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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
31 March 2022 (31.03.2022)

WIPO | PCT

(10) International Publication Number
WO 2022/063371 A1

(51) International Patent Classification:
B65B 43/26 (2006.01) *B65B 61/00* (2006.01)
B25J 15/02 (2006.01)

(21) International Application Number:
PCT/DK2021/050289

(22) International Filing Date:
21 September 2021 (21.09.2021)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PA 2020 70641 24 September 2020 (24.09.2020) DK

(71) Applicant: **BRÜEL SYSTEMS A/S** [DK/DK]; W Brüels Vej 11, 9800 Hjørring (DK).

(72) Inventors: **WØHLK, Michael**; Bakkelygade 26, 9400 Nørresundby (DK). **THOMSEN, Kenneth**; Langholmvej 12, 9800 Hjørring (DK). **MOLTSEN, Daniel Hjortnæs**; Bispensgade 83, 1.TV., 9800 Hjørring (DK).

(74) Agent: **PATRADE A/S**; Ceresbyen 75, 8000 Aarhus C (DK).

(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, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, IT, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW,

(54) **Title:** CONTAINER FOLDING DEVICE FOR FOLDING COLLAPSIBLE CONTAINERS

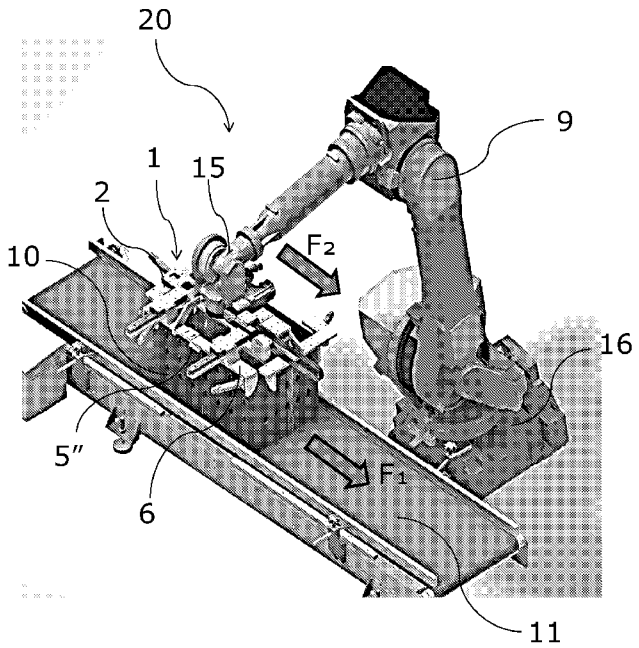


Fig. 3

(57) **Abstract:** The present invention relates to a folding device and a folding system for folding col- lapsible containers. The object of the present invention is to provide a container fold- ing device and a container folding system for folding collapsible containers in a fast and easy manner. The object of the present invention is also to provide a method for folding the collapsible containers, where the method provides an agile and simple folding process, which folds the collapsible containers. The present invention address- es this by providing a container folding device for folding collapsible containers, where the container folding device comprises: - at least one end side member having at least one first end part and at least one second end part, and an end moving means capable of moving said first end part and said sec- ond end part relative to each other, - at least one cross side member having one or more first pushing claw, and one or more second pushing claw, and a side moving means capable of moving said first pushing claw and said second pushing claw

WO 2022/063371 A1

[Continued on next page]

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, GH, GM, KE, LR, LS, MW, MZ, NA, RW, 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, 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))*

relative to each other, - at least one unlocking unit, - one or more attachment means arranged in relation to the container folding device, where in use said first unlocking unit is capable of releasing one or more collapsible container locking mechanisms, so that said cross side member is capable of folding the sides of the collapsible container when pushed by the side moving means, and the said first end part and said second end part is capable of folding the end sides of the collapsible container, when pushed by end moving means.

Container folding device for folding collapsible containers

Field of the Invention

The present invention relates to a folding device and a folding system for folding collapsible containers.

Background of the Invention

Collapsible containers are often used for the food industries, where the collapsible containers are used for storing goods, such as food and/or liquids. The collapsible containers are often recycled. During the recycling process, the collapsible container is either folded or unfolded. When the goods are removed from the collapsible container, the collapsible container is folded and stacked on pallets. This way, the collapsible container will not take up unnecessary space during transport.

When the folded collapsible containers reach their destination, the collapsible containers must be cleaned carefully before being refilled with goods. Each of the collapsible containers must be handled in order to be unfolded and emptied of garbage or leftovers, before the collapsible container enters the washing process. After the washing process, the containers must be folded and stacked on pallets to be stored and reused.

Today, the folded collapsible containers must be placed on a first conveyor, often using manpower for this purpose of moving the folded collapsible containers from a pallet to the first conveyor. The folded collapsible container must be arranged so that the lower part of the collapsible container is resting on the first conveyor, with the container side folded on top of the lower part of the collapsible container. The folded collapsible container will enter an unfolding apparatus, which first unfolds two opposite overlying container sides, and then unfolds the two opposite underlying container sides. The unfolded collapsible container is then moved away from the unfolding apparatus, and the garbage is removed from the unfolded collapsible container. The unfolded collapsible container may then enter a second conveyor or another apparatus which rotates the unfolded collapsible container upside down, in order to arrange the collapsible container in an upside down position on a third conveyor, where the upside down position is preferred when washing the collapsible container. Manpower is used

for folding the collapsible containers after the washing process, while the container is on the conveyor, and afterwards placing the folded collapsible containers onto a pallet, which may be arranged next to the conveyor.

The handling of the folding of the collapsible containers is a slow and costly process, due to the manual work and need of manpower. The monotonous movements may damage the workers' workability over time. Also, the maintenance is high due to the number of conveyers and the apparatuses' need in the pre-washing process.

Object of the Invention

The object of the present invention is to provide a container folding device and a container folding system for folding collapsible containers in a fast and easy manner. The object of the present invention is also to provide a method for folding the collapsible containers, where the method provides an agile and simple folding process, which folds the collapsible containers.

Description of the Invention

The present invention addresses this by providing a container folding device for folding collapsible containers, wherein the container folding device comprises:

- at least one end side member having at least one first end part and at least one second end part, and an end moving means capable of moving said first end part and said second end part relative to each other,
- at least one cross side member having one or more first pushing parts, and one or more second pushing parts, and a side moving means capable of moving said first pushing part and said second pushing part relative to each other,
- at least one unlocking unit,

wherein use said unlocking unit is capable of engaging and unlocking one or more collapsible container locking mechanisms, such that said cross side member is capable of folding the sides of the collapsible container when pushed by the side moving means, and the said first end part and said second end part is capable of folding the end sides of the collapsible container, when pushed by end moving means,

- one or more attachment means for moving the container folding device, wherein the attachment means is arranged in or on the container folding device.

The container folding device is capable of folding collapsible containers in a fast and easy manner. The collapsible containers are often used in the food industries, where the collapsible containers are used for storing goods, such as food and/or liquids. The term "collapsible container" shall be understood as "collapsible crate" or "folding crate". The term "sides of the collapsible container" shall be understood as the collapsible container comprises four sides, two end sides arranged opposite each other, and two cross sides arranged opposite each other. The two end sides and the two cross sides form the four sides of the collapsible container. A releasable locking mechanism may be provided on the two cross sides and/or the two end sides. One or more locking mechanisms may be locked and/or unlocked when activating a first part of the locking mechanism relative to a second part of the locking mechanism. The locking mechanisms may be configured to be unlocked by pushing a first part of the locking mechanisms out of a second part of the locking mechanism. The first part of the locking mechanism may be arranged on an edge part of a cross side of the collapsible container, and the second part of the locking mechanism may be arranged on an edge part of an end side of the collapsible container. The locking mechanism is locked when the first part of the locking mechanism is connected to the second part of the locking mechanism. The collapsible containers locking mechanism may be unlocked when moving the first part of the locking mechanism away from the second part of the locking mechanism, thereby releasing the cross side from the end side of the collapsible container.

The unlocking unit may be arranged in an unlocking angle φ relative to the longitudinal direction of the end side member. Alternatively, the unlocking unit may be arranged in an unlocking angle φ relative to the longitudinal direction of the first and second end part. The unlocking angle φ may provide an optimal unlocking effect on the collapsible container's locking mechanism.

The container folding device is capable of handling different sizes and shapes of collapsible containers. The container folding device comprises at least one end side member and at least one cross side member for pushing all four sides of the collapsible containers during the folding process. Collapsible containers may have one or more locking mechanism, so that the sides of the collapsible container are locked in an unfolded position during use. The container folding device comprises at least one un-

locking unit capable of unlocking the collapsible container's side locking mechanism. The unlocking unit may unlock the locking mechanism by engaging a first part of the locking mechanism. By engaging a first part of the locking mechanism the unlocking unit may remove a locking part of the first part out of a second part of the locking mechanism. The locking mechanism is unlocked when the first part of the locking mechanism is not connected to the second part of the locking mechanism. The locking part of the first part may be a pin, rod or pawl etc. configured to engage the second part. The sides of the collapsible container are unlocked before the sides are folded.

The end side member may be provided with at least one first end part and at least one second end part arranged so that the first end part is arranged relative to a first end of the collapsible container and the second end part is arranged relative to a second end of the collapsible container. An end moving means may be capable of moving said first end part and said second end part relative to each other to fit the distance between the first and the second end of the collapsible container and to push the ends of the collapsible container into a folded position. The end moveable means may for example comprise a motor, belt and/or piston etc. The shape of the first end part may be different from the shape of the second end part. The first end part and the second end part may or may not be identical. The shape of the first end part and the second end may depend on the shape of the collapsible containers to be folded. The moveable means may comprise a motor, an actuator, a belt and/or a piston etc.

The cross side member may be provided with at least one first pushing claw and at least one second pushing claw arranged so that the first pushing claw is arranged relative to a first side of the collapsible container and the second pushing claw is arranged relative to a second side of the collapsible container. A side moving means may be capable of moving said first pushing claw and said second pushing claw relative to each other to fit the distance between the first and the second end of the collapsible container and to push the sides of the collapsible container into a folded position. The side moveable means may for example comprise a motor, belt and/or piston etc.

The shape of the first pushing part may be different from the shape of the second pushing part. The first pushing part and the second pushing part may or may not be identical. The shape of the first pushing part and the second pushing part may depend

on the shape of the collapsible containers to be folded. The first pushing part and/or the second pushing part may be claws, plates or similar. Alternatively, the first pushing part and/or the second pushing part may be a nozzle pushing the cross sides of the collapsible container using an air jet.

The container folding device handles the folding process quickly and agilely without forcing the sides into a folded position and stressing the joints in the collapsible container unnecessarily. The container folding device handles the collapsible containers in a predefined folding sequence, step by step. The predefined folding sequence may comprise the steps where the first step is unlocking the sides from the ends, then a step of folding the ends followed by a step of folding the sides. The container folding device comprises means to arrange a collapsible container from an unfolded position to a folded position. This reduces the costs of recycling collapsible containers.

The container folding device also comprises one or more attachment means, which is arranged in relation to the container folding device. The attachment means are provided such that a moving device is capable of engage the attachment means, and move the container folding devices from a first position to a second position.

In an advantageous embodiment of the invention, said unlocking unit is arranged relative to said end side member and/or to said cross side member.

The collapsible container may be arranged in an unfolded position, where the bottom of the collapsible container is arranged downwards and the four sides extend upwards. The container folding device is arranged above the collapsible container and engages the edges of the four sides, respectively the two end sides and two cross sides. The unlocking unit may be attached to said end side member. The two cross sides of the collapsible container may be provided with locking mechanisms, one locking mechanism in each side of the cross side edges. The locking mechanism is capable of locking onto the two end sides respectively. The pushing unit is triggered, before the end sides and the cross sides are folded. The unlocking unit or unlocking units is capable of interacting with the locking mechanism and thereby releasing the lock or locks, so both sides are unlocked from both ends of the collapsible container.

The unlocking unit may be an actuator or a piston. The unlocking unit is triggered, before the end sides and the cross sides are folded. The unlocking unit may be controlled electrically, hydraulically and/or pneumatically. The unlocking unit is carefully adjusted so the impact at the ends is not damaging the locking mechanism of the collapsible container. The tip of the unlocking unit which interacts with the locking mechanism may be provided with a soft rubber material.

Alternatively, the unlocking unit may be attached to the cross side member. The two cross sides on the collapsible container may be provided with locking mechanisms, one locking mechanism in each side of the cross side edges. The locking mechanism is capable of locking onto the two ends respectively. The unlocking unit or unlocking units arranged on the cross side member is/are capable of interacting with the locking mechanism, and release the lock or locks, so both sides are unlocked from both ends of the collapsible container.

In a still further advantageous embodiment of the invention, said unlocking unit comprises at last one pushing part.

The unlocking unit comprises at least one pushing unit. The unlocking unit may be attached to the first end part and/or the second end part. The unlocking unit may comprise an actuator configured to activating the pushing part. The pushing part may be a piston. The pushing part may be controlled electrically, hydraulically, and/or pneumatically. The pushing part is carefully adjusted so the impact does not damage the collapsible container. The tip of the pushing unit, which interacts with the locking mechanism of the collapsible container, may be provided with a resilient material.

In a still further advantageous embodiment of the invention, said pushing unit is arranged on said end side member.

To ensure that the end sides of the collapsible container are folded, the end side member comprises at least one pushing unit. The pushing unit may be attached to the first end part and/or the second end part. The pushing unit may be an actuator. Alternatively, the pushing unit may be a piston. The pushing unit may be arranged in the middle of the first end part and/or a second end part. Alternatively, two pushing units may be

arranged in each side of the first end part and/or two pushing units may be arranged in each side of the second end part. The pushing unit is triggered when the two cross sides between the end sides of the collapsible container are to be folded and the end sides are ready to be folded. The pushing unit may be controlled electrically, hydraulically and/or pneumatically. The pushing unit is carefully adjusted so the impact at the end sides are not damaging the collapsible container. The tip of the pushing unit, which interacts with the end sides of the collapsible container, may be provided with a resilient material. The pushing units may also be arranged as an alternative to the pushing parts on the cross side member. The pushing unit may be substantially similar to the unlocking unit.

In a further advantageous embodiment of the invention, said container folding device has at least one sensor for detecting an unfolded collapsible container position.
The collapsible container may be arranged in an unfolded position, where the bottom of the collapsible container is arranged downwards, and the four sides extend upwards. The container folding device is arranged above the collapsible container and may use sensors to locate the collapsible container and adjust the end side member and cross side member to the size of the collapsible container. Thereafter the container folding device is ready to engage the edges of the four sides of the collapsible container and fold the collapsible container accordantly to the predefined folding sequence.

The present invention addresses the object of the invention by providing a container folding system for folding collapsible containers, comprising
- at least one container folding device,
- at least one moveable device, where said moveable device is releasably attached to the container folding device, using at least one complementary attachment means, which is configured to engage container folding device´s attachment means,
where the moveable device is configured to move said container folding device from a first device position to a second device position relative to a predefined moving sequence.

A container folding system comprises at least one container folding device and at least one moveable device. The moveable device may engage the attachment means ar-

ranged on or in relation to the container folding device. The moveable device may be provided with complementary attachment means which may be releasably fastened to the attachment means. The moveable device may be provided with at least one rotatable joint, so the moveable device is capable of moving the folding device from a first device position to a second device position.

The moveable device may be similar to a robot arm with at least one rotatable joint. The moveable device may be computer controlled, and the moveable device may rotate the individual joint using electrical, hydraulic or pneumatic means. The container folding device may be in communication with the moveable device using electrical, hydraulic or pneumatic means. The container folding device may be controlled from the moveable device. Alternatively, the container folding device may be preprogrammed and/or reprogrammed, e.g. through the moveable device. The container folding device may be controlled and/or programmed from an external controlling device directly using wire or wireless communication. The moveable device may be controlled and/or programmed from an external controlling device directly using wire or wireless communication. By controlling the moveable device, the moveable device is capable of moving the container folding device from a first device position to a second device position relative to a predefined moving sequence.

In an advantageous embodiment of the invention, said container folding system comprises at least one conveyor, where the moveable device moves said container folding device from a first position to a second position relative to said conveyor.

The unfolded collapsible containers may be arranged on a conveyor in a line. A moveable device moves said container folding device from a first position to a second position relative to the conveyor and/or to the unfolded collapsible container. The moveable device moves the container folding device towards the unfolded collapsible container. The container folding device engages the unfolded collapsible container and folds the collapsible container. After the collapsible container has been folded, the moveable device moves the container folding device towards the next unfolded collapsible container. Alternatively, the moveable device moves the container folding device towards the folded collapsible container and grips the folded collapsible container using the end side member and/or the cross side member. The moving device

then moves the container folding device with the folded collapsible container to a pallet or similar, and stacks the folded collapsible containers.

In a further advantageous embodiment of the invention, said container folding system comprises a controlling unit controlling the movement of said container folding device and the moveable device in relation to the conveyor.

The container folding device may be controlled from the moveable device. Alternatively, the container folding device may be preprogrammed and/or reprogrammed, e.g. through the moveable device. The container folding device may be controlled and/or programmed from an external controlling device directly using wire or wireless communication. The moveable device may be controlled and/or programmed from an external controlling device directly using wire or wireless communication.

By controlling the moveable device, the moveable device is capable of moving the container folding device along the conveyor from a first device position to a second device position relative to a predefined moving sequence.

The present invention furthermore provides a method for folding collapsible containers using a container folding system having a container folding device, comprising the steps of

a) providing at least one unfolded collapsible container,

b) arranging said container folding device relative to the unfolded collapsible container,

c) releasing one or more collapsible container locks using the unlocking unit,

d) folding the sides of the collapsible container, when moving said first pushing part and said second pushing part towards each other using the side moving means,

e) folding the end sides of the collapsible container, when moving said first end part and said second end part relative to each other using the end moving means.

The collapsible containers may be arranged in a row on a conveyor. The container folding system may start the conveyor, which may move the collapsible containers to the folding position at the conveyor relative to the moveable device. The container folding system may stop the conveyor from moving the collapsible containers further

down the conveyor line. The container folding system may activate the moveable device, which may move the container folding device towards the unfolded collapsible container.

The container folding device may engage the unfolded collapsible container and release one or more collapsible container locks using the unlocking unit. The container folding device folds the cross sides of the collapsible container, when moving said first pushing claw and said second pushing claw towards each other using the side moving means. The container folding device folds the end sides of the collapsible container, when moving said first end part and said second end part relative to each other using the end moving means. Alternatively, container folding device folds the end sides and/or the cross sides of the collapsible container using one or more pushing units.

The container folding system may activate the moveable device, which may then move the container folding device away from the folded collapsible container. The container folding system may then start the conveyor, which may move the next collapsible container to the folding position at the conveyor relative to the moveable device etc.

The method comprises further steps of using the moving device to move the container folding device relative to the collapsible container, when the collapsible container is moving along the conveyor at a predefined speed while folding the collapsible container.

The container folding system may start the conveyor, which may move the collapsible containers at a steady speed. The container folding system may activate the moveable device, which may move the container folding device towards the first unfolded collapsible container in the conveyor line. The container folding device may use sensors to locate the unfolded collapsible container. The moving device moves the container folding device in a folding position above the collapsible container, while moving the container folding device relative to the unfolded collapsible container along the conveyor line. The container folding device may adjust the end side member and cross side member to the size of the unfolded collapsible container. Thereafter the container

folding device is ready to engage the edges of the four sides of the collapsible container and fold the collapsible container accordantly to the predefined folding sequence, while the collapsible container moves along the conveyor line. The container folding system may activate the moveable device, which may move the container folding device towards the next unfolded collapsible container in the conveyor line and so forth.

The unfolded collapsible containers may be arranged on a conveyor in a line and/or two by two in pairs in a parallel row alone the conveyor line. In the case where the one conveyor may be provided, the container folding system may comprise a moving device on each side of the conveyor. The first moving device with a container folding device may handle the row on a first side of the conveyor, and the second moving device with a container folding device may handle the row on a second side of the conveyor. Instead of two container folding systems in a facility, it may be more optimal and more cost effective to provide one container folding system handling a plurality of moving devices comprising container folding devices and a plurality of conveyors.

The invention has now been explained with reference to a few embodiments which have only been discussed in order to illustrate the many possibilities and varying design possibilities achievable with the container folding device and the container folding system to the present invention. The present invention provides a container folding device and a container folding system for folding collapsible containers in a fast and easy manner. The present invention also describes a method for folding the collapsible containers, where the method provides an agile and simple folding process, which folds the collapsible containers. The invention provides products which reduce the time/costs per collapsible container being handled effectively and agilely during the folding process. Also maintenance costs are reduced due to the use of less equipment.

Description of the Drawing

The embodiments of the invention are described in the following with reference to:

Fig. 1: Illustrating a container folding device for folding collapsible containers.

Fig. 2: Illustrating an embodiment of a container folding device comprising locking units and a pushing unit.

Fig. 3: Illustrating a container folding system engaging an unfolded collapsible container.

Fig. 4: Illustrating an example of a container folding system.

Detailed Description of the Invention

Embodiments of the invention are explained in the following detailed description. It is to be understood that the invention is not limited in its scope to the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced or carried out in various ways.

Fig. 1 illustrates a container folding device 1 for folding collapsible containers 10. The container folding device 1 is capable of handling different sizes and shapes of collapsible containers 10. The container folding device 1 comprises at least one end side member 2 and an end moving means 4, which is capable of moving said first end part 2´and said second end part 2´´relative to each other. The container folding device 1 also comprises at least one cross side member 5 and at least one unlocking unit 7.The container folding device 1 comprises further more one or more attachment means, not shown on the fig. 1, for attachment to a moving device 9.

The end side member 2 and the cross side member 5 are forcing all four sides of the collapsible container 10 into a folded position during the folding process. The collapsible container 10 may have one or more locking mechanisms, which is not shown on the fig. 1. The locking mechanisms may be configured to releasable locked the collapsible container 10, such that the collapsible container 10 is kept in an unfolded position. The locking mechanism locks the sides of the collapsible container 10, when the collapsible container 10 is in an unfolded position during use. The locking mechanisms may be configured of being unlocked by pushing a first part of the locking mechanisms out of a second part of the locking mechanisms. On fig. 1, the collapsible container 10 is in a folded position. In an unfolded position, the collapsible container 10 must be unlocked before the end sides and the cross sides can be folded. The cross sides of the collapsible container must be unlocked before the end sides and the cross

sides are folded. The container folding device 1 comprises at least one unlocking unit 7 capable of unlocking the collapsible container 10 locking mechanism. The unlocking units 7 are attached to the first end part 2′ and to the second end part 2′′. The first part of the locking mechanisms may be arranged on an edge part of a first side of the collapsible container 10, and the second part of the locking mechanisms may be arranged on an edge part of a second side of the collapsible container 10. The first edge part of a first side is arranged substantially adjacent to the edge part of a second side of the collapsible container 10. The second side of the collapsible container may be an end side of the collapsible container 10. The locking mechanisms may be unlocked by pushing the first part of the locking mechanisms out of the second part of the locking mechanisms, using the unlocking mechanisms.

The end side member 2 may be provided with at least one first end part 2′and at least one second end part 2′′ arranged so that the first end part 2′ is arranged relative to a first end of the collapsible container and the second end part 2′′ is arranged relative to a second end of the collapsible container. An end moving means 4 may be capable of moving said first end part 2′ and said second end part 2′′ relative to each other to fit the distance between the first and the second end sides of the collapsible container 10. The end moving means comprises a motor 4 and a belt 3. The end moving means moves the first end part 2′ and said second end part 2′′.Then the first end part 2′ and said second end part 2′′pushes the end sides of the collapsible container into a folded position.

The cross side member 5 may be provided with at least one first pushing claw 5′ and at least one second pushing claw 5′′, showed on fig. 3, arranged so that the first pushing claw 5′ is relative to a first cross side of the collapsible container 10 and the second pushing claw 5′′ is arranged relative to a second cross side of the collapsible container 10. A side moving means 6 moves the first pushing claw 5′and said second pushing claw relative to each other to fit the distance between the first and the second cross sides of the collapsible container 10. A side moving means 6 moves the first pushing claw 5′and said second pushing claw 5′′ towards each other and thereby pushes the cross sides of the collapsible container 10 into a folded position.

A moveable device 9 is configured to engage the attachment means. The moveable device 9 configured to move the container folding devices 1 from a first device position to a second device position. The moveable device 9 may be configured to move the container folding devices 1 from a first device position relative to a first collapsible container to a second device position relative to a second collapsible container. The container folding device 1 may comprise attachment means for attachment to a moveable device 9. The attachment means is not showed on the fig. 1. The attachment means arranged on or at the container folder device may be in hydraulic and/or electrical contact with the moveable device 9.

Fig. 2 illustrates an embodiment of a container folding device comprising locking units 7′, 7′′ and a pushing unit 8. The container folding device 1 comprises unlocking units 7′, 7′′ which is capable of unlocking the collapsible container 10 locking mechanism. The unlocking units 7′, 7′′ is in this employment attached to the cross side members 5. The pushing unit 8 is arranged in a distance from the first end part 2′.

Unlocking units 7′, 7′′ are attached to the respective cross side members 5. The first unlocking unit 7′ is arranged in a first unlocking angle φ^1 relative to the longitudinal direction of the first end part 2′. The second unlocking unit 7′′ is arranged in a second unlocking angle φ^2 relative to the longitudinal direction of the second end part 2′′. The first unlocking angle φ^1 and the second unlocking angle φ^2 provide an optimal unlocking effect on the collapsible container's locking mechanism.

The pushing unit 8, which is arranged in a distance from the first end part 2′, is attached on a bracket to the first end part 2′. When the bracket 14 is arranged adjacent to an end side of a collapsible container 10, the pushing unit 8 is released and pushing the end side of the collapsible container 10, so the end side falls into a folding position.

Fig. 3 illustrates a container folding system engaging an unfolded collapsible container. The container folding system 20 comprises a moveable device 9, which is arranged on a floor-standing base 16 next to a conveyor 11. The moving device 9 is capable of rotating and/or pivoting one or more joints. The moving device 9 comprises one container folding device 1, which is attached in one extending end 15 of the moving de-

vice 9 opposite the floor-standing base 16. The moving device 9 is arranged with a plurality of rotatable joints, which provide an agile movement between the collapsible containers provided on the conveyor 11. The conveyor 11 moves the collapsible container 10 in a forward direction F_1 in a predefined speed. The collapsible container is arranged in an unfolded position, where the bottom of the collapsible container is arranged downwards resting on the conveyor 11, and the four sides extend upwards towards the container folding device 1.

The container folding device 1 may use sensors to locate the collapsible containers 10 on the conveyor 11. The collapsible containers 10 may be in non-sorted sizes. The container folding device 1 easily adjusts the end side member 2 and cross side member 5 to the size of the collapsible container 10. Thereafter the container folding device 1 is ready to engage the edges of the four sides of the collapsible container 10 and fold the collapsible container 10 accordantly to the predefined folding sequence. The container folding device 1 handles the folding process of the collapsible container 10 in a predefined folding sequence, step by step. The predefined folding sequence may comprise the steps, where the first step is unlocking the cross sides from the end sides, then a step of folding the end sides followed by a step of folding the cross sides. While the container folding device 1 is folding the collapsible container, the moving device 9 moves the container folding device 1 along the conveyor in the same direction F_2 and at the same continuity speed as the collapsible container 10.

Fig. 4 illustrates a container folding system. The container folding system 20 comprises a moveable device 9, which is arranged on a floor-standing base 16 next to a conveyor 11. The conveyor 11 moves the collapsible containers 10^1, 10^2, 10^3, 10^4 in a forward direction towards the container folding device 1. The collapsible containers 10^2, 10^3, 10^4 are arranged in an unfolded position, where the bottom of the collapsible container is arranged downwards resting on the conveyor 11. The four sides of the collapsible container, two end sides 17 and two cross sides 18, extend upwards in a locked position.

The container folding device 1 has folded the collapsible container 10^1, and is moved toward the next unfolded collapsible container 10^2 in line. The container folding device 1 is engaging the unfolded collapsible container 10^2. The container folding device

1 first releases one or more collapsible container locks using the unlocking units. The container folding device 1 folds the cross sides 18 of the collapsible container by moving the first pushing claw 5′ and the second pushing claw 5′′ towards each other using the side moving means 6. The container folding device 1 folds the end sides of the collapsible container 10^2 when moving said first end part 2′ and said second end part 2′′ relative to each other using the end moving means 4. When the collapsible container 10^2 is folded, the container folding device 1 moves toward the next unfolded collapsible container 10^3, which is in the conveyor line, etc. The container folding device 1 handles the folding process quickly and agilely without forcing the four sides (17, 18) into a folded position.

CLAIMS

1. Container folding device for folding collapsible containers, wherein the container folding device (1) comprises:

- at least one end side member (2) having at least one first end part (2′) and at least one second end part (2′′), and an end moving means (3, 4) capable of moving said first end part (2′) and said second end part (2′′) relative to each other,

- at least one cross side member (5) having one or more first pushing part (5′), and one or more second pushing part (5′′), and a side moving means (6) capable of moving said first pushing part (5′) and said second pushing part (5′′) relative to each other,

- at least one unlocking unit (7),wherein use said unlocking unit (7) is capable of engaging and unlocking one or more collapsible container locking mechanism, such that said cross side member (5) is capable of folding the cross sides of the collapsible container 10 when pushed by the side moving means (5), and the said first end part (2′) and said second end part (2′′) are capable of folding the end side of the collapsible container (10) when pushed by end moving means (5),

- one or more attachment means for moving the container folding device (1), wherein the attachment means is arranged in or on the container folding device (1).

2. Container folding device (1) according to claim 1, wherein said unlocking unit (7) is arranged relative to said end side member (2) and/or to said cross side member (5).

3. Container folding device (1) according to claim 1, wherein said unlocking unit (7) comprises at last one pushing part.

4. Container folding device (1) according to claim 1, wherein a pushing unit (8) is arranged on said end side member (2).

5. Container folding device (1) according to claim 1, wherein said container folding device (1) has at least one sensor for detecting an unfolded collapsible container (10) position.

6. Container folding system for folding collapsible containers, comprising

- at least one container folding device (1) according to claim 1-5, and

- at least one moveable device (9), where said moveable device (9) is releasably attached to the container folding device (1), using at least one complementary attachment means, which is configured to engage the container folding device´s (1) attachment means,

where the moveable device (9) is configured to move said container folding device (1) from a first device position to a second device position relative to a predefined movement sequence.

7. Container folding system according to claim 6, wherein said container folding system (20) comprises at least one conveyor (11), where the moveable device (9) moves said container folding device (1) from a first position to a second position relative to said conveyor.

8. Container folding system according to claim 6 or 7, wherein said container folding system (20) comprises a controlling unit controlling the movement of said container folding device (1) and the moveable device (1) in relation to the conveyor (11).

9. Method for folding collapsible containers using a container folding system (20) according to claims 6-8, having a container folding device (1) according to claims 1-5, comprising the steps of,

a) providing at least one unfolded collapsible container (10),

b) arranging said container folding device (9) relative to the unfolded collapsible container (10),

c) releasing one or more collapsible container (10) locks using the unlocking unit (7),

d) folding the cross sides (18) of the collapsible container (10), when moving said first pushing part (5´) and said second pushing part (5´´) towards each other using the side moving means (6),

e) folding the end sides (17) of the collapsible container (10), when moving said first end part (2´) and said second end part (2´´) relative to each other using the end moving means (4).

10. Method according to claim 9, comprising further steps of using the moving device (9) to move the container folding device (1) relative to the collapsible container (10),

when the collapsible container (10) is moving along the conveyor (11) at a predefined speed while folding the collapsible container (10).

5

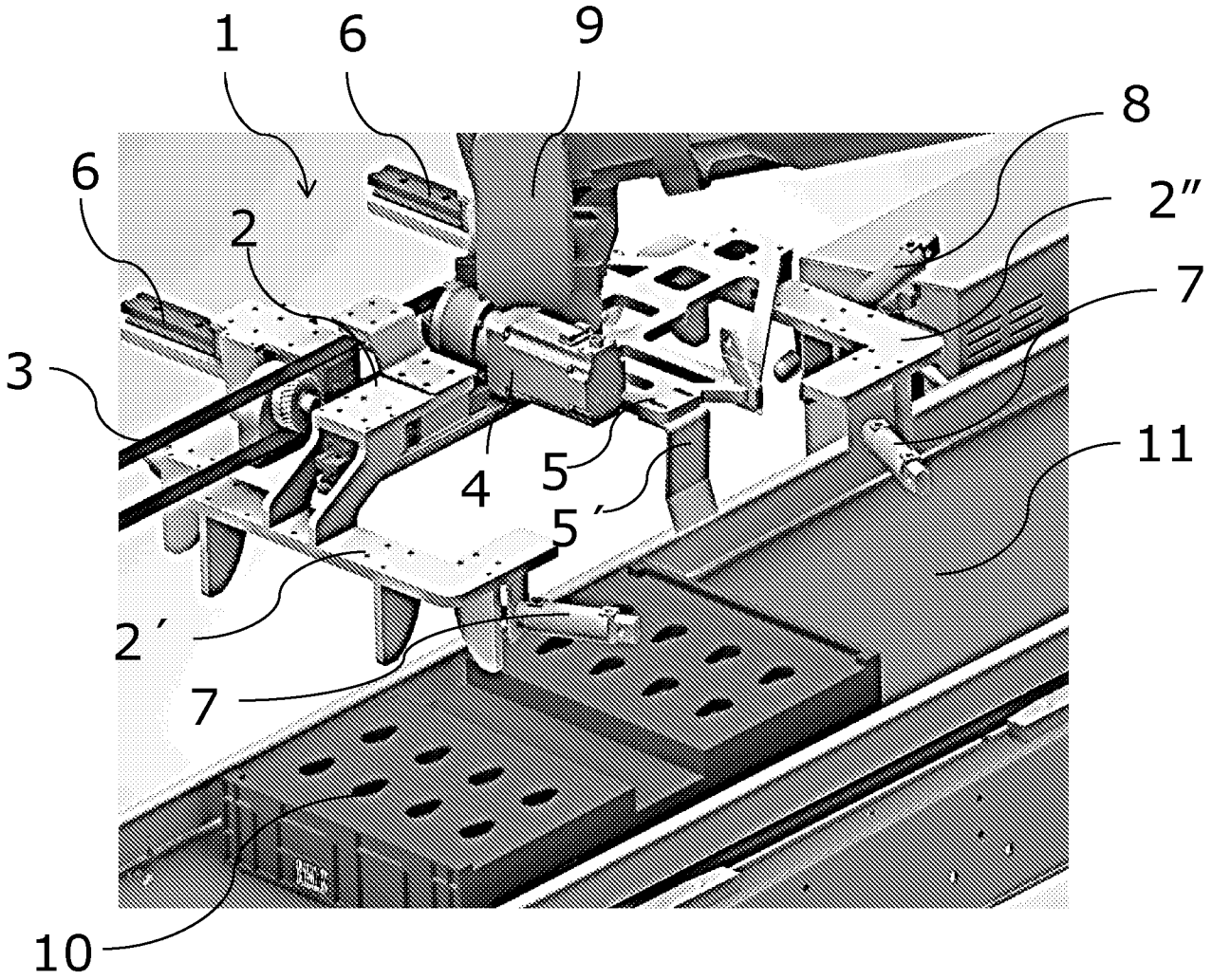


Fig. 1

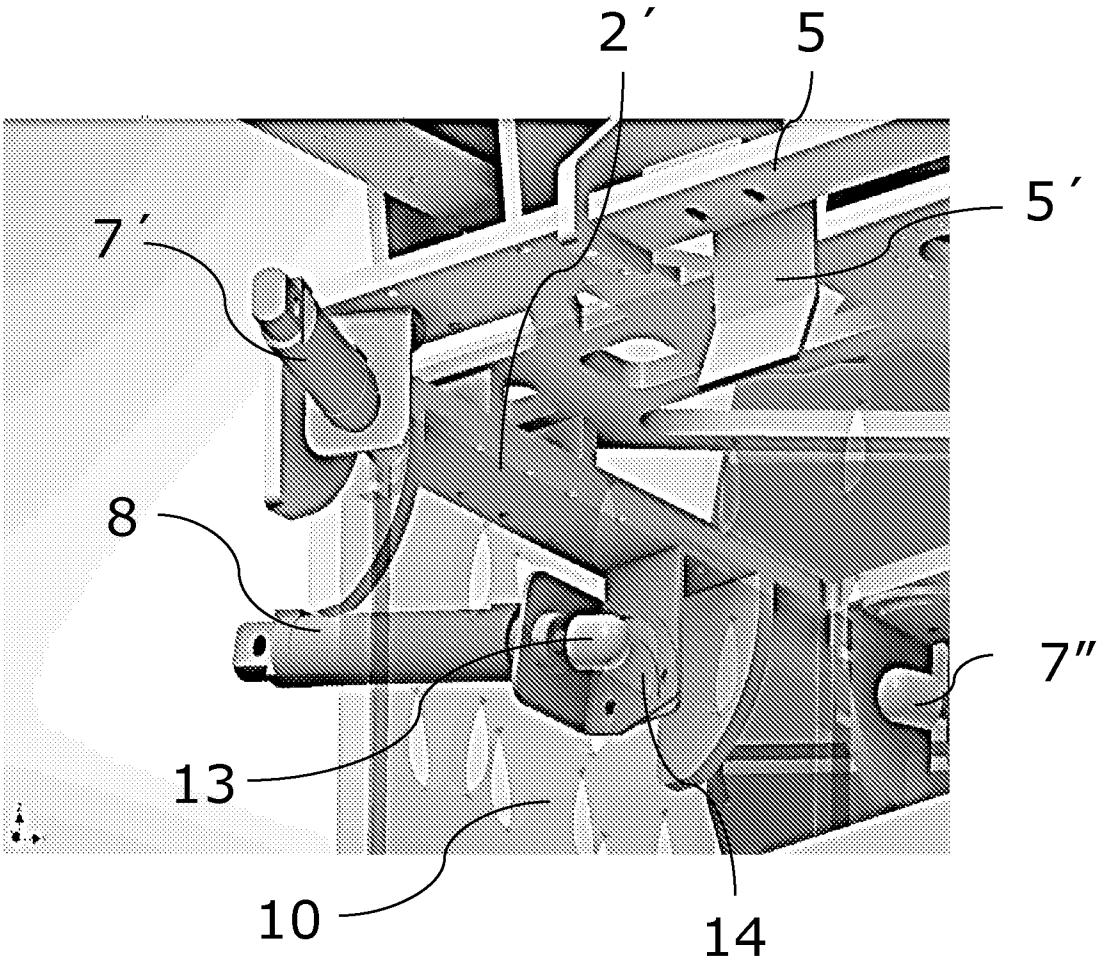


Fig. 2

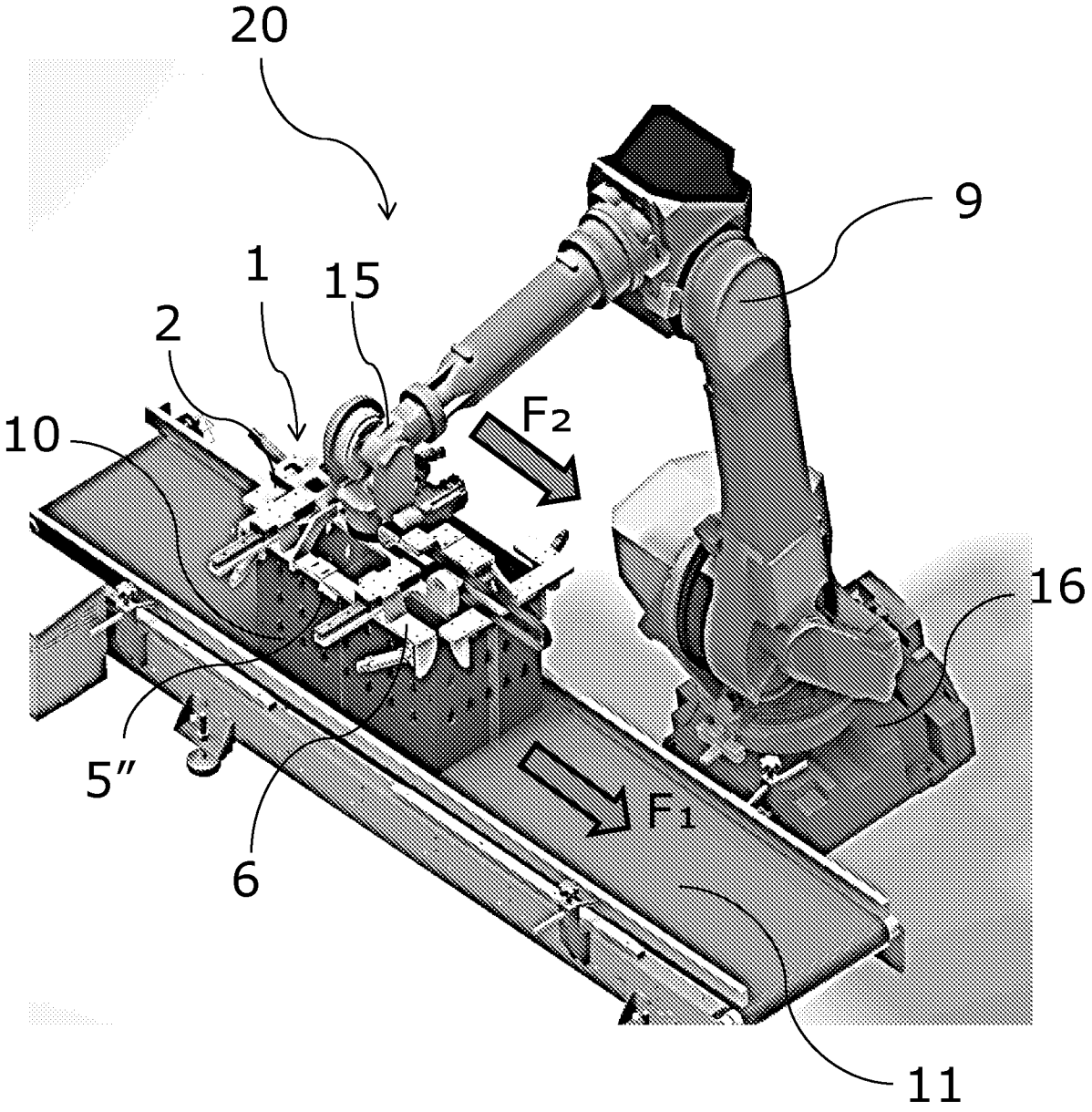


Fig. 3

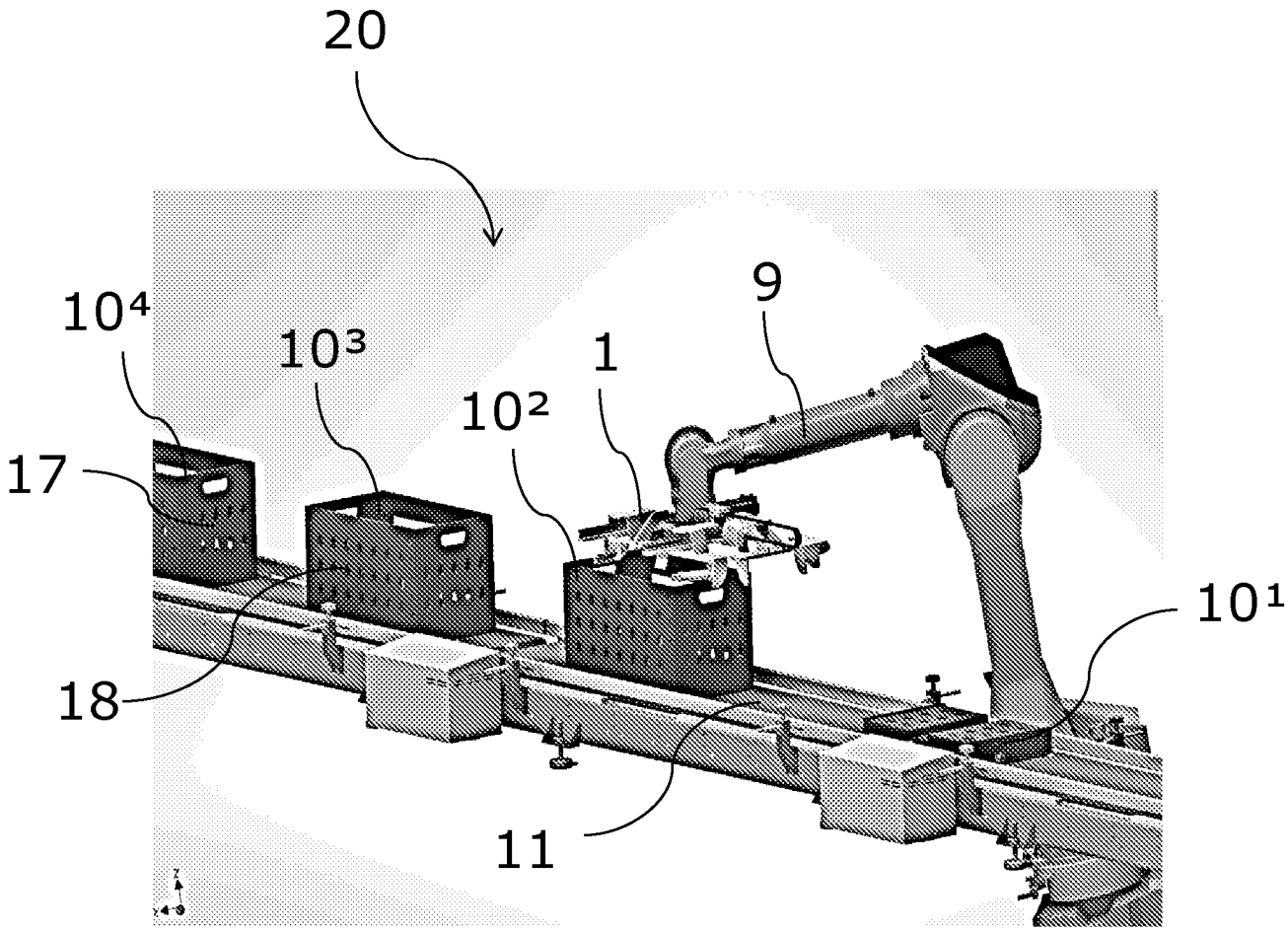


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/DK2021/050289

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65B43/26 B25J15/02 B65B61/00
ADD.

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)
B65B B25J B65D B31B

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2 181 841 A1 (TANZER PETER MASCHB [IT]) 5 May 2010 (2010-05-05)	9
Y	paragraph [0024] - paragraph [0031]	1-8,10
Y	WO 96/20113 A1 (FRUTMAC S R L [IT]) 4 July 1996 (1996-07-04) page 3, line 36 - page 5, line 18	1-8,10
Y	WO 2019/235555 A1 (SHISEIDO CO LTD) 12 December 2019 (2019-12-12) paragraph [0026] - paragraph [0064]	1-8,10
A	GB 2 245 213 A (BOIX MAQUINARIA SA [ES]) 2 January 1992 (1992-01-02) the whole document	1-10

-/--

[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
1 December 2021	10/12/2021

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	Yazici, Baris

2

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

INTERNATIONAL SEARCH REPORT

International application No
PCT/DK2021/050289

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 052 087 A2 (ROBOTSYSTEMS GES FUER PALETTIE [DE]) 15 November 2000 (2000-11-15) the whole document -----	1-10
A	IT RN20 100 022 A1 (SIT SRL) 30 July 2010 (2010-07-30) the whole document -----	1-10

2

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/DK2021/050289

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2181841 A1	05-05-2010	AT 508861 T	15-05-2011
		EP 2181841 A1	05-05-2010
WO 9620113 A1	04-07-1996	AT 163608 T	15-03-1998
		EP 0746500 A1	11-12-1996
		ES 2116784 T3	16-07-1998
		IT BZ940064 A1	23-06-1996
		WO 9620113 A1	04-07-1996
WO 2019235555 A1	12-12-2019	CN 112218799 A	12-01-2021
		EP 3805113 A1	14-04-2021
		JP 6656306 B2	04-03-2020
		JP 2019210038 A	12-12-2019
		TW 202003339 A	16-01-2020
		US 2021253287 A1	19-08-2021
		WO 2019235555 A1	12-12-2019
GB 2245213 A	02-01-1992	ES 2024866 A6	01-03-1992
		FR 2663292 A1	20-12-1991
		GB 2245213 A	02-01-1992
EP 1052087 A2	15-11-2000	DE 19921006 A1	16-11-2000
		EP 1052087 A2	15-11-2000
IT RN20100022 A1	30-07-2010	---	---