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(54) **UNIT AND METHOD FOR MANUFACTURING ARTICLES FILLED WITH A POURABLE PRODUCT**

(57) There is disclosed a unit (1) for manufacturing articles (2) filled with a pourable product, comprising: a filling station (11), which is adapted to fill articles (2) with pourable product; a labelling station (14), which is adapted to apply a plurality of labels onto articles (2) and is arranged downstream of filling station (11), proceeding according to the advancing direction of article (2); a drying assembly (13), which is adapted to dry articles (2) and is interposed between said filling station (11) and labelling station (14); and a transfer station (16), which is in-

terposed between filling station (11) and labelling station (14) and is adapted to transfer articles (2) along a curved path (T) from filling station (11) to labelling station (14); unit (1) comprises an inspection device (17) and a discharge device (18), which are interposed between filling station (11) and labelling station (14); inspection device (17) is adapted to inspect articles (2) as the latter travel along path (T); discharge device (18) is adapted to discharge articles (2) which are not suitable to be labelled.

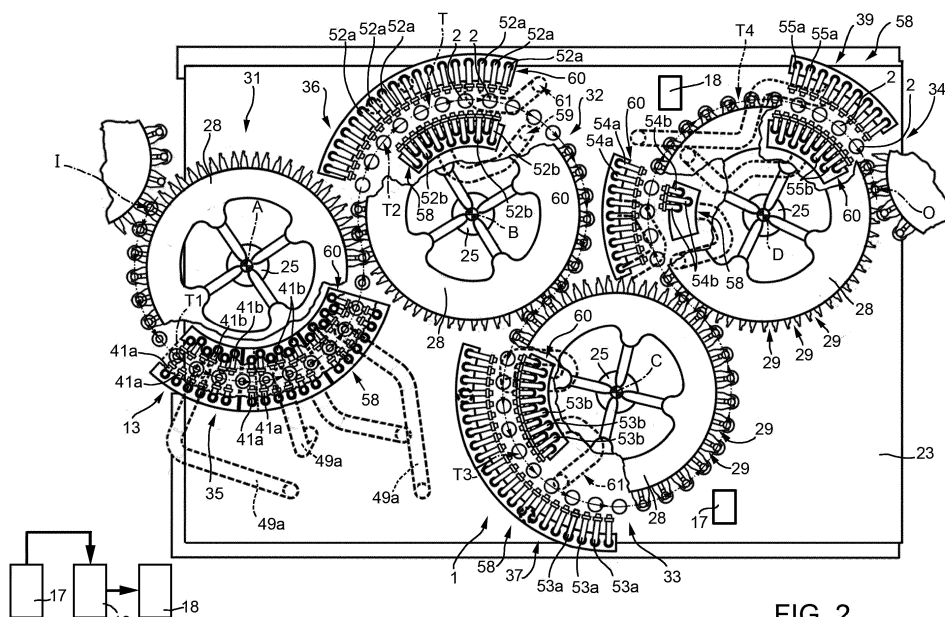


FIG. 2

Description

[0001] The present invention relates to a unit and a method for manufacturing articles filled with pourable products.

[0002] As is known, many pourable food product comprising not only food product like milk, fruit juice or beverages in general, but also detergents are sold in articles having different shape and dimension.

[0003] These articles are typically made within bottling units, which comprise a plurality of stations for carrying out respective operations on the articles.

[0004] Very briefly, the bottling unit comprises at least one rinsing station for rinsing the articles, one filling unit for filling the articles with a pourable food product, one capping station for applying a plurality of caps onto the respective articles and one labelling station for applying labels onto the outer surface of respective articles.

[0005] Though excellently performing, the known bottling units leave room for improvement.

[0006] In particular, the outer surface of the articles can get wet or dirty inside the filling unit, thus affecting the proper operation of the labelling unit.

[0007] Furthermore, the caps could not be precisely applied on the container, as regards to the position and the orientation of the caps, could be wet or even could have not been applied by the capping unit.

[0008] In all these situations, the labelling unit of the known bottling unit uselessly applies the labels onto defected containers.

[0009] US 2011/0108156 discloses a bottling unit according to the preamble of claim 1.

[0010] It is an object of the present invention to provide a unit for manufacturing articles filled with pourable products, which is designed to eliminate the drawbacks connected with the known units in a straightforward, relatively low-cost manner.

[0011] The aforementioned object is achieved by the present invention as it relates to a unit for manufacturing articles with a pourable product, as claimed in claim 1.

[0012] The invention also relates to a method for manufacturing articles filled with a pourable product, as claimed in claim 15.

[0013] One preferred embodiment is hereinafter disclosed for a better understanding of the present invention, by way of non-limitative example and with reference to the accompanying drawings, in which:

- Figure 1 is a schematic view of a unit for manufacturing articles filled with a pourable product in accordance with the present invention, with parts removed for clarity;
- Figure 2 is a top view of a transfer station of the unit of Figure 1, with parts removed for clarity;
- Figure 3 is a perspective view of the transfer station of the unit of Figure 2, with parts removed for clarity;
- Figure 4 is a top view of some components of the transfer station of Figures 2 and 3;

- Figure 5 is a bottom view of some components of the transfer station of Figures 2 to 4;
- Figures 6 and 7 are perspective bottom views taken along different visual angle and showing first nozzles of the transfer unit of Figures 2 to 5;
- Figure 8 is a perspective lateral view of second nozzles of the transfer unit of Figures 2 to 7 with second nozzles;
- Figure 9 is a perspective view of a star-wheel of the transfer unit of Figures 2 to 8 with third nozzles;
- Figure 10 is a perspective enlarged view of the third nozzles of Figure 9;
- Figures 11 and 12 are top view of fourth nozzles and fifth nozzles respectively;
- Figure 13 is a perspective view of a further component of the transfer station of Figures 2 to 11;
- Figure 14 shows a frontal view of the transfer unit of Figures 2 to 12; and
- Figure 15 shows a schematic sequence of the operation of first, second, third and fourth nozzles of the transfer unit of Figures 2 to 14.

[0014] With reference to Figure 1, numeral 1 indicates as a whole a unit for manufacturing articles 2 with a pourable product.

[0015] In particular, articles 2 extend about relative axes H and can be made of glass or of a plastic material and comprise, each, (Figure 15):

- a body 3, which defines a lateral surface of article 2;
- a neck 4 arranged on one side of body 3; and
- a bottom portion 5, which bounds body 3 on the opposite side of neck 4.

[0016] Unit 1 comprises, in sequence and in this order, (Figure 1) :

- a blowing station 10 for blowing articles 2 starting from respective not-shown pre-forms;
- a filling station 11 for filling articles 2 with the pourable product;
- a capping station 12 for applying a plurality of caps 15 onto relative articles 2;
- a drying station 13 for drying articles 2; and
- a labelling station 14 for applying relative labels onto articles 2.

[0017] Furthermore, unit 1 comprises a transfer station 16 for transferring articles 2 along a transfer path T and from capping station 12 to labelling station 14.

[0018] In the embodiment shown, filling station 11, capping station 12, drying station 13 and labelling station 14 are defined by only one machine.

[0019] In particular, each cap 15 comprises (Figure 15):

- a frame 20 which is screwed on neck 4 of relative article 2; and

- a ring seal (or tamper evidence ring) 21, which is integral with frame 20 when cap 15 is properly applied for the first time by capping station 12 and is detached by frame 20 when cap 15 is for the first time open and removed from neck 4 of article 2.

[0020] Advantageously, unit 1 comprises (Figures 2 and 3) an inspection device 17 and a discharge device 18, which are interposed between filling station 11 and labelling station 14;

inspection device 17 is adapted to inspect articles 2 and discharge device 18 is adapted to discharge those articles 2 which are not suitable to be conveyed to labelling station 14.

[0021] In greater detail, drying station 13, inspection device 17 and discharge device 18 are arranged along path T one after other and in this sequence.

[0022] Furthermore, drying station 13, inspection device 17 and discharge device 18 are stationary with respect to article 2 travelling along path T.

[0023] Inspection device 17 comprises, in the embodiment shown, at least one video-camera and extracts one or more images associated to each article 2 and relative caps 15 travelling along path T.

[0024] Inspection device 17 is in the embodiment shown, a high resolution video-camera.

[0025] Furthermore, inspection device 17 is adapted to check, for each article 2,:

- the position along axis H and/or the angular inclination about axis H of relative cap 15 applied thereon; and/or
- the presence or not of the relative cap 15; and/or
- the accidental detachment of ring 21 of relative caps 1 from relative frame 20; and/or
- whether or not cap 15 are wet; and/or
- the level of pourable product inside article 2.

[0026] In particular, inspection device 17 is adapted to control that the level of the pourable product inside articles 2 is not lower than a given level, as a result of a damage in bodies 3 of same articles 2.

[0027] Unit 1 also comprises a control unit 19 (only schematically shown in Figure 3), which is programmed, for each article 2 travelling along path T, to:

- receive the images extracted by inspection device 17; and
- generate, on the basis of the extracted images, a control signal for discharge device 18.

[0028] Path T comprises:

- an inlet station I, at which transfer station 16 receives articles 2 from capping station 12;
- an outlet station O, at which transfer station 16 outputs articles 2 to be labelled to labelling station 14; and

- a plurality of consecutive and adjacent arc-shaped portions T1, T2, T3, T4, and extend between inlet station I and outlet station O.

[0029] Path T preferably does not comprise any straight portion.

[0030] Drying station 13 is adapted to dry articles 2 and relative caps 15, as articles 2 travel along portions T1, T2, T3, T4 of path T.

[0031] Inspection device 17 is adapted to inspect articles 2 along portion T3 of path T; and discharge device 18 discharges those article 2 that are unsuitable to be fed to labelling station 14 along portion T4 of path T.

[0032] Discharge device 18 is selectively arranged, on the basis of the control signal generated by control unit 19, either in a first position in which it allows article 2 suitable to be labelled to advance along portion T4 of path T, or in a second position in which it prevents article 2 not suitable to be labelled from advancing along portion T4 of path T.

[0033] In the embodiment shown, discharge device 18 is of the type shown in the European patent application 014167076 in the name of the same Applicant.

[0034] Furthermore, discharge device 18 comprises a chute 24 (Figure 3) interposed along portion T4 of path T between dryers 38, 39 and adapted to allow articles 2 discharge by discharge device 18 to move away from transfer station 16 and unit 1 towards a not-shown waste station.

[0035] Transfer station 16 comprises:

- a frame 22, which rests on the ground by means of a plurality of pedestals;
- a table 23; and
- a plurality of star-wheels 31, 32, 33, 34, four in the embodiment shown, which convey articles 2 along respective portions T1, T2, T3, T4 of path T and are rotatable with respect to table 23 about relative axes A, B, C, D parallel to one another.

[0036] Each star-wheel 31, 32, 33, 34 comprises:

- a motor-reducer 25;
- a shaft driven in rotation by motor-reducer 25 about respective axes A;
- a body 28 angularly integral with shaft; and
- a plurality of pairs of gripping members 29 (Figure 2) which are fixed to body 28.

[0037] Table 23 defines a plurality of seats, which extend about respective axes A, B, C, D and house respective motor-reducers 25 of corresponding star-wheel 31, 32, 33, 34.

[0038] The gripping members 29 of each pair are movable between:

- a respective open position, in which they allow the enter/exit of a relative article 2; and

- a respective closed position, in which they firmly grip neck 4 of relative article 2.

[0039] In the embodiment shown, motor-reducers 25 are brushless.

[0040] Star wheels 31, 34 define respectively inlet station I and outlet station O.

[0041] Star wheels 31, 32, 33, 34 define respectively T1, T2, T3, T4 of path T.

[0042] In particular, drying station 13 comprises, proceeding from inlet station I to outlet station O,:

- a dryer 35, which is adapted to dry necks 4 and bottoms 5 of articles 2 and caps 15 applied on articles 2, as the latter are travelling along portion T1 of path T and conveyed by star-wheel 31;
- a dryer 36, which is adapted to dry bodies 3 of articles 2, as the latter are travelling along portion T2 of path T and are conveyed by star-wheel 32;
- a dryer 37, which is adapted to dry bodies 3 of articles 2, as the latter are travelling along portion T3 of path T and are conveyed by star-wheel 33; and
- a pair of dryers 38, 39, which are adapted to dry bodies 3 of articles 2, as the latter are travelling along portion T4 of path T and are conveyed by star-wheel 34.

[0043] In greater detail, dryer 37 is arranged upstream of inspection device 17, proceeding along portion T3 of path T according to the advancing direction of articles 2.

[0044] Discharge device 18 is interposed between dryers 38, 39, proceeding along portion T4 of path T according to the advancing direction of articles 2.

[0045] With reference to Figures 4, 5, 6, 8 and 13, dryer 35 comprises:

- a fan 40, which is operated to create an air current;
- a plurality of nozzles 41a, 41b (Figure 7), which are fed by fan 40 and are adapted to convey air current on both lateral sides of necks 4 and caps 15 applied thereto of respective articles 2 travelling along portion T1;
- a plurality of nozzles 42 (Figure 7), which are fed by fan 40 and are adapted to convey air current on caps 15 of articles 2 travelling along portion T1;
- a plurality of nozzles 43 (Figure 8), which are fed by fan 40 and are adapted to convey air current on bottoms 5 of articles 2 travelling along portion T1; and
- a fluidic circuit 44 (Figure 4) for fluidly connecting fan 40 with nozzles 41a, 41b, 42, 43.

[0046] Fluidic circuit 44 comprises, in turn,:

- a box 46 (Figure 4), which is fluidly connected by means of a duct 47 to fan 40;
- a plurality of arc-shaped boxes 48a, 48b, 48c (Figure 7), which are fluidly connected by means of respective ducts 49a to box 46 and which are fluidly con-

nected to nozzles 41a, 41b; 42; and

- an arc-shaped box 30 (Figure 8), which is fluidly connected by means of a duct 49b to box and which is fluidly connected to nozzle 43.

[0047] Fan 40 is arranged on the opposite side, bottom side in the embodiment shown, of table 23 with respect to bodies 28 of star-wheels 31, 32, 33, 34.

[0048] Boxes 48a, 48b, 48c are arranged on the same side, top side in the embodiment shown, of table 23 as bodies 28 of star-wheels 31, 32, 33, 34.

[0049] Box 46 is integrally defined by table 23 and is embedded inside table 23.

[0050] Boxes 48a, 48b, 48c are also fixed to table 23 above, in the embodiment shown, box 46.

[0051] Each box 48a, 48b, 48c comprises (Figures 6 and 7):

- a relative top wall 51a, which lies on a plane orthogonally to axis A and through which relative duct 49a enters;
- a relative bottom wall 51b, which is parallel to wall 51a and from which nozzles 41a, 41b; 42 downwardly protrude.

[0052] In the embodiment shown in Figure 7, only one nozzle 42 downwardly protrudes from each box 48a, 48b, 48c and a plurality of pairs of nozzles 41a, 41b protrude from each box 48a, 48b, 48c.

[0053] Still more precisely, each box 48a, 48b, 48c comprises, proceeding according to the advancing direction of articles 2 along portion T1 of path T (Figure 7):

- a pair of nozzles 41a; and
- a plurality, five in the embodiment shown, of pairs of nozzles 41a and 41b facing one another.

[0054] With reference to Figures 5 to 7, boxes 30; 48a, 48b, 48c and star-wheel 31 are mutually arranged in such a way that:

- the mouths of nozzles 42 are aligned with the trajectory of axes H of articles 2 travelling along portion T1 of path T and are aligned with the trajectory of relative caps 15 of same articles 2;
- the mouths of nozzles 41a, 41b are arranged on opposite radial sides of the trajectory of necks 4 of articles 2 travelling along portion T1 of path T; and
- the mouths of nozzles 43 face parallel to axes A, H the trajectory of bottoms 5 of articles 2 travelling along portion T1 of path T.

[0055] Mouths of nozzles 41a, 41b; 42, 43 are arranged at the same position parallel to axis A with respect to body 28 of star-wheel 31 and table 23.

[0056] In particular, nozzles 43 are arranged (Figure 8) in two groups, which are circumferentially spaced around axis A and radially extend with respect to axis A.

[0057] Nozzles 43 have respective mouths open parallel to axis A and directed towards bottoms 5 of articles 2.

[0058] The mouths of nozzles 43 are also parallel to axes H of articles 2 travelling on star-wheel 31.

[0059] Nozzles 41a, 41b are arranged (Figure 6) radially externally and radially internally with respect to articles 2.

[0060] Nozzles 41a, 41b have respective mouths slightly inclined with respect to a direction radial to axis A.

[0061] The mouths of nozzles 41a are directed towards axis A, while the mouths nozzles 41b are directed on the opposite sides of axis A.

[0062] The mouths of nozzles 41a, 41b face respectively radially external and radially internal regions of necks 4 of articles 2 and cap 15 applied thereto, with respect to axis A.

[0063] Furthermore, the mouths of nozzles 41a, 41b are arranged on opposite sides of axes H of articles 2 travelling along portion T1 of path T and along star-wheel 31.

[0064] Nozzles 42 have respective mouths open axially with respect to axis A and directed towards caps 15 of articles 2.

[0065] The mouths of nozzles 42 are directed parallel to axes H of articles 2 travelling along portion T1 of path T.

[0066] Box 30 is interposed between boxes 48b and table 23, proceeding parallel to axis A.

[0067] Box 30 comprises (Figure 8):

- a radially outer wall 50a, through which enters duct 49b; and
- a top wall 50b, which lies on a plane orthogonally to axis A, lies below articles 2 travelling along portion T1 of path T, faces box 48b parallel to axis A, and comprises a pair of radially extending open slots 62 inside which nozzles 43 are housed and relative mouths are open.

[0068] Boxes 48a, 48b, 48c comprise respective pressure sensors 27a (only one of which is shown in Figure 7).

[0069] Box 30 comprise a pressure sensor 27b, which is shown in Figure 8.

[0070] Each dryer 36, 37; 38, 39 comprises (Figures 2, 3 and 13) :

- a respective fan 40 which are operated to create an air current;
- a respective plurality of nozzles 52a, 52b; 53a, 53b; 54a, 54b; 55a, 55b, which are fed by respective fan 40 and are adapted to convey air on both sides of respective bodies 3 of articles 2 travelling on respective portion T2, T3; T4 of path T; and
- a respective fluidic circuit 56 for fluidly connecting relative fan 40 with respective plurality of nozzles 52a, 52b; 53a, 53b; 54a, 54b; 55a, 55b.

[0071] Each fluidic circuit 56 comprises, in turn, (Figures 2, 4 and 10):

- a box 57, which defines a hollow body fluidly connected with relative fan 40;
- an arc-shaped box 58, which is fluidly connected by means of relative ducts 59 to relative box 57 and which is fluidly connected to relative nozzles 52a, 53a; 54a, 55a; and
- an arc-shaped box 60, which is fluidly connected by means of relative ducts 61 to relative box 57 and which is fluidly connected to relative nozzles 52b, 53b; 54b, 55b.

[0072] Fan 40 of each fluidic circuit 56 is arranged on the opposite side, bottom side in the embodiment shown, of table 23 with respect to bodies 28 of star-wheels 32, 33, 34. Boxes 57 are integrally defined by table 23 and are embedded inside table 23.

[0073] Boxes 58, 60 are fitted to table 23 on the same side, top side in the embodiment shown, of bodies 28 of star-wheels 32, 33, 34.

[0074] In particular, each pair of boxes 58, 60 (Figure 10) of the same fluidic circuit 56 face one another along a radial direction with respect to relative axis B, C, D.

[0075] Each pair of boxes 58 and 60 are arranged respectively radially outer and inner with respect to the trajectory of articles 2 along respective portion T2, T3 and T4 of path T.

[0076] Still more precisely, boxes 58 are arranged radially outer with respect to bodies 28 of relative star-wheels 32, 33; 34 while boxes 60 are arranged radially inner with respect to bodies 28 of relative star-wheels 32, 33; 34.

[0077] Boxes 58, 60 and respective nozzles 52a, 52b; 53a, 53b; 54a, 54b; 55a, 55b are arranged below bodies 28 of star-wheels 32, 33; 34 along axis B, C; D.

[0078] Each box 58, 60 comprises, in turn,:

- a relative top wall 63, from which respective nozzles 52a, 52b; 53a, 53b; 54a, 54b; 55a, 55b upwardly protrude;
- a relative bottom wall 64, which is opposite to wall 63 parallel to axis A;
- a relative radially inner wall 65; and
- a relative radially outer wall 66, which is opposite to wall 65 along a radial direction with respect to axis A.

[0079] In greater detail, walls 63, 64 lie on relative planes orthogonal to axis A.

[0080] Wall 65 of box 58 faces wall 66 of box 60.

[0081] Nozzles 52a, 52b; 53a, 53b; 54a, 54b; 55a, 55b comprise respective mouths which are slightly inclined with respect to a radial direction to axis A and define obtuse angles with respect to axes H of articles 2 travelling on portion T1 of path T.

[0082] Mouths of nozzles 52a, 53a, 54a, 55a are directed towards axis A while mouths of nozzles 52a, 53a, 54a, 55a on the opposite side of axis A.

[0083] Furthermore, mouths of nozzles 52a, 52b; 53a, 53b; 54a, 54b; 55a, 55b are arranged at decreasing dis-

tance measured parallel to relative axis B, C; D from table 23 and, therefore, at increasing distances parallel to axis from bodies 28 of relative star-wheels 32, 33; 34.

[0084] Accordingly, nozzles 52a, 52b; 53a, 53b; 54a, 54b; 55a, 55b eject air on regions of respective bodies 3 of articles 2 arranged progressively closer to relative bottoms 5, as articles 2 advance along relative portions T2; T3; T4 of path T.

[0085] As regards to dryer 36, the angular extension about axis B of box 58 is larger than that of box 60 (Figure 10).

[0086] In particular, box 58 comprises (Figure 10), proceeding along portion T2 according to the advancing direction of articles 2,:

- a first body 67 which is angularly staggered from box 60; and
- a second body 68 facing box 60.

[0087] Nozzles 52a, 52b carried by body 68 of box 58 and box 60 are substantially aligned radially to axis A.

[0088] Box 58 of dryer 36 comprises a pair of pressure sensors 69a and box 60 comprises a further pressure sensor 69b (Figures 9 and 10).

[0089] As regard to dryer 37, the angular extension about axis C of box 58 is larger than that of box 60.

[0090] In particular, box 58 comprises (Figures 11), proceeding along portion T3 according to the advancing direction of articles 2,:

- a first portion 70a, which faces box 60; and
- a second portion 70b, which is angularly staggered from box 60.

[0091] Nozzles 53a, 53b carried by portion 70a of box 58 and box 60 are substantially aligned radially to axis B.

[0092] Box 58 of dryer 37 comprises pair of pressure sensors 71a and box 60 of dryer 37 comprises a pressure sensor 71b.

[0093] Ducts 59, 61 of dryer 37 enter through respective walls 64 of boxes 58, 60 of dryer 37.

[0094] As regard to dryer 38, the angular extension about axis D of box 58 is larger than that of box 60.

[0095] In particular, box 58 comprises (Figure 12), proceeding along portion T4 according to the advancing direction of articles 2,:

- a first portion 72, which is angularly staggered from box 60 of dryer 38; and
- a second portion 73, which faces box 60 of dryer 38.

[0096] Nozzles 54a, 54b carried by portion 73 of box 58 and box 60 are substantially aligned radially to axis C.

[0097] Box 58 of dryer 38 comprises a pressure sensor 74 and box 60 of dryer 38 comprises a pressure sensor 75.

[0098] As regard to dryer 39, boxes 58, 60 have substantially the same angular extensions about axis D.

[0099] Nozzles 55a, 55b carried by box 58 and box 60 are substantially aligned radially to axis D.

[0100] Box 58 of dryer 39 comprises a pressure sensor 78 and box 60 of dryer 39 comprises a pressure sensor 77.

[0101] Sensors 27a and 27b; 69a, 69b; 71a, 71b; 75, 74; 78, 77 are only schematically shown in the enclosed Figures and are adapted to detect the air flow inside respectively boxes 48a, 48b, 48c and 30; and boxes 58, 60 of dryers 36; 37; 38; 39.

[0102] Each fan 40 of dryer 35, 36, 37, 38, 39 comprises (Figure 13):

- a respective inlet 80; and
- a respective outlet 79, which is fluidly connected to relative box 57.

[0103] Furthermore, transfer station 16 comprises a plurality of housings 82 for respective fans 40.

[0104] Each housing 82 is box-shaped, is supported on the ground by a pair of retractable pedestals 83 and is also connected to frame 22 by columns 83a. A wheel 84 and a wheel 85 which can be turned about its own rotation axis may be provided according to the needs.

[0105] Each housing 82 further comprises (Figure 13):

- a wall 86, which lies on a vertical plane in the embodiment shown and defines a hole for outlet 79 of relative fan 40; and
- a wall 87, which is opposite to wall 86 and comprises a plurality of passages 88 for air, so as to cool relative fan 40.

[0106] Unit 1 finally comprises an extraction unit 90 for extracting hot air which can contain droplets from transfer station 16 (Figure 14).

[0107] In particular, extraction unit 90 is arranged at the top of frame 22.

[0108] Furthermore, extraction unit 90 comprises:

- a trapezoidal hood 89;
- a pair of fans 91 for creating a circulation of inside transfer station 16 and avoiding the stagnation of air with impurities; and
- a pair of discharges 92, which are operatively connected to relative fan 91 and are adapted to allow the air from evacuating the top portion of transfer station 16.

[0109] The operation of unit 1 is described with reference to only one article 2 and to the relative only one pre-form.

[0110] In particular, article 2 is, in this sequence, blown from pre-form inside blowing station 10, is filled with pourable product inside filling station 11, is capped with cap 15 inside capping station 12, is transferred along path T inside transfer station 16, and is labelled with a label inside labelling station 14.

[0111] Still more precisely, capping station 12 applies cap 15 onto neck 4 of article 2.

[0112] In case of proper application, frame 20 and ring 21 of applied cap 15 remain integral to one another, as article 2 is transferred inside transfer station 16 along path T.

[0113] Differently, in case of not proper application of caps 15 onto relative articles 2, frame 20 and relative ring 21 are not integral to one another, as article 2 is transferred inside transfer station 16 along path T.

[0114] Furthermore, in case of damage of body 3 of article 2, the level of the pourable liquid inside damaged article 2 is lower than the reference level with which articles 2 are filled inside filling station 11 and which is stored inside control unit 19.

[0115] In greater detail, article 2 enters transfer station 16 at inlet station I defined by star-wheel 31, is conveyed along consecutive portions T1, T2, T3, T4 by respective star-wheels 31, 32, 33, 34 and exits from transfer station 16 at station O defined by star-wheel 34.

[0116] As article 2 moves along path T, it undergoes the following operation in this sequence.

[0117] As article 2 is conveyed by star-wheel 31 along portion T1 of path T, neck 4 and bottom 5 of article 2 and cap 15 are dried by dryer 35.

[0118] In particular, nozzles 41a, 41b eject an air flow onto opposite lateral sides of neck 4 and cap 15 applied thereto and on respective opposite lateral side thereof, nozzles 42 eject an air flow onto the top side of cap 15 and nozzles 43 eject an air flow onto bottom 5 of article 2.

[0119] The mouths of nozzles 41a, 41b respectively eject the air flow onto a radially external and radially internal portion of cap 15. More precisely, the air flow ejected by the mouths of nozzles 41a, 41b, which define respective acute angles with respect to axis A and respective obtuse angle with respect to axis H of article 2.

[0120] Still more precisely, fan 40 of dryer 35 generates an air flow, which reaches box 46.

[0121] A first portion of the airflow then flows from box 46 to arc-shaped boxes 48a, 48b, 48c and, therefore to nozzles 41a, 41b; 42.

[0122] A second portion of the airflow then flows from box 46 to box 30 and, therefore to nozzles 43.

[0123] The air current flow is then conveyed from box 46 to nozzles 43 and from box 48a, 48b, 48c to respective nozzles 41a, 41b, 42.

[0124] Afterwards, as article 2 is conveyed by star-wheel 32 along portion T2 of path T, body 3 of article 2 is dried by dryer 36.

[0125] As article 2 is conveyed by star-wheel 33 along portion T3 of path T, at first body 3 of article 2 is dried by dryer 37 and then article 2 is inspected by inspection device 17. In particular, inspection device 17 visually checks:

- the axial position and/or the angular inclination with respect to axis H of cap 15 applied onto said articles 2; and/or

- the presence or not of cap 15 onto article 2; and/or
- the accidental detachment of ring 21 of cap 15 from relative frame 20; and/or
- whether or not cap 15 is wet; and/or
- the level of pourable product inside article 2.

[0126] In particular, inspection device 17 is adapted to control that the level of the pourable product inside articles 2 is not lower than the reference level, as a result of a damage in bodies 3 of same articles 2.

[0127] Control unit 19 receives the images of article 2 extracted by inspection device 17 and generates, on the basis of the extracted images, a control signal for discharge device 18 arranged along portion T4 of path T.

[0128] In particular, control signal is such that:

- in case article 2 is suitable to be labelled inside labelling station 14, discharge device 18 does not interfere with the advancement of article 2 along portion T4; and
- in case article 2 is not suitable to be labelled inside labelling station 14, discharge device 18 discharges article 2 travelling along portion T4 by means of chute 24.

[0129] As article 2 is conveyed by star-wheel 34 along portion T4 of path T,:

- at first, body 3 of article 2 is dried by dryer 38;
- then article 2 not suitable to be labelled inside labelling station 14 are discharged from star-wheel 34 by discharge device 18; and
- finally, body 3 of article is again dried by dryer 39.

[0130] In particular, the mouths of nozzles 52a, 52b; 53a, 53b; 54a, 54b, and 55a, 55b of relative dryers 36; 37; 38; 39 eject the air flow onto respective opposite lateral sides of body 3 of articles 2 travelling onto respective portions T2, T3, T4 of path T and conveyed by respective star-wheels 32, 33, 34.

[0131] Furthermore, the mouths of nozzles 52a, 52b; 53a, 53b; 54a, 54b, and 55a, 55b of relative dryers 36; 37; 38; 39 are arranged at progressive increasing axial distances from neck 4 and at progressive decreasing axial distances from bottom 5, as article 2 is advanced on respective portions T2, T3, T4 of path T by respective star-wheels 32, 33, 34 (Figure 14)

[0132] Accordingly, article 2 is repeatedly axially dried from neck 4 to bottom 5 parallel to axis H, as articles 2 advances on portions T2, T3, T4 of path T and is conveyed by respective star-wheels 32, 33, 34.

[0133] Furthermore, as article 2 is advanced along portion T2 of path T by star-wheel 32, body 3 is at first dried only by nozzles 52a carried by body 67 of box 58 of dryer 36, and then dried by both nozzles 52a and 52b facing one another and carried by body 68 of box 58 and body 60 of dryer 36 (Figure 9) .

[0134] As article 2 is advanced along portion T3 of path

T by star-wheel 33, body 3 is at first dried by both nozzles 53a and 53b facing one another and carried by body 70b of box 58 and body 60 of dryer 36, and then dried only by nozzles 53a carried by body 70a of box 58 of dryer 36 (Figure 11).

[0135] As article 2 is advanced by star-wheel 34 along portion T4 of path T, body 3 is at first dried only by nozzles 54a carried by portion 72 of box 58 of dryers 38; 39 and then dried by both nozzles 54a and 54b facing one another and carried by portion 72, 73 of box 58 and box 60 (Figure 12).

[0136] Then, article 2 is either discharged by discharge device 18 by means of chute 24 if not suitable to be labelled in labelling station 14, or conveyed to dryer 39.

[0137] Finally, body 3 is dried only by nozzles 55a, 55b facing one another radially to axis D and carried respectively by boxes 58, 60 of dryers 39.

[0138] In particular, fan 40 of dryer 36, 37; 38, 39 generates an air flow, which reaches box 57, and, then boxes 58, 60 and relative nozzles 52a, 53a; 54a, 55a and 52b, 53b; 54b, 55b.

[0139] Fans 40 are cooled by passages 88.

[0140] Fans 91 of extraction unit 90 is effective in discharging the air from the top of frame 22 by means of discharges 92.

[0141] Sensors 27a and 27b; 69a, 69b; 71a, 71b; 75, 74; 78, 77 detect the air flow inside respective boxes 48a, 48b, 48c and 30 of dryer 35 and respective boxes 58, 60 of dryers 36, 37, 38, 39.

[0142] Star-wheel 34 outputs articles 2 dried and suitable to be labelled at station O, from which they are conveyed inside labelling station 14.

[0143] From an analysis of the features of unit 1 and method made according to the present invention, the advantages it allows to obtain are apparent.

[0144] In particular, inspection device 17 inspects articles 2, as the latter are conveyed by transfer station 16 along curved path T.

[0145] In this way, on one hand, inspection device 17 ensures that articles 2 which are not suitable to be labelled in labelling station 14, e.g. because respective bodies 3 are damaged or because caps 15 have not been properly positioned or rings 21 have been detached from relative frames 20, are not conveyed by labelling station 14, thus optimizing the efficiency of labelling station 14 and, therefore, of whole unit 1.

[0146] On the other hand, the inspection of articles 2 does not require a further dedicated linear station distinct from transfer station 14, thus reducing the whole size of unit 1 and simplifying the layout thereof.

[0147] Furthermore, unit 1 comprises a discharge device 18, which discharges articles 2 which are not suitable to be labelled along path T.

[0148] In this way, the discharge of articles 2 not suitable to be labelled does not require a further dedicated linear station distinct from transfer station 14, thus further reducing the whole size of unit 1 and further simplifying the layout thereof.

[0149] Transfer station 16 comprises star-wheels 31, 32, 33, 34, which convey articles 2 gripped on respective necks 4 along respective portions T1, T2, T3, T4 of path T.

[0150] Therefore, inspection device 17 inspects articles 2 as the latter are gripped on respective necks 4 and conveyed by star-wheel 33, and discharge device 18 discharges articles 2 as the latter are gripped on respective necks 4 and conveyed by star-wheel 34.

[0151] In this way, the inspection of articles 2 and the discharge of articles 2 does not create a need for a more complex transfer station 16, thus containing the overall cost of unit 1.

[0152] Furthermore, unit 1 comprises a plurality of dryers 35, 36, 37, 38, 39, which are arranged along path T, and progressively and repeatedly dry necks 4, caps 15 and bodies 3 of articles 2 travelling on this path T.

[0153] It is therefore ensured that labelling station 14 is fed with dried articles 2 and can therefore properly operate.

[0154] Finally, it is apparent that modifications and variants not departing from the scope of protection of the claims may be made to unit 1 and to the method.

[0155] In particular, nozzles 41a, 41b, 42, 43; 52a, 52b; 53a, 53b; 54a, 54b, 55a, 55b. could be used to eject a water flow onto articles 2 travelling along respective portions T1, T2, T3, T4 of path T.

[0156] In this case, fans 40 would be replaced by corresponding pumps.

[0157] Furthermore, the number of drying stations 13, inspection devices 17 and ejection station 18 can be varied according to the needs, such as for example increasing production speeds.

Claims

1. A unit (1) for manufacturing articles (2) filled with a pourable product, comprising:

- a filling station (11), which is adapted to fill said articles (2) with said product;
 - a labelling station (14), which is adapted to apply a plurality of labels onto said articles (2) and is arranged downstream of said filling station (11), proceeding according to the advancing direction of said article (2);
 - a drying assembly (13), which is adapted to dry said articles (2) and is interposed between said filling station (11) and labelling station (14); and
 - a transfer station (16), which is interposed between said filling station (11) and said labelling station (14) and is adapted to transfer said articles (2) along a curved path (T) from said filling station (11) to said labelling station (14);
- characterized by** comprising an inspection device (17) and a discharge device (18), which are interposed between said filling station (11) and

- said labelling station (14);
 said inspection device (17) being adapted to inspect said articles (2) as the latter travel along said path (T);
 said discharge device (18) being adapted to discharge said articles (2) which are not suitable to be labelled.
2. The unit of claim 1, **characterized in that** said inspection device (17) captures, in use, an image of each said article (2).
3. The unit of claim 1 or 2, **characterized in that** said discharge device (18) is adapted to discharge said articles (2), as the latter (2) are advanced along said path (T).
4. The unit of any one of the foregoing claims, **characterized in that** said drying assembly (13; 35, 36, 37, 38, 39) is arranged in part (35, 36, 37) upstream of said inspection device (17) and in part (38, 39) downstream of said inspection device (17), proceeding according to the advancing direction of said articles (2) along said path (T); and/or **characterized in that** said drying assembly (13; 35, 36, 37, 38, 39) is arranged in part (35, 36, 37, 38) upstream of said discharge device (18) and in part (39) downstream of said discharge device (18), proceeding according to the advancing direction of said articles (2) along said path (T).
5. The unit of any one of the foregoing claims, **characterized in that** said drying assembly (13; 35, 36, 37, 38, 39) comprises:
- a first dryer (35), which is adapted to dry, in use, a neck (4), a cap (15) and a bottom (5) of each said article (2) travelling along said path (T); and
 - at least one second dryer (36, 37, 38, 39), which is adapted to dry in use, a body (3) of each said article (2) travelling along said path (T).
6. The unit of claim 5, **characterized in that** said first dryer (35) is arranged upstream of said at least one second dryer (36, 37, 38, 39), proceeding according to the advancing direction of said article (2) along said path (T).
7. The unit of any one of the foregoing claims, **characterized in that** said transfer path (T) comprises:
- an inlet (I), which receives, in use, said articles (2) coming from said filling station (11);
 - an outlet (O), which outputs, in use, said articles (2) directed to said labelling station (14); and
 - a plurality of consecutive and adjacent arc-shaped portions (T1, T2, T3, T4), which extends
- without interposition of straight portions from said inlet station (I) to said outlet station (O).
8. The unit of claim 7, **characterized in that in that** said transfer station (16) comprises:
- a base (22, 23); and
 - a plurality of adjacent and consecutive rotary transfer elements (31, 32, 33, 34), which define said transfer path (T) and are rotatably supported by said base (22, 23);
- each said rotary transfer element (31, 32, 33, 34) comprising a plurality of relative gripping elements (29), which grip, in use, said neck (4) of relative article (2).
9. The unit of claim 8, **characterized in that** said transfer station (16) comprises, proceeding along said path (T), :
- a first rotary transfer element (31) defining said inlet station (I) and rotatable about a first axis (A);
 - a second rotary transfer element (32), which is rotatable about a second axis (B);
 - a third rotary transfer element (33), which is rotatable about a third axis (C); and
 - a fourth rotary transfer element (34), which is rotatable about a fourth axis (D) and defines said outlet station (O);
- said first dryer (35) being adapted to dry, in use, said articles (2), as the latter are travelling on said first rotary transfer element (31);
 said second dryer (36) being adapted to dry, in use, said articles (2), as the latter are travelling on said second rotary transfer element (32);
 said unit (1) further comprising:
- a third dryer (37), which is adapted to dry, in use, said articles (2), as the latter are travelling on said third rotary transfer element (33); and
 - a fourth dryer (38) and a fifth dryer (39), which are adapted to dry, in use, said articles (2), as the latter are travelling on said fourth rotary transfer element (34);
- said inspection device (17) being arranged to check out, in use, said articles (2), as the latter are travelling on said third rotary transfer element (33), and being arranged upstream of said inspection device (17), proceeding along said path (T) according to the advancing direction of said articles (2);
 said discharge device (18) being adapted to selectively discharge said articles (2), as the latter are travelling on said fourth rotary transfer element (34) and being interposed between said fourth dryer (38) and said fifth dryer (39).
10. The unit of claim 9, **characterized in that** at least one of said second, third, fourth and fifth dryer (36,

37, 38, 39) comprises a plurality of first nozzles (52a, 52b; 53a, 53b; 54a, 54b; 55a, 55b), which are arranged circumferentially about said corresponding second, third and fourth axis (B, C, D); said first nozzles (52a, 52b; 53a, 53b; 54a, 54b; 55a, 55b) being arranged at a progressively lower position with respect to said corresponding second, third and fourth axis (B, C, D), proceeding according the advancing direction of said articles (2) along said path (T).

11. The unit of claim 10, **characterized in that** said first nozzles (52a, 52b; 53a, 53b; 54a, 54b; 55a, 55b) are arranged, in use, in pairs; each pair comprising:

- one said first nozzle (52a; 53a; 54a; 55a, 55b), which is arranged, in use, radially outer with respect to the trajectory of said articles (2), proceeding radially to said corresponding second, third and fourth axis (B, C, D); and
- another said first nozzle (52b; 53b; 54b; 55b), which is arranged, in use, radially inner with respect to the trajectory of said articles (2), proceeding radially to said corresponding second, third and fourth axis (B, C, D).

12. The unit of any one of claim 9 to 11, **characterized in that** said first dryer (35) comprises:

- a plurality of second nozzles (41a, 41b), which are arranged circumferentially around said first axis (A) and adapted to eject a first air flow transversally to said first axis (A); said first air flow being directed, in use, on said necks (4) and said caps (15) of said articles (2); and
- a plurality of third nozzles (43), which are arranged circumferentially around first axis (A) and are adapted to eject a second air flow parallel to said axis (A); said second air flow being directed, in use, on a bottom (5) of said articles (2); and
- a plurality of fourth nozzles (42), which are arranged along an arc about said first axis (A) and are adapted to eject a third air flow parallel to said axis (A) on said cap (15); said third air flow being directed, in use, on said cap (15); said second air flow and said third air flow being directed opposite to one another.

13. The unit of claim 12, **characterized in that** said second nozzles (41a, 41b) are arranged, in use, in pairs; each pair comprising:

- one said second nozzle (41a), which is arranged, in use, radially outer with respect to the trajectory of said articles (2), proceeding radially to said first axis (A); and

- another said second nozzle (41b), which is arranged, in use, radially inner with respect to the trajectory of said articles (2), proceeding radially to said first axis (A).

14. The unit of anyone of the foregoing claims, **characterized by** comprising a capping station (12), which is interposed between said filling station (11) and said transfer station (16), along the advancing direction of said articles (2); said inspecting device (17) being adapted to inspect at least one parameter of:

- the position and/or the inclination of the caps applied onto said articles (2); and/or
- the presence or not of said caps (15) applied onto said articles (2); and/or
- whether or not said caps (15) is wet; and/or
- the level of said pourable product inside said articles (2).

15. A method for manufacturing articles (2) filled with pourable product, comprising the steps of:

- i) filling said articles (2) with said pourable product inside a filling station (11);
- ii) drying said articles (2) after said step i);
- iii) applying a plurality of labels onto respective articles (2) inside a labelling station (14) after said step ii); and
- iv) transferring said filled articles (2) from said filling station (11) to said labelling station (14) and along a curved path (T);

characterized in that said step iv) comprises the steps:

- v) inspecting said articles (2); and
- vi) discharging those articles (2) which are not suitable to be labelled.

16. The method of claim 15, **characterized by** comprising a step vii) of gripping a neck (4) of said article (2) during said step i) and ii).

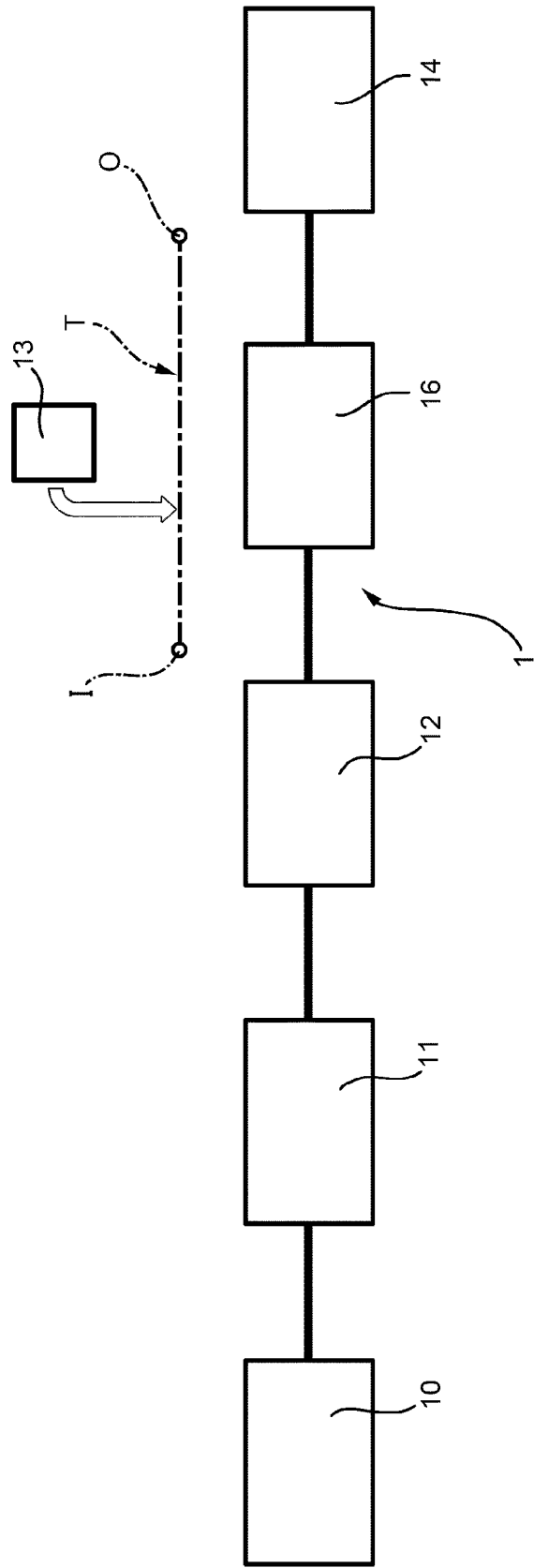


FIG. 1

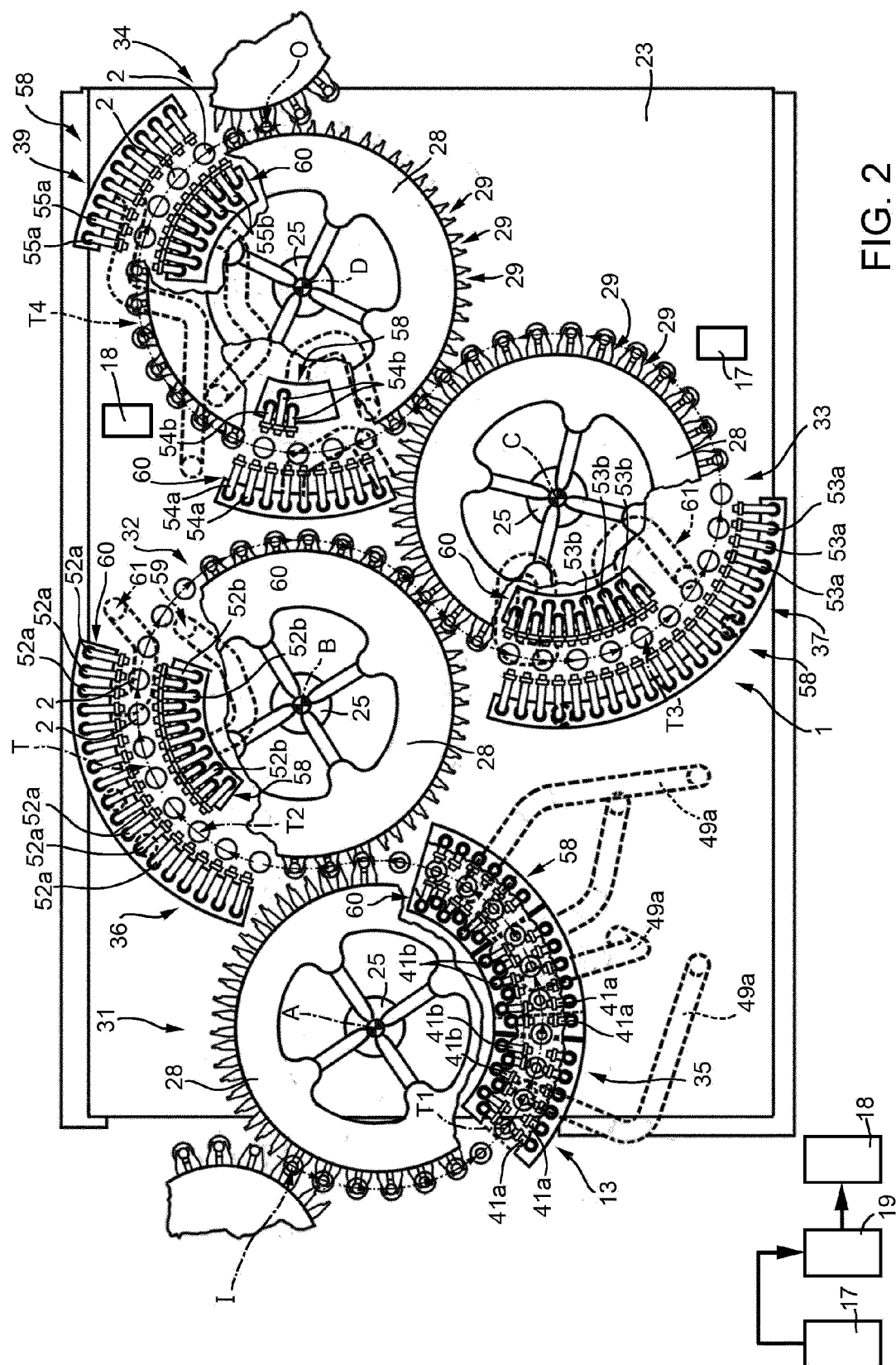
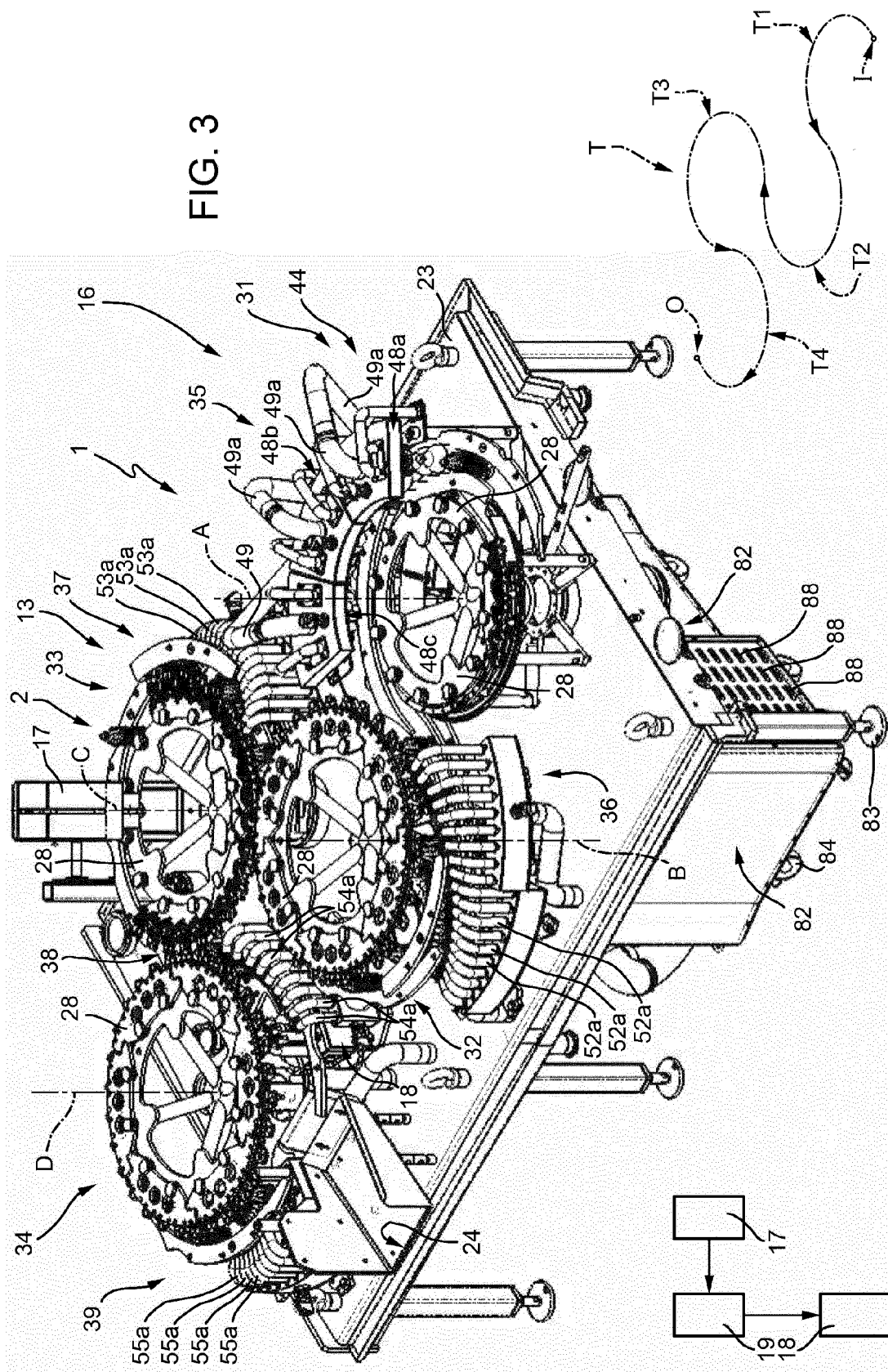
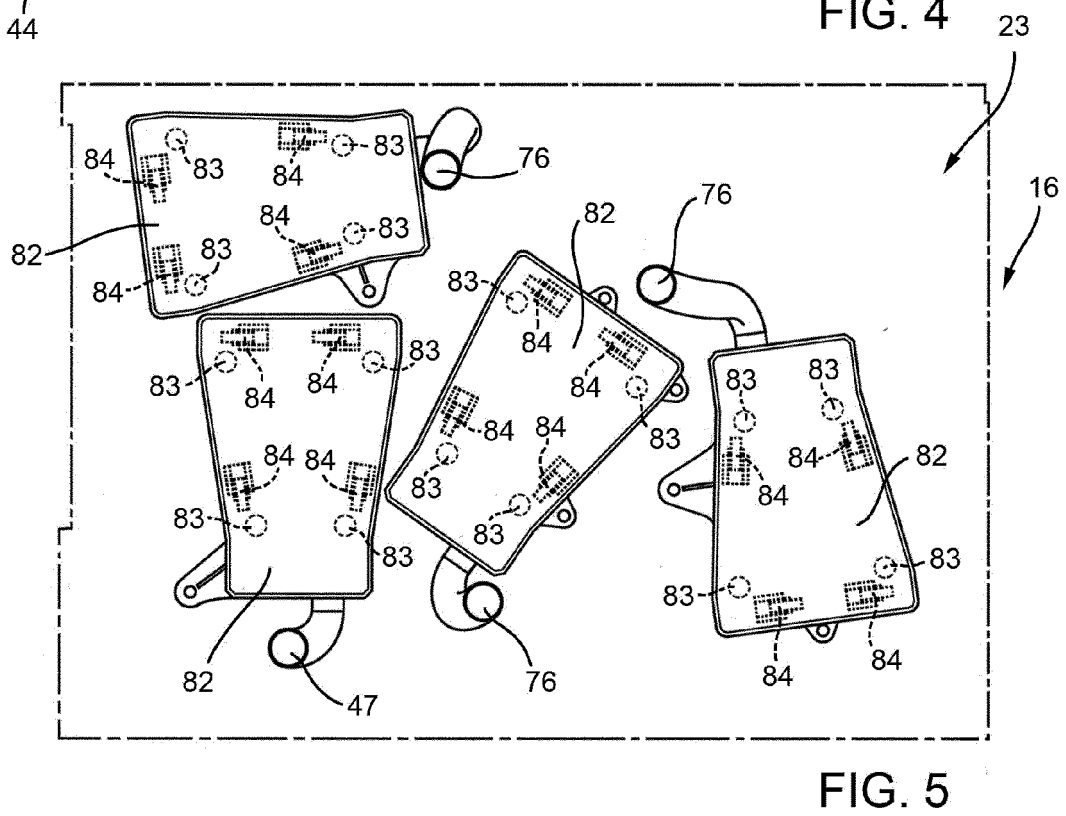
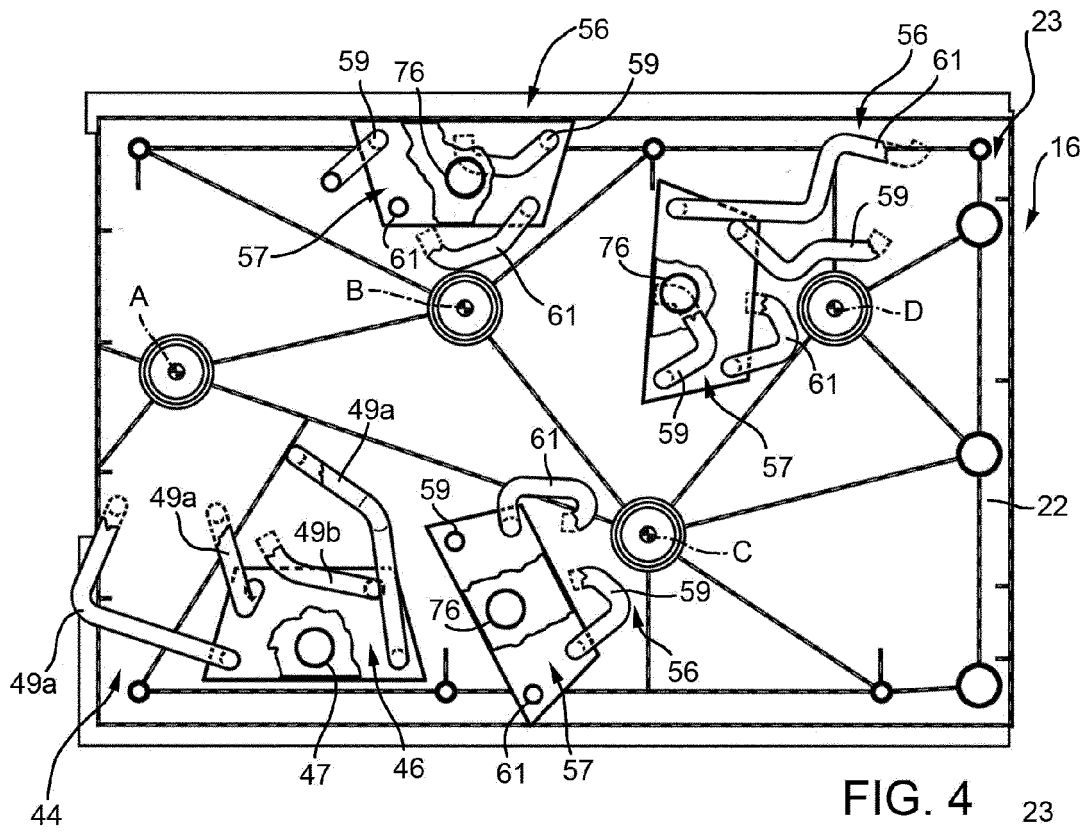


FIG. 2

FIG. 3





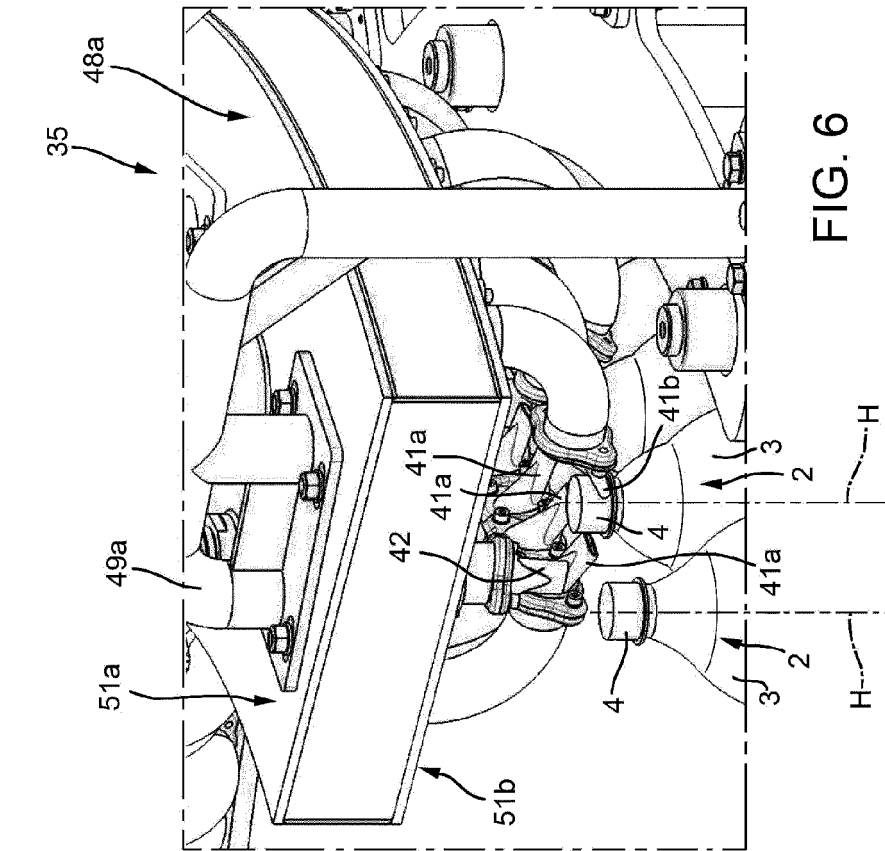


FIG. 6

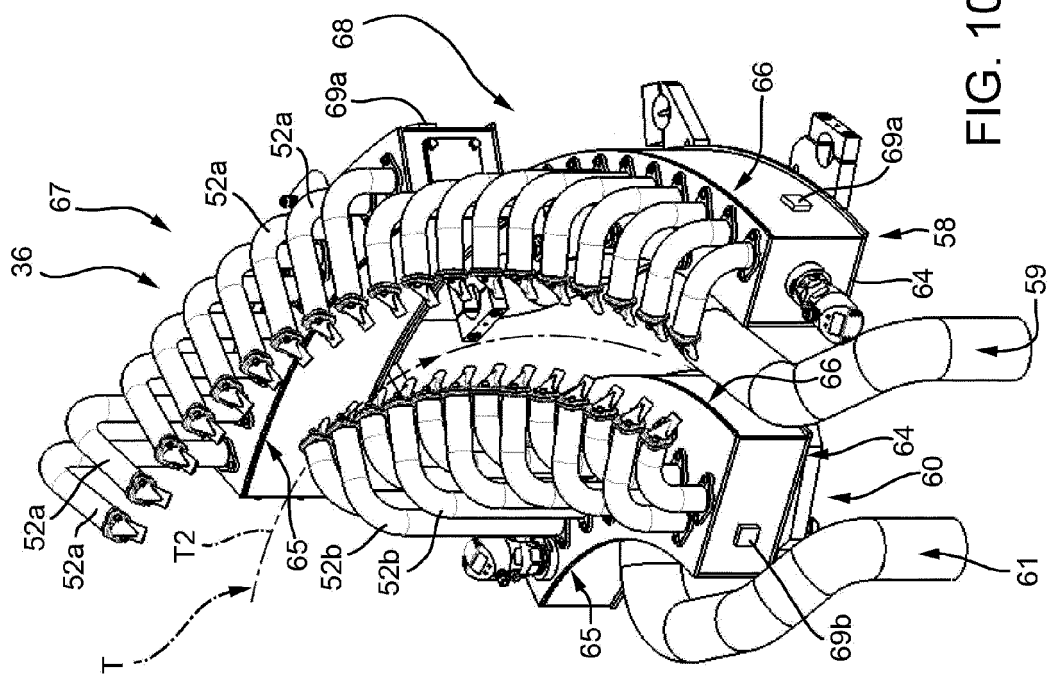
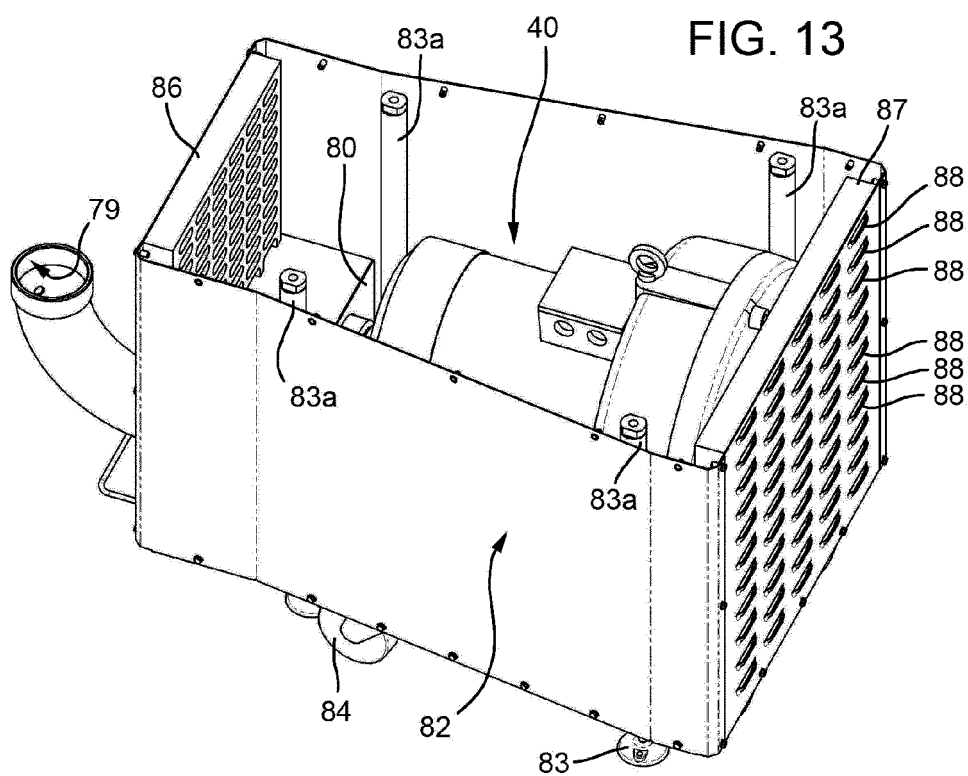
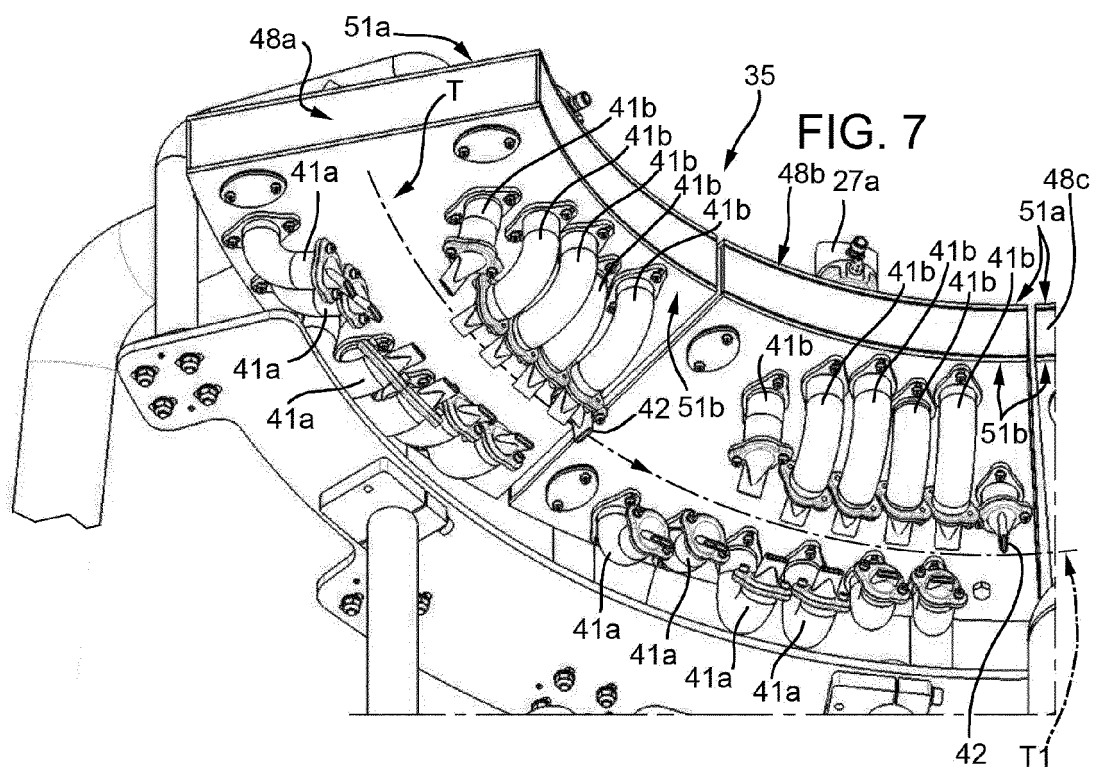


FIG. 10



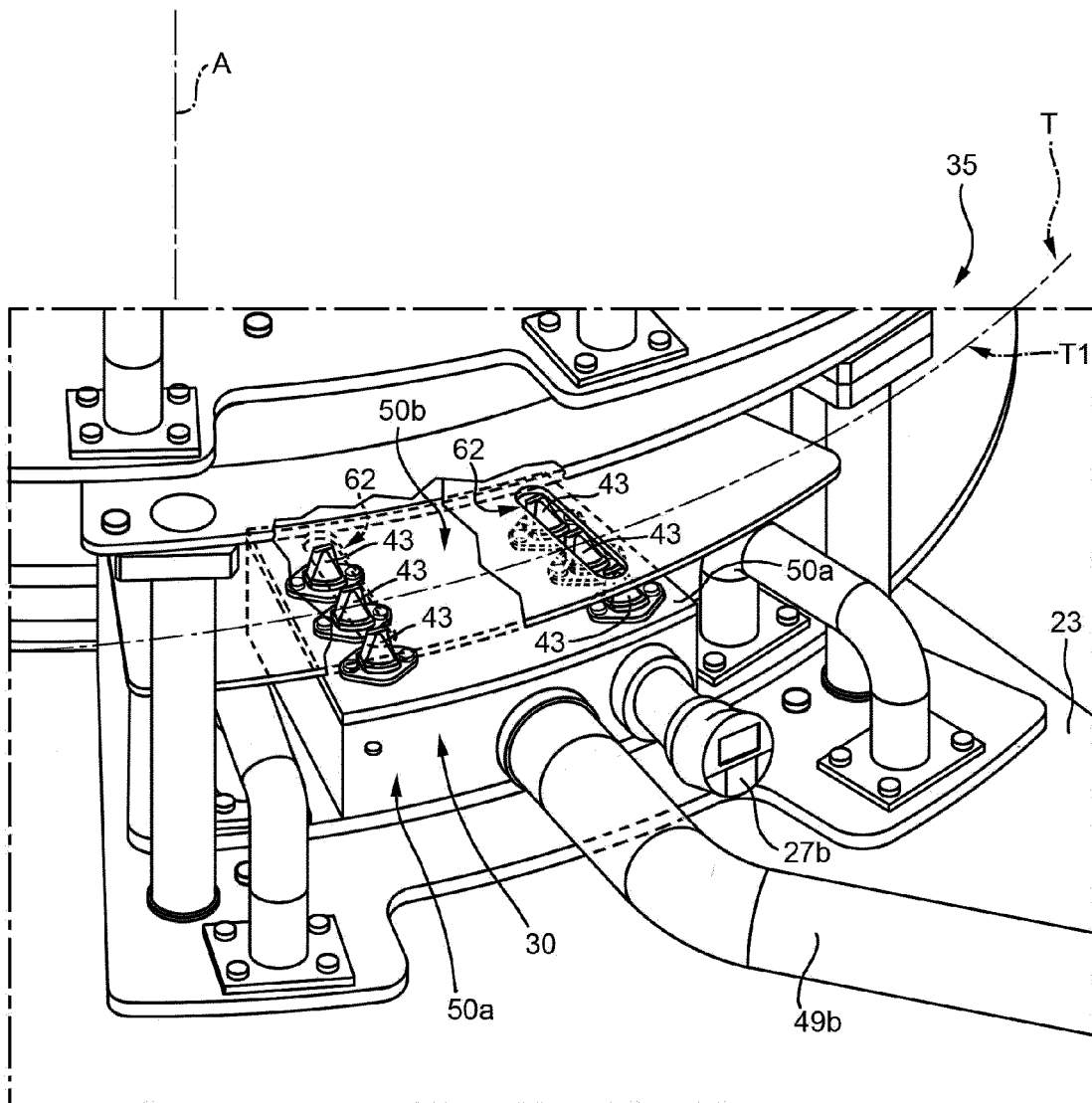


FIG. 8

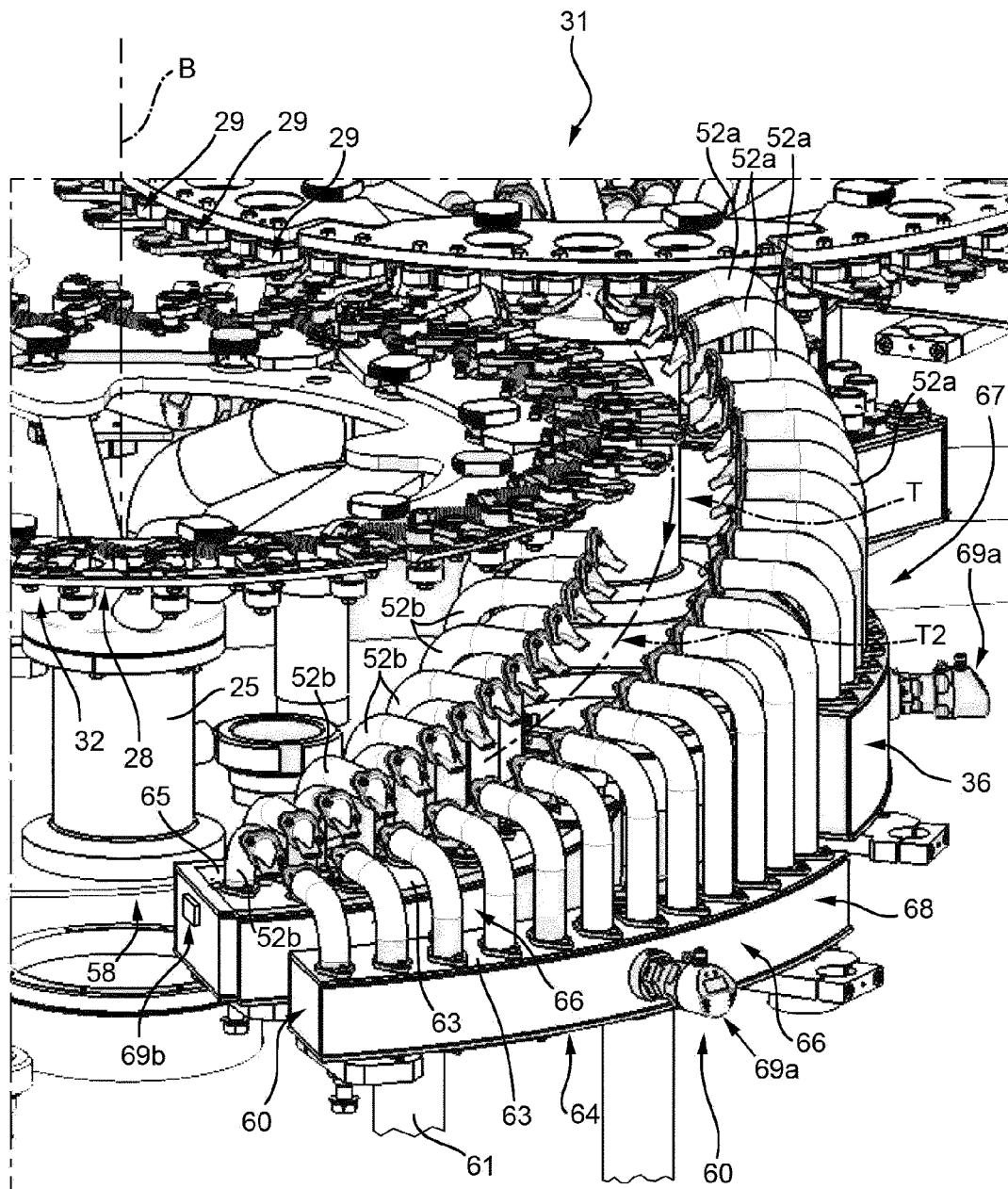


FIG. 9

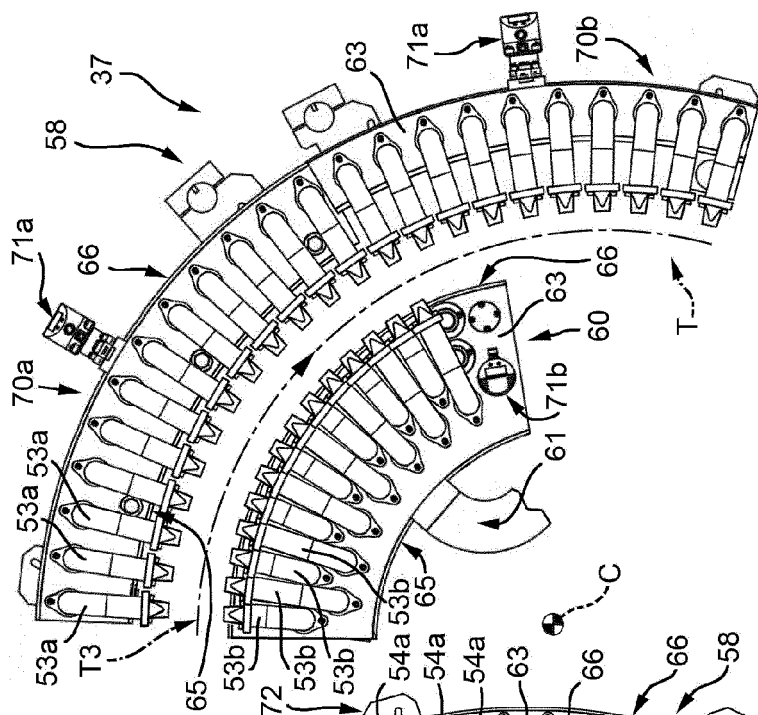


FIG. 11

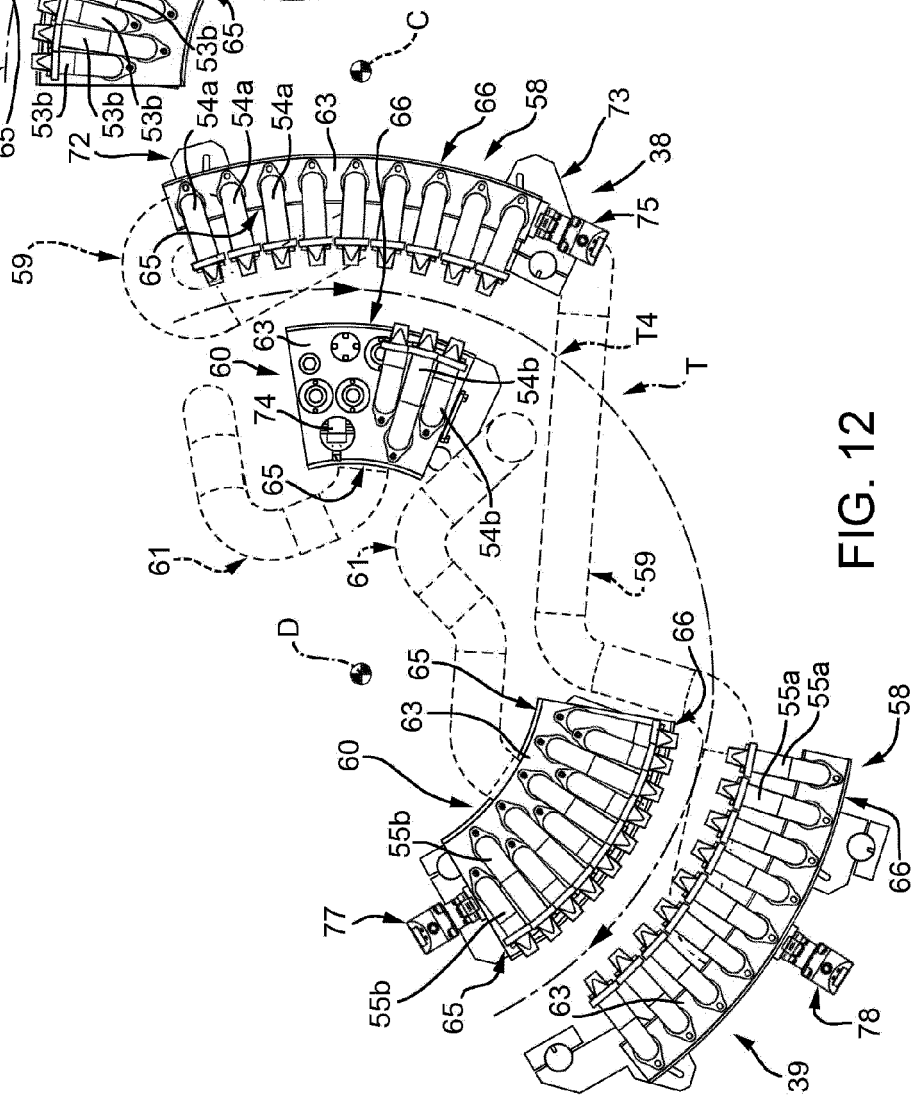


FIG. 12

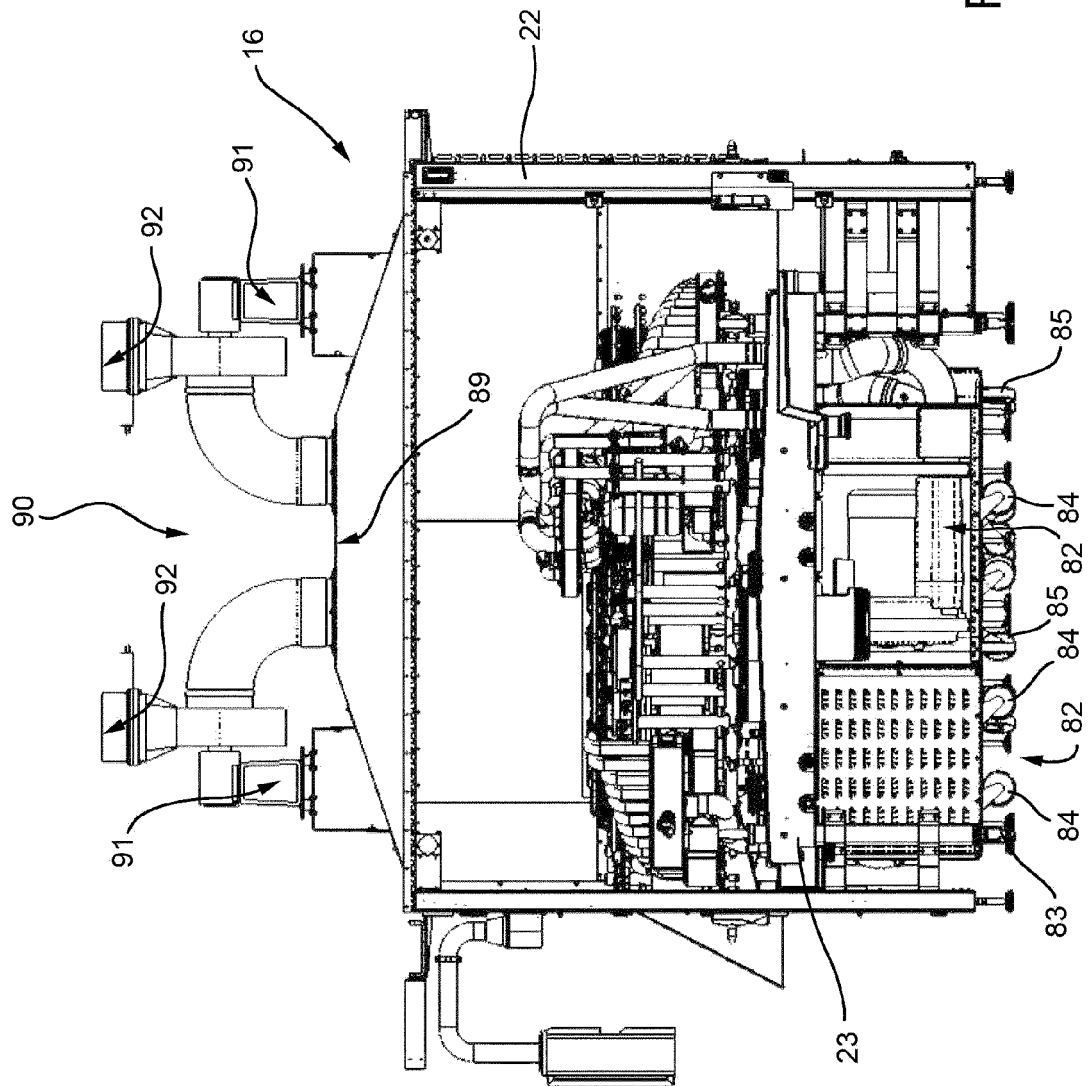


FIG. 14

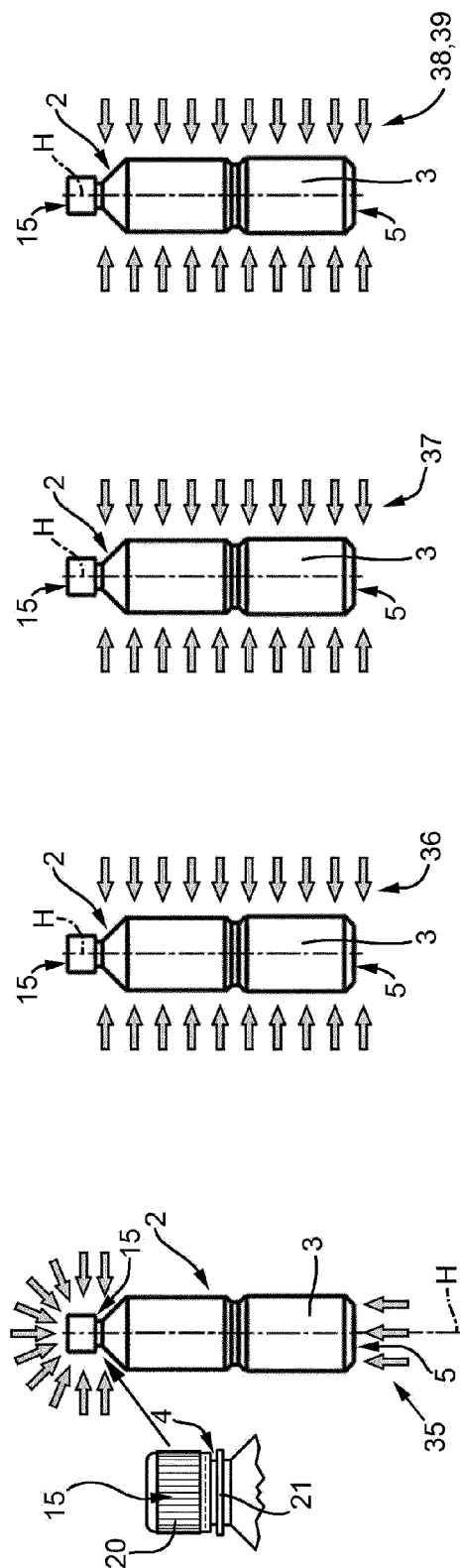
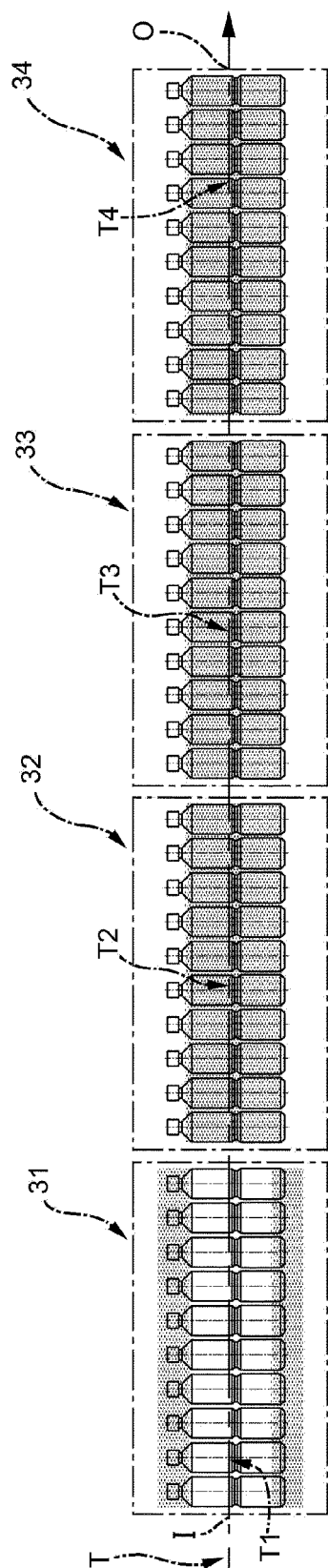


FIG. 15



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Place of search The Hague		Date of completion of the search 2 October 2015	Examiner Luepke, Erik
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