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(54) **An apparatus for drying bottles**

(57) An apparatus (1) for drying bottles (2) comprises a conveyor line (10) for transferring the bottles (2) through means (41) for drying the external surfaces of the bottles (2), while the bottles rotate about their axes. The drying means (41) comprise a pair of ducts (41) for forced air, which are downwards inclined in the advancing

direction of the bottles (2) and are equipped with channels (47; 57; 67; 77) conveying the forced air towards air discharge holes (43; 53; 63; 73); said channels comprise a flared, funnel-shaped portion (472; 572; 672; 772) to convey air flowing in the respective duct (41) towards the associated discharge hole (43; 53; 63; 73).

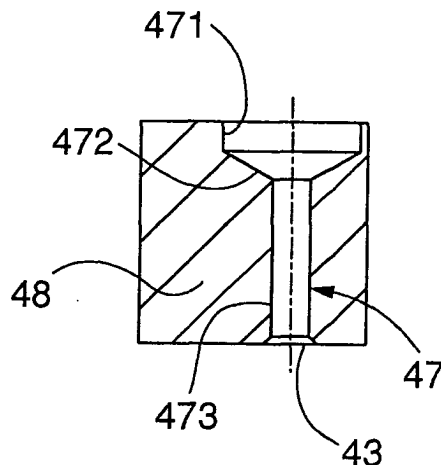


Fig. 4

Description

[0001] The present invention refers to an apparatus for drying bottles, particularly of the type used in combination with a machine for washing bottles in a bottling plant.

[0002] The large bottling plants generally comprise a series of automated apparatuses performing the several operations of the bottling cycle, such as washing and drying the inside of the bottles, filling, corking or capping, washing and drying the bottle outside, labelling and packaging.

[0003] According to the prior art, the drying of the bottle external surfaces after the washing step is generally performed by advancing the standing bottles by means of a conveyor belt through streams of forced air directed around the bottle external surfaces.

[0004] The drying apparatuses must ensure a complete drying of the whole external surface of the bottle, without leaving areas that are not completely dried at the end of the drying step, which areas could impair the success of the subsequent labelling step. Moreover, in large bottling plants, said apparatuses must ensure a high drying speed, to prevent undue delays in the bottling plant.

[0005] EP-A 1 028 300, upon which the preamble of claim 1 is based, discloses an apparatus for drying bottles in which the bottles are simultaneously submitted to a rotary and a translatory motion while passing through air streams coming from nozzles located along the path. Other apparatuses operating according to the same principle are disclosed for instance in FR-A 2 444 908, FR-A 2 573 187, FR-A 2 660 583 and US-A 2 501 367.

[0006] The apparatus disclosed in EP-A 1 028 300 provides for conveying the bottles on a pair of conveyor belts, adjacent and parallel to each other and advancing at different speeds in the same direction, the belts supporting the bases of such bottles so that half base rests on one belt and half on the adjacent belt. Forced air is sent against the moving bottles through delivery ducts arranged parallel to the belts conveying the bottles and equipped with holes formed in the wall delimiting the ducts.

[0007] Such an arrangement ensures the complete drying of the bottles only with a relatively long path and hence with relatively long drying times. This is due in part to the pressure drop of the drying air when leaving the delivery ducts, such drop making the air streams impinging on the bottles have a considerably lower pressure than the air flowing in said ducts.

[0008] It is an object of the invention to improve the drying efficiency of an apparatus of the above kind, so that the complete drying can be achieved with reduced length paths, whereby shorter drying times and simpler structures are obtained.

[0009] To attain such object without employing complex structures, it is possible to increase the flow rate of the drying air impinging onto the bottles or to increase

the pressure of the drying air streams.

[0010] Yet, too strong air streams, or streams at too high pressure, can interfere with the advancing and simultaneous rotation of the bottles along the conveyor line, with the risk of causing collisions among adjacent bottles or collisions of the bottles against parts of the drying apparatus, with consequent delays along the bottling line.

[0011] Therefore, it is another object of the invention to obviate the above drawbacks, by manufacturing an apparatus that, while achieving a high drying efficiency, ensures the proper advancing of the bottles along the conveyor line, without risks of collisions of the bottles with each other or with parts of the apparatus.

[0012] The above and other objects are achieved by the apparatus for drying bottles as claimed in the appended claims.

[0013] According to the invention, in order to optimise the bottle drying, the channels provided inside the drying air delivery ducts and feeding the discharge holes with air have a flared, funnel shaped initial portion, allowing conveying the pressurised air present in said ducts towards the corresponding discharge hole, thus limiting the air pressure drop and consequently allowing sending highpressure and high-speed air streams against the bottles.

[0014] In an embodiment of the invention, the holes discharging the drying air streams towards the bottles are arranged in two parallel rows along the respective ducts and are preferably arranged in staggered relationship. Thus a stronger and better distributed air stream is sent onto the bottles, allowing complete drying during a path of reduced length.

[0015] In a preferred embodiment, in order to ensure the bottle stability while the bottles advance along the conveyor line, said conveyor line is made of a pair of conveyor belts with different surface characteristics. More particularly, it is advantageous that the belt moving in the bottle advancing direction has a rougher surface and the belt moving in the opposite direction has a smoother surface.

[0016] Always in order to ensure a proper advancing of the bottles through the drying air streams, the air delivery ducts may be constructed so that said air streams are inclined forward with respect to the bottle advancing direction. Thus, the pressurised air impinges onto said bottles on their rear sides, with reference to the advancing direction, and pushes the bottles during their motion along said conveyor line, keeping their distances unchanged.

[0017] Some embodiments of the present invention will be better understood from the description given by way of non-limiting example, with reference to the attached drawings, in which:

- Figure 1 is a side view of the apparatus according to the invention, located past a station for washing the bottles;

- Figure 2 is a sectional view along line II-II of the apparatus shown in Figure 1;
- Figure 3 is a schematic representation of the effect caused by the drying means of the apparatus shown in Figure 1 onto a bottle surface;
- Figures 4 to 7 show a number of different shapes of the air discharge channels in the apparatus shown in Figure 1;
- Figure 8 is a sectional view along line IV-IV of Figure 2;
- Figure 9 is a schematic sectional view of the channel arrangement in a second embodiment of the invention.

[0018] With reference to Figure 1, apparatus 1 for drying bottles according to the invention is disposed downstream a bottle washing station 50 and is integrated therewith.

[0019] Apparatus 1 and station 50 are mounted on a substantially parallelepiped base 3, constituted by a box-shaped frame 3d and provided with a roof 3a, detachable side walls 3b and a plurality of adjustable supporting feet 3c.

[0020] Washing station 50 and the means for bottle transfer from said washing station 50 to conveyor line 10 of apparatus 1 are substantially known and are similar to those disclosed in EP-A 1 028 300, and therefore they will not be described.

[0021] Apparatus 1 comprises a conveyor line 10 guiding the bottles along drying means capable of sending forced air streams towards the bottles.

[0022] The drying means comprise a pair of ducts 41 for delivering drying air, which ducts are located alongside conveyor line 10. A pair of blowers 44 are further located on roof 3 a for producing a flow of forced air inside ducts 41. Each blower 44 is equipped, for each duct 41, with a hose 45 connected to a hub 46 secured to the duct. One hub 46 is mounted for instance near the upstream end of duct 41 and the other one is mounted in a central portion of the duct.

[0023] Blowers suitable to this aim are for instance blowers or compressors ELMO manufactured by Siemens AG.

[0024] Ducts 41 hang from roof 3a of base 3 through brackets 42, such that ducts 41 are tilted downwards, in a vertical plane, in the bottle advancing direction. Advantageously, brackets 42 have adjustable lengths, so that the positions of ducts 41 can be adjusted in a vertical plane to suit bottles with different sizes.

[0025] The air streams are obtained through a plurality of discharge holes provided along each duct 41 and oriented towards the bottle transit zone, so as to generate a laminar air stream that licks the external surfaces of bottles 2 with a desired inclination.

[0026] A guide 29, adjustable both in height and horizontally through corresponding handle grips 30, is located parallel to conveyor line 10 so as to keep the bottles in upright position during the translation along the

conveyor line, in co-operation with the air streams coming from duct 41 on the opposite side of conveyor line 10.

[0027] To avoid interference with duct 41 located on the same side, guide 29 can stop in correspondence of the end portion of that duct, if the latter ends at a level below guide 29. In such position, bottles 2 will be kept in upright position by the air streams only.

[0028] Referring now to Figure 2, conveyor line 10 along which bottles 2 advance between said ducts 41 comprises a pair of conveyor belts 12, 13, adjacent and parallel to each other, supporting the bases of bottles 2 with half a base resting on one belt and the other half base resting on an adjacent belt. Conveyor belts 12, 13 move at different speeds, preferably in opposite directions: in that case, the speed of belt 12 moving in the transfer direction of bottles 2 will be higher than that of belt 13 moving in the opposite direction. This way, during the advancing movement of the belts, a rotary motion around their axes is also imparted to bottles 2.

[0029] Conveyor belts 12 and 13 are preferably made of a mesh of a resistant and inextensible plastic material, and they run over supports 11, preferably made of box-type stainless steel. Spacers 17 and 18 of a material having a low coefficient of friction are secured to said supports and are arranged so that belts 12 and 13 are inclined by an angle α , preferably in the range of about 1° to 5° , towards the centre line of the conveyor line. Thus, the cross section of the conveying surface on which bottles 2 rest is substantially V-shaped.

[0030] Always with reference to Fig. 2, it is clearly apparent that the positions and the inclinations of ducts 41 along the conveyor line are such that the air streams arrive at the region of cork or cap 2a in the initial portion of ducts 41 (position 1), at the intermediate region between neck 2b and body 2c of bottles 2 in the central portion of ducts 41 (position 2), and at the region adjacent to bases 2d of bottles 2 in the end portion of ducts 41 (position 3).

[0031] Thanks to the rotary motion of bottles 2 and to the inclination of ducts 41, while bottles 2 advance along conveyor line 10, a spiral drying effect, from top to down, is obtained, which drags downward the film of water covering bottles 2 and ensures a complete drying of the whole external surfaces of bottles 2.

[0032] The air streams are discharged from ducts 41 through a plurality of discharge holes 43.

[0033] Said holes 43 do not open directly into the body of the respective duct 41, but they are formed at the ends of respective channels 47 provided in a spout 48, extending along the whole lower corner of duct 41 and projecting towards bottles 2. Said spout 48, when seen in cross section, has a greater length in the initial zone of duct 41 (position 1). Thus holes 43 are at the proper distance from the concerned region of bottle 2 at any position along the bottle travel, and spacing apart ducts 41 in the area where the bottles leave the apparatus (position 3) is not required.

[0034] Referring to Figure 3, there is schematically

shown the effect caused by the air coming from holes 43 onto the surface of the bottle advancing in direction F, in a preferred arrangement of said holes.

[0035] Reference symbols A1 - A5 denote the areas licked by the air discharged from the holes on a plane spaced by about 1.5 cm from the bottle surfaces. It can be appreciated that discharge holes 43 are mutually spaced so that there is an overlap between adjacent areas on which air impinges while the bottles advance.

[0036] Overlapping areas Z1...Z4 form a security margin in order to obtain an optimum drying effect. Indeed, the bottle portions corresponding to such overlapping areas will be dried not only by the air stream coming from the first hole, but also by the subsequent one.

[0037] As better shown in Fig. 4, according to the invention channels 47 feeding said discharge holes 43 with air have a non-uniform cross section.

[0038] More particularly, in the embodiment shown, the channels comprise, in the air advancing direction, a first cylindrical portion 471, a flared portion 472 and a second cylindrical portion 473 of smaller diameter than the first cylindrical portion 471.

[0039] The particular shape of channels 47, and in particular the provision of a flared portion, allows reducing the pressure drop of the drying air when passing in said channels. Consequently, for a given pressure of air in ducts 41, it is possible to send, against the bottles to be dried, air streams at higher pressures and higher speeds than attainable with cylindrical channels of uniform cross section.

[0040] This way, drying efficiency is improved and it is possible to reduce the length of the bottle drying path and the bottle drying time.

[0041] In an exemplary embodiment, the ratio of the diameter of said first cylindrical portion 471 to the diameter of said second cylindrical portion 473 is preferably less than 5. Moreover, the second cylindrical portion 473 of channel 47 has a substantially greater length than the sum of the lengths of the first cylindrical portion 471 and the flared portion. Preferably, the ratio of said lengths is about 2.75. Moreover, said first cylindrical portion has about the same length as the flared portion.

[0042] For instance, said channels 47 may have an overall length of the order of 1.5 cm, with a first cylindrical portion 471 0.2 cm long, a flared portion also 0.2 cm long and a second cylindrical portion 1.1 cm long. The first cylindrical portion 471 may have a diameter of about 1 cm, whereas the second cylindrical portion 473 may have a diameter in the range 0.2 to 0.8 cm.

[0043] Other possible shapes of the air discharge channels that can be constructed without departing from the scope of the invention are shown in Figures 5 to 7.

[0044] In the variant shown in Fig. 5, air discharge channels 57 comprise, in the air advancing direction, a flared portion 572 that directly opens into duct 41 and is followed by a cylindrical portion 573 of which the diameter is smaller than the maximum diameter of said flared portion and preferably is substantially the same as the

minimum diameter. The cylindrical portion ends in air discharge hole 53.

[0045] Preferably, the ratio of the maximum diameter of said flared portion 572 to that of said cylindrical portion 573 is less than 5, and the ratio of the length of said cylindrical portion 573 to that of said flared portion 572 is about 1.55.

[0046] For instance, said channels 57 may have an overall length of the order of 1.5 cm, with a flared portion 0.59 cm long and a cylindrical portion 0.91 cm long. The flared portion may have a maximum diameter of about 1 cm and a minimum diameter of about 0.3 cm.

[0047] Air discharge channels 67 made in accordance with the variant shown in Fig. 6 comprise, in the air advancing direction, a flared portion 672, an intermediate frusto-conical portion 674 and a cylindrical portion 673 ending in air discharge hole 63. Intermediate frusto-conical portion 674 has a maximum diameter equal to the minimum diameter of flared portion 672, and cylindrical portion 673 has a diameter that is substantially the same as the minimum diameter of said flared portion.

[0048] Preferably, the ratio of the maximum diameter of said flared portion 672 to the diameter of said cylindrical portion 673 is less than 5, and the ratio of the sum of the lengths of said cylindrical portion 673 and said frusto-conical portion 674 to the length of said flared portion 672 is about 2.

[0049] For instance, said channels 67 may have an overall length of the order of 1.5 cm, with a flared portion 0.5 cm long, a frusto-conical portion about 0.6 cm long and a cylindrical portion about 0.4 cm long. Flared portion 672 may have a maximum diameter of about 1 cm and a minimum diameter of about 0.42 cm, whereas the second cylindrical portion 473 may have a diameter of about 0.3 cm.

[0050] Lastly, according to the variant shown in Fig. 7, air discharge channels 77 comprise, in the air advancing direction, a flared portion 772 and a frusto-conical portion 774 ending in air discharge hole 73.

[0051] Preferably, the maximum diameter of said frusto-conical portion 774 is the same as the minimum diameter of flared portion 772. Moreover, the ratio of the maximum diameter of said flared portion 772 to the minimum diameter of said frusto-conical portion 774 is less than 5, and the ratio of the length of said frusto-conical portion 774 to the length of said flared portion 772 is about 2.

[0052] For instance, said channels 77 may have an overall length of the order of 1.5 cm, with a flared portion 0.5 cm long and a frusto-conical portion 774 about 1 cm long. Flared portion 772 may have a maximum diameter of about 1 cm and a minimum diameter of about 0.42 cm, whereas the frusto-conical portion 774 may have a minimum diameter of about 0.25 cm.

[0053] As a general indication, a good performance in terms of drying efficiency is obtained by using channels with a length in the range 0.5 to 3.5 cm, ending in an air discharge hole with a diameter in the range 0.1 to

0.8 cm and comprising a flared portion with a length in the range 0.25 to 1.5 cm and a maximum diameter in the range 0.25 to 1.5 cm.

[0054] Referring to Fig. 8, in order to improve the bottle drying efficiency, the air streams are generated by at least two sets of channels 47 provided with respective discharge holes 43 arranged in staggered relationship in at least two parallel rows along each duct 41. It is thus possible considerably to increase the number of holes per length unit of the path run by the bottles, thereby further reducing the drying time and the drying path length.

[0055] Referring to the above mentioned example, the distance between said parallel rows may be in the range 0.3 to 1.5 cm and the distance between two successive holes in a same row may be in the range 0.5 to 2.5 cm.

[0056] It is clear that the features described above entail a considerable reduction in the drying time and the drying path length. It is also clear that, in order to create the spiral drying effect on the bottles over a greatly reduced length, ducts 41 should have a much greater inclination relative to the plane of conveyor line 10 on which the bottles advance.

[0057] Yet, the great inclination of ducts 41 and the high pressure of the air discharged from holes 43 can lead to an irregular advancing of the bottles along conveyor line 10 and to the consequent risk of collisions. For a good operation of the apparatus it is on the contrary necessary that the distance between the bottles does not change during drying and that it is kept within security limits to avoid breakings.

[0058] To obviate such drawback, the surfaces of conveyor belts 12, 13 in contact with the bottoms of bottles 2 are made different so that they have different friction coefficients with respect to the bottle glass surfaces. More particularly, belt 12 moving in the same direction as bottles 2 has a surface of which the adhesion with respect to the glass of bottles 2 is greater than that of belt 13 moving in the opposite direction.

[0059] Such a difference may be obtained by using different materials for belts 12, 13, or by submitting one of the belts to a chemical or mechanical process (e.g. grinding) changing its roughness.

[0060] That solution ensures the proper advancing of bottles 2 between air delivery ducts 41 even in case of very short drying paths with greatly inclined ducts 41 and high air discharge pressures.

[0061] It is to be appreciated that such a feature may be advantageously employed not only in the apparatus of the invention, but also in all known apparatuses in which the bottles to be dried are placed on a pair of conveyor belts advancing at different speeds, in order to increase the stability of said bottles.

[0062] Fig. 9 shows a second embodiment of the invention that, in order to solve the problem of avoiding the irregular advancing of the bottles, uses channels 47 inclined forward with respect to the advancing direction

of bottles 2.

[0063] Thus, the air streams coming from said holes 43 impinge on the surfaces of bottles 2 on the rear sides 2e with reference to the advancing direction of said bottles and, besides providing for the complete drying of bottles 2, said streams assist in pushing the bottles along conveyor line 10, thereby helping in reducing the risk of collisions with adjacent bottles.

[0064] The skilled in the art will appreciate that such a feature may be advantageously employed not only in the apparatus of the invention, but also in all known apparatuses in which the bottles are dried by means of pressurised air streams.

[0065] Thus, it is clear that in all embodiments disclosed the apparatus of the invention allows improving the bottle drying efficiency, by limiting the drying path length and the drying time, without thereby negatively affecting the proper advancing of the bottles along the drying path or entailing the risk of undue delays on the bottling line.

[0066] It is also clear that the above description is given only by way of non limiting example and that changes and modifications are possible without departing from the scope of the invention.

Claims

1. An apparatus (1) for drying the external surfaces of bottles (2), comprising means (10, 12, 13) for conveying the bottles (2) along drying means (41) and for imparting to the bottles a rotary motion about their axes, the drying means comprising a pair of ducts (41) for delivering forced air streams, which ducts are located along at least one side of the bottle path, are downwards inclined in the advancing direction of the bottles (2) and are equipped with a plurality of holes (43; 53; 63; 73) for discharging air towards the bottles (2), each said hole (43) being fed with air through a channel (47; 57; 67; 77) formed inside the respective duct (41) and oriented so that the stream discharged from the respective hole (43; 53; 63; 73) is sent towards the bottle, **characterised in that** said channel comprises a flared initial portion (472; 572; 672; 772) flaring in the air discharge direction.
2. An apparatus (1) as claimed in claim 1, **characterised in that** said channels (47) comprise, in the air discharge direction, a first cylindrical portion (471), a flared portion (472) and a second cylindrical portion (473), the channel diameter decreasing in the air advancing direction.
3. An apparatus (1) as claimed in claim 2, **characterised in that** the length of said second cylindrical portion (473) is at least twice the sum of the lengths of said first cylindrical portion (471) and said flared

portion (472).

4. An apparatus (1) as claimed in claim 2 or 3, **characterised in that** the length of said first cylindrical portion (471) is the same as the length of said flared portion (472). 5
5. An apparatus (1) as claimed in claim 1, **characterised in that** said channels (57) comprise, in the air discharge direction, a flared portion (572) and a cylindrical portion (573), the channel diameter decreasing in the air advancing direction. 10
6. An apparatus (1) as claimed in claim 5, **characterised in that** the length of said cylindrical portion (573) is at least equal to the length of said flared portion (572). 15
7. An apparatus (1) as claimed in claim 1, **characterised in that** said channels (67) comprise, in the air discharge direction, a flared portion (672), a frusto-conical portion (674) and a cylindrical portion (673), the channel diameter decreasing in the air advancing direction. 20
8. An apparatus (1) as claimed in claim 7, **characterised in that** the sum of the lengths of said frusto-conical portion (674) and said cylindrical portion (673) is about twice the length of said flared portion (672). 25
9. An apparatus (1) as claimed in claim 1, **characterised in that** said channels (77) comprise, in the air discharge direction, a flared portion (772) and a frusto-conical portion (774), the channel diameter decreasing in the air advancing direction. 30
10. An apparatus (1) as claimed in claim 9, **characterised in that** the length of said frusto-conical portion (774) is about twice the length of said flared portion (772). 35
11. An apparatus (1) as claimed in claim 1, **characterised in that** the ratio of the maximum diameter of said flared portion (472; 572; 672; 772) to the diameter of said air discharge hole (43; 53; 63; 73) is less than 5. 40
12. An apparatus (1) as claimed in claim 1, **characterised in that** said channels (47; 57; 67; 77) have a length in the range 0.5 to 3.5 cm and end in an air discharge hole (43; 53; 63; 73) with a diameter in the range 0.1 to 0.8 cm, said channels having a flared portion (472; 572; 672; 772) of which the length is in the range 0.25 to 1.5 cm and the maximum diameter is in the range 0.25 to 1.5 cm. 45
13. An apparatus (1) as claimed in claim 1, **characterised in that** the distance between two successive holes (43; 53; 63; 73) on said duct (41) is chosen so that the area impinged on by the air coming from a channel on the surfaces of the advancing bottles partly overlaps with the area impinged on by the air coming from the adjacent channel. 50
14. An apparatus (1) as claimed in claim 1, **characterised in that** said conveyor means comprise a pair of conveyor belts (12, 13) disposed adjacent and parallel to each other, on which the bases of the bottles (2) rest so that half a base is supported by one belt (12) and the other half base is supported by the adjacent belt (13), a first one (12) of said two belts moving in the direction of conveyance of the bottles (2) and the second belt (13) moving in opposite direction to and at a lower speed than the first one (12). 55
15. An apparatus (1) as claimed in claim 14, **characterised in that** the surfaces of said first and second belts (12, 13) have different friction characteristics.
16. An apparatus (1) as claimed in claim 15, **characterised in that** the friction coefficient of said first belt (12, 13) with respect to the bottles is higher than that of said second belt (12, 13).
17. An apparatus (1) as claimed in claim 1, **characterised in that** said friction difference is obtained by submitting said first belt (12) and/or said second belt (13) to a chemical and/or mechanical process.
18. An apparatus (1) as claimed in claim 1, **characterised in that** said channels (47; 57; 67; 77) are inclined forward with respect to the advancing direction of said bottles (2) on said conveyor means.
19. An apparatus (1) as claimed in any preceding claim, **characterised in that** said holes (43; 53; 63; 73) are arranged in staggered relationship on at least two parallel rows along said ducts (41).
20. An apparatus (1) as claimed in any preceding claim, **characterised in that** said ducts (41) are so arranged that the holes (43; 53; 63; 73) in an initial portion of the ducts (41) send their streams in correspondence of the corks (2a) of the bottles (2), and the holes (43) in a final portion of the ducts (41) send their streams in correspondence of the bottoms (2d) of the bottles (2).
21. An apparatus (1) as claimed in any preceding claim, **characterised in that** said ducts (41) are mounted so that they are adjustable in height.
22. An apparatus (1) as claimed in any preceding claim, **characterised in that** said ducts (41) have a main

body and a spout (48) extending along the whole of the main body and transversally projecting from said body towards the bottles (2) conveyed on said conveyor means (10, 12, 13), and said channels (47; 57; 67; 77) are formed in said spout (48).

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23. An apparatus (1) as claimed in claim 22, **characterised in that** said spout (48) has a greater transversal size in said initial portion of the ducts than in the remaining portion of the respective duct (41).

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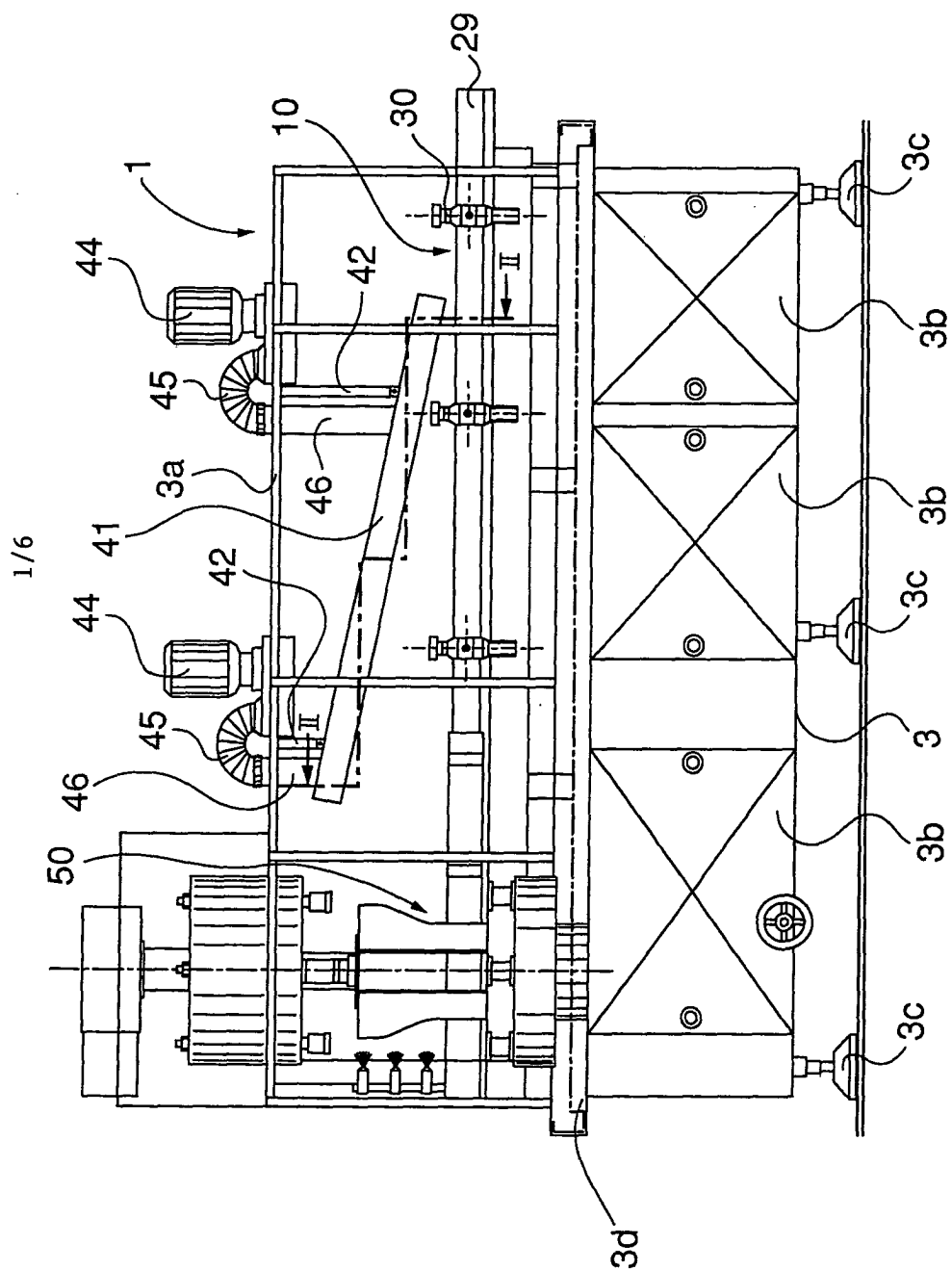


Fig. 1

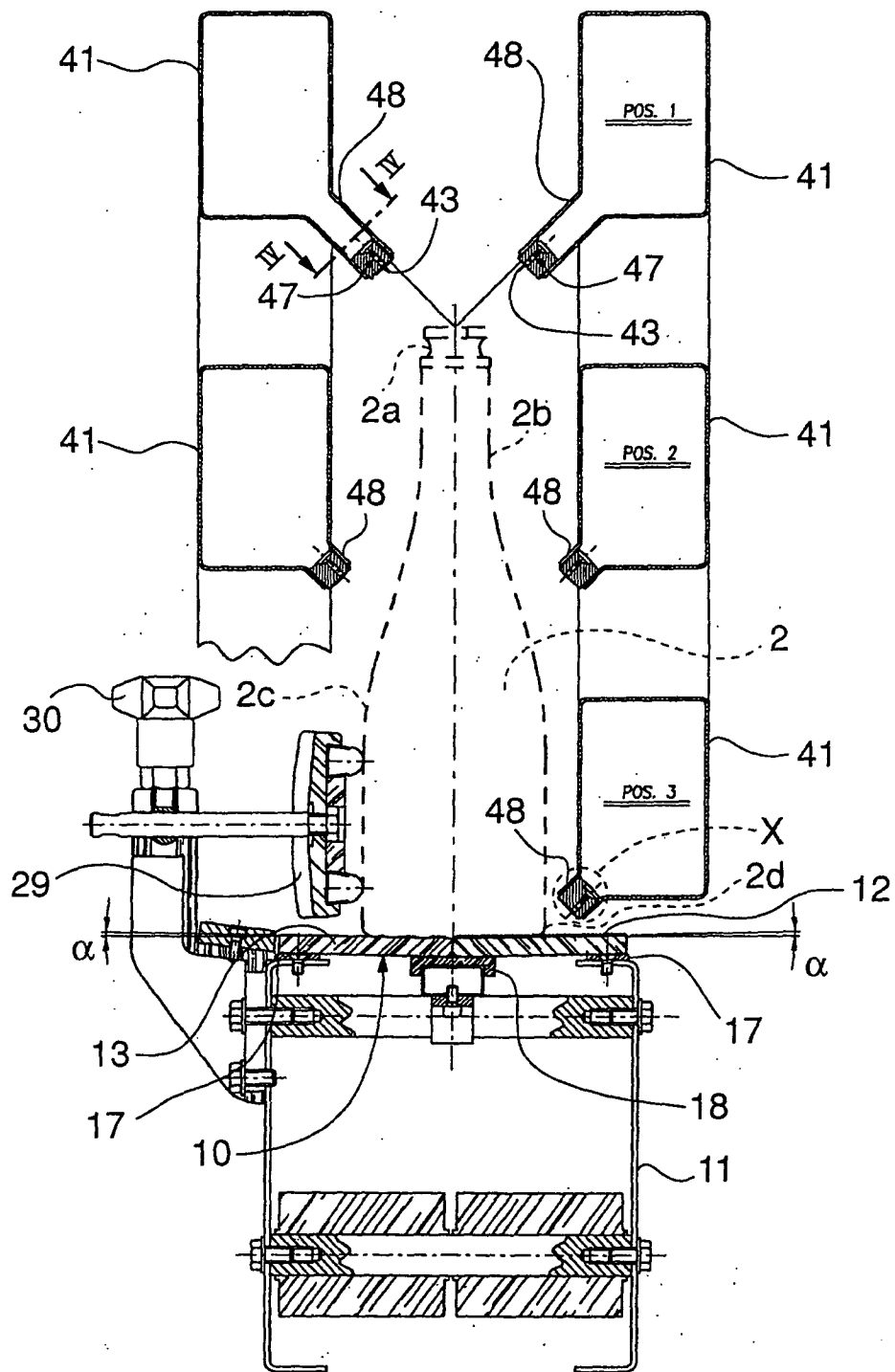


Fig. 2

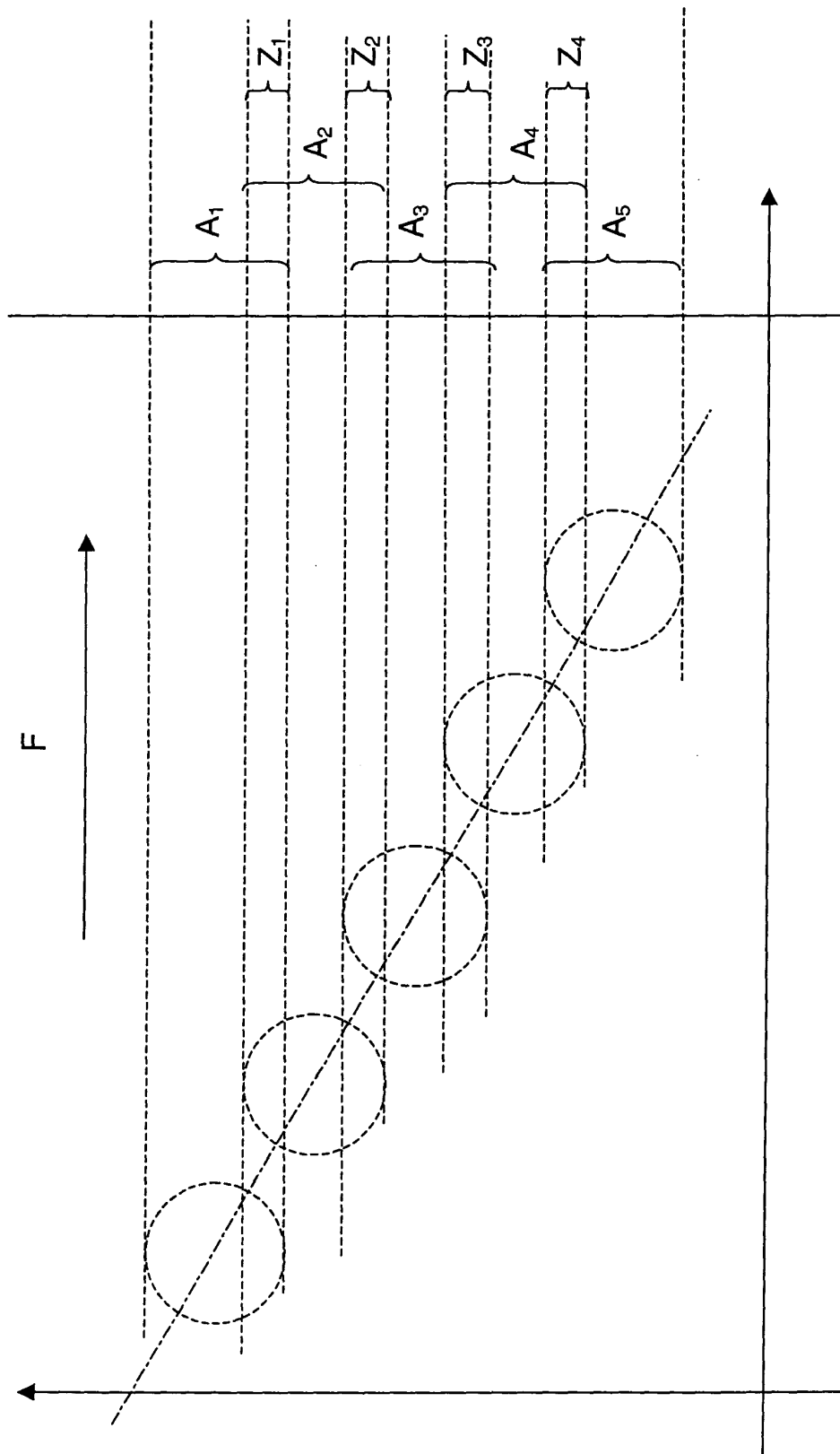


Fig. 3

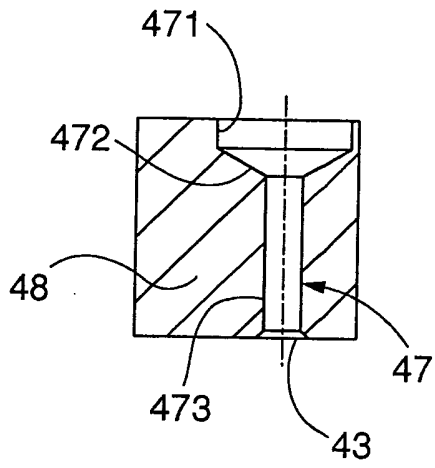


Fig. 4

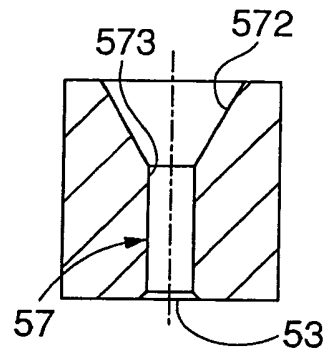


Fig. 5

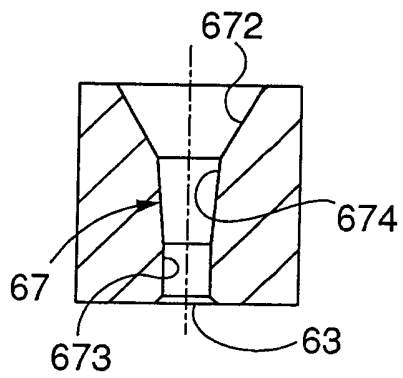


Fig. 6

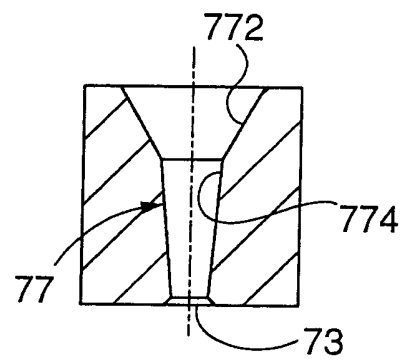


Fig. 7

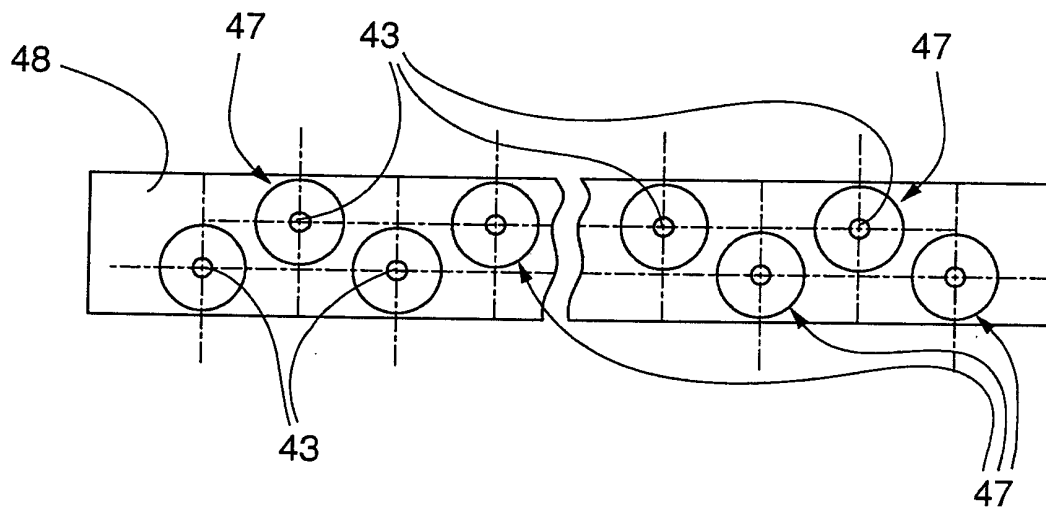


Fig. 8

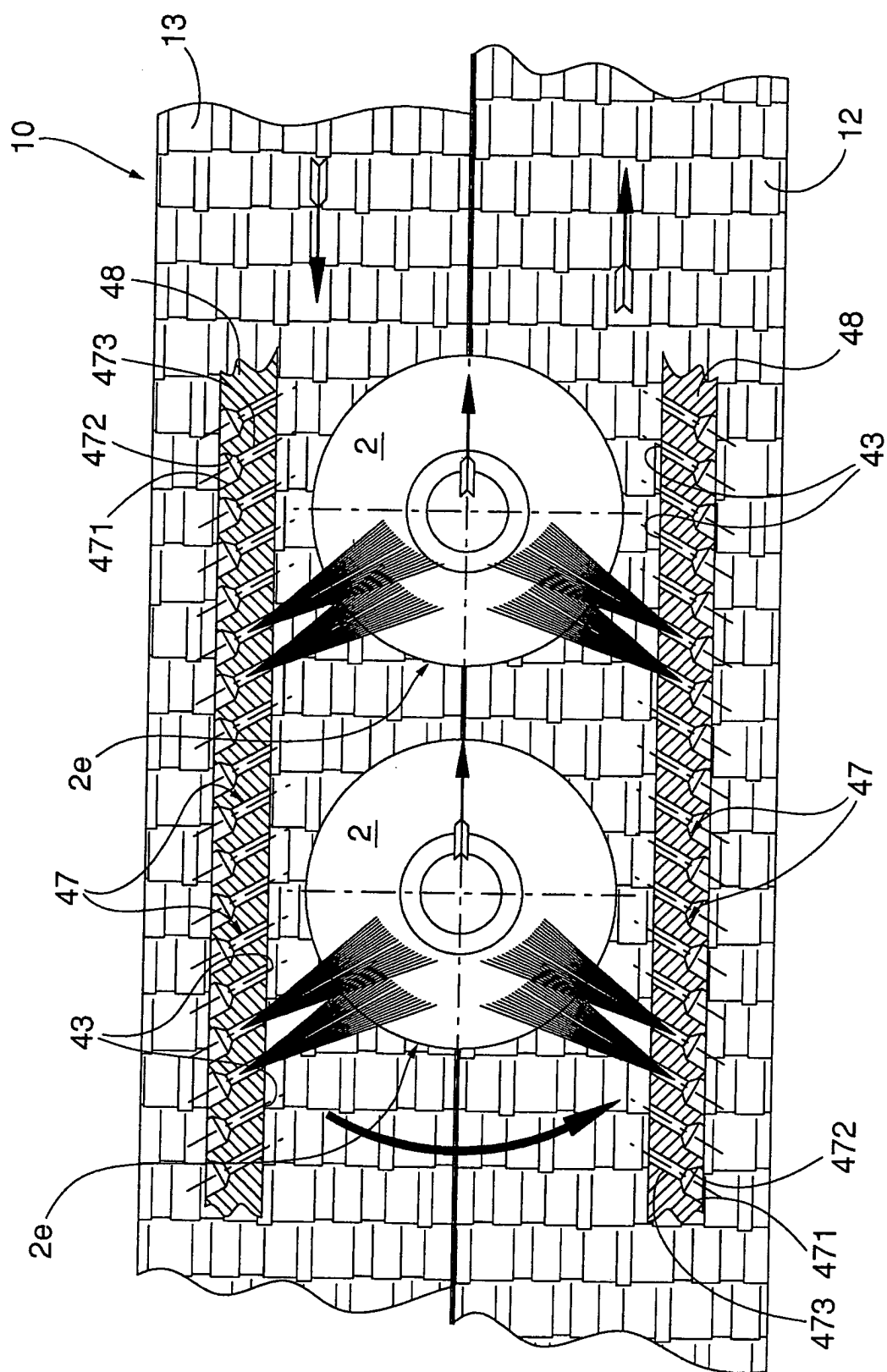


Fig. 9



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 42 5479

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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