures 3e and 3f), this only partially covers the dispensing surface 14. In this case, the transit surface 36 of the substance S is therefore comprised between zero and a maximum value corresponding to the size of the dispensing surface 14. Depending on the degree of covering of the dispensing surface 14 by means of the access means 16, it is possible to modulate the dispensing of substance S outward of the compartment 12 into container C.

[0103] Figure 3A shows a particular configuration of the actuator 18 used for activating the access means 16. The actuator 18 includes at least one induction reel/winding 33 and a plurality of magnetized elements 35, 37, 39. The figure shows a portion of the compartment 12 wall 41 inside which the components of actuator 18 are inserted. It should be noted that for an exemplary representation, the figure shows the wall portion 41 extended in length on a plane even if the compartment 12 wall actually achieves a curved shape. In particular, Figure 3Aa shows the configuration in which the access means 16 are slidably inserted inside said portion 41 and Figure 3Ab shows the configuration in which the access means 16 are separated from said portion 41.

[0104] The induction reel/winding 33 is arranged inside the wall portion 41 at the dispensing surface 14 and is adapted to wrap the access means 16 when it slides, in the shape of a door, along the wall of compartment 12 inside the cavity 38. The reel 33 is arranged so as to not covering, i.e. hampering, in any way the transit surface 36 of the compartment 12.

[0105] The reel 33 is connected to a circuit, represented by the voltage generator 43, controlled by the controlling means 20. However, it is also conceivable that the reel 33 is directly communicating with the power supply means 22 which supply the entire device 10. At the ends of the wall portion 41 there are two magnetized elements 35 entirely covering the transverse section of the wall portion 41 and are positioned at the starting and end points of the sliding stroke of the door. The access means 16 has in turn magnetized elements 37, 39. In particular, the access means includes an internal element 37 that extends for the entire length of the door and two elements 39 positioned at the ends of the door.

[0106] The magnetized elements 35 placed in proximity of the end point and of the starting point perform the anchoring function in lack of excitation on the induction reel 33. These elements exert on the internal magnetized elements 37 and 39 of the access means 16 a minimum, but sufficient, force so that, in absence of excitation of the induction reel 33, the access means 16 are in the stroke starting point state, or in the stroke end point state, it remains in that state. In this

manner, the access means are maintained in the total opening or total closure configurations.

[0107] Based on an application of voltage to the heads of the reel 33, a magnetic field induced around the access means 16 is determined. In this manner, a force is generated such as to overcome the anchoring force exerted by the magnetized elements 35 so as to move the access means 16 from stroke starting point to stroke end point, or vice versa, from stroke end point to stroke starting point. The movement of the access means 16 in one or the other direction will depend on the direction of the current applied to the reel 33 to create the induced magnetic field.

[0108] Figure 3Ba shows a device 10 cross section in which the actuator 18 described in Figure 3A is applied. From the figure it is possible to notice the end and starting point positions of the magnetized elements 35 and those of the reel 33 relatively to the dispensing surface 14. The sliding of the access means 16 within the cavity 38 caused by the magnetic field induced by reel 33 will determine the opening or closing of the dispensing surface 14.

[0109] In Figure 3Bb the dispensing surface 14 is shown frontally. In this case, the device 10 is in a total closure configuration.

[0110] Instead, Figure 3Bc shows a situation in which the access means 16 cover only part of the dispensing surface 14 thus resulting in a transit surface 36 for the substance S.

[0111] Figure 4 shows an embodiment in which the device 10 consists of five compartments 12_1, 12_2, 12_3, 12_4 and 12_5 reciprocally adjacent, not communicating and reciprocally isolated. Four of the five compartments 12_1, 12_2, 12_3 and 12_4 are each provided with an access means 16_1, 16_2, 16_3 and 16_4 to dispense the substances S contained therein towards the outside of device 10. The remaining compartment 12_5 is not equipped with access means and is used to accommodate the internal components of device 10, namely the controlling means 20, the communication means 24, the power supply means 22, etc.

[0112] The access means 16_1, 16_2, 16_3 e 16_4 shown in the figure are represented in partial opening configuration. It is worth noting that the corresponding transit surfaces 36_1, 36_2, 36_3 and 36_4 are different from compartment to compartment. The movement of one of these access means 16_1, 16_2, 16_3 and 16_4 makes the inside of the corresponding compartment 12_1, 12_2, 12_3 and 12_4 accessible.

[0113] In this device 10 it is possible to insert up to four different substances S. For example, in the case of an application of the device 10 inside a washing machine, it is possible to use a compartment 12_1 for inserting the detergent dose required for the prewash, a second compartment 12_2 can be used to insert the detergent dose required for the second part of the wash cycle, a third compartment 12_3 can be used to insert the softener. A fourth compartment 12_4 can be used for another substance S to be dispensed during the wash cycle, for example a perfume, a dye, a stain remover, a scale preventer, etc. Depending on the type of substance S, it is possible to vary the instant in which the dispensing occurs and/or modulate the dispensing itself by gradually varying the opening configuration. The perfume can for example be released at the end of the wash cycle while the stain remover is released in an earlier time.

[0114] Figures 5A and 5B show protective means 40 dismoutable in three parts 40_1, 40_2 and 40_3, inside which device 10 can be inserted. The protective means 40 has a capsule shape with cylindrical structure. Figure 5a shows the configuration in which the parts are joined together and figure 5b shows the dismounted configuration in which lateral parts 40_1 and 40_3 and a middle part 40_2 can be distinguished.

[0115] The lateral parts 40_1 and 40_3 have an extension along the cylinder axis that is concentric and of smaller radius to the side surface. The extension includes a male thread 42. The middle part 40_3 is instead equipped with two internal female threads 44 placed at the ends of part 40_2.

[0116] The two male threads 42 correspond to the two female threads 44 and are such as to make the lateral parts 40_1 and 40_3 screwable and unscrewable relative to the middle part 40_2, as shown by the arrows in figure 5b. Both the lateral parts 40_1 and 40_3 and the central part 40_2 of the protective means 40 comprise a plurality of openings 46 for the transit of the substance S from the device 10 to the container C and of other substances, such as washing water, from the container C to the device 10. In other words, the protective means 40 protects device 10 from external objects that could damage it. However, it should not prevent the transit of the substance S dispensed from the compartment 12 nor the entry, for example of water, to mix with the substance S itself.

[0117] Figure 6 shows a representation of the device 10 inserted into the protective means 40 in the not-dismounted configuration (figures 6a, 6b and 6c) and in the dismounted configuration (figure 6d).

[0118] The protective means 40 is equipped with anchorages 48 or fasteners, for anchoring to the device 10. These anchorages 48 if necessary, can also be structured as shock absorbers, to absorb part of the energy of the impacts that affect the protective means 40 and thus decrease the stresses on device 10. As apparent from the figures, device 10 is only anchored to the central part 40_2 of the protective means 40. The lateral parts 40_1 and 40_3 are not anchored to the device 10 and can be unscrewed and removed from the central part 40_2 even when the device 10 is inserted into the protective means 40.

[0119] The anchorages 48 secure the protective means 40 to the device 10 in an area of the device in which no dispensing surface 14 is present, for example at the compartment 12_5 adapted to contain the component parts of the device 10.

[0120] The anchorages 48 can be made in plastic material.

[0121] Figures 7 and 8 show an alternative embodiment to that proposed in fig. 2-6 but which maintains the same base concepts.

[0122] Device 10 is divided in five compartments 12_1, 12_2, 12_3, 12_4 and 12_5 as in the case of figure 4, however differently arranged.

[0123] A compartment 12_5, of cylindrical shape is closed and is adjacent to one of the bases of the cylinder that constitutes device 10. The other four compartments 12_1, 12_2, 12_3 and 12_4 extend longitudinally to the cylinder axis. The device 10 according to this embodiment comprises one single access means 16 which has the shape of a disc positioned at one of the bases of the cylindrical structure which forms the device 10.

[0124] The closed compartment 12_5 is not equipped with access means 16 and is used to accommodate the controlling means 20, the communication means 24, the power supply means 22, etc.

[0125] The four compartments 12_1, 12_2, 12_3 and 12_4 have the same dimensions and together constitute a cylindrical shape, i.e. a section of cylindrical shape that constitutes the device 10.

[0126] The four compartments 12_1, 12_2, 12_3 and 12_4 divide the circle that constitutes the base of the cylindrical shape, in four circular sectors of equal sizes, as visible in figure 7b and 7c.

[0127] For each of the four compartments 12_1, 12_2, 12_3 and 12_4, one of the surfaces 50_1, 50_2, 50_3 and 50_4 parallel to the base of the cylindrical shape of device 10 is adjacent to the closed compartment 12_5 of cylindrical shape. Such surfaces 50_1, 50_2, 50_3 and 50_4 are coplanar. The opposite surface, parallel to the base of the cylindrical shape of device 10, of each of the four compartments 12_1, 12_2, 12_3 and 12_4 is instead equipped with one opening 52_1, 52_2, 52_3 and 52_4 representing the dispensing surface 14 of each compartment 12_1, 12_2, 12_3 and 12_4.

[0128] The openings 52_1, 52_2, 52_3 and 52_4 are of the same size, on the circle which forms the base of cylindrical shape appear as triangles, with arched base, within the circular sectors.

[0129] The openings 52_1, 52_2, 52_3 and 52_4 are closed by access means 16 with disc shape and the four compartments 12_1, 12_2, 12_3 and 12_4 are separated from the inside of the device 10 by four separation surfaces 56_1, 56_2, 56_3 and 56_4 of rectangular shape. As in the previous configuration, the separation surfaces 56_1, 56_2, 56_3 and 56_4 can (just some or all) have an openable portion which can be controlled by the controlling means 20 through a suitable actuator to enable the transit of the substance contained in a compartment 12_1, 12_2, 12_3 and 12_4 into an adjacent compartment 12_1, 12_2, 12_3 and 12_4, i.e. the mixing of two substances in adjacent containers 12_1, 12_2, 12_3 and 12_4, before the dispensing takes place from device 10 towards the inside of container (C).

[0130] The access means 16 consists of a stack 58 of different elements of circular shape 60. The elements 60 constituting the stack 58 are of two types. The first type consists of fully impermeable discs of circular shape except for a circular sector 62 that is permeable. The second type consists of fully impermeable discs of circular shape with the exception of four areas 64 which are permeable.

[0131] In figure 8 stack 58 is shown which constitutes the access means 16 in mounted shape (figure 8a) and in dismounted shape (figure 8b). The elements 60_2 and 60_4 represent the discs of the first type, while the elements 60_1, 60_3 and 60_5 those of the second type. All elements 60_1, 60_2, 60_3, 60_4 and 60_5 have the size of the base of the cylindrical shape of the device 10.

[0132] Each permeable circular sector 62 of the discs of the first type 60_2 and 60_4 corresponds in size to the circular sector that each of the compartments 12_1, 12_2, 12_3 and 12_4 make based on the cylindrical shape of the device 10. Every permeable area 64 of discs of the second type 60_1, 60_3 and 60_5 corresponds in size to the opening 52_1, 52_2, 52_3 and 52_4 of the compartments 12_1, 12_2, 12_3 and 12_4. The impermeable area of each element 60 of the stack 58 corresponds to the total area of the disc less the permeable part 62, 64. Consequently, the impermeable area of each of first type disc 60_2 and 60_4 corresponds to a surface roughly equivalent to three adjoining sectors of circumference 66 while the impermeable area of each disc of the second type 60_1, 60_3 and 60_5 corresponds to a sort of grid constituted by a cross structure 68 inserted inside a circumference.

[0133] The stack 58 shown in figure 8 consists of five discs 60, two discs of the first type 60_2 and 60_4 and three discs of the second type 60_1, 60_3 and 60_5, in which at the extremes of the stack 58 two elements of the second type 60_1 and 60_5 are positioned.

[0134] It should be noted that the stack 58 thus formed does not allow the transit of the substance S outwardly from the compartments 12_1, 12_2, 12_3 and 12_4 at the same time. But it allows the transit only through a compartment 12 at a time. This is made based on a rotation of discs of the first type 60_2 and 60_4 that occurs thanks to the application of means of rotation placed at base of the cylindrical structure of the device 10 (not shown in the figure). The discs of the second type 60_1, 60_3 and 60_5 are not rotated by the means of rotation but remain fixed at the openings of the compartments 12. Every permeable area 64 matches with one of the openings 52_1, 52_2, 52_3 and 52_4 of the compartments 12_1, 12_2, 12_3 and 12_4.

[0135] The rotation means include an electromechanical actuator, for example an electric motor, provided with a suitable mechanical system, for example a shaft system, which allows the mechanical transmission to the discs 60.

[0136] In order for a compartment 12 to be accessible from outside it is necessary that the permeable sectors 62 of both the discs of the first type 60_2 and 60_4 have at least one part superimposed on the opening 52 of the compartment

12 to which one must access.

[0137] This occurs moving the discs of the first type 60_2 and 60_4 so that each of the median (central) axes 70 and 72 of the permeable circular sectors 62 of the discs of the first type 60_2 and 60_4 is aligned, with the same direction, with the central axis of the opening 52 of compartment 12 to which is to be accessed.

[0138] To close access to each compartment 12, the discs of the first type 60_2 and 60_4 are placed so that the central axes 70 and 72 of the permeable circular sectors 62 of the discs of the first type 60_2 and 60_4 are between them at an angle of at least 90 degrees, preferably of 180 degrees, and are aligned one with a central axis of an opening 52 of a compartment 12 and the other with a central axis of an opening 52 of a different compartment 12. The discs of the first type 60_2 and 60_4 do not move simultaneously but in succession.

[0139] The discs of the second type 60_1, 60_3 and 60_5 act as a seal between the two discs of the first type 60_2 and 60_4, and between a disc of first type 60_2 and 60_4 and the plastic material surrounding the openings of the compartments 12_1, 12_2, 12_3 and 12_4. In this manner, the probability that there is an unwanted exchange of substances S from a compartment 12 to another is decreased, both during the rotation of discs of the first type 60_2 and 60_4 and when the discs of the first type 60_2 and 60_4 are stationary.

[0140] The discs of the second type 60_1, 60_3 and 60_5 also decrease the friction during the rotation of discs of the first type 60_2 and 60_4. The contact surface between a disc of first type 60_2 and 60_4 and a disc of second type 60_1, 60_3 and 60_5 is smaller than the contact surface between two discs of the first type 60_2 and 60_4.

[0141] Both the discs of the first type 60_2 and 60_4 and those of the second type 60_1, 60_3 and 60_5 are constituted by a material that, in addition to allow the functionality of device 10 optimizes the seal conditions and the friction reduction.

[0142] The discs of the first type 60_2 and 60_4 are moved by an axis, passing through their center, arriving to the rotation means. This axis may also act as anchorage for said discs 60_2 and 60_4. The rotation means are inserted inside the closed compartment 12_5.

[0143] The discs of the second type 60_1, 60_3 and 60_5 are mutually fixed to one another by means of an element external to the access means 16, for example a mask (not shown in the figure), made of the same impermeable material of the discs of the second type 60_1, 60_3 and 60_5 such as to cover the entire side surface of the cylindrical shape that constitutes the stack 58 of the access means 16. This external element is fixed in proximity of the base of the cylindrical shape of device 10 on which the openings 52 of compartments 12_1, 12_2, 12_3 and 12_4 are placed.

[0144] Figure 8Aa shows an alternative embodiment of the access means 16 to be applied to device 10 shown in figure 7. In particular, the access means 16 are constituted by two circular surfaces 61_1 and 61_2 superimposed one on the other.

[0145] As shown in figure 8Ab, the upper surface 61_1 consists of a circular shape disc made of an impermeable area corresponding to a kind of grid constituted by a cross structure inserted inside a circumference 68. Surface 61_1 therefore determines four open sectors 63.

[0146] The bottom surface 61_2 is instead constituted by a circular shape disc made of impermeable sectors 65 having the same size of the open sectors 63 of the upper surface 61_1.

[0147] The bottom surface 61_2 is characterized in that each single sector 65 can rotate around its central axis 67 so as to allow the opening of the dispensing surface 14 of the corresponding compartment 12 and create a transit for substance S. The rotary movement of the single sectors 65 occurs thanks to the application of a rotation means placed at the base of the cylindrical structure of device 10 (not shown in figure) or integrated in the device 10 in vicinity of the central axes 67 of the single sectors 65. The rotation means include an electromechanical actuator, for example at least one electric motor, provided with a suitable mechanical system, for example a shaft system, which allows the mechanical transmission to sectors 65. The rotating sectors 65 can be activated independently from one another so that it is possible a simultaneous or sequential opening of various compartments 12.

[0148] Figure 8Ac shows in detail the rotation of sector 65 about axis 67 when the two surfaces 61_1 and 61_2 of the access means 16 are superimposed. By rotating, a part of the sector 65 enters into the compartment 12 and a part of the sector 65 crosses the open sector 63 of the surface 61_1 outward the compartment 12, so as to determine a transit surface 36 for the substance S.

[0149] Figure 9 shows a system 100 consisting of the device 10 inserted inside a container C that represents the drum/basket of a washing machine L and a programming device 74. The washing machine L is a standard washing machine of any brand currently present on the market. The device 10 is programmed and controlled via the programming apparatus 74 from outside the container C. This programming apparatus 74, for example a tablet or smartphone, communicates in bidirectional mode 76 with device 10 via communication means 24.

[0150] Figures 10 and 11 show a washing system 200 in which the programming apparatus 74 is integrated in the washing machine L, acting as a control unit of the washing machine L itself. In one case (figure 10), the programming apparatus 74 communicates with the device 10 via cable 78, 80, in another case (figure 11) the communication takes place in remote mode via the bidirectional exchange 76 of electromagnetic waves.

[0151] In the case of a wired communication, the exchange of information between device 10 and programming apparatus 74 integrate in the washing machine L takes places using communication buses 78 integrated in the washing

machine L and the cable 80 connecting these buses 78 to the device. In this configuration, the communication cables 80 can be made so as to operate also as anchor cables.

[0152] In the case of a remote communication, the antenna used for the wireless transmission may be the same used for the transmission of power supply.

[0153] It is worth noting that it is possible to implement any combination of the systems 100 and 200 described in figures 9, 10 and 11. For example, it is conceivable a system in which the programming apparatus 74, integrated in the washing machine L, may communicate via cable 78 and 80 with device 10 inserted in container C and at the same time in wireless mode 76 with an element external to the washing machine L.

[0154] Furthermore, it is worth noting that any aspect of the device described in figures 1-3 can be transferred and applied to the device described in figures 4-6 and 7-8, within the limits of process application.

[0155] Although the present invention has been previously explained by means of the detailed description of some of its embodiments represented in the figures, the present invention is not limited to the embodiments described; conversely, the present invention comprises all the changes or improvements which will appear clear to the person skilled in the art.

[0156] The person skilled in the art, with the purpose of satisfying further and contingent requirements, may make several further modifications and variants to the device, to the system and to the washing system described above, all of them falling however within the scope of protection of the present invention as defined by the appended claims.

Claims

1. Device (10) for automatically dispensing at least a solid or fluid substance (S) within a container (C), wherein the device is insertable into the container (C) and extractable from it,
characterized by comprising:

   - at least a compartment (12) for containing said substance (S) having a dispensing surface (14) for dispensing the substance (S) outward the compartment (12) into the container (C),
   - at least an access means (16) coupled to said dispensing surface (14) such as to achieve at least a configuration of total opening in order to allow a dispensing of the substance (S) through the entire dispensing surface (14) and of total closure in order to prevent the dispensing of the substance (S) through the dispensing surface (14),
   - at least an actuator (18) connected to the access means (16) for activating said access means (16),
   - controlling means (20) connected to the actuator (18) and programmable for automatically managing the dispensing of said substance (S) within the container (C), by varying the configurations of said access means (16) and
   - a power supply means (22) connected to said controlling means (20) for supplying the device (10),

   wherein said device (10) is movable with respect to the container (C) and the dispensing of the substance (S) within the container (C) takes place in dependency of the movement of the device (10) with respect to the container (C).

2. Device (10) according to claim 1, **characterized in that** the access means (16) is such as to achieve furthermore a configuration of partial opening, between the configuration of total opening and total closure, in order to allow the dispensing of the substance (S) only through a portion of said dispensing surface (14).

3. Device (10) according to one of the preceding claims, **characterized by** comprising a plurality of compartments (121, 122, 123, 124), at least two of which being contiguous, each compartment (121, 122, 123, 124) containing a solid or fluid
substance (S) intended to be dispensed into the container (C) through a dispensing surface (14), wherein the controlling means (20) is programmable for managing the dispensing of the substance (S) from each compartment (121, 122, 123, 124) according to different timings.

4. Device (10) according to claim 3, **characterized in that** at least a wall portion dividing two said contiguous compartments (121, 122, 123, 124) can be opened in order to allow the mixing of the substances contained in the two contiguous compartments (121, 122, 123, 124) within the device (10).

5. Device (10) according to claim 3 or 4 **characterized by** comprising a plurality of access means (161, 162, 163, 164) each of which is coupled to the dispensing surface (14) of each compartment (121, 122, 123, 124), wherein the controlling means (20) is programmable for managing the configuration of the access means (161, 162, 163, 164) of each compartment (121, 122, 123, 124) independently of one another.

6. Device (10) according to one of the preceding claims, **characterized in that** the access means (16) comprise a door slidable along the dispensing surface (14), thereby determining an initial position of starting point and a final position of end point.

7. Device (10) according to claim 6, **characterized in that** the actuator (18) is of electromagnetic type and comprises at least an induction coil (33) and magnetized elements (35, 37, 39), wherein said induction coil (33) is located on the sides of the sliding door and the magnetized elements (35, 37, 39) are located within the door and at the starting and end point of the latter.

8. Device (10) according to claim 3 or 4, **characterized in that** the access means (16) comprise a plurality of membranes (60) having a partially impermeable surface, said access means (16) being rotatable relative to the dispensing surface (14).

9. Device (10) according to claim 8, **characterized in that** the membranes have a form of a disc (60) and are rotatable relative to an axis passing through their centre in dependency of a driving action of a motor coupled to them.

10. Device (10) according to claim 3 or 4, **characterized in that** the access means (16) comprise a plurality of membranes (611, 612) with circular form, one of which having sectors (65) rotatable relative to their own central axis (67).

11. Device (10) according to one of the preceding claims, **characterized in that** said device (10) is entirely insertable and fixable within an hollow protective means (40) having at least an opening (46) for the transit of the substances from the device (10) towards the container (C) and from the container (C) towards the device (10).

12. Device (10) according to one of the preceding claims, wherein:

- said device (10) comprises communication means (24) for receiving and transmitting data, wherein said communication means (24) is connected to the power supply means (22) and to the controlling means (20), and/or
- the actuator (18) is an electromechanical actuator, and/or
- said device (10) comprises at least one sensor (26) connected to the controlling means (20) for detecting a physical or chemical quantity within the container (C), and/or
- said container (C) is the drum of a washing machine (L), and/or
- said device (10) is intended to be immersed in an aqueous environment, and/or
- in the configuration of total closure, the compartment (12) is hermetic relative to the external environment.

13. System (100) for dispensing at least a solid or fluid substance (S) within a container (C), comprising:

a device (10) according to one of the preceding claims and a programming apparatus (74) for the remote control and programming of the controlling means (20) of said device (10),
wherein the programming apparatus is in communication with the device (10) through the communication means (24) of the device (10).

14. System (100) according to claim 13, wherein said programming apparatus (74) is a computer, a smartphone, a tablet, a laptop or a remote control.

15. Washing system (200) comprising:

- a washing apparatus (L) comprising at least a support structure having a container (C) in which to insert at least an object to be washed, wherein said container (C) is movable relative to the supporting structure, at least a washing unit for inserting and extracting water from the container (C) and at least a container (C) movement managing unit for managing the movement of the same;
- a device (10) according to one of the claims 1 to 12 intended to be inserted into the container (C), wherein the substance (S) to be dispensed is employed during the washing of the object;
and
- a programming apparatus (74) for the remote control and programming of the programming means (20) of said device (10), wherein the programming device (74) is integrated in the supporting structure of the washing apparatus (L) and is in communication with the device (10) through the communication means (24) of the device (10).

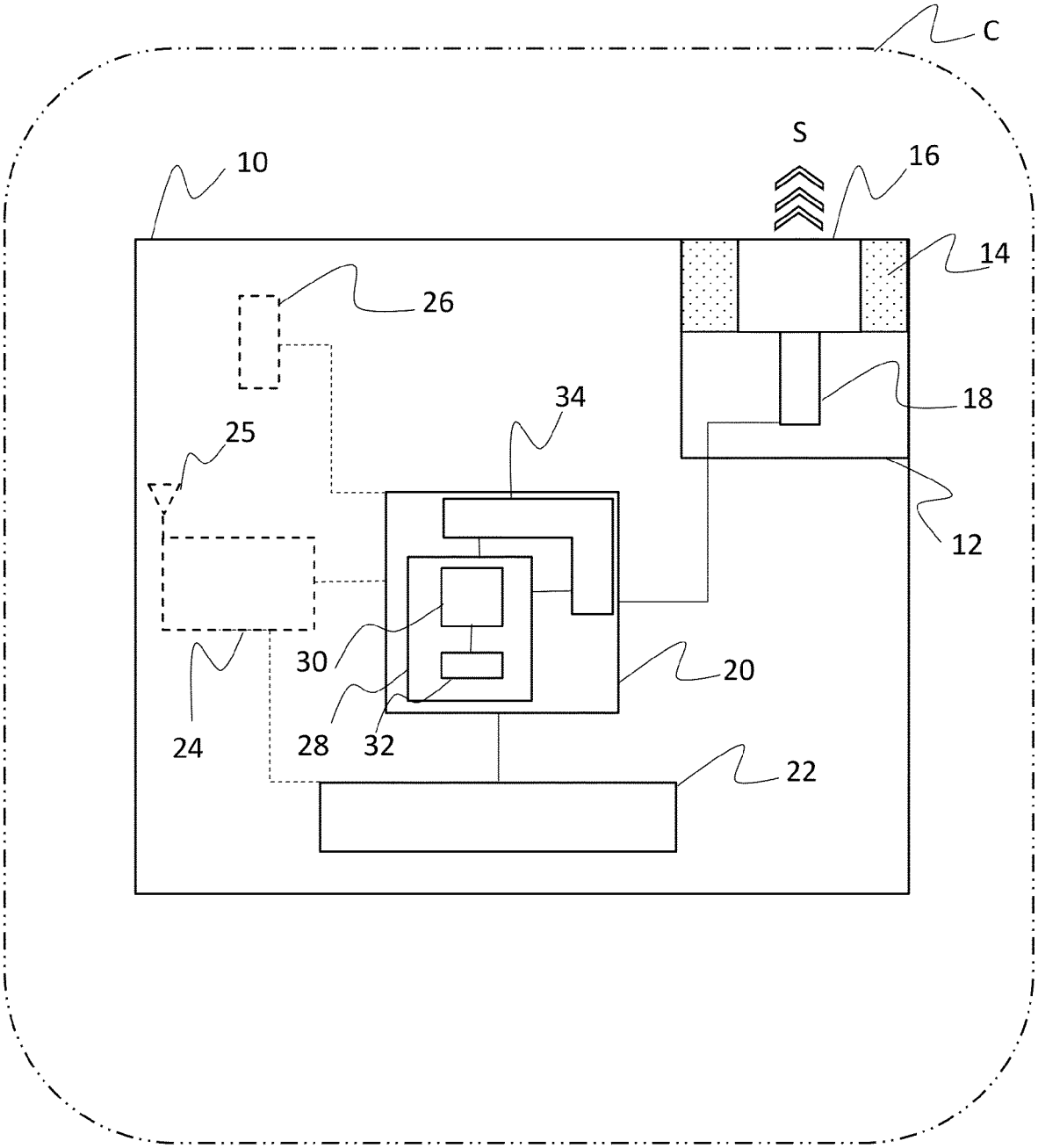


FIG. 1

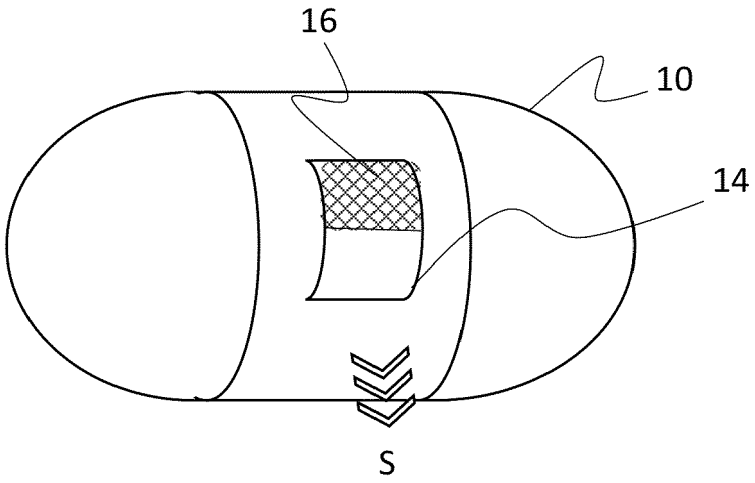


FIG. 2

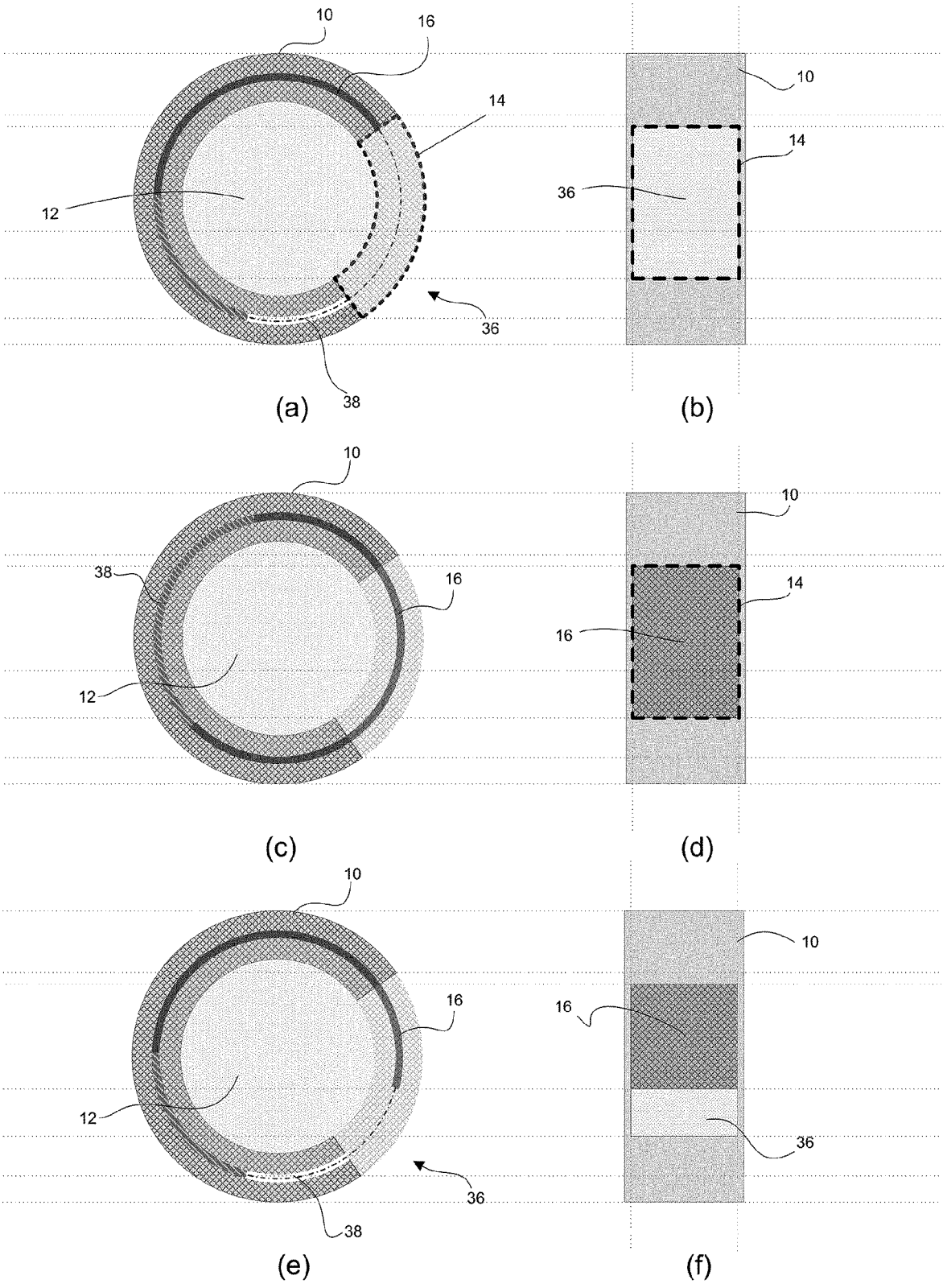
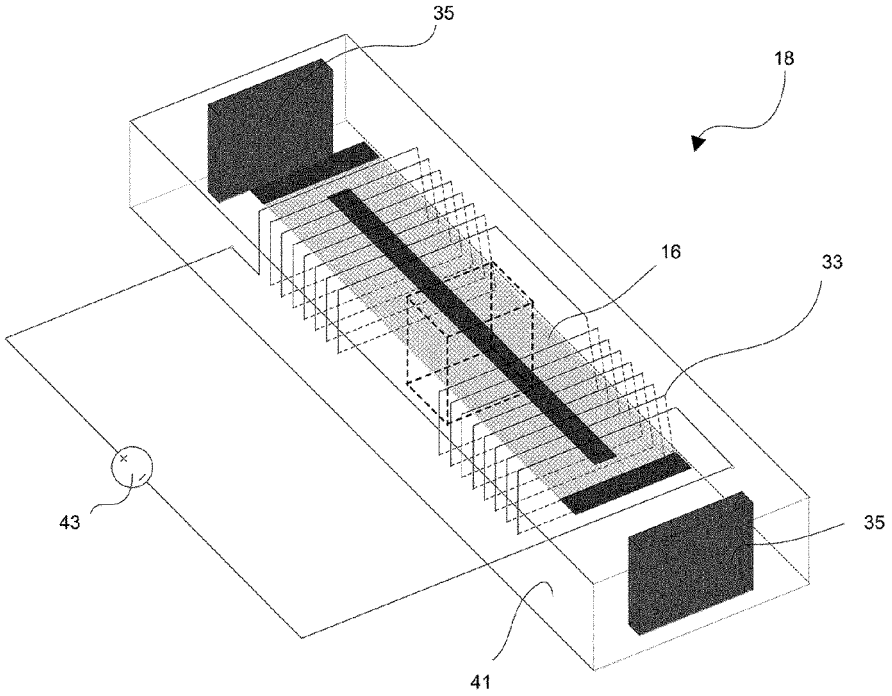

10
16
14
12
36
38
(a)
10
14
36
(b)
10
38
16
12
(c)
10
14
16
(d)
10
16
12
36
38
(e)
10
16
36
(f)

FIG. 3



(a)

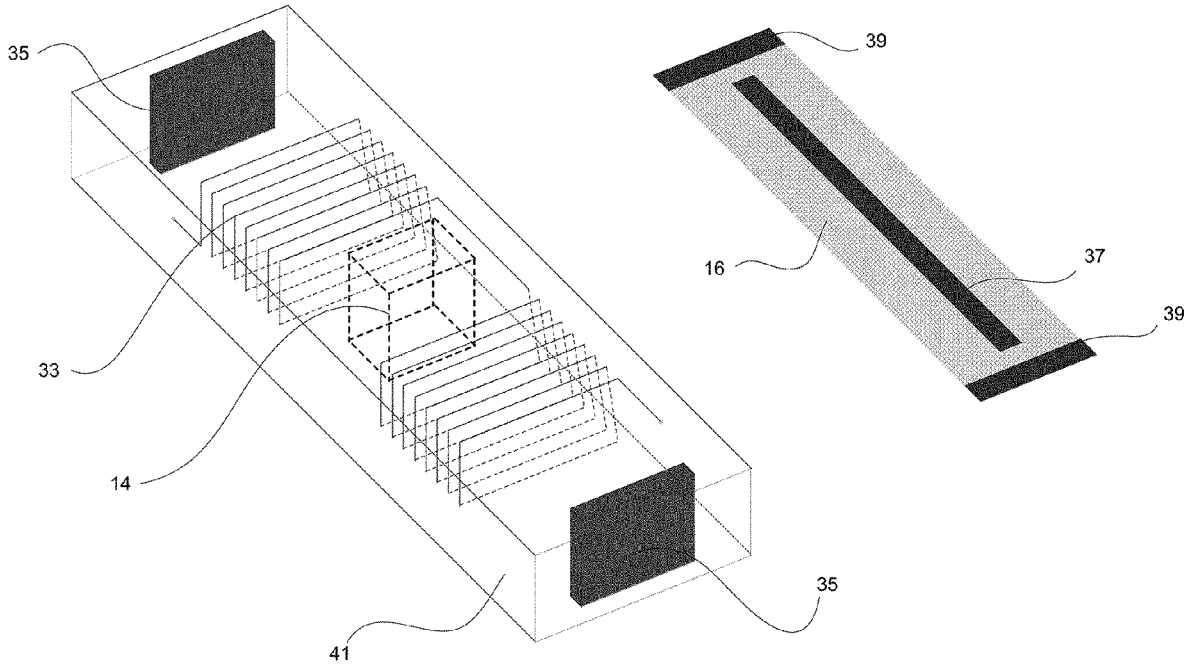
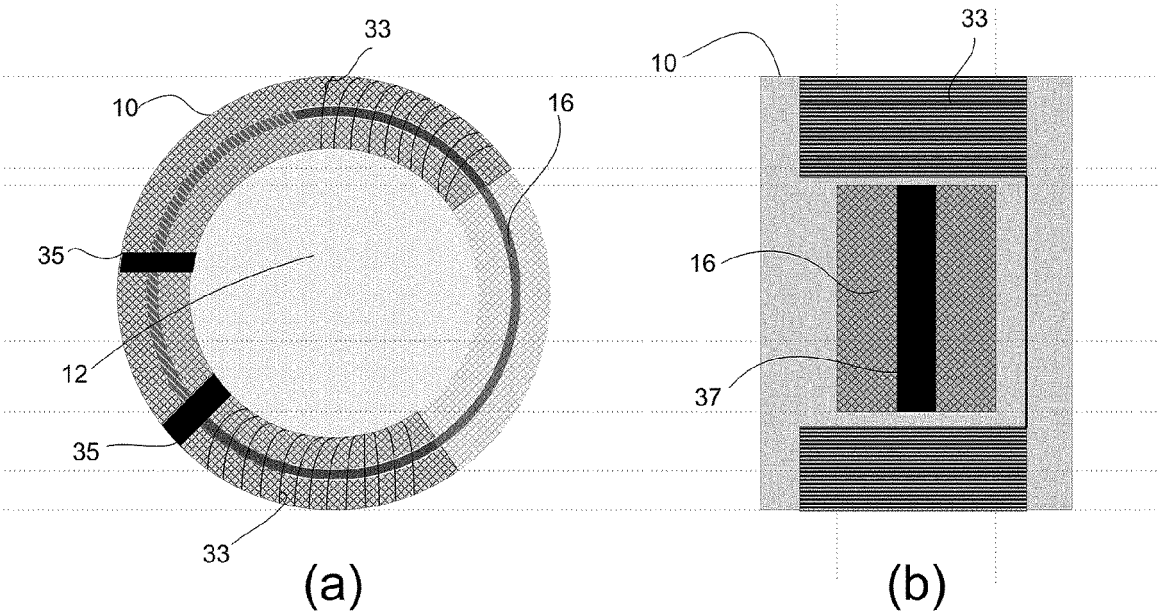


FIG. 3A

(b)



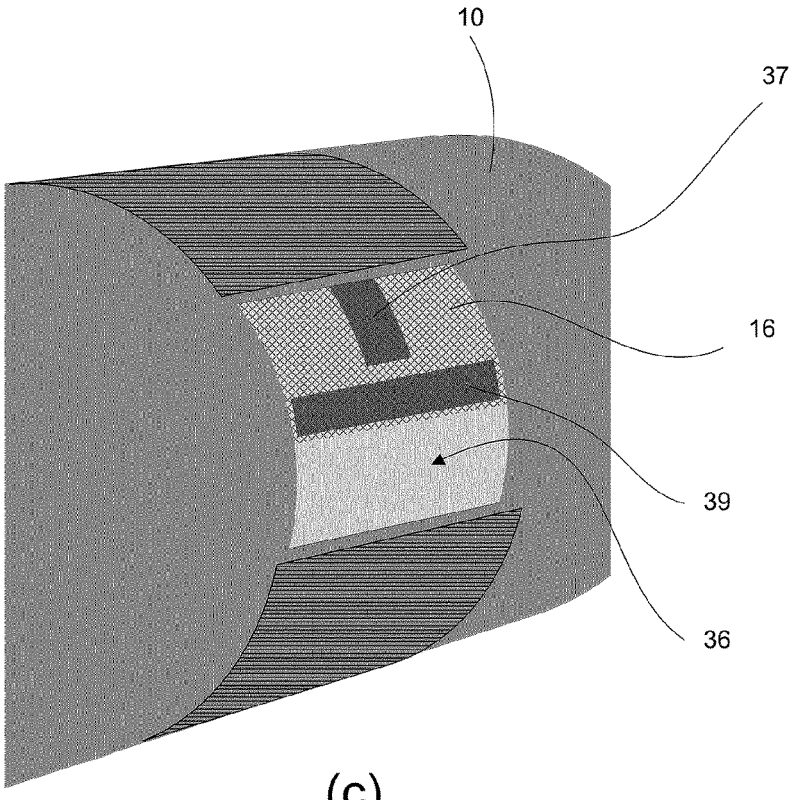


FIG. 3B

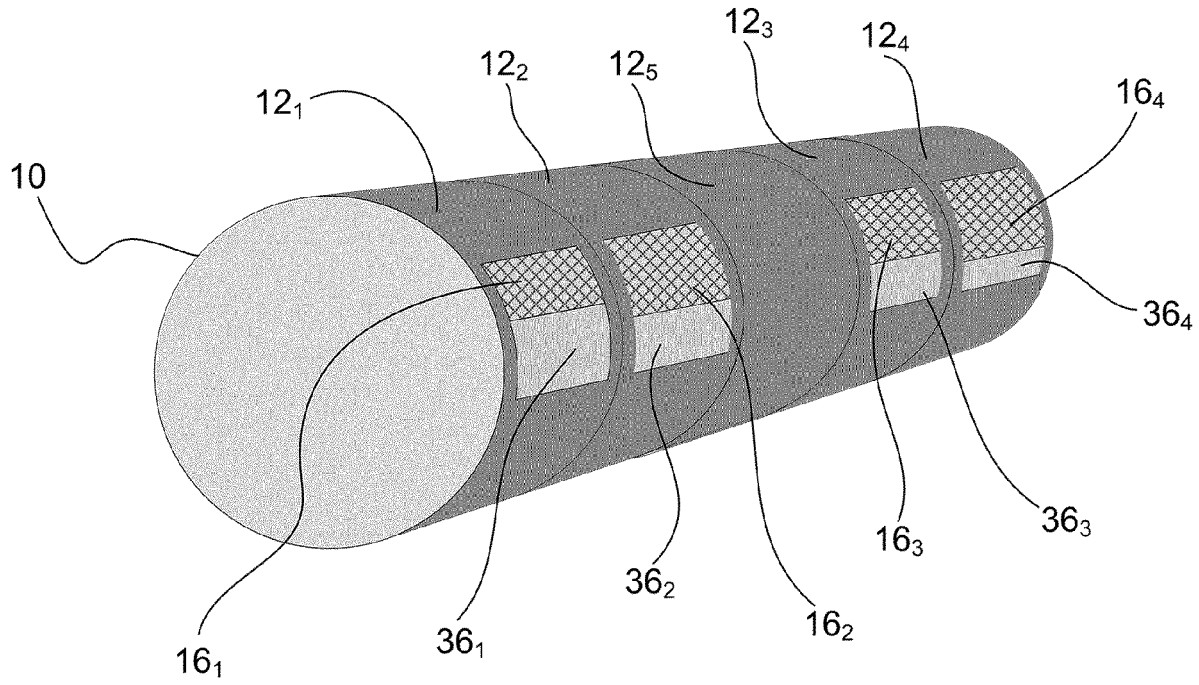
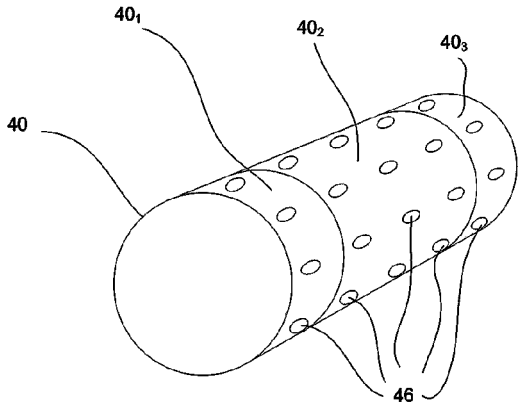
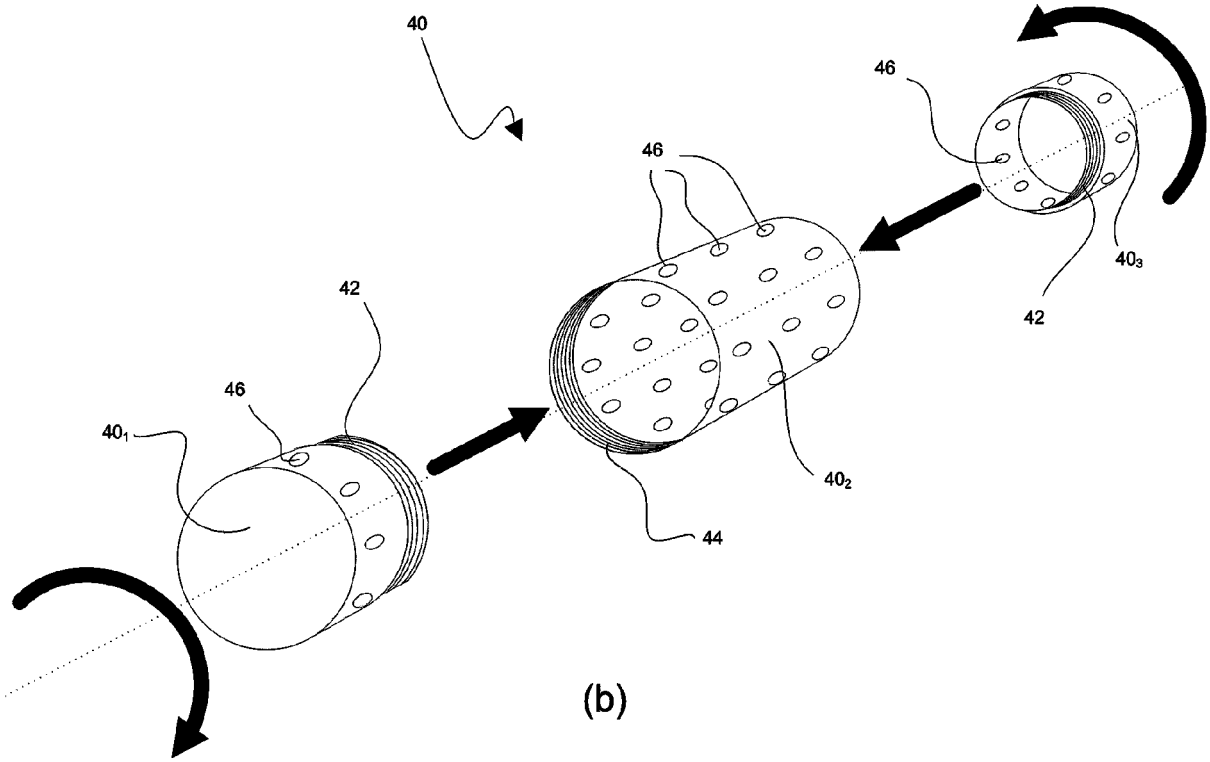


FIG. 4



(a)



(b)

FIG. 5

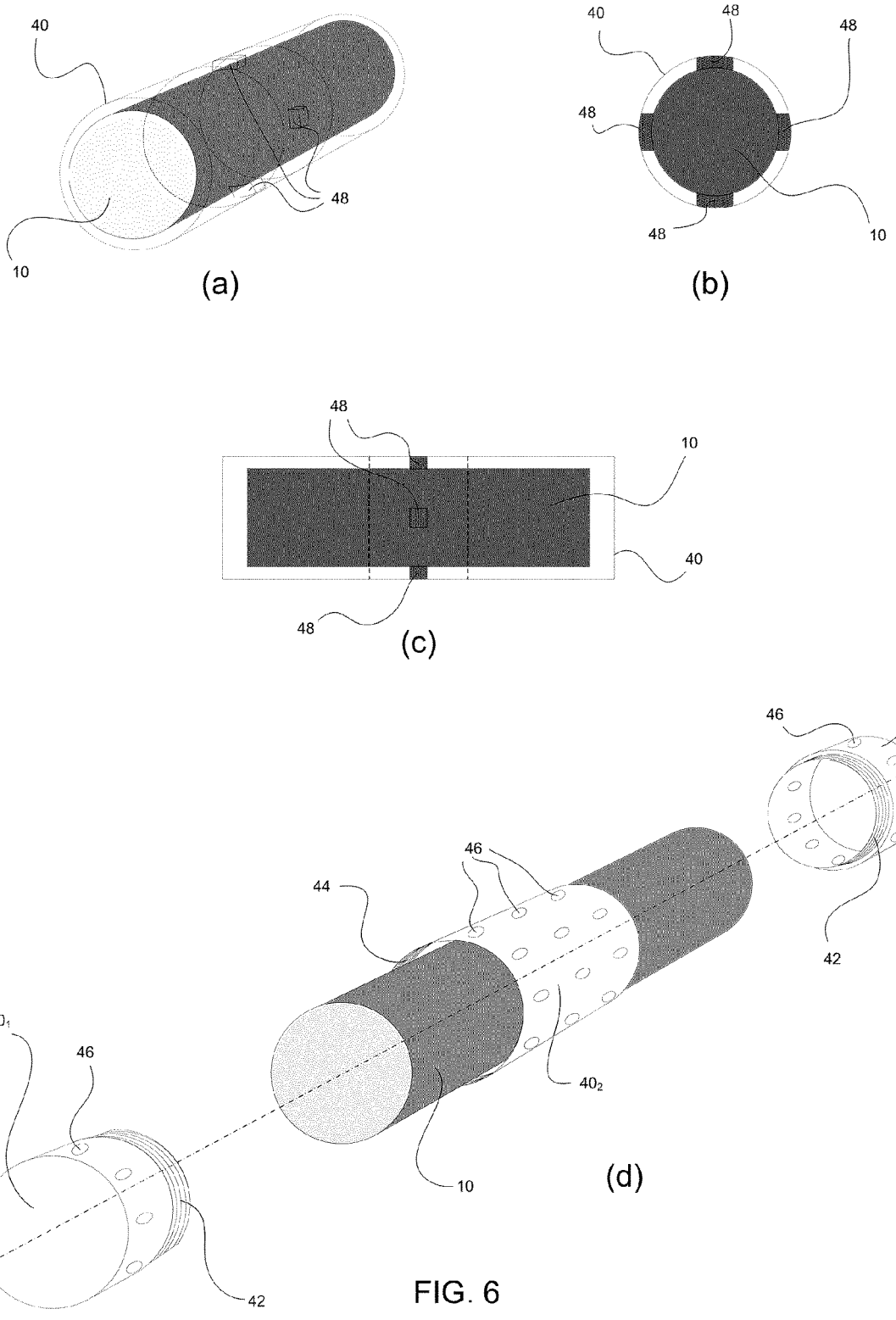

40
48
10
(a)
40
48
48
48
48
10
(b)
48
10
40
48
(c)
40_3
46
46
44
42
40_1
46
40_2
10
(d)

FIG. 6

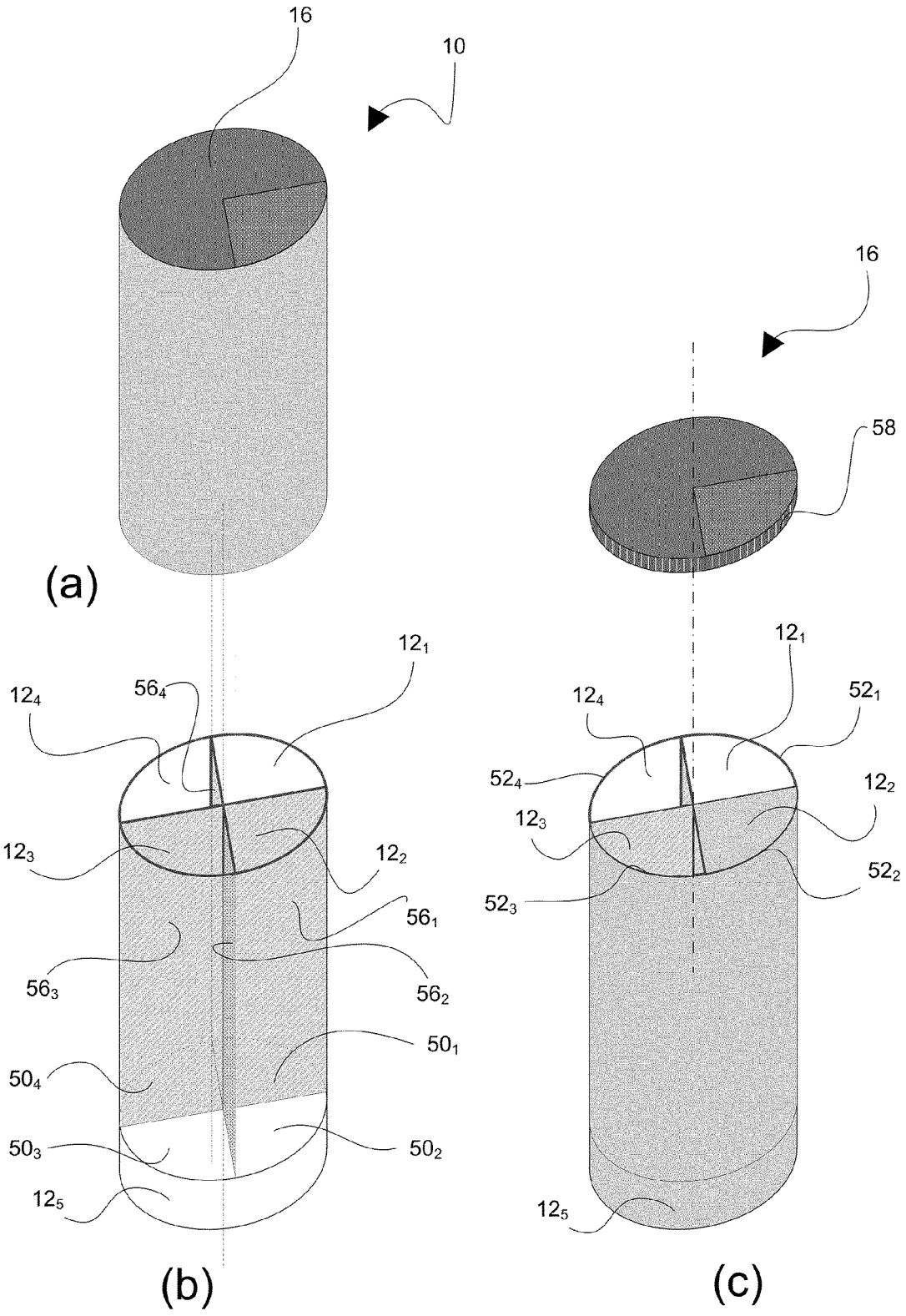

16
10
(a)
16
58
12_1
12_4
56_4
12_3
12_2
56_1
56_3
56_2
50_1
50_4
50_3
50_2
12_5
(b)
12_1
12_4
52_1
52_4
12_2
12_3
52_2
52_3
12_5
(c)

FIG. 7

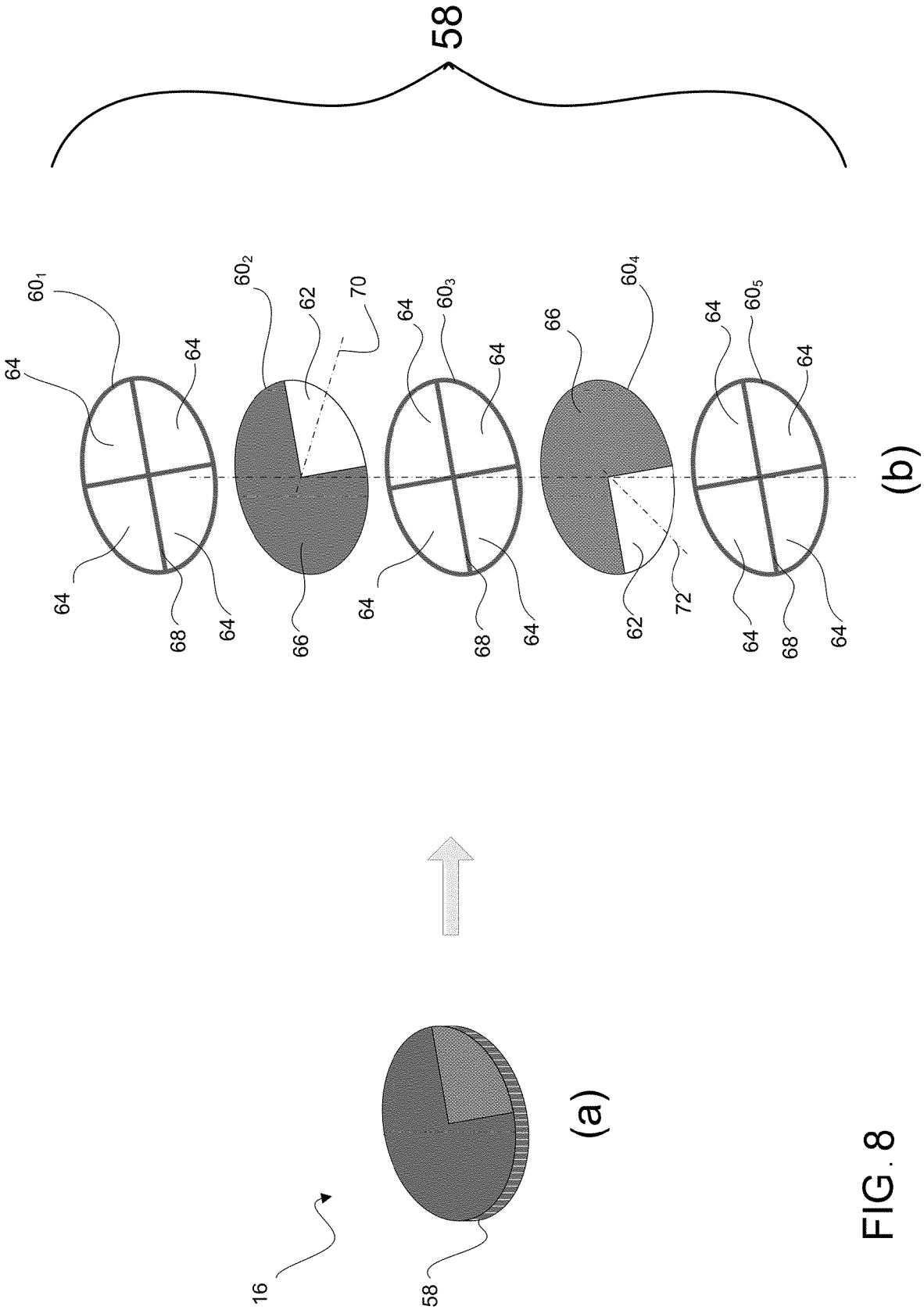


FIG. 8

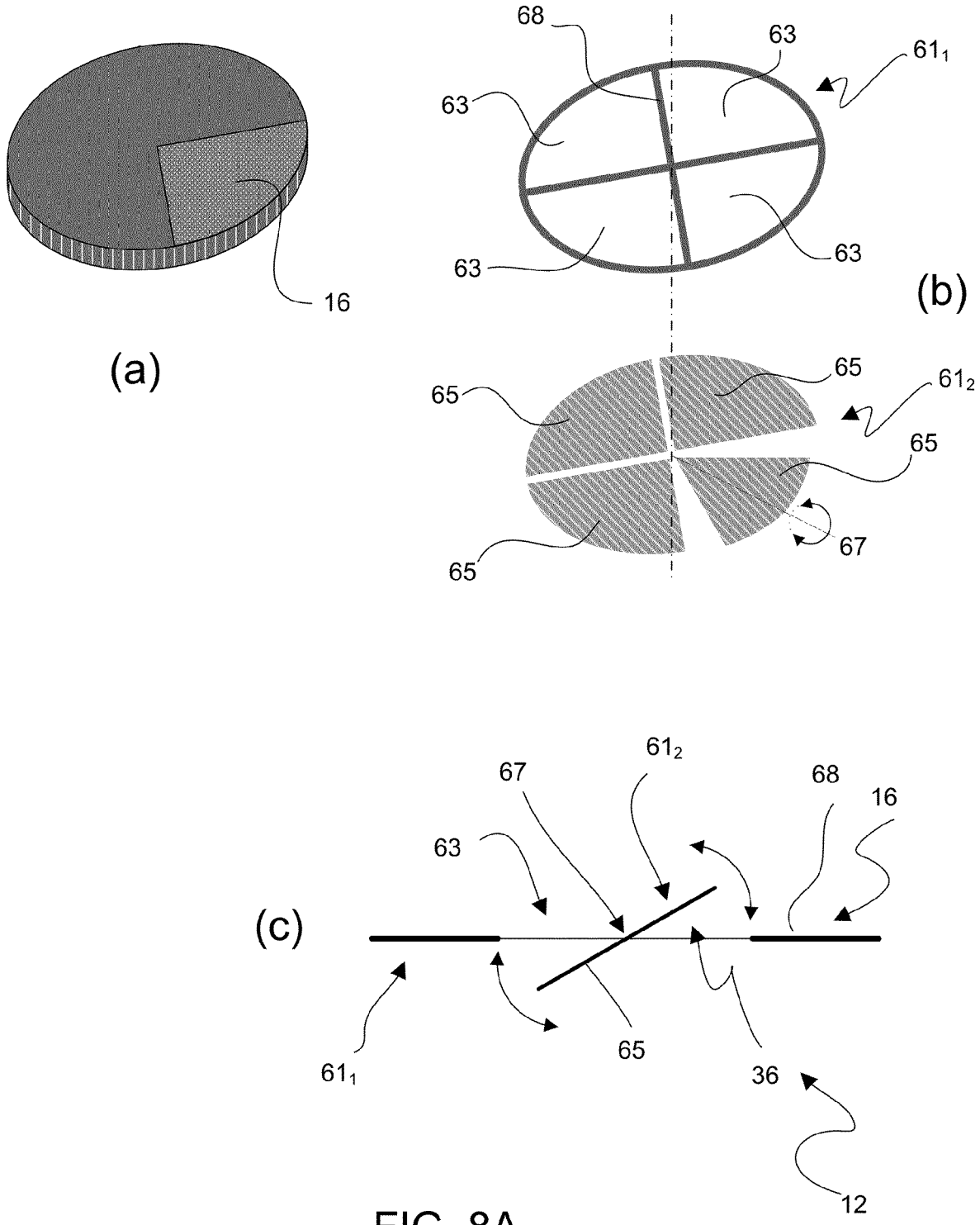

(a)
16
(b)
68
63
61_1
63
63
63
65
61_2
65
65
67
65
(c)
61_2
67
68
16
63
61_1
65
36
12

FIG. 8A

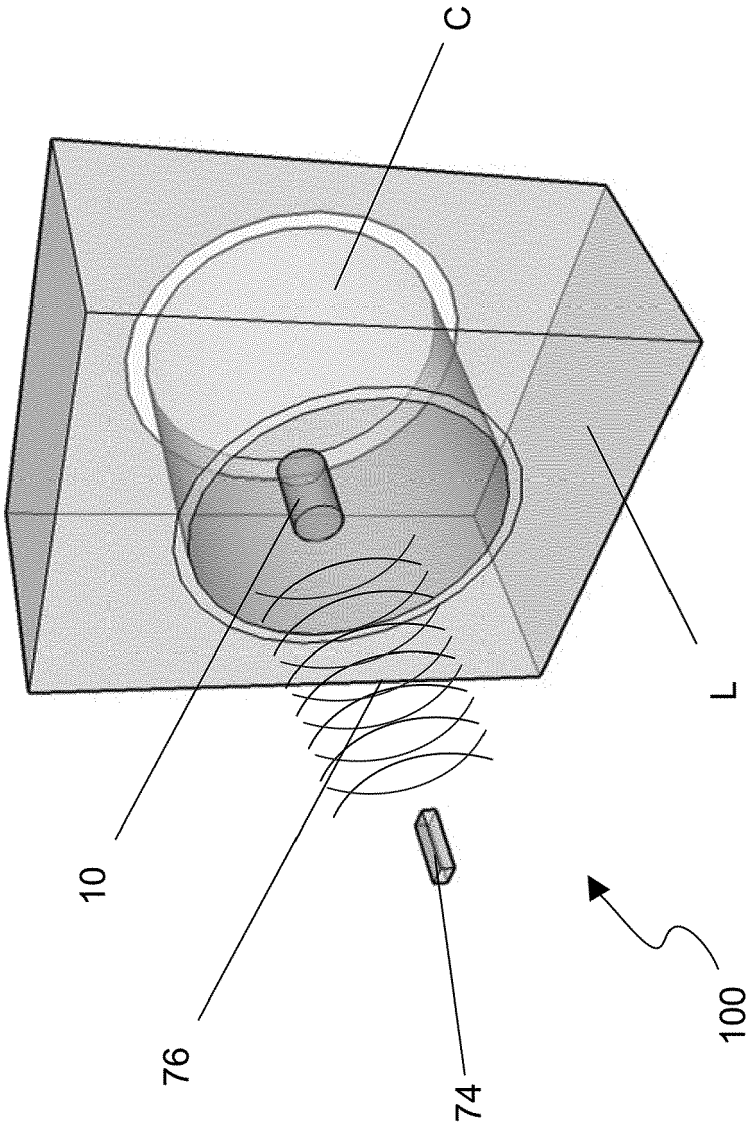


FIG. 9

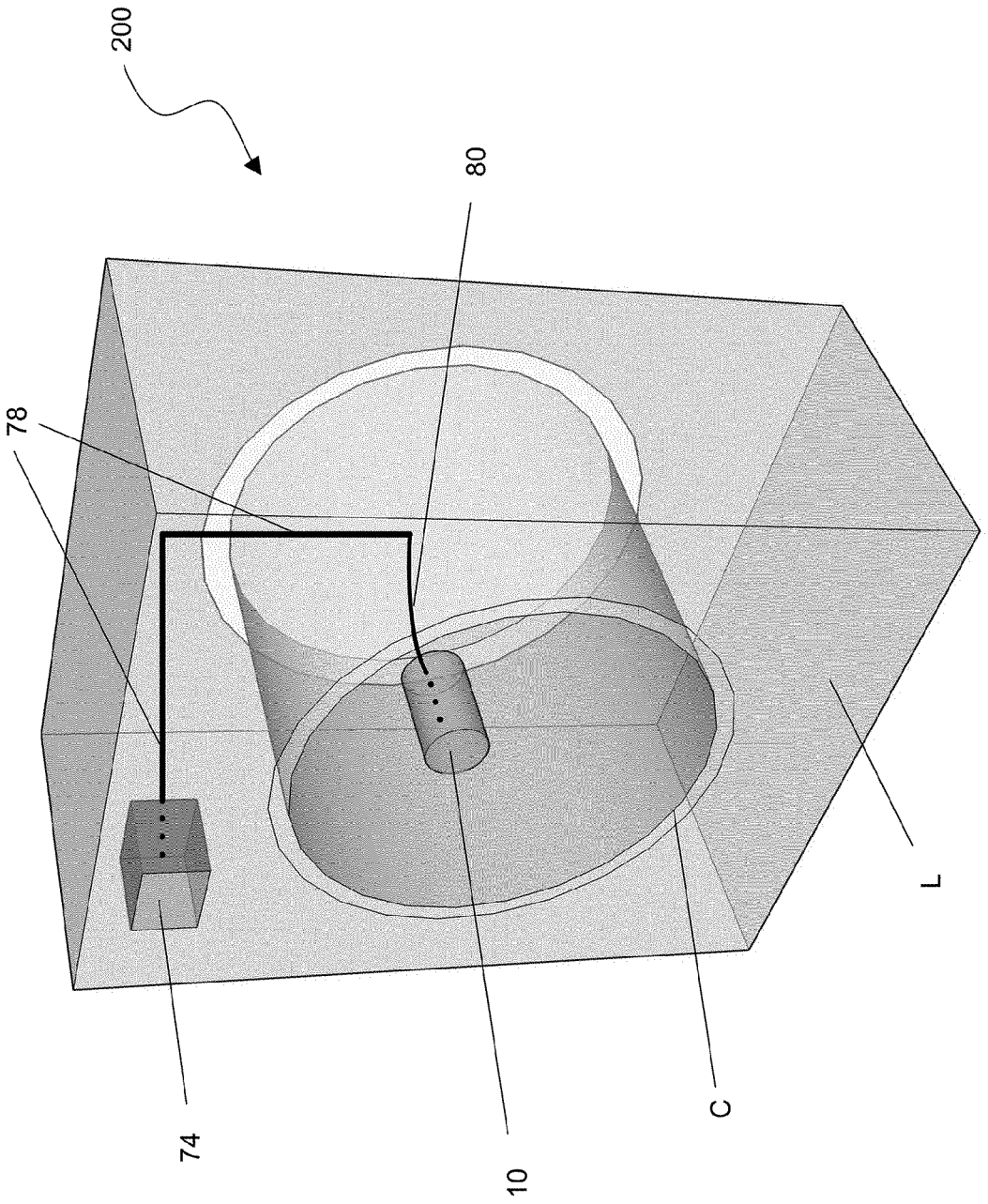


FIG. 10

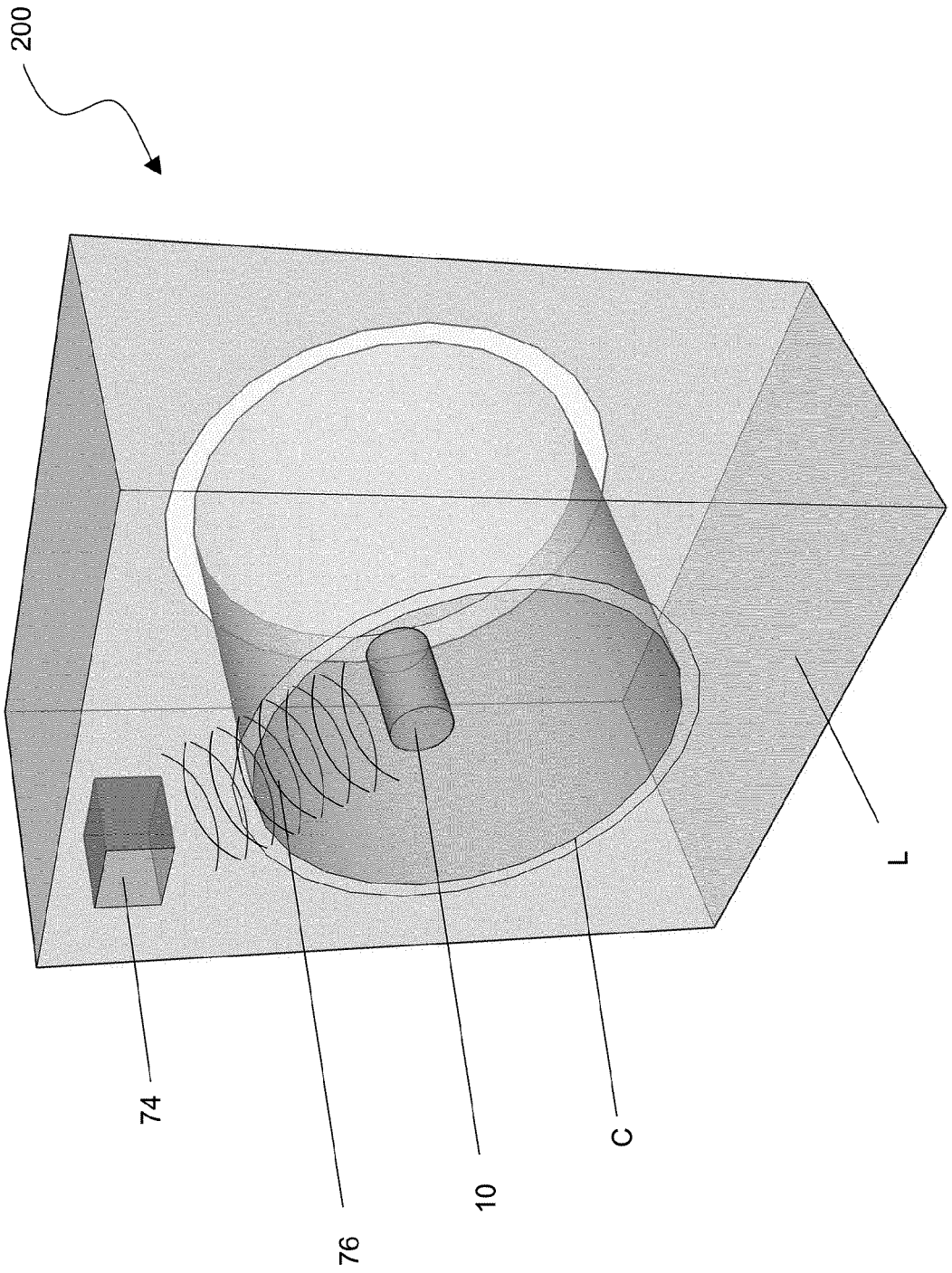


FIG. 11

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 16 19 0574

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	US 2003/182732 A1 (DAVENET DOROTHEE HELENE [CH] ET AL) 2 October 2003 (2003-10-02) * paragraph [0001] - paragraph [0084] *	1,3,5, 11-13,15 2,4, 6-10,14	INV. D06F39/02 A47L15/44
X A	US 2011/180118 A1 (SCHROTT HARALD [DE]) 28 July 2011 (2011-07-28) * page 1 - page 20 *	1,3,5, 12,13 2,4, 6-11,14, 15	
A	CA 2 006 870 A1 (BUSCH PETER [DE]) 30 June 1990 (1990-06-30) * page 2, line 17 - page 3, line 19 *	1,11	

TECHNICAL FIELDS SEARCHED (IPC)

D06F
A47L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 November 2016	Jezierski, Krzysztof

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 19 0574

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

11-11-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2003182732 A1	02-10-2003	NONE	
US 2011180118 A1	28-07-2011	CA 2733108 A1	11-02-2010
		CN 102112035 A	29-06-2011
		DE 102008036586 A1	11-02-2010
		EP 2306881 A2	13-04-2011
		KR 20110055538 A	25-05-2011
		RU 2011103962 A	10-08-2012
		US 2011180118 A1	28-07-2011
		WO 2010015367 A2	11-02-2010
CA 2006870 A1	30-06-1990	CA 2006870 A1	30-06-1990
		DE 3844368 C1	12-04-1990
		ES 1012701 U	01-09-1990
		WO 9007605 A1	12-07-1990

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82