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(54) Title: AN APPARATUS AND A METHOD FOR OPENING ENDS OF TUBULAR WEB PIECES TO MAKE BLOCK BOTTOM BAGS

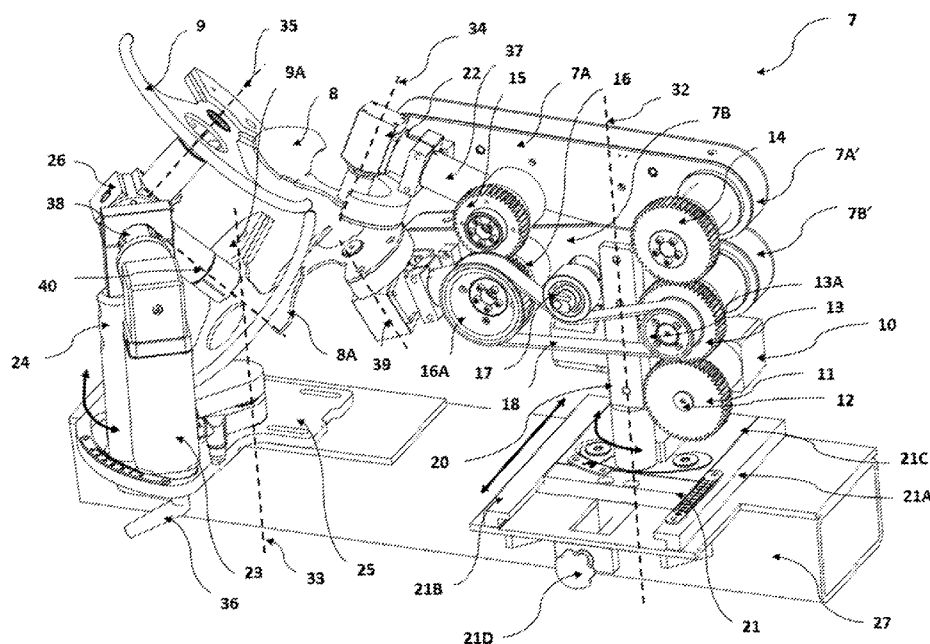


Figure 3

(57) Abstract: The invention relates to an apparatus and a method for opening ends of tubular web pieces (2) to make squared or block bottoms. Apparatus comprises an end-opening device (7), two rotating differentials (22, 26) positioned angularly to the plane of web pieces (2). Each differential (22, 26) has a shaft on which a pair of splaying elements (8, 9) formed by shaping bars into curvilinear shape is 10 mounted. Splaying elements (8, 8A, 9, 9A) form a three-dimensional virtual shape upon rotation. Individual layers of the bag body at its open-end portion are spread apart by guiding elements (7A, 7B) of opening device (7) near one corner to form an opening at the bottom into which one of the splaying elements is inserted. Continued rotational motion of drives ensures that both splaying elements enter the opening and gradually and continually spread apart from each other the layers of web pieces (2) at open end to form a block bottom.

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AN APPARATUS AND A METHOD FOR OPENING ENDS OF TUBULAR WEB PIECES TO MAKE BLOCK BOTTOM BAGS

Field Of Invention

- 5 The invention relates to an apparatus and a method for opening the ends of tubular web pieces to make squared or block bottoms.

Background Of Invention

- The production of block bottom bags usually comprises providing tubular web material which is either obtained by producing tubular material webs or by joining
10 the longitudinal edges of flat material webs so as to obtain a tubular configuration, cutting the tubular material so as to obtain bag bodies of suitable length, and forming a bag bottom by appropriately folding over and closing one end of the bag body. A bag having a rectangular bottom produced in this way is usually called a box-type bag by specialists in the field.

15

- In order to form the bottom of such a box-type bag, the end part of one of the two bag body walls lying one on top of the other in a flattened bag body is folded over along a folding line running transversely to the longitudinal axis of the bag body, so that the end of the bag body takes a hexagonal folding configuration with two
20 parallel seams opposing each other and two pairs of parallel folding edges opposing each other. By folding the two seams towards each other and securing the folding lobes comprising the seams to each other or to a cover sheet the bag body is provided with a bottom which takes a rectangular configuration when the completed bag is folded apart. It is also possible to apply a valve sheet before
25 folding the seams towards each other, which valve sheet takes a tubular configuration when folding the bag body end to its final shape.

Devices for opening the ends of tubing to open bottom squares are already known and are part of bag/sack making devices. Here the bag/ sack making devices that can handle pieces of tubing made of any materials, preferably pieces of plastic, are processed on the devices described below, in particular those comprising woven
5 fabric of stretched plastic tape.

An apparatus for producing sacks has been disclosed in the patent application DE 19502251 A1 which describes a bottom opening device in which a piston rod which carries a slider means for opening the bottom squares is provided. This
10 slider is moved to a raised position and at the same time extended into the tube piece plane in order to fold over the upper wall of a piece of tubing along the fold line on itself. Subsequently, the slider is lowered in the extended position to press the wall, and then retracted again. In order for the slider to work properly, it is necessary that the piece of hose to be opened is at rest. A supplied piece of tubing
15 must therefore be stopped first. After the bottom has been opened, the tube piece must be accelerated again to be transported to the next processing station.

However, a bottom ends opening device as disclosed in the said DE 19502251A1 proves to be disadvantageous as it is too slow. In addition, such a device is
20 susceptible to wear.

Another DE application No DE912045 discloses a device for cross bottom bag machines, in which a sickle-like bottom laying stick or a sickle of a drive has been used, which consists of the machine drive and two gears is being driven. This
25 bottom laying stick/sickle, which can be referred to as means for opening in the sense of the said patent application moves at least partially in the transport direction and in the extension direction of the hose pieces. The gears and the machine drive can be considered as a first means of moving. However, the sickle-like bottom laying stick/sickle touches the hose piece only at certain points, so

that pieces of hose, especially if they include tissue plastic tapes are often not opened safely.

In addition, in the prior art, bottom opening stations were used with rotating spreading tools with an upper part and a lower part, which are moved apart during the orbital movement of a mechanism. However, such multi-part spreading tools are disadvantageous as they are structurally complex and error-prone. In addition, extensive settings are required for such spreader tools.

Yet another example of bag opening apparatus is disclosed in EP3148788A1 ('788) where in a device and method to form bottom opening between the bag section is shown with the cluster of wedges elements having complex geometry. It is further disclosed in patent ('788) that these wedge elements are driven by a common drive. The main drawback of the said invention is that there is no setting of wedge elements to accommodate wide range of bag. Further another drawback of the invention ('788) is that the bag bottom wide cannot be altered while machine is running. Yet another drawback which can be stated with respect to the invention ('788) is that when all the wedge elements are driven by a single drive, there is no possibility of correcting errors if aroused during bag making process by the movement of wedge elements.

Other devices for opening tube bottoms are also disclosed, for example, in US 6328683 or US 6042526, however such devices are unable to meet the requirement of bottom opening ends at high speed and rapid adjustment for accommodation of different size of opening and tubular web width. Further, such devices involve very complex process and movement of various components which reduces overall efficiency and accuracy of the system.

Therefore, there is a requirement of opening device which can operate at high speed, at lower maintenance cost and which has ease of setting for different material specification.

- 5 The present invention provides a device for bottom opening by which the disadvantages of the state of the art are overcome and which is sturdy, reliable and at the same time needs little maintenance and permits a production speed by far higher than that of systems known in the state of art.

10 **Objects of Invention:**

The object of the present invention is to provide bottom opening apparatus which can operate accurately at high speeds.

- 15 Further object of the present invention is to provide an apparatus that has ease of setting for processing different types of tubular web material.

Another object of the present invention is to provide a device and method for rapid adjustment for accommodation of different size of opening and tubular web width.

- 20 One another object of the present invention is to provide a device that has minimal wear and is easy to maintain.

- 25 A still further object of the present invention is to provide a device that generates the bottom openings with high precision and reliability in continuous operation and wherein the device is structurally simple.

Brief Description Of Figures:

Figure 1 shows the perspective view of bag making line

- 30 Figure 1A shows a flow diagram for the process of opening bag ends

- (a) Tubular cut piece of fabric
(b) Initial opening by guide elements
(c) Insertion of first splaying element to form an opening
(d) Pressing the opening form by second splaying element
5 (e) Bag with open ends

Figure 2 shows the apparatus of invention

Figure 3 shows the perspective view of the opening device

10

Figures 4, 4A, 4B shows different stages of bag opening including the initial stage of opening

Figures 4C, 4D shows the enlarged view of the bag opening by splaying elements

15

Figure 5 shows splaying elements and their movement

Summary Of Invention:

According to the present invention, an apparatus for opening a bag end is

20 provided. In an automated bag making line, a number of processes are carried out by which a tubular or a flat fabric is converted into a bag. A number of stations are provided to carry out these processes. Some of these are:

- Web roll feeding means wherein woven or non-woven fabric roll is loaded to feed the fabric in forward direction.
- 25 • Web edge guiding and unwinding means wherein the fabric is guided over rollers and unwinds from the fabric roll
- Web fabric preparatory means wherein

- Preparatory means optionally consist of web perforation means which removes all the air traps between the layers of the fabric for smooth operation
- Preparatory means optionally consist of index hole punching means
- 5 -Web cleaning means
 - Inspection and sensing means which senses the quality of the fabric
 - Web length cutting means which cuts the fabric in required bag length
 - Transportation means which transports the fabric towards different zones of bag manufacturing
- 10 • Traverse transfer and guiding/feeding means which changes the direction of fabric from longitudinal to transverse for bag formation
- Defect Rejection means which rejects the defective fabric before bag formation
- Top and bottom edge opening means wherein both the sides top and
 15 bottom edge of fabric is opened or folded
 - the edge opening means being vertically position
 - Opening means having rotary mechanism
 - Valve patch storing, conveying & pasting means wherein a patch is applied on the folded fabric before making the valve
- 20 • Folding means which folds the fabric edge with valve patch to form a valve
- Further transporting means which further transports the bag with valve at one end to the further stations
- Stacking means to store the bags

25

The apparatus of the present invention which is designed to provide opening of the bag ends on a bag manufacturing automated line , comprises of two rotating drives positioned angularly w.r.t. the plane of movement of the cut pieces of web. Each of the rotating drives has a shaft on which a pair of splaying elements is

mounted. The splaying elements are formed by shaping bars or rods into a curvilinear shape. The positioning of the two drives is such that during any full rotation of the individual splaying elements, a three-dimensional virtual shape is formed corresponding to each element. The two virtual shapes are partially
 5 annular relative to each other.

During the transportations on the transport device, the individual layers of the bag body at the open-end portion of the tubular bag body is spread apart by the guiding elements near one corner to form the initial opening at the bottom.

10

To open the bag, one of the pair of raised contour shaped splaying elements is inserted into the initial opening. The continued rotational motion of the drives ensures that both splaying elements enter the initial opening and gradually and continually spread apart from each other the layers of the bag body at the open
 15 end to form a block bottom. Further, another pair of splaying element driven by separate drive presses the bag end to form hexagonal shape.

List of Parts:

1. Apparatus of invention
- 20 2. Tubular web piece
 - 2A. Upper section
 - 2B. Lower section
 - 2C. open end region
 - 2D. upper section of bottom opening
 - 25 2D'. lower section of bottom opening
 - 2E. web piece opening
3. Conveyor table
4. Belt
5. Direction of movement of fabric
- 30 6. Longitudinal extension axis
7. Opening device
 - 7A. Upper guide element
 - 7A' Upper guide surface

	7B. lower guide element
	7B' Lower guide surface
	8. First Upper Splaying element
5	8A. First lower splaying element
	8B. First wedge surface
	8C. First wedge extension
	8D. First wedge end
	8E. First wedge collar
10	9. Second Upper Splaying element
	9A. Second lower splaying element
	9B. Second wedge surface
	9C. Second wedge extension
	9D. Second wedge end
	9E. Second wedge collar
15	10. First motor
	11. First gear
	12. shaft
	13. Second gear
	13A. First flanged pulley
20	14. Third gear
	15. Fourth gear
	16. Fifth gear
	16A. Second flanged pulley
	17. idler pulley
25	18. toothed Belt
	19. mounting plate
	20. First rotatable shaft
	21. First Adjustable base
	21A. right arm
30	21B. Left arm
	21C. Sliding tray
	21D. Adjusting knob
	22. First Differential
	23. Second Motor
35	24. Second rotatable shaft
	25. Second Adjustable base
	26. Second Differential
	27. Base frame
	28. Support plate upper
40	29. Support plate lower

- 30. Connecting plate
- 31. Opening
- 32. Axis A
- 33. Axis B
- 5 34. Axis C
- 35. Axis D
- 36. Locking knob
- 37. First Differential shaft
- 38. Second Differential shaft
- 10 39. Axis E
- 40. Axis F

Detail Description Of Invention with reference to drawings:

Figure 1 shows a bag making line for producing bags, wherein a web material, is
 15 processed in various stations to form finished block bottom bags or block bottom
 valve bags. The machine comprises of various units, one of which is cutting unit
 (not shown) for the purpose of cutting or separating the web material into tubular
 web piece (2). The tubular web piece (2) comprises two bag sections i.e. upper
 section (2A) and lower section (2B) lying one upon the other, wherein each bag
 20 section (2A, 2B) can be constituted by a plurality of layers of different material.
 Tubular web piece (2) are transferred over conveyor table (3) by moving belts (4).
 Over conveyor table (3), tubular web piece (2) are successively conveyed in the
 transport direction (5) transverse to their longitudinal extension axis (6) shown in
 Figure 4, 4A, 4B.

25 An apparatus of invention (1) for forming a bottom opening (2D) between bag
 sections (2A, 2B) at open end region (2C) of tubular web piece (2), is placed in-
 line with the succeeding units of bag making line such that tubular web piece (2)
 when opened by the apparatus (1) can be transferred over conveyor table (3) from
 30 a state lying flat one upon the other into a state spaced apart from one another to
 the next station for perfect block bottom opening.

The succeeding units of bag making line are provided to carry out these processes.
Some of these are:

- Web roll feeding means wherein woven or non-woven fabric roll is loaded to feed the fabric in forward direction
- 5 • Web edge guiding and unwinding means wherein the fabric is guided over rollers and unwinds from the fabric roll
- Web fabric preparatory means wherein
 - Preparatory means optionally consist of web perforation means which removes all the air traps between the layers of the fabric for smooth
 - 10 operation
 - Preparatory means optionally consist of index hole punching means
 - Web cleaning means
- Inspection and sensing means which senses the quality of the fabric
- Web length cutting means which cuts the fabric in required bag length
- 15 • Transportation means which transports the fabric towards different zones of bag manufacturing
- Traverse transfer and guiding/feeding means which changes the direction of fabric from longitudinal to transverse for bag formation
- Defect Rejection means which rejects the defective fabric before bag
- 20 formation
- Top and bottom edge opening means wherein both the sides top and bottom edge of fabric are opened or folded
 - the edge opening means being vertically position
 - Opening means having rotary mechanism
- 25 • Valve patch storing, conveying & pasting means wherein a patch is applied on the folded fabric before making the valve
- Folding means which folds the fabric edge with valve patch to form a valve

- Further transporting means to further transports the bag with valve at one end to the further stations
- Stacking means to store the bags

5 Figure 2 shows the apparatus of invention (1), which comprises of an opening device (7), an upper support plate (28), a lower support plate (29) and a conveyor table (3) with belts (4). The said upper support plate (28) and lower support plate (29) are identical in construction but are placed mirrored to each other such that an opening (31) or gap is created for the tubular web piece (2) to travel easily in
10 the direction of movement of fabric (5). Further, upper and lower support plates (28, 29) are well connected by a connecting plate (30) such that a required opening (31) is constant through the bag making process.

In one of the embodiments, the upper and lower support plate (28, 29) can be
15 made from a sheet or a plate and are strong enough to bear the load of other members likes pulleys, rollers, belt and drives (not shown).

In another embodiment, the connecting plate (30) is constructed from a plate or sheet, metallic or non-metallic to provide a connection between upper and lower
20 support plate (28, 29).

Further, connecting plate (30) is rigidly affixed to the base frame (27). The base frame (27) can be of rectangular cross section, or any other suitable shape, in construction such that it can bear the load of the apparatus of invention (1).

25

An opening device (7) is mounted on the mounting plate (19) and connected to the base frame (27) via first rotatable shaft (20) which is rotated as per the requirement during bag making process. By such kind of adjustments, bag of wide variety can be made with customise block bottom width ('h') shown in figure 4B.

30

Figure 3 shows a perspective view of the opening device (7) which comprises of an upper guide element (7A) with an upper guide surface (7A') ascending upwards in transport direction (5) and a lower guide element (7B) with lower guide surface (7B') descending downwards in transport direction (5). Endless belts (4) are provided to guide elements (7A, 7B), such that said endless belts being driven by a first motor (10) to provide rotational motion to the belts. Guide elements (7A, 7B) are each connected to a suction element (not shown) for ensuring that the tubular pieces (2) adhere to the guide elements (7A, 7B) during their travel through them with a suction force in manner well known to person skilled in art.

In one of the embodiments, motor (10) can be selected from a set of asynchronous motor, stepper motor or any kind of motor which provide discrete step motion to the adjoining parts.

The upper guide element (7A) and lower guide element (7B) are connected via meshing of third gear (14) and second gear (13) respectively and further second gear (13) is meshed with first gear (11). The motor (10) is connected with the first gear (11) through a shaft (12) such that the power and the rotational movement of the motor (10) are transferred to the respective gears (13, 14). Such system of gear meshing ensures that the equal rotational speed is provided to belts of upper guide element (7A) and lower guide element (7B). The equal rotational speed of the belt ensures the symmetrical opening of the upper section (2A) and lower section (2B) with respect to the movement of the fabric (5).

An opening device (7) further comprises pairs of splaying element (8, 8A) which penetrates between the bag section (2A, 2B) at open end region (2C) of the tubular web piece (2) as shown in Figure 4, thereby forming an opening (2E). At least one pair of first splaying element i.e. first upper and first lower splaying element (8, 8A) is present such that it rotates about the axis C and axis E (34, 38).

Further, a driving mechanism is provided for ensuring that the pair of first splaying elements (8, 8A) are synchronised with the movement of the tubular web pieces (2) during the end-opening process. The driving mechanism comprises a number of pulleys and belts so that the power is transmitted from the first motor (10) ultimately to the first splaying elements (8, 8A). A first flanged pulley (13A) is coupled with second gear (13) which is driven by a first motor (10). The said first flanged pulley (13A) is further connected to second flanged pulley (16A) via a toothed belt (18). Belt (18) ensures the efficient power transmission from one pulley to another. An idler pulley (17) is present to provide a specified tension to the toothed belt (18) so that any slag in the belt can be overcome by adjusting idler pulley (17). This kind of adjustment of idler pulley (17) to provide tension in the belt (18) is well known to a person skilled in art. A fifth gear (16) is provided and is coupled with the second flanged pulley (16A) so as to get equal rotation achieved in the second flanged pulley (16A). Further, the said fifth gear (16) is meshed with fourth gear (15). Both the gears (15, 16) are rotated at equal speed as provided by the first motor (10).

Further, the first upper and first lower splaying elements (8, 8A) are connected individually to the fourth gear (15) and fifth gear (16) respectively via separate first differential (22). The first differential (22) can be any type such that it transfers the motion of the respective gears due to first motor (10) to the rotational movement of the first splaying element (8, 8A).

In one of the embodiments, the meshing of the gears (15, 16) provides the equal rotational movement to the first splaying elements (8, 8A) such that tubular web piece (2) is opened equally into upper section (2A) and lower section (2B) to form an opening (2E).

As shown in Figure 2, the gears (11, 13, 14, 16, and 15) are all mounted on a mounting plate (19) along with the splaying elements (8, 8A) and guide elements

(7A, 7B) are affixed to the first rotatable shaft (20). The said first rotatable shaft (20) is mounted on a first adjustable base (21) which is capable of rotating about an axis A (32). Further, first adjustable base (21) comprises of right arm (21A), left arm (21B), sliding tray (21C) and adjusting knob (21D).

5

In one of the embodiments, the adjustable base (21) can be made from a metallic or non-metallic plate such that it can withstand the weight of the elements mounted on it.

- 10 In another embodiment, the right and left arm (21A, 21B) can be made from a square or angled cross section with groove such that sliding tray (21C) can slide over it easily with minimum friction. This sliding of the sliding tray (21C) over arms (21A, 21B) can be achieved by using any kind of sliding mechanism such as ball bearing on track, rack and pinion, lead screw arrangement, linear motor etc.

15

- The opening device (7) further comprises of pair of second splaying element (9, 9A) which press over the bag section (2A, 2B) at open end region (2C) of the tubular web piece (2) to form upper and lower section of bottom opening (2D, 2D') as shown in Figure 4A, 4B thereby forming a bottom opening (2D). At least
20 one pair of second splaying element i.e. second upper and second lower splaying element (9, 9A) is present such that it rotates about the axis D and axis F (35, 40). The second splaying elements (9, 9A) are affixed to corresponding individual second differential (26) which in turn connected to a second motor (23) via a single second differential shaft (38). The second differential (26) can be any type
25 such that it transfers the rotational motion of the second motor (23) to the rotational movement of the second splaying element (9, 9A). The second motor (23) is mounted on a second rotatable shaft (24).

- To accommodate the wide variety of tubular web piece (2) and also to vary the
30 height 'h' of bottom opening (2D) as shown in figure 4B, the distance between the

splaying element (8, 8A, 9, 9A) and support plates (28, 29) can be varied separately. This variation can be done by adjusting the first rotatable shaft (20) by rotating it about axis A (32) and by first adjusting base (21) via sliding tray (21C) over arms (21A, 21B) and locking it by knob (21D). Alternatively, this may be
 5 achieved by adjusting the second rotatable shaft (24) by rotating it about an axis B (33) over second adjustable base (25) and the position of which is locked by the locking knob (36) as can be seen from figure 3.

As shown in the figure 5, the first upper and first lower splaying elements (8, 8A)
 10 are identical in construction which moves, in the set up shown in Figure 5, in the counter clockwise direction about axis (34,39) respectively. First splaying elements (8, 8A) comprises of first wedge surface (8B), first wedge extension (8C), first wedge end (8D) such that it forms one part. The first wedge surface (8B) is constructed from a sheet metal part or can be machined and bent at an
 15 acute angle such that it can enters the corner (2C) of the tubular piece (2) easily to further opens the upper and lower sections (2A, 2B) of the tubular web piece (2). Further, first wedge extension (8C) connects the first wedge surface (8B) with the first wedge end (8D). A first wedge collar (8E) is provided to form a connection with the first differential (22).

20

The first wedge extension (8C) can be form same material as of first wedge surface (8B) which can be slightly bent such that during movement it does not interfere with other moving elements such as second splaying element..

25 Further the first wedge end (8D) is a solid on which counter weight (not shown) can be mounted to provide accurate rotation of the first splaying element (8, 8A) about the axis (34, 39).

Moreover, the first wedge collar (8E) can be made from hollow tube or have
 30 tubular cross section such that one end is fixed to the first wedge extension (8C)

and other end is press fitted to the first differential (22). Such kind of fixing can also be achieved by bolting, screwing or welding.

Further shown in the figure 5, the second upper and lower splaying elements (9,9A) are identical in construction which moves in the counter clockwise direction about axis (33, 40) respectively. Second splaying elements (9, 9A) comprises of second wedge surface (9B), second wedge extension (9C), second wedge end (9D) such that it forms one part. The second wedge surface (9B) is constructed from a rod such that it is bend at an angle greater than 90° and rounded at the corners to provide a smooth profile such that it reduces the friction when the second splaying element (9, 9A) presses against the upper and lower sections (2A, 2B) of the tubular web piece (2). Further, second wedge extension (9C) connects the second wedge surface (9B) with the second wedge end (9D). A second wedge collar (9E) is provided to form a connection with the second differential (26).

The second wedge extension (9C) can be constructed from sheet metal or can be machined and is affixed with the second wedge surface (9B) which can be made into a desired profile in order to reduce its weight and also constructed such that during movement it does not interfere with other moving elements.

Also, second wedge end (9D) is a solid on which counter weight (not shown) can be mounted to provide accurate rotation of the splaying element (9, 9A) about the axis (33,40).

Further, the second wedge collar (9E) can be made from hollow tube or have tubular cross section such that one end is fixed to the second wedge extension (9C) and other end is press fitted to the second differential (26). Such kind of fixing can be achieved by bolting, screwing or welding.

Figure 1A and Figures 4, 4A, 4B, 4C, and 4D show a method to form bottom opening at the open ends of tubular web piece.

In particular, Figure 1A shows the following stages:

- 5 (a) Tubular cut piece of fabric
- (b) Initial opening by guide elements
- (c) Insertion of first splaying element to form an opening
- (d) Pressing the opening form by second splaying element
- (e) Bag with open ends

10

Figures 4, 4A, 4B, 4C, and 4D show some of these stages in detail.

The method of opening the ends of tubular web piece into a block bottom involves following steps:

- 15 a. Transporting the tubular web piece (2) over a conveyor table (3) via belts (4);
- b. Tubular web piece (2) enters the opening (31) such that support plate upper (28) and support plate lower (29) form a barrier to upper section (2A) and lower section (2B) respectively and tubular web piece (2) moves
- 20 in the direction of movement (5);
- c. The two sections (2A, 2B) are sucked by the upper guide element (7A) and lower guide element (7B) passing over upper guide surface (7A') and lower guide surface (7B') respectively;
- d. A web piece opening (2E) is created as the tubular web piece (2) advances
- 25 further by movement of the guide surfaces (7A', 7B,) by the first motor (10) and gears (12, 13, 14) arrangement;
- e. First upper splaying element (8) opens the upper section (2A) of web piece (2) and first lower splaying element (8A) opens the lower section (2B) of web piece (2).

- f. Tubular web piece (2) is advanced further and second splaying element (9, 9A) are rotated about an axis D (35) counter clockwise by second motor (23);
- g. Further, second upper splaying element (9) presses the upper section of bottom opening (2D) and second lower splaying element (9A) presses the lower section of bottom opening (2D') to opens the tubular web piece (2) into block bottom opening.

Since the state-of-the-art machines on the operating and drive side are constructed almost identically in order to be able to work simultaneously on both ends of the tubular piece, the above description does not deal in detail with the various sides of the machine. It is evident from the foregoing description that the invention has a number of embodiments.

While the above description contains much specificity, these should not be construed as limitation in the scope of the invention, but rather as an exemplification of the preferred embodiments thereof. It must be realized that modifications and variations are possible based on the disclosure given above without departing from the spirit and scope of the invention. Accordingly, the scope of the invention should be determined not by the embodiments illustrated, but by the invention as a whole and in addition to appended claims and their legal equivalents.

Claims:

1. An apparatus for opening ends of tubular web pieces (2) to make block bottom bags, characterised in that said apparatus (1) comprises:
 - an end-opening device (7) consisting of an upper guide element (7A) with an upper guide surface (7A') ascending upwards in the transport direction (5) of said tubular web piece (2), and a lower guide element (7B) with lower guide surface (7B') descending downwards in transport direction (5); said upper and lower guide elements (7A, 7B) being connected via meshing of a third gear (14) and a second gear (13) respectively, and said second gear (13) is meshed with a first gear (11); a pair of first splaying elements (8, 8A) which penetrates between the bag section (2A, 2B) at open end region (2C) of the said tubular web piece (2), thereby forming an opening (2E), said splaying elements (8, 8A) positioned to rotate about corresponding axes (34, 39) that are inclined with vertical; a pair of second splaying elements (9, 9A) which presses over the bag section (2A, 2B) at open end region (2C) of the tubular web piece (2) to form upper and lower section of bottom opening (2D, 2D') thereby forming a bottom opening (2D), said second splaying elements (9, 9A) positioned to rotate about corresponding axes (35, 40) that are inclined with vertical;
 - an upper support plate (28) and a lower support plate (29) said support plates (28, 29) being placed mirrored to each other such that an opening (31) or gap is created between them;
 - a connecting plate (30) to which said support plates (28, 29) are fixedly attached, said connecting plate (30) being rigidly affixed to a base frame (27);
 - a conveyor table (3) with endless belts (4), on which said tubular web piece (2) are successively conveyed in the transport direction (5) transverse to their longitudinal extension axis (6).

2. The apparatus as claimed in claim 1, wherein said upper and lower support plate (28, 29) are made from a sheet or a plate and said connecting plate (30) is constructed from a metallic or non-metallic plate or sheet.
3. The apparatus as claimed in claims 1 and 2, wherein said base frame (27) has a rectangular cross section, and the connection of said opening device (7) with said base frame (27) is adjustable.
4. The apparatus as claimed in claims 1 to 3, wherein said endless belts (4) are driven by a first motor (10).
5. The apparatus as claimed in claims 1 to 4, wherein said guide elements (7A, 7B) are each connected to a suction element which apply suction to said tubular pieces (2) travelling over them.
6. The apparatus as claimed in claims 1 to 5, wherein said motor (10) is connected with said first gear (11) through a shaft (12) and in turn transfers power and the rotational movement to the respective gears (13, 14).
7. The apparatus as claimed in claims 1 to 6, wherein a driving mechanism is provided for synchronising said pair of first splaying elements (8, 8A) with the movement of the tubular web pieces (2) during the tubular web piece (2) end-opening process by transmitting power from the first motor (10) ultimately to the first splaying elements (8, 8A).
8. The apparatus as claimed in claim 7, wherein said driving mechanism comprises:
- a first flanged pulley (13A) coupled with second gear (13) and directly driven by a first motor (10),
 - a second flanged pulley (16A) driven by said first flanged pulley (13A) via a toothed belt (18),
 - an idler pulley (17) providing specified tension to the toothed belt (18)
 - a fifth gear (16) coupled with the second flanged pulley (16A), and meshed with a fourth gear (15),
- wherein both said gears (15, 16) are rotated at equal speed.

9. The apparatus as claimed in claim 8, wherein said first upper and first lower splaying elements (8, 8A) are respectively connected individually to the fourth gear (15) and fifth gear (16) respectively via separate first differential (22).
- 5 10. The apparatus as claimed in claims 1-9, wherein rotational movement of said first splaying elements (8, 8A) is equal.
11. The apparatus as claimed in claims 1 to 10, wherein the distance between the said first and second splaying elements (8, 8A, and 9, 9A) and support plates (28, 29) is variable.
- 10 12. The apparatus as claimed in claims 1 to 11, wherein said first, second, third, fourth and fifth gears (11, 13, 14, 16, and 15) are all mounted on a mounting plate (19), which is affixed to a first rotatable shaft (20), which in turn is mounted on a first adjustable base (21) that is directly supported by the base frame (27).
- 15 13. The apparatus as claimed in claim 12, wherein said first adjustable base (21) comprises of right arm (21A), left arm (21B), a sliding tray (21C) which is capable of sliding over said arms (21A and 21B), and an adjusting knob (21D) to fix said sliding tray (21C) in specific position.
- 20 14. The apparatus as claimed in claims 12 and 13, wherein said right and left arms (21A, 21B) have a square or angled cross section, and provided with grooves for facilitating sliding of said sliding tray (21C) and can slide over it using a sliding mechanism such as ball bearing on track, rack and pinion, lead screw arrangement, or a linear motor.
- 25 15. The apparatus as claimed in claims 1 to 14, wherein said second splaying elements (9, 9A) are affixed to corresponding individual second differential (26) that is in turn connected to a second motor (23) via a single second differential shaft (38), and wherein said second motor (23) is mounted on a second rotatable shaft (24) that is affixed to a second adjustable base (25).

16. The apparatus as claimed in claims 1 to 15, wherein said second rotatable shaft (24) is locked in position by a locking knob (36).
17. The apparatus as claimed in claims 1 to 16, wherein each of said first splaying elements (8, 8A) comprise a first wedge surface (8B) and a first wedge end (8D), and a first wedge extension (8C) integrally connecting said first wedge surface (8B) and said first wedge end (8D), and a first wedge collar (8E) that connects said first splaying elements (8, 8A) to respective said first differential (22).
18. The apparatus as claimed in claims 1 to 17, wherein each of said second splaying elements (9, 9A) comprise a second wedge surface (9B) and a second wedge end (9D), and a second wedge extension (9C) integrally connecting said second wedge surface (9B) and said second wedge end (9D), and a second wedge collar (9E) that connects said second splaying elements (9, 9A) to respective said second differential (26).
19. The apparatus as claimed in claim 18, wherein said second wedge surface (9B) is constructed from linear member with a smooth surface and bent to form an inclusive angle greater than 90°.
20. The apparatus as claimed in claims 1 to 19, wherein said first wedge surface (8B) is bent to have convex shape that does not interfere with other moving elements.
21. The apparatus as claimed in claims 17 to 20, wherein counter weight is mounted on said first wedge end (8D) and/or on second wedge end (9D).
22. The apparatus as claimed in claims 1 to 21, wherein separate motors drive said first and second splaying elements (8, 8A and 9, 9A).
23. A method of opening the ends of tubular web piece into a block bottom using the apparatus as claimed in claims 1 to 22, said method comprising the steps of:
- transporting the tubular web piece (2) over the conveyor table (3) via belts (4);

- b. passing said tubular web piece (2) through the opening (31) such that support plate upper (28) and support plate lower (29) form a barrier to upper section (2A) and lower section (2B) respectively and said tubular web piece moves in the direction of transport movement (5);
- 5 c. sucking the two sections (2A, 2B) by the upper guide element (7A) and lower guide element (7B) passing over upper guide surface (7A') and lower guide surface (7B') respectively;
- d. using said pairs of splaying element (8, 8A) to penetrate between the bag section (2A,2B) at open end region (2C) of the tubular web piece
10 (2) to form an opening (2E), following which advancing said tubular web piece (2) further by movement of the guide surfaces (7A',7B) driven by said first motor (10) and said gears (12, 13, and 14);
- e. simultaneously opening the upper section (2A) of web piece (2) with the first upper splaying element (8), and the lower section (2B) of web
15 piece (2) using the lower splaying element (8A);
- f. further advancing said tubular web piece (2) and rotating using said second motor (23) the second upper splaying element (9) around the axis (35) and thereby pressing the upper section of bottom opening (2D) and simultaneously rotating said second lower splaying element (9A) to
20 press the lower section of bottom opening (2D') to open the tubular web piece (2) into a block bottom opening.

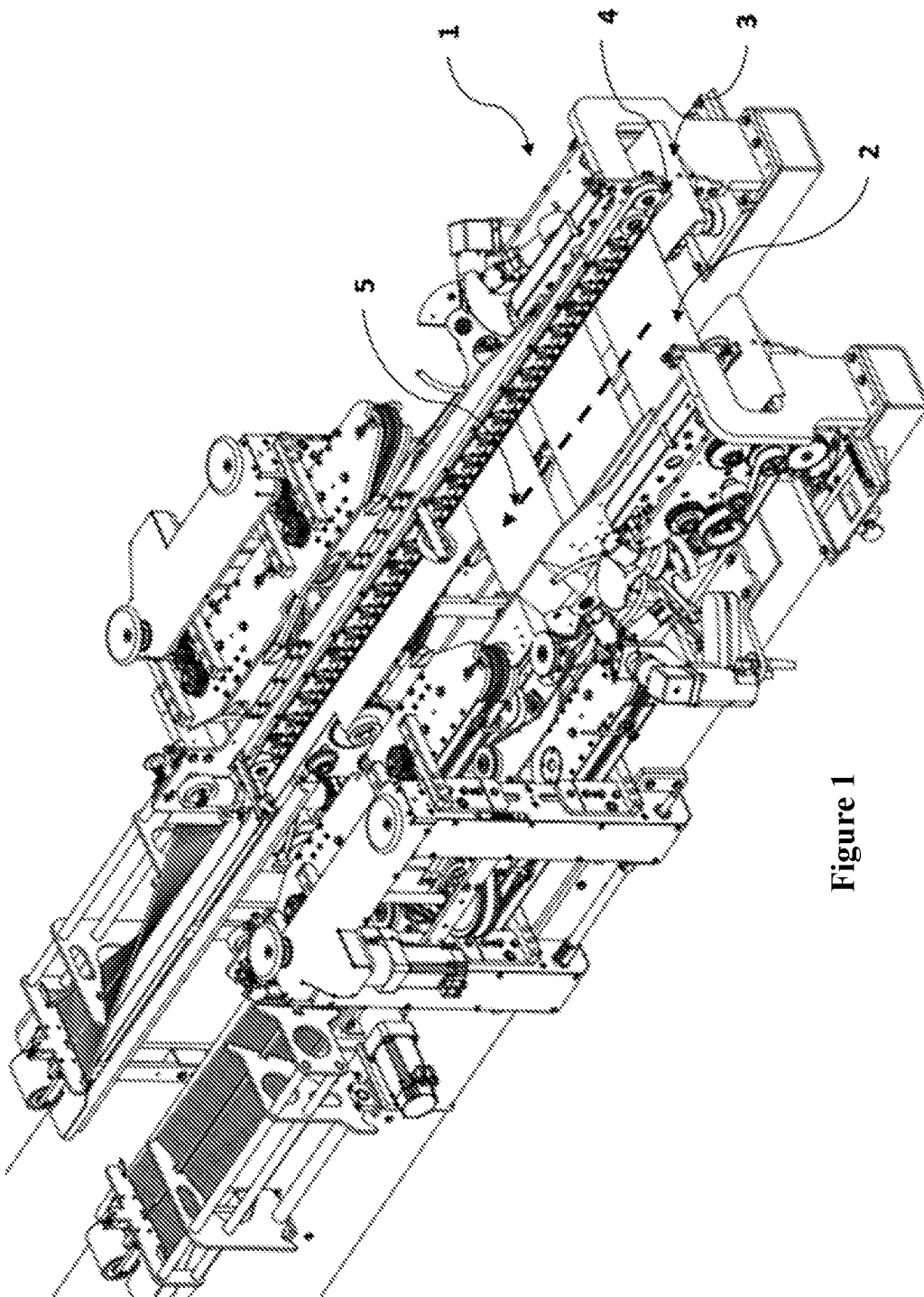


Figure 1

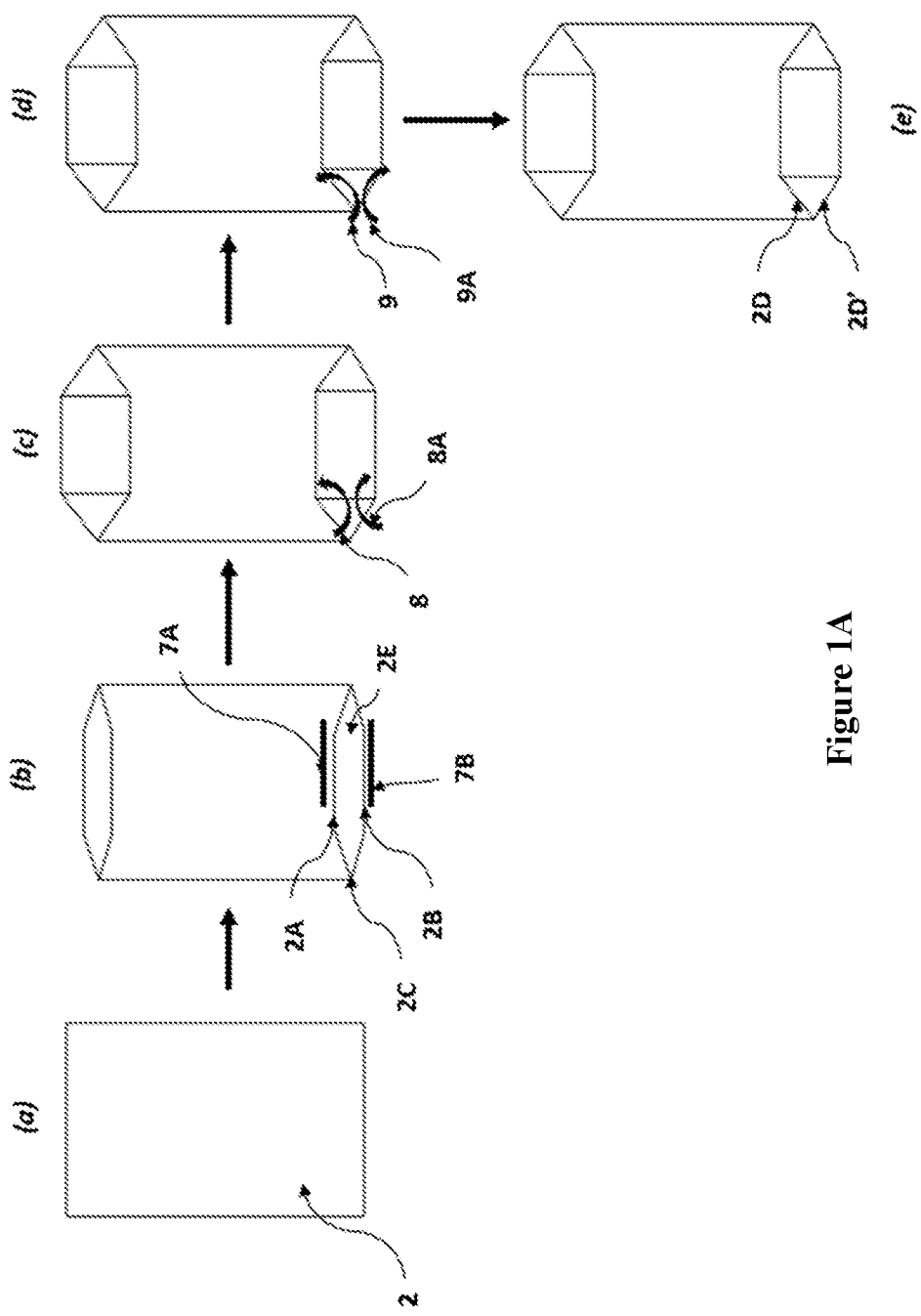


Figure 1A

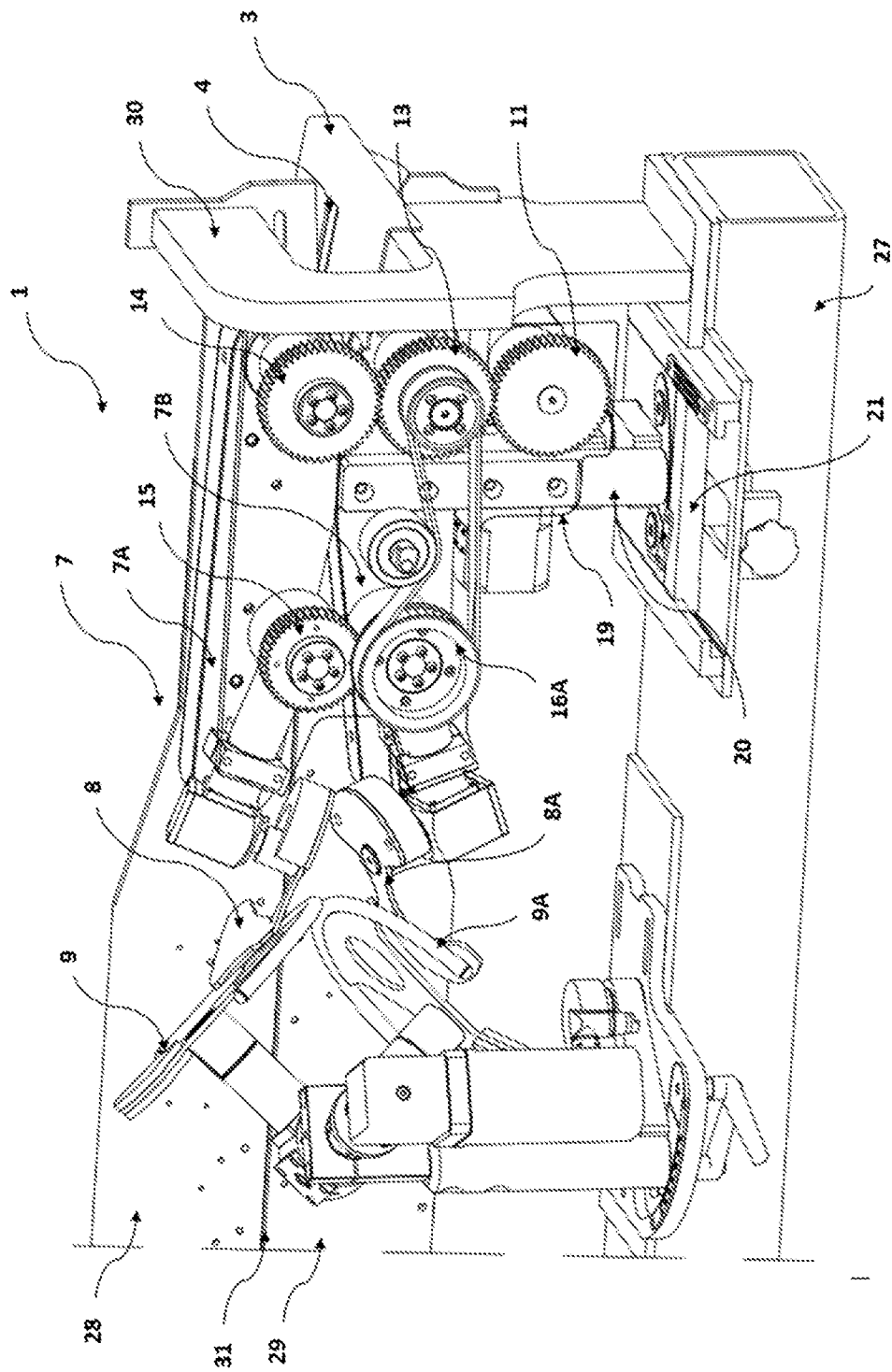


Figure 2

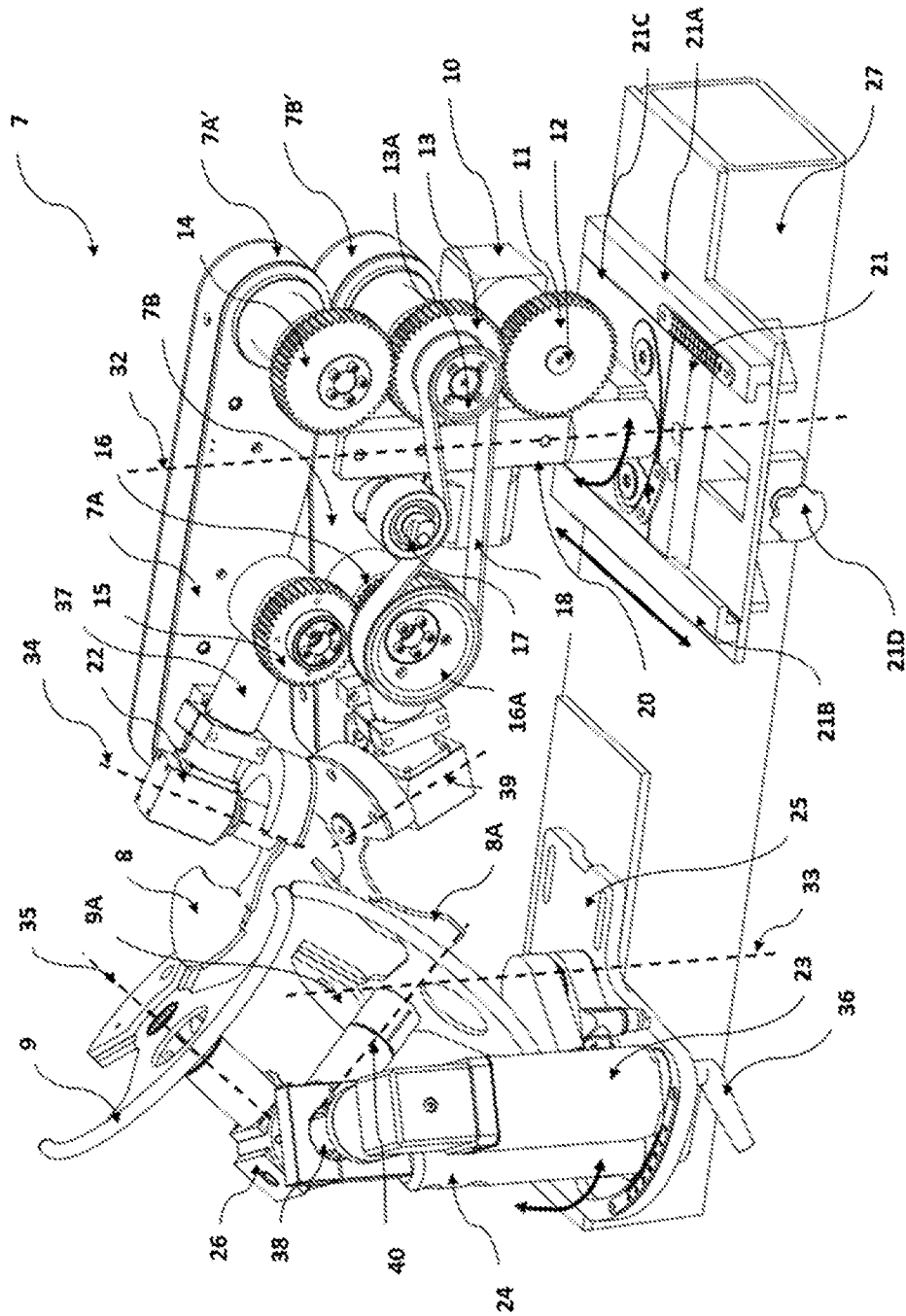


Figure 3

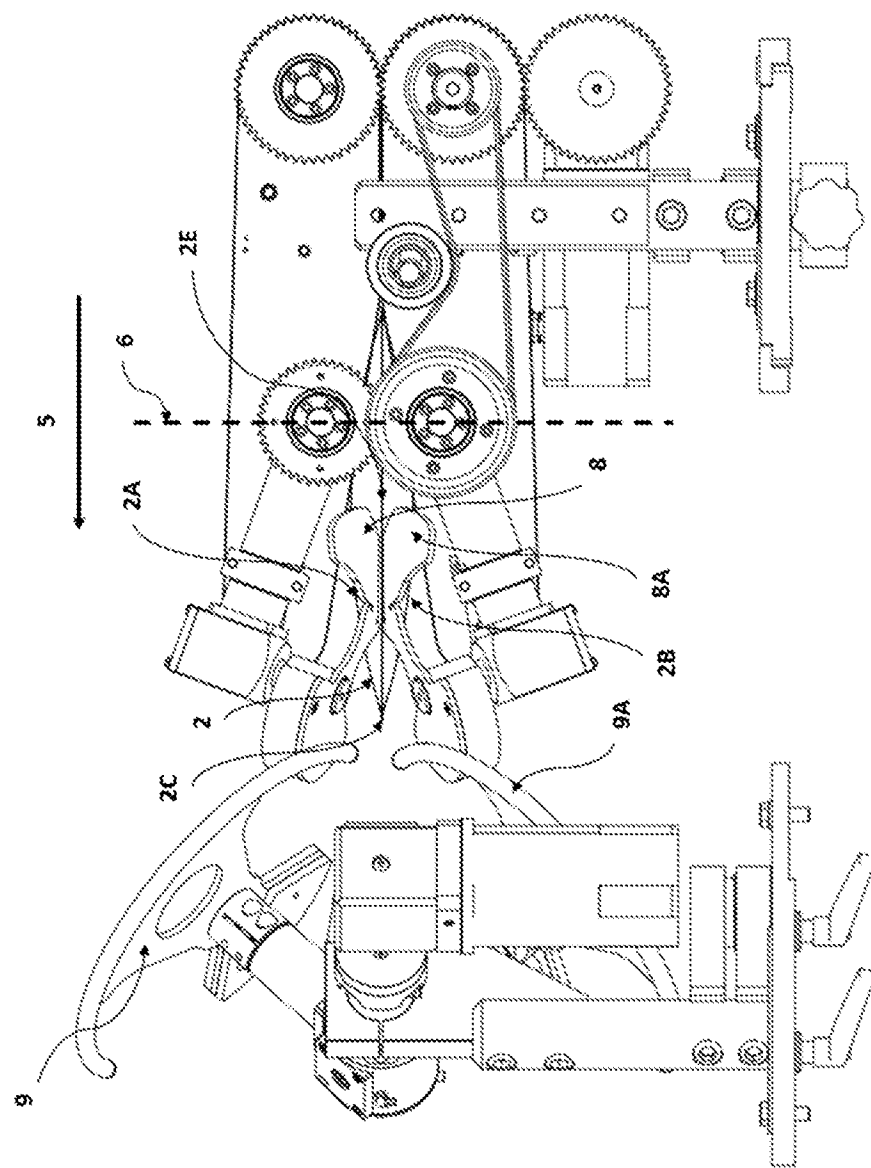


Figure 4

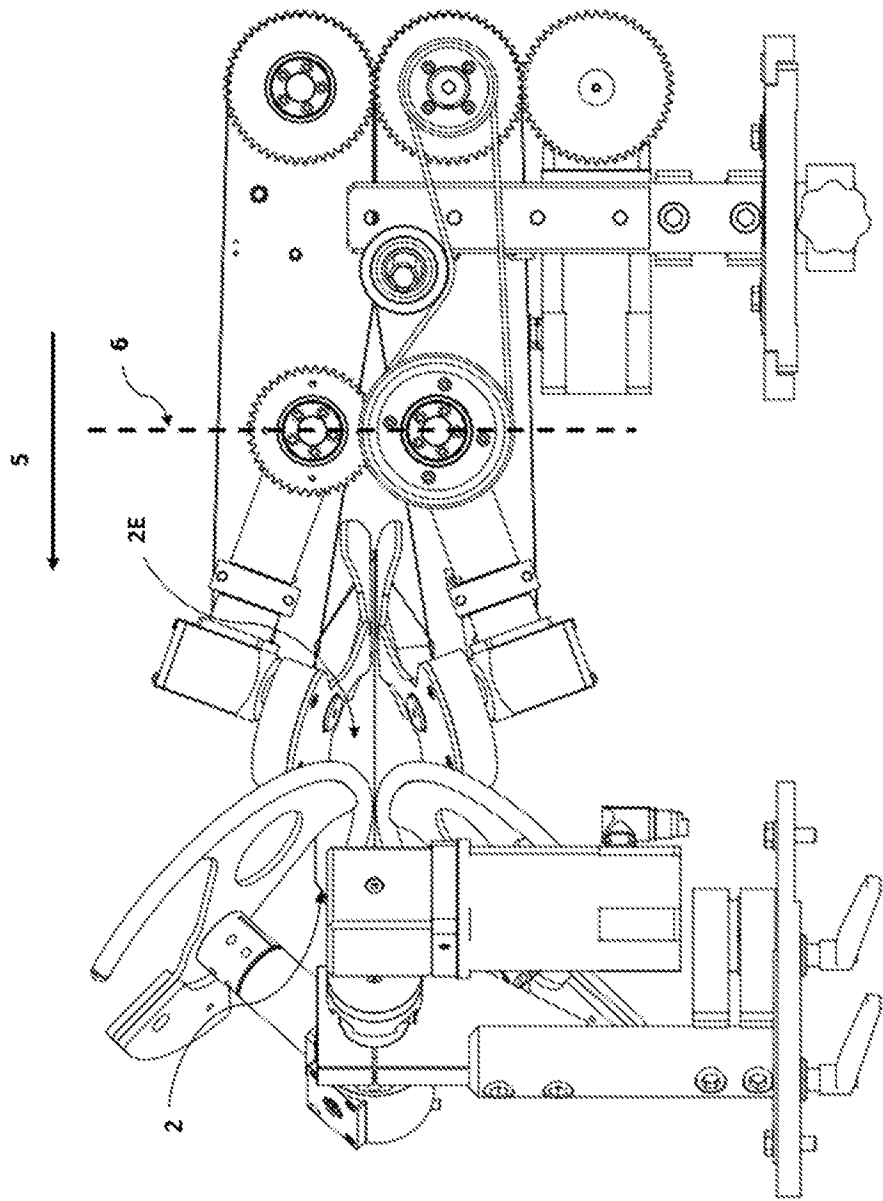


Figure 4A

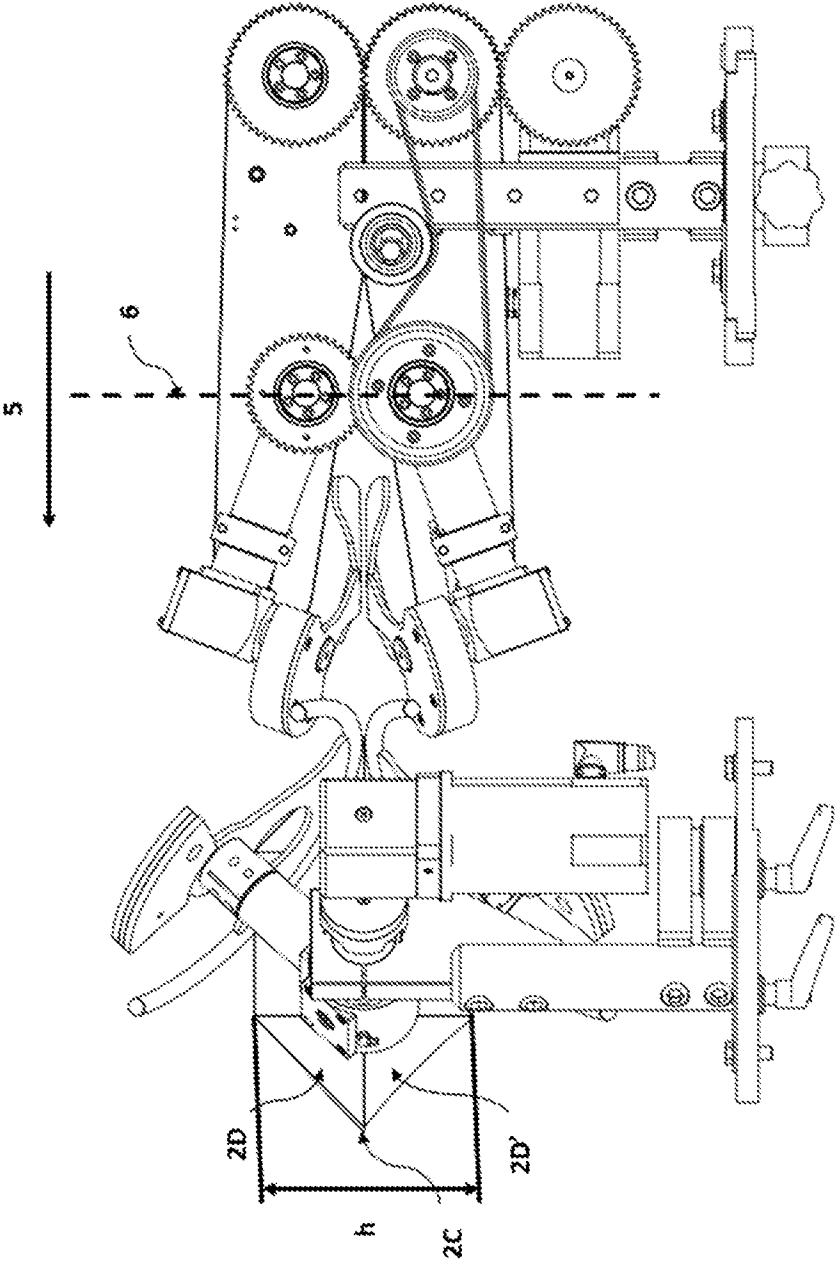


Figure 4B

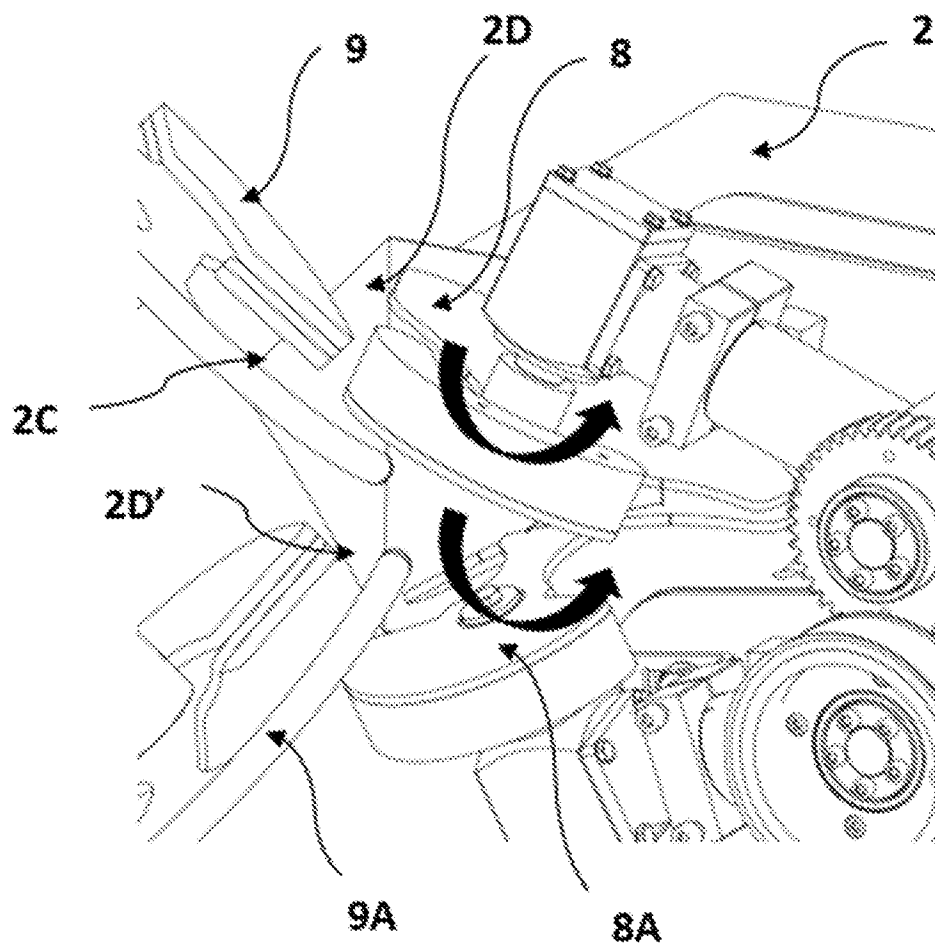


Figure 4C

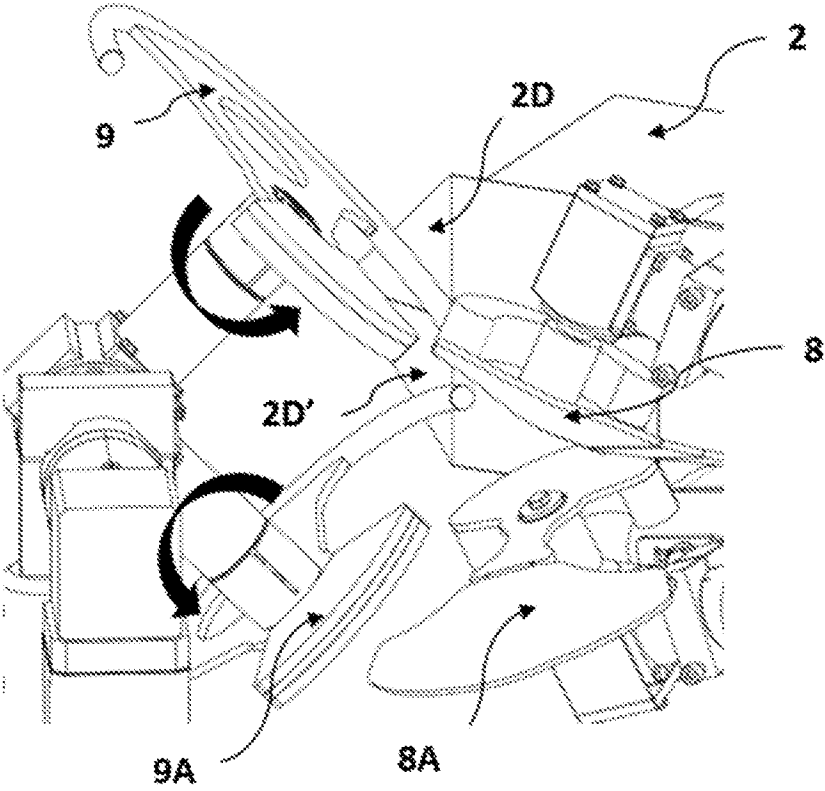


Figure 4D

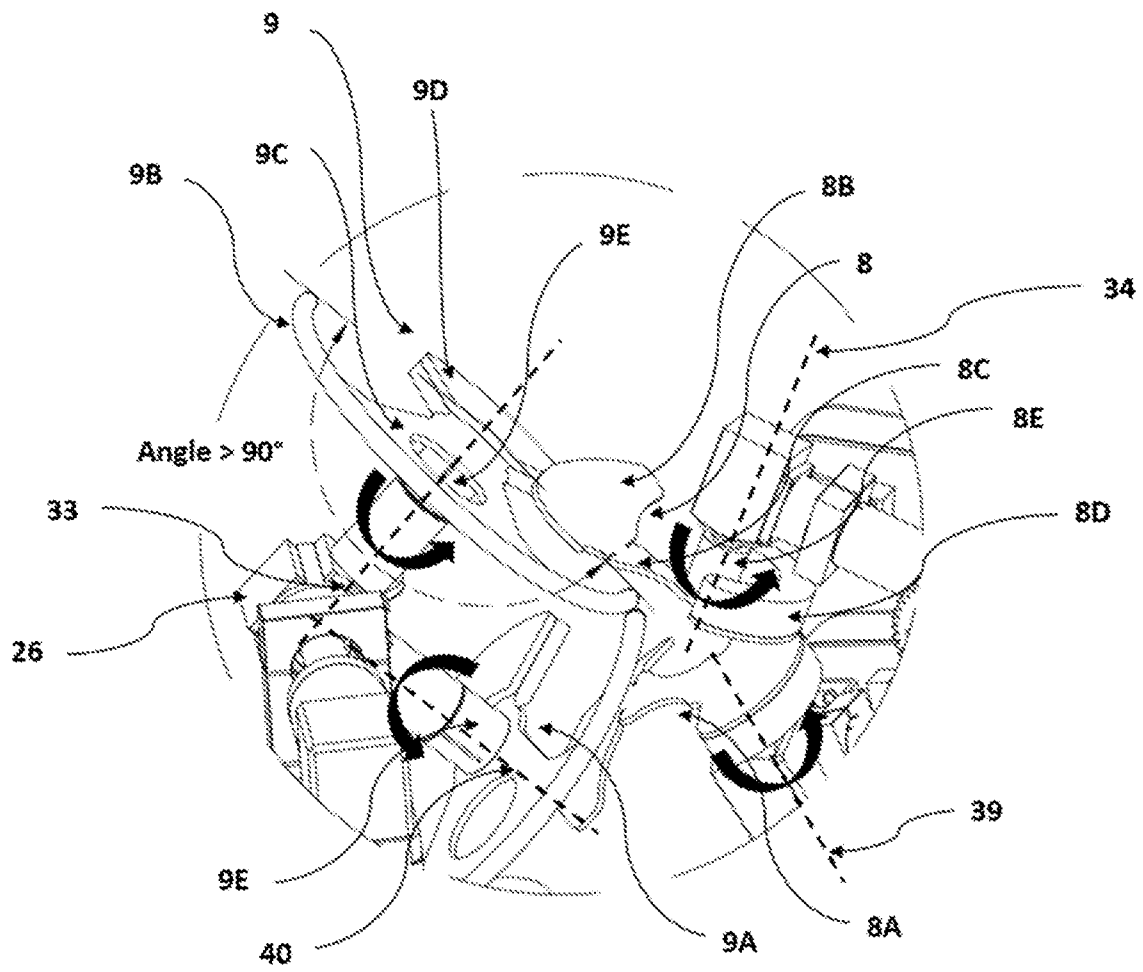


Figure 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB2021/053924

A. CLASSIFICATION OF SUBJECT MATTER

B31B70/00, B31B150/00, B31B155/00 Version=2021.01

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B31B

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)

PatSeer, IPO Internal Database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US20110053747A1, (WINDMOELLER & HOELSCHER KG), 03 March 2011 (03-03-2011) Column 5, Line 9-31; Column 6, Line 56 -Column 7, Line 5; Figures 2, 5, 7; Claims 1,10	1-23



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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"D" document cited by the applicant in the international application

"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

16-08-2021

Date of mailing of the international search report

16-08-2021

Name and mailing address of the ISA/

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Plot No.32, Sector 14, Dwarka, New Delhi-110075
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Authorized officer

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IB2021/053924

Citation	Pub.Date	Family	Pub.Date
US 20110053747 A1	03-03-2011	CN 101983125 A	02-03-2011
		DE 102008017446 A1	15-10-2009
		EP 2276628 A1	26-01-2011
		JP 2011516304 A	26-05-2011
		WO 2009121836 A1	08-10-2009