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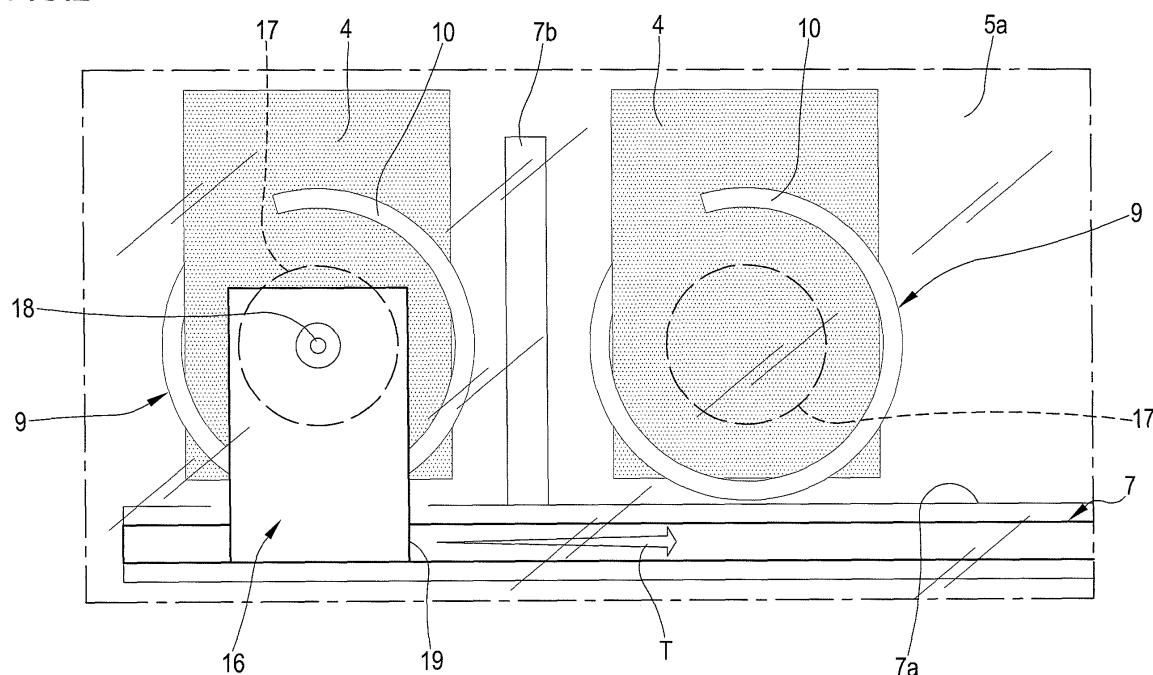
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(54) **Product vending machine**

(57) The invention concerns a product dispensing machine, in which a plurality of spiral dispensers (9) are associated to respective planes (7); the spiral dispensers (9) comprise successive spires (10) and exhibit a prevalent development directed along a rotation axis (11) between a rear end (9a) and a front release end (9b); the machine further comprises a movement device (12) for selectively generating a rotary motion of the spiral dispenser (9) about the respective rotation axis (11) such

as to determine an advancement of the products to be dispensed interposed between successive spires up to the release end (9b). The machine further comprises at least a sensor (16) configured such as to detect a presence of a further product (4) in the spiral dispenser (9) beyond the product dispensed; the sensor (16) is configured such as to emit a signal directed to a central area (17) of the spires (10) arranged about the rotation axis (11) thereof.

FIG.2



Description

[0001] The present invention relates to a product dispensing machine, otherwise known as a vending machine, destined to dispense a product selected by a user via spiral dispensing devices.

BACKGROUND

[0002] As is known, product dispensing, or vending, machines of products constituted by a frame which defines internally thereof a store which is able to contain a predetermined number of products that are put up for sale.

[0003] By means of a user interface, the user selects the product desired and, following payment of the correct sum, the machine releases the product at a collecting zone that is accessible to the user.

[0004] In particular, vending machines are known in which the store is constituted by a plurality of drawers that develop horizontally and which each are equipped with a plurality of dispensing spirals.

[0005] The spirals are mounted with a horizontal axis and keyed to an appropriate mechanism for setting them in rotation.

[0006] The user views, through a transparent window, the various drawers and the various spirals which bear the respective products.

[0007] Following the selection of the desired product and payment therefor, the machine proceeds to activating a motor which, via a transmission, sets the appropriate spiral in rotation.

[0008] The various products are borne between successive turns of the spiral and therefore a rotation, for example by 180° or 360°, of the spiral corresponds to an advancing of the product towards the window.

[0009] Between the terminal zone of the spiral and the window, a drop volume is usually included, with the product pushed by the spiral towards the volume and being able to fall freely towards the collecting zone.

[0010] One of the problems connected to vending machines with spiral dispensing systems is linked to the correct management of the dispensing, i.e. a check on the functionality of the dispensing.

[0011] Various solutions over a period of time have been proposed to overcome this problem.

[0012] In one of these, described in patent no. WO 00/74009, each drawer is provided, at a lower front portion thereof, with an infrared ray sensor system such that the fall of a product is determined as the transmission of the infrared signal between the transmitter and the receiver is interrupted.

[0013] In this situation the machine is automatically able to determine that a product has been dispensed, or whether there are no products within that particular spiral following an unsuccessful dispensing thereof after selection, or also the presence of jammed products.

[0014] In a technological development of the above

concept, described for example in US patent US 2002/0017531, apart from the presence of the mentioned sensor/s, able to detect the effective fall of the product, a mechanism is described such that in the absence of a delivery after the selection by the user, the spiral is further moved to seek to shift products that might be jammed, thus guaranteeing dispensing in any case.

[0015] It is evident that the above-described systems, no matter how evolved, have the main aim of verifying the dispensing of the product and, in a case of non-delivery, blocking the possibility that someone else can select the spiral involved, whether it is empty or has a jammed product in it.

[0016] However, these devices are not able to prevent the event of an unsuccessful delivery once the store has been emptied if the machine is not already aware of this datum.

[0017] With the aim of obviating the above drawback, in patent no. EP 572119 a system is described which is able to detect both the dispensing of the selected product and the presence of at least a further product on the spiral.

[0018] In particular, the compartments described in the above-mentioned patents are provided, at the outlet of each of the spirals, with two sensors.

[0019] These are: a first sensor located frontally and in a lower position, able to establish that the product has actually been dispensed following the fall thereof, and a laterally-located sensor with respect to each spiral and at the last spires before the dispensing, which lateral sensor is capable of detecting a presence of a further product not yet dispensed from the spiral.

[0020] This sensor arrangement enables the machine to verify the availability in the spiral of at least a further product to be dispensed, or to inhibit the spiral should there be no more products available at the final treatment spire.

[0021] A further document, JP 7249161, illustrates a product dispensing machine equipped with spirals which uses an ultrasound sensor, mounted fixed on the rear portion of each spiral a little above the drive axis, which ultrasound sensor is able to detect a presence of the product located further back in the spiral, detecting also the distance from the sensor by means of an analysis of the travel time of the signal.

[0022] This document teaches a methodology that is especially suitable for managing the stores as it can supply information to an operative about to refill the store relating to when to refill, so that he can thus optimise times and bring only the required products.

[0023] This device however suffers from some important drawbacks: in fact, the sensor is positioned far away from the detecting point when the store is about to run out of products. In this situation, the signal can move over all the distance to the final spires and then return. If the sensor is not perfectly mounted in axis and especially in a case of even small deformations of the spiral in its axial arrangement, this can result in false readings.

[0024] In fact quite often it occurs that an axial mis-

alignment of the spiral is such that the sensor detects the presence not of the product, but of the spiral as the detecting axis of the sensor is inclined with respect to the axis of the spiral. Further, in addition to the considerable installation costs of a sensor for each spiral, it should not be forgotten that if a product is not inserted in each of the spires, the information detected by the sensor becomes unreliable in relation to the effective dispensing of the product.

[0025] If there were only one product inserted at a half-way place in the spiral, the sensor would detect the presence thereof, while when selected for dispensing no product would be released.

[0026] The prior art described briefly above leads to an improvement with respect to the devices marketed today, but leads to design complications in the structure of each spiral and the use of various sensors, as well as the relative control logic.

[0027] Further, the reliability of the detection by means of the sensor destined to verify the presence of a further product on the spiral is not very high as it is known that the spirals transport products of various nature, dimensions and lateral volumes, as well as special profiles, that are different from one another.

[0028] The detection that can be performed by means of the lateral sensor is subject to various false detections which can lead, alternatively, to a blocking of a spiral in which products are still present, or an unsuccessful dispensing of the product already paid-for following a wrong positive detecting of a presence of a product that is effectively not present.

[0029] Also, the lateral position of the sensor suffers from the detections of the metal portion of the spiral that on the one hand during the movement crosses the visual field of the sensor and has to be recognised and filtered, and on the other hand, even in static conditions (with the spiral stationary) problems might emerge were the portion of the spiral to stop exactly in front of the sensor, blocking the view (it is known that to dispense products of different dimensions a same spiral has to be stopped in different angular positions).

SUMMARY

[0030] An aim of the present invention is to obviate one or more of the drawbacks in the prior art as described above.

[0031] A first aim is to provide a dispensing machine which is able to reliably verify further products in each of the spirals from which dispensing can be carried out in such a way as to prevent the user from selecting products that are no longer available.

[0032] A further aim is to minimise, if possible, the number of sensors used for carrying out the detection of the presence of products.

[0033] An aim is to optimise the detecting of the products on the spirals without any need for performing various and numerous controls.

[0034] A further aim is to reduce false detections, increasing the operative reliability of the machine.

[0035] In a first independent aspect, a product dispensing machine is provided comprising: a support frame defining internally thereof a housing chamber for the products to be dispensed and optionally exhibiting a wall provided with at least a transparent portion for a visual access to the products; a magazine located in the housing chamber and provided with a predetermined number of planes for containing the products to be distributed; a collecting compartment of the product released associated to the support frame for enabling collection of the product; a plurality of spiral dispensers associated to respective planes, the spiral dispensers comprising successive spires and exhibiting a prevalent development direction directed along a rotation axis between a rear end and a front end for releasing, the spiral dispensers being destined to house the products to be dispensed interposed between successive spires and resting on the plane; at least a movement device for selectively generating a rotating motion of at least a spiral dispenser of the spiral dispensers about the respective rotation axis, the rotary motion causing an advancement of the products to be dispensed interposed between successive spires towards the front release end, a product interposed between successive spires being released at the release end, **characterised in that** it further comprises a sensor of a presence of at least a product located between two spires of a spiral dispenser, the sensor being configured such as to determine a presence of a portion of the product at a central area of an area occupied by the spires located about the rotation axis.

[0036] In a second aspect according to the preceding aspect, a machine is provided in which the sensor is suitable for sending and/or receiving a signal in a substantially parallel direction to the rotation axis of the spiral dispenser, the sensor sending and/or receiving the signal towards and/or from the central area of occupation of the spires.

[0037] In a third aspect according to any one of the preceding aspects, a machine is provided in which, during the detecting stage, the sensor exhibits an active portion suitable for emitting/receiving the signal, the active portion being positioned in a zone situated about the rotation axis of the spiral dispenser.

[0038] In a fourth aspect according to any one of the preceding aspects, a machine is provided which further comprises a mobile support at least in a plane that is substantially parallel to a lie plane of the planes, i.e. in particular a vertical plane in use conditions of the machine, at least the sensor being mounted on the mobile support in order to be positioned, during the detecting stage, with an active portion arranged and directed along the rotation axis of the spiral detector. In a fifth aspect according to the preceding aspect, the mobile support is in the housing compartment, interposed between a front wall of the support frame and the front release end 9b of the spiral dispensers.

[0039] In a sixth aspect, according to any one of the preceding aspects 4 and 5, a machine is provided in which the mobile support enables the at least a sensor a motion along a transversal direction (T, V), and in particular perpendicular, to the rotation axis (11).

[0040] In a seventh aspect according to any one of the preceding aspects 4, 5 and 6, a machine is provided in which the mobile support comprises a plurality of sensors mounted aligned along a transversal direction (T, V) and in particular perpendicular, to the rotation axis (11) in particular such as to be able to read, with a movement from a start run to an end run, the presence of products to be dispensed substantially on all the spiral dispensers involved in the movement. In an eighth aspect according to any one of the preceding aspects from four to seven, a machine is comprised further including a mobile support at least in a perpendicular plane to the lie plane of a plane along a transversal direction to the rotation axis, at least the sensor being mounted on the mobile support in order to be positionable, during the detecting step, with an active portion arranged and directed along the rotation axis of the spiral dispenser, in particular the support being mobile such as to bring the active portion of the sensor to at least a respective spiral dispenser mounted on each of the superposed planes, for example by means of a vertical movement according to a direction V, the support optionally being mobile such as to bring the active portion of the sensor to each spiral dispenser mounted on any one of the planes, in particular the support being mobile in at least two directions T, V transversal to one another and transversal to the rotation axis of the spiral dispensers.

[0041] In a ninth aspect according to any one of the preceding aspects, a machine is comprised further comprising a support that is mobile in at least a lie plane of a plane of the dispenser along a direction that is transversal to the rotation axis, at least the sensor being mounted on the mobile support in order to be positioned, during the detecting stage, with an active portion arranged and directed along the rotation axis of the spiral dispenser, in particular the support being mobile such as to bring the active portion of the sensor to at least each spiral dispenser mounted on the plane, the support optionally being mobile such as to bring the active portion of the sensor to each spiral dispenser mounted on any one of the planes, in particular the support being mobile in at least two directions that are transversal to one another and transversal to the rotation axis of the spiral dispensers.

[0042] In a tenth aspect according to any one of the preceding aspects, a machine is provided in which, during the detecting stage, an active portion of the sensor is interposed between the frontal portion, optionally transparent, of the wall and the interior releasing end of the spiral dispenser, in particular a sensor positioned, during the detecting stage, externally of the spiral dispenser at the front release end being aligned along a rotation axis such as to receive a signal indicating a presence or not

of a product interposed between two spires.

[0043] In an eleventh aspect according to any one of the preceding aspects, a machine is provided in which the sensor comprises an optical sensor, such as for example a photocell or a CMOS, or a video or television camera, destined to send a signal towards the central area of occupation of the spires and such as to receive an eventual signal reflected by a product which is present there.

[0044] In a twelfth aspect according to any one of the preceding aspects, a machine is comprised that further includes a further sensor defined by a photographic camera, the camera exhibiting an angle of vision and being positioned in the housing chamber such as to enable the vision of at least a central area of volume of the spires of at least a spiral dispenser, preferably the photographic camera having a positioning and an angle of vision that are such as to frame a plurality of central areas of occupation of the spires of respective spiral dispensers.

[0045] In a thirteenth aspect according to any one of the preceding aspects, a machine is provided that further includes a further presence sensor of at least a product between two spires of a spiral dispenser the further sensor being configured such as to determine a presence of a portion of the product located at a central area of occupation of the spires located about the rotation axis of the spiral dispenser, the sensor and the further sensor being configured such as to determine the presence or not of the product on the spiral dispenser, optionally a control unit being configured such as to activate a control procedure by means of the sensors and such as to receive a respective signal of presence/absence of product from the sensor and such as to determine, independently of and according to the respective signals, a presence or absence of the product, in particular, in a case of a non-agreement in detection, the control unit sending an error signal and/or repeating the control procedure.

[0046] In a fourteenth aspect according to any one of the preceding aspects, a machine is provided in which, during the detecting stage, and an active portion of the sensor is interposed between the frontal portion, optionally transparent, of the wall and the interior releasing end of the spiral dispenser, in particular a sensor positioned, during the detecting stage, externally of the spiral dispenser at the front release end being aligned along a rotation axis such as to receive a signal indicating a presence or not of a product interposed between two spires, the machine further comprising a control unit configured such as to receive the signal coming from the sensor and determining whether the product is housed in a further spire for immediate dispensing.

[0047] In a fifteenth aspect according to the preceding aspect, a machine is provided in which the control unit can alternatively inhibit dispensing of a product in a case in which the product to be dispensed is not on the last spire, for immediate dispensing, but on a preceding spire, closer to the rear end of the spiral dispenser, enabling dispensing thereof by commanding a number of rotations

of the spiral dispenser such as to lead to dispensing of the detected product, or commanding a number of turns such as to bring the detected product onto the final spire.

[0048] In a further independent aspect, a procedure is provided for inhibiting dispensing of a product in product dispensing machines of a type comprising: a support frame defining internally thereof a housing chamber for the products to be dispensed and exhibiting a wall provided with at least a transparent portion; a magazine located in the housing chamber provided with a predetermined number of planes for containing the products to be distributed; a collecting compartment of the product released associated to the support frame for enabling collection of the product; a plurality of spiral dispensers associated to respective planes, the spiral dispensers comprising successive spires and exhibiting a prevalent development direction directed along a rotation axis between a rear end and a front end for releasing, the spiral dispensers being destined to house the products to be dispensed interposed between successive spires and resting on the plane; at least a movement device for selectively generating a rotating motion of at least a spiral dispenser of the spiral dispensers about the respective rotation axis, the rotary motion causing an advancement of the products to be dispensed interposed between successive spires towards the front release end, a product interposed between successive spires being released at the release end, a sensor of a presence of at least a product located between two spires of a spiral dispenser, the sensor being configured such as to determine a presence of a portion of the product at a central area of an area occupied by the spires located about the rotation axis, the procedure comprising following stages: following dispensing of a product from a spiral dispenser, verifying, by use of the sensor, a presence of a further product by observing a central area of occupation of the spires; in a case of detecting an absence of a further product, inhibiting selection by a user of a further product in the same spiral dispenser.

[0049] In a seventeenth aspect according to the preceding aspect, the procedure comprises following stages: receiving the signal in arrival from the sensor and determining whether the product is housed in a final spire for immediate dispensing.

[0050] In an eighteenth aspect according to the preceding aspect, the procedure comprises following stages, alternatively: inhibiting dispensing of a product in a case in which the product to be dispensed is not on the final spire for immediate dispensing, but on a preceding spire closer to the rear end of the spiral dispenser, or enabling dispensing by commanding a number of rotations of the spiral dispenser such as to cause dispensing of the detected product or commanding a number of revolutions such as to bring the product detected onto the final spire. In a nineteenth aspect according to the preceding aspect, the procedure comprises following steps: following dispensing of a product by a spiral dispenser, verifying, independently by use of a further sensor, a

presence of a further product by observing the central area of occupation of the spires; comparing outcomes of the detections using two sensors such as to verify an agreement; in a case of agreement of detecting of an absence of a further product, inhibiting selection by a user of a further product in the spiral dispenser; in a case of disagreement in detecting, alternatively or in combination: repeating the independent verifications by means of the sensors and comparing the detection outcomes in order to verify an agreement; sending an error signal.

[0051] In a further independent aspect, product dispensing machine is provided comprising: a support frame defining internally thereof a housing chamber for the products to be dispensed and optionally exhibiting a wall optionally provided with at least a transparent portion; a magazine located in the housing chamber provided with a predetermined number of planes for containing the products to be distributed; a collecting compartment of the product released associated to the support frame for enabling collection of the product; a plurality of spiral dispensers associated to respective planes, the spiral dispensers comprising successive spires and exhibiting a prevalent development direction directed along a rotation axis between a rear end and a front end for releasing, the spiral dispensers being destined to house the products to be dispensed interposed between successive spires and resting on the plane; at least a movement device for selectively generating a rotary motion of at least a spiral dispenser of the spiral dispensers about the respective rotation axis, the rotary motion causing an advancement of the products to be dispensed interposed between successive spires towards the front release end, a product interposed between successive spires being released at the release end, **characterised in that** it further comprises at least a photographic camera exhibiting an angle of vision and being positioned in the housing chamber such as to enable vision of at least a central area of occupation of the spirals of at least a spiral dispenser, in particular the camera having a positioning and an angle of vision which are such as to frame a plurality of central areas of occupation of the spires of the respective spiral dispensers and still more in particular comprising a plurality of photographic cameras destined to enable vision of all the central areas of occupation of the spires of all the respective spiral dispensers located internally of the housing chamber.

[0052] In a twenty-first aspect according to any one of aspects from 1 to 15, a machine is provided in which an active portion 18 of a further sensor is interposed between a rear wall of the machine, for example at the rear end (9a) of the spiral dispenser (9), and the front release end (9b), in particular the sensor (16) receiving a signal indicating a presence of at least a product (4) interposed between two spires (10), optionally a control unit being configured such as to determine, in accordance with the signal received by the sensor (16), a parameter indicating a percentage of stock filling of the spiral dispenser 9. These and other aims which will more fully emerge during

the course of the following description are substantially attained by a product dispensing machine according to the embodiment described in the following.

[0053] Further characteristics and advantages will more fully emerge from the following detailed description of a preferred but not exclusive embodiment of the invention, in accordance with one or more of the accompanying claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0054] The description will be made in the following with reference to the appended drawings, which are provided by way of non-limiting example, in which:

- figure 1 illustrates, in a perspective view, a product dispensing machine according to a described embodiment;
- figure 2 is a partial front view of the machine of figure 1;
- figure 3 is a further embodiment of the machine of figure 1;
- figure 4 is a partial front view of the machine of figure 3;
- figure 5 is a further embodiment of the machine of figure 1;
- figure 6 is a schematic view of a mobile basket usable in the machine of figure 5;
- figure 7 illustrates a further embodiment of the machine of figure 1.

[0055] The present invention relates to a product dispensing machine or "vending machine", which has been denoted in its entirety by number 1 in the accompanying figures.

[0056] The machine primarily comprises a support frame 2 which internally defines a housing chamber 3 destined to receive the various products to be dispensed 4. The support frame 2 exhibits substantially a parallelepiped shape (figure 1) equipped with a bottom, a top wall and four lateral walls of which at least one is an openable wall 5 (i.e. a door) for allowing access to the housing chamber 3.

[0057] In general, but not necessarily, at least one of said side walls exhibits a transparent portion 5a for enabling visual access to the housing chamber 3, and in particular to the products 4 accommodated in the magazine 6.

[0058] In a non-limiting specific embodiment, the openable wall 5 (hinged at a lateral end thereof to the remaining portion of the support frame 2) is the front wall provided with a large transparent portion 5a suitable for allowing visibility of the products on sale.

[0059] In this way an operator or technician will have access to the inside of the machine so that it can be loaded with fresh products and/or to carry out normal maintenance services.

[0060] Obviously, the presence of a wall with a trans-

parent portion is optional, as the products might simply be represented by images and/or descriptions and the machine might not allow any visual access to the magazine.

5 **[0061]** As previously mentioned, the housing chamber 3 is intended to contain an appropriate store 6 which carries the different products 4 to be released.

10 **[0062]** From the structural point of view the store 6 consists of a predetermined number of planes 7 which, in a specific embodiment, are constituted by extractable trays. In this way, once the front side wall 5 has been opened, the technician or operator can extract each of the planes 7 towards the outside making the operations of loading/unloading of the machine easier.

15 **[0063]** In this regard, the trays are, for example, mobile on respective lateral guides and supported, for example, by a suitable number of wheels to allow the said movement (structure not shown in the accompanying drawings).

20 **[0064]** Each of the planes 7 (or trays) has a respective substantially flat base wall 7a which, as explained below, will contribute to the support of the products 4 to be dispensed and left and right side walls and a rear wall to define a containment structure.

25 **[0065]** Further, each of the planes 7 will be provided with a plurality of spiral dispensers 9 which constitute the single delivery devices for the respective products.

30 **[0066]** The spiral dispensers 9 are in general constituted by a metal bar, or a bar made of plastic or another suitable material, wound in a spiral to define a plurality of spires 10 that are circular in a front view (see for example figure 2) spaced by a respective step "p" between them (see figure 7).

35 **[0067]** The volume defined between two successive spires 10 is the space intended to receive the product to be dispensed.

40 **[0068]** The spiral dispenser 9 is housed in the respective tray in such a way as to exhibit a prevalent development direction arranged substantially horizontally and coincident with the axis of rotation 11 of the spiral dispenser 9.

45 **[0069]** In general the spiral dispenser 9 will exhibit a rear end 9a facing the rear wall of the machine and a front end 9b, i.e. a release end, facing the transparent portion 5a arranged frontally in the machine.

50 **[0070]** In general, at least a part of a movement device 12 will be located at the rear end 9a, which movement device 12 is capable of selectively generating a rotary motion of each of the spiral dispensers 9 about the rotation axis 11 thereof.

[0071] In particular, a rotation by a suitable number of degrees (180° or 360° for example) of the spiral dispenser 9 generates an advancing movement from the rear end 9a towards the front release end 9b of all the products that are contained and housed between respective successive turns 10 in the dispenser.

[0072] In general, during this motion, the product is supported at the bottom by the base surface 7a of the

respective plane 7, while it is supported in front and behind by successive spires 10 of the dispenser 9.

[0073] Note also that between the front release ends 9b of the various spiral dispensers 9 and the front wall 5 a fall gap 20 is provided such that when the product is pushed into the said fall gap 20, it can fall towards a collecting compartment 8 of the released product which it is associated to the support frame 2, usually at a lower portion of the frame itself (figures 3 and 7).

[0074] The user can collect the released product from the collecting compartment 8.

[0075] In still other words, following the rotation command to the spiral dispenser 9 following selection of a given product by a user via a user interface 21, the product closest to the front release end 9b of the dispenser in question is made to advance up to being no longer interposed between two successive turns (having reached the front end) and/or not be supported by the base surface of the plane 7.

[0076] In this situation, the product is located at the fall gap 20 and can therefore fall by gravity into the collecting compartment of the machine.

[0077] In an alternative embodiment (figure 5) the product to be released might not go to the fall gap directly by gravity, but might rather be collected by a mobile basket 13 which, being controlled by control unit of the machine, will be positioned at a lower release volume of the spiral dispenser 9 concerned with the selected product.

[0078] In this way, the product will be released by the spiral dispenser 9 by means of a rotation around its own axis 11 by the spiral dispenser 9 itself only following a positioning of the mobile basket 13 immediately below the spiral dispenser 9. In other words, the product is collected immediately below the dispenser 9 and does not suffer damage or shock as a result of the fall in the compartment 8, as could happen in the machines of the type previously described.

[0079] Obviously, the mobile basket 13 will be then further moved by the control unit in order to bring the released product to the collecting compartment 8 where the user can collect it.

[0080] In this regard different structures can be realised to enable the movement of the basket 13.

[0081] Respective vertical guides 15 are shown in the embodiment of figure 5, which in turn are fitted with a horizontal guide 14.

[0082] The basket 13 can move along the horizontal direction by sliding along the guide 14 and vice versa the guide 14 will be moved along the vertical direction thanks to the guides 15.

[0083] In this way, in its vertical plane of movement contained in the space afforded between the front portions of the dispensers 9a and the transparent window 5a, the basket 13 can reach all the collecting positions located immediately below each spiral dispenser 9.

[0084] Once more from the design point of view, note that the spirals can have different radial dimensions of the spires from dispenser 9 to dispenser 9 and can also

have a different pitch (i.e. the distance between successive turns) to one another so that products of differing dimensions and volumes can be handled.

[0085] In other words the radius "R" of the turns of a spiral dispenser 9 can be different from the corresponding radius "R" of the spires of a further dispenser 9 so as to be able to contain, support and distribute products having different frontal dimensions.

[0086] In addition, the pitch "p" between successive turns of a spiral dispenser may be different from the pitch "p" of another dispenser, so that products of different thickness or lateral size can be handled.

[0087] In this sense, the spiral dispensers 9 may be different from plane 7 to plane 7, but also different on a same plane, according to requirements.

[0088] Note also that each plane or drawer 7 will be equipped with intermediate lateral walls 7b able to separate adjacent spiral dispensers 9, defining respective housing volumes.

[0089] In particular, the two lateral walls 7b immediately adjacent to each spiral dispenser 9, and the base surface 7a of the plane 7, will contribute to the correct support and correct guidance of the product 4 during the stages of advancement before delivery.

[0090] The movement device 12 can also assume different embodiments depending on whether a motor is provided for each spiral dispenser 9 with the respective transmission or whether there is an individual motor for each plane 7 with a suitable distribution system of the motion to the various dispensers 9 or other systems besides.

[0091] In general, motion will be transmitted to the spiral dispensers at the respective rotation axis 11, and at the rear end 9a.

[0092] Moreover the various spiral dispensers 9 will also be supported (projectingly) and constrained to the respective plane 7 at the rear portion 9a.

[0093] In general, observing the machine frontally, for example through the transparent portion 5a, the various planes 7 can be seen to be positioned horizontally one above another and the various spiral dispensers 9 are arranged on the various planes 7 with respective transversal rotation, in general substantially perpendicular to the front wall of the support frame 2.

[0094] In this way the observer positioned axially to one of the spiral dispensers 9 would see the first circular spire 10 superimposed on all the further spires that form the dispenser and would also see (in the absence of products stocked in the device) the rear end 9b, where the attachment to the movement device is located. In still further terms, the frontal dimensions of each spiral dispenser 9 will consist of a circular ring having a radius R centred on the line of the rotation axis 11 and the respective free volume defined thereby will have a cylindrical shape an axis of which coincides with the rotation axis 11.

[0095] It should also be further noted that the machine of the present description is also provided with at least a sensor 16 configured to determine the presence of at

least a residual product 4 between two spires 10 of a spiral dispenser 9.

[0096] In particular, each time a product is dispensed from a predetermined spiral 9, the machine verifies the presence of at least one further product that can subsequently be put up for sale at the same spiral dispenser 9.

[0097] In the absence of detection of further products mounted on the spiral distributor 9, a control unit is selectively able to inform and/or inhibit the selection of further products from the spiral dispenser 9.

[0098] In particular and advantageously the sensor 16 is able to "sense" the presence of a portion of the product housed at a central area 17 of the spires 10 positioned around the axis of rotation 11 (in other words the sensor detects or senses or observes a central space 17 of the spires).

[0099] In other terms, the sensor 16 is responsible for sending and/or receiving a signal in a substantially parallel direction to the rotation axis 11 of the spiral dispenser 9, frontally observing the spiral dispenser 9 or the respective spires 10 at the central area of the spire.

[0100] As shown in figure 2, the sensor 16 observes the spiral dispenser 9 from a position that is located within the volume of the front of the dispenser itself.

[0101] In this way, the detection is made independent of the lateral dimensions or thickness of the product contained in the spirals in that the product itself is in fact observed frontally and in a zone (central area 17 of dimensions of the spires 10) in which if a product is present it must be positioned.

[0102] In fact, the products significantly smaller in height to the radius "R" of the spire 10 might be difficult to support and dispense using the spiral.

[0103] This type of verification by the sensor 16 significantly increases the internal reliability performances relating to detection of the presence of a product or less. In still other words, the key choice of the central area 17 of the spires 10 for the sensor to make the detection is in fact an optimal detection area since it enables a reduction in false positives.

[0104] From the structural point of view, at least during the detection phase the sensor 16 has an active portion 18 which emits/receives the detection signal positioned in a zone arranged around the rotation axis 11 of the dispenser (if not centred on it).

[0105] In still other terms, yet the active portion 18 of the sensor 16 is located generally interposed between the transparent portion 5a of the front wall 5 and the front release end of the dispenser 9b spiral 9; in greater detail, during the detection phase, the sensor 16 is positioned externally to the spiral dispenser 9 and aligned along the axis of rotation 11 in such a way to send and receive the signal indicating the presence or absence of the product 4 interposed between two spires 10 directed substantially parallel to the axis of rotation 11.

[0106] In an alternative (or additional) embodiment the sensor (or a further sensor) may conversely be positioned at the rear end 9a, and be visually pointed in a

direction aligned with the rotation axis 11.

[0107] Obviously, in this second case, the sensor 16 might detect the presence of further products or not on the same spiral dispenser, but not detect the possible presence of a space between the first two spires destined to dispense, as the product "visible" via the sensor might actually be the last of the row of products, namely the one nearest the rear end 9a.

[0108] However, the sensor 16 positioned at the rear has the advantage of being able to provide a signal indicating the percentage the spiral element 9 is filled to. In fact the time delay between sending and receiving the signal indicates the distance of the product detected from the sensor, and therefore, as long as the spires have been correctly loaded, the residual number or percentage of products still present in the spiral itself.

[0109] In this situation the use of a sound sensor - such as ultrasound - appears advantageous, as it makes it easy to detect said time delay; obviously other and different types of sensors can be used.

[0110] In this regard, optical sensors, such as photo-cells or even cameras or video cameras, may be advantageously adopted as sensors 16.

[0111] Note also that, with the use of a control unit able to process the times taken to send/receive the control signal emitted by the sensor 16, when the sensor 16 is mounted in front, i.e. between the front wall 5 and the spirals 9, it could also be possible to determine whether any product remaining on the spiral dispenser 9 is positioned interposed between the last spires 10, i.e. those closest to the fall gap 20 and thus immediately ready for dispensing or vice versa whether there are spires empty of product which would result in failure to deliver a product should it be selected.

[0112] In any case there are several possible embodiments of the invention as briefly described in the foregoing.

[0113] Observing in particular the embodiment illustrated in figures 3 and 4, it can be seen how it is possible to position a sensor 16 for each of the dispensers in a spiral, for example at the rear end 9a or even the front end 9b of each of them. Each of the sensors will exhibit the corresponding active portion 18 aligned with the rotation axis 11 of the respective spiral dispenser 9, and will take in the entire internal volume of each spiral dispenser 9 in order to verify the presence of any products.

[0114] In an alternative embodiment, not illustrated, fixed sensors 16 could be provided, one for each spiral dispenser 9, positioned frontally to the spiral dispensers 9; in other words corresponding sensors 16 might be present, positioned in an area interposed between the transparent portion 5a of the wall 5 and the front release end 9b.

[0115] In a further embodiment illustrated in figures 1 and 2 a mobile support 19 can also be provided, mobile in a vertical plane or a plane substantially parallel to the front wall 5.

[0116] In this way various configurations can be pro-

vided, enabling a reduction in the number of sensors 16 necessary for a complete reading.

[0117] For example a mobile support 19 can be positioned at least in a lie plane of one of the planes 7 along a transversal direction T to the rotation axis 11.

[0118] The sensor 16 could be mounted on said mobile support 19 such as to be positioned, in the detection phase, with the respective active portion 18 arranged on the rotation axis 11 of the spiral dispenser 9 involved.

[0119] In other words, the mobile support 19 would bring the sensor to each of the spiral dispensers 9 mounted on a respective plane 7 by moving the sensor 16 along the direction T shown in figures 1 and 2.

[0120] This direction in fact lies in a horizontal plane in order to bring the active portion 18 of the sensor 16 to the axis of each of the spiral dispensers 9 mounted on the respective plane 7.

[0121] In this way a single sensor could be used to verify the presence of dispensable products on each of the spiral dispensers 9 of a same plane 7.

[0122] Each time one of the spiral dispensers 9 of the plane 7 releases a product the mobile support 19 is moved until the respective sensor 16 is located at the axis 11 of the dispenser 9 of interest in order to verify the presence of further products or not.

[0123] As an alternative to the above-described solution may provide a vertically-mobile support that scans each plane in succession.

[0124] For example, the mobile support 19 could comprise a predetermined number of sensors 16 aligned along a substantially parallel axis to the arrangement plane of the planes 7 (i.e. a horizontal axis) and move vertically (direction V) so as to take in a plurality, for example all, of the planes 7.

[0125] In this way each of the sensors 16 will cover a spiral 9 for each plane 7.

[0126] Note however that the mobility of the support 19 may be total in the vertical plane, i.e. such as to enable the positioning of the active portion 18 of a sensor 16 at each spiral dispenser 9 independently of the plane where the sensor 16 is mounted.

[0127] In particular, the support 19 can in this case be mobile at least in two directions T, V, transversal to one another (in particular perpendicular) and transversal (in particular perpendicular) to the rotation axis of the in a spiral dispenser 11.

[0128] Note also that the mobile support 19 could also be defined by the above-mentioned basket 13 or in any case associated thereto (and not necessarily be mobile independently of a support which exploits, for example, the guides).

[0129] In still other words, in more complex machines equipped with a basket for the collection of the dispensed product, the sensor 16 can be mounted on the basket itself, directly on the basket 13, or on appropriately-positioned side supports, so that for each release of a product into the basket 13, by using the sensor 16 it is possible immediately after (or at a different point in time) to verify

the presence of further products that can be delivered by the spiral dispenser 9.

[0130] In this way the movement of the sensor 16 is guaranteed by the movement means which enable moving the basket 13, or, for example, the guides 14 and 15 schematically represented in figure 5.

[0131] In general, the sensor/the sensors used can be of any type.

[0132] Photo-detectors could be used, i.e. detectors of electromagnetic radiation; the sensor 16 may be an optical sensor such as a photocell, a photodiode, a phototransistor, a CCD or C-MOS, a photo or video camera, or other besides without forsaking the concept of the present invention.

[0133] Alternatively, and as mentioned above, an acoustic sensor can also be used such as an ultrasonic sensor. In fact, for certain applications the acoustic wave sensor is simpler to manage.

[0134] Advantageously, then the machine can also comprise a further sensor 16 suitable for carrying out the same measurements as the sensor 16 described above, i.e. able to analyse the presence of at least a product interposed between two spires 10 of a spiral dispenser 9 by verifying the presence of a portion of the product itself at the central area 17 of the volume of the spires 10 located around the rotation axis 11.

[0135] This further sensor 16 may be, for example, dedicated to verifying the presence of the product in the spiral dispenser so as to perform a double check of the presence and to avoid erroneous detections.

[0136] In this regard, a control unit will be configured to activate the aforementioned double control procedure using the above-mentioned sensors and to receive the respective signal of the presence/absence of the product in or from the sensor and the further sensor and to independently determine the presence or the absence of the product.

[0137] If the signals are in agreement and establish the presence of the product, no more actions will follow.

[0138] Conversely, in the case of signals consistent with the absence of product, dispensing of an additional product by the same spiral dispenser 9 will be inhibited.

[0139] If there is a discrepancy, the control unit can alternatively send an error signal to the user/technician, possibly repeating the procedure so as to double check before sending this message.

[0140] Note that the above-described double control procedure enables limiting detection errors and also to signal any fault/malfunctioning of a sensor. Furthermore, the two sensors responsible for detecting the presence of the product 4 can be of the same nature or of a different nature, both mounted on the mobile support or not.

[0141] In an advantageous embodiment, the further sensor 16 may be defined by a photo camera 22 mounted within the housing compartment and intended to observe one or more spiral dispensers 9.

[0142] In particular, the camera can present a viewing angle and a position as to allow to observe at least a

central area 17 of occupation of the spires 10 of at least one spiral dispenser 9 and preferably the camera 22 will be positioned and have a viewing angle such as to frame a plurality of central areas 17 of occupation of the spires 10 of the respective spiral dispensers 9.

[0143] In particular the use of multiple cameras, suitably arranged inside the housing compartment, for example positioned at the transparent portion 5a of the window 5, in order to observe the front end 9b of delivery of the various spiral dispensers 9, will allow, via the processing of the signal, such as to determine the presence or absence of additional products in the spirals.

[0144] This type of detection can be used independently (i.e. regardless of the presence of other fixed or mobile sensors mounted axially to the spiral dispensers 9) or also in combination there-with such as to enable the double control mentioned above.

[0145] The invention achieves important advantages.

[0146] First of all the various illustrated embodiments ensure increased reliability of detection, enabling a selective inhibiting of the selection of products no longer available before even a single failure to deliver occurs.

[0147] The presence of mobile sensors on respective supports at least in the lie plane of a drawer, or along the entire dispensing surface, enables a reduction in the number of sensors needed to perform the measurements.

[0148] The use of a dual control enables improving the operational reliability of the system and verifies the actual functionality of each of the sensors used, further improving the operation of the machine.

Claims

1. A product dispensing machine, comprising:

- a support frame (2) defining internally thereof a housing chamber (3) for the products to be dispensed (4) and optionally exhibiting a wall (5) provided with at least a transparent portion (5a) for a visual access to the products;
- a magazine (6) located in the housing chamber (3) and provided with a predetermined number of planes (7) for containing the products to be distributed;
- a collecting compartment (8) of the product released associated to the support frame (2) for enabling collection of the product;
- a plurality of spiral dispensers (9) associated to respective planes (7), the spiral dispensers (9) comprising successive spires (10) and exhibiting a prevalent development direction directed along a rotation axis (11) between a rear end (9a) and a front end (9b) for releasing, the spiral dispensers (9) being destined to house the products to be dispensed interposed between successive spires (10) and resting on the

plane (7);

- at least a movement device (12) for selectively generating a rotating motion of at least a spiral dispenser of the spiral dispensers (9) about the respective rotation axis (11), the rotary motion causing an advancement of the products to be dispensed interposed between successive spires (10) towards the front release end (9b), a product interposed between successive spires (10) being released at the release end (9b),

characterised in that it further comprises a sensor (16) of a presence of at least a product (4) located between two spires (10) of a spiral dispenser (9), the sensor (16) being configured such as to determine a presence of a portion of the product at a central area (17) of an area occupied by the spires (10) located about the rotation axis (11).

2. The machine of the preceding claim, wherein the sensor (16) is suitable for sending and/or receiving a signal in a substantially parallel direction to the rotation axis (11) of the spiral dispenser (9), the sensor sending and/or receiving the signal towards and/or from the central area (17) of occupation of the spires (10).
3. The machine of any one of the preceding claims, wherein, during the detecting stage, the sensor (16) exhibits an active portion (18) suitable for emitting/receiving the signal, the active portion (18) being positioned in a zone situated about the rotation axis (11) of the spiral dispenser (9).
4. The machine of any one of the preceding claims, further comprising a mobile support (19) in at least a lie plane of a plane (7) of the dispenser along a direction (T) that is transversal to the rotation axis (11), at least the sensor (16) being mounted on the mobile support (19) in order to be positioned, during the detecting stage, with an active portion (18) arranged and directed along the rotation axis (11) of the spiral dispenser (9), in particular the support (19) being mobile such as to bring the active portion (18) of the sensor (16) to at least each spiral dispenser (9) mounted on the plane (7), the support (19) optionally being mobile such as to bring the active portion (18) of the sensor (16) to each spiral dispenser (9) mounted on any one of the planes (7), in particular the support being mobile in at least two directions (T), (V) that are transversal to one another and transversal to the rotation axis (11) of the spiral dispensers (9).
5. The machine of any one of the preceding claims, wherein, during the detecting stage, an active portion (18) of the sensor (16) is interposed between the frontal portion, optionally transparent (5a), of the wall

- (5) and the interior releasing end (9b) of the spiral dispenser (9), in particular a sensor (16) positioned, during the detecting stage, externally of the spiral dispenser (9) at the front release end (9b) being aligned along a rotation axis (11) such as to receive a signal indicating a presence or not of a product (4) interposed between two spires (10).
6. The machine of any one of the preceding claims, wherein the sensor (16) comprises an optical sensor, such as for example a photocell, destined to send a signal towards the central area (17) of occupation of the spires (10) and such as to receive an eventual signal reflected by a product (4) which is present there.
7. The machine of any one of the preceding claims, wherein an active portion (18) of the sensor (16) is interposed between a rear wall of the machine, for example at the rear end (9a) of the spiral dispenser (9), and the front release end (9b), in particular the sensor (16) receiving a signal indicating a presence of at least a product (4) interposed between two spires (10), optionally a control unit being configured such as to determine, in accordance with the signal received by the sensor (16), a parameter indicating a percentage of stock filling of the spiral dispenser.
8. The machine of any one of the preceding claims, further comprising a further sensor (16) defined by a photographic camera (22), the camera (22) exhibiting an angle of vision and being positioned in the housing chamber (3) such as to enable vision of at least a central area (17) of occupation of the spires (10) of at least a spiral dispenser (9), the photographic camera (22) preferably having a positioning and an angle of vision that are such as to frame a plurality of central areas (17) of occupation of the spires (10) of respective spiral dispensers.
9. The machine of any one of the preceding claims, further comprising a further sensor (16) of a presence of at least a product (4) between two spires (10) of a spiral dispenser (9) the further sensor (16) being configured such as to determine a presence of a portion of the product located at a central area (17) of occupation of the spires (10) located about the rotation axis (11) of the spiral dispenser (9), the sensor and the further sensor being configured such as to determine the presence or not of the product on the spiral dispenser (9), a control unit being configured such as to activate a control procedure by means of the sensors (16) and such as to receive a respective signal of presence/absence of product from the sensor and such as to determine, independently of and according to the respective signals, a presence or absence of the product, in particular, in a case of a non-agreement in detection, the control

unit sending an error signal and/or repeating the control procedure.

10. A procedure for inhibiting dispensing of a product in dispensing machine of products, of a type comprising:

a support frame (2) defining internally thereof a housing chamber (3) for the products to be dispensed (4) and exhibiting a wall (5) optionally provided with at least a transparent portion (5a); a magazine (6) located in the housing chamber (3) provided with a predetermined number of planes (7) for containing the products to be distributed;

a collecting compartment (8) of the product released associated to the support frame (2) for enabling collection of the product;

a plurality of spiral dispensers (9) associated to respective planes (7), the spiral dispensers (9) comprising successive spires (10) and exhibiting a prevalent development direction directed along a rotation axis (11) between a rear end (9a) and a front end (9b) for releasing, the spiral dispensers (9) being destined to house the products to be dispensed interposed between successive spires (10) and resting on the plane (7); at least a movement device (12) for selectively generating a rotating motion of at least a spiral dispenser of the spiral dispensers (9) about the respective rotation axis (11), the rotary motion causing an advancement of the products to be dispensed interposed between successive spires (10) towards the front release end (9b), a product interposed between successive spires (10) being released at the release end (9b), a sensor (16) of a presence of at least a product (4) located between two spires (10) of a spiral dispenser (9), the sensor (16) being configured such as to determine a presence of a portion of the product at a central area (17) of an area occupied by the spires (10) located about the rotation axis (11), the procedure comprising following stages:

following dispensing of a product from a spiral dispenser (9), verifying, by use of the sensor (16), a presence of a further product by observing a central area (17) of occupation of the spires;

in a case of detecting an absence of a further product, inhibiting selection by a user of a further product in the same spiral dispenser (9).

11. The procedure of the preceding claim, comprising following stages:

following dispensing of a product by a spiral dispenser (9), verifying, independently by use of a further sensor, a presence of a further product by observing the central area (17) of occupation of the spires; 5
 comparing outcomes of the detections using two sensors such as to verify an agreement;
 in a case of agreement of detecting of an absence of a further product, inhibiting selection by a user of a further product in the spiral dispenser; 10
 in a case of disagreement of detecting, alternatively or in combination:

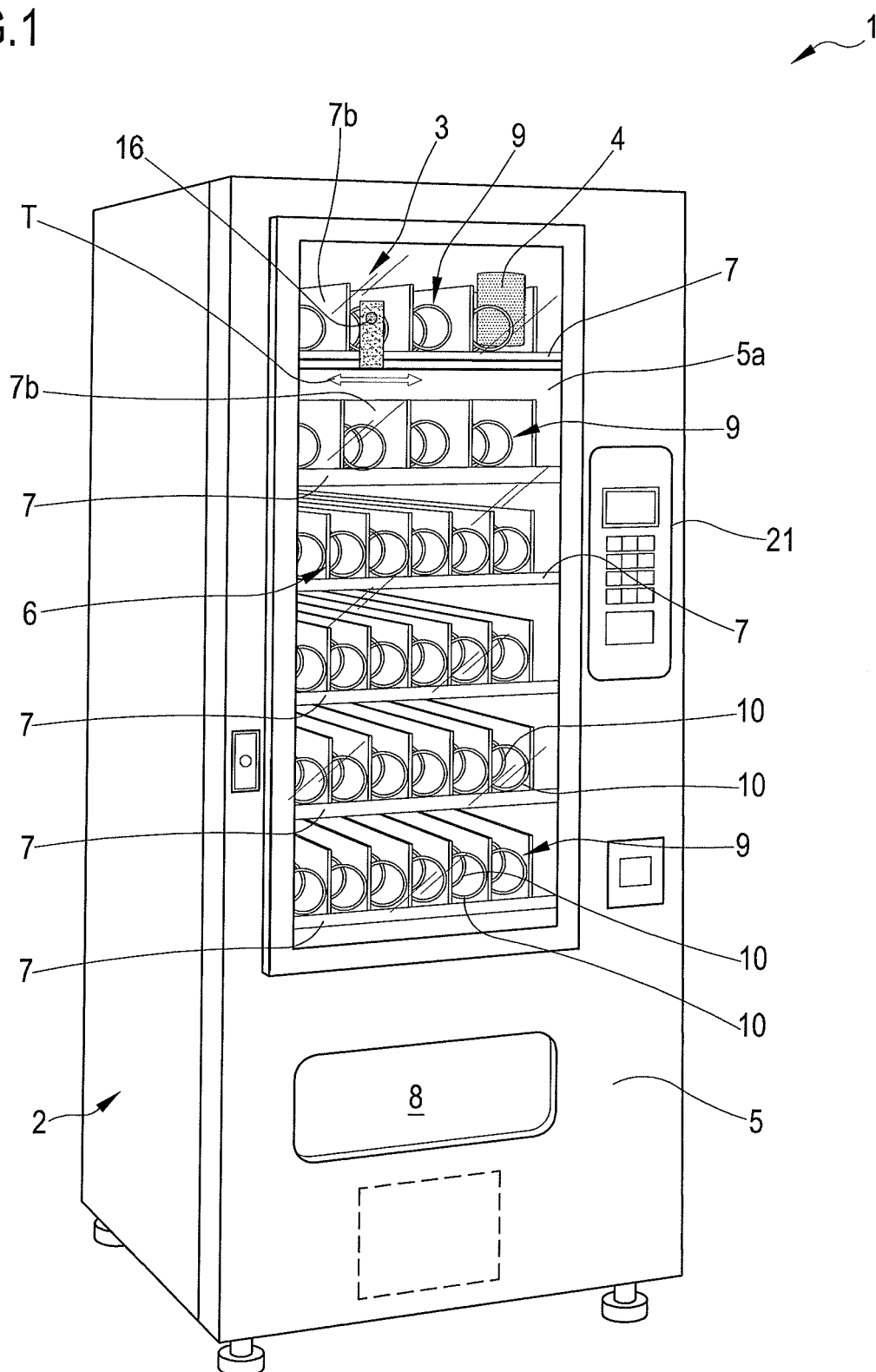
repeating the independent verifications by means of the sensors and comparing the detection outcomes in order to verify an agreement; 15
 sending an error signal. 20

12. A product dispensing machine, comprising:

a support frame (2) defining internally thereof a housing chamber (3) for the products to be dispensed (4) and optionally exhibiting a wall (5) 25
 optionally provided with at least a transparent portion (5a);
 a magazine (6) located in the housing chamber (3) provided with a predetermined number of planes (7) for containing the products to be distributed; 30
 a collecting compartment (8) of the product released associated to the support frame (2) for enabling collection of the product;
 a plurality of spiral dispensers (9) associated to respective planes (7), the spiral dispensers (9) comprising successive spires (10) and exhibiting a prevalent development direction directed along a rotation axis (11) between a rear end (9a) and a front end (9b) for releasing, the spiral dispensers (9) being destined to house the products to be dispensed interposed between successive spires (10) and resting on the plane (7); 35
 at least a movement device (12) for selectively generating a rotary motion of at least a spiral dispenser of the spiral dispensers (9) about the respective rotation axis (11), the rotary motion causing an advancement of the products to be dispensed interposed between successive spires (10) towards the front release end (9b), 40
 a product interposed between successive spires (10) being released at the release end (9b),
characterised in that it further comprises at least a photographic camera (22) exhibiting an angle of vision and being positioned in the housing chamber (3) such as to enable vision of at least a central area (17) of occupation of the spirals (10) of at least a spiral dispenser, in par- 45
 50
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ticular the camera (22) having a positioning and an angle of vision which are such as to frame a plurality of central areas (17) of occupation of the spires (10) of the respective spiral dispensers (9) and still more in particular comprising a plurality of photographic cameras (22) destined to enable vision of all the central areas (17) of occupation of the spires (10) of all the respective spiral dispensers (9) located internally of the housing chamber (3).

FIG.1



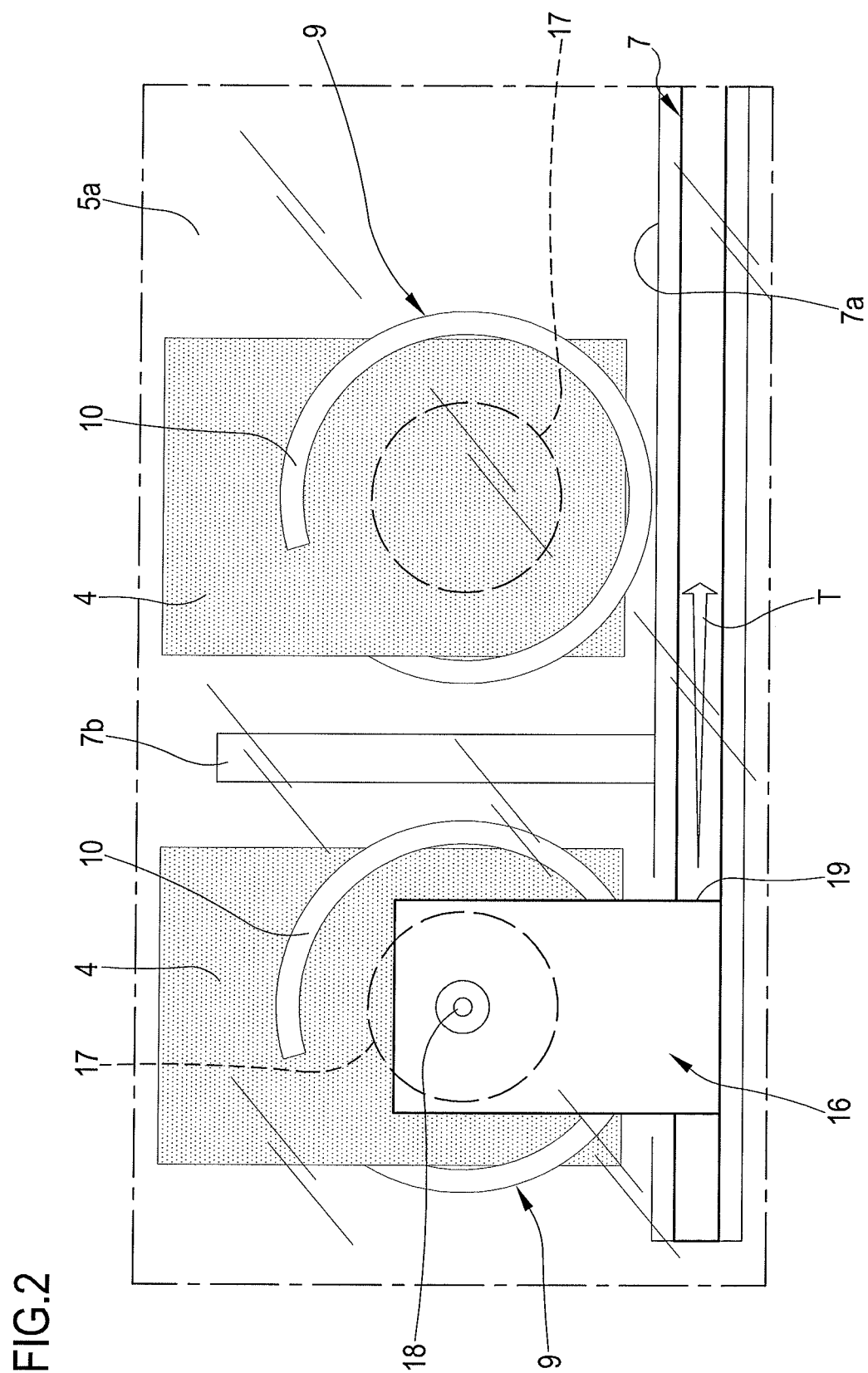
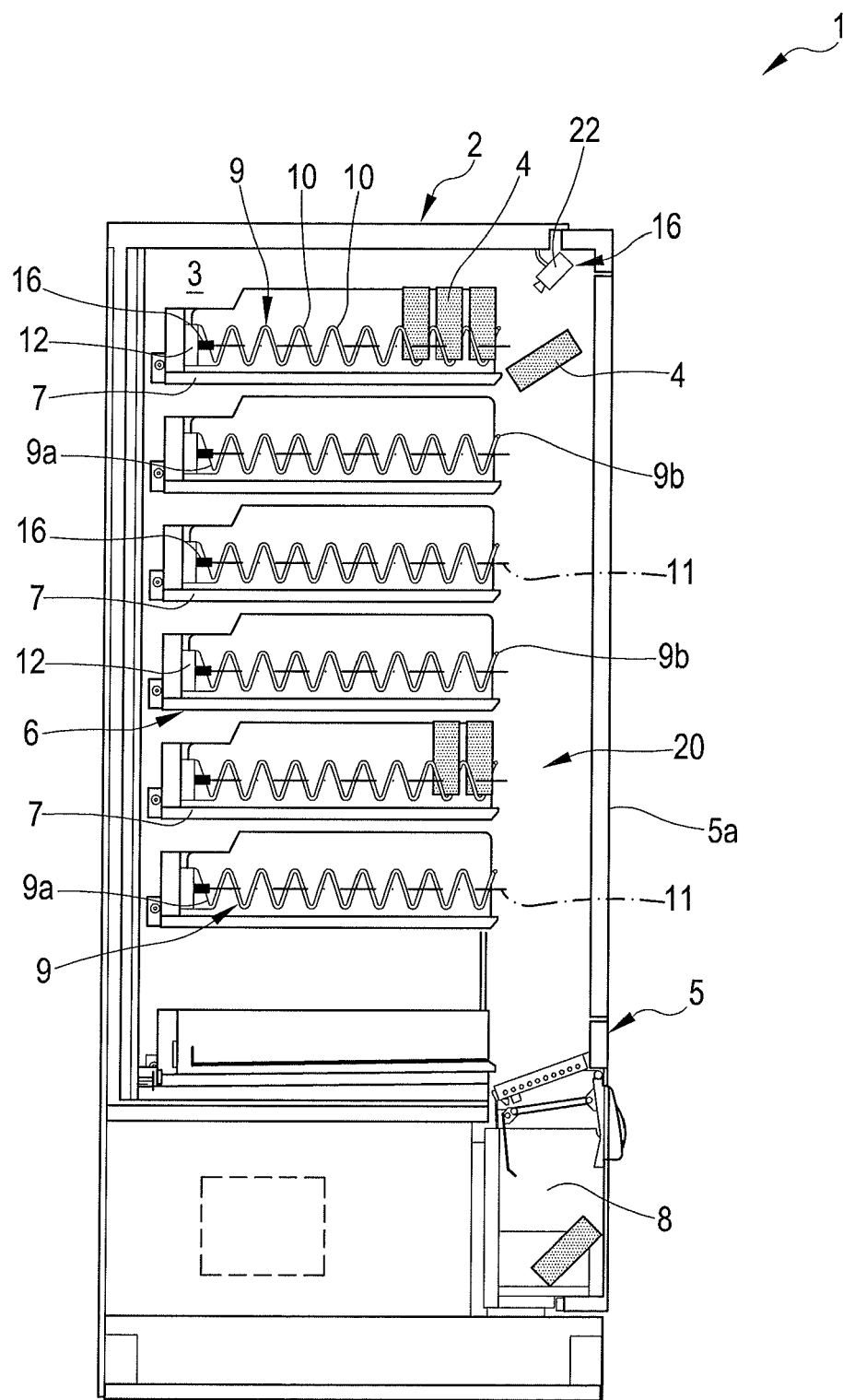


FIG.3



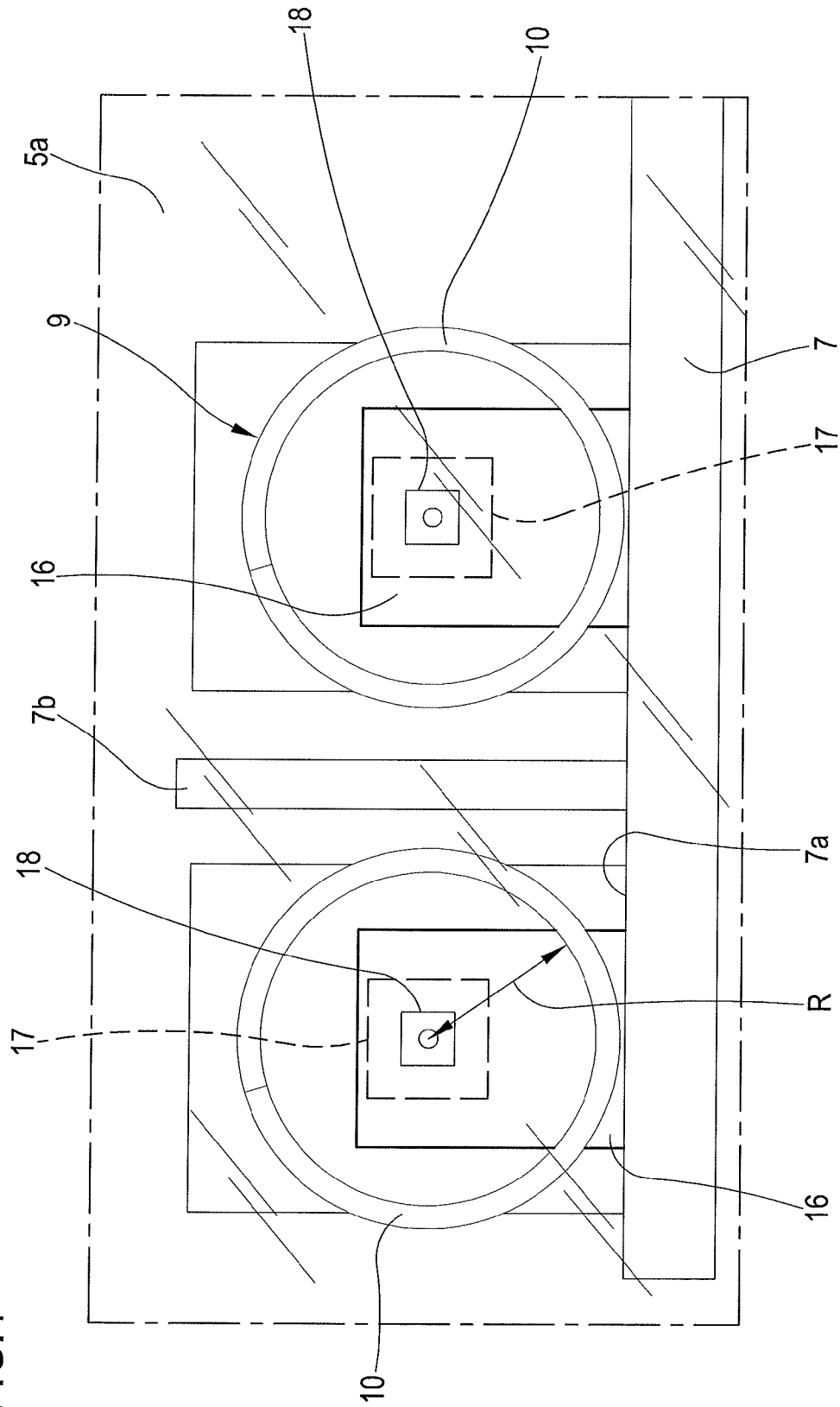


FIG. 4

FIG.5

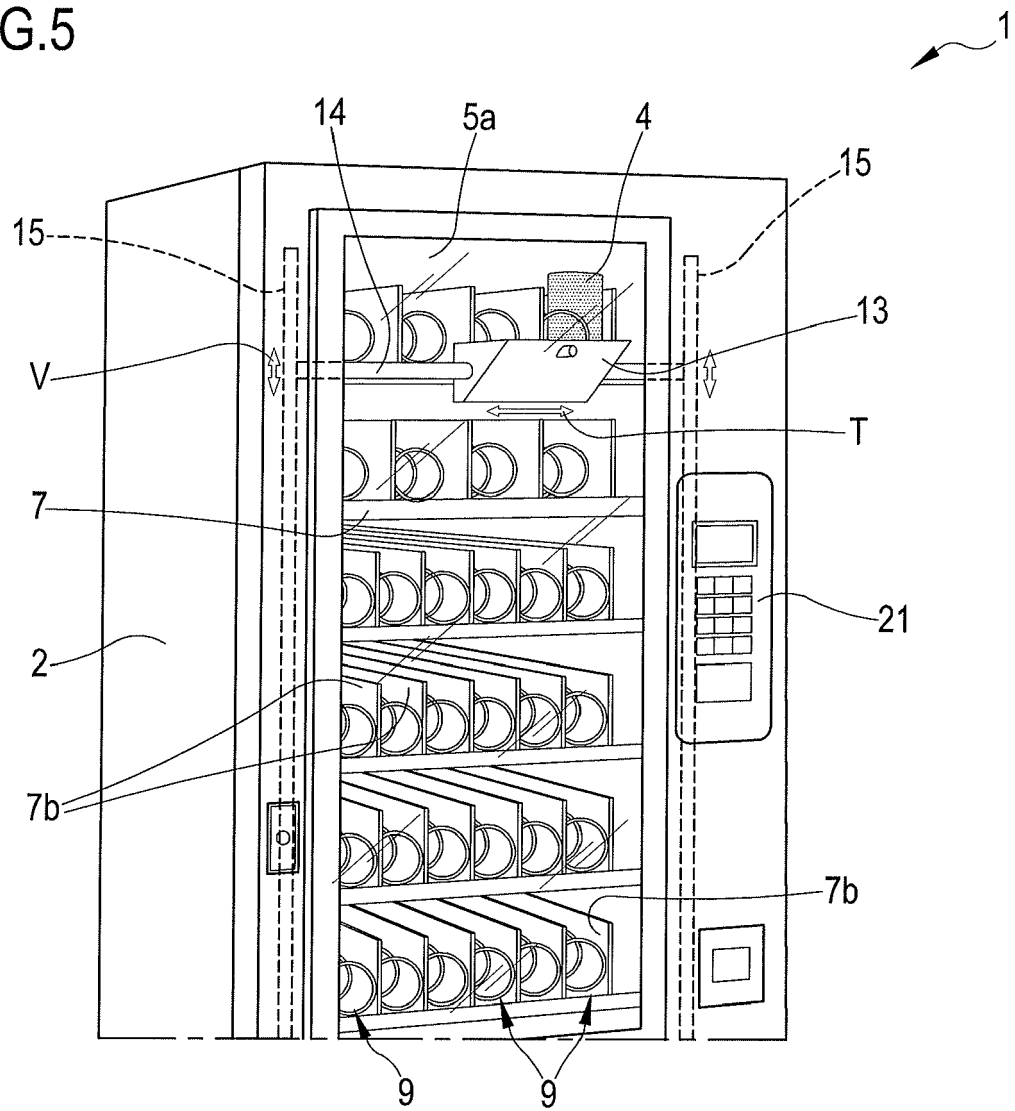


FIG.6

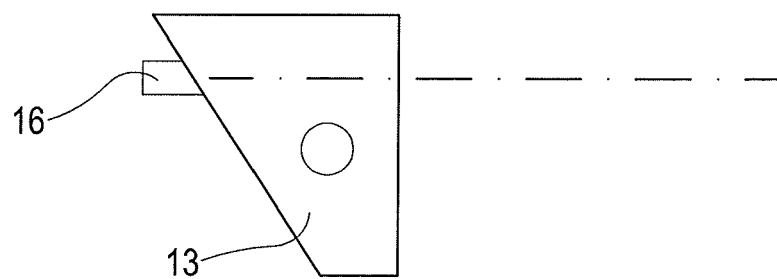
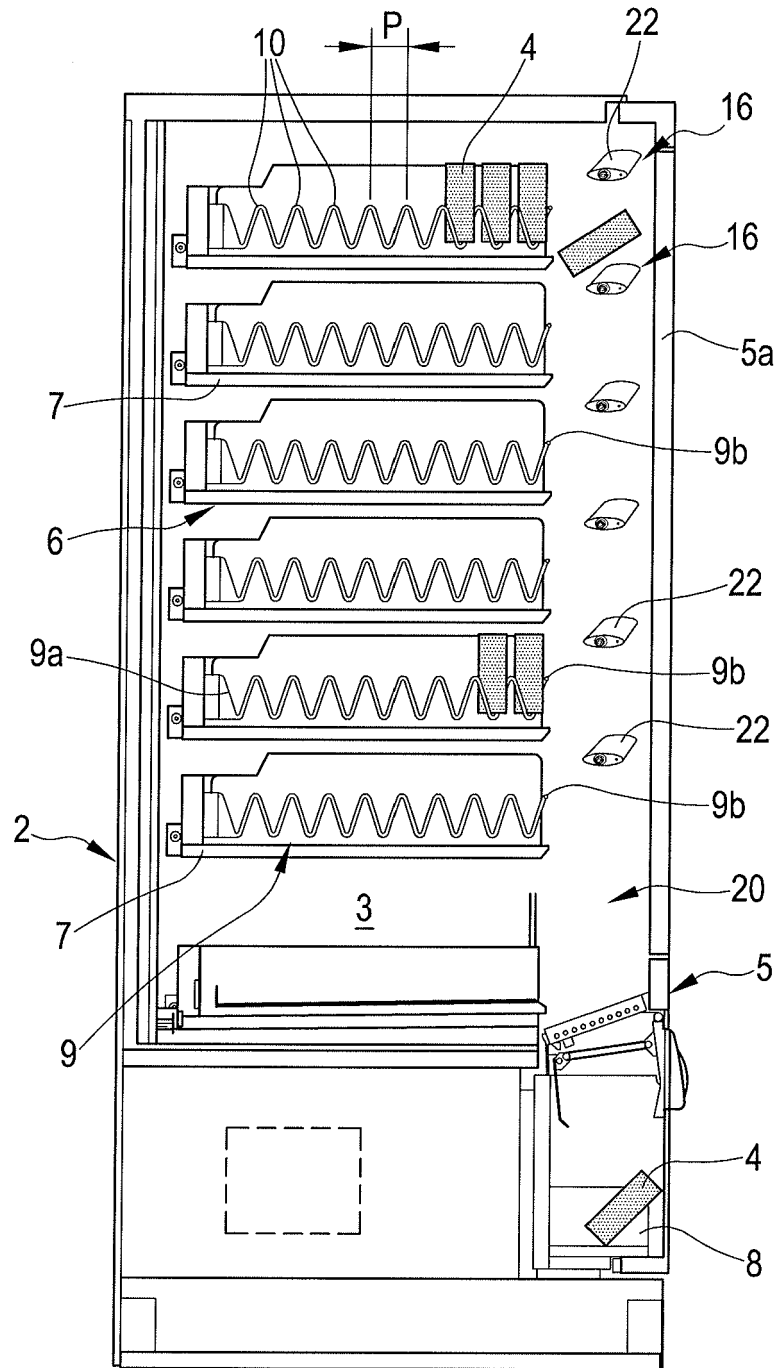


FIG.7





EUROPEAN SEARCH REPORT

Application Number
EP 12 17 1962

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 20 August 2012	Examiner Fyhr, Jonas
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20-08-2012

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