(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
19 September 2024 (19.09.2024)

WIPO | PCT

(10) International Publication Number
WO 2024/188940 A1

(51) International Patent Classification:
B31B 50/84 (2017.01) *B65B 65/02* (2006.01)
B65B 7/28 (2006.01) *B31B 110/35* (2017.01)
B65B 61/18 (2006.01)

(21) International Application Number:
PCT/EP2024/056369

(22) International Filing Date:
11 March 2024 (11.03.2024)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
202310231887.4 10 March 2023 (10.03.2023) CN

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,

(54) Title: SPOUT APPLYING DEVICE AND SPOUT APPLYING METHOD

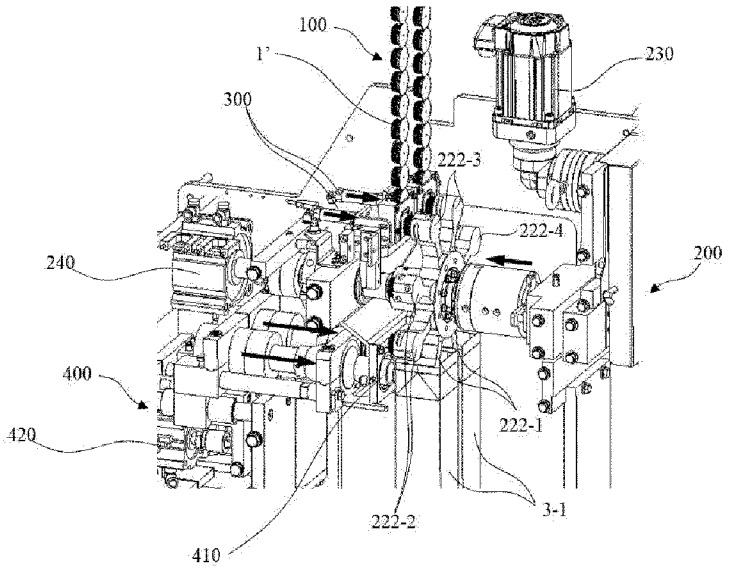

FIG. 8

(57) Abstract: The present disclosure relates to a spout applying device and a spout applying method for attaching a spout body (1') onto a package (3). The spout applying device includes a spout-conveying mechanism (200) and a spout-feeding mechanism (100). And the spout applying device defines a feeding position and an attaching position. The spout-conveying mechanism (200) is configured to receive a spout body (1') from the spout-feeding mechanism (100) at the feeding position and convey the spout body (1') to the attaching position. The spout-conveying mechanism (200) includes a rotating shaft (210) and a spout-suction wheel (220). The spout-suction wheel (220) is arranged around the rotating shaft (210) and it includes a central part (221) and a plurality of claw groups (222-1, 222-2, 222-3, 222-4) extending radially outward from the central part. A free end of the claw in the claw group is provided with a suction part (223) for sucking the spout body (1'). The spout-suction wheel (220) is configured to be rotatable around an axis of the rotating shaft

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HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(210), so that the suction part (223) of the claw in the claw group rotates between the feeding position and the attaching position to convey the spout body (1') from the feeding position to the attaching position, and in a case that one claw group of the plurality of claw groups (222-1, 222-2, 222-3, 222-4) is located at the feeding position, another claw group of the plurality of claw groups (222-1, 222-2, 222-3, 222-4) is located at the attaching position. The spout applying device and the spout applying method according to the present disclosure are beneficial to simplifying the spout applying process and accelerating the processing speed.

SPOUT APPLYING DEVICE AND SPOUT APPLYING METHOD

TECHNICAL FIELD

[0001] The present disclosure relates to the field of packaging technology, and in particular to a spout applying device and a spout applying method for attaching a spout body onto a package, which improve the manner of conveying the spout body.

BACKGROUND

[0002] Contents of this section only provide background information related to the present disclosure without definitely constituting the prior art.

[0003] The present disclosure mainly relates to packages with spouts, in which, for example, beverages may be filled. For producing a conventional package with spout, it usually needs to attach (for example, weld) a spout body onto a tube-like sleeve for forming the package. An involved spout applying device generally includes a spout-feeding mechanism for continuously supplying spout bodies and a spout-conveying mechanism for receiving the spout bodies from the spout-feeding mechanism and conveying the spout bodies to an attaching position. A commonly used spout body includes a cap and a pull ring. The pull ring is arranged at a neck inside the spout and provided with a sealing part (such as a sealing film) to close a pouring opening. When in use, the cap needs to be unscrewed and taken away firstly, and then the pull ring is pulled away, which results in a complicated spout-opening process. For such kind of spout body, an existing and typical spout-conveying mechanism includes a protrusion that is inserted into an interior of the spout body from the bottom end of the pouring opening of the spout body and then clamp-fitted with the spout body, so as to transport the spout body to an attaching position. In order to open the spout in a single step, the spout body has been improved by providing a planar membrane at the bottom end thereof, so that the membrane can be automatically cut off by the spout when the cap is unscrewed. Since such kind of spout body has a bottom end in a substantially planar shape, it cannot be transported by the conventional spout-conveying mechanism of clamp-fitting type.

[0004] On the other hand, the spout-conveying mechanism of the conventional spout applying device usually conveys only one spout body from a feeding position to a position for

attaching at one time, and cannot simultaneously perform spout applying procedures of a plurality of groups of spout bodies in parallel. Moreover, the conventional spout-conveying mechanism usually has a completed movement path of conveying the spout body from the feeding position to the attaching position, and there is still space for further optimizing the processing flow.

SUMMARY

[0005] An objective of the present disclosure is to simplify a spout applying process during producing a package with spout and to accelerate the processing speed.

[0006] Another objective of the present disclosure is to provide a spout applying device and a spout applying method suitable for simultaneously performing spout applying procedures of a plurality groups of spout bodies in parallel, and in particular to provide a spout applying device and a spout applying method suitable for receiving spout bodies and attaching spout bodies synchronously in a single spout-conveying mechanism.

[0007] Yet another objective of the present disclosure is to provide a spout applying device and a spout applying method suitable for conveying and attaching a spout body provided with a planar membrane at a bottom end of the spout body.

[0008] An aspect of the present disclosure provides a spout applying device for attaching a spout body onto a package. The spout applying device includes a spout-conveying mechanism and a spout-feeding mechanism, and defines a feeding position and an attaching position; the spout-conveying mechanism is configured to receive a spout body from the spout-feeding mechanism at the feeding position and convey the spout body to the attaching position. The spout-conveying mechanism includes a rotating shaft and a spout-suction wheel, the spout-suction wheel is arranged around the rotating shaft and includes a central part and a plurality of claw groups extending radially outward from the central part, and a free end of a claw in the claw group is provided with a suction part for sucking a spout body. The spout-suction wheel is configured to be rotatable around an axis of the rotating shaft, so that the suction part of the claw in the claw group rotates between the feeding position and the attaching position to convey the spout body from the feeding position to the attaching position; and in a case that one claw group of the plurality of claw groups is located at the feeding position, another claw group of

the plurality of claw groups is located at the attaching position.

[0009] In some embodiments, the spout applying device is configured such that in a case that the spout-suction wheel rotates to a state where one claw group of the plurality of claw groups is located at the feeding position and another claw group of the plurality of claw groups is located at the attaching position, the spout-suction wheel suspends rotating and translates from a first axial position that allows for a rotation of the spout-suction wheel to a second axial position along an axial direction of the rotating shaft to stay for a preset time, and then the spout-suction wheel returns back to the first axial position along the axial direction and continues to rotate. At the second axial position, the suction part of the claw located at the feeding position grabs the spout body from a feeding port of the spout-feeding mechanism, and the claw located at the attaching position positions the spout body at an attaching location so as to attach the spout body onto the package.

[0010] In some embodiments, each claw group of the plurality of claw groups includes a plurality of claws, and the spout-feeding mechanism includes a plurality of feeding ports in one-to-one correspondence with the plurality of claws in the claw group.

[0011] In some embodiments, an air suction channel is arranged in an interior of each claw of the spout-suction wheel, and the suction part of each claw is provided with a suction hole communicated with the air suction channel.

[0012] In some embodiments, the air suction channels of all claws in each claw group of the spout-suction wheel are communicated with each other, and air paths of the air suction channels of all claws in each claw group are independently controlled to be closed or opened by a single fluid control element; or, the air suction channels of respective claws of the spout-suction wheel are not communicated with each other, and air paths of the air suction channels of respective claws are independently controlled to be closed or opened by respective fluid control elements.

[0013] In some embodiments, the spout applying device further includes a vacuum generator, and the vacuum generator is communicated with the air suction channel.

[0014] In some embodiments, the spout-conveying mechanism further includes a pneumatic rotary joint arranged around the rotating shaft and adjacent to the spout-suction wheel, and the vacuum generator is communicated with the air suction channel through the

pneumatic rotary joint.

[0015] In some embodiments, the pneumatic rotary joint includes a fixed end and a rotary end, the fixed end is provided with a fixed negative pressure interface for receiving a negative pressure from the vacuum generator, and the rotary end is provided with a rotary negative pressure interface for conveying the negative pressure to the air suction channel.

[0016] In some embodiments, the spout applying device further includes a conveying belt arranged below the spout-suction wheel, and the conveying belt is adapted to convey a package to be attached with the spout body sucked by the spout-suction wheel to pass through the attaching position; and the conveying belt moves in cooperation with the spout-suction wheel, so that in a case that the package passes through the attaching position, the suction part of the claw of the spout-suction wheel rotates to enter the inside of the package through a top opening of the package and then rotates to depart from the package through the top opening after the spout body is attached onto the package.

[0017] In some embodiments, the suction part of the claw of the spout-suction wheel includes a rigid suction disc or a flexible suction disc.

[0018] In some embodiments, in a case where the claw group of the spout-suction wheel includes a plurality of claws, an interval angle between two adjacent claws in the claw group of the spout-suction wheel is less than or equal to an interval angle between two adjacent claw groups.

[0019] Another aspect of the present disclosure provides a spout applying method for attaching a spout body onto a package. The spout applying method includes steps of:

[0020] a) providing a spout applying device, the spout applying device including a spout-conveying mechanism and a spout-feeding mechanism and defining a feeding position and an attaching position; wherein the spout-conveying mechanism includes a rotating shaft and a spout-suction wheel, and the spout-suction wheel is arranged around the rotating shaft and includes a central part and a plurality of claw groups extending radially outward from the central part, and a free end of a claw in the claw group is provided with a suction part for sucking a spout body;

[0021] b) positioning the spout-suction wheel at a first axial position along an axial direction of the rotating shaft;

[0022] c) rotating the spout-suction wheel around an axis of the rotating shaft until one claw group of the plurality of claw groups is located at the feeding position and another claw group of the plurality of claw groups is located at the attaching position;

[0023] d) translating the spout-suction wheel from the first axial position to a second axial position along the axial direction of the rotating shaft to stay for a preset time; and at the second axial position, grabbing the spout body from a feeding port of the spout-feeding mechanism by using the suction part of the claw located at the feeding position, and positioning the spout body at an attaching location by the claw located at the attaching position;

[0024] e) attaching the spout body at the attaching location onto a package; and

[0025] f) returning the spout-suction wheel back to the first axial position along the axial direction.

[0026] In some embodiments, the spout applying method further includes: conveying the package to be attached with the spout body sucked by the spout-suction wheel to pass through the attaching position by means of a conveying belt arranged below the spout-suction wheel of the spout applying device; and the conveying belt moves in cooperation with the spout-suction wheel so that in a case that the package passes through the attaching position, the suction part of the claw of the spout-suction wheel rotates to enter the inside of the package through a top opening of the package and then rotates to depart from the package through the top opening after the spout body is attached onto the package.

[0027] In some embodiments, the step e) includes: welding the spout body at the attaching location onto the package by using an ultrasonic welding process.

[0028] In some embodiments, grabbing the spout body from the feeding port of the spout-feeding mechanism by using the suction part of the claw located at the feeding position in the step d) and attaching the spout body at the attaching location onto the package in the step e) are performed synchronously.

[0029] According to the present disclosure, a rotatable wheel structure is utilized to realize simultaneously grabbing and attaching a plurality of groups of spout bodies, and a movement path of conveying the spout body from a feeding position to an attaching position can be simplified, so that the processing speed can be effectively accelerated. Moreover, the combination of the wheel structure and the vacuum suction structure allows the present

disclosure to be particularly suitable for attaching a spout body in which a planar membrane covers a bottom end thereof onto the package.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] Embodiments of the present disclosure will be described below with reference to the accompanying drawings by way of example only. In the drawings, the same features or components are denoted by the same reference numerals, and the drawings are not necessarily drawn to scales. In the drawings:

[0031] FIG. 1 illustrates a central sectional view of a conventional spout body;

[0032] FIG. 2 illustrates a central sectional view of an improved spout body;

[0033] FIG. 3 illustrates a perspective view of a spout applying device according to an embodiment of the present disclosure, with part of a housing of the spout applying device removed for clarity;

[0034] FIGS. 4 and 5 illustrate perspective views of a spout-conveying mechanism of a spout applying device when viewed from different perspectives;

[0035] FIG. 6 illustrates a perspective view of a spout-suction wheel of a spout-conveying mechanism;

[0036] FIG. 7 illustrates a sectional view taken along a longitudinal central axis of the spout-suction wheel in FIG. 6; and

[0037] FIGS. 8 to 10 schematically illustrate a flow of a spout applying method according to the present disclosure.

DETAILED DESCRIPTION

[0038] Hereafter, exemplary embodiments will be described in a more comprehensive way with reference to the accompanying drawings.

[0039] Exemplary embodiments are provided here so that the present disclosure will be detailed and will fully convey the scope to those skilled in the art. Numerous specific details, such as examples of specific components, devices, and methods, are set forth to provide a thorough understanding of various embodiments of the present disclosure, and these specific details should not be construed as limiting the scope of the present disclosure. It will be clear

to those skilled in the art that the exemplary embodiments can be implemented in many different forms without limited to the details specifically disclosed. In some exemplary embodiments, well-known processes, well-known device structures and well-known techniques are not described in detail.

[0040] If any, related orientation terms such as “upper”, “lower”, “top” and “bottom” as used here are determined in terms of the positions illustrated in the accompanying drawings, for example. The use of these orientation terms is intended for the convenience of description and is not intended to limit the present disclosure.

[0041] First, application scenarios of the present disclosure are briefly introduced with reference to FIG. 1 and FIG. 2. The present disclosure mainly relates to a spout applying device and a spout applying method for attaching a spout body onto a package, such as a package for forming a carton. FIG. 1 illustrates a central sectional view of a conventional spout body 1. The spout body 1 includes a cap 11 and a pull ring 12 arranged at a neck inside the spout so as to close a pouring opening. When in use, the cap 11 needs to be unscrewed and taken away firstly, and then the pull ring 12 needs to be pulled away, which results in a complicated cap-opening process. When attaching the spout body 1 onto the package, the spout body 1 is usually transported by utilizing a spout-conveying mechanism 200 including a protrusion which is protruded into the spout body 1 from a bottom end of the pouring opening of the spout body 1 and clamp-fitted with the spout body 1. FIG. 2 illustrates a central sectional view of an improved spout body 1'. The spout body 1' includes a cap 11' and a planar membrane 12' covering an entire bottom end of the cap 11'. When the cap 11' is unscrewed, it can automatically cut off the planar membrane 12' to open the cap 11’ in a single step. Since the planar membrane 12' completely covers the pouring opening at the bottom end of the cap 11', such kind of spout body 1' cannot be transported by a conventional spout-conveying mechanism 200 of clamp-fitting type. The spout applying device and the spout applying method described below are mainly designed for the spout body 1' illustrated in Fig. 2, but it should be understood that the spout applying device and the spout applying method according to the present disclosure can also be applied, mutatis mutandis, for example, to other types of spout bodies, such as the conventional spout body 1 illustrated in Fig. 1.

[0042] FIG. 3 illustrates a perspective view of a spout applying device according to an

embodiment of the present invention, and a part of a housing of the spout applying device is removed for clarity. As illustrated in FIG. 3, the spout applying device generally includes a spout-feeding mechanism 100 and a spout-conveying mechanism 200 and defines a feeding position and an attaching position. The spout-feeding mechanism 100 continuously supplies the spout body 1' to the feeding position, and the spout-conveying mechanism 200 at the feeding position can receive a spout body 1' from the spout-feeding mechanism 100 and convey the spout body 1' to the attaching position. In this embodiment, the spout-feeding mechanism 100 includes two feeding chutes (not illustrated) arranged approximately in a vertical direction, and two columns of spout bodies 1' fall into two feeding ports 110 along the corresponding feeding chutes, respectively, under the action of gravity. The spout applying device may further include a spout-pushing mechanism 300 arranged close to the feeding position, for pushing the spout body 1' to depart from the feeding port 110 and move towards the spout-conveying mechanism 200, so that the spout-conveying mechanism 200 can grab the spout body 1'. The spout-pushing mechanism 300 may include, for example, a spout/pushing air cylinder. The spout applying device may further comprise an attaching mechanism 400 arranged close to the attaching position, for attaching the spout body 1' located at the attaching position onto a corresponding package 3. In this embodiment, the attaching mechanism 400 includes an ultrasonic welding joint 410, which can weld the spout body 1' to a predetermined position of the package 3 through an ultrasonic welding process. The exemplary package 3 may be a carton with an opened top, and an attachment hole for receiving the spout body 1' is opened at a predetermined position on a side wall of the carton. The attaching mechanism 400 may further include a welding joint driver 420 for driving the ultrasonic welding joint 410 to move towards or move away from the spout-conveying mechanism 200, and the welding joint driver 420 may include an air cylinder, for example. In some other embodiments, any other suitable means can also be utilized to attach the spout body onto the package. Moreover, the spout applying device may further include a conveying belt (not illustrated) arranged below the attaching mechanism 400, for continuously conveying the package 3 to pass through the attaching position.

[0043] FIGS. 4 and 5 illustrate perspective views of the spout-conveying mechanism 200 when viewed from different perspectives. As illustrated in FIGS. 4 and 5, the spout-conveying mechanism 200 includes a rotating shaft 210 and a spout-suction wheel 220

arranged around the rotating shaft 210. FIG. 6 further illustrates a perspective view of the spout-suction wheel 220 of the spout-conveying mechanism 200, and FIG. 7 illustrates a sectional view taken along a longitudinal central axis of the spout-suction wheel 220 in FIG. 6.

[0044] Referring to FIGS. 3 to 7, the spout-suction wheel 220 includes a central part 221 and a plurality of claw groups extending radially outward from the central part 221, and the central part 221 can be configured as a sleeve for easy installation. As best illustrated in FIG. 6, in this embodiment, the spout-suction wheel 220 includes eight claws divided into four claw groups, namely, a first claw group 222-1, a second claw group 222-2, a third claw group 222-3 and a fourth claw group 222-4, and each claw group includes two claws adjacent to each other. The eight claws of the spout-suction wheel 220 are arranged at equal intervals along a circumferential direction of the spout-suction wheel 220. A free end of each claw is provided with a suction part 223 for sucking the spout body 1'. While the spout-suction wheel 220 rotates once around an axis of the rotating shaft 210, the suction parts 223 of the four claw groups rotates from the feeding position to the attaching position sequentially, and then returns back to the feeding position after the spout body 1' is attached. At the feeding position, the two suction parts 223 of one claw group are aligned with two feeding ports 110 of the spout-feeding mechanism 100, respectively. As illustrated in FIG. 3, at the feeding port 110, a planar membrane 12' at a bottom end of the spout body 1' faces towards the suction part 223 of the spout-suction wheel 220. At the attaching position, two suction parts 223 of one claw group are aligned with two ultrasonic welding joints 410 of the attaching mechanism 400, respectively. When one claw group of the spout-suction wheel 220 is located at the attaching position, another claw group is located at the feeding position. For example, in this embodiment, when the first claw group 222-1 is located at the attaching position, the third claw group 222-3 arranged opposite to the first claw group 222-1 is located at the feeding position. Two claws of each claw group can handle two spout bodies at the same time; that is to say, two claws in each claw group can grab two spout bodies 1' from corresponding two feeding ports 110 simultaneously and transport the two spout bodies 1' to the attaching position simultaneously so as to be attached onto corresponding two packages 3. In some other embodiments, the number of the claw groups included in the spout-suction wheel 220, the number of the claws included in each claw group, and an interval angle between claw groups or claws can be

adjusted according to actual needs, and the numbers and positions of the feeding ports 110 and the ultrasonic welding joints 410 can also be adjusted according to the configuration of the spout-suction wheel 220, so that the feeding ports and the ultrasonic welding joints 410 respectively are in one-to-one correspondence with the claws in one claw group of the spout-suction wheel 220. For example, in the case where each claw group of the spout-suction wheel 220 includes a plurality of claws, an interval angle between two adjacent claws in the claw group of the spout-suction wheel 220 can be smaller than an interval angle between two adjacent claw groups, which can be beneficial to distinguishing different claw groups during the operation and maintenance of the spout applying device.

[0045] In this embodiment, the spout-suction wheel 220 grabs and transports the spout body 1' in such a way that the suction parts 223 of respective claw groups vacuum suction the planar membrane 12' at the bottom end of the spout body 1'. As illustrated in FIG. 3, the spout applying device may include one or more vacuum generators 500. In this embodiment, four vacuum generators 500 are provided for the four claw groups of the spout-suction wheel 220. As illustrated in FIG. 7, an air suction channel 224 configured to be communicated with the vacuum generator 500 is provided in an interior of each claw of the spout-suction wheel 220. A first end 224-1 of each air suction channel 224 may be arranged on an end face 225 of the spout-suction wheel 220 facing away from the feeding port 110 to receive a pipeline coupled with the vacuum generator 500. A second end 224-2 of each air suction channel 224 can be arranged at a radially outer side of the claw of the spout-suction wheel 220, so that at least a part of the air suction channel 224 can be machined directly along an extension direction of the claw during machining the spout-suction wheel 220; and the second end 224-2 will be sealed when in use. The first end 224-1 and the second end 224-2 may be provided as threaded holes to connect pipelines or sealing member.

[0046] As illustrated in FIG. 7, the suction part 223 of each claw of the spout-suction wheel 220 is provided with a suction hole 226 communicated with the air suction channel 224. The suction part 223 may further include a rigid suction disc or a flexible suction disc (227) arranged at the suction hole 226 or close to the suction hole 226, so as to form a suction surface for sucking the planar membrane 12' at the bottom end of the spout body 1 '. As illustrated in FIGS. 4 and 6, the suction part 223 may include a concave part 228 for receiving the flexible

suction disc 227. For example, the flexible suction disc 227 can be installed in the concave part 228 by threaded connection, and an avoidance slot 229 can be arranged on a side wall of the suction part 223 surrounding the concave part 228, so that tools such as a wrench for installing the flexible suction disc 227 can be inserted into the concave part 228.

[0047] In order to facilitate the grabbing, conveying and attaching of the spout body 1', the spout-suction wheel 220 may be configured to intermittently perform a rotary motion around the axis of the rotating shaft 210 and an axial reciprocating motion along the axial direction of the rotating shaft 210. When the spout-suction wheel 220 is located at a first axial position away from the feeding port 110 and the attaching mechanism 400, the spout-suction wheel 220 is allowed to rotate. When the spout-suction wheel 220 rotates until one claw group is located at the feeding position and another claw group is located at the attaching position, the spout-suction wheel 220 suspends rotating and moves to a second axial position close to the feeding port 110 and the attaching mechanism 400 along the axial direction of the rotating shaft 210, so as to perform the action of grabbing the spout body 1' by one claw group and the action of attaching the spout body 1' by another claw group simultaneously. When the actions of grabbing the spout body 1' and attaching the spout body 1' are completed, the spout-suction wheel 220 can return back to the first axial position along the axial direction of the rotating shaft 210 and continue to rotate. As illustrated in FIGS. 3 to 5, the spout-conveying mechanism 200 may include a rotary driver 230 for driving the spout-suction wheel 220 to rotate around the axis of the rotating shaft 210 and an axial driver 240 for driving the spout-suction wheel 220 to carry out a reciprocate motion along the axial direction of the rotating shaft 210. For example, the rotary driver 230 may include a motor, and the axial driver 240 may include an air cylinder.

[0048] As illustrated in FIGS. 4 and 5, the spout-conveying mechanism 200 may further include a pneumatic rotary joint 250 arranged around the rotating shaft 210 and adjacent to the spout-suction wheel 220. The pneumatic rotary joint 250 may include a fixed end 251 and a rotary end 252 and has the function of conveying a distribution of negative pressure generated by the vacuum generator 500 coupled to the fixed end 251 to respective air suction channels 224 of the spout-suction wheel 220 coupled to the rotary end 252. The fixed end 251 includes a fixed negative pressure interface 253 that can be coupled with the vacuum generator

500 via a pipeline (not illustrated). In this embodiment, four fixed negative pressure interfaces 253 for coupling with four vacuum generators 500 respectively are arranged on the radially outer side of the fixed end 251. The rotary end 252 is coupled with the spout-suction wheel 220 and can rotate together with the spout-suction wheel 220 relative to the fixed end 251. The rotary end 252 is provided with a rotary negative pressure interface 254 which can be communicated with the air suction channel 224 of the spout-suction wheel 220 via a pipeline (not illustrated). In this embodiment, four rotary negative pressure interfaces 254 are uniformly arranged along the radially outer side of the rotary end 252, and each of the rotary negative pressure interfaces 254 can be communicated with two first ends 224-1 of two air suction channels 224 in one claw group of the spout-suction wheel 220 via a pipeline. Thus, the air suction channels 224 of all claws in each claw group of the spout-suction wheel 220 are communicated with each other and are coupled to an independent vacuum generator 500. In other words, air paths of the air suction channels 224 in each claw group of the spout-suction wheel 220 are independently controlled to be closed or opened by a single vacuum generator 500, which is beneficial to synchronously controlling all claws in each claw group to grab the spout body 1' and to be disconnected from the spout body 1'. In some other embodiments, the air suction channels 224 of respective claws of the spout-suction wheel 220 may also be not communicated with each other, and air paths of the air suction channels 224 of respective claws are respectively controlled to be closed or opened by their own vacuum generators 500, which can prevent from affecting a normal operation of other claws when the vacuum generator 500 associated with one claw fails. Moreover, it should also be taken into account that only a single vacuum generator 500 is provided, and the air paths of respective air suction channels 224 and/or respective groups of air suction channels 224 are controlled to be closed or opened by valves and/or other fluid control elements associated with the respective air suction channels 254.

[0049] Hereinafter, the flow of the spout applying method performed by using the spout applying device according to the foregoing embodiments will be described in details with reference to FIGS. 8 to 10.

[0050] During the spout applying process which is continuously performed, a conveying belt (not illustrated) located below the spout-suction wheel 220 conveys a series of

packages to pass through the attaching position. The rotary motion of the spout-suction wheel 220 cooperates with the motion of the conveying belt, so that the suction parts 223 of respective claws of the spout-suction wheel 220 are engaged with the package on the conveying belt in a manner similar to an engagement between a gear and a rack. More specifically, when the package passes through the attaching position, the suction part 223 of the claw of the spout-suction wheel 220 can rotate to enter the inside of the package through a top opening of the package and then rotate to depart from the package through the top opening after the spout body 1' is attached onto the package.

[0051] FIG. 8 illustrates that the spout-suction wheel 220 at the first axial position rotates to the state where the suction part 223 of the first claw group 222-1 is located at the attaching position and the suction part 223 of the third claw group 222-3 is located at the feeding position. At this time, all the suction parts 223 of the first claw group 222-1 and of the second claw group 222-2 that previously rotated to pass through the feeding position have been sucked with a spout body 1 ', and the suction parts 223 of the first claw group 222-1 have rotated to enter the interior of the corresponding first group of packages 3-1, so that the spout body 1 ' on the first claw group 222-1 is aligned with an attachment hole on the side wall of the first group of packages 3-1. As illustrated by the arrow in FIG. 8, the rotation of the spout-suction wheel 220 pauses, and the axial driver 240 drives the spout-suction wheel 220 to translate from the first axial position to a second axial position along an axial direction of the rotating shaft 210, so that the suction part 223 of the first claw group 222-1 positions the spout body 1' thereon at an attaching location (i.e., so that the spout body 1' is received in the attachment hole on the side wall of the package), and the suction part 223 of the third claw group 222-3 is closer to the feeding port 110 and ready for grabbing the spout body 1'. Moreover, the spout-pushing mechanism 300 moves towards the spout-suction wheel 220 along the axial direction of the rotating shaft 210, to push the spout body 1' to depart from the feeding port 110 and move towards the suction part 223 of the third claw group 222-3 of the spout-suction wheel 220, so that the suction part 223 of the third claw group 222-3 sucks the spout body 1'. The welding joint driver 420 of the attaching mechanism 400 drives the ultrasonic welding joint 410 to move towards the spout-suction wheel 220 along the axial direction of the rotating shaft 210, so as to attach the spout body 1' on the first claw group 222-1 onto the first group of

packages 3-1. When the action of attaching the spout body 1' on the first claw group 222-1 onto the first group of packages 3-1 is completed, the vacuum generator 500 communicated with the air suction channel 224 of the first claw group 222-1 breaks the vacuum state, so that the suction part 223 of the first claw group 222-1 is disconnected from the spout body. In some embodiments, the translation of the spout-suction wheel 220 from the first axial position to the second axial position, the movement of the spout-pushing mechanism 300 towards the spout-suction wheel 220, and the movement of the ultrasonic welding joint 410 towards the spout-suction wheel 220 are carried out simultaneously, so that the spout applying process can be further accelerated.

[0052] Subsequently, as illustrated by the arrow in FIG. 9, the axial driver 240 drives the spout-suction wheel 220 to return back to the first axial position from the second axial position along the axial direction of the rotating shaft 210. At the same time, the spout-pushing mechanism 300 is reset by moving away from the spout-suction wheel 220 along the axial direction of the rotating shaft 210, and the welding joint driver 420 drives the ultrasonic welding joint 410 to reset by moving away from the spout-suction wheel 220 along the axial direction of the rotating shaft 210.

[0053] Next, as illustrated by the arrow in FIG. 10, the rotary driver 230 drives the spout-suction wheel 220 to rotate around the axis of the rotating shaft 210 until the second claw group 222-2 is located at the attaching position and the fourth claw group 222-4 is located at the feeding position; and at the same time, the conveying belt conveys the second group of packages 3-2 that have not been attached with any spout body to the attaching position. The above steps are repeated, so that the spout body on the second claw group 222-2 is welded onto the second group of packages 3-2, while the fourth claw group 222-4 grabbing a spout body from the feeding port 110.

[0054] By repeating the above cycle, it can realize a continuous spout applying process.

[0055] By using the wheel structure that can carry out a rotary motion and an axial reciprocating motion, the spout applying device according to the present disclosure can simultaneously perform spout applying procedures for a plurality of groups of spout bodies in parallel, and simplify the movement path of transporting the spout body from the feeding position to the attaching position, thereby effectively accelerating the production speed.

Moreover, the spout-conveying mechanism of the spout applying device according to the present disclosure does not need to move up and down in translation, which also simplifies the structure of the spout-conveying mechanism. Additionally, the spout applying device according to the present disclosure combines the wheel structure with the vacuum suction structure, so that such spout applying device is particularly suitable for attaching a spout body in which a planar membrane covers a bottom end thereof onto a package. However, it should be understood that the wheel structure in the spout applying device according to the present disclosure can also be modified to grab and convey the conventional spout body by clamp-fitting with the spout body.

[0056] Additionally, the present disclosure allows for various feasible modifications.

[0057] For example, in the foregoing, it is specifically described that there is a spout-pushing mechanism and the spout-pushing mechanism is used for pushing the spout body to depart from the feeding port and to move towards the spout-conveying mechanism. However, it is conceivable to omit the spout-pushing mechanism and instead of providing a stopper member which is located at the feeding port and faces away from the spout-conveying mechanism. In this case, it is only necessary for the spout-conveying mechanism to axially translate towards the feeding port so as to grab the spout body which is clamped between the stopper member and the suction part of the spout-suction wheel of the spout-conveying mechanism.

[0058] For another example, it is conceivable that the ultrasonic welding joint may not move towards the spout-suction wheel but may be configured as a fixed one.

[0059] Here, exemplary embodiments of the spout applying device and the spout applying method according to the present disclosure have been described in detail, but it should be understood that the present disclosure is not limited to the specific embodiments described and illustrated in details above. Those skilled in the art can make various modifications and variations to the present disclosure without departing from the spirit and scope of the present disclosure. All these modifications and variations are fallen within the scope of the present disclosure. Moreover, all components described herein can be replaced by other technically equivalent components.

WHAT IS CLAIMED IS:

1. A spout applying device for attaching a spout body (1') onto a package (3), comprising a spout-conveying mechanism (200) and a spout-feeding mechanism (100), as well as defining a feeding position and an attaching position, wherein the spout-conveying mechanism (200) is configured to receive a spout body (1') from the spout-feeding mechanism (100) at the feeding position and convey the spout body (1') to the attaching position, wherein:

the spout-conveying mechanism (200) comprises a rotating shaft (210) and a spout-suction wheel (220), wherein the spout-suction wheel (220) is arranged around the rotating shaft (210) and comprises a central part (221) and a plurality of claw groups (222-1, 222-2, 222-3, 222-4) extending radially outward from the central part (221), and a free end of a claw in each claw group (222-1, 222-2, 222-3, 222-4) is provided with a suction part (223) for sucking the spout body (1'),

the spout-suction (220) wheel is configured to be rotatable around an axis of the rotating shaft (210), so that the suction part (223) of the claw in each claw group rotates between the feeding position and the attaching position to convey the spout body (1') from the feeding position to the attaching position; and in a case that one claw group of the plurality of claw groups (222-1, 222-2, 222-3, 222-4) is located at the feeding position, another claw group of the plurality of claw groups (222-1, 222-2, 222-3, 222-4) is located at the attaching position.

2. The spout applying device according to claim 1, wherein the spout applying device is configured such that in a case that the spout-suction wheel (220) rotates to a state where one claw group of the plurality of claw groups (222-1, 222-2, 222-3, 222-4) is located at the feeding position and another claw group of the plurality of claw groups (222-1, 222-2, 222-3, 222-4) is located at the attaching position, the spout-suction wheel (220) suspends rotating, translates from a first axial position that allows for a rotation of the spout-suction wheel (220) to a second axial position along an axial direction of the rotating shaft (210) and stays for a preset time. Then the spout-suction wheel (220) returns to the first axial position along the axial direction and continues to rotate, and

at the second axial position, the suction part (223) of the claw located at the feeding

position grabs the spout body (1') from a feeding port (110) of the spout-feeding mechanism, and the claw located at the attaching position positions the spout body (1') at an attaching location so as to attach the spout body (1') onto a package (3).

3. The spout applying device according to claim 1 or 2, wherein each claw group of the plurality of claw groups (222-1, 222-2, 222-3, 222-4) comprises a plurality of claws, and the spout-feeding mechanism comprises a plurality of feeding ports (110) in one-to-one correspondence with the plurality of claws in each claw group (222-1, 222-2, 222-3, 222-4).

4. The spout applying device according to claim 1 or 2, wherein an air suction channel (224) is arranged in an interior of each claw of the spout-suction wheel (220), and the suction part (223) of each claw is provided with a suction hole (226) communicated with the air suction channel (224).

5. The spout applying device according to claim 4, wherein the air suction channels (224) of all claws in each claw group (222-1, 222-2, 222-3, 222-4) of the spout-suction wheel (220) are connected with each other, and air paths of the air suction channels (224) of all claws in each claw group (222-1, 222-2, 222-3, 222-4) are independently controlled to be closed or opened by a single fluid control element; or,

the air suction channels (224) of respective claws of the spout-suction wheel (220) are not communicating with each other, and air paths of the air suction channels (224) of respective claws are independently controlled to be closed or opened by respective fluid control elements.

6. The spout applying device according to claim 4, further comprising a vacuum generator (500), wherein the vacuum generator (500) is connected with the air suction channel (224).

7. The spout applying device according to claim 6, wherein the spout-conveying mechanism (200) further comprises a pneumatic rotary joint (250) arranged around the rotating shaft (210) and adjacent to the spout-suction wheel (220), and the vacuum generator (500) is communicated with the air suction channel (224) through the pneumatic rotary joint (250).

8. The spout applying device according to claim 7, wherein the pneumatic rotary joint (250) comprises a fixed end (251) and a rotary end (252), wherein the fixed end (251) is provided with a fixed negative pressure interface (253) for receiving a negative pressure from the vacuum generator (500), and the rotary end (252) is provided with a rotary negative pressure interface (254) for transferring the negative pressure to the air suction channel (224).

9. The spout applying device according to claim 1 or 2, further comprising a conveying belt arranged below the spout-suction wheel (220), and the conveying belt is adapted to convey a package (3) to be attached with the spout body (1') sucked by the spout-suction wheel (220) to pass through the attaching position; and the conveying belt moves in cooperation with the spout-suction wheel (220), so that in a case that the package (3) passes through the attaching position, the suction part (223) of the claw of the spout-suction wheel (220) rotates to enter the inside of the package (3) through a top opening of the package (3) and then rotates to depart from the package (3) through the top opening after the spout body (1') is attached onto the package (3).

10. The spout applying device according to claim 1 or 2, wherein the suction part (223) of the claw of the spout-suction wheel (220) comprises a rigid suction disc or a flexible suction disc (227).

11. The spout applying device according to claim 1 or 2, wherein in a case that the claw group of the spout-suction wheel (220) comprises a plurality of claws, an interval angle between two adjacent claws in the claw group of the spout-suction wheel (220) is less than or equal to an interval angle between two adjacent claw groups.

12. A spout applying method for attaching a spout body (1') onto a package (3), comprising steps of:

a) providing a spout applying device, which comprising a spout-conveying mechanism (200) and a spout-feeding mechanism and defining a feeding position and an attaching position;

wherein the spout-conveying mechanism (200) comprises a rotating shaft (210)and a spout-suction wheel (220), and the spout-suction wheel (220) is arranged around the rotating shaft (210) and comprises a central part (221) and a plurality of claw groups (222-1, 222-2, 222-3, 222-4) extending radially outward from the central part (221), and a free end of a claw in the claw group is provided with a suction part (223) for sucking a spout body (1');

b) positioning the spout-suction wheel (220) at a first axial position along an axial direction of the rotating shaft (210);

c) rotating the spout-suction wheel (220) around an axis of the rotating shaft (210) until one claw group of the plurality of claw groups (222-1, 222-2, 222-3, 222-4) is located at the feeding position and another claw group of the plurality of claw groups (222-1, 222-2, 222-3, 222-4) is located at the attaching position;

d) translating the spout-suction wheel (220) from the first axial position to a second axial position along the axial direction of the rotating shaft (210) and staying for a preset time; and at the second axial position, grabbing the spout body (1') from a feeding port (110) of the spout-feeding mechanism by using the suction part (223) of the claw located at the feeding position, and positioning the spout body (1') at an attaching location by the claw located at the attaching position;

e) attaching the spout body (1') at the attaching location onto a package (3); and

f) returning the spout-suction wheel (220) back to the first axial position along the axial direction.

13. The spout applying method according to claim 12, further comprising:

conveying the package (3) to be attached with the spout body (1') sucked by the spout-suction wheel (220) to pass through the attaching position by means of a conveying belt arranged below the spout-suction wheel (220) of the spout applying device; wherein the conveying belt moves in cooperation with the spout-suction wheel (220), so that in a case that the package (3) passes through the attaching position, the suction part (223) of the claw of the spout-suction wheel (220) rotates to enter the inside of the package (3) through a top opening of the package (3) and then rotates to depart from the package (3) through the top opening after the spout body (1') is attached onto the package (3).

14. The spout applying method according to claim 12 or 13, wherein the step e) comprises: welding the spout body (1') at the attaching location onto the package (3) by using an ultrasonic welding process.

15. The spout applying method according to claim 12 or 13, further comprising: disconnecting the suction part (223) of the claw located at the attaching position of the spout-suction wheel (220) from the spout body (1'), after the step e) is completed.

16. The spout applying method according to claim 12 or 13, wherein grabbing the spout body (1') from the feeding port (110) of the spout-feeding mechanism (100) by using the suction part (223) of the claw located at the feeding position in the step d) and attaching the spout body (1') at the attaching location onto the package (3) in the step e) are performed synchronously.

FIG. 1

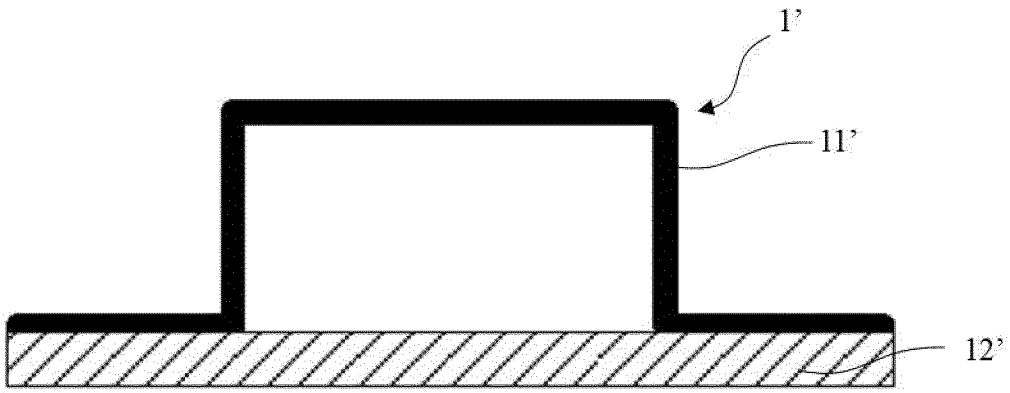

FIG. 2

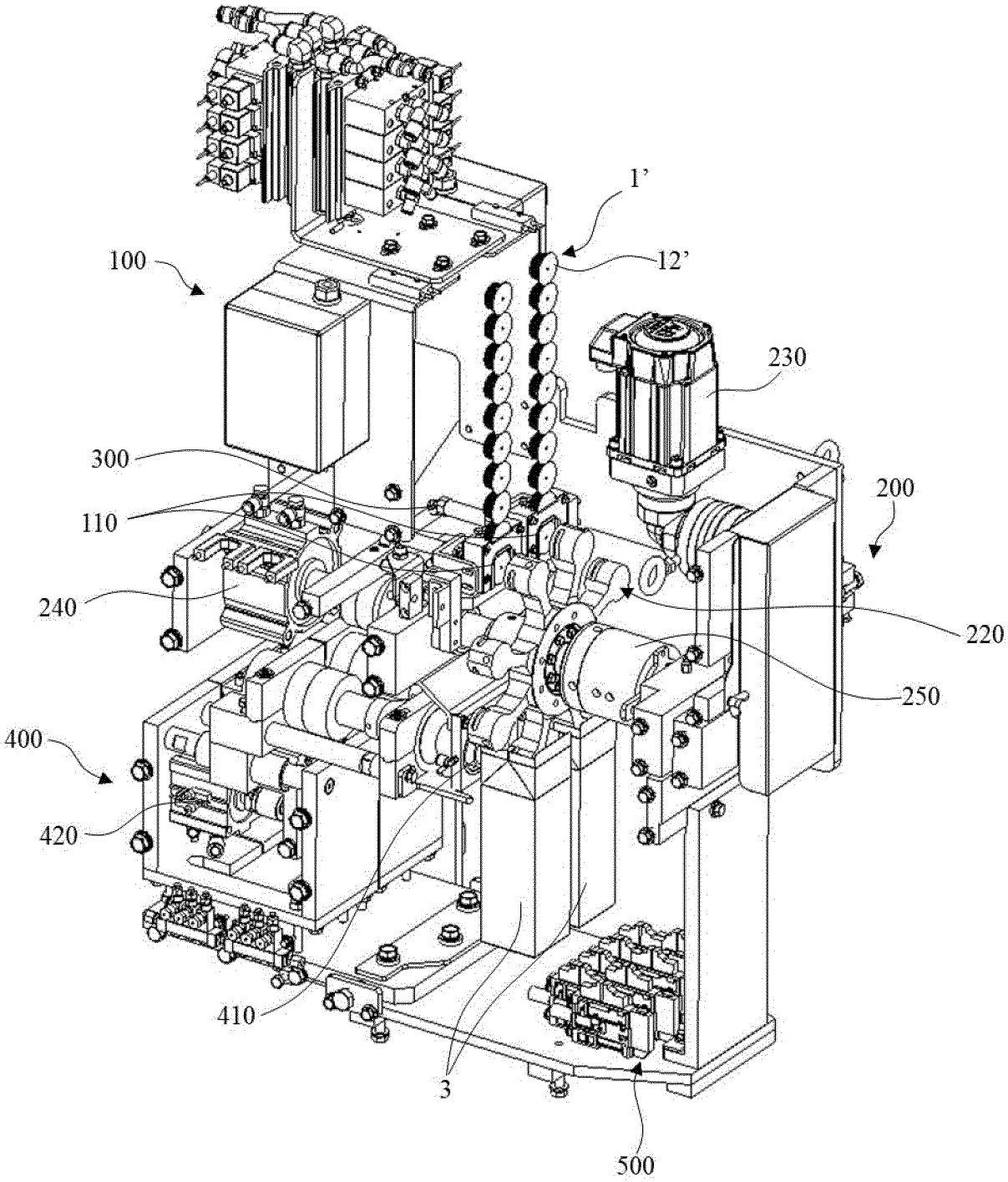

FIG. 3

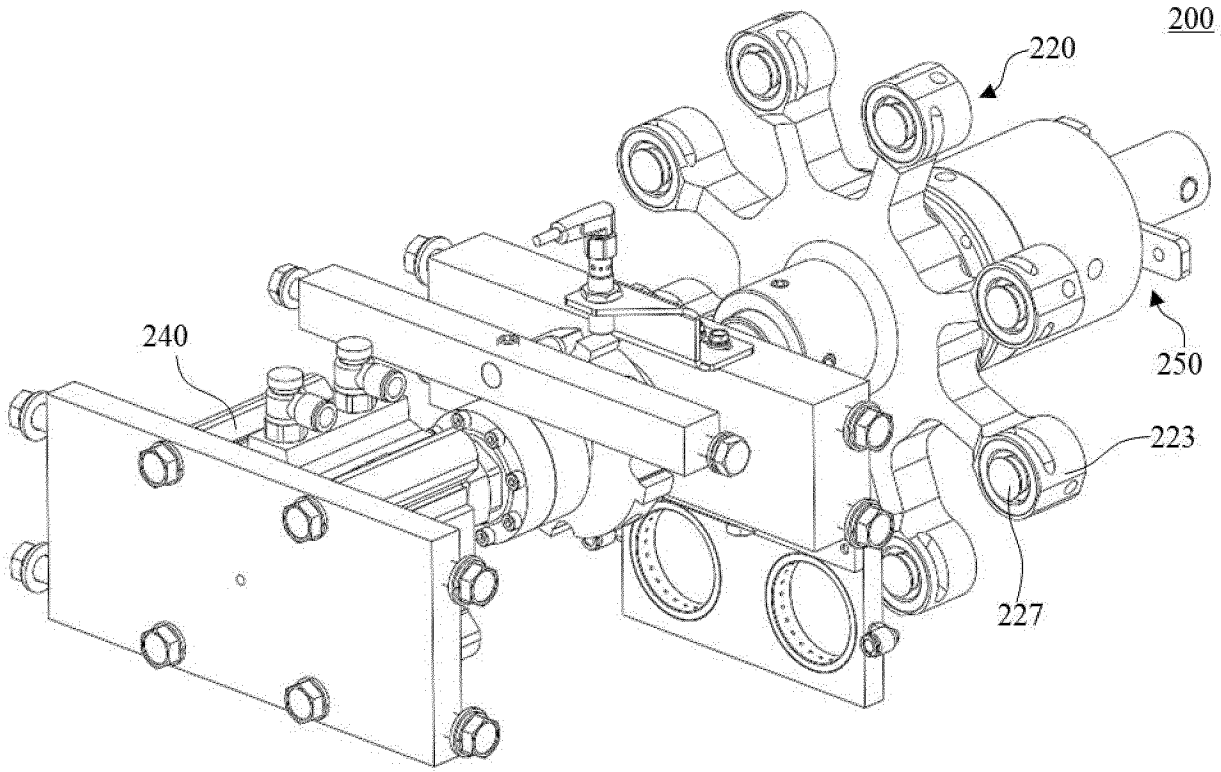

FIG. 4

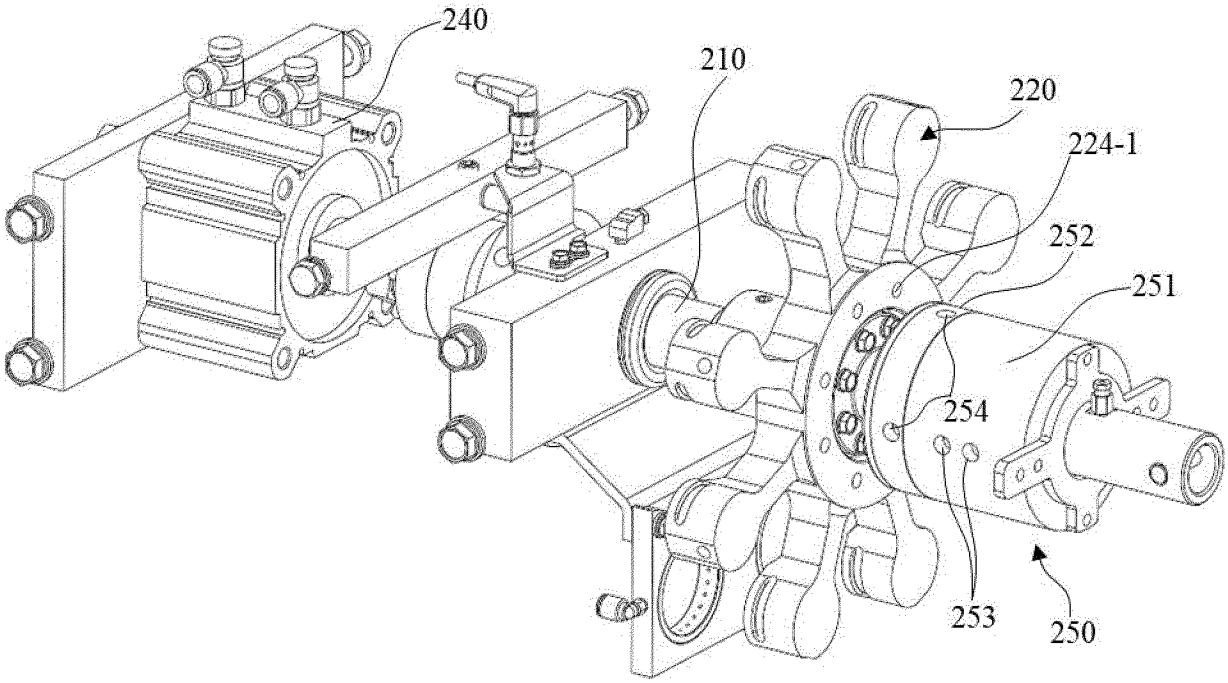

FIG. 5

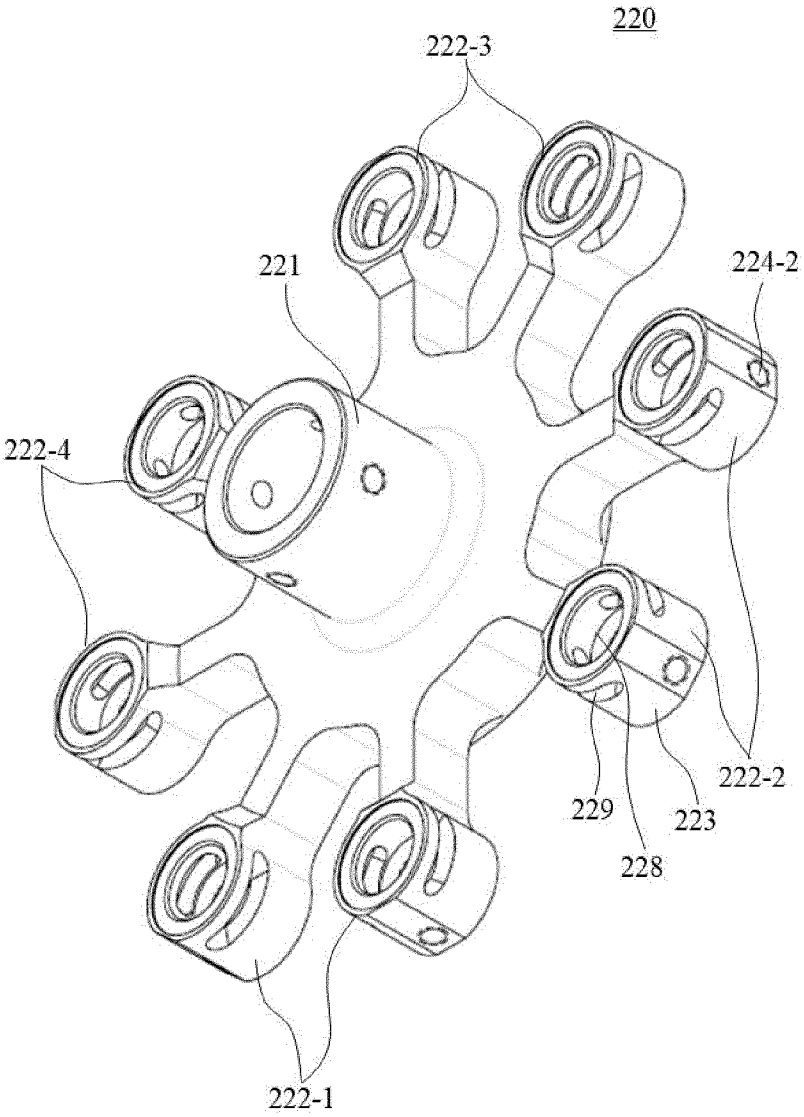

FIG. 6

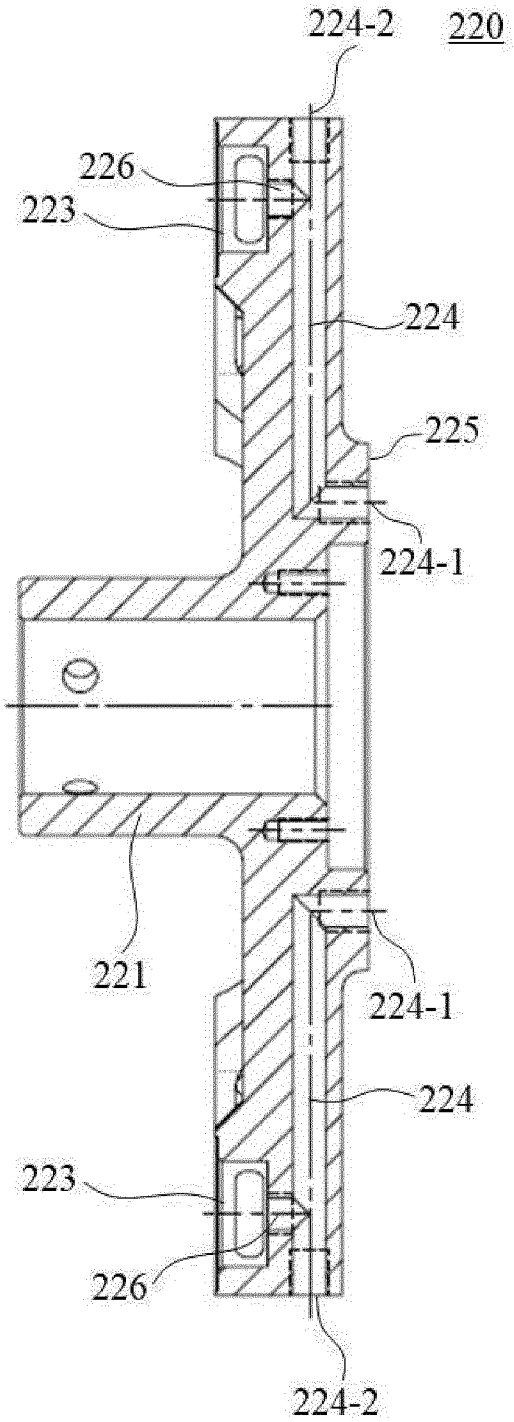

FIG. 7

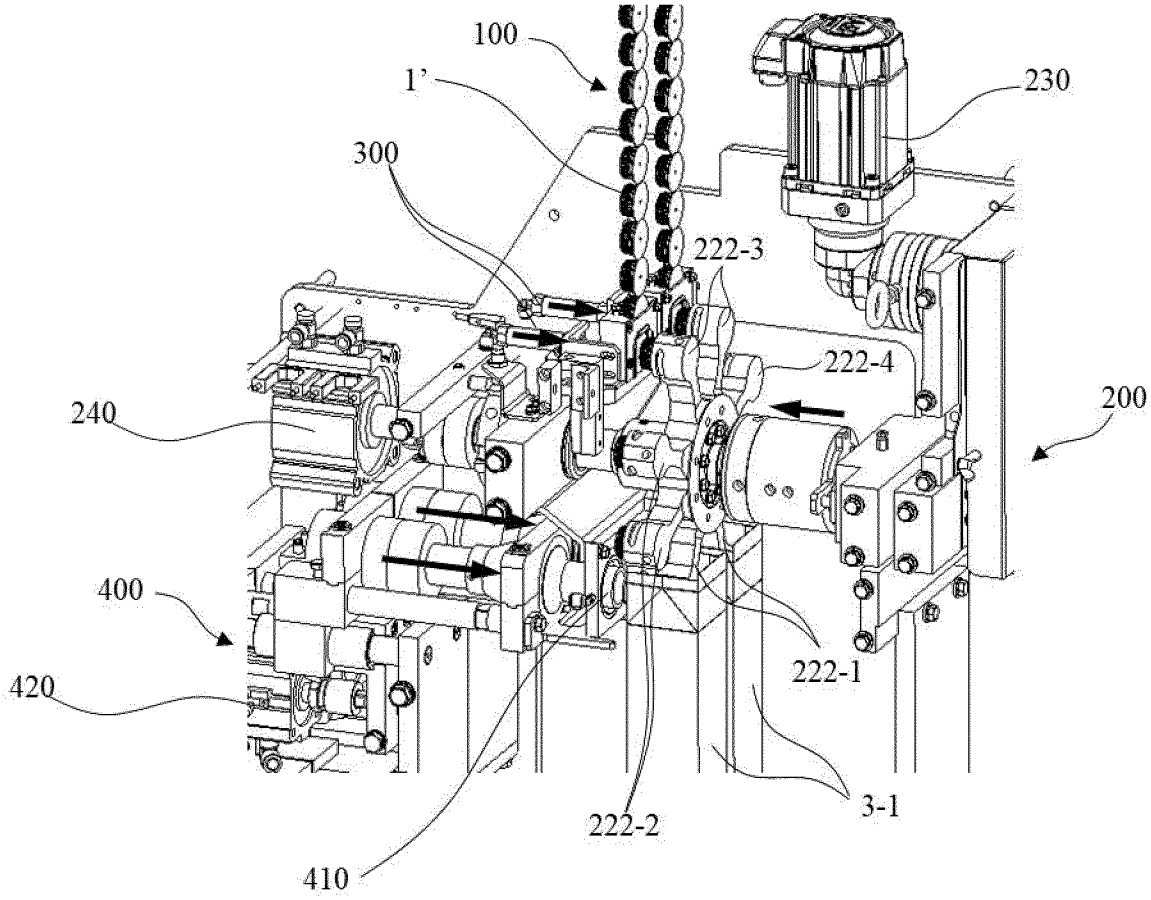

FIG. 8

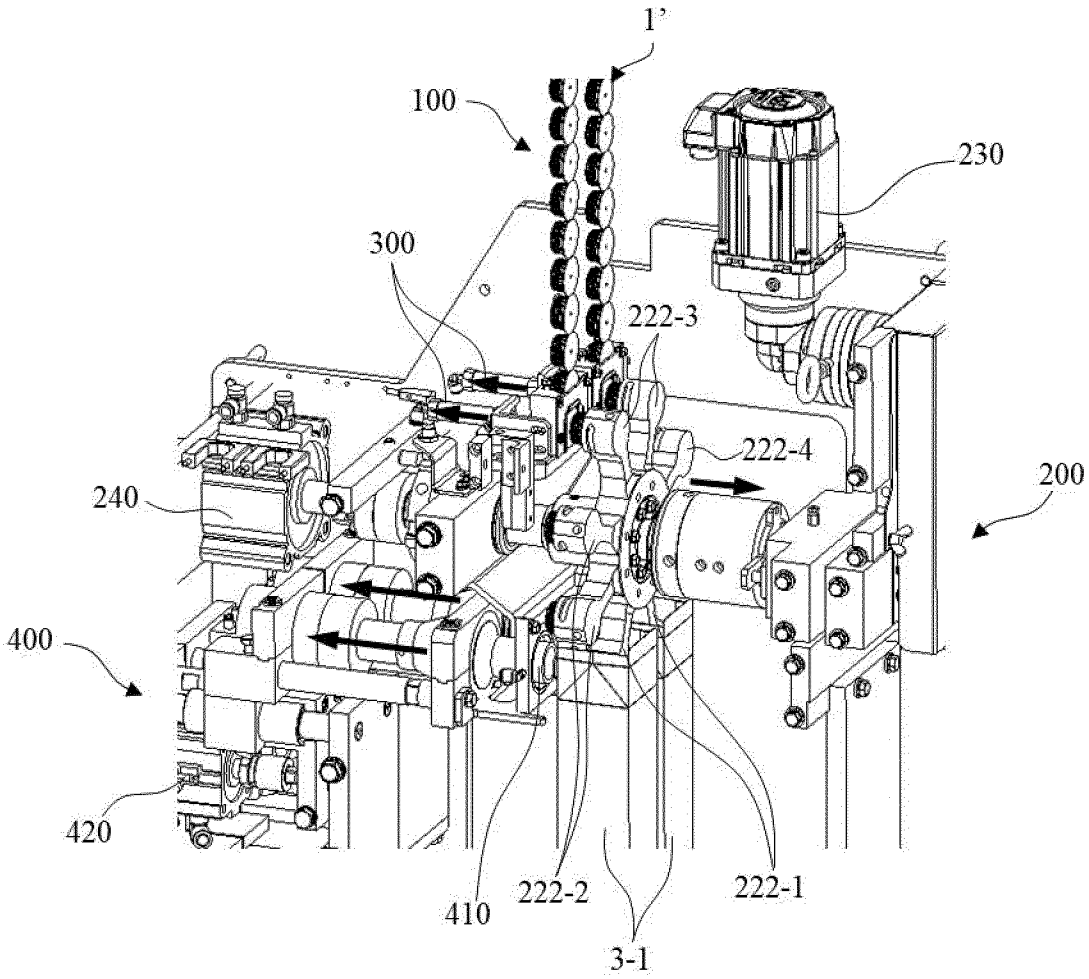

FIG. 9

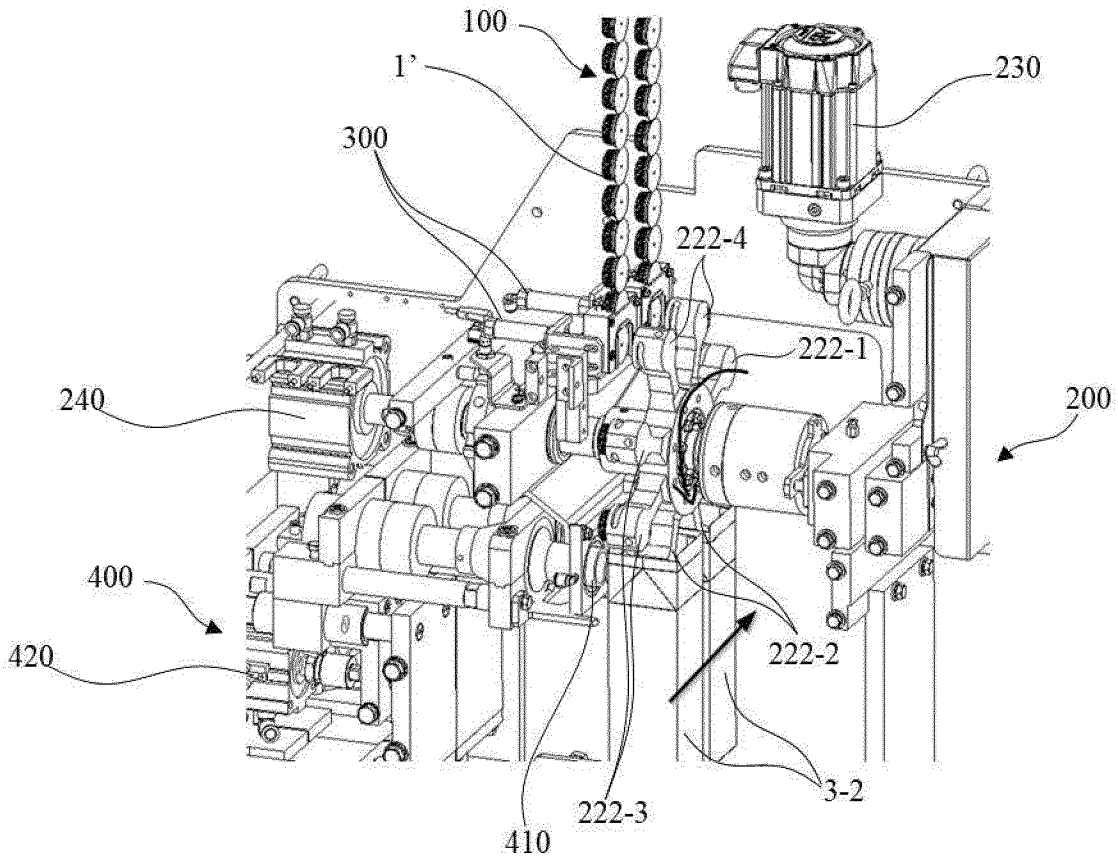

FIG. 10

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2024/056369

A. CLASSIFICATION OF SUBJECT MATTER

INV. B31B50/84 B65B7/28 B65B61/18 B65B65/02
ADD. B31B110/35

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B31B B65B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	the whole document	1-16
Y	EP 3 746 285 B1 (ELOPAK GMBH [DE]) 12 January 2022 (2022-01-12) paragraphs [0033] - [0034]; figures 1, 11-13	1-16
A	EP 0 620 152 B1 (ELOPAK SYSTEMS [CH]) 4 June 1997 (1997-06-04) column 4, lines 3-58; figure 2	1-16
A	EP 2 146 902 B1 (ANDERSEN STEIN VIDAR [NO]) 12 July 2017 (2017-07-12) paragraph [0027]; figure 1	1-16

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[x] Further documents are listed in the continuation of Box C.

[x] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance;; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 June 2024	05/07/2024

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Cardoso, Victor

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2024/056369

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2010/037998 A1 (ELOPAK SYSTEMS [CH]; BUDROW LOREN [US] ET AL.) 8 April 2010 (2010-04-08) figures 1-3	1-16
A	EP 0 962 391 B1 (ELOPAK SYSTEMS [CH]) 23 November 2005 (2005-11-23) figure 3	1-16

1

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Information on patent family members

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