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(54) **DEVICE FOR FOLDING A COLLAPSIBLE CRATE**

(57) There is provided a device for folding a collapsible crate, the collapsible crate comprising a base, a first pair of opposed walls pivotable about their upper edges from a locked position to initiate folding of the collapsible crate and a second pair of opposed walls configured to buckle after the first pair of opposed walls have moved from the locked position. The device comprises: a frame defining a vertical process channel for the collapsible crate; conveying means defining a conveyor plane moveable along the vertical process channel, the conveying means configured to convey the collapsible crate along the vertical process channel by supporting the base of the collapsible crate on the conveyor plane; unlocking means configured to apply a horizontal force to the first pair of opposed walls to unlock the first pair of opposed walls during the initial conveyance of the collapsible crate along the vertical process channel; pivoting means configured to pivot the first pair of opposed walls away from the conveyor plane; and, buckling means configured to buckle the second pair of opposed walls to enable folding of the collapsible crate during continuing conveyance of the collapsible crate along the vertical process channel.

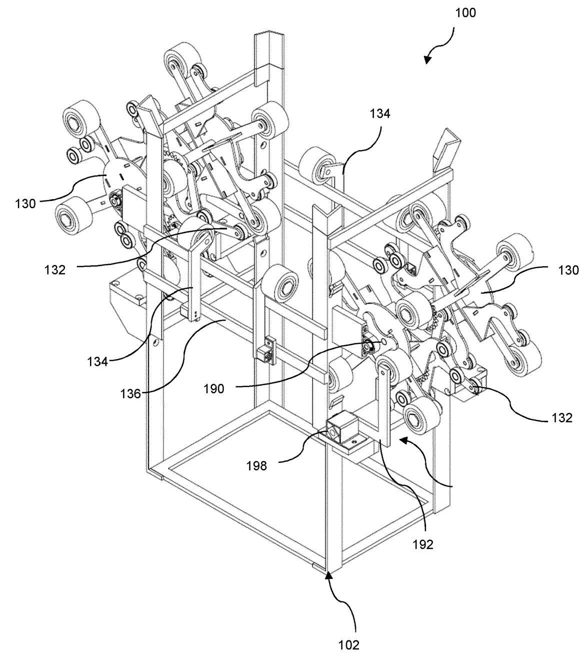

Fig. 2

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to devices for folding collapsible crates.

BACKGROUND

[0002] Space-saving collapsible crates and boxes are commonly used to transport goods. Once the goods have been delivered in the assembled crates, the crates are collapsed to reduce the volume that they occupy. The collapsed crates can then be stacked for efficient storage.

[0003] The collapsible crates comprise a base and a first pair of opposed walls pivotable about their upper sections from a locked position to initiate the folding process. A second pair of opposed walls are then configured to buckle after the first pair of opposed walls have moved from the locked position.

[0004] While it is convenient to have a collapsible crate for storage and transport, the process of folding the crate is typically performed manually. This process has poor ergonomics, and so is both labour-intensive and time-consuming. In industries using large numbers of collapsible crates, a significant amount of time may be invested and wasted in the process of collapsing each crate. Accordingly, any saving in the time taken to collapse a single crate would lead to a large overall time saving when applied at scale.

[0005] It is against this background that the invention has been devised.

SUMMARY OF THE INVENTION

[0006] According to an aspect of the invention, there is provided a device for folding a collapsible crate, the collapsible crate comprising a base, a first pair of opposed walls pivotable about their upper sections from a locked position to initiate folding of the collapsible crate and a second pair of opposed walls configured to buckle after the first pair of opposed walls have moved from the locked position. The device comprises: a frame defining a vertical process channel for the collapsible crate; conveying means defining a conveyor plane moveable along the vertical process channel, the conveying means configured to convey the collapsible crate along the vertical process channel by supporting the base of the collapsible crate on the conveyor plane; unlocking means configured to apply a horizontal force to the first pair of opposed walls to unlock the first pair of opposed walls during the initial conveyance of the collapsible crate along the vertical process channel; pivoting means configured to pivot the first pair of opposed walls away from the conveyor plane; and, buckling means configured to buckle the second pair of opposed walls to enable folding of the collapsible crate during continuing conveyance of the collapsible crate along the vertical process channel.

[0007] As a whole, the device advantageously reduces the burden of folding a collapsible crate manually. Only minor user input is needed when using the device to achieve what was previously an entirely manual task. Each of the individual features of the device further reduce the input demanded of the user. For example, the provision of the conveying means, the unlocking and pivoting means, and the buckling means all individually remove the onus on the user to perform particular acts that they would ordinarily have had to have performed on their own when folding a collapsible crate. As a result, it is envisaged that the device may save, on average, 2 to 3 seconds. When hundreds or thousands of crates require collapsing, an economy of scale is achieved that results in many hours of man-power otherwise wasted folding being saved.

[0008] The device is capable of folding a collapsible crate because of its individual features being specifically suited to the requirements of folding such collapsible crates. The conveying means conveys the crate through the device and additionally supports the base of the crate. By supporting the base of the crate, the conveying means permits actions to be performed on the base during its conveyance through the vertical process channel, such as the unlocking, pivoting, and buckling, without the danger of the crate re-opening and attaining its unfolded state once more. It has been identified that an unsupported base during conveyance of the crate reduces the efficiency of the device by causing some crates to re-open during folding.

[0009] It has also been identified that it is advantageous to have an unlocking means specifically for unlocking the first pair of opposed walls and a pivoting means for moving those walls. The provision of an unlocking means vastly improves the reproducibility of the process, by consistently unlocking the opposed walls rather than having to rely on the pivoting action of the pivoting means alone.

[0010] Furthermore, the use of the vertical process channel is particularly advantageous. The vertical process channel results in a compact frame and overall device. The vertical process channel permits receipt of crates in their unfolded positions in their normal orientation and the sequential performance of the various actions that result in folding the crate. The use of a vertical process channel also takes advantage of gravity for folding; the folding of the crate is aided by its own weight once the sides are pivoted and buckled.

[0011] The crate may progress from along the vertical process channel from a starting position where it enters the device and is not collapsed, to an end point where it is collapsed. The starting point may be vertically higher than the end point.

[0012] The conveying means may comprise a pair of primary rotary arms each rotatable about an axis of a first pair of axes, wherein the axes of the first pair of axes are positioned on opposite sides of the frame, the primary rotary arms being configured to extend into the vertical process channel to define the conveyor plane and counter-rotate to move the conveyor plane through the vertical process channel.

[0013] Rotary arms beneficially provide a controlled, or controllable, conveyance of the crate through the device, permitting the sequential actions to be performed accurately and at the correct moment. Accordingly, reliability of the system is improved. The positioning of the arms are opposite sides of the frame ensures that the crate is supported at both sides. The positioning in combination with the counter-rotation of the arms ensures that the progress of the crate along the channel is also reliable.

[0014] The primary rotary arms may be configured to move the conveyor plane through an upper section of the vertical process channel. The conveying means may comprise a pair of secondary rotary arms each rotatable about an axis of a second pair of axes, wherein the axes of the second pair of axes are positioned on opposite sides of the frame, the secondary rotary arms being configured to extend into the vertical process channel to define the conveyor plane and counter-rotate to move the conveyor plane through a lower section of the vertical process channel. The conveyor plane may be defined by the primary and secondary rotary arms at an intersection between the upper and lower sections of the vertical process channel.

[0015] Primary and secondary rotary arms may be used to vary how the crate is conveyed along different portions of the channel. The ability to vary the progression of the crate relative to other components is particularly useful in ensuring that the correct folding actions are performed at the correct time. Furthermore, the inclusion of two pairs of arms may be useful in encouraging the crate to adopt a folded position during operation of the device.

[0016] The length of the secondary rotary arms may be smaller than the length of the primary rotary arms.

[0017] As described above, the rotary arms may be useful in encouraging the crate to adopt a folded position. Having secondary rotary arms that are smaller than the primary rotary arms results in a smaller circumference of rotation than that of the primary rotary arms. Therefore, transference from the crate to the secondary rotary arms from the primary rotary arms may result in compression of the crate because of the difference in circumference, thereby encouraging folding of the crate.

[0018] The conveying means may comprise a pair of coupling means, each coupling means coupling the primary and secondary rotary arms on each side of the frame so that rotation of one of the primary or secondary rotary arms rotates the other of the primary of secondary rotary arms.

[0019] The coupling means ensures that the primary and secondary rotary arms are in the correct positions to transfer the crate between them. Effectively, the coupling means is a timing mechanism that achieves concurrent rotation of the primary and secondary rotary arms to reliably convey the crate. When combined with the different lengths of the primary and secondary arms, the coupling mechanism enhances the compression effect of the secondary arms.

[0020] The conveying means may comprise a plurality of pairs of primary rotary arms, wherein the arms of each pair of primary rotary arms are configured to radially extend from and counter-rotate about a respective axis of the first pair of axes to define a series of conveyor planes as each pair of primary rotary arms rotates through the vertical process channel. Additionally, the conveying means may comprise a plurality of pairs of secondary rotary arms equal to the number of pairs of primary rotary arms, wherein the arms of each pair of secondary rotary arms are configured to radially extend from and counter-rotate about a respective axis of the second pair of axes to define a series of conveyor planes as each pair of secondary rotary arms rotates through the lower section of the vertical process channel.

[0021] Incorporating a plurality of pairs of primary rotary arms and/or secondary rotary arms beneficially allows the device to receive and collapse a plurality of crates concurrently. Furthermore, the ability to receive more than one crate also beneficially allows the rotary arms to be driven by the insertion of another crate, further reducing the input from the user. As the force applied by a newly introduced crate to the rotary arms will be better distributed than the force typically applied by a user to the device or the crate being folded, the inclusion of a plurality of rotary arms also results in the reliability of the device being improved.

[0022] The conveying means may comprise a positioning mechanism configured to hold the pair of primary rotary arms at one or more predefined positions to pause the conveyance of the conveyor plane along the vertical process channel.

[0023] The positioning mechanism holds the advantage that each crate can be progressed through the device to a point where a new crate can be inserted, thereby improving reliability and reducing the risk that the user mistimes the insertion of a new crate into the device.

[0024] The unlocking means may comprise a pair of unlocking arms each rotatable about a respective axis positioned on opposite sides of the frame, the unlocking arms being configured to extend into the vertical process channel adjacent the conveyor plane so as to engage the lower ends of the first pair of opposed walls. The pivoting means may comprise a pair of pivoting arms each rotatable about a respective axis positioned on opposite sides of the frame, the pivoting arms being configured to extend into the vertical process channel so as to engage the upper ends of the first pair of opposed walls.

[0025] As with the rotary arms of the conveying means, rotary arms beneficially provide a controlled, or controllable, operation of the unlocking or pivoting means, permitting the particular action performed by these means to be precisely performed by rotation of the arms. Accordingly, reliability of the system is improved. Furthermore, having performed their respective action, the arms can rotate away from the vertical process channel, avoiding the risk of unwanted interference between these means and the crate during its continued conveyance.

[0026] Each respective axis about which the pivoting arms are rotatable may comprise a respective axis of the first pair of axes. Each respective axis about which the unlocking arms are rotatable may comprise a respective axis of the first pair of axes. The pivoting arms may be connected to primary rotary arms of the conveying means for rotation therewith. The unlocking arms may be connected to primary rotary arms of the conveying means for rotation therewith.

[0027] Rotating the pivoting arms and/or unlocking arms about the first pair of axes provides a more compact device, and also improves reliability and precision of the device by ensuring that the relative action of the conveying means and the pivoting and/or unlocking means correspond to one another.

[0028] Furthermore, by connecting the primary rotary arms to the pivoting arms and/or the unlocking means, the timing of the system can be accurately controlled so that the pivoting and/or unlocking occurs when the conveyor plane is at a particular point in the vertical process channel.

[0029] Each pivoting arm may extend from a respective unlocking arm. As the pivoting and unlocking actions are performed on the same wall of the crate, it is beneficial to combine the pivoting arms and unlocking arms so that their actions are linked.

[0030] The end of each pivoting arm may be configured to follow a path along the vertical process channel having a larger radius of curvature relative to the path along the vertical process channel followed by the end of each unlocking arm. Each pivoting arm may extend substantially normally to its respective unlocking arm. The pivoting means may be configured to pivot the first pair of opposed walls away from the conveyor plane during continuing conveyance of the collapsible crate along the vertical process channel.

[0031] The buckling means may be configured to buckle the second pair of opposed walls to enable folding of the collapsible crate during continuing conveyance of the collapsible crate along the vertical process channel following pivoting of the first pair of opposed walls by the pivoting means to an angle of at least 70 degrees from vertical. When the walls have been moved above 70 degrees from vertical, the buckling of the second pair of opposed walls is highly reliable as the first pair of opposed walls do not interfere with the buckling of the second pair of opposed walls.

[0032] The buckling means may comprise a roller attached to the frame by a cantilevered spring. The cantilevered spring may be configured to bias the roller into the vertical process channel so that conveyance of the collapsible crate along the vertical process channel causes the roller to apply a horizontal force to the second pair of opposed walls.

[0033] The buckling means comprising a cantilevered spring provides the benefit of providing a reliable buckling system. The cantilevered spring buckling means also provides the benefit of having to move over a top part of the crate during continued conveyance of the crate along the vertical process channel. The cantilevered spring's bias causes interference with the buckling means against the top of the crate, providing an additional encouragement of the crate towards its collapsed configuration by applying a positive compression to the top of the crate as it passes the buckling means.

[0034] The unlocking means may be configured to disengage the collapsible crate sooner in the vertical process channel than the pivoting means. The pivoting means may be configured to disengage the collapsible crate sooner in the vertical process channel than the conveying means. This feature further improves reliability of the device by removing the possibility that the pivoting means may inadvertently re-open the crate.

[0035] The vertical process channel may extend beyond a point of disengagement of the conveying means to allow the collapsible crate to fall. Allowing the crate to fall advantageously permits only partial folding of the crate when being conveyed by the conveying means, and the use of the fall to fully compress the crate, either by contact with the ground or a lower surface of the device, or by air resistance urging the base of the crate and its top frame together during the fall due to the larger surface area of the base than of the top of the crate.

[0036] The frame may comprise a hopper for positioning the collapsible crate with respect to the vertical process channel when the collapsible crate is placed into the device at the top of the vertical process channel. A hopper is useful for increasing the speed at which a user can load crates into the device. Precise positioning of the crates is not required by the user, because the hopper correctly positions the crate for folding.

[0037] Within the scope of this application it is expressly intended that the various aspects, embodiments, examples and alternatives set out in the preceding paragraphs, in the claims and/ or in the following description and drawings, and in particular the individual features thereof, may be taken independently or in any combination. That is, all embodiments and/ or features of any embodiment can be combined in any way and/ or combination, unless such features are incompatible. The applicant reserves the right to change any originally filed claim or file any new claim accordingly, including the right to amend any originally filed claim to depend from and/ or incorporate any feature of any other claim although not originally claimed in that manner.

BRIEF DESCRIPTION OF THE DRAWINGS

[0038] The above and other aspects of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figures 1a and 1b shows a known type of collapsible crate in respective assembled and collapsed configurations;

Figure 2 shows a perspective view of a device for collapsing collapsible crates according to an embodiment of the invention;

Figure 3 shows a front view of the device of Figure 2;

Figure 4 shows a perspective view of a frame for the device of Figure 2;

Figure 5 shows a perspective view of a first assembly for use in the device of Figure 2;

Figure 6 shows a perspective view of a second assembly for use in the device of Figure 2;

Figure 7 shows a perspective view of a third assembly for use in the device of Figure 2; and

Figures 8a to 8i show steps of a process of collapsing a collapsible crate using the device of Figure 2.

SPECIFIC DESCRIPTION

[0039] An example of a collapsible crate 10, for use with embodiments of the invention, is shown in Figure 1a, in an unfolded configuration, and in Figure 1b, in a folded configuration.

[0040] Referring first to Figure 1a, the crate 10 has a rectangular base 12 and a rectangular top frame 22. A first pair of opposed side walls 14, 18 and a second pair of side walls 16, 20 extend normally between corresponding short edges and long edges of the base 12 and the rectangular top frame 22 respectively. The crate 10 has an internal volume 24 defined by the base 12, side walls 14, 16, 18, 20, and top frame 22 when in the configuration shown in Figure 1a for receiving items for storage and/or transport.

[0041] Each of the first side walls 14, 18 are movably attached to the top frame 22 by a respective hinge 26, permitting rotation of the side walls 14, 18 relative to the top frame 22. That is, the first side walls 14, 18 are pivotable about their upper sections to allow a swinging movement from their position in the folded configuration through the internal volume 24. Each of the second side walls 16, 20 is movably attached to the top frame 22 and base 12 by respective hinges 34, 38, and incorporates a third hinge 42 that permits folding, or buckling, of the second side walls 16, 20 inwardly towards the internal volume 24 of the crate 10. The third hinges 42 extend centrally along each side wall 16, 20 parallel to the long edges of the base 12 and top frame 22. The hinges 34, 38, 42 therefore permit the side walls 16, 20 to fold over on themselves so that a top part 46 of each second side wall 16, 20 folds over onto a lower part 50 of each side wall 16, 20.

[0042] In the unfolded configuration of Figure 1a, the first side walls 14, 18 are in a locked position in which they extend normally between the base 12 and the top frame 22. The first side walls 14, 18 are unattached or temporarily attached to the other side walls 16, 20 and the base 12. In some crates, the base 12 comprises an indentation configured to receive a protrusion from a corresponding first side wall 14, 18 to temporarily join the side wall 14, 18 and base 12, and to maintain the side wall 14, 18 in position extending perpendicularly to the base 12.

[0043] To hold the side walls 14, 18 in their locked positions, the base 12 incorporates a respective stop that prevents rotation of each side wall 14, 18 beyond the locked position. If the side walls 14, 18 have protrusions that correspond to indentations in the base 12, the interference between protrusion and indentation may form the stop.

[0044] In the locked position, the first side walls 14, 18 prevent the second side walls 16, 20 from folding inwardly. The second side walls 16, 20 are prevented from folding outwardly, either by virtue of a stop or by the configuration of the hinges of the second side walls 16, 20.

[0045] The crate 10 is reconfigurable from its unfolded position in Figure 1a to its folded position in Figure 1b. To reconfigure the crate 10, the first side walls 14, 18 are unlocked from their locked position and pivoted about their hinge to a position above the third hinge 42 of the second side walls 16, 20. Pivoting the first side walls 14, 18 in this way provides the clearance to allow the second side walls 16, 20 to be buckled. In some crates, the angle to which the first side walls 14, 18 are pivoted to permit the folding of the second side walls 16, 20 is in excess of 70 degrees to vertical. However, in crates having differing dimensions, this angle may be 70 degrees to vertical or less.

[0046] Pivoting the first side walls 14, 18 and fully buckling the second side walls 16, 20 so that the two halves of the second side 16, 20 walls touch results in the crate 10 adopting its folded configuration shown in Figure 1b. In the folded configuration, the lower and top parts 46, 50 of the second side walls 16, 20 are fully folded over on one another so that the lower part 50 is sandwiched between the top part 46 and the base 12 of the crate 10, while the top frame 22 rests on the top part 46. The first side walls 14, 18 also rest on the top parts 46 of the second side walls 16, 20.

[0047] The crate 10 can be returned to its unfolded configuration from its folded configuration by pulling the top frame 22 vertically away from the base 12. In doing so, the folded second side walls 16, 20 are forced to unfold and the first side walls 14, 18 can rotate down into their unfolded positions.

[0048] During reconfiguration, vertical forces acting on the crate 10 cause an improved connection between the first side walls 14, 18 and the base 12, increasing the force required to dislodge the side walls 14, 18 from their unfolded positions and so making it more difficult to fold the crate 10. However, following the initial movement of the first side walls 14, 18 from their unfolded positions, it is preferable to support the base 12 of the crate 10 because if the base 12 is unsupported during reconfiguration, the crate 10 is likely to re-attain its unfolded configuration. This is because the base 12 falls under its own weight, unfolding the triple-hinged second side walls 16, 20 and permitting the single-hinged first side walls 14, 18 to fall back to their unfolded positions.

[0049] In some embodiments of collapsible crates, the side walls may be arranged differently, so that the side walls along the long edges of the base have a single hinge, while the side walls along the short edges of the base have three hinges. In some embodiments, the base and top frame may be square. In some embodiments, actuatable joins other than hinges may be used to permit relative movement of the sides, top frame, and base.

[0050] Figures 2 and 3 show a device, generally designated by 100, for folding one or more collapsible crates of the type described above according to an embodiment of the invention. Figure 2 illustrates the device 100 in a perspective view, while Figure 3 shows the device 100 from the front.

[0051] With reference also to Figure 4, the device 100 has frame 102 comprising a rectangular base 104 and four supports 106, each support 106 extending normally away from a different corner of the base 104. The frame 102 provides a mounting structure for mounting the components of the device 100. The supports 106 of the frame 102 define a vertical process channel therebetween along which a crate 10 is downwardly conveyed to be folded. A vertical process channel means a process channel that extends vertically or substantially vertically. A vertical process channel may be substantially vertical if it is angled relative to the absolute vertical. The vertical process channel may be angled up to 30 degrees from vertical and still be considered to be a vertical process channel. Angling the vertical process channel slightly helps with the ergonomics of the process, making the apparatus easier to load and unload.

[0052] During folding, an unfolded crate 10 is received at a top opening 108 of the frame 102 and is guided vertically downwards along the vertical process channel until it is folded before reaching the end of the vertical process channel, which is defined by the base 104 of the frame 102.

[0053] To guide the crates 10 along the vertical process channel, the supports 106 incorporate right-angled portions 110 to restrict horizontal movement of crates 10 within the vertical process channel. To permit removal of the crates 10 close to the base 104 of the frame 102, at least two of the supports 106 are flattened in the region of the base 104 so that the folded crates 10 can be removed in a horizontal direction from the frame 102 and the vertical process channel. Alternatively, the supports 106 may be flared close to the base 104 to provide an easier removal of the folded crates 10 from the vertical process channel.

[0054] At the top opening 108 of the frame 102, a hopper 114 is provided comprising four outwardly-splayed right-angled portions attached to upper ends of the supports 106. The hopper 114 is configured to receive crates 10 and direct them into the vertical process channel, thereby negating the requirement for the user to be precise when placing crates 10 into the vertical process channel. The efficiency and speed with which crates 10 can be put into the device 100 is therefore increased.

[0055] Mounts are provided on opposing sides of the frame 102 to mount rotary components of the device 100 to the frame 102. Two first mounting sets 122, for a pair of first assemblies, and two second mounting sets 124, for a pair of second assemblies, are provided on the frame 102. The mounting sets 122, 124 extend outwardly from the supports 106 away from the vertical process channel. Each of the first and second mounting sets 122, 124 incorporate bearings 126 to permit free rotation of assemblies mounted thereto.

[0056] To fold the crate 10, the device 100 further comprises conveying means, unlocking means, pivoting means, and buckling means provided in the form of two first assemblies 130, two second assemblies 132, and four third assemblies 134 that are mounted to the frame 102 (see Figure 2). The conveying means defines a conveyor plane moveable along the vertical process channel and is configured to convey the crate 10 along the vertical process channel. The conveying means supports the base 104 of the crate 10 on the conveyor plane. The unlocking means is configured to apply a horizontal force to each of the first pair of opposed side walls 14, 18 to unlock them during the initial conveyance of the collapsible crate along the vertical process channel, while the pivoting means is configured subsequently to pivot the first pair of opposed walls 14, 18 away from the conveyor plane. The buckling means is configured to buckle the second pair of opposed side walls 16, 20 to enable folding of the crate 10 during the continued conveyance of the crate 10 along the vertical process channel. The first assemblies 130 include the unlocking and pivoting means and part of the conveying means. The second assemblies 132 include part of the conveying means. The third assemblies 134 include the buckling means.

[0057] The two first assemblies 130 and two second assemblies 132 are mounted on the frame 102 in pairs comprising a first assembly 130 and a second assembly 132. Each pair is mounted on an opposing side of the frame 102. The first and second assemblies 130, 132 are arranged to extend into the vertical process channel in order to engage with the first pair of opposed side walls 14, 18 of each crate 10. First assemblies 130 are mounted to the first mounting sets 122, while second assemblies 132 are mounted to the second mounting sets 124. The four third assemblies 134 are mounted on crossbars 136 extending between supports 106 so that two third assemblies 134 are disposed on one side of the frame 102, and two third assemblies 134 are disposed on an opposing side of the frame 102. The sides on which the third assemblies 134 are mounted are the long sides of the frame 102, i.e. the sides that the second pair of opposed side walls 16, 20 of each crate 10 will be disposed at. The third assemblies 134 are mounted to the frame 102 to be partly positioned within the vertical process channel. In some embodiments, only a single third assembly may be provided on each side, while in others, more than two third assemblies may be provided on each side of the frame 102.

[0058] Figure 5 shows a first assembly 130 in isolation, while Figure 6 shows a second assembly 132 in isolation. The first assembly 130 and second assembly 132 each have a respective central shaft 138, 140. When the two first assemblies 130 are mounted to the frame, each end 142 of the central shaft 138 is received within the bearing set 126 of one of the first mounting sets 122. When the two second assemblies 132 are mounted to the frame 102, each end 144 of its central shaft 140 of are received within the bearing sets 126 of one of the second mounting sets 124.

[0059] As discussed above, the conveying means is defined in part by the two first assemblies 130 and in part by the two second assemblies 132. The first assembly 130 comprises two sets 148 of primary rotary arms 150 arranged at opposite ends of and fixedly mounted to the central shaft 138. Each set 148 of primary rotary arms 150 comprises four primary rotary arms 150 that extend radially outwardly from a concentric disc 152 mounted to the shaft 138. The primary rotary arms 150 are equally-spaced radially around the central disc 152 at intervals of 90 degrees. Accordingly, the primary rotary arms 150 extend radially outwards from a central rotational axis defined by the shaft 138.

[0060] As the first assembly 130 has a set 148 of primary rotary arms 150 at either end of its central shaft 138 and each set 148 has four primary rotary arms 150, there are eight primary rotary arms 150 in total. Corresponding primary rotary arms 150 of each set 148 are aligned so that they extend from their respective central disc 152 and the shaft 138 in a parallel arrangement.

[0061] Each of the primary rotary arms 150 comprises an elongate bar 154. At a free end of each primary rotary arm 150 is disposed a roller 156. Each roller 156 is a cylindrical buffer rotatable with respect to its respective elongate bar 154 about a respective pin received through the elongate bar 154. The rollers 156 are rotatable about an axis parallel to the axis of the central shaft 138.

[0062] Similarly, the second assembly 132 comprises two sets 158 of secondary rotary arms 160 arranged at opposite ends of and fixedly mounted to the central shaft 140 of the second assembly 132. Each set 158 of secondary rotary arms 160 comprises four rotary arms 160 that extend radially outwardly from a central disc 162 mounted to the shaft 140. The secondary rotary arms 160 are equally-spaced radially around the central disc 162. Accordingly, the secondary rotary arms 160 extend radially outwards from a central rotational axis defined by the shaft 160.

[0063] As the second assembly 132 has a set 158 of secondary rotary arms 160 at either end of its central shaft 140 and each set 158 has four secondary rotary arms 160, there are eight secondary rotary arms 160 in total. Corresponding secondary rotary arms 160 of each set 158 are aligned so that they extend in parallel from their respective central discs 162 and the shaft 140.

[0064] Each of the secondary rotary arms 160 comprises an elongate bar 164. At a free end of each secondary rotary arm 160 is disposed a roller 166. Each roller 166 is a cylindrical buffer rotatable with respect to its respective elongate bar 164 about a respective pin received through the elongate bar 164. The rollers 166 are rotatable about an axis parallel to the axis of the central shaft 140.

[0065] Although the parts of the conveying means found in each of the first and second assemblies 130, 132 are generally similar, some differences do exist. Particularly, the radius of the primary rotary arms 150 and secondary rotary arms 160 differs. In the embodiment shown in the Figures, the primary rotary arms 150 are longer than the secondary rotary arms 160. In conjunction with the concurrent rotation of the first and second assemblies 130, 132 as will be described later, this enables a change in the distance of travel of the base 12 of a crate 10 for the same rotation of the assemblies 130, 132 when the crate 10 is transferred from being conveyed by the primary rotary arms 150 to being conveyed by the secondary rotary arms 160. As a result, the secondary rotary arms 160 urge further folding of the crate 10, as will be described below.

[0066] It should also be noted that the rollers 156, 166 differ in size; the rollers 156 of the primary rotary arms 150 have a larger diameter than the diameter of the rollers 166 of the secondary rotary arms 160. The central discs 152 of the first assembly 130 have a greater diameter than the central discs 162 of the second assembly 132. This allows the central discs 152 of the first assembly 130 to support other components mounted on the first assembly 130, as will become apparent.

[0067] The secondary rotary arms 160 are mounted on their shaft 140 so that, when mounted to the frame 102, they are positioned between the rotary arms of the first assembly 130 and do not interfere with the rotation of the first assembly 130.

[0068] Returning to Figures 2 and 3, it can be seen that the first and second assemblies 130, 132 are mounted to the frame 102 so that at least one rotary arm 150, 160 of each assembly 130, 132 extends into the vertical process channel. In this way, the base 12 of a crate 10 can be received on the rollers 156 of the primary rotary arms 150 extending into the vertical process channel. The primary rotary arms 150 will therefore collectively form the conveyor plane. The secondary rotary arms 160 also extend into the vertical process channel for receiving the base 12 of the crate 10 as the primary rotary arms 150 rotate and disengage from the base 12 of the crate 10.

The process of conveyance will be described in relation to Figures 8a to 8i below.

[0069] Referring to the first assembly 130 of Figure 5, a plurality of further arms 168 are also provided. The further arms 168 each combine unlocking means and pivoting means so that the first pair of opposed side walls 14, 18 of each crate 10 is moved from the locked position to a position where the second pair of opposed side walls 16, 20 can be buckled and the crate 10 folded.

[0070] In a similar way to the first and second assemblies 130, 132, the plurality of further rotary arms 168 comprises two sets 170 of further rotary arms 168 arranged at opposite ends of and fixedly mounted to the shaft 138 of the first assembly 130. Each set 170 of further rotary arms 168 comprises four further rotary arms 168. As the first assembly 130 has a set 170 of further rotary arms 168 at either end of its central shaft 138 and each set 170 has four further rotary arms 168, there are eight further rotary arms 168 in total. Corresponding further rotary arms 168 of each set 170 are aligned so that they extend in parallel from the shaft 138.

[0071] The further rotary arms 168 are each connected to the shaft 138 via a reinforcement 172, which is reinforced against each of the primary rotary arms 150.

[0072] Each further rotary arms 168 has a first, unlocking portion 174 extending normally to the reinforcement 172. The unlocking portion 174 has a ridge 176 at its end with an attached roller 178. A pivoting portion 180 extends normally from the end of the unlocking portion 174. The pivoting portion 180 also has a roller 182 attached to its free end. The roller 182 of the pivoting portion 180 sweeps through a path having a greater radius than the path defined by the roller 178 of the unlocking portion 174. When the first assembly 130 is in mounted as part of the device 100 and rotates, the unlocking portion 174 makes contact with one of the first pair of opposed side walls 14, 18 of the crate 10 before the pivoting portion 180 to permit unlocking of the side walls 14, 18 before they are pivoted. This will be explained in more detail below. The use of rollers 178, 182 reduces the friction of the relative movement between the further rotary arms 168 and the side walls 14, 18 of the crate 10 and also enables the further rotary arms 168 to move across any surface detail that might be present on the side walls 14, 18.

[0073] The combined unlocking portion 174 and pivoting portion 180 together generally define a hook-shape for each further rotary arm 168. The further rotary arms 168 are arranged about the shaft 138 to extend between consecutive primary rotary arms 150. The further rotary arms 168 extend into the vertical process channel adjacent the conveyor plane. In doing so, engagement with the first side walls 14, 18 of each crate 10 is achieved. The provision of further rotary arms 138 at each side of the shaft 138 of the first assembly 130 ensures a more uniform force is applied to the sides 14, 18 of each crate 10, ensuring that unlocking and pivoting are more effective and repeatable.

[0074] The further rotary arms 168 are positioned inwardly of the primary rotary arms 150. This is to avoid interference of the further rotary arms 168 with the second pair opposed sides 16, 20 as they buckle inwardly.

[0075] At the centre of the shafts 138, 140 of each of the first and second assemblies 130, 132, a gear 184, 186 is fixedly mounted to the shafts 138, 140. The gears 184, 186 of the pairs of first and second assemblies 130, 132 on each side of the frame 102 are joined by a chain (not shown). By virtue of the chain connection between assemblies 130, 132, rotation of the first assembly 130 causes the second assembly 132 to rotate and vice versa. The gear ratio between the gears 184, 186 is 1:1 so that the assemblies 130, 132 operate synchronously. In other embodiments where the assemblies 130, 132 have different numbers of arms, the gear ratio between the gears 184, 186 may be different so that the arms of the assemblies 130, 132 continue to operate synchronously.

[0076] A timing mechanism 188 is also incorporated into the first assembly 130. The timing mechanism 188 comprises a grooved part 190 fixedly attached at one end of the shaft 138 outwardly of one of the sets 148 of primary rotary arms 150. The grooved part 190 has four equally spaced grooves 194 between peaks 196. The grooved part 190 cooperates with a roller 192 (see Figure 1) that is biased by a torsion spring 198, also known as a rubber suspension unit, to force it into each groove 194. As the first assembly 130 rotates, each peak 196 of the grooved part 190 displaces the roller 192. When the peak 196 has passed the roller 192, the roller 192 springs back towards its biased position to sit in and against the groove 194. In doing so, the roller 192 holds the first assembly 130 in the position corresponding to that groove 194, allowing the movement of the first assembly 130 to be controlled and held at particular positions.

[0077] The peaks 196 are configured to displace the roller 192 by a particular amount. The peaks 196 may be configured to displace the roller 192 by at least 5 degrees, at least 10 degrees or greater than 10 degrees from its position in a groove 194.

[0078] Figure 7 shows a third assembly 134 for mounting to the frame 102 for use in buckling the second side walls 16, 20. In use in the device 100, at least two third assemblies 134 are mounted to the frame 102, one on each side. In the arrangement of Figure 2, two third assemblies 134 are provided on either side of the frame 102.

[0079] The third assembly 134 has an arm 200, attached to a torsion spring 202 at one end and having a roller 204 at the other. The arm 200 is bent at the end having the roller 204, as can be seen in Figure 2. When attached to the frame 102, as can be seen in Figure 2, the spring 202 biases the arm 200 so that the roller 204 partially sits in the vertical process channel. As will be described below, crates 10 travelling along the vertical process channel outwardly displace the roller 204 and arm 200 of the third assembly 134 from the vertical process channel. The resulting rectifying force applied by the spring 202 causes the roller 204 to apply a force inwardly on the crate 10 towards the vertical process channel, which buckles the second pair of opposed side walls 16, 20.

[0080] The spring 202 comprises a four resilient rubber stops 208 fixed in the corners of a casing 210. A protrusion 206 extending from the arm 200 is positioned between the stops 208. Rotation of the protrusion 206 is opposed by the stops 208, and bias the arm 200 to return to the position shown in Figure 7. However, any rotational or torsion spring that biases the roller 204 and arm 200 to the position shown in Figure 2 may be used.

[0081] When mounting to the frame 102, the third assemblies 134 can be positioned so that the roller 204 is vertically above the spring 202 as shown in Figure 2, or below the spring 202 as shown in Figures 8a to 8i.

[0082] Figures 8a to 8i illustrate how the device 100 operates to fold a collapsible crate 10. In Figures 8a to 8i, the device 100 is depicted from the front so that a long edge faces the viewer, and so that the first and second assemblies 130, 134 are viewed from the side. Crates 10 inserted into the device 100 are depicted with one of the second sides 16 facing the viewer, with each of the first pair of opposed walls 14, 18 to the left and right of the figure respectively.

[0083] Initially (Figure 8a), the first assemblies 130 arranged on either side of the frame 102 are positioned so that one of the primary rotary arms 150 on each side is positioned highest in the vertical process channel for receiving the crate 10 on the rollers 156. In other words, four primary rotary arms 150, i.e. two for each first assembly 130, extend into the vertical process channel and define the conveyor plane. The base 12 of the crate 10 is received on the conveyor plane within the vertical process channel, supported by the primary rotary arms 150 of the first assemblies 130. The crate 10 is in its unfolded configuration, and has already been directed into the vertical process channel by a user and the hopper 114 respectively. It should be noted that the timing mechanism 188 of the device 100 is configured to hold the first assemblies 130 in the position shown in Figure 8a prior to the insertion of an unfolded collapsible crate 10 so that the device 100 is configured to receive the crate 10.

[0084] When a force is applied to the crate 10 by the user, the base 12 of the crate 10 conveys the force to the primary rotary arms 130, causing the first assemblies 130 to counter-rotate. By virtue of the chain (not shown) connecting the first and second assemblies 130, 132, the second assembly 132 is also caused to rotate. As the assemblies 130, 132 rotate, the conveyor plane is moved along the vertical process channel, and hence the crate 10 is lowered through the device 100.

[0085] Rotation of the first assemblies 130 causes two further rotary arms 168 of each assembly 130 to come into contact with respective ones of the first pair of opposed side walls 14, 18 of the crate 10, as shown in Figure 8b. The roller 178 mounted on the unlocking portion174 of each further rotary arm 168 initially contacts its respective first side wall 14, 18, at a point close to the base 12 of the crate 10 and away from hinges 26. As the first assembly 130 continues to rotate, the unlocking portion 174 applies a force to the lower part of its side wall 14, 18. Applying the force close to the base 12 of the crate 10 results in a large moment that causes the side wall 14, 18 to unlock from its locked position and to move inwardly. Applying the unlocking force further from the pivot of the wall 14, 18 causes a greater unlocking moment. The shape and orientation of the unlocking portion of the further rotary arms 168 permits the application of the unlocking force as far from the pivot as possible without interference with the base 12 of the crate 10.

[0086] During continued conveyance, i.e. as the first assemblies 130 continue to counter-rotate and convey the crate 10 along the vertical process channel, the pivoting portions 180 of the further rotary arms 168 also contacts the opposed first side walls 14, 18, see Figure 8c. As the pivoting portions 180 extend normally away from the unlocking portions 174, the point of contact between the rollers 182 of the pivoting portions 180 and each respective first side wall 14, 18 is closer to the pivot of each first side wall 14, 18 than that of the unlocking portion 174. As can be seen from Figure 8d, a small movement of a pivoting portion 180 when in contact with a first side wall 14, 18 causes a large movement of that side wall 14, 18 about its pivot. The pivoting portions 180 effectively accelerate the side walls 14, 18 after unlocking so that they cannot interfere with the second pair of opposed side walls 16, 20 as they are inwardly buckled.

[0087] As can also be seen in Figures 8c and 8d, the outer edges of the base 12 contacts the third assemblies 134, also referred to as the buckling means, disposed on either of the long sides of the frame 102 as the crate 10 is conveyed downwardly. Only one third assembly 134 is shown in Figures 8a to 8i. The third assemblies 134 are displaced outwardly by the base 12 of the crate 10, and come into contact with their respective second side wall 16, 20 as the crate 10 is conveyed further along the vertical process channel as depicted in Figure 8d. As the pivoting portions 180 of the first assemblies 130 have already moved the first pair of opposed side walls 14, 18 from their locked position to a position that allows the second pair of opposed walls 16, 20 to be folded, there is no resistance to the second side walls 16, 20 buckling when the third assembly 134 comes into contact with them. Under the action of its spring 202, each third assembly 134 applies a buckling force to its respective wall 16, 20, causing folding of the second wall 16, 20. This can be seen in Figure 8e.

[0088] Also in Figure 8e, it can be seen that the shape of the further rotary arms 168 causes the first side walls 14, 18 to be propelled above the top frame 22 of the crate 10.

[0089] At Figure 8f, the first assemblies 130 have completed a quarter rotation so that their position matches the position they were initially in when receiving the crate in Figure 8a. As already discussed, the timing mechanism 188 holds the first assemblies 130 in this position. It can therefore be seen that the quarter rotation of the first assemblies 130 corresponds to the roller 192 of the timing mechanism 188 moving between two consecutive grooves 194. As the position matches that shown in Figure 8a, the device 100 can now receive another crate 10. Force applied to the assemblies 130 by the user via a newly introduced crate 10 can be used to progress the current crate through the final few stages according to Figures 8g to 8i. Alternatively, the user may apply further force to the crate 10 or manually rotate the assemblies 130, 132 to progress the crate 10 through the device 100.

[0090] In Figure 8e, the conveyor plane is defined by the primary rotary arms 150 of the first assemblies 130. In Figure 8f, the conveyor plane is defined by both the primary rotary arms 150 of the first assemblies 130 and the secondary rotary arms 160 of the second assemblies 132. Effectively, the configuration shown in Figure 8f is the transfer of support of the base 12 of the crate 10 from the first assemblies 130 to the second assemblies 132.

[0091] As discussed above, the change in effective diameter of the secondary rotary arms 160 causes some compression of the base 12 of the crate 10 towards the top frame 22, and it can be seen in Figure 8f that the crate 10 is more compressed than in Figure 8e.

[0092] The third assemblies 134 also contribute to the compression. In Figure 8f, the third assembly 134 shown is in contact with and has rolled over the top frame 22 of the crate 10. As with the base 12, rolling over the top frame 22 displaces the roller 204 and arm 200 of the third assembly 134 outwardly. When the roller 204 is against an upper surface of the top frame 22, it is still displaced and so is applying an inward force to the top of the top frame 22 by virtue of the spring 202 of the third assembly 134. The application of such a force to the top of the top frame 22 when the second pair of opposed sides 16, 20 of the crate 10 are able to fold causes the crate 10 to compress to a semi-folded state as shown in Figure 8f.

[0093] Additionally, in Figure 8f, it can be seen that the hook-shape formed by the further rotary arms 168 ensures that the crate 10 can adopt the semi-folded state shown.

[0094] As discussed above, another crate 10 may be introduced to the device 100 to drive the current crate 10 through the final stages of the process, or force may be applied to the crate to propel it through. Regardless of how rotation of the first and second assemblies 130, 132 is achieved, Figure 8g illustrates the continued conveyance of the crate along the vertical process channel.

[0095] In Figure 8g, the conveyor plane is defined by the secondary rotary arms 160, as the primary rotary arms 150 that initially defined the conveyor plane have left the vertical process channel.

[0096] In Figures 8g and 8h, the semi-folded state of the crate 10 is maintained. As can be seen in both Figures, the base 12 is supported by the secondary rotary arms 160, while the top frame 22 is supported by the upper surface of each of the further rotary arms 168. The hook-shape of the further rotary arms 168 enables maintenance of the semi-folded state. However, the hook-shape is not essential in other embodiments, as a similar effect may be achieved in other ways.

[0097] Finally, in Figure 8i, it can be seen that the continued rotation of the first assemblies 130 causes the further rotary arms 168 to sweep away from and out of contact with the top frame 22 of the crate 10. The crate 10 is still supported by the secondary rotary arms 160.

[0098] It will be appreciated that following Figure 8i, the secondary rotary arms 160 will exit the vertical process channel, permitting the crate 10 to fall towards the base 104 of the frame 102 and any other folded crates 10 already present. Although the crate 10 is depicted as maintaining its semi-folded state in Figure 8i, it may have already folded under its own weight to adopt the folded state. Alternatively, the action of permitting the crate 10 to drop towards the base 104 of the frame 102 may cause folding of the crate 10. For example, drag of the base 12 of the crate 10 may cause it to fully fold, or the impact of the crate 10 on other crates 10 or the base 104 of the frame 102 may cause full folding. In all circumstances, the result is a folded collapsible crate 10.

[0099] Advantageously, the vertical process channel acts to effectively stack crates after folding for easy transport. As discussed above, folded crates 10 may be removed from the frame 102 after folding.

[0100] In some embodiments, the device may incorporate a single primary rotary arm and a single further rotary arm on each first assembly, and a single secondary rotary arm on each second assembly. The first assembly may be configured to return to a starting position in order to receive a new crate once the process of folding an earlier crate has been completed.

[0101] In some embodiments, a single set of primary rotary arms, further rotary arms, and/or secondary rotary arms may be utilised on respective assemblies, rather than the two sets on each assembly currently.

[0102] It will be appreciated that various changes and modifications can be made to the present invention without departing from the scope of the present application.

Claims

1. A device for folding a collapsible crate, the collapsible crate comprising a base, a first pair of opposed walls pivotable about their upper sections from a locked position to initiate folding of the collapsible crate and a second pair of opposed walls configured to buckle after the first pair of opposed walls have moved from the locked position, the device comprising:

   a frame defining a vertical process channel for the collapsible crate;
   conveying means defining a conveyor plane moveable along the vertical process channel,

the conveying means configured to convey the collapsible crate along the vertical process channel by supporting the base of the collapsible crate on the conveyor plane;
unlocking means configured to apply a horizontal force to the first pair of opposed walls to unlock the first pair of opposed walls during the initial conveyance of the collapsible crate along the vertical process channel;
pivoting means configured to pivot the first pair of opposed walls away from the conveyor plane; and,
buckling means configured to buckle the second pair of opposed walls to enable folding of the collapsible crate during continuing conveyance of the collapsible crate along the vertical process channel.

2. A device according to claim 1, wherein the conveying means comprises a pair of primary rotary arms each rotatable about an axis of a first pair of axes, wherein the axes of the first pair of axes are positioned on opposite sides of the frame, the primary rotary arms being configured to extend into the vertical process channel to define the conveyor plane and counter-rotate to move the conveyor plane through the vertical process channel.

3. A device according to claim 2, wherein the primary rotary arms are configured to move the conveyor plane through an upper section of the vertical process channel, and wherein the conveying means comprises a pair of secondary rotary arms each rotatable about an axis of a second pair of axes, wherein the axes of the second pair of axes are positioned on opposite sides of the frame, the secondary rotary arms being configured to extend into the vertical process channel to define the conveyor plane and counter-rotate to move the conveyor plane through a lower section of the vertical process channel.

4. A device according to claim 3, wherein the conveyor plane is defined by the primary and secondary rotary arms at an intersection between the upper and lower sections of the vertical process channel.

5. A device according to claim 3 or 4, wherein the length of the secondary rotary arms is smaller than the length of the primary rotary arms.

6. A device according to any one of claims 3 to 5, wherein the conveying means comprises a pair of coupling means, each coupling means coupling the primary and secondary rotary arms on each side of the frame so that rotation of one of the primary or secondary rotary arms rotates the other of the primary of secondary rotary arms.

7. A device according to any one of claims 2 to 6, wherein the conveying means comprises a plurality of pairs of primary rotary arms, wherein the arms of each pair of primary rotary arms are configured to radially extend from and counter-rotate about a respective axis of the first pair of axes to define a series of conveyor planes as each pair of primary rotary arms rotates through the vertical process channel.

8. A device according to claim 7, wherein the conveying means comprises a plurality of pairs of secondary rotary arms equal to the number of pairs of primary rotary arms, wherein the arms of each pair of secondary rotary arms are configured to radially extend from and counter-rotate about a respective axis of the second pair of axes to define a series of conveyor planes as each pair of secondary rotary arms rotates through the lower section of the vertical process channel.

9. A device according to any one of claims 2 to 8, wherein the conveying means comprises a positioning mechanism configured to hold the pair of primary rotary arms at one or more predefined positions to pause the conveyance of the conveyor plane along the vertical process channel.

10. A device according to any preceding claim, wherein the unlocking means comprises a pair of unlocking arms each rotatable about a respective axis positioned on opposite sides of the frame, the unlocking arms being configured to extend into the vertical process channel adjacent the conveyor plane so as to engage the lower ends of the first pair of opposed walls.

11. A device according to any preceding claim, wherein the pivoting means comprises a pair of pivoting arms each rotatable about a respective axis positioned on opposite sides of the frame, the pivoting arms being configured to extend into the vertical process channel so as to engage the upper ends of the first pair of opposed walls.

12. A device according to claim 10 or 11, wherein the respective axis comprises a respective axis of the first pair of axes.

13. A device according to claim 12, wherein each pivoting arm extends from a respective unlocking arm.

14. A device according to claim 13, wherein the end of each pivoting arm is configured to follow a path along the vertical process channel having a larger radius of curvature relative to the path along the vertical process channel followed by the end of each unlocking arm.

15. A device according to claim 13 or 14, wherein each pivoting arm extends substantially normally to its respective unlocking arm.

16. A device according to any preceding claim, wherein the pivoting means is configured to pivot the first pair of opposed walls away from the conveyor plane during continuing conveyance of the collapsible crate along the vertical process channel.

17. A device according to any preceding claim, wherein the buckling means is configured to buckle the second pair of opposed walls to enable folding of the collapsible crate during continuing conveyance of the collapsible crate along the vertical process channel following pivoting of the first pair of opposed walls by the pivoting means to an angle of at least 70 degrees from vertical.

18. A device according to claim 17, wherein the buckling means comprises a roller attached to the frame by a cantilevered spring, the cantilevered spring configured to bias the roller into the vertical process channel so that conveyance of the collapsible crate along the vertical process channel causes the roller to apply a horizontal force to the second pair of opposed walls.

19. A device according to any preceding claim, wherein the unlocking means is configured to disengage the collapsible crate sooner in the vertical process channel than the pivoting means, and wherein the pivoting means is configured to disengage the collapsible crate sooner in the vertical process channel than the conveying means.

20. A device according to claim 19, wherein the vertical process channel extends beyond a point of disengagement of the conveying means to allow the collapsible crate to fall.

21. A device according to any preceding claim, wherein the frame comprises a hopper for positioning the collapsible crate with respect to the vertical process channel when the collapsible crate is placed into the device at the top of the vertical process channel.

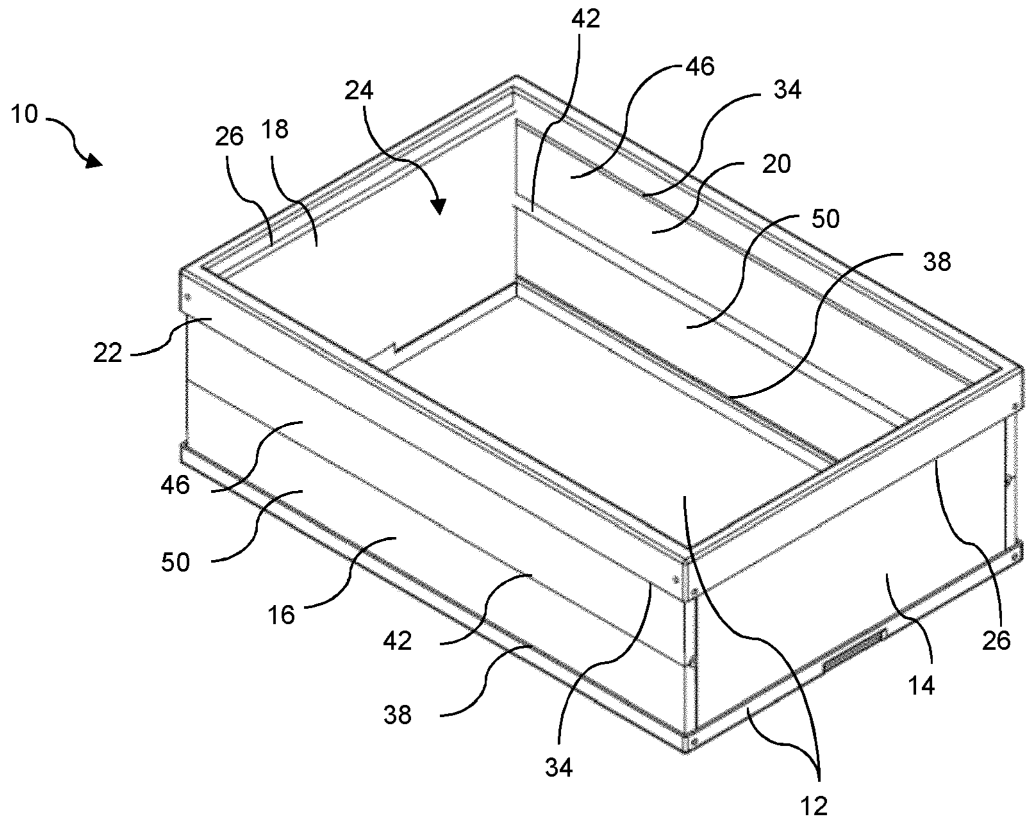
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Fig. 1a

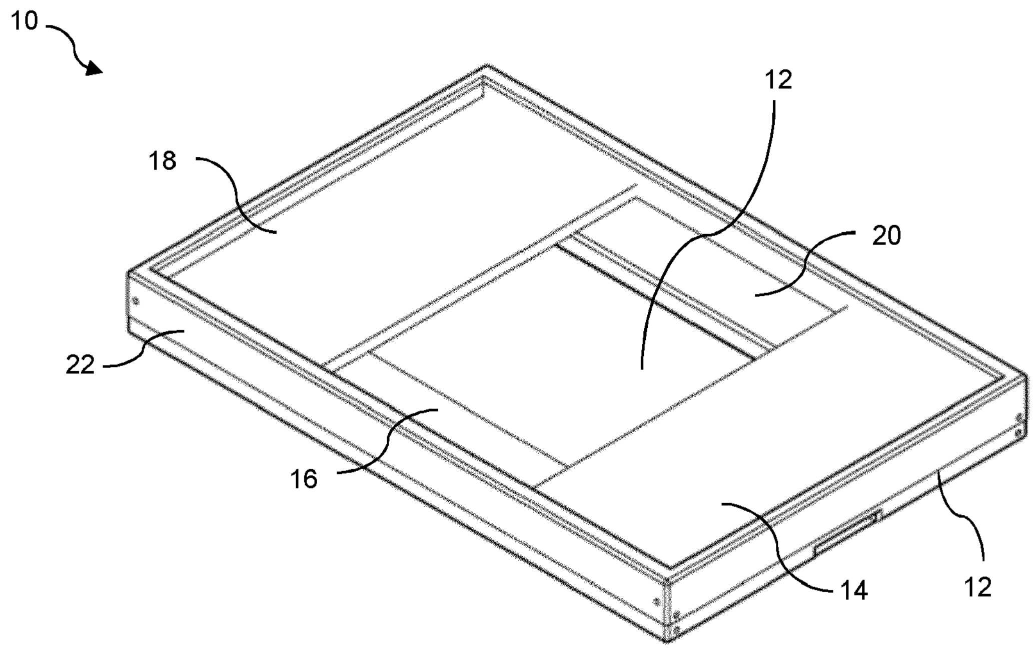
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Fig. 1b

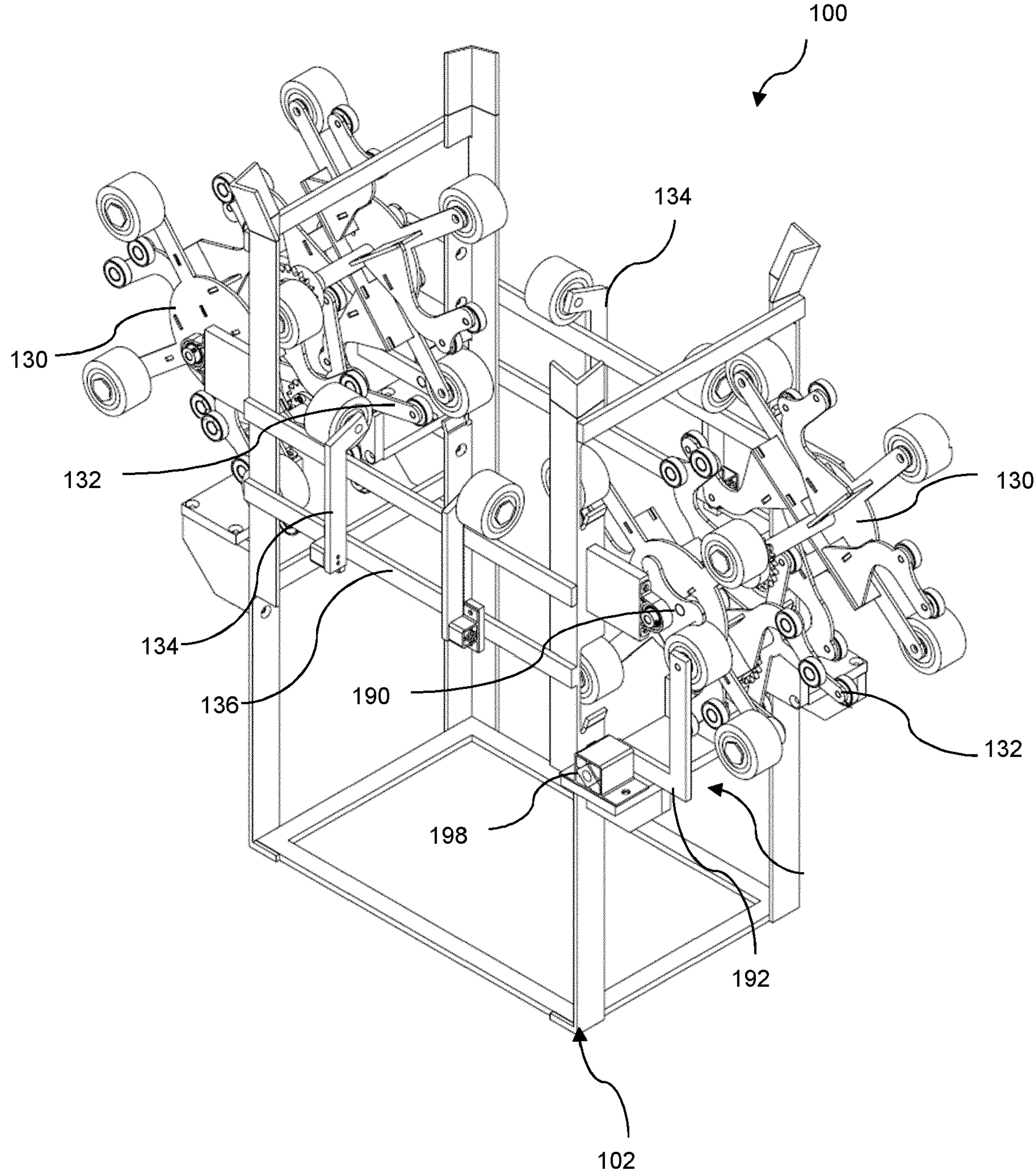

Fig. 2

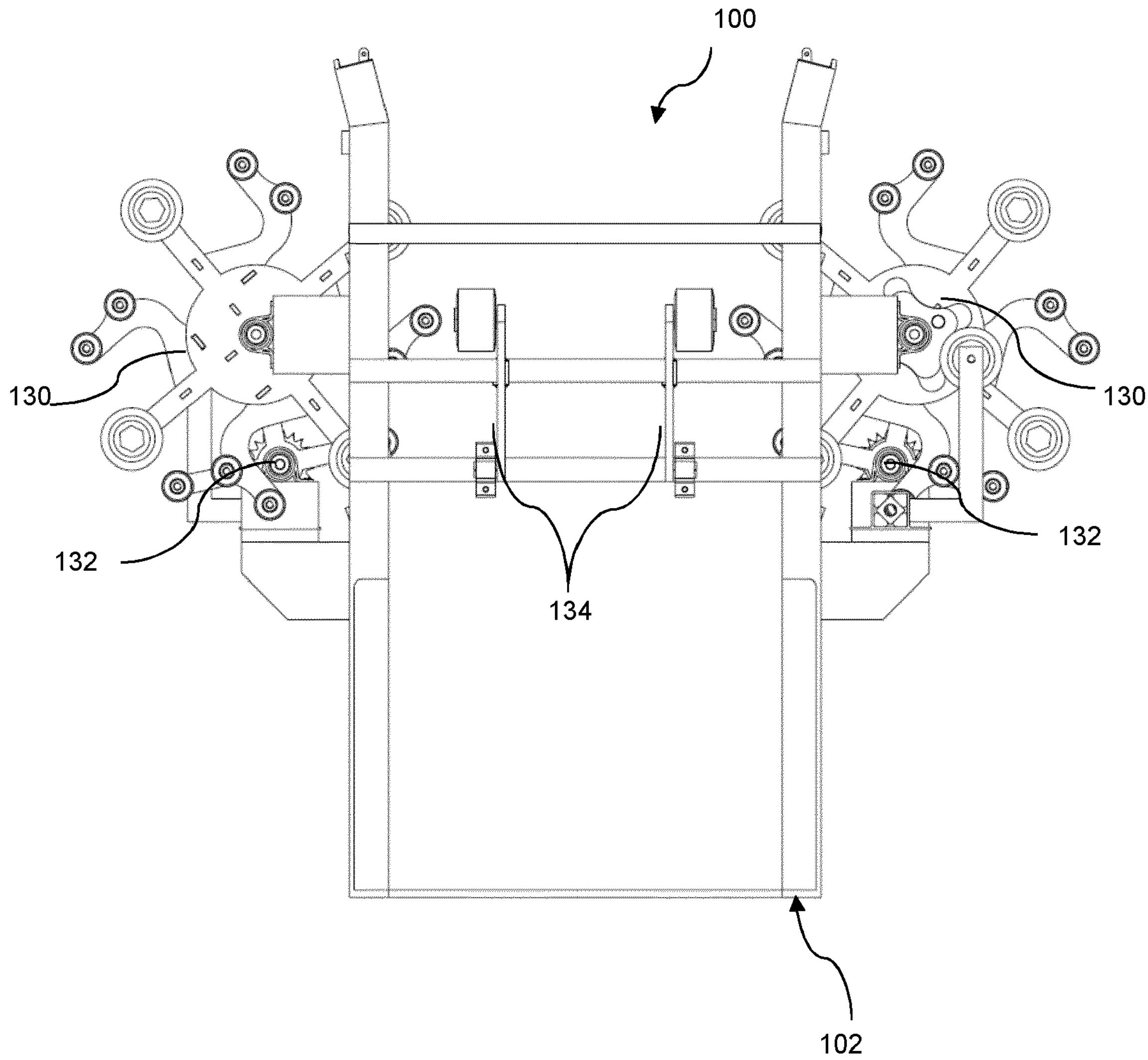

Fig. 3

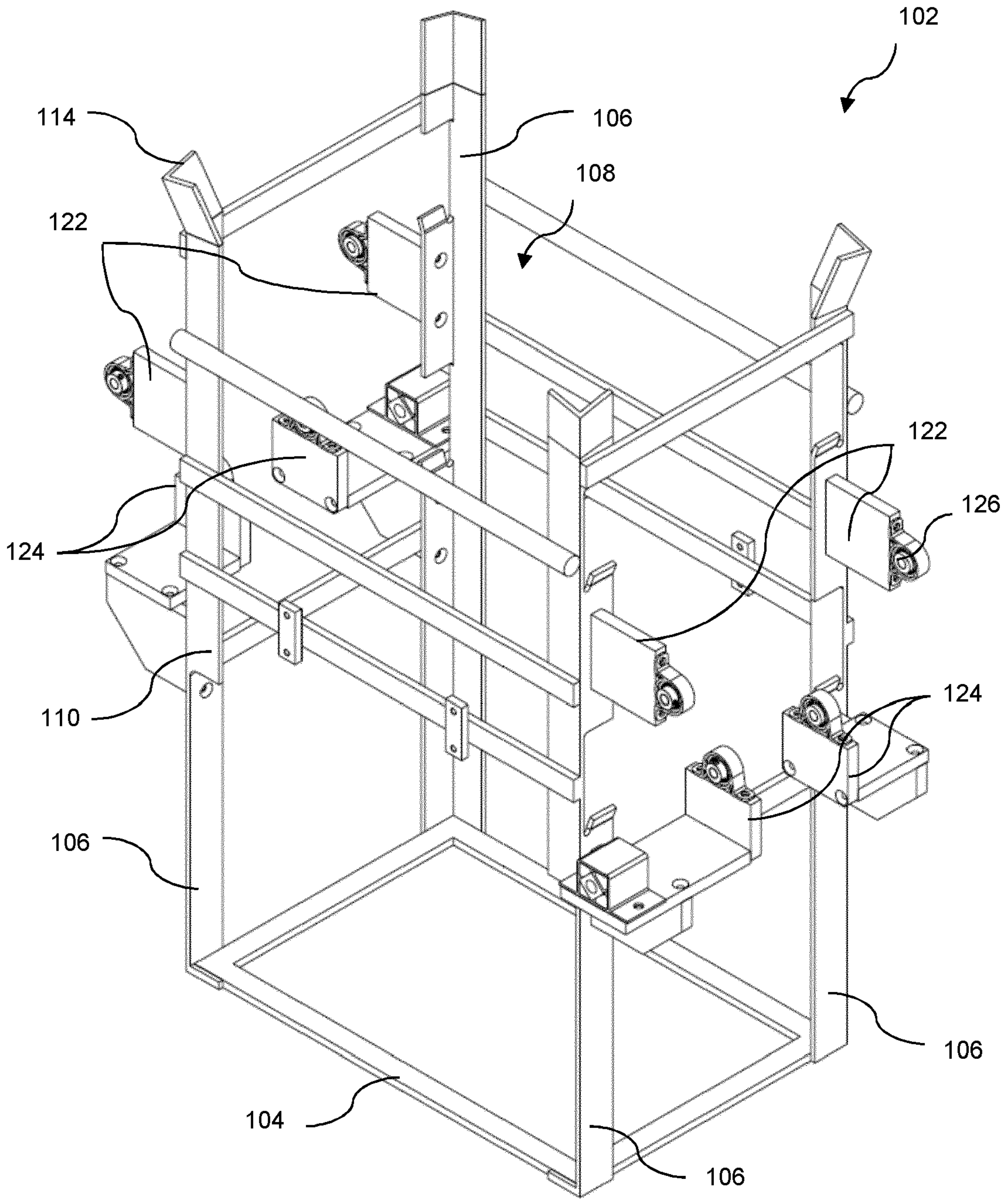

Fig. 4

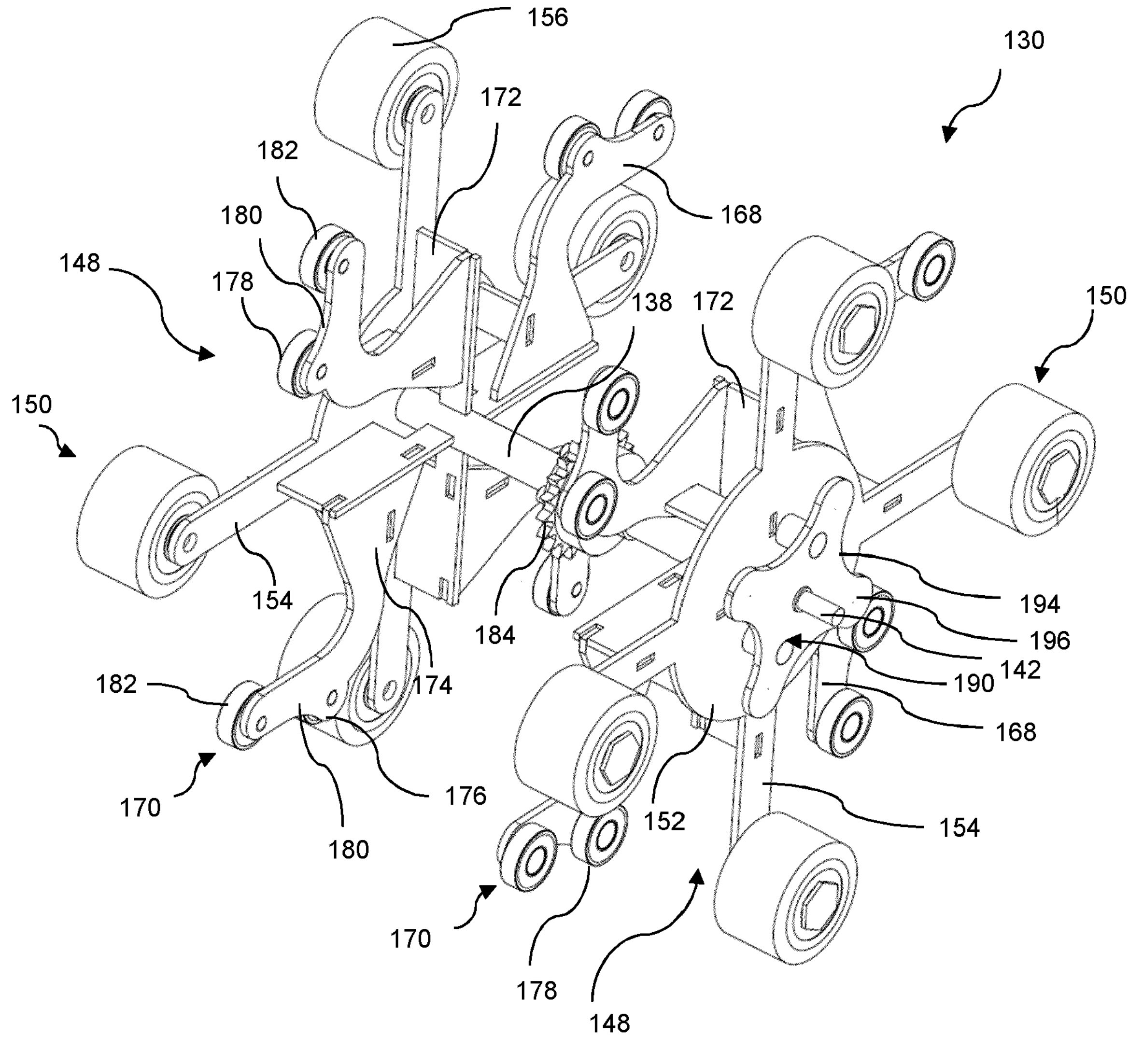
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Fig. 5

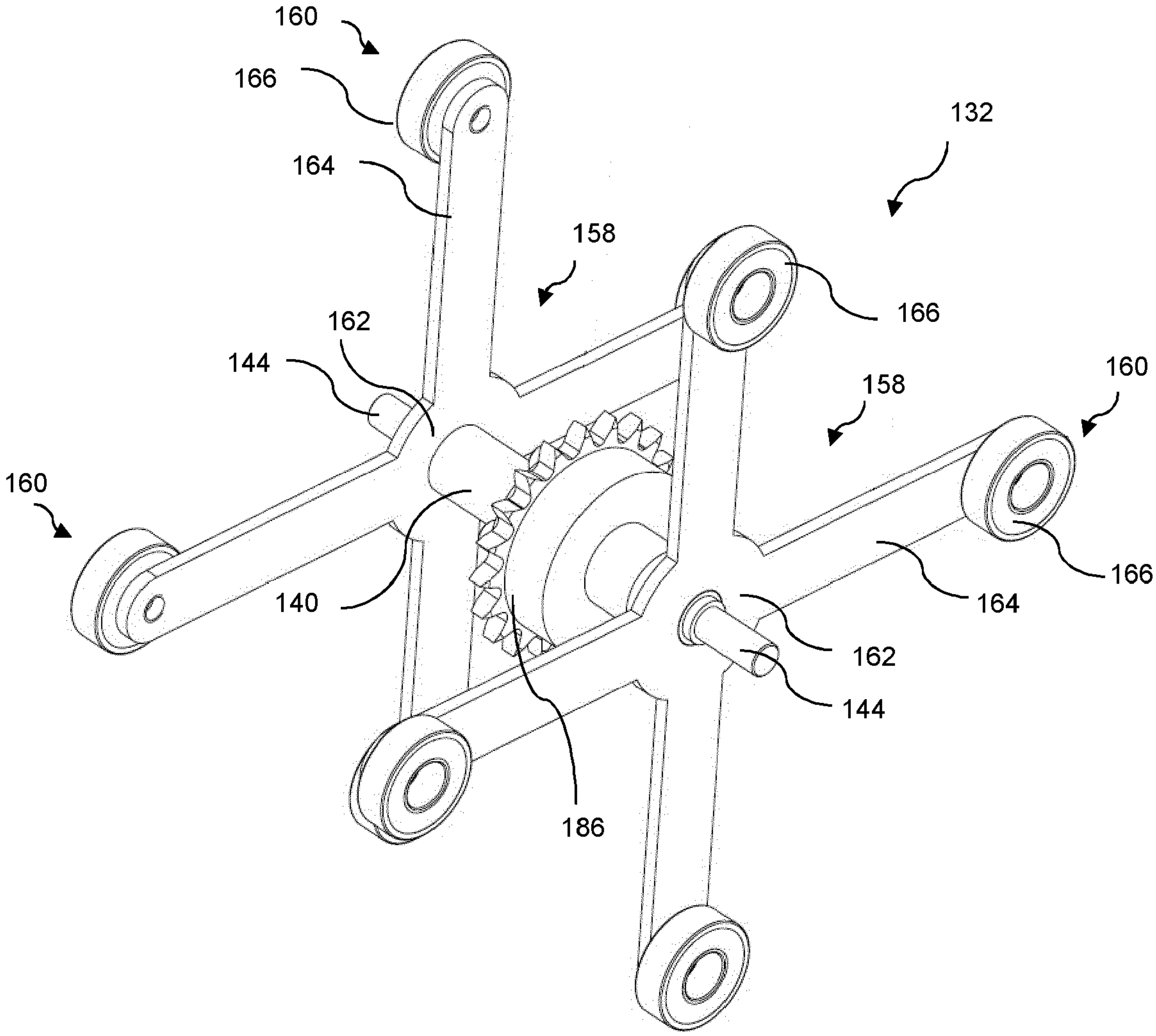
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Fig. 6

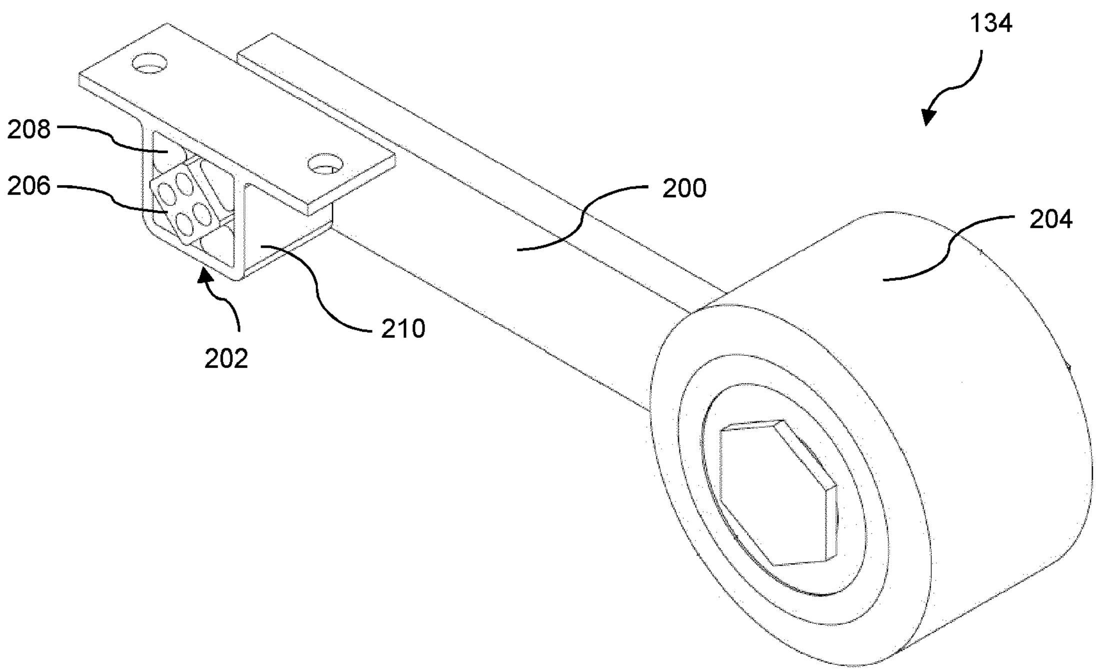

Fig. 7

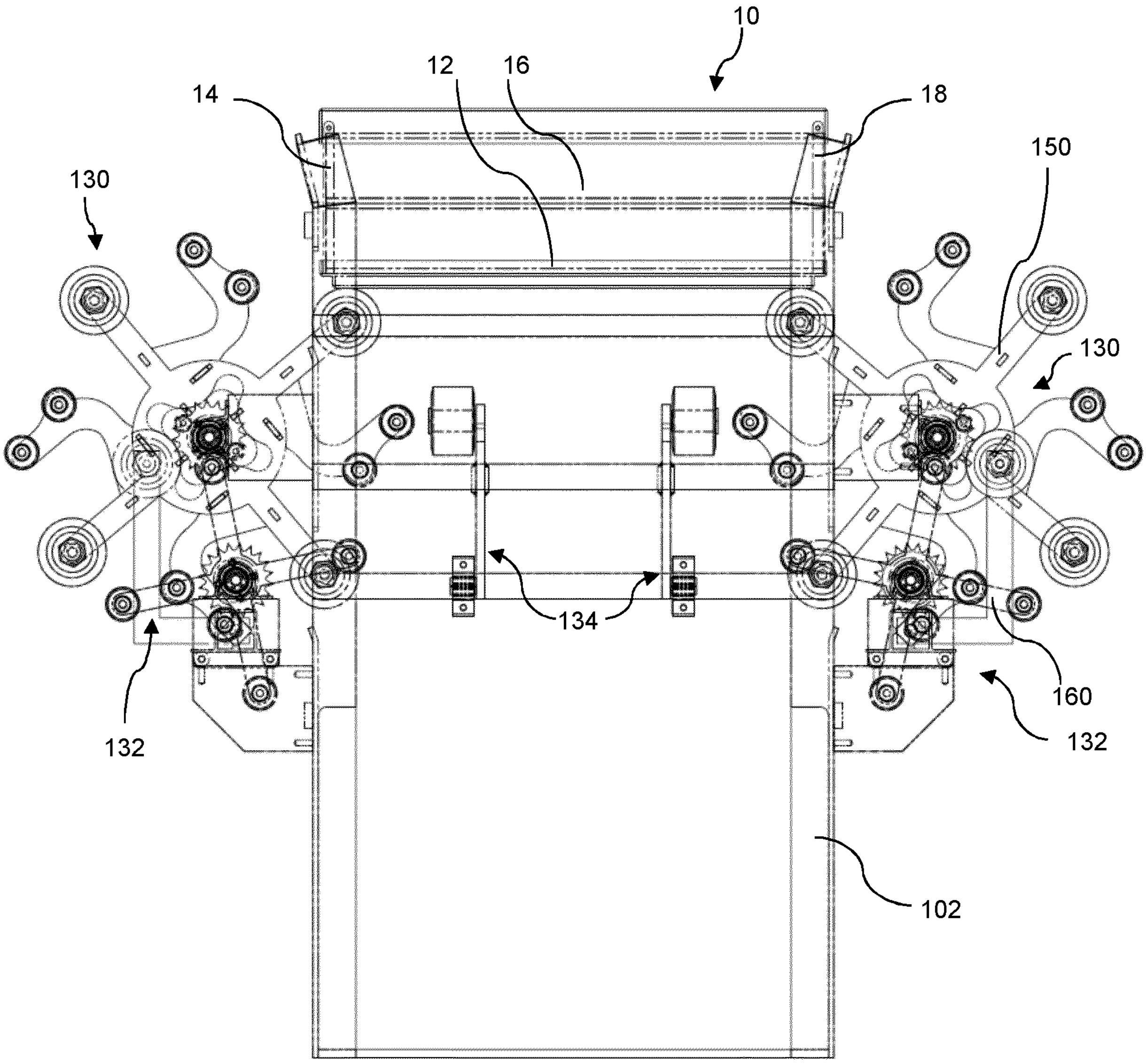

Fig. 8a

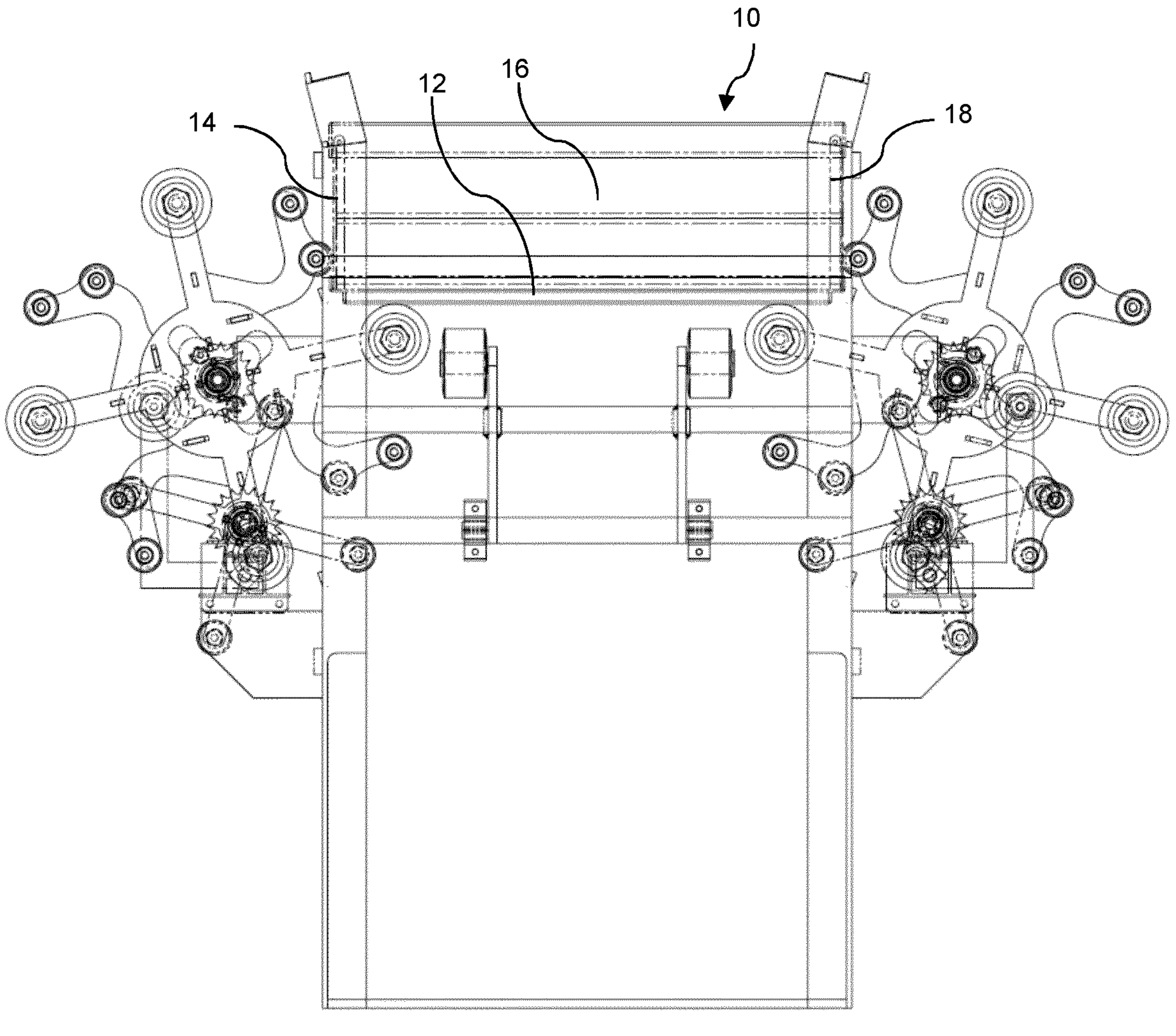

Fig. 8b

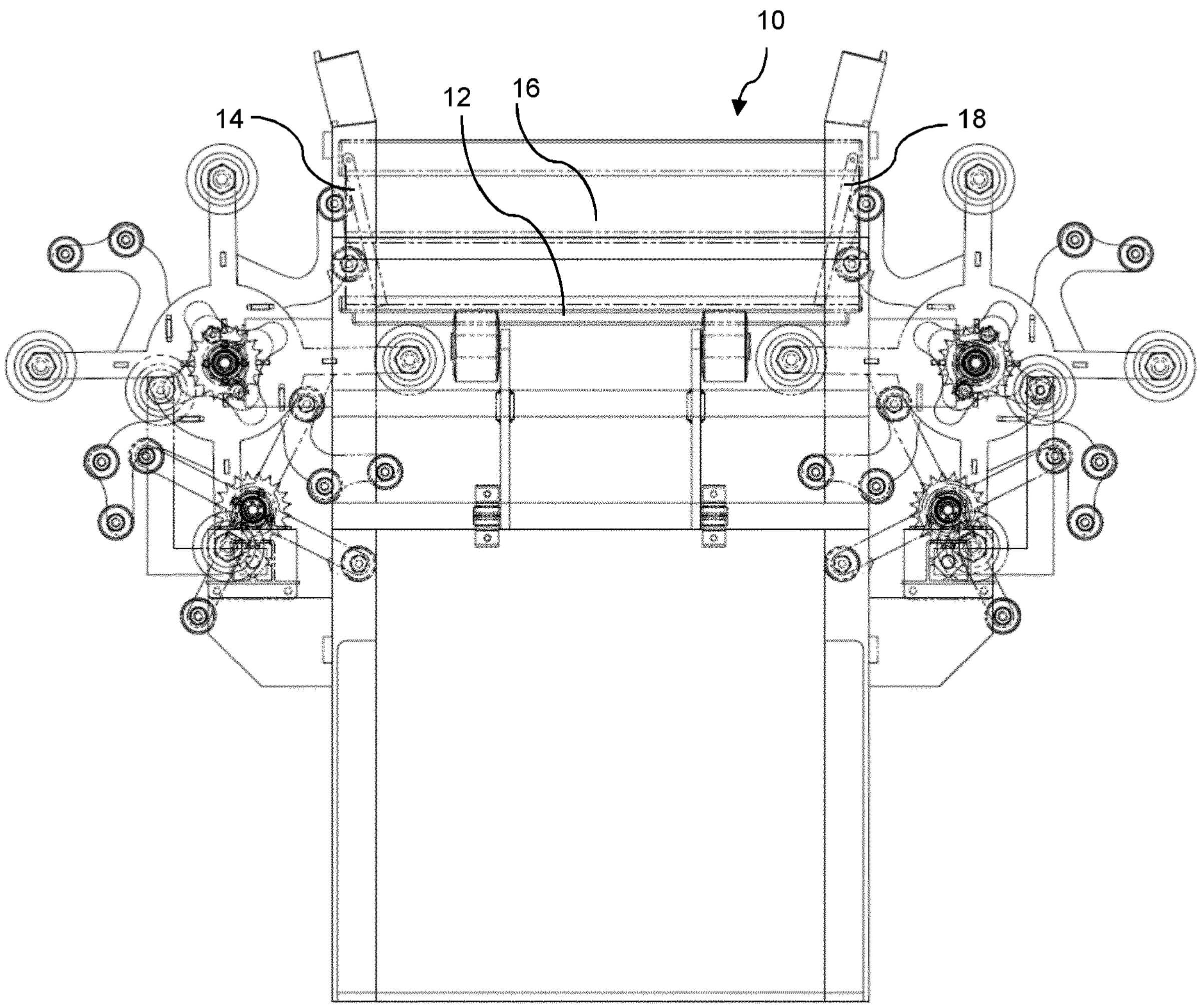

Fig. 8c

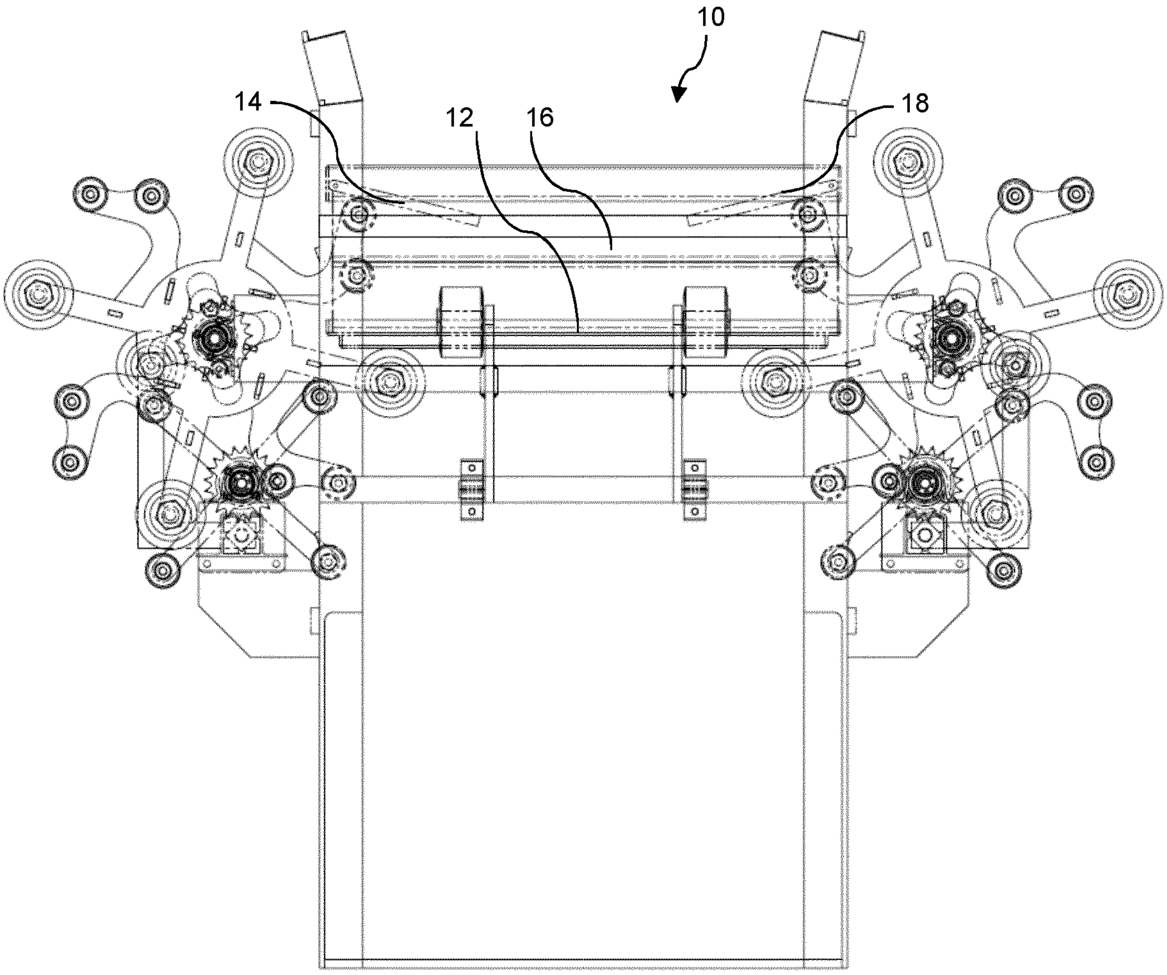

Fig. 8d

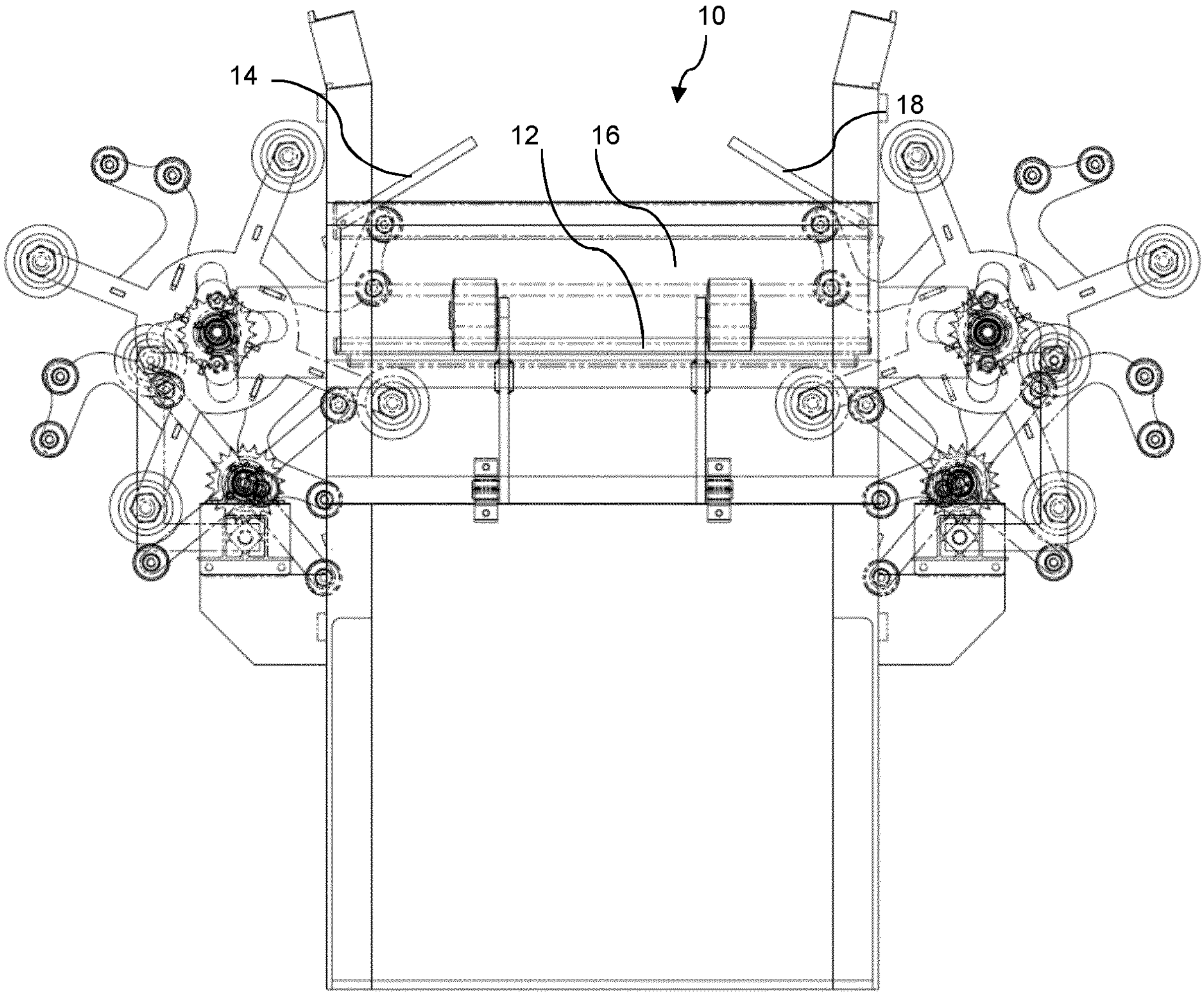

Fig. 8e

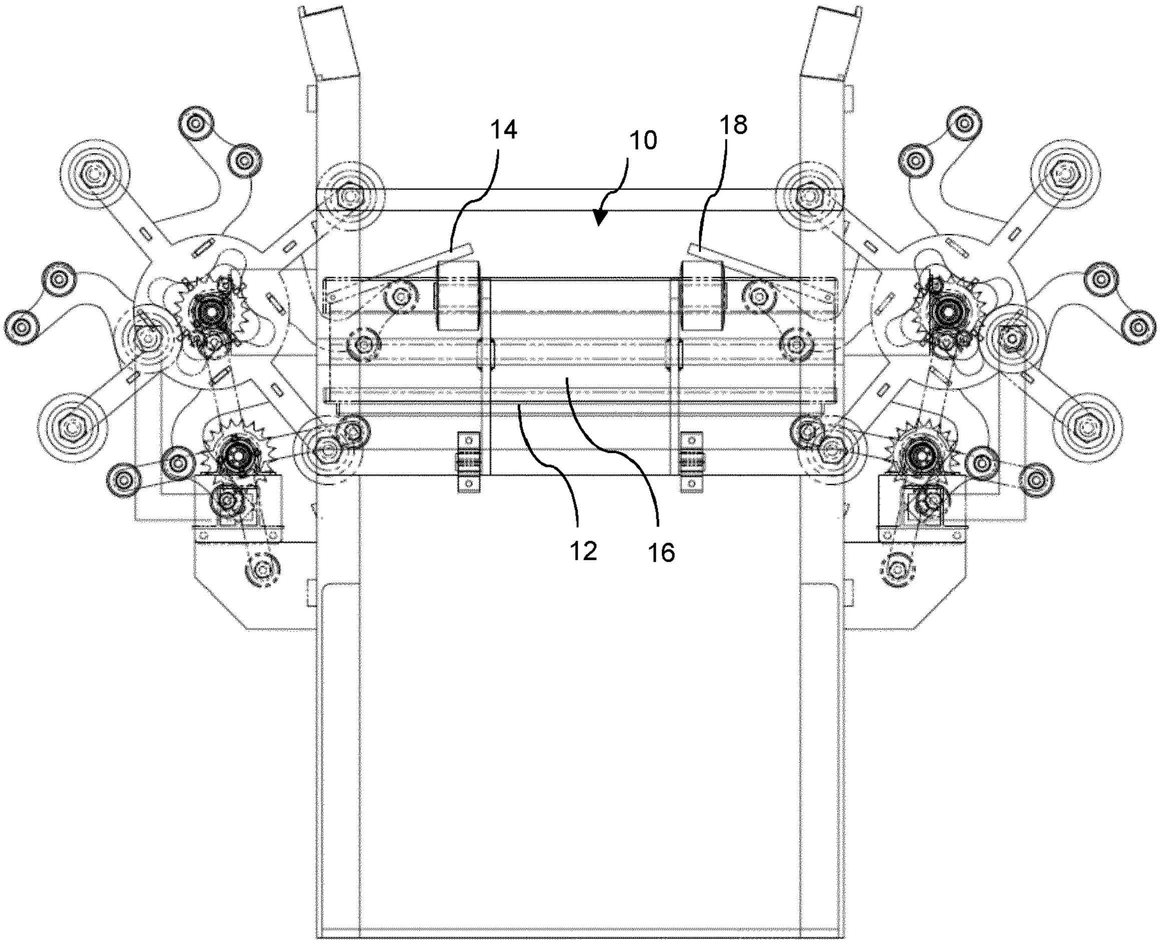

Fig. 8f

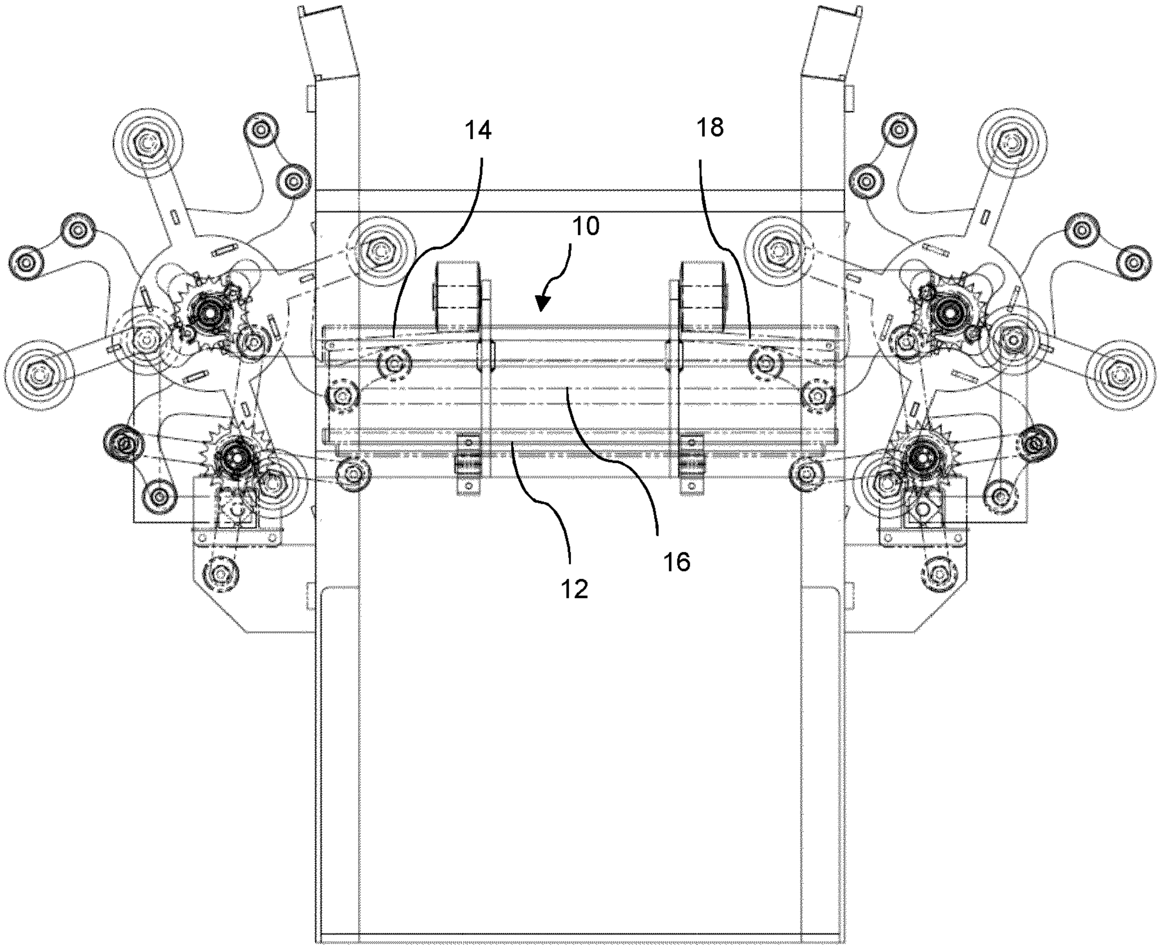

Fig. 8g

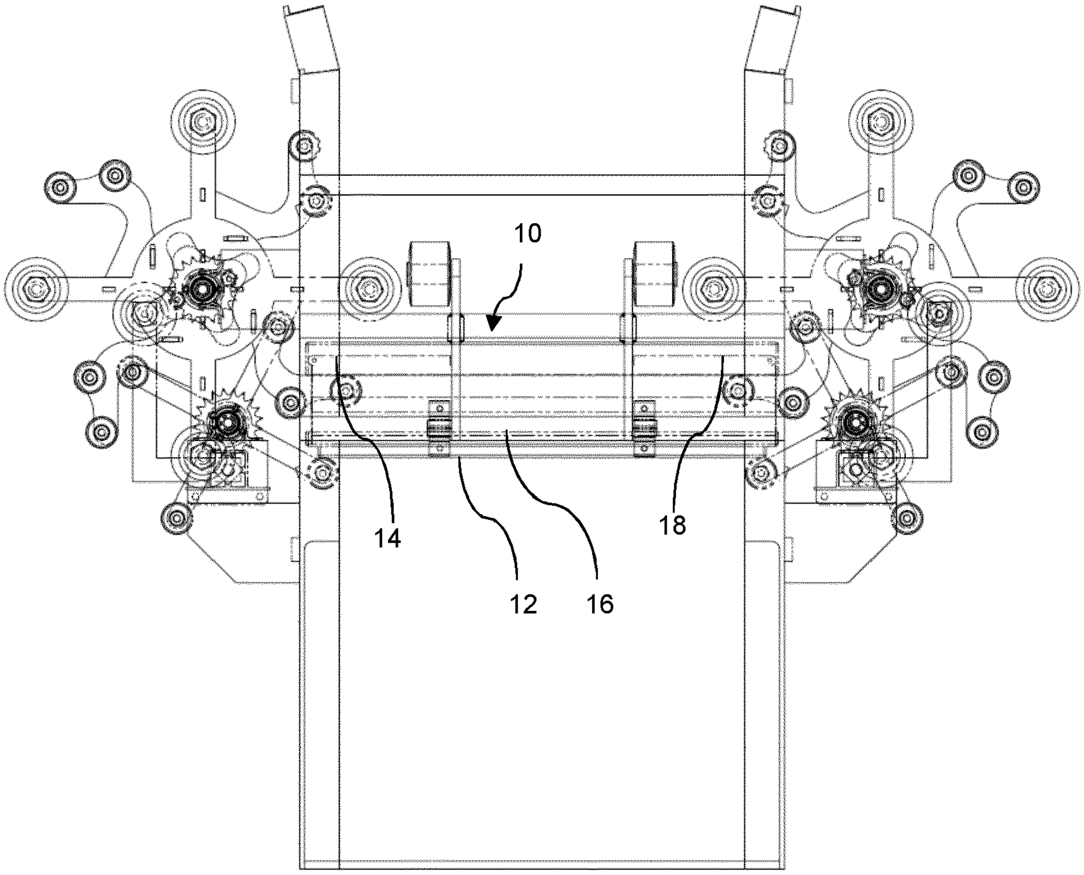

Fig. 8h

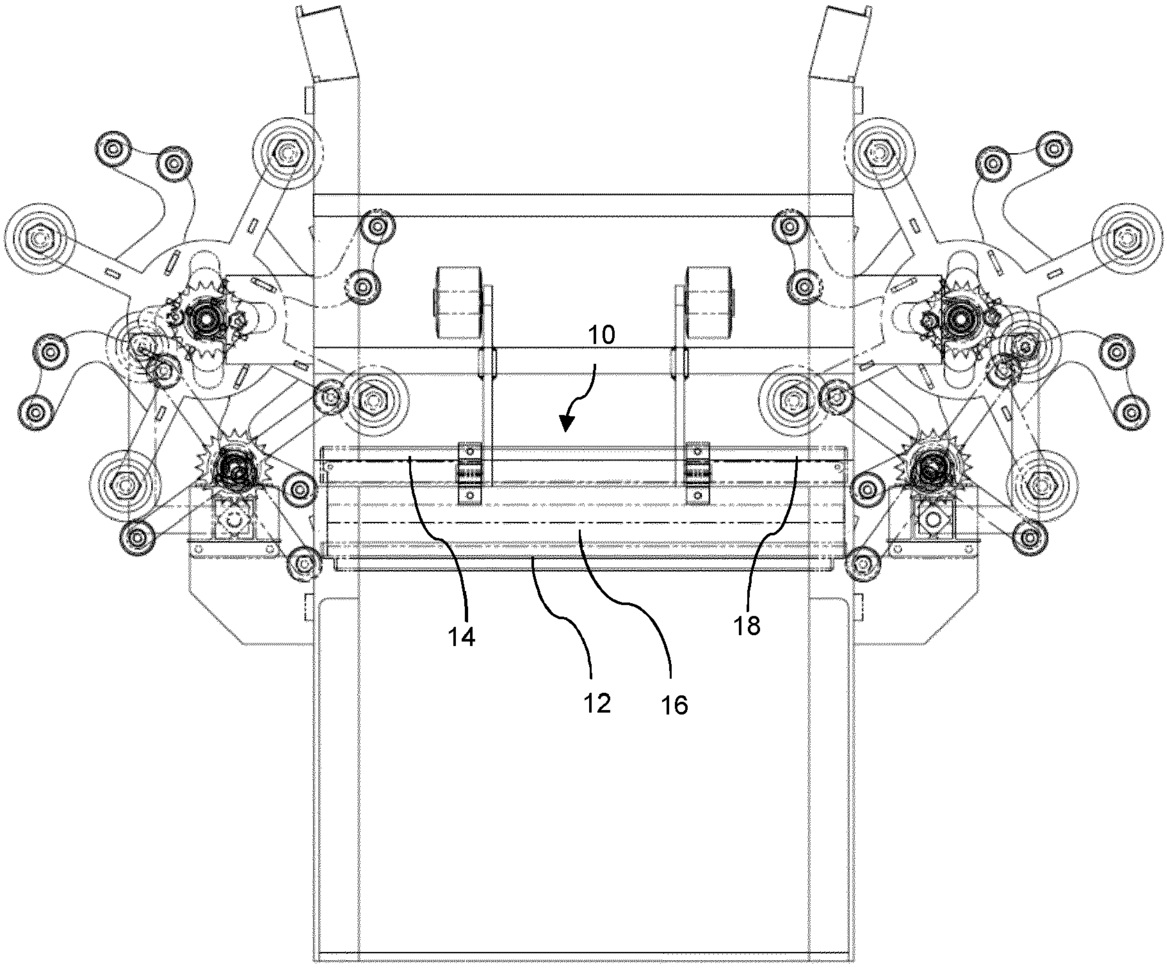

Fig. 8i

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EUROPEAN SEARCH REPORT

Application Number
EP 20 16 9906

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 1 052 087 A2 (ROBOTSYSTEMS GES FUER PALETTIE [DE]) 15 November 2000 (2000-11-15) * figures 1-18 * * paragraph [0010] - paragraph [0018]; claim 26 * -----	1-21	INV. B65B43/26 ADD. B65B69/00
A	EP 2 181 841 A1 (TANZER PETER MASCHB [IT]) 5 May 2010 (2010-05-05) * figures 1-7 * * paragraph [0028] * -----	1-21	
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TECHNICAL FIELDS SEARCHED (IPC)

B65B
B31B

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	14 October 2020	Dick, Birgit

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 16 9906

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14-10-2020

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