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CA 2649377 A1 2007/11/01

(21) 2 649 377

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(86) Date de dépôt PCT/PCT Filing Date: 2007/04/03
(87) Date publication PCT/PCT Publication Date: 2007/11/01
(85) Entrée phase nationale/National Entry: 2008/10/15
(86) N° demande PCT/PCT Application No.: EP 2007/002999
(87) N° publication PCT/PCT Publication No.: 2007/121835
(30) Priorité/Priority: 2006/04/24 (DE10 2006 019 441.1)

(51) Cl.Int./Int.Cl. *B65C 9/46* (2006.01),
B67B 3/00 (2006.01)

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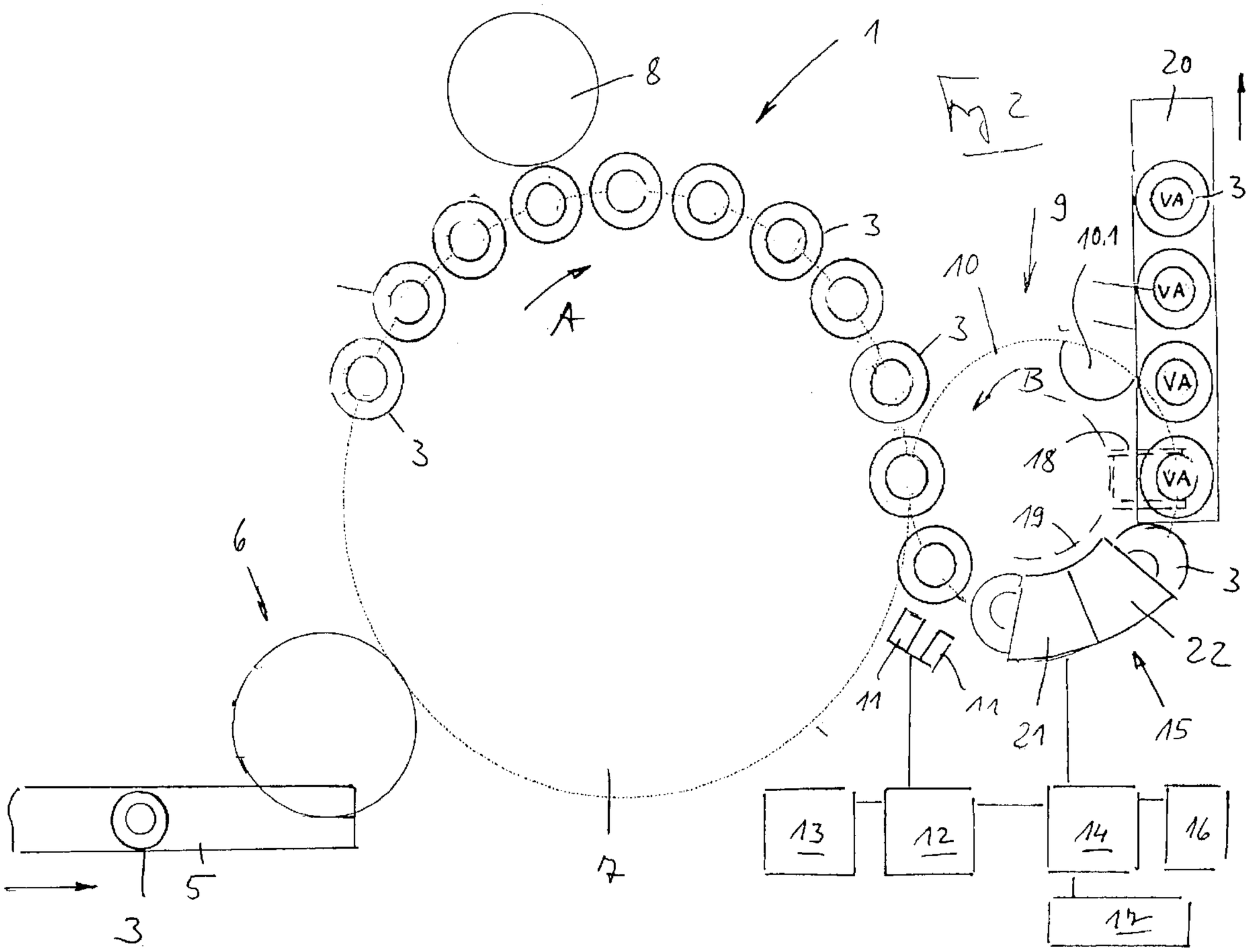
(54) Titre : PROCEDE ET DISPOSITIF POUR L'IMPRESSION DE RECIPIENTS
(54) Title: PROCESS AND DEVICE FOR PRINTING CONTAINERS



(57) Abrégé/Abstract:
The invention relates to a process for the application of at least one imprint (VA) on a container surface, for example, the seal of a container (4), using at least one printing station (15) with at least one electrically-controlled printing unit (21).

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
1. November 2007 (01.11.2007)

PCT

(10) Internationale Veröffentlichungsnummer
WO 2007/121835 A1

(51) Internationale Patentklassifikation:
B65C 9/46 (2006.01) *B67B 3/00* (2006.01)

(21) Internationales Aktenzeichen: PCT/EP2007/002999

(22) Internationales Anmeldedatum:
3. April 2007 (03.04.2007)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
10 2006 019 441.1 24. April 2006 (24.04.2006) DE

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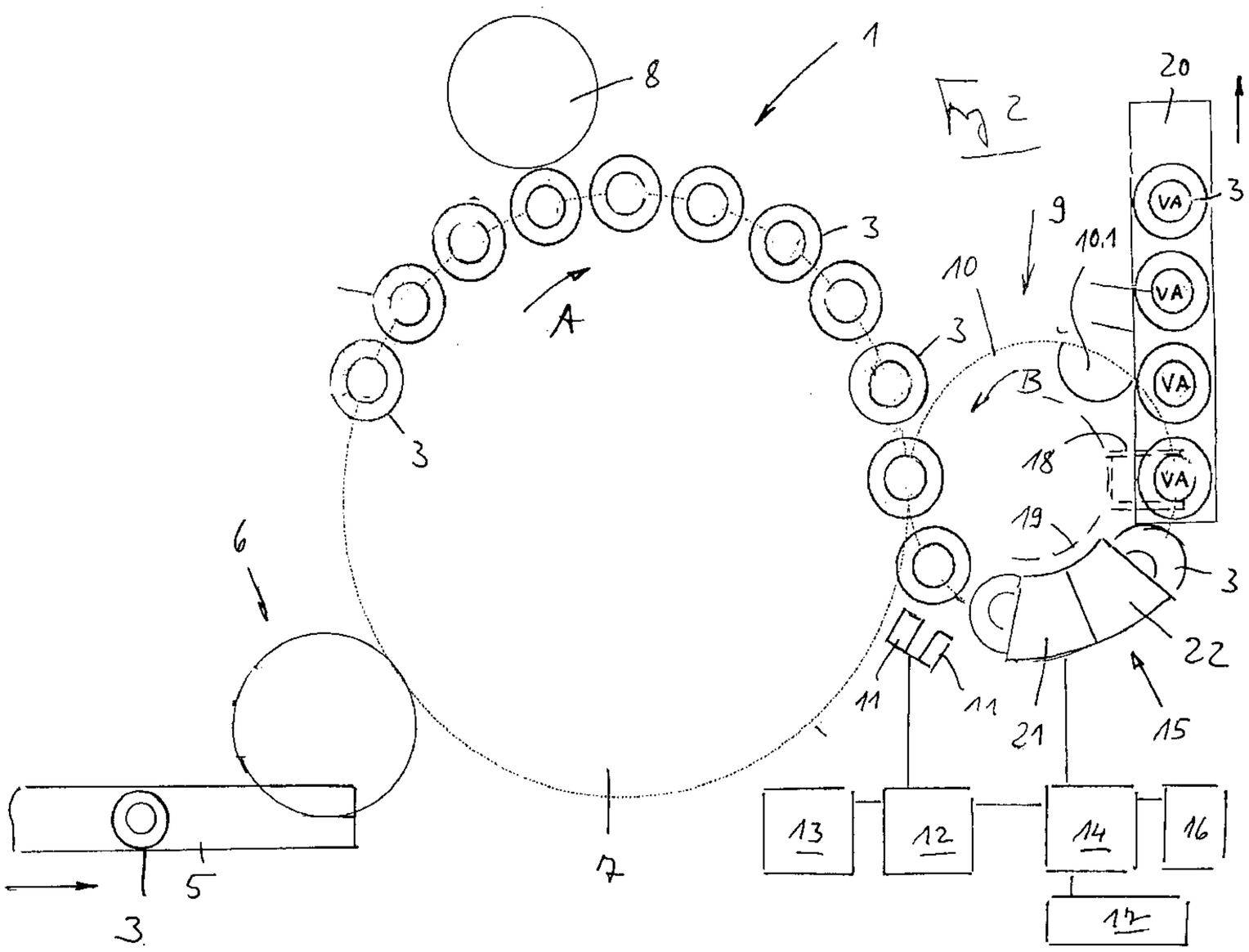
Erklärung gemäß Regel 4.17:
— *Erfindererklärung (Regel 4.17 Ziffer iv)*

Veröffentlicht:
— *mit internationalem Recherchenbericht*

[Fortsetzung auf der nächsten Seite]

(54) **Title:** PROCESS AND DEVICE FOR PRINTING CONTAINERS

(54) **Bezeichnung:** VERFAHREN SOWIE VORRICHTUNG ZUM BEDRUCKEN VON BEHÄLTERN



(57) **Abstract:** The invention relates to a process for the application of at least one imprint (VA) on a container surface, for example, the seal of a container (4), using at least one printing station (15) with at least one electrically-controlled printing unit (21).

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Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

(57) Zusammenfassung: Die Erfindung bezieht sich auf ein Verfahren zum Aufbringen wenigstens eines Aufdrucks (VA) auf eine Behälterflache, beispielsweise einen Behälterverschluss (4), unter Verwendung wenigstens einer Druckstation (15) mit wenigstens einer elektrisch ansteuerbaren Druckeinheit (21).

Process and Device for Printing Containers

The invention relates to a method for printing bottles or the like containers according to the preamble of claim 1 and to a device for carrying out the method according to the preamble of claim 19.

Furthermore, a print head is known that is determined for printing flat printing material and with which a plurality of printing points can be produced in one line closely adjacent to one another or at a very small distance from one another, for example, at least one hundred and fifty printing points per inch on a surface to be printed of the printing material, namely through a plurality of individually controllable single jets. The active printing width of this print head, which is also known by the name "Tonejet," is dependent only on the capacity of the processing power of a computer to control the print head. Print heads of 1.7 to 6.8 inches printing width (corresponding to a 256 bit control or a 1024 bit control) are thus possible. With this print head the printing of a two-dimensional imprint with sufficiently large area through relative movement between the surface to be printed and the print head is possible in only one axial direction.

It is often necessary to apply closures, for example, bottle caps or screw tops, which have an imprint, for example in the form of an emblem, a brand or the like, on bottles or the like containers such that the imprint on the closure has a predetermined orientation with respect to the other equipment of the bottle or of the container, for example, with respect to one or more labels or other equipment features.

In order to achieve this, it has already been proposed with a labeling machine for labeling bottles to align the bottles standing upright before the application of the labels by rotation about their vertical bottle axis such that when the bottles reach the labeling unit the imprint on the bottle closures respectively has a predetermined orientation so that then after the labeling the imprint on the bottle closures and the equipment formed by the labeling have the desired uniform orientation.

However, this known approach requires not only an optical detection of the random orientation of the imprint, but also a subsequent mechanical alignment or rotation of the bottles about their bottle axis, to which end, i.a., a relatively complex motor drive

of a rotary table serving as a stand area of the bottle, with correspondingly complex control is necessary.

The object of the invention is to disclose a method and a device with which it is possible to achieve a uniform orientation of an imprint on a container surface orientated in a perpendicular manner to a container axis and the other equipment of the container in a simplified manner.

To achieve this object, a method is embodied according to claim 1. A device for carrying out this method is the subject matter of claim 19.

An essential property of the method according to the invention lies in that starting from a purely random orientation of the containers with respect to the equipment features already present on this container, for example, a label already applied, the at least one imprint is applied, for example, on the closure solely by electronic alignment or rotation of the master pattern available in digital form on the container surface orientated in a perpendicular or transverse manner to the container axis, such that the imprint produced has the desired orientation with respect to the other equipment of the container. An alignment or rotation around their container axis of the containers preferably standing upright during printing is not necessary. Therefore no complex control drives are necessary either. Instead, the alignment of the imprint with respect to the other equipment of the respective container is carried out purely electronically or by means of software.

The printing unit is embodied thereby such that it generates the respective printed image aligned on the container surface depending on the control by an electronic control device or printer electronic system (computer), namely according to an electronic printing mask or a printing mask formed from a data record by means of software and stored for example in a memory of the printer electronic system. By changing this printing mask, an easy change or adjustment of the imprint is also possible, namely in every respect, i.a., in terms of content, graphics, color, image but also with respect to size and shape. The invention thus also provides the possibility as needed to change and/or update the respective imprint easily, namely, for example, depending on the respective product and/or the respective brand.

The printing unit preferably has at least one print head that is embodied preferably as a "Tonejet" print head or as a print head corresponding to a "Tonejet" print head of this type. A print head of this type has a plurality of single jets on a print area that is arranged during printing of the area to be printed opposite to this area at a small distance, which single jets are provided in close succession in a print head longitudinal axis and are formed respectively by a jet opening and by an electrode assigned to each jet opening. The printing ink present in the print head does not exit from each individual jet or from the associated jet opening until, upon activation of an individual jet, the electrode assigned thereto is acted on with an electric voltage, the polarity and or electric potential of which deviates from the polarity and/or electric potential of the print head or the printing ink in the print head so that through electrostatic forces a specific amount of printing ink is ejected or discharged from the jet opening of the activated single jet. A print head of this type is referred to below as an "electrostatic print head."

Containers as defined by the invention are i.a., bottles, bottle-type containers, cans of various materials.

The invention is explained in more detail below on the basis of an exemplary embodiment based on the figures. They show:

Fig. 1 In individual representation a container embodied as a bottle together with a printing unit, represented diagrammatically, for printing the container closure;

Fig. 2 In diagrammatic representation and in plan view a labeling device for labeling the bottles together with the printing unit provided at the container outlet;

Fig. 3 In diagrammatic representation the print heads of the printing unit embodied as electrostatic print heads together with a closure to be printed;

Fig. 4 One of the print heads of the printing unit in side view.

In the figures 1 is a labeling machine for applying labels 2 on containers embodied as bottles 3, which are closed on their top side or container opening by a closure 4. The

labeling machine 1 is embodied in the known manner as a rotating machine i.e., the bottles 3 are fed via a transporter 5 to a container intake 6 having, i.a., a star-shaped feed device and from there reach respectively successively container carriers, which are provided on the circumference of a rotor 7 driven in the direction of the arrow A around a vertical machine axis. With the rotating rotor 7 the bottles 3 are moved past at least one labeling unit 8, on which the glued labels 2 are transferred to the bottles 3, so that the labels 3 then are pressed onto or brushed onto the respective bottle 3 in a suitable manner, e.g., through successive pressure and/or brush-on elements, not shown. The bottles 3, for example, thus labeled in the convention manner known to one skilled in the art then with the rotating rotor 7 reach the container outlet 9 or a star-shaped outlet device or transport star wheel 10, which has on its circumference several seats 10.1 for respectively one bottle 3 and is likewise driven about a vertical machine axis synchronously but in the opposite direction to the rotor 7, i.e., in the direction of the arrow B.

The bottles 3 respectively accommodated by a seat 10 are held in the transport star wheel 10 or in the seats 10.1 thereof in a rotationally fixed manner so that they cannot rotate about their vertical bottle axis FA.

The bottles 3 thus arranged in the seats 10.1 are moved with the transport star wheel 10 past one or more optoelectrical sensors 11, which are part of a sensor or image recognition and processing system 12 with which the labels 2 applied on the bottles 3 and/or marked areas or equipment features 2.1 of the labels are detected and, through comparison of the signals supplied by the sensors 11 with data stored in a memory 13 of the image recognition system 12, the current and most likely random orientation of the label of each bottle 3 accommodated in a rotationally fixed manner in a seat 10.1 is determined. This information corresponding to the orientation of the respective label 2 is transmitted to a printer electronic system 14 (e.g., computer), which then controls a printer unit 15 to produce an imprint on the top side 4.1 of the closure 4. This imprint is labeled generally in Fig. 2 by the letters VA and can be designed in any desired form, e.g., graphically and/or in color. However, the essential factor here is that, controlled through the information of the image processing system 12, the imprint is carried out on the top side 4.1 of the closures 4 of the bottles 3 still held in

the seats 10.1 in a rotationally fixed manner in such a manner that this imprint VA has a predetermined alignment to the respective label 2, for example, to the marked areas 2.1 of this label 3. This alignment is carried out through corresponding "electronic" rotation or alignment of the printed image produced with the printing unit 15 purely by means of software. A mechanical alignment or rotation of the bottles 3 about their bottle axis FA is not necessary.

The printing mask for the respective imprint VA is stored in a memory 16 of the printer electronic system 14, so that, as needed, the type of the closure imprint (VA) can also be easily changed solely through an electronic shift or a program change without a replacement of mechanical elements, such as, e.g., printing masks, being necessary. The respective printing mask necessary for the application of the imprint VA can be retrieved via an input device 17 from the memory 16 or selected and/or altered for the printing process.

The sensors 11 are, for example, electronic cameras that supply an image signal to the image processing system 12, in which the respective camera image is compared as an actual value to an image stored in the memory 13 as a desired value and from this the orientation of the respective label 2 is determined. Other systems are also conceivable, for example, scanner devices or systems with which marked areas or elements 2.1 of the respective label 3 are scanned, for example image components, such as, e.g., image edges or image transitions in the label typical of the label, or additional markings applied to the label, for example, those that also serve other purposes at the same time, for example, barcodes characterizing the product, information on the manufacturer, date of manufacture, etc.

A clamping device, for example, is used for the rotationally fixed support of the bottles 3 in the respective seat 10.1, which clamping device is provided at each seat 10.1 and is indicated in Fig. 2 diagrammatically by 18. The clamping devices 18 can be controlled by a control cam 19. The bottles 3 printed on their closures 4 reach with the transport star wheel 10 a transporter 20, via which the bottles 3 are supplied to a further use or a further station, for example, to a packer.

The printing station 15, which is arranged in a locally fixed manner above the track of motion of the bottles 3 or of the closures 4 on the transport star wheel 10, comprises a

printing unit 22 and a unit 23 following this in the rotational direction B for drying the respective imprint VA or printed image, namely depending on the printing ink used for the printing by heating or heat treatment or UV treatment, etc.

The printing station 15 can furthermore contain means that help to increase the sharpness and/or the contrast of the respective imprint VA, e.g., corona devices. Furthermore, there is the possibility of providing devices between the individual print heads 24, in order to dry the printing ink applied with the respective print head, for example, a color set of a multicolor printing at least such that another color set can be printed without a mixing of the printing inks occurring.

According to Figs. 3 and 4 the printing unit 22 comprises several print heads 24 that are arranged transversely or in a perpendicular manner to the direction of rotation B of the transport star wheel 10 at a small distance above the horizontal plane E (printing plane) on which the closures 4 move.

In this embodiment the print heads 24 are embodied as electrostatic print heads. For a multicolor printing at least three print heads are provided, of which each serves to print one color set of a multicolor printing. The print heads thus contain in their coloring different printing inks, e.g., red, blue and yellow. Fundamentally, it is also possible to provide further print heads 24 on the printing unit 22, for example, a fourth print head 24 for black printing ink.

As Figs. 3 and 4 show, each print head 24 essentially comprises a housing 25, which forms i.a. a closed interior 26 for accommodating the liquid or viscous printing ink. Each housing 25 is embodied such that the interior 26 narrows to a lower housing section 25.1 in a funnel-shaped or wedge-shaped manner. At this housing section 25.1, which extends over the entire length of each print head 24 or the housing 25 thereof, and is oriented parallel to a housing or print head longitudinal axis DL and thus also parallel to the printing pane E, a plurality of individually controllable single jets 27 is provided for the controlled discharge of the printing ink, namely in at least one row in the direction of the print head longitudinal axis DL following one another and in a close arrangement, so that, for example, one hundred and fifty single jets 27 per inch or more are formed on the housing section 25.1. With the housing section 25.1 having the single jets 27, each print head 24 is arranged at the referenced

predetermined small distance above the top side of the closures 4 to be printed or the printing plane. The closures 4 are moved during printing in the direction of rotation B continuously past the respective print head 24. Through the already mentioned orientation of the print heads 24, the direction of movement B is thereby oriented transversely, however, preferably perpendicular to the print head longitudinal axis DL of the print heads 24. With the embodiment shown the print heads 24 are arranged parallel to one another in the horizontal direction with their print head longitudinal axis DL, namely preferably in a joint horizontal plane.

Each single jet 27 comprises an opening 28 and a needle-shaped electrode 29 assigned to this opening 28, which is arranged along the same axis with the axis of the respective opening 28 and ends at a small distance from this opening 28 inside the housing interior 26. Each print head 24 is furthermore embodied such that at least during the printing process the printing ink accommodated in the housing interior 26 bears with a certain hydrostatic pressure against the openings 28 of the single jets 27. The cross section of the openings 28, however, is selected taking into consideration the viscosity and/or the surface tension of the printing ink such that when single jet 27 is not activated, printing ink is not discharged from the openings 28, despite the hydrostatic pressure.

The electrodes 29 can be controlled individually via the printer electronic system 14, namely such that when single jet 27 is not activated, the corresponding electrode 29 is located at the same electric potential as the printing ink in the housing interior 26. When a single jet 27 is activated, the electric potential of the associated electrode 29 through corresponding activation or control through the printer electronic system 14 is changed briefly or in a pulse-like manner so that printing ink for producing a printing point 30 on the respective closure 4 is discharged via the opening 28.

Since the print heads 24 are arranged transversely or in a perpendicular manner with their print head longitudinal axis DL to the direction of movement B of the closures 4, the respective printing application VA is carried out respectively in rows that extend perpendicular to the longitudinal extension or perpendicular to the direction of movement B of the closures 4, namely progressively in the direction of movement B. The activation of the single jets 27 is possible at high speed. Furthermore, only one

relative movement between the closures 4 and the respective print head 24 is necessary for the printing, namely only the feed movement of the bottles 3 with the transport star wheel 10. For these reasons a high print rate can be achieved so that the labeling machined 1 can also work with high output. The respective print image is generated purely digitally in the printer electronic system 14 by corresponding control of the single jets 27.

The printing of the closures 4 takes place in the printing unit 22, for example, such that the imprint VA and/or the graphic and/or color design or equipment of the respective closure 4 is generated completely through the printing unit 22 on the neutral closure 4, or an imprint already present on the closures 4 is supplemented in a desired manner with the printing unit 22, for example, it is provided with an addition in terms of language, color and/or graphics.

Because the closures 4 are not printed until the labeling machine 1, and through the control of the printing unit 22 or the print heads 24 there by the printer electronic system 14 using print forms or print masks stored digitally or in terms of data, various advantageous possibilities result, i.e., i.a., the possibility of a quick shifting of the imprint VA to various products, an adjustment of the size of the respective imprint to the size of the closures 4, etc. Furthermore, an easy change of the imprint VA is possible solely through a new programming or a program change. In particular there is also the possibility of changing the imprint VA during a running process, for example, in an extreme case to redesign the print image for each closure 4, in particular also in the manner that each print image or each imprint VA is then composed of a constant component remaining the same and of variable contents and/or information.

The drying or the setting of the printing ink, namely through heating or in another suitable manner, for example by curing under UV light, etc., is carried out in the unit 23 following the printing unit 22 in the direction of movement or direction of rotation B.

Naturally, to generate clear print images or imprints VA, the control of the print heads 24 or the single jets 27 is synchronized with the rotary motion of the transport star wheel 10.

The invention was described above based on an exemplary embodiment. Naturally, numerous changes or modifications are possible without thereby leaving the inventive concept on which the invention is based.

It was assumed above that the imprint VA on the closures 4 occurs respectively in an orientation corresponding to the orientation of the labels 2. It is fundamentally also possible that markings or marked design features of these containers provided on the bottles 3 or the like containers are used as a criterion for the orientation of the respective imprint. Also with an embodiment of this type the containers or bottles 3 are then guided past the at least one sensor 11 of the image processing system 12 in a random, not controlled or aligned orientation, so that the purely random orientation of the respective container is detected and then with the print station 15 through corresponding control of the printing unit 22 or through corresponding electronic rotation of the print image, the imprint VA takes place in the necessary orientation.

In principle, the part of the labeling machine 1 described by way of example formed by the transport star wheel 10 or another transporter that renders possible a rotationally fixed transportation of the containers or bottles 3, of which at least one sensor 11, the image processing system 12, the electronic print control or printing electronic system and the electrically controllable printing station 15, can also form an independent machine, which is then arranged downstream, for example, of a labeling machine and/or to which the containers already provided with an equipment are supplied.

Even though the invention was described above in connection with the printing of closures 4 on bottles, the invention can also be used with other containers, namely not only for printing container closures but also for printing other container surfaces, in particular those that lie in planes perpendicular to a container axis.

Within the scope of the present invention it is provided that the printing mask for the respective imprint VA contains the complete design in terms of graphics, text and/or image of the area to be printed.

Likewise within the scope of the invention it is provided that the print mask for the respective imprint VA contains only a part of the design in terms of graphics, text and/or image of the area to be printed.

List of Reference Numbers

1	Labeling machine
2	Label
3	Bottle
4	Closure
5	Transporter
6	Container intake
7	Rotor
8	Labeling unit
9	Container outlet
10	Transport star wheel
10.1	Seat
11	Image sensor
12	Image processing system
13	Memory
14	Printer electronic system
15	Printing station
16	Memory
17	Input device
18	Clamping device
19	Control cam
20	Transporter
21	Printing unit
22	Unit for drying the printing ink

22	Printing unit
23	Unit for drying the printing ink
24	Print head
25	Housing
25.1	Housing section
26	Interior
27	Single jet
28	Opening
29	Electrode
30	Printing point

Claims

1. Method for applying at least one imprint (VA) on container surfaces of bottles or the like containers (3) using at least one printing station (15) with at least one electrically controllable printing unit (21), characterized in that to apply the at least one imprint (VA) respectively on a container surface (4.1) oriented in a perpendicular or transverse manner to a container axis (FA) in a predetermined orientation with respect to a container equipment (2, 2.1), the orientation of this container equipment and/or at least one equipment feature (2, 2.1) of the containers (3) secured on a transporter (10) from rotation about their container axis (FA) is detected and the respective imprint (VA) with the information thus characterizing the container equipment (2) is applied in an electronically aligned manner such that it has the desired orientation with respect to the equipment (2) of the container (3).

2. Method according to claim 1, characterized in that the orientation of the container equipment and/or the at least one equipment feature (2, 2.1) are detected by means of an optoelectric sensor system (11, 12, 13).

3. Method according to claim 1 or 2, characterized in that at least one feature (2.1) of a label (2) applied to the container (3) serves as equipment feature.

4. Method according to one of the preceding claims, characterized in that at least one shaping feature of the container (3) serves as equipment feature.

5. Method according to one of the preceding claims, characterized in that the at least one imprint (VA) is carried out on the top side (4.1) of a closure (4).

6. Method according to one of the preceding claims, characterized in that the orientation of the equipment or of the at least one equipment feature (2.1) is detected by at least one optoelectric sensor (11), for example an image sensor of an image detection and/or processing system.

7. Method according to claim 6, characterized in that the at least one image sensor (11) is an electronic camera or a scanner.

8. Method according to one of the preceding claims, characterized in that the printed image of the at least one imprint (VA) is produced depending on printing masks stored in a printer electronic system (14) electronically or by means of software.

9. Method according to one of the preceding claims, characterized in that during printing of a plurality of containers (3) the printed image is at least partially changed during the printing process.

10. Method according to one of the preceding claims, characterized in that the at least one imprint (VA) is carried out with relative movement between the printing station (15) or the printing unit (21) there and the container (3), namely line-by-line perpendicular or transversely to the relatively movement.

11. Method according to one of the preceding claims, characterized in that the at least one printing unit (21) has at least one electrostatic print head (24) with a plurality of individually controllable single jets (27) for the controlled discharge of printing ink, and that the single jets are arranged in at least one row following one another in a print head longitudinal axis (DL).

12. Method according to claim 11, characterized in that the relative movement between the at least one print head (24) and the container surface (4.1) is carried out in a transverse or perpendicular manner to the print head longitudinal axis (DL).

13. Method according to one of the preceding claims, characterized in that the container surface (4.1) is oriented horizontally or essentially horizontally during printing.

14. Method according to one of the preceding claims, characterized in that the at least one print head (24) is arranged above the surface (4.1) to be printed.

15. Method according to one of the preceding claims, characterized by the use of at least two, preferably at least three print heads (24).

16. Method according to one of the preceding claims, characterized in that to produce a multicolor imprint (VA) a color set of this imprint is produced with each print head (24).

17. Method according to one of the preceding claims, characterized in that after application the printing ink is dried or set by the application of an energy source, for example, by heating and/or UV light.

18. Method according to one of the preceding claims, characterized in that the at least one imprint (VA) is carried out in a labeling machine (1) after the labeling of the container (3).

19. Method according to one of the preceding claims, characterized in that the printing mask for the respective imprint VA comprises the complete design in terms of graphics, text and/or image.

20. Method according to one of the preceding claims, characterized in that the printing mask for the respective imprint VA comprises part of the design in terms of graphics, text and/or image of the area to be printed.

21. Device for printing bottles or the like containers (3) on a container surface (4.1) using at least one printing station (15) with at least one printing unit (21) electrically controllable by a printer electronic system (14), past which printing unit the containers (3) are moved on a transporter (10), characterized in that means (11, 12, 13) for detecting the random orientation of the equipment and/or at least one equipment feature (2.1) of the containers (3) secured from rotation about their container axis (FA) is provided on a transporter (10), that the at least one printing unit (21) for printing the containers (3) is arranged on the container surface (4.1) oriented in a perpendicular or transverse manner to the container axis (FA) controlled by the printer electronic system (14) applies the at least one imprint (VA) aligned to the equipment (2) or equipment features (2.1).

22. Device according to claim 21, characterized in that it is a component of a labeling machine (1).

23. Device according to claim 21, characterized in that it is an independent device.

24. Device according to one of the preceding claims, characterized in that the transporter has seats (10.1) for accommodating one container (3) in each case.

25. Device according to claim 24, characterized in that the transporter [has] a transport star wheel (10) that can be driven rotating about a vertical machine axis.

26. Device according to one of the preceding claims, characterized in that the printing unit (21) is arranged for printing the topside (4.1) of container closures (4).

27. Device according to one of the preceding claims, characterized in that the printing unit produces the at least one imprint (VA) depending on printing masks stored in the printer electronic system electronically or by software.

28. Device according to one of the preceding claims, characterized in that the at least one imprint (VA) is carried out on the top side (4.1) of a closure (4).

29. Device according to one of the preceding claims, characterized by at least one optoelectric sensor (11), for example, an image sensor of an image detection and/or processing system for detecting the orientation of the equipment or the at least one equipment feature (2.1).

30. Device according to claim 29, characterized in that the at least one image sensor (11) is an electronic camera or a scanner.

31. Device according to one of the preceding claims, characterized by printing masks stored electronically or by software for producing the printed image of the at least one imprint (VA).

32. Device according to one of the preceding claims, characterized in that the at least one printing unit (21) has at least one electrostatic print head (24) with a plurality of individually controllable single jets (27) for the controlled discharge of printing ink, and that the single jets are arranged in at least one row one after the other in a print head longitudinal axis (DL).

33. Device according to one of the preceding claims, characterized in that the container surface (4.1) is oriented horizontally or essentially horizontally during printing.

34. Device according to one of the preceding claims, characterized in that the at least one print head (24) is arranged above the area (4.1) to be printed.

35. Device according to one of the preceding claims, characterized by at least two, preferably by three print heads (24).

36. Device according to one of the preceding claims, characterized in that each print head (24) is provided for a color set for the imprint to produce a multicolor imprint (VA).

37. Device according to one of the preceding claims, characterized by means for drying or setting the printing ink after the application by the application of an energy source, for example, by heating and/or UV light.

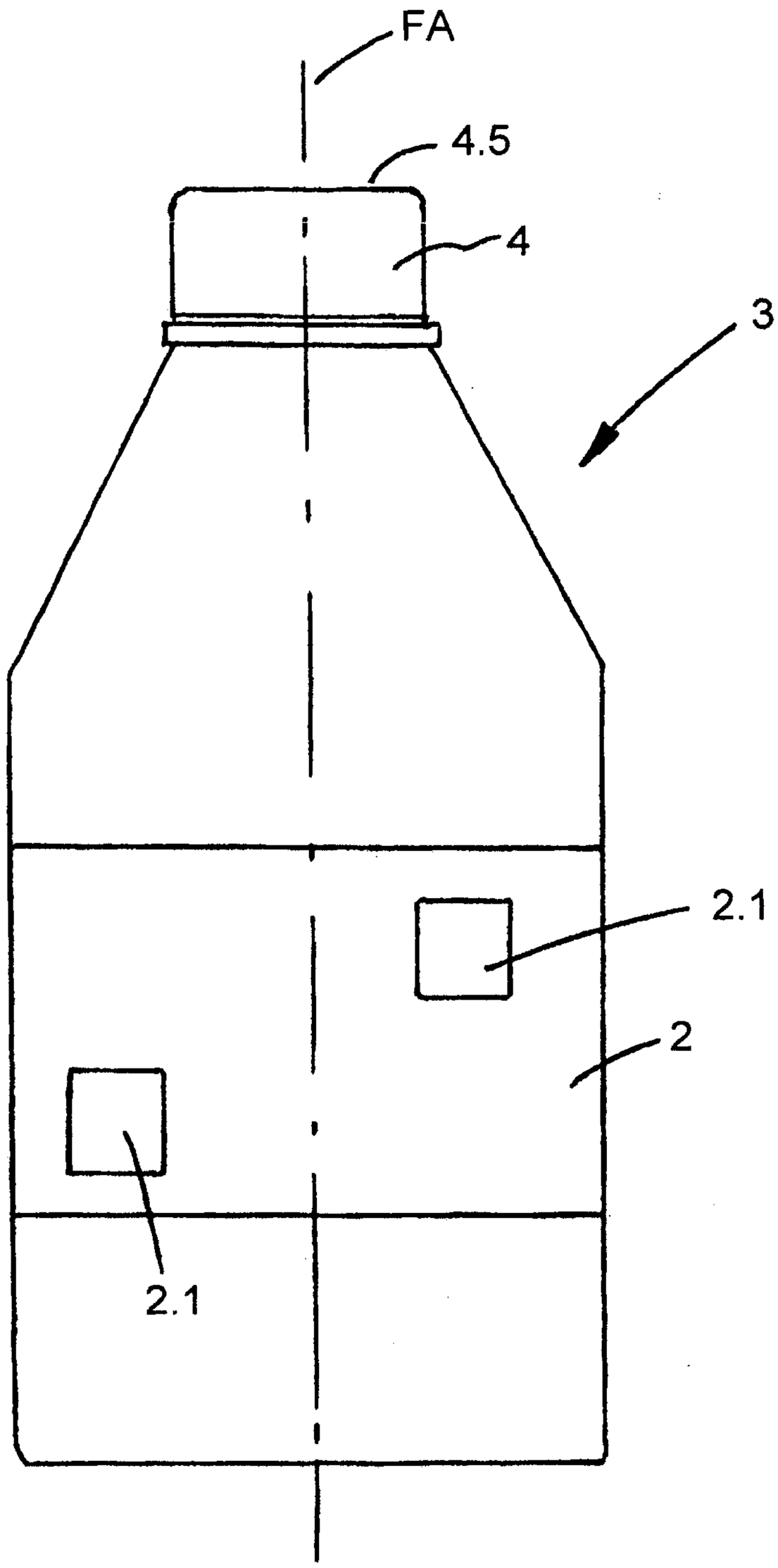


FIG. 1

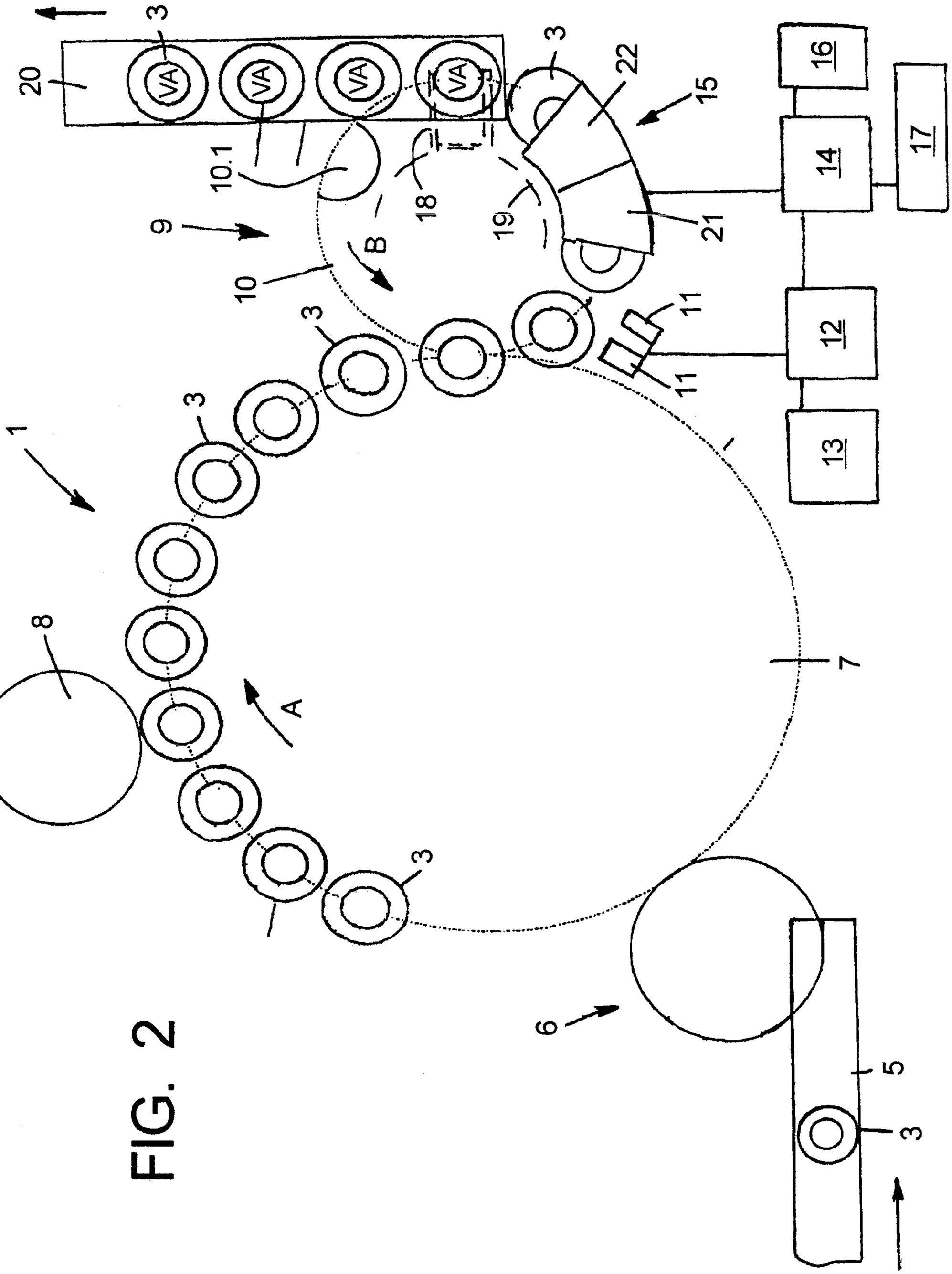
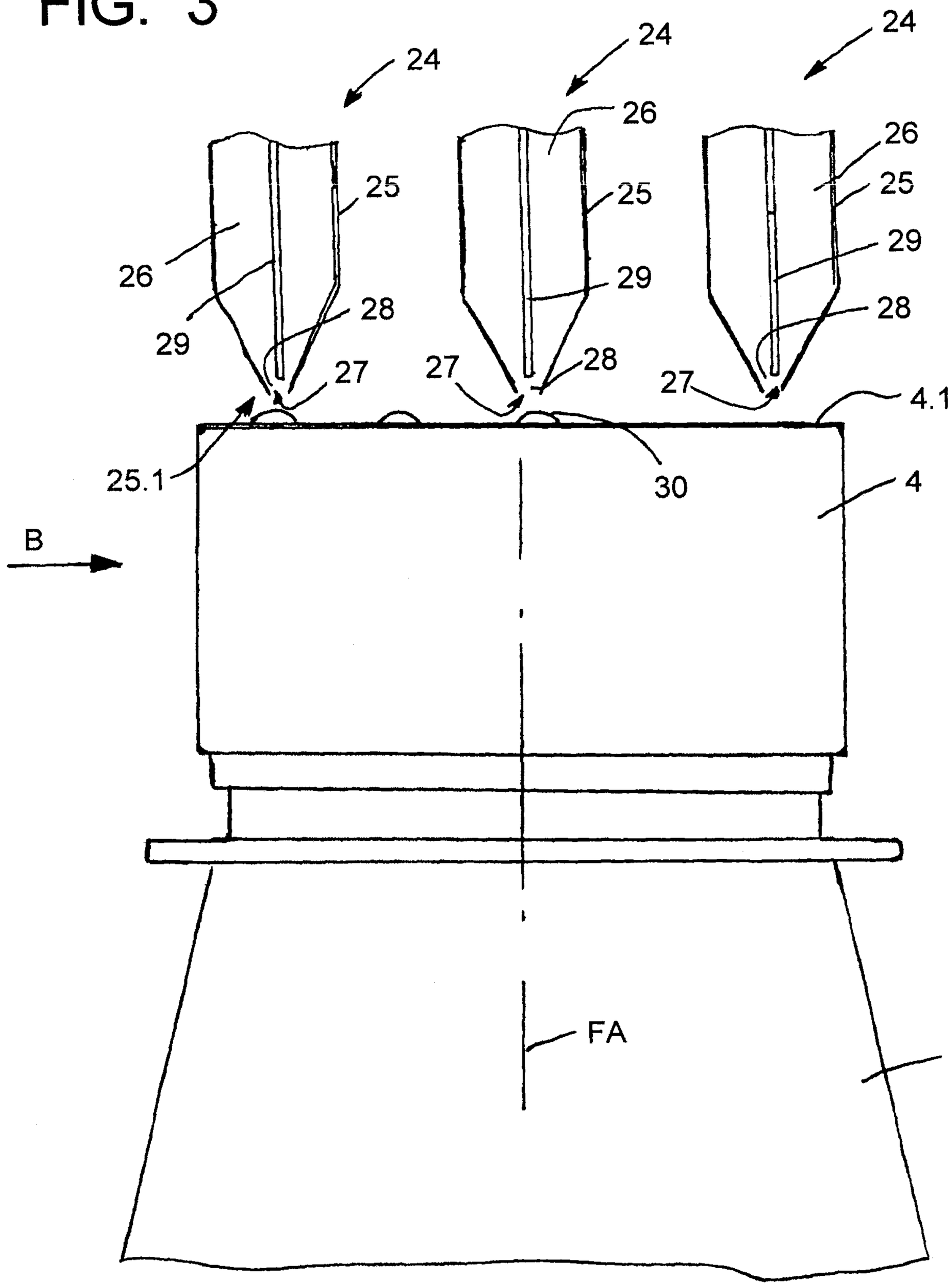


FIG. 2

FIG. 3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27
27
4.1
25.1
30
4
B
FA
3

FIG. 4

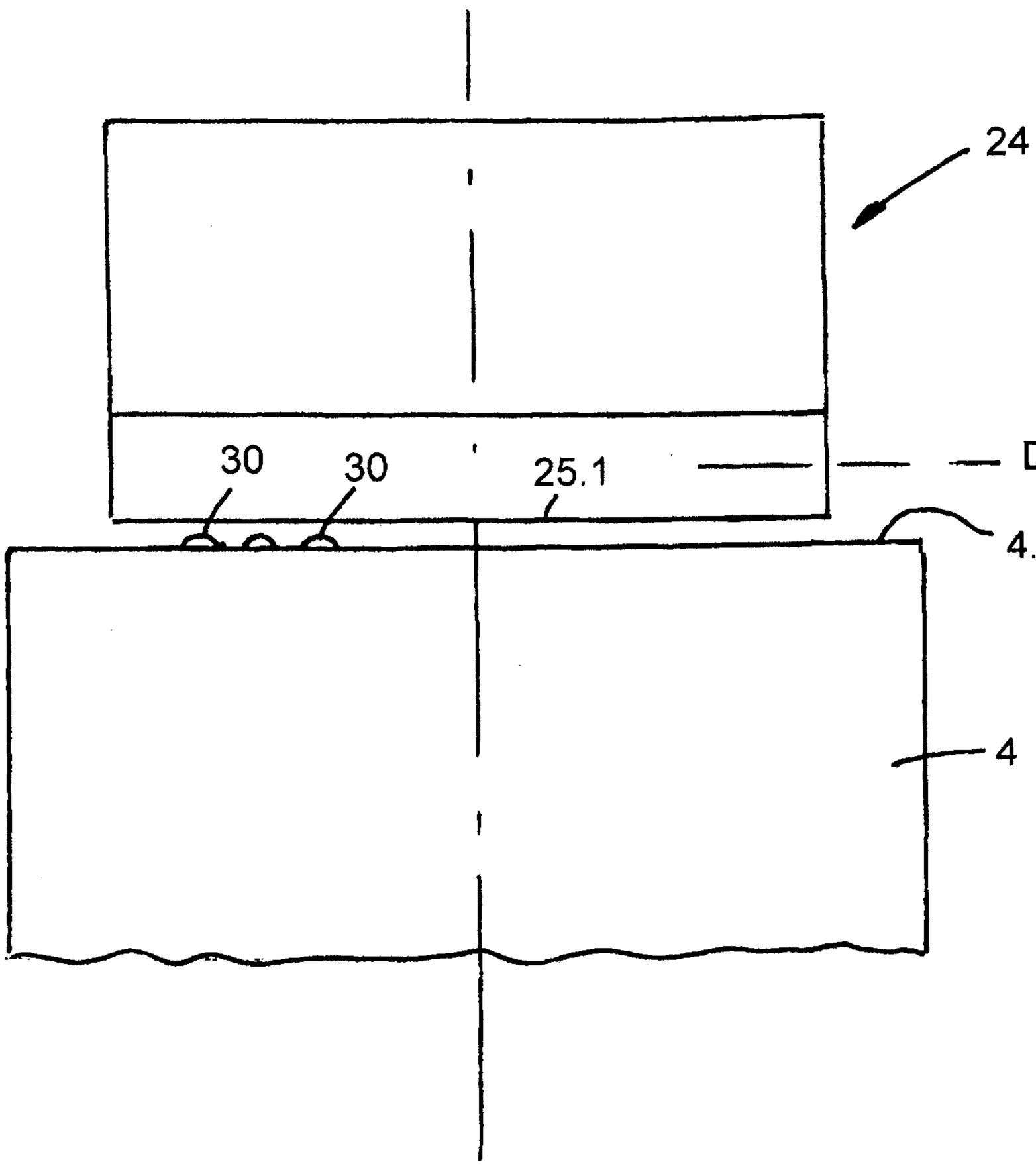
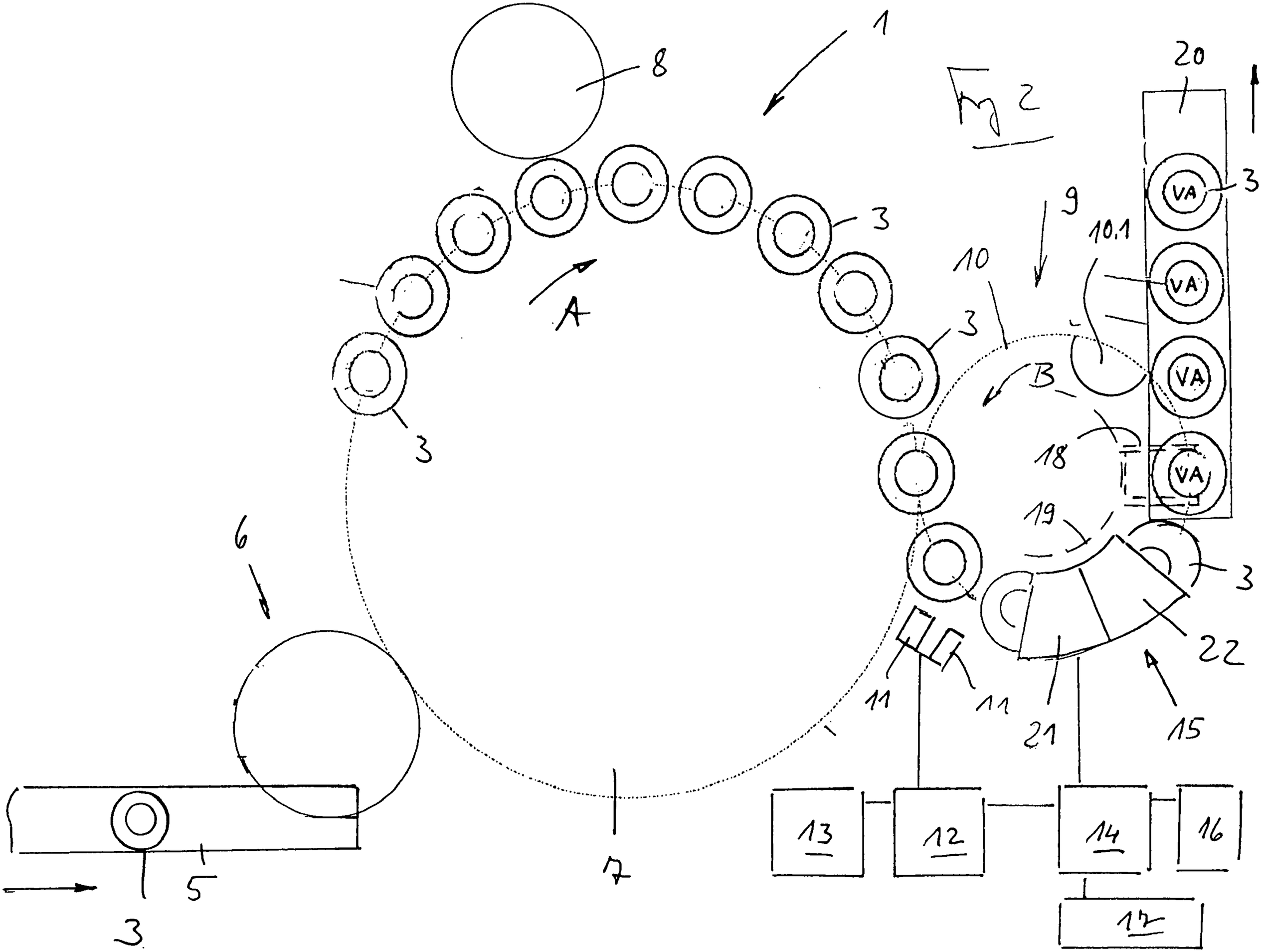


Fig 2


1
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A
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VA
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10.1
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VA
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B
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VA
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