



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
02.02.2011 Bulletin 2011/05

(51) Int Cl.:
B24C 1/00 (2006.01) B08B 9/08 (2006.01)

(21) Application number: **09009740.3**

(22) Date of filing: **28.07.2009**

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

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(54) **Method for removing transport labels**

(57) The invention relates to a method for removing labels from containers used in the production, storage, transport and/or distribution of food products or pharma-

ceutical products, which is **characterized in that** solid CO₂ particles, especially CO₂ pellets or CO₂ snow particles, are blasted onto said containers (figure 1).

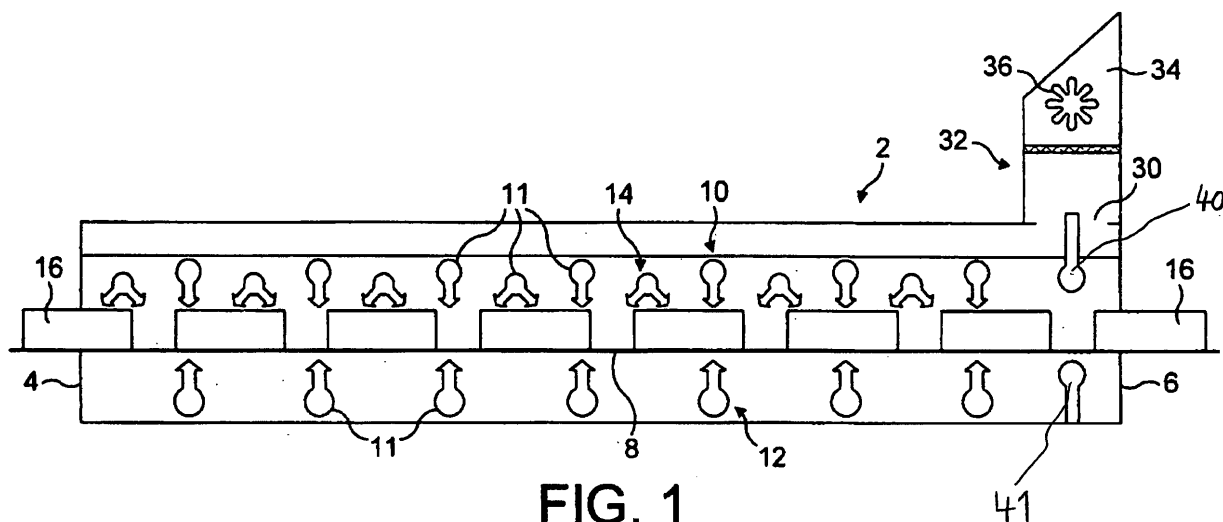


FIG. 1

Description

[0001] The invention relates to a method for removing labels from containers used in the production, storage, transport and/or distribution of food products or pharmaceutical products.

[0002] In the food industry plastic trays are used to transport products from the factory to a central distribution and further to a supermarket by vehicle. In order to log and identify the trays a system of adhesive labels is used. During the transport and handling the trays also become quite soiled.

[0003] Before the trays can be used again they require cleaning to remove soil and labels. In the state of the art the trays are cleaned in a wash system with water and a detergent using pre-wash, main wash and final rinse. Such a wash system works continuously and enables large numbers of supermarket tray carriers to be cleaned very quickly.

[0004] However, many labels cannot completely be removed by these water wash systems so that labels and debris on the trays build up over time. This repeated accumulation of labels not removed by the conventional wet wash system leads to trays being returned for cleaning using a labour intensive manual high pressure wet wash jet cleaning system.

[0005] Further, the conventional wet wash systems leave the trays in a wet condition after washing. Therefore, there is a potential risk of cross contamination due to moisture.

[0006] It is an object of the present invention to provide an improved method for cleaning containers used in the production, storage, transport and/or distribution of food products or pharmaceutical products.

[0007] This object is achieved by a method for removing labels from containers used in the production, storage, transport and/or distribution of food products or pharmaceutical products, which is **characterized in that** solid CO₂ particles, especially CO₂ pellets or CO₂ snow particles, are blasted onto said containers.

[0008] According to the invention the containers are cleaned by CO₂ blasting. The CO₂ particles are blown onto the container surface at high speed. The cold CO₂ particles induce a thermal shock at the container surface which loosens the contaminants. Immediately after impact the CO₂ particles begin to sublime from the solid phase to a gas which blows away the loosened contaminants.

[0009] The inventive system does not use wet techniques to wash. So the trays remain dry thus preventing bacterial growth and the need to dry the trays as in a conventional wet wash system.

[0010] The term "container" shall mean any kind of container, box, tray or crate used for storage, transport and distribution of products, in particular containers in the food and/or pharmaceutical industry. Preferred examples are plastic crates and trays for fruits and vegetables, bakery products, meat, fish, dairy products or beverages.

erages.

[0011] The term "label" shall mean any kind of label, sticker or tag and remainders of such labels.

[0012] According to a preferred embodiment solid CO₂ in the form of CO₂ pellets is used. The CO₂ pellets are propelled by a gas and blasted onto the containers. The pellets will remove debris and soil by the use of abrasive techniques. CO₂ pellets shall mean bodies of compressed or compacted carbon dioxide snow. CO₂ pellets are small particles, often in the form of rice, with a length between 5 and 30 mm and a diameter of approximately 3 mm. When the cold CO₂ pellets strike the surface of the containers a significant temperature gradient between the label or coating to be removed and the container occurs. Instead of using CO₂ pellets it is also possible to use CO₂ snow particles.

[0013] According to a preferred embodiment, after the cleaning process a parameter which is indicating the cleanliness of the container is monitored and the container is cleaned again if the parameter does not meet a pre-defined value. This feed back loop allows to measure the effectiveness of the cleaning process and thus to fully automate the cleaning system. Any container which has not been sufficiently cleaned and which is still contaminated will be moved back into the system for further cleaning. The cleaning effectiveness of the containers is preferably monitored by means of a refractive light measurement system.

[0014] The feed back loop described above can also be used to set and regulate the feed rate of containers. Thus, it will be possible to have a maximum number of containers or trays cleaned by means of a given CO₂ blasting system.

[0015] On the other hand, it is also possible to control the abrasive force which is required to clean the containers and to remove the labels. For example, the pressure of the blasting air which is used to propel the CO₂ pellets is controlled depending on the result of the monitoring. If after the cleaning step not only a single container but a number of containers are not sufficiently clean the abrasive force of the CO₂ pellet jet stream is increased.

[0016] It is further preferred to install an exhaust system to remove CO₂ gas and debris particle produced by the cleaning system. Carbon dioxide vapour and any airborne particulate material which has been disengaged from the surfaces of the containers by the impact of the CO₂ pellets are sucked off. For example, an extractor fan is associated with the exhaust.

[0017] Preferably compressed gas is used to accelerate and to discharge CO₂ dry ice pellets at velocity onto the surfaces of the containers and to remove debris and labels. Labels and debris are removed from the cleaning tunnel with the use of an air extraction system and collected in a waste bin. The labels will then be removed for environmental disposal.

[0018] The extraction system will also remove spent CO₂ gas and soil through filter system and out to atmosphere. The exhaust is preferably provided with a filter for

the removal of any particles such as particulate waste and debris. Preferably the filter is provided upstream the extractor fan.

[0019] The inherent properties of CO₂ which has a low pH will be expected to have some sanitising effect. According to a preferred embodiment the containers are further subjected to a UV treatment after the inventive cleaning process. The containers are exposed to UV light on all surfaces subsequent to the CO₂ cleaning in order to destroy any bacterial residue.

[0020] The inventive cleaning process is preferably carried out in a cleaning tunnel. The containers are transported through the cleaning tunnel. According to the invention CO₂ jet nozzles are positioned inside the cleaning tunnel and CO₂ particles are blasted onto the containers to remove adhering labels.

[0021] The cleaning tunnel is preferably a stainless steel construction with an automated belt carrier to convey soiled trays or containers through the cleaning tunnel. A number of CO₂ jets nozzles is positioned inside the tunnel to clean the containers along their sides, base and top.

[0022] Preferably, a number of CO₂ jets nozzles is positioned inside the cleaning tunnel such that all surfaces of said containers are impacted by solid CO₂ particles ejected from the CO₂ jet nozzles.

[0023] At least one CO₂ jet nozzle is preferably arranged on a robotic arm. The robotic arm allows to move the CO₂ jet nozzle such that all surfaces of the container can be cleaned with jets of solid CO₂. The robotic arm may also be controlled by a control system which monitors the cleanliness of the container.

[0024] According to another preferred embodiment the cleaning tunnel is designed such that at least the CO₂ jet nozzles are movably arranged within the cleaning tunnel. The CO₂ jet nozzles can be moved within the tunnel so that the expelled CO₂ pellets can reach all surfaces of the containers to be cleaned.

[0025] The CO₂ jet nozzle is preferably designed as a Laval nozzle or Venturi nozzle. For example, the CO₂ pellets are discharged at or above sound velocity.

[0026] The invention has several advantages compared to the state of the art:

- can be fully automated
- Removal of soil and labels
- High throughput
- No moisture
- Low pH from CO₂ which will lead to reduced bacterial growth
- Cleaning process uses dry abrasive cleaning method (no water)
- Feed back loop to monitor cleaning standard achieved and to reject containers and trays which do not meet the required standard
- No waste water
- No cross contamination from wet containers
- Reduced carbon foot print

- Application has potential for further refinement within food factories to clean process equipment.
- The inventive CO₂ cleaning can be used in bakeries where wet cleaning would be a problem.
- Removal of difficult soils and bio films within a food process area
- Cleaning of food equipment between product changes where wet cleaning would be a problem.

[0027] The inventive method will now be described with reference to the accompanying drawings, in which

figure 1 is a schematic sectional view of a cleaning tunnel for removing labels from trays and

figure 2 is a schematic end elevation of the tunnel shown in figure 1.

[0028] Figure 1 shows an apparatus for cleaning of containers and especially of trays which are used for internal and/or external distribution of food products. For example, such trays are used to transport food products from the factory to a central distribution and to the supermarket. For identification the trays are provided with adhesive labels. Before re-use the labels have to be removed from the trays.

[0029] The inventive system for removing labels can be fully automated. The system comprises a cleaning tunnel 2 with an inlet 4 and an outlet 6. The tunnel is provided with an endless conveyor 8 with an upper run and a lower run (not shown).

[0030] The tunnel 2 is further provided with a first row 10 of nozzles 11 positioned above the upper run of the conveyor belt 8. The row 10 of nozzles 11 extends from a region within the tunnel 2 near its inlet 4 to a region within the tunnel 2 near its outlet 6. There is a complementary second row 12 of nozzles 11 within the tunnel 2 positioned beneath the upper run of the conveyor 8 but above the lower run (not shown) of the conveyor. A third row 14 of nozzles 11 is provided along one side of the tunnel 2 from a region near its inlet 4 to a region near its outlet 6. There is a fourth row of nozzles (not shown) on the opposite side the tunnel 2.

[0031] Each of the nozzles 11 communicates with a carrier gas stream, preferably air at a pressure in the range of 7 bar to 30 bar, into which pellets of carbon dioxide are fed from, for example, a hopper (not shown) having a rotary valve (not shown) at its bottom for the discharge of pellets from the hopper into the carrier gas. In one arrangement, each row of nozzles may be served by a common conduit (not shown). Each conduit may have a dedicated hopper and supply of carrier gas. Alternatively, there may be a single hopper and a single supply of carrier gas with which the four common conduits communicate. If a common supply of carrier gas is used, allowance needs to be made for pressure drop along the particle conveying network. The arrangement is such that each nozzle projects the pellets of solid carbon dioxide at a velocity of at least 100 metres per second and typi-

cally in the order of 200 to 300 metres per second. The rows of nozzles are arranged so that the upper row 10 directs pellets of carbon dioxide at the bottom forward and rearward internal surfaces and the forward and rearward external surfaces of the trays (indicated by the reference 16 in the drawings) as they are advanced through the tunnel 2 on the conveyor 8. Preferably, the nozzles in the row 10 swivel so as to facilitate the cleaning of these surfaces. Most preferably, the nozzles in the row 10 are self-swivelling.

[0032] The nozzles in the row 12 are arranged and configured so as to propel pellets of solid carbon dioxide against the exterior surface or surfaces at the base of each soiled tray 16 as it passes through the tunnel 2. Similarly to the nozzles in the row 10, the nozzles in the row 12 may be swivelling, preferably self-swivelling. The nozzles in the side rows 14 are arranged and configured to propel pellets of solid carbon dioxide at the internal and external side surfaces of the trays 16 as they are advanced through the tunnel 2 by the conveyor 8. The rows of nozzles 11 are deployed such that, in use, all internal and external surfaces of the trays are subjected to impact by the high velocity pellets of carbon dioxide.

[0033] In operation of the tunnel 2 shown in the drawings cold carbon dioxide vapour is formed by sublimation of the solid carbon dioxide pellets. There is thus a need to extract the cold carbon dioxide vapour from the tunnel 2. In addition, the impact of the pellets of solid carbon dioxide against soiled areas of the trays 16 tends to cause minute particles of dust to be formed. The tunnel 2 is provided at its outlet end with a port 30 in its roof. The port 30 communicates with a hood 32 defining an outlet duct 34 for carbon dioxide vapour laden with particles of dust. The hood 32 is provided with a fan 36 which is operable to extract the dust-laden carbon dioxide from the interior of the tunnel 2. The hood 32 is preferably provided with a filter 38 either above or beneath the fan 36 so as to disengage particles of dust from the vapour being extracted.

[0034] The used pellets of carbon dioxide collect at the bottom of the tunnel 2. There is typically no need to extract the used pellets as they sublime naturally. The sublimation of the pellets has the effect of chilling the atmosphere within the tunnel 2. In general, the tunnel 2 is operated such that the temperature within the tunnel is between 0°C and -20°C. There is no need to provide a means for recovering spent pellets of carbon dioxide from the tunnel. There is a tendency for some solid particles of dust to remain in the cleaned tray or adhering to surfaces thereof. Such particles may be dislodged by direction of at least one high velocity jet of air or other gas at the cleaned trays at a region near the exit 6 from the tunnel 2. Preferably, there is a first air jet provided from a nozzle 40 located above the upper run of the conveyor 8 and a second nozzle 41 for forming an air jet below the upper run of the conveyor 8. The effect of the air jet is to dislodge such particles of dust from the trays causing them to become entrained in the atmosphere within the tunnel 2

and to be extracted by the fan 36.

[0035] In operation, the conveyor 8 typically passes 400 trays per hour through the tunnel 2 for cleaning. Typically, the inventive cleaning system is provided an UV source which is utilised to expose the trays to UV radiation for the purpose of destroying any resident bacterial on the trays.

10 Claims

1. Method for removing labels from containers (16) used in the production, storage, transport and/or distribution of food products or pharmaceutical products, **characterized in that** solid CO₂ particles, especially CO₂ pellets or CO₂ snow particles, are blasted onto said containers (16).
2. Method according to claim 1, **characterized in that** after the cleaning process a parameter which is indicating the cleanliness of the container (16) is monitored and the container (16) is cleaned again if the parameter does not meet a pre-defined value.
3. Method according to any of claims 1 to 2, **characterized in that** CO₂ gas and debris particles which are produced during cleaning the containers (16) are removed by suction.
4. Method according to any of claims 1 to 3, **characterized in that** during and/or after the cleaning process a parameter which is indicating the cleanliness of the container (16) is monitored and the abrasive force of the solid CO₂ particles is regulated depending on said parameter.
5. Method according to any of claims 1 to 4 **characterized in that** the containers (16) are exposed to UV light after the cleaning process.
6. Method according to any of claims 1 to 5 **characterized in that** said containers (16) are transported through a cleaning tunnel (2) and wherein solid CO₂ particles, especially CO₂ pellets or CO₂ snow particles, are blasted onto said containers (16) from CO₂ jet nozzles (11) positioned inside the cleaning tunnel (2).
7. Method according to any of claims 1 to 6 **characterized in that** said containers (16) are transported through a cleaning tunnel (2) by means of an endless conveyor belt (8).
8. Method according to any of claims 1 to 7, **characterized in that** a number of CO₂ jets nozzles (11) is positioned inside the cleaning tunnel (2) such that all surfaces of said containers (16) are impacted by solid CO₂ particles ejected from the CO₂ jet nozzles

(11).

9. Method according to any of claims 1 to 8, **characterized in that** CO₂ particles are ejected from a CO₂ jet nozzle which is arranged on a robotic arm. 5

10. Method according to any of claims 1 to 9, **characterized in that** gaseous CO₂ is extracted from the cleaning tunnel (2). 10

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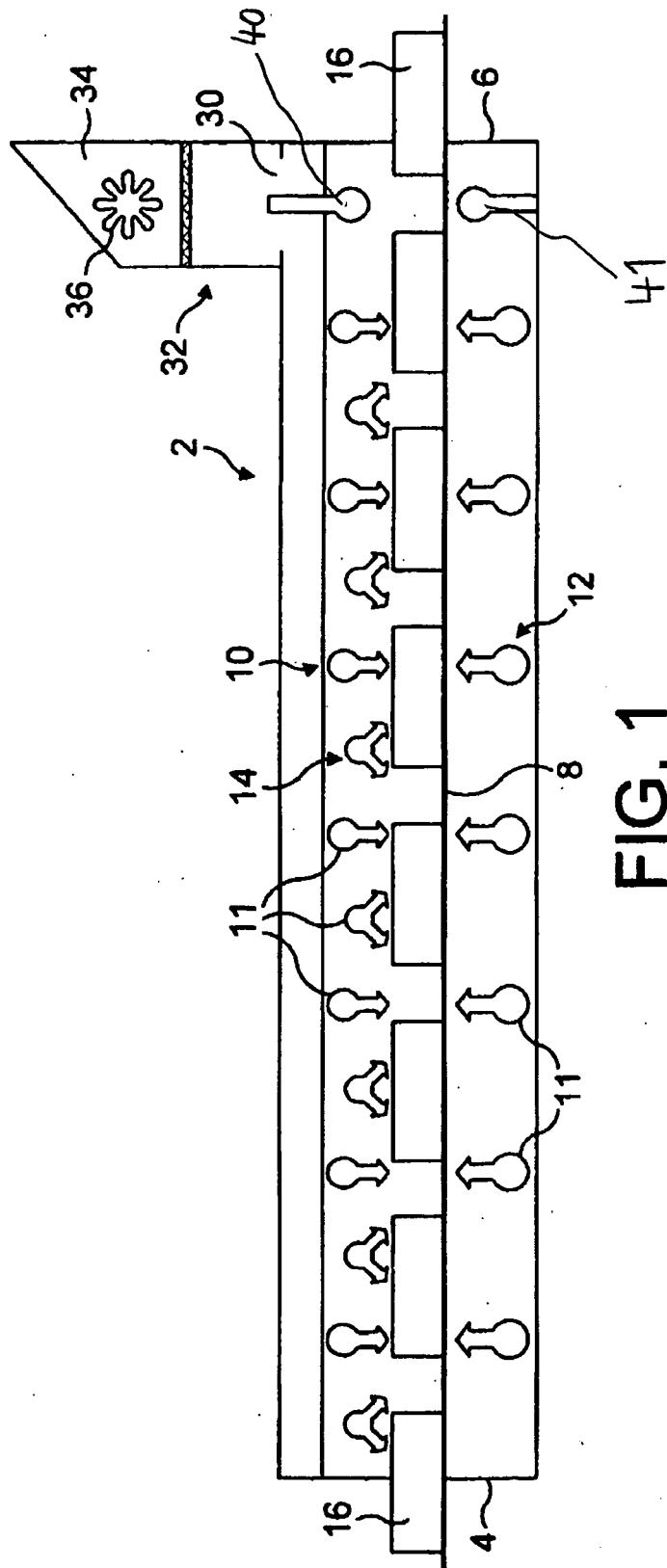
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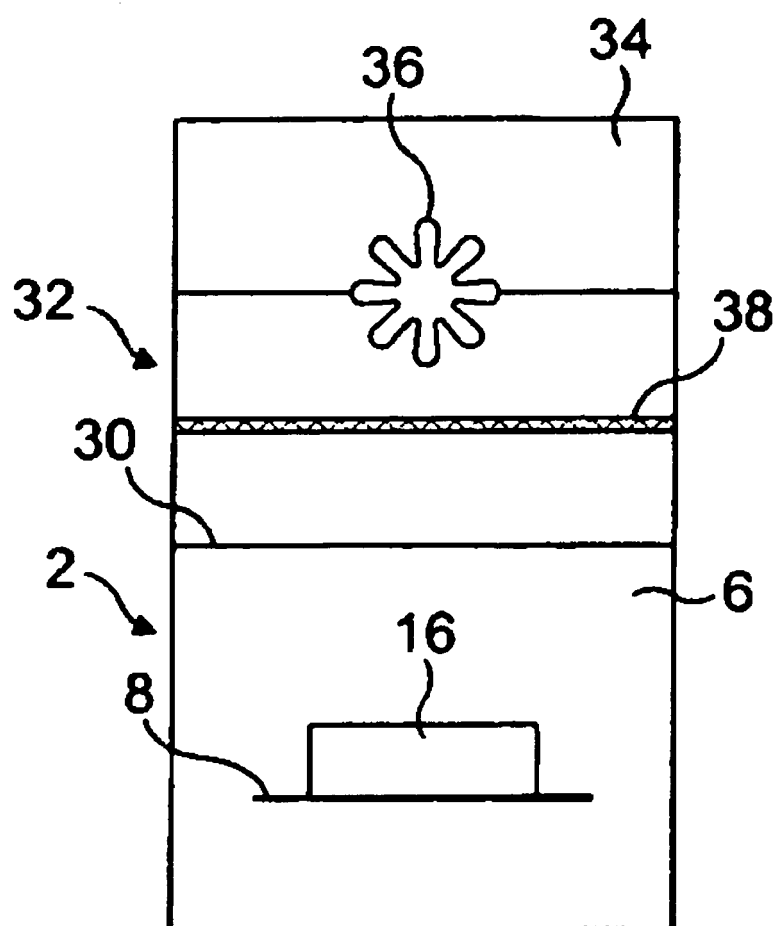


FIG. 2



EUROPEAN SEARCH REPORT

Application Number
EP 09 00 9740

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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