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(54) **HEAT-CONTROL APPARATUS AND METHOD FOR CONTAINERS**

(57) A heat-control apparatus for containers (2) comprises a plurality of conveyors (1, 5, 8), adapted to transport a plurality of containers (2) in sequence, a first and a second diverting means (4, 7), configured to sort the

containers (2) among mutually perpendicular conveyors, and heating means (6), adapted to transmit a predetermined quantity of heat to these containers (2).

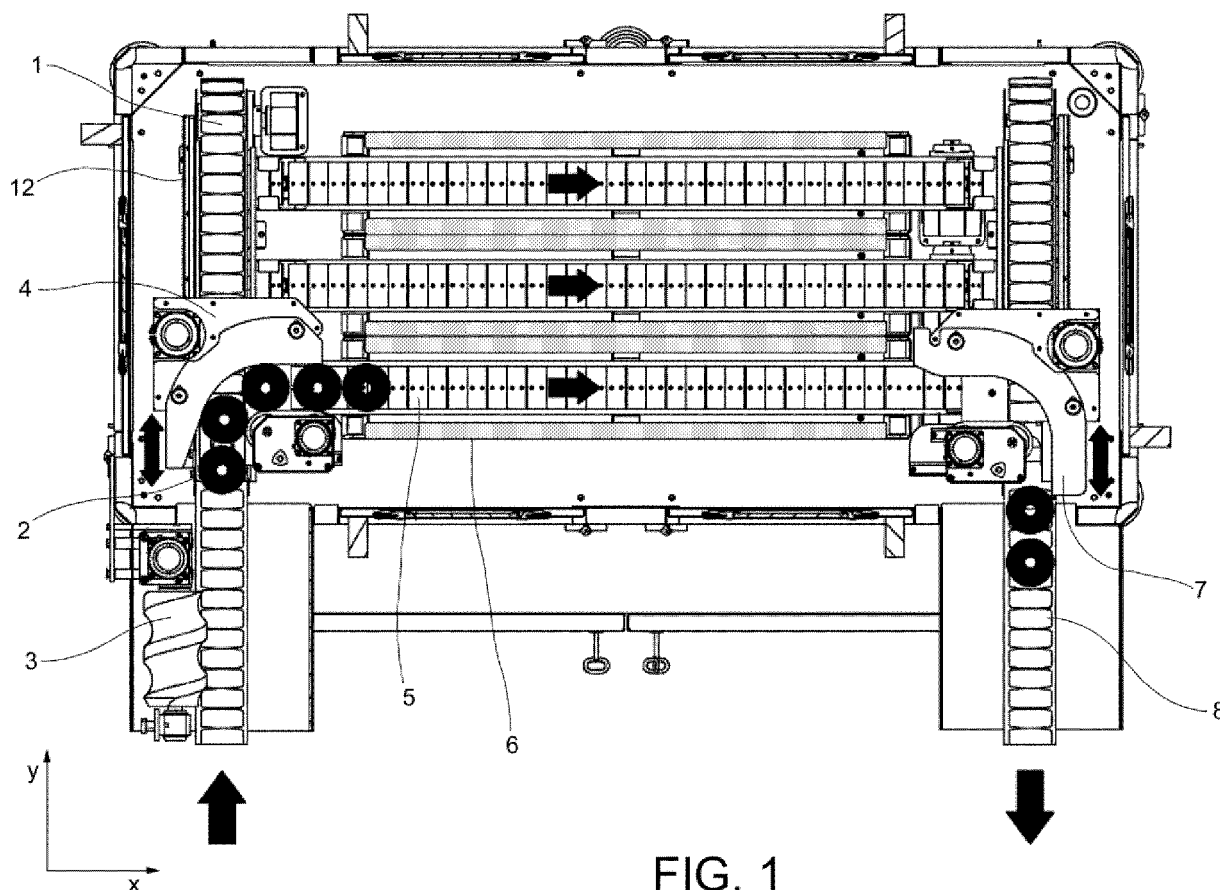


FIG. 1

Description

Technical field

[0001] This invention falls, in general, in the field of conveyor means; in particular, the invention relates to a heat-control apparatus and method for containers.

Prior art

[0002] Heat-control apparatuses for containers (typically, glass bottles for containing liquids) by means of heating are known.

[0003] The term "heater" designates a machine capable of bringing the container, which in initial conditions is at a known temperature, to a predetermined temperature. Usually, this process is carried out in the "cold" filling of bottles; in effect, following this phase, condensation is generated on the surface of the bottles due to the temperature difference with the external environment. This prevents proper labeling of the bottles.

[0004] To eliminate the condensation phenomenon, the bottles are brought to a usual temperature of about 20°C, a temperature at which, in normal humidity conditions, the bottle remains dry.

[0005] The current heaters are machines which comprise a heat-control system associated with an internal transport system.

[0006] The heat-control system makes use of a heating fluid (hot water or steam) introduced into the machine. This heating fluid is released or sprayed towards the containers, bringing them to the desired temperature in a given time interval. Alternatively, in the prior art the solution of using a heat-control system which uses electric infrared lamps is also considered.

[0007] In general, the internal transport system may have a single belt along which the containers advance ("mass" system) or several belts that transport the containers from one line to another ("single-line" system), i.e. in single file.

[0008] The heaters operating "in mass" are configured in such a way that the containers, coming from the production line, are made to merge from several conveyors (on which they travel in "single-line" mode) onto a single belt, running inside the machine.

[0009] In a system configured in this way, however, many critical issues may be found, for example in relation to the fact that the passage from a single-line belt conveyor (wherein the containers are arranged in bulk) constitutes a moment of strong instability for the container, as it must almost instantly change its direction by 90° (angle of entry onto the belt). This problem, together with the presence of a step or a gap (physiological in the passage from one conveyor to another), makes this system unreliable. An additional element of risk is given by the fact that, in the transition phase, the containers stop in an intermediate position to the two conveyors and, in order to move forward, must be pushed by the arriving

containers; if, as often happens, the shape of the transported elements is not stable, there is an overturning of said elements and a domino effect on the adjacent elements. Furthermore, once on the belt, the containers in any case present a high risk of falling, as they are in mutual contact, and the relative thrusts constitute another element of strong imbalance. In addition, an aspect taken into consideration by buyers is the traceability of the product along the line, i.e. the identification of the single element within a lot, which is not possible when the containers are transported in bulk. A disadvantage of bulk transport also lies in the fact that the heat treatment time is not uniform for all products, because not all of them remain inside the machine for the same time interval. Moreover, the heating fluid that is circulated hits the containers not only where it is needed, but also in parts of the containers that do not need to be touched. There is therefore a significantly high waste of energy.

[0010] The heaters that operate in a single-line system, or in "single file", are generally more efficient than the previous ones. However, these too have drawbacks.

[0011] In effect, single-line transport operates as a transport of the product on several belts inside the machine. The containers pass from one belt to another by means of conveyors that divert their direction and accompany them on the way from one belt to the next. The problem of "dead spots" is also present in this case, as the product is pushed along the conveyors by the arriving products. In particular, the disadvantage is represented by the fact that, for each lane, a conveyor is required and usually such machines have a large number of lanes. Furthermore, a dedicated conveyor is required for each container format to be transported. What is more, these machines are very bulky. For all these reasons, the management of format changes is long and expensive.

[0012] A further physiological disadvantage of single-line systems is inherent in the fact that, if there is some problem with an individual element in a line, to remedy it, it is necessary to wait for it to come out and then empty the whole machine. It is also a noisy system (a problem it shares with the mass system), as the bottles being pushed touch each other, generating a noise which, in the presence of glass or metal containers, may be deafening and generate considerable annoyance for line operators.

[0013] As mentioned above, in general the heating fluid is introduced into the machine and directed towards the product to be heated. By conduction and convection, the containers in a given time interval are brought to the desired temperature and leave the machine. The critical issues for the system in question are, in particular, the high standard cycle time, i.e. the time that a common container takes to reach the desired temperature, and the fact that the elements to be heated, being subjected to a jet of fluid, come out of the cycle wet, and therefore must be dried afterwards.

[0014] Due to these factors, the working conditions wherein the machines are found are conducive to the

proliferation of fungi, algae, limestone and dirt. Due to the long cycle time, the overall size of the machines, with the same production regime, is very large. All the plant engineering intrinsic to the system is very laborious and expensive, as elements such as boilers, pumps, tanks, valves, heat exchangers and a complex fluid distribution system are required. Obviously, a direct consequence of these factors is having a series of losses in the generation, exchange and distribution system, which significantly increase the energy expenditure. Furthermore, the maintenance of these machines is expensive.

[0015] These limitations, understandably, make the process of heat-control of the conveyed containers inefficient and uneconomical.

Summary of invention

[0016] An object of this invention is to overcome the aforementioned problems.

[0017] To obtain this result, a heat-control apparatus according to the invention comprises a sequence of conveyors which move the product to be treated therein, and by a heating system that raises the temperature of the products to a predetermined value.

[0018] A motorized primary conveyor conveys the containers inside the machine. A pair of diverters distributes the containers from the aforesaid primary conveyor to a plurality of secondary conveyors perpendicular thereto. Said secondary conveyors are fed in sequence: once a line has been created, the corresponding secondary conveyor stops, and the heating process begins.

[0019] Expediently, each secondary conveyor is flanked by gas-fueled infrared emitting catalytic panels, which are tasked with raising the temperature of the product to be treated to a set value in a fixed time interval.

[0020] When the desired temperature is reached, the secondary conveyor starts operating and accompanies the containers towards an outgoing transfer conveyor.

[0021] A machine operating in the manner described above has the advantages of drastically reducing the cycle time and the overall dimensions of the machine, further ensuring the total stability of the elements during the process.

[0022] The fact that the containers are stationary during the heating phase facilitates directing the heat towards the parts that are actually to be heated, ensuring uniformity of treatment.

[0023] A system according to the invention may be defined as a "dynamic accumulation" system, since the first free line for the entry of the other bottles may be chosen, unlike the forced accumulation systems imposed in all the other existing single-line systems.

[0024] Furthermore, the parallel conveyor system allows each line to be fully independent from the others, whereby any event that occurs on a conveyor during heat control does not directly affect what happens on the other conveyors, and the operation of the machine is not invalidated.

[0025] The aforesaid and other objects and advantages are achieved, according to an aspect of the invention, by a heat-control apparatus and method for containers having the features defined in the appended claims. Preferred embodiments of the invention are defined in the dependent claims.

Brief description of the drawings

[0026] The functional and structural features of some preferred embodiments of a heat-control apparatus and method according to the invention will now be described. Reference is made to the appended drawings, wherein:

- 15 - Fig. 1 is a schematic plan view of a heat-control apparatus for containers, according to an embodiment of the invention;
- Fig. 2 is a schematic plan view of a diverting device, included in the apparatus of Fig. 1; and
- 20 - Fig. 3 is a schematic front view in cross section of two side-by-side stationing conveyors, included in the apparatus of Fig. 1.

Detailed description

[0027] Before describing in detail a plurality of embodiments of the invention, it should be clarified that the invention is not limited in its application to the construction details and configuration of the components presented in the following description or illustrated in the drawings. The invention is capable of assuming other embodiments and of being implemented or constructed in practice in different ways. It should also be understood that the phraseology and terminology have a descriptive purpose and should not be construed as limiting.

[0028] Referring by way of example to Fig. 1, a heat-control apparatus for containers 2, adapted to modify the temperature of said containers 2 in such a way as to confer to said containers a predetermined temperature, comprises a plurality of conveyors 1, 5, 8, adapted to transport a plurality of containers 2 in sequence.

[0029] The conveyors 1, 5, 8 comprise, in turn, a feeding conveyor 1 (adapted to transport the plurality of containers 2 along a first direction y), and a plurality of stationing conveyors 5, arranged parallel to each other and adapted to transport the plurality of containers 2 (transported by the feeding conveyor 1) along a second direction x, perpendicular to the first direction y.

[0030] In order to allow the transfer of the containers 2 from the feeding conveyor 1 to the stationing conveyors 5, said conveyors have first ends adjacent to said feeding conveyor 1, whereby the feeding conveyor 1 defines with each stationing conveyor 5 a path adapted to allow the containers 2 to pass from the feeding conveyor 1 to the corresponding stationing conveyors 5.

[0031] A discharge conveyor 8 is further provided, adapted to transport the plurality of containers 2 (transported by the stationing conveyors 5) along a direction

parallel to said first direction y, the stationing conveyors 5 having second ends, opposite to said first ends, adjacent to said discharge conveyor 8, in such a way that each stationing conveyor 5 defines with the discharge conveyor 8 a path adapted to allow the passage of the containers 2 from the stationing conveyors 5 to the discharge conveyor 8.

[0032] In other words, the feeding conveyor 1 is adapted to convey the containers 2 inside the apparatus, to distribute them to the stationing conveyors 5 (where they undergo the heat treatment), such stationing conveyors 5 being configured to unload the treated containers onto the discharge conveyor 8, adapted to convey these containers 2 outside of the heat-control station.

[0033] The apparatus further comprises a first and a second diverting means 4, 7, both comprising a primary curvilinear guide 10, configured to divert the containers 2 from the feeding conveyor 1 towards a single stationing conveyor 5 and from a single stationing conveyor 5 towards the discharge conveyor 8, respectively.

[0034] The primary curvilinear guides 10 of the first and second diverting means 4, 7 are slidable respectively along the side of the feeding conveyor 1 distal to the first end of the stationing conveyors 5 and along the side of the discharge conveyor 8 distal to the first ends of the stationing conveyors 5, in such a way that said first and second diverting means 4, 7 connect the feeding conveyor 1 in sequence with the stationing conveyors 5, and the stationing conveyors 5 in sequence with the discharge conveyor 8, respectively.

[0035] Heating means 6 are located on at least one side of each stationing conveyor 5 and are adapted to transmit a predetermined quantity of heat to said containers 2.

[0036] According to an embodiment, the heating means 6 are configured in such a way as to deliver a fluid capable of heating the containers 2.

[0037] For example, the heating means 6 may be configured as nozzles adapted to deliver a fluid (water, steam, etc.) at a higher temperature than the surface temperature of the containers 2.

[0038] According to an alternative embodiment, the heating means 6 are configured in such a way as to direct a flow of heat towards the containers 2 capable of increasing the temperature of parts of the containers 2 by means of convection and/or radiation.

[0039] For example, the heating means 6 can be configured as infrared emitting catalytic panels, of a known type. These panels may expediently extend for the entire length of the associated stationing conveyor 5, expediently from both sides thereof (as shown by way of example in Fig. 1 and 3).

[0040] According to an embodiment, the primary curvilinear guide 10 has a curved surface along which the containers 2 slide in the passage between two mutually perpendicular conveyors 1, 5, 8, said curved surface being arranged vertically with respect to the plane of the conveyors 1, 5, 8 in such a way as to form a barrier adapt-

ed to forcibly direct the containers 2 from either the first or second direction y, x towards the direction y, x perpendicular thereto.

[0041] Expediently, along said curved surface of the primary curvilinear guide 10, there is a secondary conveyor means (for example, a belt or a band sliding along said curved surface), adapted to push the containers 2 from either the first or second direction y, x towards the direction y, x perpendicular thereto.

[0042] According to a preferred embodiment, the diverting means 4, 7 each comprise a respective secondary curvilinear guide 9, associated with the primary curvilinear guide 10 and movable integrally thereto along the side of the feeding conveyor 1 proximal to the first ends of the stationing conveyors 5 and along the side of the discharge conveyor 8 proximal to the second ends of the stationing conveyors 5, respectively.

[0043] The primary and secondary curvilinear guides 10, 9 jointly define a laterally delimited elbow path, wherein the containers 2 slide, ensuring a stable transition between two perpendicular conveyors.

[0044] Expediently, the secondary curvilinear guide 9 may be equipped with a tertiary conveyor means (for example, a belt or band sliding along the face of said secondary curvilinear guide 9 facing the elbow path, defined together with the primary curvilinear guide 10), adapted to push the containers 2 from either the first or second direction y, x towards the direction y, x perpendicular thereto.

[0045] According to an embodiment, illustrated by way of example in Fig. 2, one or both of the diverting means 4, 7 are movable, relative to the corresponding feeding and discharge conveyors 1, 8, along racks 12, extending along the side of the feeding conveyor 1 distal to the first ends of the stationing conveyors 5 and along the side of the discharge conveyor 8 distal to the second ends of the stationing conveyors 5 respectively, these racks being engaged by pinions 11, rotatably supported by the primary curvilinear guides 10 of the respective feeding conveyors 1 and discharge conveyors 8.

[0046] Preferably, the apparatus and the relative conveyors are configured for handling and heating containers adapted to contain fluids, for example jars or bottles (glass, metal, etc., for example 75 cL, 150 cL, 200 cL, etc.).

[0047] As shown by way of example in Fig. 1, a timing device 3 may be provided, arranged adjacent to the feeding conveyor 1 and upstream of the stationing conveyors 5.

[0048] The timing means 3, which may pivot about an axis parallel to the first direction y, has a lateral surface with a helical development with a pitch such that the containers 2 may be received between two consecutive crests of said lateral surface, said crests projecting onto the feeding conveyor 1. In this way, the containers 2 arriving from the feeding conveyor 1 are received in sequence on the roots between two consecutive crests of the helical surface by virtue of the rotary motion of the

timing device 3 (which is substantially configured as a threaded cylindrical body, similar to a screw or an auger), whereby the containers 2 are separated by a predetermined pitch, depending on the pitch of the timing device 3. This allows the containers 2 to be spaced so that, during transport along the conveyors 1, 5, 8, they will not collide with each other, thus reducing the noise of the process and the risk of the containers becoming unbalanced, damaged or falling due to contact or collision with adjacent containers.

[0049] A method for heating containers 2, according to this invention, therefore comprises the steps of: providing an apparatus according to any one of the embodiments described above; conveying a plurality of containers 2 along the first direction y, by means of the feeding conveyor 1; diverting said containers 2 towards a first stationing conveyor 5, extended along the second direction x, perpendicular to the first direction y; translating said containers 2 along said second direction x until a predetermined number of containers 2 is on said first stationing conveyor 5; interrupting the feeding of additional containers 2 from the feeding conveyor 1 to said first stationing conveyor 5; stopping the sliding of the containers 2 along said first stationing conveyor 5, and, in stationing conditions of said containers 2, transmitting a predetermined quantity of heat (expediently, in a predetermined period of time) to said containers 2; when the feeding of additional containers 2 from the feeding conveyor 1 to said first stationing conveyor 5 has been interrupted, diverting the containers 2 arriving from the feeding conveyor 1 towards a second stationing conveyor 5, parallel to the first; at the end of the heat transmission phase (i.e. when the containers 2 on the first stationing conveyor 5 have been brought to the predetermined temperature), conveying the containers 2 from the aforesaid stationing conveyor 5 to the discharge conveyor 8, diverting said containers 2 from the second direction x to the first direction y, until the first stationing conveyor 5 is empty; repeating the preceding steps with the second stationing conveyor 5 and (any) additional stationing conveyors 5.

[0050] An apparatus and a method according to the invention, in addition to the advantages already described, allows a plurality of effects to be achieved.

[0051] In particular, the heat treatment of the containers in a stationary position (which is not inconvenient or impossible with single-line conveyors of the known type) offers a total guarantee of stability of the elements during the process. It also ensures no contact and therefore no noise. Moreover, since the containers are spaced apart from each other, the whole surface is exposed to radiation. In addition, it is much easier to target the parts to be treated when the containers are stationary, ensuring uniformity of treatment.

[0052] The system is a "dynamic accumulation" system, as the first free line may be chosen for the entry of the other bottles and is no longer a forced accumulation system, as in all the other existing single-line systems.

[0053] The parallel transport system allows the complete independence of each line from the others, whereby any event that occurs on a conveyor during air conditioning does not directly affect the others and the machine may continue its operation.

[0054] Moreover, parallel distribution maximizes the space in which the product is distributed. In the classic single-line system, since there is a single drive that moves the containers forward, if a gap is formed and stopping the line is not desired, an unused dead space is generated. In the parallel system, since the lanes are independently motorized, the upstream system may stop while the lanes may continue to work.

[0055] It is possible to diversify the treatment (for example by modulating the intensity of the heat released by the heating means in a diversified way along the stationing conveyors, or by creating a "heating ramp") for each individual line according to the production needs, as each single line is independent from the others.

[0056] Various aspects and embodiments of an apparatus and a method according to the invention have been described. It is understood that each embodiment may be combined with any other embodiment. Furthermore, the invention is not limited to the described embodiments, but may be varied within the scope defined by the appended claims.

Claims

1. Heat-control apparatus for containers (2), adapted to modify the temperature of said containers (2) in such a way as to bring them to a predetermined temperature, comprising:

- a plurality of conveyors (1, 5, 8), adapted to transport a plurality of containers (2) in sequence and comprising:

- a feeding conveyor (1), adapted to transport the plurality of containers (2) along a first direction (y);

- a plurality of stationing conveyors (5), arranged parallel to each other and adapted to transport the plurality of containers (2) along a second direction (x), perpendicular to the first direction (y), said stationing conveyors (5) having first ends adjacent to said feeding conveyor (1), in such a way that the feeding conveyor (1) defines with each stationing conveyor (5) a path adapted to allow the containers (2) to pass from the feeding conveyor (1) to the corresponding stationing conveyors (5); and

- a discharge conveyor (8), adapted to transport the plurality of containers (2) along a direction parallel to said first direction (y), the stationing conveyors (5) having second

ends, opposite to said first ends, adjacent to the said discharge conveyor (8), in such a way that each stationing conveyor (5) defines with the discharge conveyor (8) a path adapted to allow the containers (2) to pass from the stationing conveyor (5) to the discharge conveyor (8);

- a first and a second diverting means (4, 7), both comprising a primary curvilinear guide (10), configured to divert containers (2) respectively from the feeding conveyor (1) to a single stationing conveyor (5) and from a single stationing conveyor (5) to the discharge conveyor (8), said primary curvilinear guides (10) of the first and second diverting means (4, 7) being slidable respectively along the side of the feeding conveyor (1) distal to the first ends of the stationing conveyors (5) and along the side of the discharge conveyor (8) distal to the first ends of the stationing conveyors (5), in such a way that said first and second diverting means (4, 7) respectively connect the feeding conveyor (1) in sequence with the stationing conveyors (5), and connect the stationing conveyors (5) in sequence with the discharge conveyor (8); and
 - heating means (6), arranged on at least one side of each stationing conveyor (5) and adapted to transmit a predetermined amount of heat to said containers (2).
2. Apparatus according to claim 1, wherein the heating means (6) are configured so as to deliver a fluid capable of heating the containers (2).
 3. Apparatus according to claim 2, wherein the heating means (6) are configured as nozzles adapted to deliver a liquid at a temperature higher than the surface temperature of the containers (2).
 4. Apparatus according to claim 1, wherein the heating means (6) are configured so as to direct to the containers (2) a heat flow capable of increasing the temperature of parts of the containers (2) by convection and/or radiation.
 5. Apparatus according to claim 3, wherein the heating means (6) are configured as infrared emitting catalytic panels.
 6. Apparatus according to any one of the preceding claims, wherein the primary curvilinear guide (10) has a curved surface along which the containers (2) are slidable as they pass between two mutually perpendicular conveyors (1, 5, 8), said curved surface being arranged vertically with respect to the plane of the conveyors (1, 5, 8) in such a way as to form a barrier adapted to forcibly direct the containers (2)

from either the first or second directions (y, x) towards the direction (y, x) perpendicular thereto.

7. Apparatus according to claim 6, wherein, along said curved surface of the primary curvilinear guide (10), there is a secondary conveyor means, adapted to push the containers (2) from either the first or second directions (y, x) towards the direction (y, x) perpendicular thereto.
8. Apparatus according to any one of the preceding claims, wherein each of the diverting means (4, 7) comprises a respective secondary curvilinear guide (9), associated with the primary curvilinear guide (10) and slidable integrally thereto respectively along the side of the feeding conveyor (1) proximal to the first ends of the stationing conveyors (5) and along the side of the discharge conveyor (8) proximal to the second ends of the stationing conveyors (5), said primary and secondary curvilinear guides (10, 9) jointly defining an elbow path, delimited laterally, wherein the containers (2) are slidable.
9. Apparatus according to any one of the preceding claims, configured for the handling and heating of containers adapted to contain fluids.
10. Apparatus according to any one of the preceding claims, comprising a timing device (3), arranged adjacent to the feeding conveyor (1) and upstream of the stationing conveyors (5), said timing device (3) being pivotable about an axis parallel to the first direction (y), having a helically developed lateral surface with a pitch such that the containers (2) are receivable between two consecutive crests of said lateral surface, said crests protruding over the feeding conveyor (1).
11. Method for heating containers (2), including the steps of:
 - a) providing an apparatus according to any of the preceding claims;
 - b) conveying a plurality of containers (2) along a first direction (y), by means of the feeding conveyor (1);
 - c) diverting said containers (2) to a first stationing conveyor (5), extended along a second direction (x), perpendicular to the first direction (y);
 - d) moving said containers (2) along said second direction (x) until a predetermined number of containers (2) is on said first stationing conveyor (5);
 - e) stopping the feed of further containers (2) from the feeding conveyor (1) to the first stationing conveyor (5);
 - f) stopping the containers (2) from sliding along said first stationing conveyor (5) and, said con-

ainers (2) being stationary, transmitting a pre-determined amount of heat to said containers (2);

g) during phase e), diverting the containers (2) coming from the feeding conveyor (1) to a second stationing conveyor (5), parallel to the first one;

h) at the end of phase f), conveying the containers (2) from the first stationing conveyor (5) to the discharge conveyor (8), diverting said containers (2) from the second direction (x) to the first direction (y), until the first stationing conveyor (5) is emptied; and

h) repeating steps d) to h).

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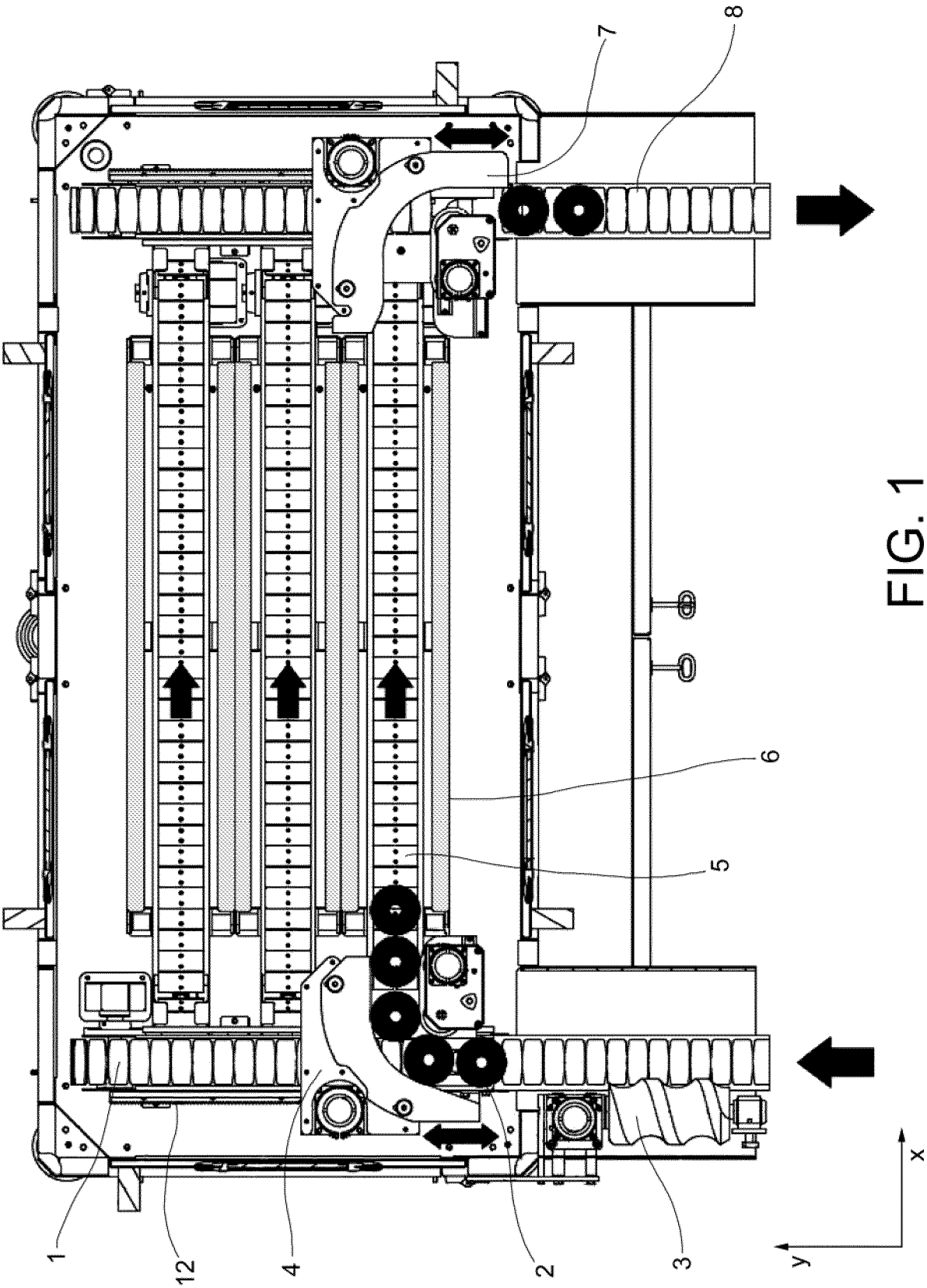


FIG. 1

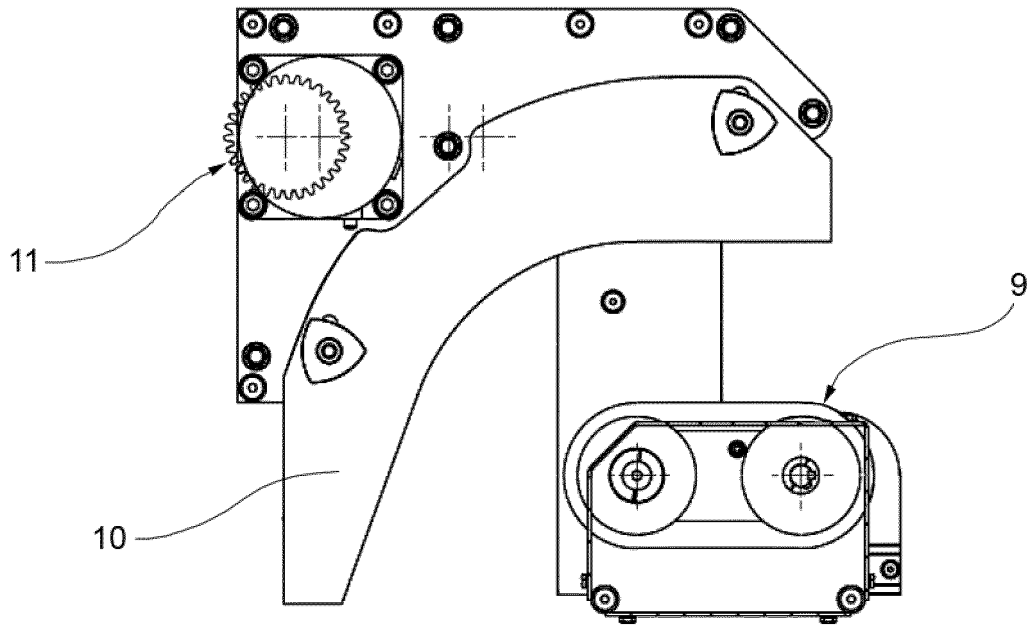


FIG. 2

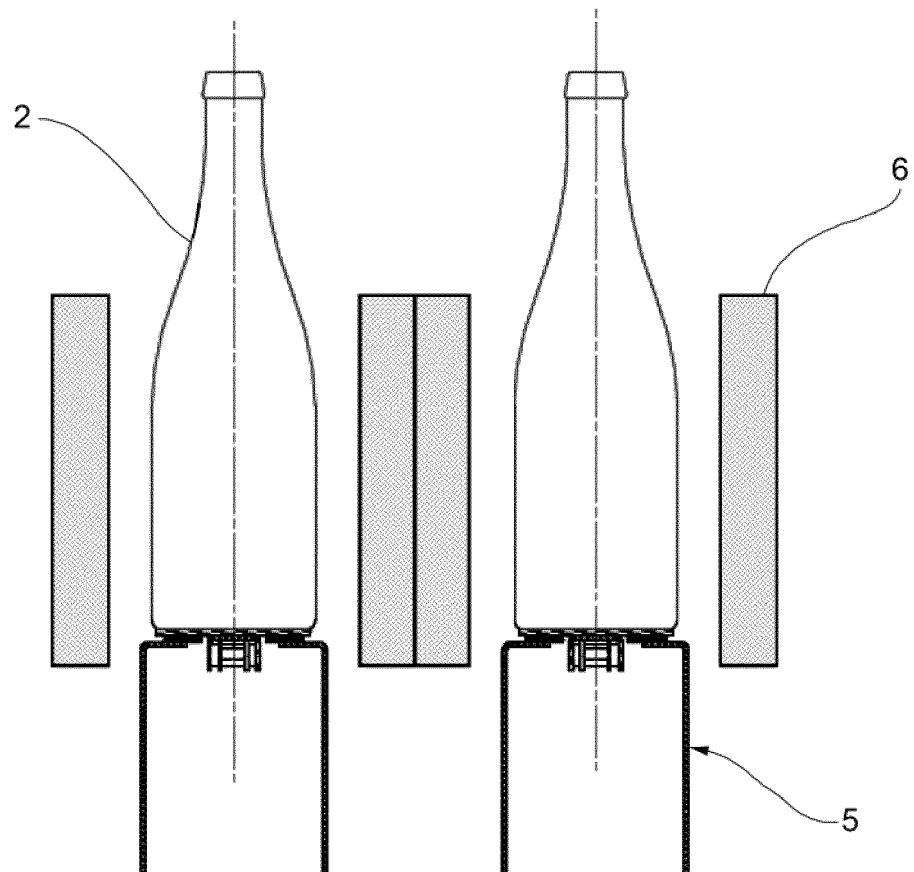


FIG. 3



EUROPEAN SEARCH REPORT

Application Number
EP 20 20 7589

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
			B65C F26B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 8 April 2021	Examiner Wartenhorst, Frank
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 20 20 7589

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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08-04-2021

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EP 2915598	A1	09-09-2015	NONE
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