Title: A CONTAINER FILLING MACHINE

Abstract: The present invention provides a container filling machine comprising a sensing device for detecting the integrity of discrete articles for personal treatment to be packaged in a container. The sensing device comprises a pair of capacitor plates positioned in a substantially opposing relationship for creating therebetween an electric field, a track for guiding the discrete articles for personal treatment through said electric field and a processing unit. The processing unit is in communication with the pair of capacitor plates, and is operative for detecting a change in capacitance as a discrete article passes through the electric field in order to determine the integrity of the discrete article on the basis of the change in capacitance and a characteristic capacitance change signature. The container filling machine further comprises a transportation device, a rejection device, a counting device and a plurality of path blocking devices.
TITLE: A CONTAINER FILLING MACHINE

FIELD OF THE INVENTION

[001] The present invention relates to container filling machines, and specifically to container filling machines for assessing and discarding defective discrete articles for personal treatment, such as pharmaceutical pills.

BACKGROUND OF THE INVENTION

[002] Packaging machines for filling containers with discrete articles for personal treatment, such as pharmaceutical pills, are known in the art. However, existing container filling machines are plagued with numerous deficiencies that often render them ineffective and inefficient.

[003] The purpose of container filling machines for discrete articles for personal treatment is to take a large supply of such discrete articles and to transport them towards a container, while ensuring that a desired number of the discrete articles for personal treatment are placed into the container. Many container filling machines are also operative for detecting the integrity of the discrete articles for personal treatment so that defective discrete articles for personal treatment are not included in the containers.

[004] A first deficiency with existing container filling machines for packaging discrete articles for personal treatment is that they use vibrating trays in order to space the discrete articles from each other and move them towards one or more sensing devices, and ultimately towards the containers. However, these vibrating trays do not evenly space and distribute the discrete articles for personal treatment as they move towards the sensing devices that are operative to detect the integrity of the discrete articles. As such, in some cases, two or more discrete articles for personal treatment are provided to the sensing device at the same time, which can cause incorrect readings.
A second deficiency with many existing container filling machines is that they use optical sensors in order to determine the integrity of each discrete article for personal treatment. Such optical sensors take an optical scan of the exterior shape of the discrete article for personal treatment as it passes in front of one or more optical cameras. The optical cameras then determine the integrity of the discrete article for personal treatment based on the optical scan. While such optical sensors can detect the integrity of most discrete articles for personal treatment, depending on the orientation of the discrete article for personal treatment as it passes by the optical cameras, the optical scan may not detect a defective region of the discrete article. In addition, if two discrete articles for personal treatment pass through the optical scanner at the same time, the optical cameras will be unable to detect the integrity of one or both of the discrete articles for personal treatment.

In addition, the manner in which many existing container filling machines detect whether there exists one or more defective discrete articles for personal treatment in a container is to weigh the container once the container has been filled. In the case where the container does not weigh a predetermined correct weight, then it is determined that the container contains one or more defective discrete articles for personal treatment and the entire container is emptied and then re-filled. It can be appreciated that this is both inefficient, and causes a lot of wasted discrete articles for personal treatment.

In light of the above, there is a need in the industry for an improved container filling machine that alleviates, at least in part, the deficiencies of existing container filling machines, and container filling machine systems.

SUMMARY OF THE INVENTION

In accordance with a first broad aspect, the present invention provides a device for carrying discrete articles for personal treatment from a pick-up location to a drop-off location. The device is suitable for use in container filling machines for placing the discrete articles for personal treatment into containers such as bottles. The device
comprises a moving surface comprising a plurality of spaced apart air passageways arranged according to a pattern and a vacuum device for suctioning air through the plurality of spaced apart air passageways such that a discrete article located in proximity to a pick-up location of the moving surface is suctioned to an air passageway of the moving surface. The suctioned article is transported by the moving surface to a drop-off location where the discrete articles for personal treatment are no longer transported by the moving surface.

[009] In accordance with a second broad aspect, the present invention provides a method for carrying discrete articles for personal treatment from a pick-up location to a drop-off location. The method comprises providing a moving surface having a plurality of spaced apart air passageways arranged according to a pattern, suctioning air through the plurality of spaced apart air passageways such that discrete articles for personal treatment located at a pick-up location are suctioned to respective ones of the spaced apart air passageways and releasing the discrete articles for personal treatment from the moving surface at the drop-off location such that the discrete articles for personal treatment are no longer transported by the moving surface.

[010] In accordance with a third broad aspect, the present invention provides a container filling machine for bottling discrete articles for personal treatment. The container filling machine comprises a transportation device suitable for carrying discrete articles for personal treatment from a pick-up location to a drop-off location and a sensing device suitable for determining the integrity of the discrete articles for personal treatment that are released at the drop-off location. The transportation device comprises a moving surface comprising a plurality of spaced apart air passageways arranged according to a predetermined pattern and a vacuum device for suctioning air through the plurality of spaced apart air passageways, such that a discrete article for personal treatment located in proximity to a pick-up location of the moving surface is suctioned to a respective one of the air passageways of the moving surface. The suctioned article is carried by the moving surface to a drop-off location wherein the article is no longer transported by the moving surface. The sensing device comprises at least one capacitor through which
articles released at the drop-off location travel and a processing unit. The processing unit is operative for determining a change in capacitance at the at least one capacitor as a discrete article passes therethrough and determining at least in part on the basis of the change in capacitance if the discrete article is integral.

[010] In accordance with a fourth broad aspect, the present invention provides a sensing device suitable for use with a container filling machine for detecting the integrity of discrete articles for personal treatment to be placed in a container. The sensing device comprises a pair of capacitor plates positioned in a substantially opposing relationship for creating therebetween an electric field, a track for guiding the discrete articles for personal treatment through said electric field and a processing unit. The track prevents the discrete articles for personal treatment from tumbling during travel through said electric field. The processing unit is in communication with the pair of capacitor plates, and is operative for detecting a change in capacitance as a discrete article passes through the electric field and determining the integrity of the discrete article at least in part on the basis of the change in capacitance.

[012] In accordance with a fifth broad aspect, the invention provides a sensing device suitable for use with a container filling machine. The sensing device is operative for detecting the integrity of discrete articles for personal treatment to be loaded in a container. The sensing device comprises a measurement capacitor, a reference capacitor and a processing unit in communication with the measurement capacitor and the reference capacitor. The processing unit is operative for detecting a difference in capacitance change between the measurement capacitor and the reference capacitor as a discrete article passes through the measurement capacitor and determining the integrity of the discrete article at least in part on the basis of the difference in capacitance change.

[013] In accordance with a sixth broad aspect, the present invention provides a method for detecting the integrity of discrete articles for personal treatment to be loaded in a container. The method comprises providing a measurement capacitor, providing a reference capacitor, detecting a difference in capacitance change between the
measurement capacitor and the reference capacitor when a discrete article for personal treatment passes through the measurement capacitor and determining the integrity of the discrete article at least in part on the basis of the difference in capacitance change.

[014] In accordance with a seventh broad aspect, the present invention provides a sensing device suitable for use with a container filling machine for detecting the integrity of discrete articles for personal treatment to be loaded in a container. The sensing device comprises a pair of capacitor plates and a processing unit. The pair of capacitor plates are positioned in a substantially opposing relationship for creating therebetween an electric field in response to voltage impressed across the plates which is less than 100V. The processing unit is in communication with the pair of capacitor plates and is operative for detecting a change in capacitance as a discrete article for personal treatment passes through the electric field and for determining the integrity of the discrete article on the basis of the change in capacitance.

[015] In accordance with an eighth broad aspect, the present invention provides a container filling machine for loading discrete articles for personal treatment into a container. The container filling machine defines a path along which the discrete articles for personal treatment travel towards a container. The container filling machine comprises a sensing device suitable for detecting the integrity of a discrete article for personal treatment, a rejection device positioned between the sensing device and a container and a processing unit in communication with the sensing device and the rejection device. Upon detection at the sensing device of a defective discrete article, the processing unit is operative for causing the rejection device to remove the defective discrete article from continued travel along the path towards the container.

[016] In accordance with a ninth broad aspect, the present invention provides a container filling machine for bottling discrete articles for personal treatment. The container filling machine includes at least two paths for feeding discrete articles for personal treatment into a container and comprises a counting device for counting the discrete articles for personal treatment travelling along each path, and a path blocking
device associated to each respective path. Each path blocking device is capable of moving between a first position and a second position, wherein in the first position the discrete articles for personal treatment are able to enter a container, and in the second position the discrete articles for personal treatment are prevented from entering into the container. The container filling machine further comprises a processing unit in communication with each path blocking device. The processing unit is operative for causing each path blocking device to move between the first position and the second position at least in part on the basis of information received from a corresponding counting device.

These and other aspects and features of the present invention will now become apparent to those of ordinary skill in the art upon review of the following description of specific embodiments of the invention and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

Figure 1 shows a front representational view of a container filling machine in accordance with a non-limiting example of implementation of the present invention;

Figure 2 shows a side representational view of the container filling machine of Figure 1;

Figure 3 shows a non-limiting flow diagram of the operation of the container filling machine of Figure 1 in accordance with an example of implementation of the present invention;

Figure 4 shows a non-limiting block diagram of a computing unit suitable for implementing the functionality of the container filling machine of Figure 1;
[023] Figure 5A shows a side representational view of a transportation device in accordance with a non-limiting example of implementation of the present invention;

[024] Figure 5B shows a top representational view of the transportation device of Figure 5A;

[025] Figure 6 shows an expanded view of portion 6 shown in Figure 1;

[026] Figure 7 shows a front perspective view of a portion of a sensing device in accordance with a non-limiting example of implementation of the present invention;

[027] Figure 8 shows a non-limiting electrical representation of a measurement capacitor and a reference capacitor used in the sensing device of Figure 7;

[028] Figure 9 shows a non-limiting representation of an electrical circuit for the sensing device of Figure 7;

[029] Figure 10 shows a non-limiting flow diagram of a process used by the sensing device to detect a change in capacitance, in accordance with an example of implementation of the present invention;

[030] Figure 11 shows a side representational view of a rejection device in accordance with a non-limiting example of implementation of the present invention;

[031] Figure 12 shows an expanded view of portion 12 shown in Figure 1;

[032] Figure 13A shows a first non-limiting configuration for using two of the container filling machines of Figure 1 simultaneously;

[033] Figure 13B shows a second non-limiting configuration for using two of the container filling machines of Figure 1 simultaneously; and
Figure 13C shows a third non-limiting configuration for using two of the container filling machines of Figure 1 simultaneously.

Other aspects and features of the present invention will become apparent to those ordinarily skilled in the art upon review of the following description of specific embodiments of the invention in conjunction with the accompanying figures.
DETAILED DESCRIPTION

OVERALL MACHINE

[036] Shown in Figures 1 and 2 is a container filling machine 10 in accordance with a non-limiting example of implementation of the present invention. More specifically, Figure 1 shows a front view of the container filling machine 10, and Figure 2 shows a side view of the container filling machine 10. The container filling machine 10 is suitable for loading into containers any discrete articles for personal treatment, such as pharmaceutical discrete articles, cosmetic items, etc... As used herein, the term "discrete article for personal treatment" includes any type of pharmaceutical discrete article for personal treatment that can be ingested (such as pressed-powder or gel cap pills, among other possibilities) as well as any cosmetic item that can be applied to an external part of the body (such as moisturiser capsules, for example).

[037] In the non-limiting embodiment shown, the container filling machine 10 includes a transportation device 20, a sensing device 22, one or more rejection devices 24, a counting device 26, and a series of path blocking devices 28, which will each be described in more detail throughout the present application. The transportation device 20 is operative for transporting the discrete articles for personal treatment from an initial loading location 30 (shown in Figure 2) towards a plurality of paths 32. More specifically, the transportation device 20 delivers the discrete articles for personal treatment from the initial loading location 30 to the plurality of paths 32 in accordance with a predetermined pattern, such that the discrete articles for personal treatment are provided to the paths 32 in a predictable spaced-apart manner.

[038] Once deposited onto a path 32, each discrete article for personal treatment travels through the sensing device 22. The sensing device 22 is operative for assessing the integrity of each discrete article for personal treatment on a individual basis. In the case where a discrete article for personal treatment is found to be defective by the sensing device 22, the rejection device 24 then removes the defective discrete article from continued travel along its path 32. As such, any defective discrete articles for personal
treatment are removed from continued travel towards a container 34. In the case where a
discrete article for personal treatment is not defective, it continues along its path 32
towards the counting device 26 and one of the series of path blocking devices 28, prior
to entering a container 34. The counting device 26 is operative for counting the number
of integral discrete articles for personal treatment that pass therethrough, such that the
path blocking devices 28 can control the number of discrete articles for personal
treatment that enter each container 34. In this manner, the container filling machine 10
is able to fill a plurality of containers 34 with an exact number of integral discrete
articles for personal treatment. The path blocking devices 28 further permit the
container filling machine 10 to keep a steady flow of discrete articles for personal
treatment travelling towards the containers 34, even as filled containers 34 are being
replaced by empty containers.

[039] Once filled, the containers 34 continue towards other machines that put caps on
the containers 34, apply labels to the containers 34, and generally perform any other
operation on the containers 34 that is required prior to providing the containers 34 to an
end consumer.

[040] Shown in Figure 3, is a non-limiting flow diagram of the overall operation of the
container filling machine 10. At step 40, the container filling machine 10 receives an
initial supply of discrete articles for personal treatment that are provided to the machine
10 in a disorganised fashion. For example, the supply of discrete articles for personal
treatment may simply be poured into an initial loading location 30 from another
container. At step 42, the transportation device 20 transports the discrete articles for
personal treatment from the initial loading location 30 to a path of travel 32 in
accordance with a predetermined pattern. At step 44, the discrete articles for personal
treatment pass through the sensing device 22, such that the sensing device 22 can
determine the integrity of each of the discrete articles for personal treatment that passes
therethrough. In this manner, any defective discrete articles for personal treatment are
identified. At step 46, any defective discrete articles for personal treatment that were
identified by the sensing device 22 are discarded by the rejection device 24, such that
they are removed from their path 32 and no longer continue travelling towards a
container 34. At step 48, the counting device 26 counts the integral discrete articles for
personal treatment that remain on a path 32 towards a container 34. Finally, at step 50,
the container filling machine 10 controls the supply of discrete articles for personal
treatment to the containers 34 via the path blocking devices 28.

[041] It should be appreciated that numerous discrete articles for personal treatment
may be travelling on the paths 32 at the same time, such that once the discrete articles
for personal treatment are flowing through the machine, each of the steps described
above is performed at substantially the same time. For example, while the transportation
device 20 is transporting certain discrete articles for personal treatment, the sensing
device 22 may be sensing other discrete articles for personal treatment that are further
on in their travel towards a container 34, and the counting device 26 may be counting
discrete articles for personal treatment that are still further on in their travel towards a
container 34.

[042] In some embodiments of the invention, all or part of the functionality that will be
described below in relation to each of the transportation device 20, the sensing device
22, the rejection devices 24, the counting device 26 and the path blocking devices 28,
may be implemented as pre-programmed hardware or firmware elements (e.g.,
application specific integrated circuits (ASICs), electrically erasable programmable
read-only memories (EEPROMs), etc.) or other related components.

[043] However, in a preferred embodiment, the functionality of the transportation
device 20, the sensing device 22, the rejection devices 24, the counting device 26 and
the path blocking devices 28 is controlled via at least one software driven processing
unit.

[044] Shown in Figure 4 is a non-limiting block diagram of a computing unit 60 suitable
for controlling the different components of the container filling machine 10. As shown,
the computing unit 60 includes a processing unit 62 and a memory unit 64 that are in
communication with each other via a communication bus 66. The memory unit 64 includes program instructions 68 and data 70 that are accessed and processed by the processing unit 62, such that the processing unit 62 can control the functionality and operations of the components of the container filling machine 10. As shown, the processing unit 62 is in communication with the transportation device 20, the sensing device 22, the rejection device 24, the counting device 26 and the path blocking devices 28. The processing unit 62 is also in communication with user inputs 52 that enable the user to enter commands and/or data into the computing unit 60.

[045] In this non-limiting embodiment, all or part of the functionality of the transportation device 20, the sensing device 22, the rejection device 24, the counting device 26 and the path blocking devices 28 may be implemented as software consisting of a series of instructions for execution by the processing unit 62. For example, the series of instructions could be stored in the memory 64, which could be a medium which is fixed, tangible and readable directly by the processing unit 62 (e.g., removable diskette, RAM, flash memory, CD-ROM, ROM, PROM, EEPROM or fixed disk).

[046] The computing unit 60 may comprise a number of interfaces for receiving or sending data elements to external devices. For example, the computing unit 60 includes an interface (not shown) for receiving signals from the user inputs 52. These user inputs may allow an operator of the container filling machine 10 to enter commands and parameters for programming and/or controlling the different components of the container filling machine 10. This may be done in order to change operational settings of the different components, and/or to enter specific data, such as a desired operating speed, the number of discrete articles for personal treatment per container, etc.... The computing unit 60 may further include an interface for releasing data to be displayed to a user on a display (not shown).

[047] It should be appreciated that the functionality of some of the components of the container filling machine 10 is directly dependent on events that occur at other components of the container filling machine 10. For example, the operation of the
rejection device 24 is dependent on the detection at the sensing device 22 of a defective 
discrete article for personal treatment. Likewise, the operation of the path blocking 
devices 28 is at least partly dependent on the number of discrete articles for personal 
treatment counted by the counting device 26. As such, it is advantageous to have a 
single processing unit 62 in communication with each of the components (transportation 
device 20, the sensing device 22, the rejection devices 24, the counting device 26 and 
the path blocking devices 28) such that the processing unit 62 can co-ordinate the 
operation of the different components.

[048] However, in accordance with an alternative example of implementation, the 
transportation device 20, the sensing device 22, the rejection devices 24, the counting 
device 26 and the path blocking devices 28 may each include their own separate 
processing unit (not shown). In such an embodiment, at least some of the processing 
units would be in communication with each other over a communication link, so as to 
co-ordinate the functionality of the different components. More specifically, the 
processing unit for the sensing device 22 would need to issue a signal to the processing 
unit of the rejection device 24 upon detection of a defective discrete article for personal 
treatment, such that the processing unit for the rejection device 24 could cause the 
rejection device 24 to remove the defective discrete article for personal treatment from 
itst path of travel.

[049] The operation and functionality of the transportation device 20, the sensing device 
22, the rejection device 24, the counting device 26, and the path blocking devices 28 
will now be described in more detail hereinbelow.

TRANSPORTATION DEVICE 20

[050] As described above, the transportation device 20 is operative for receiving an 
initial load of discrete articles for personal treatment, and for releasing those discrete 
articles for personal treatment at a drop-off location in accordance with a predetermined 
pattern. As shown in Figure 2, an initial load of discrete articles for personal treatment 
is placed into the container filling machine 10 at an initial loading position 30. At the
initial loading position 30, the discrete articles for personal treatment do not need to be in any particular order or orientation, and as such can be quickly dumped into the container filling machine 10. This can be done either manually by an operator of the machine 10, or mechanically by a different machine.

[051] In accordance with a non-limiting example of implementation, the initial loading position 30 includes a pair of vibrating trays 36a and 36b that cause the discrete articles for personal treatment to approach a moving surface 38. Although only two vibrating trays 36a and 36b are shown in Figure 2, it should be appreciated that any number of vibrating trays could be used. In addition, it should also be appreciated that the vibrating tray 36b could be positioned at any height in relation to the moving surface 38.

[052] In accordance with a first non-limiting example, the vibrating trays 36a and 36b span the entire length of the moving surface 38. However, in accordance with an alternative embodiment (as shown in Figure 5b) there are multiple vibrating trays 36bi-36b, that lead towards the moving surface 38. In accordance with a specific example, there is one vibrating tray 36b, for each container 34 that is to be filled. Each of the vibrating trays 36bj-36bs can be controlled independently, such that each of the vibrating trays 36bi-36b can vibrate at a different frequency, for example. This independent control of the vibrating trays 36b, enables the container filling machine 10 to have better control over the number of discrete articles for personal treatment that are supplied to each container 34.

[053] In addition, it is possible that instead of vibrating trays 36a and 36b, the transportation device 20 may simply include a hopper, or slanted tray leading towards the moving surface 38. Any device that is operative for feeding the discrete articles for personal treatment towards the moving surface 38 is included within the spirit of the invention.

[054] In order to transport the discrete articles for personal treatment from the initial loading position 30 to a drop off position 39, shown in Figure 5A, the moving surface
38 of the transportation device 20 includes a plurality of spaced-apart air passageways 54 that are arranged in a predetermined pattern thereon. This can best be seen in Figures 1 and 5A. The transportation device 20 further includes a vacuum device (not shown) for suctioning air through the plurality of spaced apart air passageways 54. In this manner, the discrete articles for personal treatment that approach the moving surface 38 at a pick-up location 37 are suctioned to the air passageways 54 of the moving surface 38, such that they are distributed over the moving surface 38 in accordance with the predetermined pattern of air passageways 38, and are securely carried by the moving surface 38 in its direction of travel.

[055] As shown in Figure 5a, the discrete articles for personal treatment are operative to be suctioned to the air passageways 54 of the moving surface 38 at a pick up location 37, and are carried by the moving surface 38 to a drop-off location 39 wherein the discrete articles for personal treatment are no longer carried by the moving surface 38. In other words, the discrete articles for personal treatment are released from being carried by the moving surface 38 at the drop-off location 39.

[056] As mentioned above, the air passageways 54 are arranged on the moving surface 38 in accordance with a predetermined pattern, such that at the drop-off location 39, the discrete articles for personal treatment are spaced from one another in accordance with the predetermined pattern. In one non-limiting example of implementation, the air passageways 54 in the predetermined pattern are evenly spaced from one another, such that the discrete articles for personal treatment are released at the drop-off location 39 in an evenly spaced manner. However, it should be understood that the predetermined pattern may be any pattern possible, such as a random pattern, or an unevenly spaced pattern.

[057] The plurality of air passageways 54 arranged on the moving surface 38 may be of any shape and size. For example, the air passageways 54 may have a cross section that is circular, square, rectangular, octagonal or any other shape, without departing from the spirit of the invention. However, in accordance with a specific non-limiting example of
implementation, the air passageways 54 have a cross section that is circular in shape and have a diameter of between 1mm-10mm.

[058] The moving surface 38 may be any type of moving surface that is operative for enabling discrete articles for personal treatment to be suctioned thereto and then carried from a pick-up location 37 to a drop-off location 39. For example, the moving surface 38 may be in the form of a conveyor belt, that is either flat or slanted. However, in accordance with the non-limiting embodiment shown in Figures 1, 2, 5a and 5b, the moving surface 38 is in the form of a cylindrical drum that is suitable for rotation about a rotation axis 56 in a clock-wise direction.

[059] As best shown in Figures 1 and 5b, the plurality of spaced apart air passageways 54 are arranged in rings along the length of the cylindrical drum, and the air passageways 54 in each ring are evenly spaced around a circumference of the cylindrical drum. The cylindrical drum includes an exterior surface 58 and an interior surface 59 that define an interior chamber 72. The plurality of air passageways 54 extend through the drum from the exterior surface 58 to the interior surface 59. In accordance with a non-limiting example, the cylindrical drum has a diameter of between 50mm-300mm, however it should be appreciated that a drum having a diameter of any size suitable for its application can be used within the spirit of the invention.

[060] As mentioned above, the vacuum device is operative for suctioning air out of the interior chamber 72 and through the air passageways 54 of the cylindrical drum. In accordance with an alternative non-limiting embodiment, the transportation device 20 may include multiple different vacuum devices (not shown) that are each controlled individually. The individually controlled vacuum devices are operative for suctioning air through the spaced apart air passageways 54 of different regions of the moving surface 38. For example, the cylindrical drum may be divided into 5 distinct regions along its length, (each region corresponding to a container 34 to be filled) wherein each region includes its own vacuum device. In this manner, the container filling machine is better able to control the discrete articles travelling towards each container 34. More
specifically, the different vacuum devices can each be controlled separately such that
discrete articles for personal treatment that approach the moving surface 38 are
suctioned to the moving surface differently along the length of the drum. In this manner,
each of the vacuum devices can be controlled independently, which enables the
container filling machine 10 to better control the number of discrete articles for personal
treatment travelling towards each container 34.

[061] As described above, the number of discrete articles for personal treatment being
supplied to each respective container 34 can be controlled via the multiple different
vibrating trays 36b₁-36b₅, or via the multiple different vacuum devices (not shown). In
general, if multiple vibrating trays 36b₁-3Ob₅ are used, then only one vacuum device is
used. Likewise, if only one vibrating tray 36b is used, then multiple vacuum devices are
used. It should however be appreciated that multiple different vacuum devices, and
multiple different vibrating trays 36b₁-3Ob₅ can be used in combination without
departing from the spirit of the invention.

[062] The interior chamber 72, or the multiple different interior chambers in the case
where the cylindrical drum includes a plurality of vacuum devices, each include a
suction blocking device 74 for dividing the interior chamber 72 into a first portion 76
and a second portion 78. The first portion 76 and the second portion 78 are fixed in
relation to the rotation of the cylindrical drum, such that the cylindrical drum rotates
around the suction blocking device 74. As the air passageways 54 of the cylindrical
drum pass by the first portion 76 of the interior chamber 72, air is suctioned through the
air passageways 54 by the vacuum device. However, as the air passageways 54 of the
cylindrical drum pass by the suction blocking device 74 of the second portion 78, the
suction blocking device 74 prevents air from being suctioned through the air
passageways 54. Therefore, as the discrete articles for personal treatment that are
suctioned to the cylindrical drum pass by the suction blocking device 74, they are
released from being carried by the cylindrical drum, and are deposited onto individual
paths 32 that run parallel to one another and ultimately lead to a respective container 34.
More specifically, it is at the drop-off location 39 that the discrete articles for personal
treatment are released onto one of the paths 32 that lead the discrete articles for personal treatment from the drop-off location 39 towards a container 34.

[063] As shown in Figure 5A, the first portion 76 of the interior chamber 72 spans from the pick-up location 37 to the drop-off location 39, such that the discrete articles for personal treatment are suctioned to the air passageways 54 at the pick-up location 37 and are carried by the cylindrical drum to the drop-off location 39. At the drop-off location 39, the suction blocking device 74 prevents the vacuum device from suctioning air through the air passageways 54, such that the discrete articles for personal treatment are released from the air passageways 54 and are deposited onto a respective path 32 that will lead a discrete article for personal treatment into a container. In the non-limiting embodiment shown in Figure 1, the container filling machine 10 includes 20 paths 32 that eventually feed into 5 containers 34. As such, each set of four paths 32 leads into a respective one of the containers 34. It should be appreciated that the container filling machine 10 may include a different number of paths 32, and may be operative for filling a different number of containers 34, without departing from the spirit of the invention.

[064] The suction blocking device 74 covers a bottom portion of the interior chamber 72, and tapers inwardly from the drop-off location 39 towards the top of the interior chamber 72. In this manner, the suction through the air passageways 54 is strongest from the pick-up location 37 to the top of the interior chamber 72, and then the suction is reduced as the discrete article for personal treatment is carried from the top of the cylindrical drum towards the drop-off location 39. The moving surface relies, in part, on gravity to keep the discrete article for personal treatment in place as the discrete article for personal treatment is carried from the top of the cylindrical drum towards the drop-off location 39. In the embodiment shown in Figure 5A, the first portion 76 of the interior chamber 72 spans from a first side of the drum to a second side of the drum. As such, the discrete articles for personal treatment are picked up on one side of the drum, carried along a semi-circular path, and then released on the second side of the drum.
In accordance with the non-limiting embodiment shown in Figure 4, the transportation device 22 is in communication with a processing unit 62 for controlling its operational settings. Such operational settings may include the speed of the moving surface 38, the orientation of the vacuum blocking device 74 (in the case where it is able to move), and/or the level of suction being applied by the vacuum device, among other possibilities.

In a preferred embodiment shown in Figure 4, the processing unit 62 is part of a computing unit 60 that is operative for controlling the functionality of multiple components of the container filling machine 10. However, in an alternative embodiment, the transportation device 20 may be controlled by a dedicated processing unit that is operative to control only the functionality of the transportation device 20.

The processing unit 62 may be located on the body of the container filling machine 10, or alternatively, the processing unit 62 may be located remotely from the container filling machine 10, such as within a remotely located computer that is in electrical communication with the electrical circuitry of the transportation device 20.

Referring back to Figure 1, when the discrete articles for personal treatment are released by the transportation device 20 at the drop off location 39, they start travelling along a respective one of the paths 32 towards a container 34. As the discrete articles for personal treatment travel along a respective path 32, they pass through a sensing device 22 that is operative for assessing the integrity of the discrete articles for personal treatment.

As used herein, the term "assessing the integrity of the discrete articles for personal treatment" refers to detecting whether or not a discrete article for personal treatment is defective. An integrally formed discrete article for personal treatment is a non-defective discrete article that is complete and fully formed. As such, by assessing the integrity of the discrete article for personal treatment, the sensing device 22 is
verifying whether the discrete article for personal treatment is chipped, broken, or empty in the case of gel cap pills.

[070] As shown in Figure 6, the sensing device 22 includes a plurality of passageways 86, wherein each passageway 86 corresponds to a respective one of the paths 32. Each passageway 86 includes sensing circuitry that operates independently from the sensing circuitry in the other passageways 86. As will be described in more detail below, the sensing circuitry comprises at least one pair of capacitor plates for creating therebetween an electric field. As a discrete article for personal treatment passes through the passageway 86 and between the capacitor plates, the change in capacitance is detected, and is used to determine the integrity of the discrete article for personal treatment.

[071] As shown in Figure 1, the sensing device 22 is formed of an elongated body 80 of material that can be easily secured to a frame 82 of the container filling machine 10. The elongated body 80 of the sensing device 22 includes sensing circuitry therein, and when secured to the frame 82, defines a plurality of passageways 86 through which the discrete articles for personal treatment can travel. The passageways 86 through the sensing device 22 can be seen in Figure 6, which shows a blown up portion of Figure 1. Preferably, the elongated body 80 is constructed out of an FDA approved plastic material that can be easily removed and washed without damaging the sensing circuitry embedded therein. The sensing circuitry is generally embedded within the FDA approved plastic material, such that the circuitry is hermetically enclosed.

[072] Optionally, the paths 32 of the container filling machine define tracks for guiding the discrete articles for personal treatment through the passageways 86 of the sensing device 22. In the non-limiting embodiment shown in the Figures, each track is in the form of a V-shaped slope that extends through a passageway 86 of the sensing device 22. The slope may range from a 0 degree slope to a 90 degree slope with respect to the reference system shown in Figure 5A. As a discrete article for personal treatment slides down the slope, the V-shaped side walls prevent non-spherical discrete articles for
personal treatment, such as articles having an oblong shape, from tumbling end-over-end, as is often the case when a discrete article for personal treatment simply free-falls through a passageway 86, or just slides down a flat incline. As used herein, the term "tumbling" means to roll end-over-end along one or two different axes in connection with discrete articles for personal treatment that are non-spherical.

[073] Shown in Figure 7 is a non-limiting example of a single passageway 86 of the sensing device 22 that is associated with a single path 32. For the sake of simplicity, the functioning of the sensing circuitry will be described with respect to a single passageway 86. It should, however, be appreciated that the circuitry and functionality described with respect to this single passageway 86, can also be found in each of the passageways 86 that form the sensing device 22.

[074] In accordance with the present invention, the sensing circuitry includes a measurement capacitor 88 and a reference capacitor (not shown) associated to each respective passageway 86. The measurement capacitor 88 includes two plates that are positioned on either side of the passageway 86 in a substantially opposing relationship. Specifically, the plates of the measurement capacitor 88 are positioned such that there is one plate located on each side of the passageway 86 for creating therebetween an electric field through which a discrete article for personal treatment will travel. The reference capacitor (not shown) can be realised in many different ways, and in a non-limiting embodiment, may be included within the circuitry contained in the elongated body 80. Alternatively, the reference capacitor may be located elsewhere.

[075] The combination of the measurement capacitor 88 and the reference capacitor (not shown) define a sensing unit. In accordance with a non-limiting embodiment (not shown in Figure 7), each passageway 86 may include two sensing units, one on top of the other, such that a discrete article for personal treatment travelling through the passageway 86 would be inspected twice, at different points along its path of travel.
[076] Shown in Figure 8, is an electrical circuit representation of the measurement capacitor 88 and a reference capacitor 90 of a sensing unit. As shown, the measurement capacitor 88 and the reference capacitor 90 each comprise a driven plate 92, meaning a plate to which a voltage is applied from a power source, and a non-driven plate 94, to which no voltage is directly applied. In accordance with the present invention, both the measurement capacitor 88 and the reference capacitor 90 share a common non-driven plate 94.

[077] The purpose of the circuitry contained in each passageway 86 is two-fold. Firstly, the sensing circuitry detects the presence of a discrete article for personal treatment passing therethrough, and secondly the sensing circuitry determines the integrity of the discrete article for personal treatment as the discrete article for personal treatment passes through the passageway 86. The integrity of the discrete article for personal treatment can be determined at least in part on the basis of a change in capacitance manifested by the measurement capacitor 88, as the discrete article for personal treatment passes between the capacitor plates. In short, on the basis of the change in capacitance it can be determined if the mass of the discrete article for personal treatment is correct. An incorrect mass would indicate that the discrete article for personal treatment is defective in some way (i.e. broken, chipped, or not completely filled in the case of a gel-cap).

[078] In accordance with the non-limiting embodiment shown in Figure 4, the sensing device 22 is in communication with a processing unit 62 that is operative to process the capacitance change detected by the sensing circuitry associated with each passageway. Moreover, the processing unit 62 is operative for processing the capacitance change on the basis of a set of rules and instructions contained in the memory 64, for determining the integrity of a discrete article for personal treatment passing through each respective passageway 86. The processing unit 62 determines, on the basis of the capacitance change detected by the sensing circuitry, whether a discrete article for personal treatment is defective or not. In a preferred embodiment, and as shown in Figure 4, the processing unit 62 is preferably part of a computing unit 60 that is operative for
controlling the functionality of multiple components of the container filling machine 10. However, in an alternative embodiment, the sensing device 22 may be in communication with a processing unit that is dedicated to controlling the functionality of the sensing device 22.

[079] The processing unit may be located within the circuitry in the body 80 of the sensing device 10, or alternatively, the processing unit may be located remotely from the elongated body 80, such as within a remotely located computer that is in electrical communication with one or more components of the container filling machine 10. As shown in Figure 6, in the case where the processing unit 62 is located remotely from the elongated body 80, the circuitry contained within the elongated body 80 can be electrically connected to the processing unit, via a cable 87.

[080] As mentioned above, as a discrete articles for personal treatment travels through a passageway 86 of the sensing device 22, the discrete article for personal treatment causes a change in capacitance at the measurement capacitor 88 associated to that passageway 86. As this happens, the processing unit 62 is operative for:
1) sensing the change in capacitance as the discrete article for personal treatment passes through the electric field of the measurement capacitor 88; and
2) determining the integrity of the discrete article at least in part on the basis of the change in capacitance in relation to a characteristic signature. The characteristic signature will be described in more detail further on in the specification.

[081] In accordance with a non-limiting example of implementation, once the processing unit 62 has determined the capacitance change at the measurement capacitor 88, it uses program instructions 68 and data 70 stored in the memory 64 to compare that capacitance change to a characteristic signature that corresponds to an integrally formed discrete article for personal treatment. In other words, the characteristic signature corresponds to the capacitance change that would be manifested by the measurement capacitor 88, when a discrete article for personal treatment that is known to be integral, is passed through the measurement capacitor 88. It will be apparent that the
characteristic signature will depend on the actual type of discrete article for personal treatment being packaged; as the discrete article changes so will the characteristic signature. For instance, if the discrete article for personal treatment is a medicinal pill, pills of different shapes or weights will be associated with different characteristic signatures. In the case where the capacitance change detected by the processing unit 62 is not within an acceptable range from the characteristic signature, it is determined that the discrete article for personal treatment is defective (i.e. broken, chipped, an empty gel cap or of a shape or kind that does not belong to the batch). In some cases an incorrect discrete article for personal treatment can be accidentally placed into a batch of different discrete articles for personal treatment.

[082] Shown in Figure 9 is a non-limiting representation of circuitry used by the sensing device 22 to detect the capacitance change at the measurement capacitor 88. As shown, each measurement capacitor 88 and reference capacitor 90, associated to a passageway 86, includes a voltage adjusting circuit 96, a 0-volt detector 98 and a power supply 100. The power supply 100 is operative for supplying a voltage to the driven plates 92 of the measurement capacitor 88 and the reference capacitor 90. The 0-volt detector 98 is in communication with the non-driven plate 94 of the measurement capacitor 88, and the voltage adjusting circuit 90. The voltage adjusting circuit 96, in turn, is in communication with the power supply 100, the driven plate 92 of the measurement capacitor 88 and the processing unit 62. During the course of operation, the power supply 100 supplies a known voltage to the driven plates 92 of the measurement capacitor 88 and the reference capacitor 90 respectively, such that the non-driven plate 94 is at 0-volts when there is nothing positioned between the two plates of the measurement capacitor 88.

[083] The method for determining a capacitance change will now be described in more detail with respect to the flow chart of Figure 10. As described above, when a discrete article for personal treatment passes through the measurement capacitor 88, the voltage at the non-driven plate 94 changes, as a result of the change of capacitance induced by the discrete article for personal treatment. As shown at step 102, the 0-volt detector 98
is operative for monitoring the voltage at the non-driven plate 94. As a discrete article for personal treatment passes through the measurement capacitor 88, the 0-volt detector 98 detects that the voltage at the non-driven plate 94 has a non-zero reading. The readings taken by the 0-volt detector 98 are then passed to the voltage adjusting circuit 96, such that at step 104, upon detection of a non-0 reading, the voltage adjusting circuit 96 varies the voltage supplied to the driven plate 92 until the non-driven plate 94 goes back to a 0-voltage reading. This detection and correction is done throughout the travel of the discrete article for personal treatment through the measurement capacitor 88. As such it should be appreciated that the voltage correction required may vary over the course of a discrete article for personal treatment's travel through the measurement capacitor 88, such that a graph of voltage adjustment vs. time may provide a type of bell-curve according to certain mathematical functions. At step 106, data describing the voltage correction for the passage of the discrete article for personal treatment are provided to the processing unit 62.

[084] It should be appreciated that the voltage adjusting circuit 96 may provide the values for the voltage correction to the processing unit 62 continuously throughout the voltage correction, such that steps 104, and 106 are performed substantially simultaneously. However, in an alternative embodiment, the voltage adjusting circuit 96 may not provide the values for the voltage correction until the non-driven plate 94 has returned and stabilised to a 0-volt reading, which occurs when the discrete article for personal treatment has left the measurement capacitor 88. At that point the voltage adjusting circuit 96 may then supply the processing unit 62 with all of the voltage correction measurements that occurred during the course of the discrete article's travel through the measurement capacitor 88. Alternatively, the voltage adjusting circuit 96 may supply the processing unit 62 with only a single value, such as the average voltage correction value, or the greatest voltage correction value, among other possibilities.

[085] Once the processing unit 62 has received the data describing the voltage correction value or values, it then determines the change in capacitance at the measurement capacitor 88. More specifically, the level of voltage adjustment indicates
the amount of correction required, hence the capacitance change induced by the discrete article for personal treatment. By detecting a capacitance imbalance between the measurement capacitor 88 and the reference capacitor 90, the processing unit 62 detects a difference in the change of capacitance between the two capacitors. In a preferred embodiment, reference capacitor 90 maintains a constant capacitance throughout the course of operation. As such, by detecting the capacitance change at the measurement capacitor 88, the processing unit 62 is also detecting a difference in capacitance change between the measurement capacitor 88 and the reference capacitor 90.

[086] Once the change in capacitance at the measurement capacitor 88 has been detected, the processing unit 62 determines the integrity of the discrete article for personal treatment at least in part on the basis of the change in capacitance and a characteristic capacitance change signature. The processing unit 62 will analyse, over time, the voltage correction necessary to balance the capacitors, so as to determine a change in capacitance. The processing unit 62 then compares the change in capacitance at the measurement capacitor 88 with a characteristic capacitance change signature. As mentioned above, the change in capacitance at the measurement capacitor 88 may be a single value, such as the maximum amount of voltage that was applied by the voltage adjusting circuit 96 during the course of the voltage correction, or the change in capacitance may be expressed as a set of values versus time, thus describing a curve or pattern.

[087] In accordance with a preferred embodiment, the characteristic capacitance change signature may be stored in the memory 64 of the computing unit 100, such that the processing unit 62 can access it when needed. The characteristic capacitance change signature stored in the memory may be expressed in different ways depending on the intended application. For instance the characteristic capacitance change signature may be the maximal voltage value applied by the voltage adjusting circuit 96, or as a set of values describing the voltage correction variation over time. Multiple characteristic capacitance change signatures that are associated to different discrete articles for personal treatment may be stored in the memory. For example, in the case where the
container filling machine 10 is operative for processing a plurality of different kinds of
 discrete articles for personal treatment, there may be a separate characteristic
capacitance change signature for each of the different kinds of discrete articles for
personal treatment.

[088] The characteristic capacitance change signature may be entered into the memory
64 in a variety of different ways. In accordance with a first non-limiting example, the
values may be pre-stored in the memory 64 of the computing unit by a manufacturer of
the container filling machine 10, or by a software provider. Alternatively, the
characteristic capacitance change signature may be entered by a user into the memory
64 via the user inputs 52. This could be done each time a new type of discrete article for
personal treatment is being loaded into one or more containers.

[089] In accordance with an alternative embodiment, the characteristic capacitance
change signature value or values may be derived by the sensing device 22 at least in part
on the basis of capacitance change values that occur when a plurality of known integral
discrete articles for personal treatment are passed through the measurement capacitor
88. More specifically, by passing a few known integral discrete articles for personal
treatment through the measurement capacitor, and determining the corresponding
capacitance change caused by these integral discrete articles for personal treatment, the
characteristic capacitance change signature can be derived. In this manner, the sensing
device 22 is able to self calibrate.

[090] In the case where the container filling machine 10 is operative for self-calibrating,
an operator of the machine 10 would enter a few known integral discrete articles for
personal treatment through the machine. The processing unit 62 would then receive the
voltage correction values for these known integral discrete articles for personal
treatment from the voltage adjusting circuit 96. Based on these values, or the voltage
versus time curves formed by these values, the processing unit 62 establishes a value, or
a set of values versus time, that define a characteristic capacitance change signature for
an integral discrete article for personal treatment. As such, if the voltage correction
value or values for an unknown discrete article for personal treatment match those of the characteristic capacitance change signature, then it can be determined that the unknown discrete article for personal treatment is an integral discrete article for personal treatment. Whereas, if the voltage correction values do not fall within the characteristic capacitance change signature, then the discrete article for personal treatment is determined to be defective.

[091] The comparison logic used to determine if the capacitance change observed at the measurement capacitor 88 matches a given characteristic capacitance change signature may widely vary without departing from the spirit of the invention. When the characteristic capacitance change signature is expressed as a single maximal voltage adjustment value and the capacitance change at the measurement capacitor 88 is also expressed as a single maximal adjustment value, the two values are compared and if they match within a certain tolerance, the comparison logic concludes that the discrete article for personal treatment is integral. In the instance where the characteristic capacitance change signature and the capacitance change at the measurement capacitor 88 are expressed as voltage variations over time, where the time is the interval required for the discrete article for personal treatment to pass through the measurement capacitor 88, the comparison may require different techniques to establish the extent to which the measurement curve matches the signature curve. The comparison may include comparing first the maximal voltage values and then comparing another parameter which takes into account the time factor. For example, the other parameter can be the surface area under the curve established by computing the integral of the curve, among other possibilities.

[092] The reader skilled in the art will appreciate that many other comparison techniques can be used to determine if the capacitance change at the measurement capacitor 88 matches the characteristic capacitance change signature and that the present invention is not limited to any particular one of those techniques.
[093] It should be appreciated that the processing unit 62 is operative for simultaneously receiving and processing signals from each of the voltage adjusting circuits 96 associated with each one of the respective passageways 86 of the sensing device 22. As such, in the case of the container filling machine 10 shown in Figure 1, the processing unit 62 is operative to receive signals from twenty separate voltage adjusting circuits 96 at approximately the same time. In such a case, the voltage adjusting circuits 96 are operative for providing identification information to the processing unit 62, along with their voltage adjustment readings, such that in the case where a defective discrete article for personal treatment is identified, the processing unit 62 is able to determine along which path 32 the defective discrete article for personal treatment was detected.

[094] In accordance with the present invention, the measurement capacitor 88 and the reference capacitor 90 are operative to function at a relatively low voltage. Preferably, the power supply 100 is operative to supply less than 120V to the capacitors 88, 90. More preferably, the power supply 100 is operative to supply less than 100V to the capacitors 88, 90. Still more preferably, the power supply 100 is operative to supply less than 50V to the capacitors 88, 90. And still more preferably, the power supply 100 is operative to supply less than 20V to the capacitors 88, 90. Advantageously, the sensing circuitry that includes the 0-volt detector 98 and the voltage adjusting circuit 96 allows the detection of a capacitance change while operating at a relatively low voltage in comparison to existing capacitance sensing arrangements. Operating at a low voltage results in a safer, more efficient system. The low voltage further helps to reduce electrostatic dust build-up and wear on the sensing device 22.

[095] In the case where the processing unit 62 determines that a discrete article for personal treatment that has passed through the sensing device 22 is defective, the processing unit 62 issues a signal to the rejection device 24, such that the defective discrete article for personal treatment can be removed from continuing along its path 32 towards a container. The rejection device 24 will now be described in more detail below.
REJECTION DEVICE 24

[096] Associated to each one of the paths 32 is a rejection device 24. As shown in Figures 1 and 2, each rejection device 24 is positioned along a respective path 32 after the sensing device 22. More specifically, each rejection device 24 is positioned between the sensing device 22 and the counting device 26 (which will be described in more detail below). For the sake of simplicity, only one rejection device 24 will be described in more detail below. However, it should be appreciated that the below description applies to all of the rejection devices 24 contained in the container filling machine 10.

[097] As described above, in the case where the sensing device 22 detects that a defective discrete article for personal treatment is travelling along one of the paths 32, the rejection device 24 associated to that path 32 is operative to remove the defective discrete article for personal treatment from continued travel along its path 32 towards a container 34.

[098] Shown in Figure 11 is a non-limiting example of a rejection device 24 in accordance with the present invention. In the embodiment shown, the rejection device 24 includes a canister of compressed air 108 positioned behind the path 32. The opening of the canister 108 is aligned with an aperture 110 in the path 32. As such, when not in use, the rejection device 24 does not interfere with the travel of a non-defective discrete article for personal treatment along the path 32. It should be appreciated that each rejection device 24 may include a separate canister of compressed air, as shown in Figure 11, or alternatively, each rejection device 24 may be connected to a common canister of compressed air. In such a case, the supply of compressed air to each one of the apertures 110 would be controlled via a separate valve leading to each one of the apertures 110 in the container filling machine 10. Any suitable manner known in the art for mounting the one or more canisters of compressed air to the frame of the container filling device can be used without departing from the spirit of the invention.

[100] In accordance with the non-limiting embodiment shown in Figure 4, each rejection device 24 is in communication with a processing unit 62, that is operative to
activate the rejection device 24 in the case where a defective discrete article for personal treatment has been detected. Each rejection device 24 may be in communication with a common processing unit 62, or with a separate processing unit. In a preferred embodiment, and as shown in Figure 4, each rejection device 24 is in communication with a common processing unit 62, that is preferably part of a computing unit 60 that is operative for controlling the functionality of multiple components of the container filling machine 10. In an alternative embodiment, the plurality of rejection devices 24, or each individual rejection device 24, may be in communication with a processing unit that is dedicated to controlling only the functionality of the one or more rejection devices 24.

[101] In operation, the processing unit 62 that controls each rejection device 24 is operative to receive a signal indicating that the sensing device 22 has identified a defective discrete article for personal treatment travelling along one of the paths 32. Upon receipt of such a signal, the processing unit 62 causes the rejection device 24 associated to that path 32 to remove the discrete article for personal treatment from continued travel along that path 32. In the case where the rejection device 24 includes a canister of compressed air, the processing unit 62 causes the rejection device 24 to release a jet of compressed air as the defective discrete article for personal treatment passes in front of the aperture 110 corresponding to that path 32. In this manner, the discrete article for personal treatment is blown off the path 32 and removed from continued travel towards a container.

[102] The release of the jet of compressed air may be timed by the processing unit 62 such that the air is released exactly as the discrete article for personal treatment passes by the aperture 110 in the path 32. Alternatively, the release of compressed air may commence immediately upon detection at the sensing device 22 of a defective discrete article for personal treatment, such that when the discrete article for personal treatment reaches the stream of air, it hits the stream of air and is blown off its path of travel.
[103] In the case where the rejection device 24 is in communication with a processing unit 62 that also controls the functionality of the sensing device 22, the processing unit 62 will be aware when the sensing unit 22 has detected a defective discrete article for personal treatment, and can then cause the activation of the rejection device 24. However, in the case where the rejection devices 24 are controlled by a dedicated processing unit, that processing unit is in communication with the processing unit of the sensing device 22, such that it can receive a signal indicative that a defective discrete article for personal treatment has been detected, and thus activate the appropriate rejection device 24.

[104] In the case where each rejection device 24 is controlled by a common processing unit 62, the processing unit 62 is operative to control each of the rejection devices at the same time such that they can each operate independently of each other.

[105] Although not shown in the Figures, a collection vessel, such as a bucket, can be positioned just beyond the paths 32, such that any defective discrete articles for personal treatment that are ejected from their paths 32 by the rejection device 24 are collected in the vessel. Such a vessel can be emptied periodically in order to discard the defective discrete articles for personal treatment.

[106] Although the rejection device 24 shown in Figure 11 uses a jet of compressed air in order to remove a defective discrete article for personal treatment from its path of travel, it should be appreciated that any suitable device for removing a defective discrete article for personal treatment could be used. For example, the rejection device 24 could be a mechanical device, such as a spring-loaded rod, or trap door that opens when a defective discrete article for personal treatment passes by. Alternatively, the rejection device may still use compressed air, but in an indirect manner. For example, the jet of compressed air may cause a plate that is lying along the path 32 to swing outwards thus pushing a discrete article for personal treatment passing across the plate to be ejected from the path 32. It should be appreciated that any device that is operative for removing
a defective discrete article for personal treatment from continued travel along a path 32 towards a container is included within the scope of the present application.

COUNTING DEVICE 26

[107] Referring back to Figure 1, located after each rejection device 24 is a counting device 26 for counting the integral discrete articles for personal treatment that successfully pass by the rejection device 24. The purpose of the counting device 26 is to obtain a count of the integral discrete articles for personal treatment in order to ensure that a proper number of discrete articles for personal treatment are placed in each container 34.

[108] In the non-limiting embodiment shown, the counting device 26 is formed of an elongated body 112 of material that can be easily secured to the frame 82 of the container filling machine 10. When connected to the frame, the elongated body 112 defines a plurality of passageways 91 through which the discrete articles for personal treatment can travel. Each passageway 91 is associated to a respective one of the paths 32 and includes circuitry for detecting when a discrete article for personal treatment passes therethrough. More specifically, each one of the passageways 91 includes circuitry that functions independently of each other passageway 91. Preferably, this elongated body 112 is constructed out of a plastic material that can be easily removed and washed without damaging the circuitry embedded therein.

[109] In accordance with the non-limiting embodiment shown in Figure 4, the counting device 26 is in communication with a processing unit 62, that is operative to detect and count the discrete articles for personal treatment passing through each passageway 91 of the counting device 26. The processing unit 62 is in communication with the circuitry of each passageway 91 for detecting when a discrete article for personal treatment passes through each passageway 91, and for keeping a count of the number of discrete articles for personal treatment that pass through each passageway 91. In accordance with a non-limiting embodiment, the processing unit 62 may include a counter associated to each
passageway, such that each counter increments each time a discrete article for personal
treatment passes through its respective passageway.

[110] In a preferred embodiment, and as shown in Figure 4, the counting device 26 is in
communication with a processing unit 62 that is part of a computing unit 60 that
controls the functionality of multiple components of the container filling machine 10.
However, in an alternative embodiment, the counting device 26 may be in
communication with a processing unit that is dedicated to controlling the functionality
of the counting device 26. The processing unit may be located within the circuitry in the
elongated body 112, or alternatively, the processing unit may be located remotely from
the elongated body 112, such as within a remotely located computer. As shown in
Figure 6, in the case where the processing unit 62 is located remotely from the
elongated body 112, the counting circuitry contained within the elongated body 112 is
electrically connected to the processing unit 62, via a cable 85.

[111] Preferably, the processing unit 62 is operative for simultaneously receiving and
processing signals from the counting circuitry associated with each one of the
passageways 91 of the counting device 26. As such, in the case of the container filling
machine 10 shown in Figure 1, the processing unit 62 is operative to receive signals
from twenty separate passageways at approximately the same time. In such a case, the
circuitry associated to each passageway 91 is operative for providing identification
information to the processing unit 62, such that the processing unit 62 is able to keep an
appropriate count of the discrete articles for personal treatment passing through each
respective passageway 91.

[112] The circuitry contained within each passageway 91 may be any suitable circuitry
for detecting when a discrete article for personal treatment passes through the
passageway 91. For example, the counting device 26 may include optical circuitry or
capacitance circuitry without departing from the spirit of the invention. Once the
circuitry detects that an object, such as a discrete article for personal treatment, has
passed through the passageway 91, a signal is sent to the processing unit 62, such that
the processing unit 62 can keep a count of the number of discrete articles for personal
treatment that have passed through each passageway 91.

[113] The purpose of the counting device 26 is to help control the number of discrete
articles for personal treatment entering each container 34.

PATH BLOCKING DEVICES 28

[114] In the non-limiting embodiment shown in Figure 1, multiple paths 32 lead to a
single container 34. More specifically, and as best shown in
Figure 12, eight paths 32 lead into four expanded paths 93, which in turn lead into a
funnel that directs the discrete articles into a respective container 34. It should, however,
be appreciated that any number of paths 32 could lead into any number of containers 34,
without departing from the spirit of the invention. For example, there may be a one-to-
one ratio, with each path 32 leading into a separate respective container.

[115] As shown in Figures 6 and 12, positioned between the counting device 26 and a
container 34 are a plurality of path blocking devices 28; namely one path blocking
device 28 for each one of the expanded paths 93. Each one of the expanded paths 93
feeds into a funnel 120 which, in turn, leads into a container 34. Although in the
Figures, each one of the paths 32 leads into an expanded path 93, which in turn has a
respective path blocking device 28, it should be appreciated that in an alternative
embodiment, there may be one path blocking device 28 for each one of the paths 32 and
thus for each one of the counting devices 26. As such, the paths 32 do not combine into
expanded paths 93 until after the path blocking devices 28.

[116] In combination with the counting device 26, the path blocking devices 28 are
operative for controlling the number of discrete articles for personal treatment that enter
each container. More specifically, the path blocking devices 28 are operative to move
between an open position and a closed position in order to block the travel of the
discrete articles for personal treatment into a container. As shown in Figure 12, the
right-most path blocking device 28 is in a closed position, wherein the discrete articles
for personal treatment travelling along that expanded path 93 are prevented from travelling into the container 34. Whereas, the two middle path blocking devices 28 are in an open position, such that the discrete articles for personal treatment travelling along those paths are able to travel past the path blocking devices 28 into the container 34.

[117] As shown in Figure 4, the path blocking devices 28 are in communication with the processing unit 62, such that the processing unit 62 can control the movement of the path blocking devices 28 between the open position and the closed position. In a preferred embodiment, and as shown in Figure 4, the path blocking devices 28 are in communication with a processing unit 62 that is also in communication with the counting device 26, as well as the other components in the container filling machine. It should be appreciated however that a processing unit 62 dedicated to the control of the path blocking devices 28 could also be used without departing from the spirit of the invention. In such a case, the processing unit would be operative for receiving information from the counting device 26 indicative of a count of the number of discrete articles for personal treatment passing through respective passageways.

[118] In operation, the processing unit 62 controls the movement of the path blocking devices 28 at least in part on the basis of information received from the counting device 26 and the number of discrete articles for personal treatment that should be supplied to each container. The information received from the counting device 26 is generally indicative of the number of discrete articles for personal treatment that have passed through each passageway 91 of the counting device 26. The processing unit 62 processes this information in accordance with program instructions 68 stored in the memory 64. Such program instructions may include a specific algorithm, such that the control of the path blocking devices 28 is performed in accordance with a predefined algorithm. Any algorithm suitable for controlling the number of discrete articles for personal treatment that enter each container 34 is included within the scope of the present invention. For example, in the case where each container 34 is to be filled with one hundred discrete articles for personal treatment, and there are four expanded paths 93 leading into each container, the algorithm may specify that each path blocking device...
closes after twenty five discrete articles for personal treatment have passed by each path blocking device 28. Alternatively, three of the path blocking devices 28 may close after 24 discrete articles for personal treatment have passed by, and the fourth gate may close after 28 discrete articles for personal treatment have passed by. In this way, the fourth path blocking device 28 is able to more precisely monitor the final discrete articles for personal treatment entering the container 34. It should be appreciated that a variety of different algorithms can be used in order to control the functioning of the path blocking devices 28, without departing from the spirit of the invention.

[119] In the non-limiting embodiment shown in Figures 1, 2 and 12, the path blocking devices 28 are in the form of gateways 122 that pivot about a pin 124 mounted to one side of the path 32. The gateways 122 pivot about the pin 124 in order to move between the open position and the closed position. In the closed position, the gateway 122 forms a physical barrier that spans across the width of a path 93. Whereas in the open position, the gateway 122 is positioned along the length of the path 93 such that discrete articles for personal treatment can pass by the gateway 122 and enter a container 34.

[120] Although the path blocking devices 28 shown in the Figures include a gateway 122 for blocking their respective paths 93, it should be appreciated that any suitable device for blocking a path 93 or 32 could be used. For example, the path blocking device 28 could be a different type of barrier that is embedded within the path, and springs up when needed. Alternatively, the path blocking device may be a suction device that temporarily restrains the discrete articles for personal treatment via a vacuum suction. Any device that is operative for temporarily blocking the discrete articles for personal treatment from continued travel towards a container 34 is included within the scope of the present application.

[121] The path blocking devices 28 are further operative for preventing discrete articles for personal treatment from continued travel while the filled containers 34 are being replaced by new containers 34. More specifically, when the containers 34 have been filled with the appropriate number of discrete articles for personal treatment, all of
the path blocking devices 28 close. As such, the filled containers 34 can be removed and replaced with new containers without stopping the flow of discrete articles for personal treatment through the sensing device 22, the rejection device 24 and the counting device 26. Instead, the discrete articles for personal treatment simply accumulate at the path blocking devices 28. When the new containers 34 are in place underneath the funnels 120, the path blocking devices 28 open, and the discrete articles for personal treatment that have accumulated enter the new containers. In this manner, the flow of discrete articles for personal treatment through the container filling machine 10 does not slow down or stop for a container change.

MULTIPLE MACHINES

[122] As shown in Figures 13A and 13B, two or more container filling machines 10, as described above, can be used in combination in order to fill more containers simultaneously.

[123] Shown in Figure 13A are two container filling machines 10 positioned facing each other, such that two rows of containers 34 may be positioned on a single conveyor belt 130. The conveyor belt 130 is operative for transporting empty containers towards the container filling machines 10, and filled containers away from the container filling machines 10 towards a capping station, for example.

[124] Shown in Figure 13B are two container filling machines 10 positioned back-to-back, such that they may share the same initial loading location 30. As such, an initial supply of discrete articles for personal treatment can be loaded into the common loading location 30 and then travel towards one of the two transportation devices 20.

[125] Shown in Figure 13C are two container filling machines 10 positioned side-by-side such that they may share the same initial loading location, and the same conveyor belt for transporting the containers 34. Each of the cylindrical drums that form the moving surfaces 38 can be accessed from opposite ends of the two-machine set up.
It should be appreciated that one or more container filling machines 10 can be used in combination, and can be placed in any configuration with respect to each other, without departing from the spirit of the invention.

Although the present invention has been described in considerable detail with reference to certain preferred embodiments thereof, variations and refinements are possible without departing from the spirit of the invention. Therefore, the scope of the invention should be limited only by the appended claims and their equivalents.
CLAIMS:

1. A device for carrying discrete articles for personal treatment from a pick-up location to a drop-off location, said device being suitable for use in container filling machines for placing the discrete articles for personal treatment into a container, said device comprising:
   a) a moving surface comprising a plurality of spaced apart air passageways arranged according to a predetermined pattern;
   b) a vacuum device for suctioning air through said plurality of spaced apart air passageways such that a discrete article for personal treatment located in proximity to a pick-up location of said moving surface is suctioned to respective one of the air passageways of said moving surface, the suctioned discrete article is transported by said moving surface to a drop-off location where the discrete article for personal treatment is no longer transported by said moving surface.

2. A device as defined in claim 1, wherein said moving surface is operative for releasing the discrete articles for personal treatment at said drop-off location such that said discrete articles for personal treatment are spaced from one another at said drop-off location in accordance with said predetermined pattern.

3. A device as defined in claim 1, wherein said moving surface is a cylindrical drum suitable for rotation about a rotation axis, said cylindrical drum having an interior surface and an exterior surface, said interior surface defining an interior chamber.

4. A device as defined in claim 3, wherein said plurality of spaced apart air passageways are arranged in rings along the length of said cylindrical drum, the air passageways in each ring being evenly spaced around a circumference of said cylindrical drum.
5. A device as defined in claim 3, wherein said interior chamber comprises a first portion and a second portion that are fixed in relation to the rotation of said cylindrical drum, wherein said vacuum device is operative for suctioning air through the air passageways of said cylindrical drum as they pass by said first portion.

6. A device as defined in claim 5, further comprising a suction blocking device located within said interior chamber for dividing said interior chamber into said first portion and said second portion, said suction blocking device preventing air from being suctioned through the air passageways of said cylindrical drum as they pass by said second portion.

7. A device as defined in claim 6, wherein said cylindrical drum comprises a first side and a second side, said first portion spanning from said first side to said second side, and said second portion spanning from said first side to said second side.

8. A device as defined in claim 7, wherein said pick-up location is located on said first side of said cylindrical drum in proximity to the location where said first portion begins, and wherein said drop-off location is located on said second side of said cylindrical drum in proximity to the location where said first portion ends.

9. A device as defined in claim 1, wherein said plurality of air passageways each have a cross section that is circular in shape.

10. A device as defined in claim 1, wherein said plurality of air passageways each have a cross section that is oval in shape.

11. A device as defined in claim 9, wherein each of said plurality of air passageways has a diameter of between 1-10 mm.
12. A device as defined in claim 3, wherein said cylindrical drum has a diameter of between 50-300mm.

13. A device as defined in claim 1, wherein the discrete articles for personal treatment are one of gel caps and powder pills.

14. A device as defined in claim 1, wherein the discrete articles for personal treatment are cosmetic items.

15. A method for carrying discrete articles for personal treatment from a pick-up location to a drop-off location, said method comprising:
   a) providing a moving surface having a plurality of spaced apart air passageways arranged according to a predetermined pattern;
   b) suctioning air through the plurality of spaced apart air passageways such that a discrete article for personal treatment located at a pick-up location is suctioned to a respective one of the spaced apart air passageways;
   c) releasing the discrete article for personal treatment from the moving surface at the drop-off location such that the discrete article for personal treatment is no longer transported by the moving surface.

16. A method as defined in claim 15, wherein the moving surface includes a cylindrical drum suitable for rotation about a rotation axis, the cylindrical drum comprising an interior surface and an exterior surface, the interior surface defining an interior chamber.

17. A method as defined in claim 16, wherein the plurality of spaced apart air passageways are arranged in rings along a length of the cylindrical drum, the air passageways in each ring being evenly spaced around a circumference of the cylindrical drum.
18. A method as defined in claim 16, wherein the interior chamber comprises a first portion and a second portion that are fixed in relation to the rotation of the cylindrical drum, wherein air is suctioned through the air passageways of the cylindrical drum as they pass by the first portion.

19. A method as defined in claim 18, further comprising blocking air from being suctioned through the air passageways of the cylindrical drum as they pass by the second portion.

20. A method as defined in claim 18, wherein the cylindrical drum comprises a first side and a second side, the first portion spanning from the first side to the second side, and the second portion spanning from the first side to the second side.

21. A method as defined in claim 20, wherein the pick-up location is located on the first side of the cylindrical drum in proximity to the location where the first portion begins, and wherein the drop-off location is located on the second side of the cylindrical drum in proximity to the location where the first portion ends.

22. A method as defined in claim 15, wherein the discrete articles for personal treatment are one of gel caps and powderpills.

23. A method as defined in claim 15, wherein the discrete articles for personal treatment are cosmetic items.

24. A container filling machine for discrete articles for personal treatment, said container filling machine comprising:
   a) a transportation device suitable for carrying discrete articles for personal treatment from a pick-up location to a drop-off location, said transportation device comprising:
      i) a moving surface comprising a plurality of spaced apart air passageways arranged according to a predetermined pattern;
ii) a vacuum device for suctioning air through said plurality of spaced apart
air passageways, such that a discrete article for personal treatment located
in proximity to a pick-up location of said moving surface is suctioned to a
respective one of the air passageways of said moving surface, the suctioned
discrete article being carried by said moving surface to a drop-off location
wherein the discrete article is no longer transported by said moving
surface.

b) a sensing device suitable for determining the integrity of the discrete articles
for personal treatment, said sensing device comprising:

i) at least one capacitor through which the discrete articles released at the
drop-off location travel;

ii) a processing unit operative for:

(1) determining a change in capacitance at said at least one capacitor as a
discrete article for personal treatment passes therethrough;

(2) determining the integrity of the discrete article for personal treatment at
least in part on the basis of said change in capacitance.

25. A container filling machine as defined in claim 24, wherein said moving surface is
operative for releasing the discrete articles for personal treatment at said drop-off
location such that said discrete articles for personal treatment are spaced from one
another at said drop-off location in accordance with said predetermined pattern.

26. A container filling machine as defined in claim 25, wherein said moving surface is
a cylindrical drum suitable for rotation about a rotation axis, said cylindrical drum
having an interior surface and an exterior surface, said interior surface defining an
interior chamber.

27. A container filling machine as defined in claim 26, wherein said plurality of
spaced apart air passageways are arranged in rings along the length of said
cylindrical drum, the air passageways in each ring being evenly spaced around a
circumference of said cylindrical drum.
28. A container filling machine as defined in claim 24, wherein said at least one capacitor is a measurement capacitor, said sensing device further comprising a reference capacitor, wherein said processing unit is in communication with said measurement capacitor and said reference capacitor, and is operative for:
   a) detecting a difference in capacitance change between said measurement capacitor and said reference capacitor as a discrete article for personal treatment passes through said measurement capacitor;
   b) determining the integrity of the discrete article for personal treatment at least in part on the basis of said difference in capacitance change and at least one characteristic capacitance change signature.

29. A container filling machine as defined in claim 28, wherein said measurement capacitor and said reference capacitor each comprise a driven plate and a non-driven plate.

30. A container filling machine as defined in claim 29, wherein said measurement capacitor and said reference capacitor share a common non-driven plate.

31. A container filling machine as defined in claim 28, wherein said processing unit determines the integrity of a discrete article for personal treatment by comparing the difference in capacitance change with the characteristic capacitance change signature.

32. A sensing device suitable for use with a container filling machine for detecting the integrity of discrete articles for personal treatment to be placed in a container, said sensing device comprising:
   a) a pair of capacitor plates positioned in a substantially opposing relationship, for creating therebetween an electric field;
b) a track for guiding the discrete articles for personal treatment through said electric field, said track preventing the discrete articles for personal treatment from tumbling during travel through said electric field;

c) a processing unit in communication with said pair of capacitor plates, said processing unit being operative for:

i) detecting a change in capacitance as a discrete article for personal treatment passes through said electric field;

ii) determining the integrity of the discrete article for personal treatment at least in part on the basis of said change in capacitance.

33. A sensing device as defined in claim 32, wherein said processing unit determines the integrity of the discrete article for personal treatment at least in part on the basis of said change in capacitance and a characteristic capacitance change signature.

34. A sensing device as defined in claim 32, wherein the discrete articles for personal treatment are oblong shaped pills.

35. A sensing device as defined in claim 32, wherein the discrete articles for personal treatment are circular shaped pills.

36. A sensing device as defined in claim 32, wherein said track extends within at least a portion of said electric field.

37. A sensing device as defined in claim 32, wherein said track is a V-shaped slope.

38. A sensing device as defined in claim 32, wherein said pair of capacitor plates is a first pair of capacitor plates, said sensing device further comprising a second pair of capacitor plates, said first pair of capacitor plates forming a measurement capacitor and said second pair of capacitor plates forming a reference capacitor.
39. A sensing device as defined in claim 38, wherein said measurement capacitor and
said reference capacitor each comprise a driven plate and a non-driven plate.

40. A sensing device as defined in claim 39, wherein said measurement capacitor and
said reference capacitor share a common non-driven plate.

41. A sensing device as defined in claim 32, wherein said characteristic capacitance
change signature is derived by said sensing device at least in part on the basis of
capacitance change values that occur when a plurality of known integral discrete
articles for personal treatment are passed through said first capacitor.

42. A sensing device suitable for use with a container filling machine, said sensing
device being operative for detecting the integrity of discrete articles for personal
treatment to be loaded in a container, said sensing device comprising:
a) a measurement capacitor;
b) a reference capacitor; and
c) a processing unit in communication with said measurement capacitor and said
reference capacitor, said processing unit being operative for:
i) detecting a difference in capacitance change between said measurement
capacitor and said reference capacitor as a discrete article for personal
treatment passes through said measurement capacitor;
ii) determining the integrity of the discrete article for personal treatment at
least in part on the basis of said difference in capacitance change.

43. A sensing device as defined in claim 42, wherein said processing unit determines
the integrity of the discrete article for personal treatment at least in part on the
basis of said change in capacitance and a characteristic capacitance change
signature.

44. A sensing device as defined in claim 42, wherein said measurement capacitor and
said reference capacitor each comprise a driven plate and a non-driven plate.
45. A sensing device as defined in claim 44, wherein said measurement capacitor and said reference capacitor share a common non-driven plate.

46. A sensing device as defined in claim 45, wherein said processing unit determines the integrity of a discrete article for personal treatment by comparing the difference in capacitance change with a characteristic capacitance change signature.

47. A sensing device as defined in claim 46, further comprising a voltage adjusting circuit for adjusting a voltage supplied to said driven plate of said measurement capacitor in response to a change in voltage at said non-driven plate when a discrete article for personal treatment passes through said measurement capacitor.

48. A sensing device as defined in claim 47, wherein said voltage adjusting circuit adjusts the voltage supplied to said driven plate of said measurement capacitor until the voltage at said non-driven plate reaches a predetermined reference voltage.

49. A sensing device as defined in claim 48, wherein said processing unit determines the change in capacitance at least in part on the basis of the voltage adjustment controlled by said voltage adjusting circuit for causing the non-driven plate to reach the predetermined reference voltage.

50. A sensing device as defined in claim 42, further comprising a track for guiding discrete articles for personal treatment through said measurement capacitor, said track being operative for preventing the discrete articles for personal treatment from tumbling as they pass through said measurement capacitor.

51. A sensing device as defined in claim 50, wherein said track includes a V-shaped slope.
52. A sensing device as defined in claim 42, wherein said processing unit is operative for deriving the characteristic capacitance change signature at least in part on the basis of capacitance change values that are generated when a plurality of integral discrete articles for personal treatment are passed through said first capacitor.

53. A sensing device as defined in claim 42, wherein said measurement capacitor and said reference capacitor have a voltage of less than 50V.

54. A sensing device as defined in claim 42, wherein said measurement capacitor and said reference capacitor have a voltage of less than 20V.

55. A sensing device as defined in claim 42, wherein said measurement capacitor and said reference capacitor have a voltage of less than 10V.

56. A sensing device as defined in claim 42, wherein said discrete articles for personal treatment are one of gel caps and powder pills.

57. A sensing device as defined in claim 42, wherein said discrete articles for personal treatment are cosmetic items.

58. A method for detecting the integrity of discrete articles for personal treatment to be loaded in a container, said method comprising:
   a) providing a measurement capacitor;
   b) providing a reference capacitor;
   c) detecting a difference in capacitance change between the measurement capacitor and the reference capacitor when a discrete article for personal treatment passes through the measurement capacitor;
   d) determining the integrity of the discrete article for personal treatment at least in part on the basis of the difference in capacitance change.
59. A method as defined in claim 58, wherein the integrity of the discrete article for personal treatment is determined at least in part on the basis of a characteristic capacitance change signature.

60. A method as defined in claim 59, wherein determining the integrity of the discrete article for personal treatment involves comparing the capacitance change with the characteristic capacitance change signature.

61. A method as defined in claim 60, wherein the measurement capacitor and the reference capacitor each include a driven plate and share a common non-driven plate, said method further comprising adjusting a voltage supplied to the driven plate of the measurement capacitor in response to a change in voltage at the non-driven plate when a discrete article for personal treatment passes through the measurement capacitor.

62. A method as defined in claim 61, wherein the voltage supplied to the driven plate of the measurement capacitor is adjusted until the voltage at said non-driven plate reaches a predetermined reference voltage.

63. A method as defined in claim 62, wherein the change in capacitance is determined at least in part on the basis of the voltage adjustment for causing the non-driven plate to reach the predetermined reference voltage.

64. A sensing device suitable for use with a container filling machine for detecting the integrity of discrete articles for personal treatment to be loaded in a container, said sensing device comprising:

a) a pair of capacitor plates positioned in a substantially opposing relationship for creating therebetween an electric field, in response to voltage impressed across the plates which is of less than 100V;

b) a processing unit in communication with said pair of capacitor plates, said processing unit being operative for:
i) detecting a change in capacitance as a discrete article for personal treatment passes through said electric field;
ii) determining the integrity of the discrete article for personal treatment on the basis of said change in capacitance.

65. A sensing device as defined in claim 64, wherein said pair of capacitor plates have a voltage of less than 50V.

66. A sensing device as defined in claim 64, wherein said pair of capacitor plates have a voltage of less than 20V.

67. A sensing device as defined in claim 64, wherein said pair of capacitor plates have a voltage of less than 10V.

68. A sensing device as defined in claim 64, wherein said pair of capacitor plates is a first pair of capacitor plates, said sensing device further comprising a second pair of capacitor plates, said first pair of capacitor plates forming a measurement capacitor and said second pair of capacitor plates forming a reference capacitor.

69. A sensing device as defined in claim 68, wherein said measurement capacitor and said reference capacitor each comprise a driven plate and a non-driven plate.

70. A sensing device as defined in claim 69, wherein said measurement capacitor and said reference capacitor share a common non-driven plate.

71. A sensing device as defined in claim 64, wherein said characteristic capacitance change signature is derived by said sensing device at least in part on the basis of capacitance change values that occur when a plurality of known integral discrete articles for personal treatment are passed through said first capacitor.
72. A container filling machine for loading discrete articles for personal treatment into a container, said container filling machine defining a path along which the discrete articles for personal treatment travel towards a container, said container filling machine comprising:

a) a sensing device suitable for detecting the integrity of a discrete article for personal treatment;

b) a rejection device positioned between said sensing device and a container;

c) a processing unit in communication with said sensing device and said rejection device, wherein upon detection at said sensing device of a defective discrete article for personal treatment, said processing unit being operative for causing said rejection device to remove said defective discrete article for personal treatment from continued travel along the path towards a container.

73. A container filling machine as defined in claim 72, wherein said rejection device is operative for releasing a jet of compressed air for blowing defective discrete articles for personal treatment from continued travel along the path towards a container.

74. A container filling machine as defined in claim 73, further comprising a track for defining the path of travel along which a discrete article for personal treatment travels towards a container, said track including an aperture between said sensing device and the container through which the jet of compressed air shoots.

75. A container filling machine as defined in claim 74, wherein said track is a V-shaped slope.

76. A container filling machine as defined in claim 75, further comprising a rejected article collection device for collecting the defective discrete articles for personal treatment that are rejected by said rejection device.
77. A container filling machine as defined in claim 72, wherein said sensing device comprises a pair of capacitor plates positioned in a substantially opposing relationship for creating therebetween an electric field, said processing unit being in communication with said pair of capacitor plates for:

a) detecting a change in capacitance as a discrete article for personal treatment passes through said electric field;

b) determining the integrity of the discrete article for personal treatment on the basis of said change in capacitance and a characteristic capacitance change signature.

78. A container filling machine as defined in claim 72, wherein said discrete articles for personal treatment are one of gel caps and powder pills.

79. A container filling machine as defined in claim 72, wherein said discrete articles for personal treatment are cosmetic items.

80. A container filling machine as defined in claim 77, wherein said processing unit determines the integrity of a discrete article for personal treatment by comparing the change in capacitance with a characteristic capacitance change signature.

81. A container filling machine as defined in claim 80, wherein said pair of capacitor plates defines a measurement capacitor, said container filling machine further comprising a reference capacitor, wherein said processing unit is operative for:

a) detecting a difference in capacitance change between said measurement capacitor and said reference capacitor as a discrete article for personal treatment passes through said measurement capacitor;

b) determining the integrity of the discrete article for personal treatment at least in part on the basis of said difference in capacitance change and at least one characteristic capacitance change signature.
82. A container filling machine as defined in claim 81, wherein said measurement capacitor and said reference capacitor each comprise a driven plate and a non-driven plate.

83. A container filling machine as defined in claim 82, further comprising a voltage adjusting circuit for adjusting a voltage supplied to a driven plate of said measurement capacitor in response to a change in voltage at the non-driven plate when a discrete article for personal treatment passes through the measurement capacitor.

84. In a container filling machine having a sensing device for detecting the integrity of a discrete article for personal treatment and a path along which the discrete article for personal treatment travels from said sensing device to a container, a method for removing defective discrete articles for personal treatment from being placed in the container, said method comprising:

   a) receiving a signal from the sensing device indicative of a defective discrete article for personal treatment; and

   b) removing said defective discrete article for personal treatment from continued travel along the path between the sensing device and the container.

85. A method as defined in claim 84, wherein removing said defective discrete articles for personal treatment from continued travel along the path involves releasing a jet of compressed air for deflecting the defective discrete article for personal treatment from continued travel along the path towards a container.

86. A method as defined in claim 85, further comprising receiving rejected discrete articles for personal treatment in a collection device when they are removed from continued travel along the path between the sensing device and the container.

87. A method as defined in claim 84, wherein said discrete articles for personal treatment are one of gel caps and powder pills.
88. A method as defined in claim 84, wherein said discrete articles for personal treatment are cosmetic items.

89. A container filling machine for bottling discrete articles for personal treatment, said container filling machine defining a path along which the discrete articles for personal treatment travel towards a container, said container filling machine comprising:
   a) sensing means suitable for detecting the integrity of a discrete article for personal treatment;
   b) rejection means positioned between said sensing device and a container;
   c) processing means in communication with said sensing means and said rejection means, wherein upon detection at said sensing means of a defective discrete article for personal treatment, said processing means being operative for causing said rejection means to remove said defective discrete article for personal treatment from continued travel along the path towards a container.

90. A container filling machine for bottling discrete articles for personal treatment, said container filling machine including at least two paths for feeding the discrete articles for personal treatment into a container, said container filling machine comprising:
   a) a counting device for counting the discrete articles for personal treatment travelling along each path;
   b) at least one path blocking device, said path blocking device being capable of moving between a first position and a second position, wherein in said first position the discrete articles for personal treatment are able to enter a container, and wherein in said second position the discrete articles for personal treatment are prevented from entering into the container;
   c) a processing unit in communication with each path blocking device, said processing unit being operative for causing each path blocking device to move
between said first position and said second position at least in part on the basis of information received from a corresponding counting device.

91. A container filling machine as defined in claim 90, wherein said processing unit is operative for controlling each path blocking device individually.

92. A container filling machine as defined in claim 91, wherein the information received from a corresponding counting device is indicative of a count of the number of discrete articles for personal treatment that have travelled therethrough.

93. A container filling machine as defined in claim 92, wherein said processing unit is operative for causing each path blocking device to move between said first position and said second position at least in part on the basis of a predetermined algorithm.

94. A container filling machine as defined in claim 90, wherein each path is operative for providing a certain number of discrete articles for personal treatment to a container, said processing unit being operative for causing a path blocking device associated with that path to move into a closed position when the number of discrete articles for personal treatment that are supposed to be supplied from that path has been reached.

95. A container filling machine as defined in claim 90, wherein said counting device comprises at least one capacitor for detecting the presence of a discrete article for personal treatment.

96. A container filling machine as defined in claim 90, wherein said discrete articles for personal treatment are one of gel caps and powder pills.

97. A container filling machine as defined in claim 90, wherein said discrete articles for personal treatment are cosmetic items.
98. A container filling machine as defined in claim 90, wherein each path blocking device comprises a gateway pivotally mounted to a side of a respective path.

99. A method for loading discrete articles for personal treatment into a container, said method comprising:
   a) providing at least two paths for feeding discrete articles for personal treatment into a container;
   b) counting the discrete articles for personal treatment travelling along each of the at least two paths;
   c) providing a path blocking device for each one of the at least two paths, wherein said path blocking device is capable of moving between a first position and a second position, wherein in said first position the discrete articles for personal treatment are able to enter a container, and wherein in said second position the discrete articles for personal treatment are prevented from entering the container;
   d) causing each path blocking device to move between said first position and said second position at least in part on the basis of the counting at step b).

100. A method as defined in claim 99, wherein each path blocking device can be controlled individually.

101. A method as defined in claim 99, further comprising causing each path blocking device to move between said first position and said second position at least in part on the basis of a predetermined algorithm.

102. A method as defined in claim 99, wherein each path is operative for providing a certain number of discrete articles for personal treatment to a container, said method comprising causing a path blocking device associated with that path to move into a closed position when the number of discrete articles for personal treatment that are supposed to be supplied from that path has been reached.
103. A method as defined in claim 99, wherein said discrete articles for personal treatment are one of gel caps and powder pills.

104. A method as defined in claim 99, wherein said discrete articles for personal treatment are cosmetic items.

105. A method as defined in claim 99, wherein each path blocking device comprises a gateway pivotally mounted to a side of a respective path.
Receive an initial supply of discrete articles

Transport the discrete articles to a path of travel in accordance with a predetermined pattern

Determine the integrity of each discrete article

Discard defective discrete articles

Count the integral discrete articles

Control the supply of discrete articles to the containers via path blocking devices

FIG. 3
FIG. 4
FIG. 9

Monitor the voltage reading at the non-driven plate 102

Upon detection of a non-0 reading, adjust the voltage at the driven plate until a 0-reading is achieved at the non-driven plate 104

Provide voltage correction readings to the processing unit 106

FIG. 10
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC: B65B 1/16 (2006.01), B65B 35/18 (2006.01), B65B 57/20 (2006.01), B65G 47/14 (2006.01), B65G 47/91 (2006.01), GOIN 27/24 (2006.01)

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
IPC (2006.01) B65B 1/16, 35/18, 57/00-20; B65G 47/14, 91, GOIN 27/24

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

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms
Delphion, Canadian Patents Database (Keywords: convey*, endless, belt, drum, vacuum, capacit*, impedance, sensor, pharma*, pill, tablet)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant</th>
<th>Relevant to claim No.</th>
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<tbody>
<tr>
<td></td>
<td><em>Abstract; Figures 1, 4, 5; Pages 10-13</em></td>
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<td><strong>Y</strong></td>
<td>24-27, 77, 80</td>
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<td><em>Figures; Paragraphs [0013]-[0021]</em></td>
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<td>24-27, 77, 80</td>
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</table>

[X] Further documents are listed in the continuation of Box [X] See patent family annex.

* Special categories of cited documents
'A' document defining the general state of the art which is not considered to be of particular relevance
'E' earlier application or patent but published on or after the international filing date
'L' document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
'O' document referring to an oral disclosure, use, exhibition or other means
'P' document published prior to the international filing date but later than the priority date claimed
'I' later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
'X' document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
'Y' document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
'A' document member of the same patent family

Date of the actual completion of the international search: 23 October 2007 (23-10-2007)
Date of mailing of the international search report: 9 November 2007 (09-11-2007)

Name and mailing address of the ISA/CA
Canadian Intellectual Property Office
Place du Portage 1, C1 14 - 1st Floor, Box PCT
50 Victoria Street
Gatineau, Quebec K1A 0C9
Facsimile No.: 001-819-953-2476

Authorized officer
Sean Lapalme  819-994-5573
### Observations where certain claims were found unsearchable (Continuation of item 2 of the first sheet)

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

1. [ ] Claim Nos because they relate to subject matter not required to be searched by this Authority, namely

2. [ ] Claim Nos because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically

3. [ ] Claim Nos because they are dependant claims and are not drafted in accordance with the second and third sentences of Rule 6 4(a)

### Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The claims are directed to a plurality of inventive concepts as follows.

Group A - Claims 1-23 are directed to a method and device for carrying discrete articles.

Group B - Claims 24-31 are directed to a container filling apparatus with a transport device, a vacuum device, a sensor device and a processor.

See Additional Box [X]

1. [ ] As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims

2. [X] As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. [ ] As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claim Nos.

4. [ ] No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim Nos.

#### Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest and, where the payment of a protest fee.

[ ] The additional search fees were accompanied by the applicant's protest but the applicable fee was not paid within the time limit specified in the invitation.

[ ] No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (April 2007)
**INTERNATIONAL SEARCH REPORT**

**DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
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<td>US 4922181 A (PULLAN, B) 01 May 1990 (01-05-1990)</td>
<td>1-105</td>
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Form PCT/ISA/210 (continuation of second sheet) (April 2007)
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Continuation of Box No. III

Group C - Claims 32-71 are directed to sensing means and methods
Group D - Claims 72-89 are directed to a container filling apparatus with rejection means
Group E - Claims 70-105 are directed to a container filling apparatus with a counter and path blocking means

The claims must be limited to one inventive concept as set out in Rule 13 of the PCT

It is held that the independent claims presently in the application are not so linked as to form a single general inventive concept. This inventive concept must find expression in common technical features which define the inventive contribution that the claimed invention makes over the prior art. It is noted, however, that the common features linking the independent claims presently in the application, namely, a container filling apparatus comprising a transportation device, a vacuum device and a sensing device for determining the integrity of a discrete article, are known in the art as taught, for example, by CICOGNANI et al. and TAROZZI et al., and are thus prior art features and not inventive, so that they cannot form an inventive link for the independent claims.