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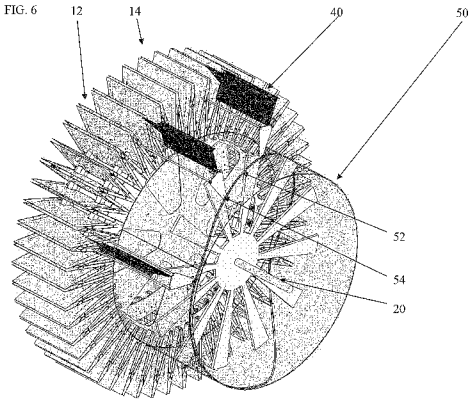
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(54) **Title:** AN INSERTER WITH A SLIDER FOR OPENING NEWSPAPERS FOR INSERTION OF SUPPLEMENTS



(57) **Abstract:** An inserter with a slider for opening newspapers for insertion of supplements An inserter for insertion of supplements into folded printed matter having two un- equally long folded half-partssuch that a first half part is longer than a second half-part, the inserter comprising: a wheel (14) with horizontal rotation axis and a plurality of outwardly open pockets (12) along the circumference of the wheel for the uptake of the folded printed matter intothe pockets; a first insertion station for insertion of folded printed matter into the pockets with the fold of two half-parts of the printed matter located in the bottom of the pockets; an opening arrangement for displacing edges of the unequally long folded half-parts from each other; a second insertion station for insertion of supplements into the space between the two half parts, characterised in that, the opening arrangement comprises a movable slider (40) arranged translational relative to the edges of the two half -parts, the slider comprising a wedge arranged at a distance from the bottom of the pocket such that translation of the slider forces the edge of the longer half part to be displaced from the edge of the shorter half part, thereby forcing the two half-parts apart.

WO 2009/043358 A1

AN INSERTER WITH A SLIDER FOR OPENING NEWSPAPERS FOR INSERTION OF SUPPLEMENTS

Field of the Invention

The present invention relates to an inserter for insertion of supplements into folded printed matter having two unequally long folded half-parts such that a first half part is longer than a second half-part. The inserter comprises

- a wheel with horizontal rotation axis and a plurality of outwardly open pockets along the circumference of the wheel for the uptake of the folded printed matter into the pockets,
- a first insertion station for insertion of folded printed matter into the pockets with the fold of two half-parts of the printed matter located in the bottom of the pockets,
- an opening arrangement for displacing edges of the unequally long folded half-parts from each other, and
- a second insertion station for insertion of supplements into the space between the two half parts.

Background of the Invention

When newspapers are delivered to clients, typically, the papers contain printed supplements, such as advertising papers or other printed information. These supplements are inserted into the newspapers in a separate process remote from the printing location of the newspapers. The newspapers are fed into a fast running machine, partly unfolded, and the supplements are inserted, after which the filled newspapers leave the machine again for stacking into a bundle ready for transport and distribution.

A corresponding arrangement for fill in of supplements is disclosed in German laid open script DE-A-32 00 594. In this arrangement, a wheel is rotating with a number of pockets which receive a newspaper at one position and releases the newspaper at another position after insertion of a supplement. The newspaper items are folded together around a transverse line lying slightly displaced from the centre cross line of the folded-out newspaper, so that opposite the fold line, the folded newspaper will appear with

two unequally long, outwardly-extending rectangular edges of the respective half-parts of the folded newspaper. A filling arrangement drops a newspaper into a pocket with secure gripping of the free edge of the one folded half part, while relying on the fact that by means of gravitation the other half part can bring about the necessary opening of the folded item to enable a supplement to be introduced into the opening. At high working speeds, however, this gravitational effect will not only be too slow but also be of uncertain influence on the folded item, i.e. this method is not suitable for use at the higher speeds of operation.

High speed in this connection implies insertion of supplements into more than 30,000 newspapers per hour, preferably 50,000 per hour.

There are other systems with transport drums, also called star-wheels, for example as disclosed in US patent No. 3,951,399, where the newspaper item is pushed transversely to the pocket with its edges into an arm with a plough-like end-part in order to press the two half parts of the folded newspaper apart. However, this arrangement requires a wide wheel with long pockets in order to provide space for the movement of the newspapers, which is disadvantageous.

With the purpose to provide an alternative to transport drums, German laid-open patent application DE 2508194 by Schick discloses a linear conveyor equipped with flat rods that are pushed in between two folded half-parts of a newspaper for lifting one part of the newspapers before insertion of supplements. However, this is a different principle, which has not been well adopted by the market.

Object of the Invention

It is therefore the object of the invention to provide a high speed supplement feeder not having the disadvantages of the prior art. Especially, it is the purpose of the invention to provide an inserter with a drum system being capable of working at high speed which does not require a translation of the newspapers in order for these to be opened.

Description of the Invention

This objects is achieved with an inserter for insertion of supplements into folded printed matter having two unequally long folded half-parts such that a first half part is longer than a second half-part. The inserter comprises

- a wheel with horizontal rotation axis and a plurality of outwardly open pockets along the circumference of the wheel for the uptake of the folded printed matter into the pockets,
- a first insertion station for insertion of folded printed matter into the pockets with the fold of two half-parts of the printed matter located in the bottom of the pockets,
- an opening arrangement for displacing edges of the unequally long folded half-parts from each other,
- a second insertion station for insertion of supplements into the space between the two half parts.

In addition, the opening arrangement comprises a movable slider arranged translational relative to the edges of the two half-parts, the slider comprising a wedge arranged at a distance from the bottom of the pocket such that translation of the slider forces the edge of the longer half part to be displaced from the edge of the shorter half part, thereby forcing the two half-parts apart.

By using a slider according to the invention, the two half-parts of the newspaper is forced apart such that safe insertion of supplements is achieved even a high speed insertion machine. The opening of the newspaper, or other printed matter in the machine, need not to rely on an opening of the newspaper by gravity.

The advantage of using a slider according to the invention is that the design of a star wheel can be made much slimmer than the wheel according to prior art as disclosed in US patent No. 3,951,399. Thus, the invention implies the possibility of a smaller inserter that can be produced at lower costs. It should be noted, that the teaching of German laid-open patent application DE 2508194 by Schick is different from the system according to the invention in that the rod is pushed into the paper near the back fold of the paper. If the system of DE 2508194 by Schick should be used in a star wheel, the rod would have to be pushed axially and radially, which is technically very demanding and a complicated and expensive solution.

In a further embodiment, the slider comprises a first holder for abutting the first half-part and a second holder for abutting the second half-part, the second holder being arranged at an angle or distance to the first holder for securing a distance between the two half-parts. The two holders hold the two half-parts apart, and supplements can then be inserted between the two half-parts.

In a preferred embodiment, the first holder is a first plate in extension of the wedge for abutting the first half-part and the second holder is a second plate for abutting the second half-part, the second plate being arranged at an angle to the first plate for securing an angular distance between the two half-parts. Optionally, the second holder is mounted rotatably relative to the first holder.

In a further embodiment, the first plate in extension of the wedge has a rounded edge extending from the first plate in the direction of the pocket for guidance of supplements into the pocket.

In a practical embodiment, the wheel is adjacent to a static drum which is provided with a rail following the circumference of the drum. The rail has a varying distance to the pockets, and the sliders have connectors connected slidingly to the rail for changing the distance between the wheel and the connectors during rotation of the wheel relative to the drum.

The invention can advantageously be combined with one or more of the following five independent inventions, as well as he following five inventions can be combined with each other.

Invention 1

An inserter for insertion of supplements into folded printed matter. The inserter comprises

- a wheel with horizontal rotation axis and a plurality of outwardly open pockets along the circumference of the wheel for the uptake of the folded printed matter into the pockets,

- a first insertion station for insertion of folded printed matter into the pockets with the fold of two half-parts of the printed matter located in the bottom of the pockets,
- a second insertion station for insertion of supplements into the space between the two half parts.

In addition, the first insertion station comprises a set of grippers arranged for gripping printed matter from a supply, for example a conveyor, and advancing the gripper with the printed matter in the direction of the wheel for guiding the printed matter into a pocket.

By gripping each printed matter individually, entire control is provided for the motion from the supplying conveyor to the pocket. For example, the gripper may grip a newspaper from a conveyor, on which the newspapers are transported in a partly overlapping manner, and the gripper may accelerate the speed of the newspaper in order to create more space between subsequent newspapers, which makes the filling into the pocket safer. In addition, the gripper may slow down again just before releasing the newspaper into the pocket of the wheel, which results in a gentle filling of the pocket.

In a practical embodiment, the grippers are mounted to a common rotating hub, the hub having a central rotation axle, wherein each gripper is mounted rotational on a rotation axis off-centred and parallel to the axle of the hub.

The differential speed of the grippers can be accomplished in the following way. In this case the grippers have first gripper connectors remote from the rotation axis of the grippers, the first gripper connectors cooperating with a groove or rail adjacent to the grippers for movement of the first connectors along the groove or rail during rotation of the hub. The groove or rail has a varying distance to the rotation axle of the hub for changing the angle of the grippers relative to the hub during rotation of the hub. As the angle is varied during the rotation of the hub, the back and forth motion results in an alternation between increasing and decreasing the speed of the gripper.

A correct timing of the grippers' opening and closing in order to grab the newspaper and release it again at the correct positions are crucial. The correct timing can be accomplished in computer controlled way. However, a safe mechanical way can be accomplished by the following. In this case, the grippers have a first clamping part and a second clamping part arranged movable to each other for gripping the printed matter between the first and the second clamping parts, where each first clamping part has a clamp connector remote from the rotation axis of the gripper, the clamping connector cooperating with a second groove or rail adjacent to the grippers for movement of the clamping connectors along the groove or rail during rotation of the hub, the groove or rail having varying distance to the rotation axle of the hub for moving the first clamping part relative to the second clamping part during rotation of the hub.

Invention 2

An inserter for insertion of supplements into folded printed matter. The inserter comprises

- a wheel with horizontal rotation axis and a plurality of outwardly open pockets along the circumference of the wheel for the uptake of the folded printed matter into the pockets,
- a first insertion station for insertion of folded printed matter into the pockets with the fold of two half-parts of the printed matter located in the bottom of the pockets,
- a second insertion station for insertion of supplements into the space between the two half parts.

In addition, each of the pockets is provided with a bottom stop, for example a ledge, defining the depth of the pockets, and wherein the stops are connected to adjustment means configured for adjustment of the stop between different distances from the edge of the pocket, and the adjustment means are driven by at least one automated actuator.

By driving the adjustment means by at least one automated actuator, manual work for the adjustment is avoided, and the adjustment can be performed fast, easy and reliable, reducing the time in which the machine is not working.

The actuator may be driven by an electrical motor or hydraulically or pneumatically. The driving can be automatically by programmed computer means, which allows a quick adjustment between different batches of insertion. Alternatively, the actuator may be controlled through a remote control operated by the trained personnel.

In a preferred solution, the adjustment means are configured for driving all stops simultaneously.

A practical embodiment is given by an inserter according to the invention, wherein the stop is a ledge extending through the pocket and being supported on bearings connected to the actuator at either end of the ledge.

For example, the actuator comprises pairs of plates on either side of the wheel, wherein each pairs of plates comprises a first plate and second plate, wherein both the first plates and the second plates are provided with grooves, where the grooves of the first plates have an angle with the grooves of the second plates, and wherein the stops are connected with a groove connector extending into both grooves for push of the connector along the grooves when the first plates are moved relatively to the second plates.

Advantageously, the first plates and the second plates are adjacent discs arranged rotational for rotation of the first discs relative to the second discs. Preferably, the first discs and the second discs are arranged rotational about a common rotation axis.

Invention 3

An inserter for insertion of supplements into folded printed matter. The inserter comprises

- a wheel with horizontal rotation axis and a plurality of outwardly open pockets along the circumference of the wheel for the uptake of the folded printed matter into the pockets,
- a first insertion station for insertion of folded printed matter into the pockets with the fold of two half-parts of the printed matter located in the bottom of the pockets,
- a second insertion station for insertion of supplements into the space between the two half parts.

In addition, the inserter comprises a conveyor for transport of supplements from a feeder station to the second insertion station. Furthermore, the conveyor comprising a top belt with a top belt roller for guidance of the supplements under the top belt, wherein the top belt roller is supported for swinging on an eccentric axle.

By providing the top belt roller on an eccentric axle, the top belt roller can be moved up and down without having to move the axle of the top belt roller. This implies that the top belt roller can be produced as a thin, light weight ring which is displaced easily and fast while still in a safely guiding configuration.

In one preferred embodiment, the first support roller works together with to further support rollers to form a triangular configuration of support rollers for supporting the ring. When the ring is moved, the first support roller is not displaced, but the two further support rollers are displaced together with the ring. In a practical embodiment, the two further support rollers are mounted on light weight arms that are provided rotationally with respect to the axis of the first support roller.

In order to make sure that the ring stays aligned with the first support roller, the ring and the outer surface of the first support roller are provided with corresponding profiles for safe guidance of the ring over the surface of the first support roller.

In the case of the support being provided by the above mentioned triangular roller arrangement, all three rollers may be provided with a profile corresponding with a profile on the inner surface of the ring,

An alternative arrangement is achieved by the ring in addition to the eccentric first roller being supported between further support rollers arranged on either side of the ring. Displacement of the ring will cause the ring to rotate about the axis of the first supporting roller and cause the ring to change position between the outer support rollers.

For example, the above mentioned profiles are provided as a projection along the circumference on the inner side of the ring and as a groove along the outer circumference of the support rollers. However, other corresponding profiles are possible within the scope of the invention.

Invention 4

An inserter for insertion of supplements into folded printed matter. The inserter comprises

- a wheel with horizontal rotation axis and a plurality of outwardly open pockets along the circumference of the wheel for the uptake of the folded printed matter into the pockets,
- a first insertion station for insertion of folded printed matter into the pockets with the fold of two half-parts of the printed matter located in the bottom of the pockets,
- a second insertion station for insertion of supplements into the space between the two half parts.
- a supplement removing station having a first conveyor for advancing supplement packages for insertion at the second insertion station and having a second conveyor for advancing defect supplement packages for rejection. In addition, the second conveyor is positioned at a higher level than the first conveyor, and a set of lifting members is provided for lifting the defect supplement packages onto the second conveyor.

By providing an additional (second) conveyor above the first transporting conveyor and lifting the package from the first to the second conveyor, the package can be moved out of the line with subsequent packages without having to stop the transport of the remaining packages, thus, the entire production continues to run at the same speed.

Preferably, the first conveyor has a belt is formed by multiple, parallel, narrow ribbons that are spaced a distance apart to form interspaces between the ribbons, and each lifting member in the set of lifting members has a curved section with a width less than the distance between the ribbons and being constructed for driving of the lifting members into the interspaces between the ribbons

In a practical embodiment, the lifting members are mounted rotational for driving the lifting members into the interspaces by rotation of the lifting members around a rotation axis. For example, the lifting members are formed as angular sections of a wheel. Optionally, the angular span of the lifting member is less than three quarters of a circle, or even less than half a circle, for example close to a quarter of a circle.

In an advantageous embodiment, each lifting member comprises a number of sub-members adjacent to each other and having widths the sum of which is less than the distance between the ribbons. Thus, one sub-member after the other can be inserted between the ribbons at high speed matching the speed of the conveyor belts.

In order to adjust the lifting members optimally, it is advantageous that the sub-members of each lifting member are driven independently from each other. For example, the sub-members are provided rotational about the same axis and configured for rotation of each sub-member from a lifting position to a non-lifting position with at most one sub-member being in a lifting position while the remaining sub-member or sub-members are in a non-lifting position.

A reliable function has been found when the sub-members are arranged for varying rotation speed during rotation, wherein the rotation speed is adapted to the speed of the conveyor during lifting action and wherein the speed in increased after the lifting for quick advance to a ready-for-lifting position. For example, the first sub-member is fastened to a rotationally driven rotation axle, and the other sub-member or sub-members are supported freely rotational on the axle and driven by a belt drive.

Invention 5

An apparatus for withdrawing flat flexible articles, in particular printed products, from a pile of these article, the apparatus having a support for the articles under the tray. The support comprises two rows of pluralities of mutually spaced rods extending from either side of the tray in a horizontal orientation below the tray which are configured for rolling repetitively along the underside of the pile and exerting upward directed pressure to support the pile.
The driving mechanism is configured to advance the rods in a horizontal orientation as a movable grid along the underside tray until the end of the tray and is configured to change the orientation of the rods thereafter to a differently angled orientation in order to provide free space underneath the grid. The separator, preferably a suction cup, is provided for separating a single article from the underside of the pile and pull the article away from the pile in the space between the spaced rods. In addition, a gripping mechanism is provided for gripping one end of the articles during pulling of the article by the separator and configured for transporting the article during the gripping with the gripping mechanism onto a destination underneath the pile.

The invention is primarily intended for a feeder station for printed sheets. The apparatus has been implemented with success in connection with an inserter for insertion of supplements in the form of printed sheets into printed matter, primarily newspapers.

In contrast the aforementioned European patent EP1254855, the rods are not mounted on a wheel by are, instead connected on either side of the tray are in

a row by a closed chain or belt driven by a set of transport wheels, which yields a higher flexibility for the motion of the rods.

In a further embodiment, analogous to European patent EP1254855, the separator has a suction cup for moving the suction cup to the underside of the pile into a space between the spaced rods for attaching a supplement by suction to the suction cup and pulling the supplement through the space between the spaced rods. In contrast to EP1254855, however, in this embodiment, the suction cup is provided on a rocker arm and not on a wheel. Optionally, this rocker arm is driven by a cam wheel.

In a concrete embodiment, the gripping mechanism comprises at least one gripper on a wheel with an orientation change mechanism configured for changing the orientation of the gripper relative to the wheel in dependence of the orientation of the wheel. Preferably, the gripper mechanism has a plurality of grippers along the circumference of the wheel in order to ease a proper function at high speed.

In order for a high control of the orientation of the separated supplement on the way to a conveyor, advantageously, the grippers are provided on two parallel wheels driving synchronously for simultaneous gripping of a supplement with a gripper on either wheel.

Description of the Drawing

The invention will be described in greater detail with reference to the drawing, where

FIG. 1 is an perspective overview drawing of a system with an inserter according to the invention,

FIG. 2 is a side view of the wheel with the first insertion station with FIG 2a being an overview image and FIG. 2b showing a section in greater detail,

FIG. 3 illustrates the first insertion station in greater detail

FIG. 4 illustrates the gripper arrangement of the first insertion station, a) in a perspective view and b) in a sectional detailed view, and FIG. 4c shows the gripper in greater detail,

FIG. 5 is a perspective view of the wheel,

FIG. 6 is a perspective view of the drum, the pockets, and some sliders,

FIG. 7 is a close-up view of a few pockets and sliders with FIG. 7a illustrating the situation before insertion of the sliders and FIG. 7b after insertion of the sliders, and FIG. 7b is an end view of a few pockets with sliders,

FIG. 8 shows a single slider,

FIG. 9 is a photograph illustrating the action of a slider,

FIG. 10 is a drawing of the removal section with the removal grippers,

FIG. 11 illustrates a closed removal gripper,

FIG. 12 illustrates an open removal gripper,

FIG. 13 is a drawing of a pocket,

FIG. 14 illustrates a bottom stop mechanism,

FIG. 15 shows a supplement transporter,

FIG. 16 a), b), c), and d) illustrate a supplement rejection sequence ,

FIG. 17 a) and b) are detailed view of lifting members cooperating with top belt rollers,

FIG. 18 a) and b) illustrate the lifting members in greater detail,

FIG. 19 a), b), and c) are perspective illustrations of a feeder station,

FIG. 20 is a side view of a feeder station,

FIG. 21 is a close–up view of the rod-drive of the feeder station,

FIG. 22 shows the grippers and the suction head of the feeder station,

FIG. 23 is a close up image of the rail for rotationary drive of the rods

FIG. 24 is an alternative system with a top belt roller.

Detailed Description of the Invention

FIG. 1 is a perspective overview drawing of a system 2 with an inserter 4 according to the invention. The system 2 comprises a feeder section 6 with a number of feeders stations 8, for example 4 feeder stations, for feeding printed supplements, such as advertising material, into folded, printed matter, for example folded newspapers. In the following, it is, for simplicity, assumed that the printed matter is a newspaper, though the invention in no way is limited for this kind of printed matter and can be used for other printed matter than newspapers as well, for example for catalogues or journals.

The number for the feeder stations of 4 is not limiting and can be larger, for example as large as 60 feeder stations or more. The inserter 4 comprises a first insertion section 10 from which newspapers are provided and filled into pockets 12 of a rotating wheel 14. Inside the pockets 12, the folded newspapers are partly unfolded in order to provide space for insertion of supplements into the folded newspaper. Supplements are provided from the feeder stations 8 in which they are piled and taken one at a time and stacked together with supplements from other feeder stations 8. The selection of supplements is computer controlled, and may vary throughout the process. For example, a first batch of newspapers may receive a first selection of supplements, for example supplements related to the local area in which the newspapers are distributed, and a second batch may receive another selection of supplements. The stack of supplements from the selected feeder stations 8 is transported on the supplement conveyor 16 to a second insertion station (not shown) at the end of the supplement conveyor 16.

FIG. 2a is a side view of the wheel 14 with the first insertion station 10, which is shown in greater detail in FIG. 2b. The wheel 14 is supported by a frame 18, shown in FIG. 5, carrying a horizontal axle 19 for the wheel 14. With reference to FIG. 2a, the wheel 14 has a plurality of pockets 12, into each of which a folded newspapers is inserted from the first insertion station 10. The newspapers 64 are provided from a conveyor 22 with a belt approaching from the right to the first insertion station 10, such that the newspapers arrive in a mutually partly overlapping configuration at the upper part of the first insertion station 10.

The first insertion section 10 comprises a gripper section 24 with grippers 26 for gripping the back edges of the newspapers and inserting the newspapers by a smooth movement into the pockets 12 of the smoothly rotating wheel 14 with the fold of the folded newspapers placed in the bottom of the pockets 12, where the fold of the newspapers is clamped by a spring mechanism to hold the newspaper in place inside the pockets 12.

By gripping each printed matter individually, entire control is provided for the motion from the supplying conveyor 22 to the pocket 12. For example, the gripper 26 may

grip a newspaper from a conveyor 22, on which the newspapers are transported in a partly overlapping manner, and the gripper 26 may accelerate the speed of the newspaper 64 in order to create more space between subsequent newspapers, which makes the filling into the pocket 12 safer. In addition, the gripper 26 may slow down again just before releasing the newspaper into the pocket 12 of the wheel 14, which results in a gentle filling of the pocket 12 without risk of deformation of the newspaper folds. A practical solution for this feature is explained in the following.

FIG. 3 illustrates the first insertion station 10 in greater detail. The gripper section 24 carries the grippers 26, as illustrated in more detail in FIG. 4a showing an open view of the gripper section with the plurality of grippers 26 mounted to a hub 38. With reference to FIG. 3, newspapers arrive from the right and are provided in space 25 below rollers 27 and above support 29. Rotation of the gripper wheel causes the gripper 26 to grip a newspaper and moves towards the pocket 12 in order to guide the newspaper into a corresponding pocket 12.

With reference to FIG. 4a, the gripper 26 follows a path with a varying radius from the centre axis 36 of the hub 38, which is accomplished by an eccentric movement due to, on the one hand, a rotation about the centre axis 36 together with the hub 38, and, on the other hand, a motion determined by guiding grooves 34, which causes a rotation about gripper rotation axis 32. In detail, the motion of the grippers 26 is as follows with reference to FIG. 4a and FIG. 4b and FIG. 4c. The grippers 26 have first gripper connectors 23 in the form of wheels remote from the rotation axis 32 of the grippers 26. The first gripper connectors 23 cooperates with a first groove 34 in the gripper section wall 24' adjacent to the grippers 26. The first groove 34 has a varying distance to the rotation axle 36 of the hub 38. When the hub 38 is rotating about its axle 36, the grippers 26 are mainly following the movement of the hub 38, however, with an alternating overlay back and forth movement which is changing the angle of the grippers 26 relative to the hub.

The grippers have a first clamping part 41 and a second clamping part 43 arranged movable to each other for gripping the printed matter between the first 41 and the second clamping part 43. The first clamping part 41 is connected to first stem 37 and the

second clamping part is connected to second stem 39, the first 37 and the second stem 39 are connected movably to each other through rotational knee joint 35. When the first stem 37 is moved relatively to the second stem 39, the gripper 26 opens or closes the clamping parts 41, 43. The first clamping part 41 has a clamp connector 45 remote from the rotation axis 32 of the gripper, the clamping connector 45 cooperating with a second groove 47 in the gripper section wall 24' adjacent to the gripper 26. The second groove also has a varying distance to the rotation axle 36 of the hub 38. When the hub 38 rotates, the grippers 26 follow the rotation of the hub 38 including the alternating back and forth movement of the grippers 26, and in addition, the movement of the second connectors 45 in the second groove 47 causes a movement of the first stem 37 relative to the second stem 39, which causes a movement of the first clamping part 41 relative to the second clamping part 53. Thus, by coordinating the first groove 34 and the second groove 47, the grippers 26 open at the correct position during their in average circular course along with the hub 38.

In addition, as it appears from FIG. 4b, the first clamping part 41 has a third connector 49 running in third groove 51 for moving the first clamping part 41 to open or closing the gripper 26. The combined action of the movement of the first clamping part 41 and the second clamping 43 part yields a fast opening and closing and a precise location of the gripper 26 relative to the printed matter to grab.

Typically, newspaper items are folded together around a transverse line lying slightly displaced from the centre cross line of the folded-out newspaper, so that opposite the fold line, the folded newspaper will appear with two unequally long, outwardly-extending rectangular edges of the respective half-parts of the folded newspaper. This fact is normally used for partly unfolding newspapers inside the pockets in order to facilitate insertion of supplements into the partly unfolded newspaper. Such an unfolding mechanism is explained in prior art in German laid open script DE-A-32 00 594. An alternative solution is given in the following in more detail in connection with the invention with reference to FIGs. 5, 6, 7, 8, and 9.

FIG. 5 is a perspective view of part of the wheel 14. For each of the pockets 12, there is provided a slider 40, which is shown in greater detail in FIG. 8 and which is used to

press the two half-parts 64a, 64b, of the newspaper 64 in the pockets 12 away from each other, as illustrated in FIG. 7a and in greater detail by photograph in FIG. 9. As illustrated in FIG. 8, the slider 40 has a wedge 42 at the front end followed by a first plate 44 in extension of the wedge 42. The first plate 44 is fixed relative to the wedge 42 and has a bend edge 46 acting as a guide in order to facilitate the insertion of supplements in to the pocket 12 of the wheel 14, when the slider 40 in inserted into the pocket 12. In addition, the slider 40 has a second plate 62, which is mounted to the first plate by a rotational axis 63 such that it can move from a first position close to the first plate to a second position under an angle, as illustrate in FIG. 7b. When the slider 40 is inserted into the pockets 12, the first plate 44 and the second plate 62 are adjacent, but during the rotation of the wheel 14 and the change of orientation of the pockets 12, gravity causes the second plate 62 to swing away from the first plate 44 and press the two newspaper 64 half-parts 64a and 64b away from each other. The partly unfolded state is illustrated in FIG. 9.

The translational motion of the slider 40 is illustrated by bidirectional arrow 48. With reference to FIG. 6, a few sliders 40 at illustrative positions are shown to the right of the wheel 14. Whereas the wheel 14 is rotating about the rotation axle 20, a drum 50 is stationary. The drum 50 is provided with guiding means 52, best illustrated in FIG. 7a, in the form of a groove or rail, and the sliders 40 are provided with cooperating connectors 54 – cams or rollers or equivalent – connected to the guiding means 54. When the wheel 14 is rotating, the sliders 40 follow the rotational motion of the wheel in alignment with the pockets 12. However, as the drum 50 is stationary with respect to the support frame, the connectors 54 of the sliders 40 are forced to moves inside the guiding means 52 and follow a motion back and forth into and out of the aligned pockets 12.

When the sliders 40 are moving into the pockets, the wedge 42, as illustrated in FIG. 9, contacts the first edge 56, which belongs to the longest 64a of the two half-parts 64a, 64b of a newspaper 64. During the rotation of the wheel 14, the slider 40 is inserted deeper into the pocket 12 forcing the two half-parts 64a and 64b apart first by means of the wedge and subsequentially by means of the combined action of the first plate 44 and a second plate 62, which due to gravity during the change of orientation of the

pocket swings away from the first plate 44 into an angle relative to the first plate 44. This situation is best illustrated in FIG. 7b and FIG. 7c. The holding apart of the two half-parts 64a, 64b by the two plates 44, 62 facilitates the insertion of the supplements into the partly unfolded newspaper 64.

For example, the newspapers 64 are inserted into a pocket 12 at a position at a first side of the wheel 14, the supplements may be inserted from the other side of the wheel, when the wheel has rotated half a rotation, and the entire package of the newspaper with supplements are retracted from the pocket from the top of the wheel 14, when the wheel has rotated another quarter turn.

As illustrated in FIG. 10, the final packages are retracted from the pockets 12 of the wheel 14 by retraction grippers 66, which are mounted on retraction arms 68 guided by a co-operational movement between guide rails 70 and rollers 72. The retraction grippers 66 are shown in greater detail in FIG. 11 in closed configuration of the tongs 74 and in open configuration and different orientation in FIG. 12.

When using the inserter for different kind of printed matter, for example newspapers, the format of the printed matter may vary from case to case. This would imply that the edges of the printed matter are located in different depth inside the pockets. In order to vary the depth of the pockets 12, the pockets 12 are provided with means to adjust the depth of the pockets 12 in order to adapt the pockets 12 to a specific format of the printed matter. These means are explained in the following.

The transverse wall 13 of the pocket 12 as illustrated in FIG. 7 is show in greater detail in FIG. 13. The wall 13 covers a bottom ledge 78 which is movable in order to adjust the distance from the bottom ledge 78 and to the edge 80 of the wall 13. This movement is illustrated by bidirectional arrow 99 in FIG. 13. The ledge 78 is connected to pairs of discs 82, 84 on either side of the pockets 12, as illustrated in FIG. 14, where the discs 82, 84 are shown and the ledge 78 but not the remaining parts including the pockets, sliders, grippers and frame. Each pair 82, 84 of discs comprise first discs 82a, 84a and second disc 82b, 84b. Both the first discs 82a, 84a and the second discs 82b, 84b are provided with grooves 88, 90, where the grooves 88 of the first discs 82a, 84a

have an angle with the grooves 90 of the second discs 82b, 84b. Thus, a roller 92 connecting the two groves 88, 90 will be pushed along the grooves 88, 90 if the first discs 82a, 84a are rotated relatively to the second discs 82b, 84b. As the ledge 78 is connected to the rollers 92 by profiles 86, a rotation of the first discs 82a, 84a relative to a rotation to the second discs 82b, 84b causes a displacement of the ledge 78. Thus, the combination of the first discs 82a, 84a and second disc 82b, 84b has the function of an actuator. This mechanism is used for adjustment of the depth of all pockets 12 simultaneously. For example, the movement of the ledge to different depths of the pocket 13 can be performed automatically by computer control or by manually operated remote control. The rotation of the first discs 82a, 84a relatively to the second disc 82b, 84b, can, in principle, be performed manually, but is according to the invention performed by actuation with electrical motors, pneumatically or hydraulically.

Also shown in FIG. 14 are spring elbows 94 rotational about a rotation axle 96 in bearings 98. These spring elbows 94 are rotated through elongate openings 100, as illustrated in FIG. 13, after a newspaper has been inserted into the pocket 12 in order to fasten the fold of the newspaper 64 to the interior of the pocket 12. After insertion of the supplements, just before the retraction gripper 66 retracts the newspaper 64 package from the pocket 12, the spring elbows 94 are rotated back out of the pocket 12 in order to release the newspaper from the pocket 12.

FIG. 15 shows the supplement conveyor 16 for transporting the supplements from the feeder stations 8 to the second insertion station. The supplement conveyor 16 has a first transport section 16a and a second transport section 16b. The first transport section 16a transports the supplements packages to the second insertion station, whereas the second transport section 16b removes incomplete packages from the series of subsequent packages. Each feeder section 8 is provided with a control mechanism giving an alert to a control computer in the case that a supplement has not correctly bee fed to the stack of supplements. In the event of a discovered failure, the computer tracing each of the packages initiates a removal of the defect package through the second transport section 16b.

The mechanism for the removal of defect packages is explained in greater detail with reference to FIG. 16. Following an accepted package 104, a new package 102 arrives at the pick-up section 106 of the transport conveyor 16, as illustrated in FIG. 16a. The package 104 has passed the pick up station 106 and is transported between a first support belt 108 and a top belt 105 towards the supplement insertion station. The new package 102 approaching on support belt 108 is defect and has to be removed from the support belt 108.

Top belt rollers 120, 122 guiding the top belts 124, 126 are used to hold the packages smoothly on the support belts 108 or 116. It should be mentioned that the support belt 108 and the top belts 105, 107 are sets of multiple narrow, parallel belts or ribbons, each running over a set of multiple narrow rollers 120, 122. This principle is shown in FIG. 15 and also illustrated in FIG. 24, where an additional roller 120' is located next to the first support roller 120. The advantage is given by the fact that a set of rollers is able to adjust to thickness variations of the packages from the centre of the package to towards the sides of the package. For example, if smaller supplements are stacked on larger supplements, the package is thinner towards the sides. In addition, the multiple belt principle is useful for the supplement removal principle according to the invention as explained in the following.

When a new package 102 on the support belt 108 is defect and has to be removed from the supplement conveyor 16, as illustrated in FIG. 16b, this is accomplished by rotating a lifting member 110 about rotation axis 111 such that its upper part 112 presses the foremost end 114 of the new package 102 upwards in order to guide it into the space 118 up to second conveyor belt 116. The lifting member 110 resembles an angular segment of a wheel and has a small width such that it fits into the space between the narrow belts/ribbons. As soon as the defect package 114 has been removed from the support belt 108, the lifting member 110 returns to its original position by continuing its clockwise rotation, as illustrated in FIG. 16c and FIG. 16d. In agreement with the belt of multiple ribbons, also the lifting member consists of multiple wheel segments, as illustrated in FIG. 18a. It should be mentioned at this point that also correct packages may be removed by the removing station in some instances, for example, when a sup-

plement package is correct, but when a newspaper is missing in a pocket. Whether a newspaper is missing in a pocket is controlled by a corresponding control unit.

The apparatus according to the invention is configured for high speed supplement insertion. This implies that the machinery has to work smoothly and fast, because there is a risk that a slowly reacting top belt roller due to its inertia deforms the approaching stack. For this reason, the top belt rollers 120 and 122 for the top belts 107 and 105 are constructed for fast reaction as illustrated in FIG. 16 and FIG. 17. Each rollers 120 has a rolling ring 133 rolling on a rotational but stationary eccentric support roller 128 combined with two lightweight arms 130a, 130b having further support rollers 131 at their ends and being in contact with the rolling ring 133. In case that a package 102 is to be rejected, and lifting member 110 is rotating upwards, as illustrated in FIG. 17b, only the set of relatively thin rings 133 is displaced rotational about its eccentric support roller 128 together with the light weight arms 130a, 130b, but the eccentric support axis 129 (best shown in FIG. 16b) of the first support roller 128 itself is not moved. The displacement of only the light weight components yields a short reaction time and reduces wear on the machinery.

An alternative principle for the support of the ring 133 is illustrated in FIG. 24. In this case, the ring 133, over which the belt 107 is moving, is likewise supported by the first support roller 128 on an eccentric support axle 129. However, instead of having further support rollers 131 inside the ring 133, other further support rollers 131' are provided on either side of the ring 133, where the ring 133 is prevented from transversal movement but can freely move about the axis of the axle 129. The ring 133 is held in place against the first support roller 128 due to the tension in the belt 107. In order for the ring 133 to stay aligned with the first support roller 128, the inner circumference 135 of the ring 133 is provided with a circumferential projection 137 matching a corresponding circumferential groove in the first support roller 128. This principle of groove and projection can advantageously be used in the embodiments of FIG. 16 and 17a and b. For example, the circumferential projection can be formed as a straight projection extending at a right angle from the inner surface of the ring, by which the ring and the projection in radial cross section constitute a T-form.

A set of lifting members 110 on a common axle 132 is illustrated separately in FIG. 18a. Using a set of lifting members is due to the fact that the support of the packages is achieved with a set of an equal number of narrow, parallel belts. The lifting members 110 are, in fact, pairs of lifting sub-members 110a, 110b, as it is illustrated in FIG. 18b. The reason for this is the fact that the lifting of the roller 120 may have to be performed for two subsequent supplement packages 102, which requires a fast performance of the lifting member 110, when the machine is running at high speed. By having pairs of lifting sub-members 110a and 110b, it is possible to lift the roller 120 by the first lifting sub-member 110a while at the same time having the second lifting sub-member 110b ready for a further lifting short time after. This situation is also illustrated in FIG. 17b. Whilst the second lifting sub-member 110b lifts the roller, the first lifting member 110a is accelerated relatively to the rotation speed of the second lifting member and is quickly advanced to stay ready for a third lifting, if necessary. Thus, the two lifting sub-members 110a, 110b are not stationary relative to each other but rotate with differentiated speed such that the second lifting sub-member 110b during lifting rotates more slowly than the first lifting sub-member 110a when it is quickly advanced in order to become ready for the next lift.

As illustrated in FIG. 17b, the first sub-member 110a is fasted to an axle 111 such that driving the axle 111 into rotation, rotates the first sub-member 110a. The second sub-member (110b) is supported freely rotational on the axle 111 and is driven by a belt 113 from a belt drive 115.

A feeder station 8 is illustrated in FIG. 19-23. The feeder station 8 has a feeder tray 134 in which a pile of supplements (not shown) of this feeder station 8 are supported on a row of feeder rods 136. The rods 136 are moving along the underside of the stack of supplements (not shown) in the tray 134 whilst the rods 136 are rotating in order not to exert force due to friction to the underside of the supplement stack. As illustrated in FIG. 23, the rotation of the rods 136 is achieved by wheels 140 mounted to one end of the rods 136, the wheel 140 engaging with the lower side 142 of a rail 144 and causing the wheel 140 to rotate when the rod 136 with the wheel 140 is moved along the rail 144 during the advance of the rod 136 along the rail 144.

As illustrated in a perspective view in FIG. 19c, in side view in FIG. 20, and in an end view in FIG. 21, the rods 136 are carried on and advanced by a chain or belt 138 driven by a set of wheels 139. As best seen in FIG. 21, the rods 136 change orientation, once they leave the supporting space underneath the stack of supplements, before the rods return again to the underside of the stack into a horizontal orientation.

The advantage of using rods 136 to support the stack is the fact that supplements can be withdrawn from the stack from below. Suction cups 146 on a rocker arm 148 driven by a cam wheel 159, as illustrated on FIG. 22 and FIG. 20, can move up and down and may, when correctly timed, grab the end of one supplement and move it downwards between two successively moving rods 136. With reference to FIG. 20, the rods 136 are advanced to the right, and the suction cup 146 grabs the left end of a supplements. The advance of the rods 136 then peels the supplement downwards off the stack such that the supplement is ready for stacking onto other supplements on the supplement conveyor for transport to the second insertion station.

In order for the supplement to be laid down onto a conveyor below the feeder station 8, for example onto a stack on a conveyor, a further set of grippers 150a are provided underneath the feeder tray. As illustrates in FIG. 22, these grippers are provided as four pairs of grippers 150 on two rotating wheels 152, 152'. Once a supplement has been gripped, from the underside of the tray, the wheels 152 take into account the motion of the rods 136 along the underside of the pile of supplements in the tray 134 such that the supplement is safely removed form the tray 134. In fact, during the rotation of the wheels, the grippers change orientation after having grabbed the front edge of a supplement, which is depicted by the two orientations 150a and 150b in FIG. 20 and FIG. 22. This causes the supplement to follow an S-formed curve from the extraction from the pile and the placement on the conveyor belt 158. This S-motion assures that the supplement is placed on the conveyor in the same orientation as in the pile. Furthermore, the gripping by the grippers 150 ensure that the entire movement of the supplement from the tray to the conveyor is under complete control also at high speed.

CLAIMS

1. An inserter for insertion of supplements into folded printed matter having two unequally long folded half-parts such that a first half part is longer than a second half-part, the inserter comprising

- a wheel with horizontal rotation axis and a plurality of outwardly open pockets along the circumference of the wheel for the uptake of the folded printed matter into the pockets,
- a first insertion station for insertion of folded printed matter into the pockets with the fold of two half-parts of the printed matter located in the bottom of the pockets,
- an opening arrangement for displacing edges of the unequally long folded half-parts from each other,
- a second insertion station for insertion of supplements into the space between the two half parts,

characterised in that .

the opening arrangement comprises a movable slider arranged translational relative to the edges of the two half-parts, the slider comprising a wedge arranged at a distance from the bottom of the pocket such that translation of the slider forces the edge of the longer half part to be displaced from the edge of the shorter half part, thereby forcing the two half-parts apart.

2. An inserter according to claim 1, wherein the slider comprises a first holder for abutting the first half-part and a second holder for abutting the second half-part, the second holder being arranged at an angle or distance to the first holder for securing a distance between the two half-parts.

3. An inserter according to claim 2, wherein the first holder is a first plate in extension of the wedge for abutting the first half-part and the second holder is a second plate for abutting the second half-part, the second plate being arranged at an angle to the first plate for securing an angular distance between the two half-parts.

4. An inserter according to claim 3, wherein the first plate in extension of the wedge has a rounded edge extending from the first plate in the direction of the pocket for guidance of supplements into the pocket.

5. An inserter according to claim 2, 3, or 4, wherein the second holder is mounted rotatably relative to the first holder.

6. An inserter according to any preceding claim, wherein the wheel is adjacent to a static drum which is provided with a rail following the circumference of the drum, wherein the rail has a varying distance to the pockets, and wherein the sliders have connectors connected slidingly to the rail for changing the distance between the wheel and the connectors during rotation of the wheel relative to the drum.

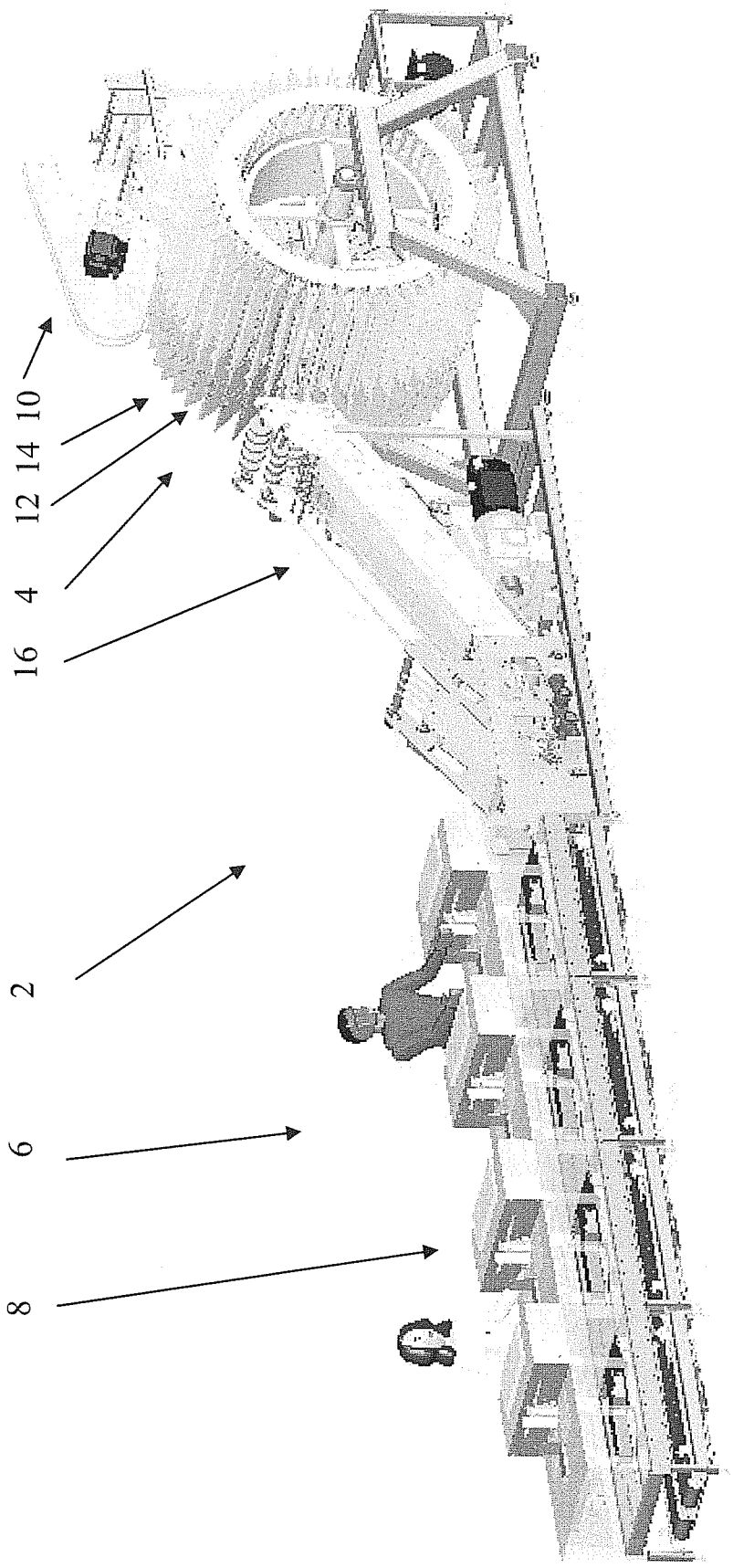


FIG. 1

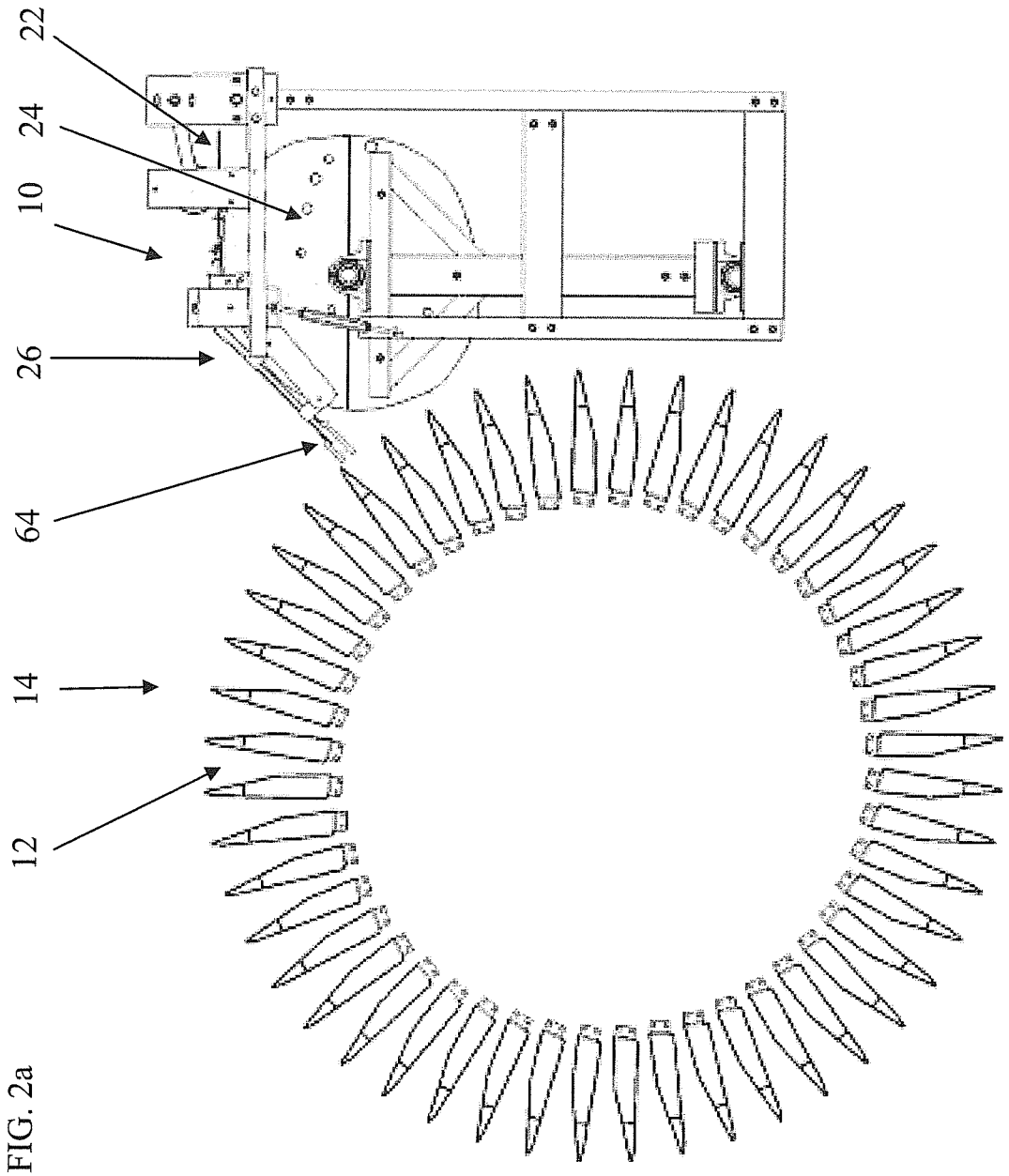
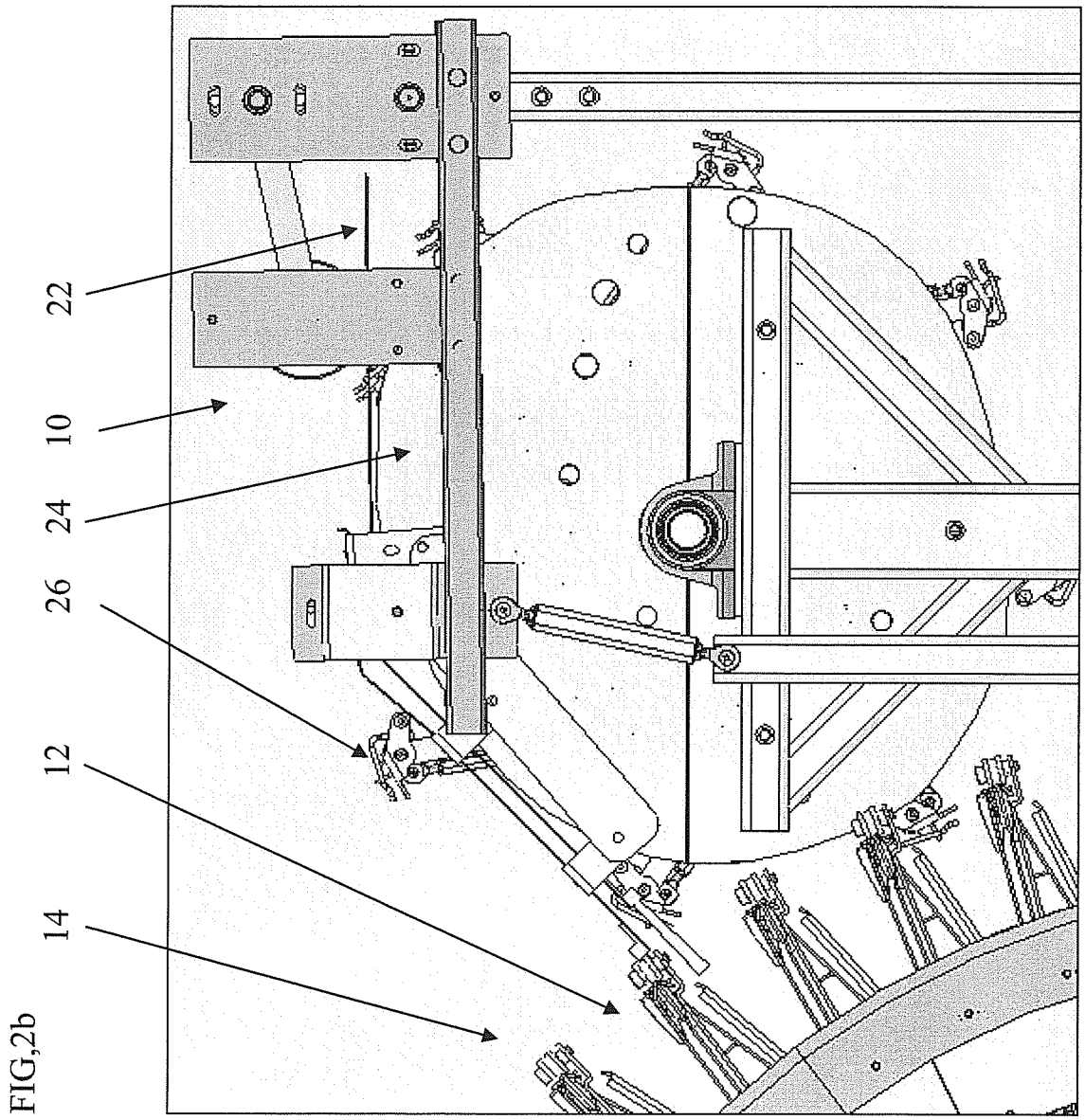


FIG. 2a



FIG,2b

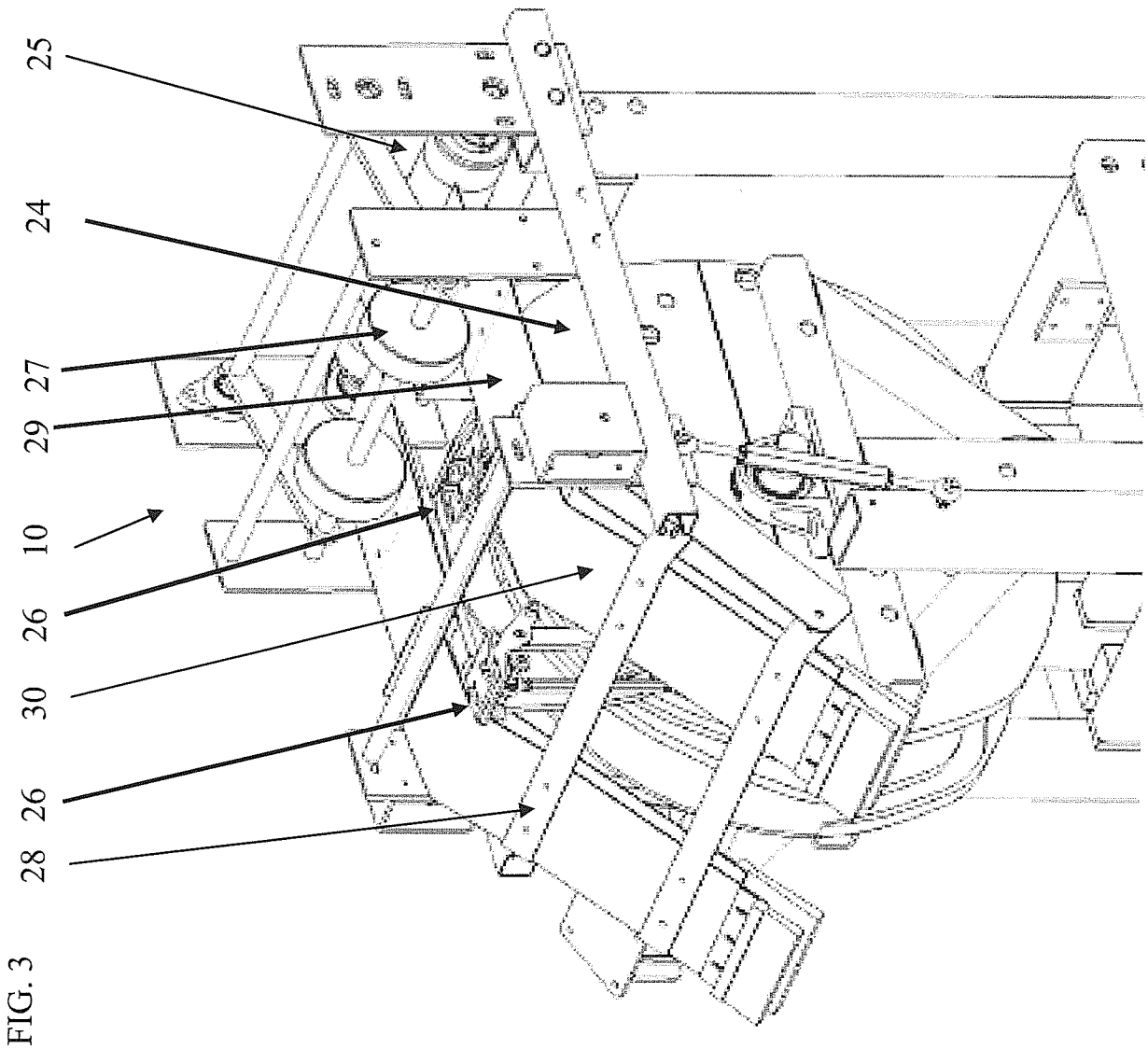


FIG. 3

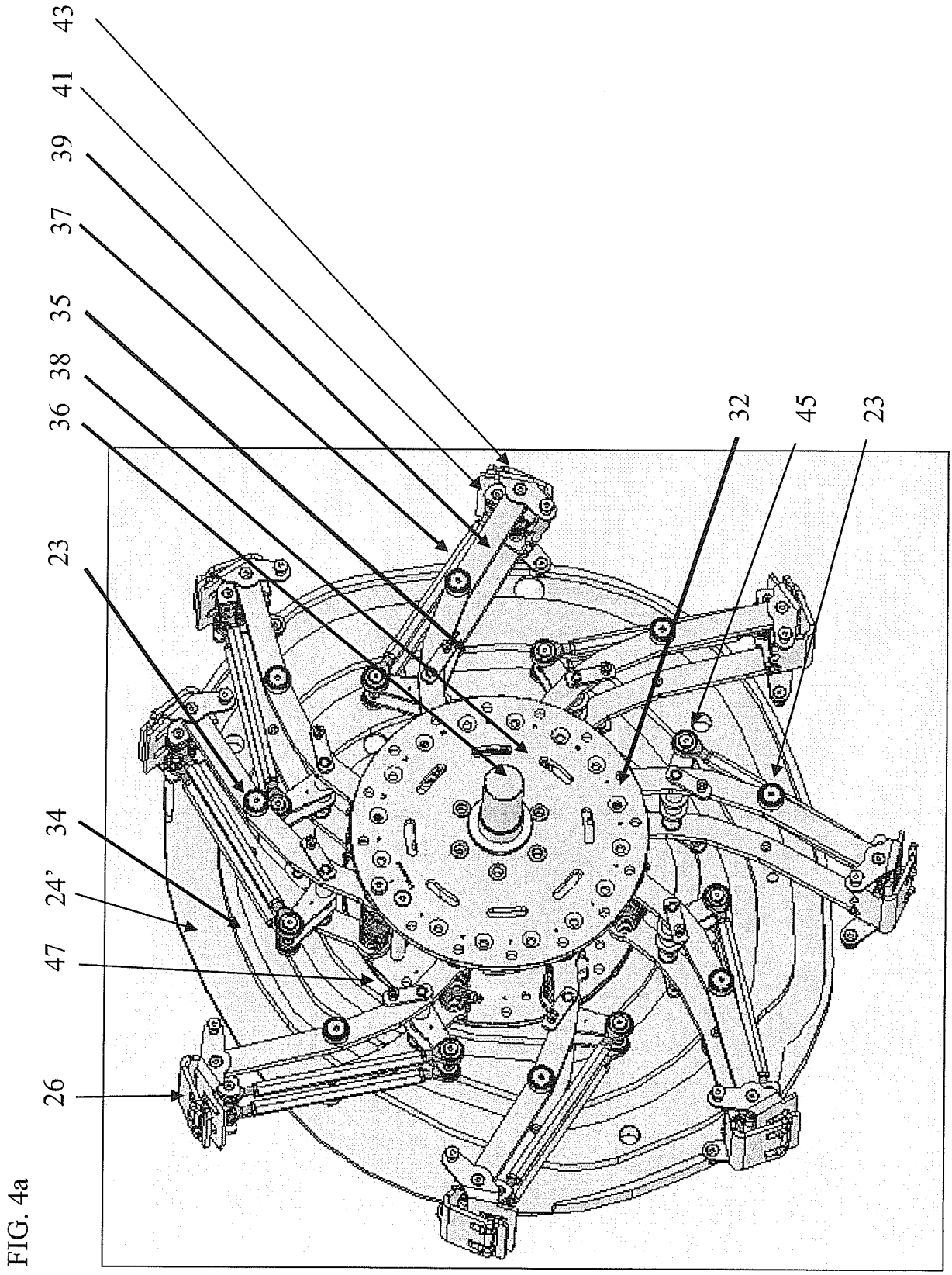


FIG. 4a

FIG. 4b

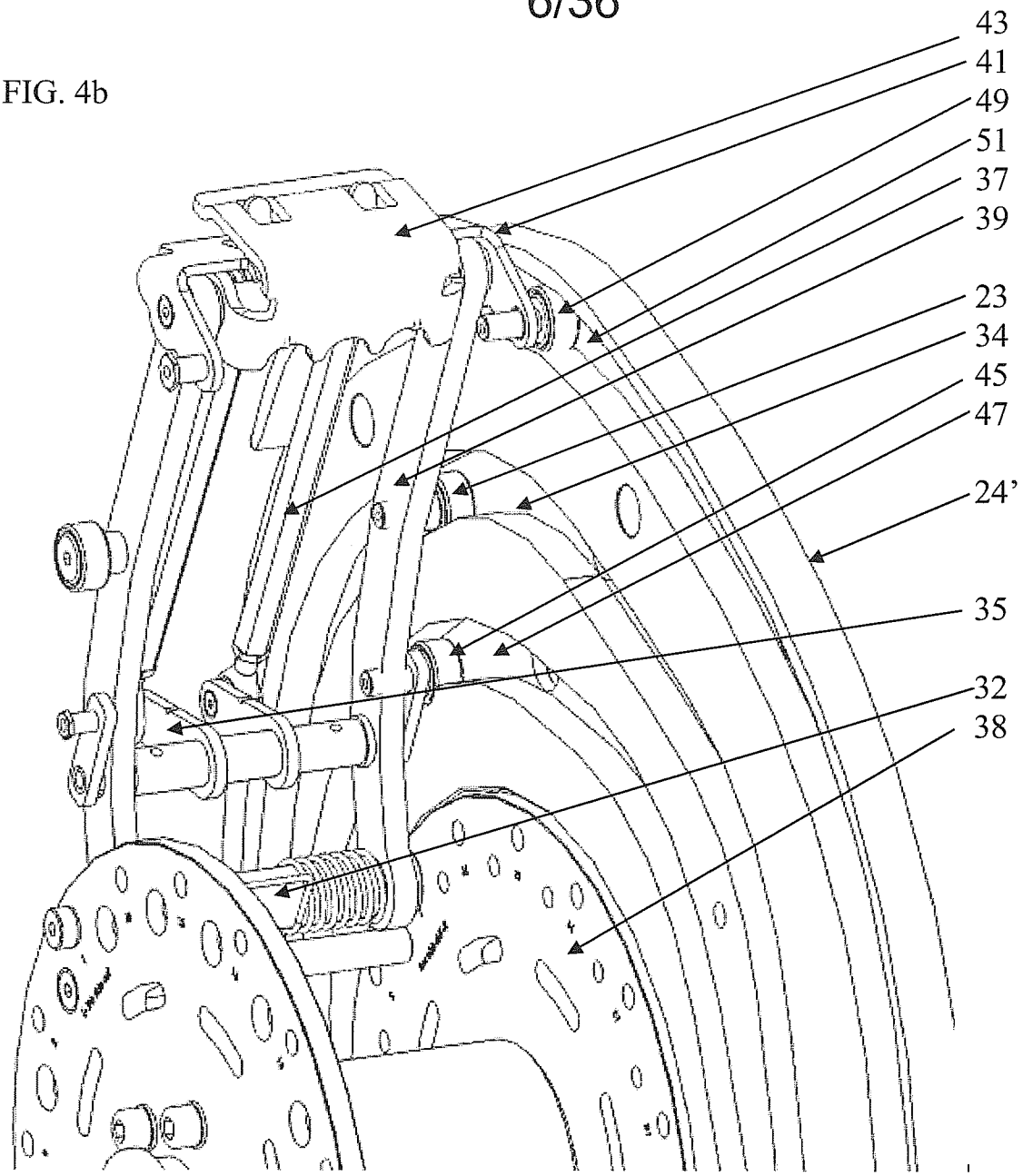
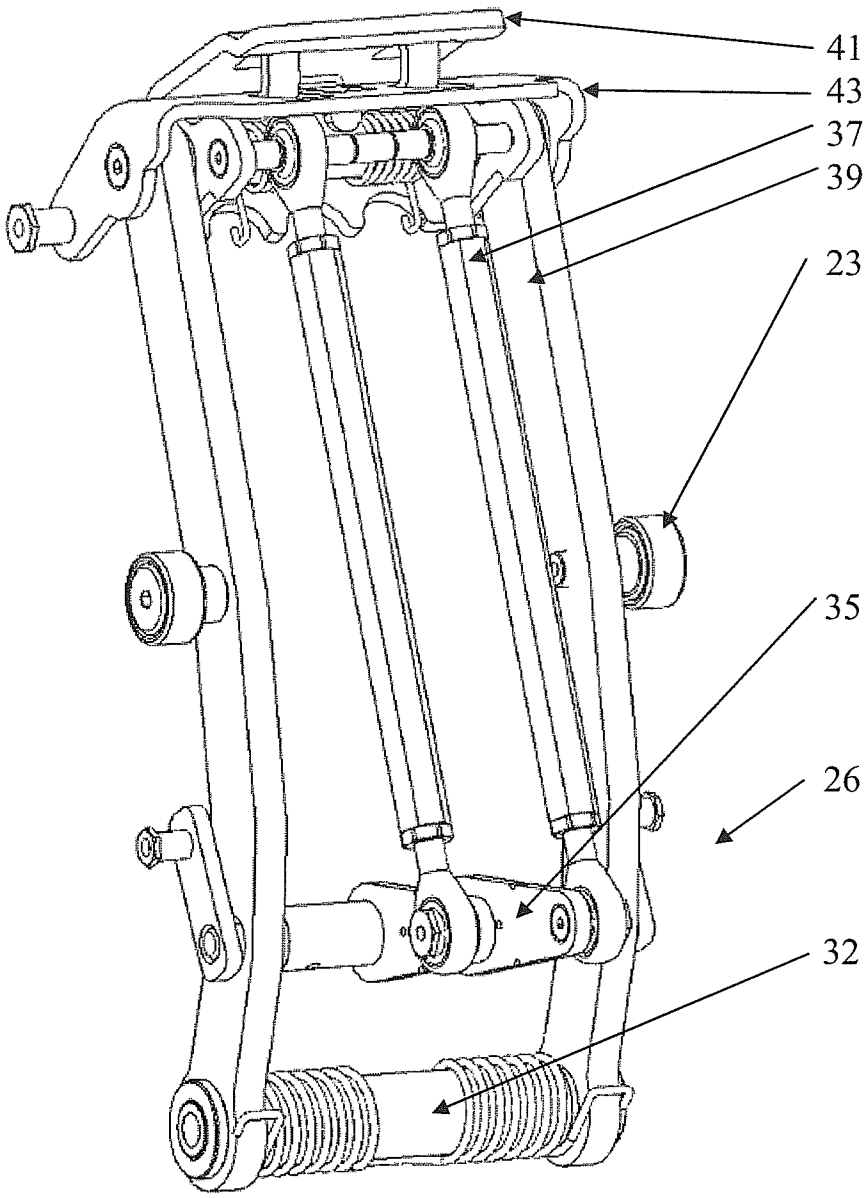


FIG. 4c



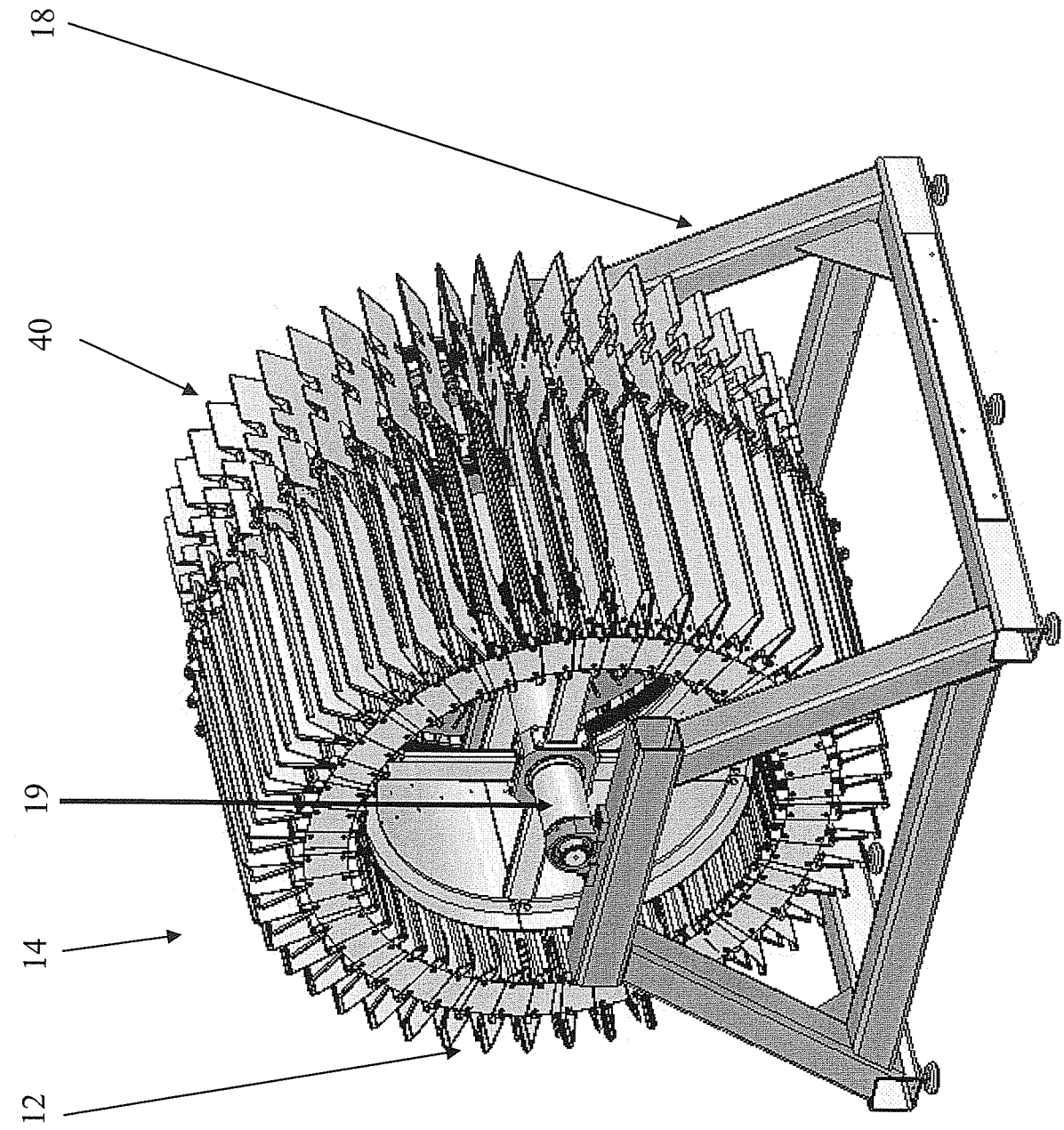


FIG. 5

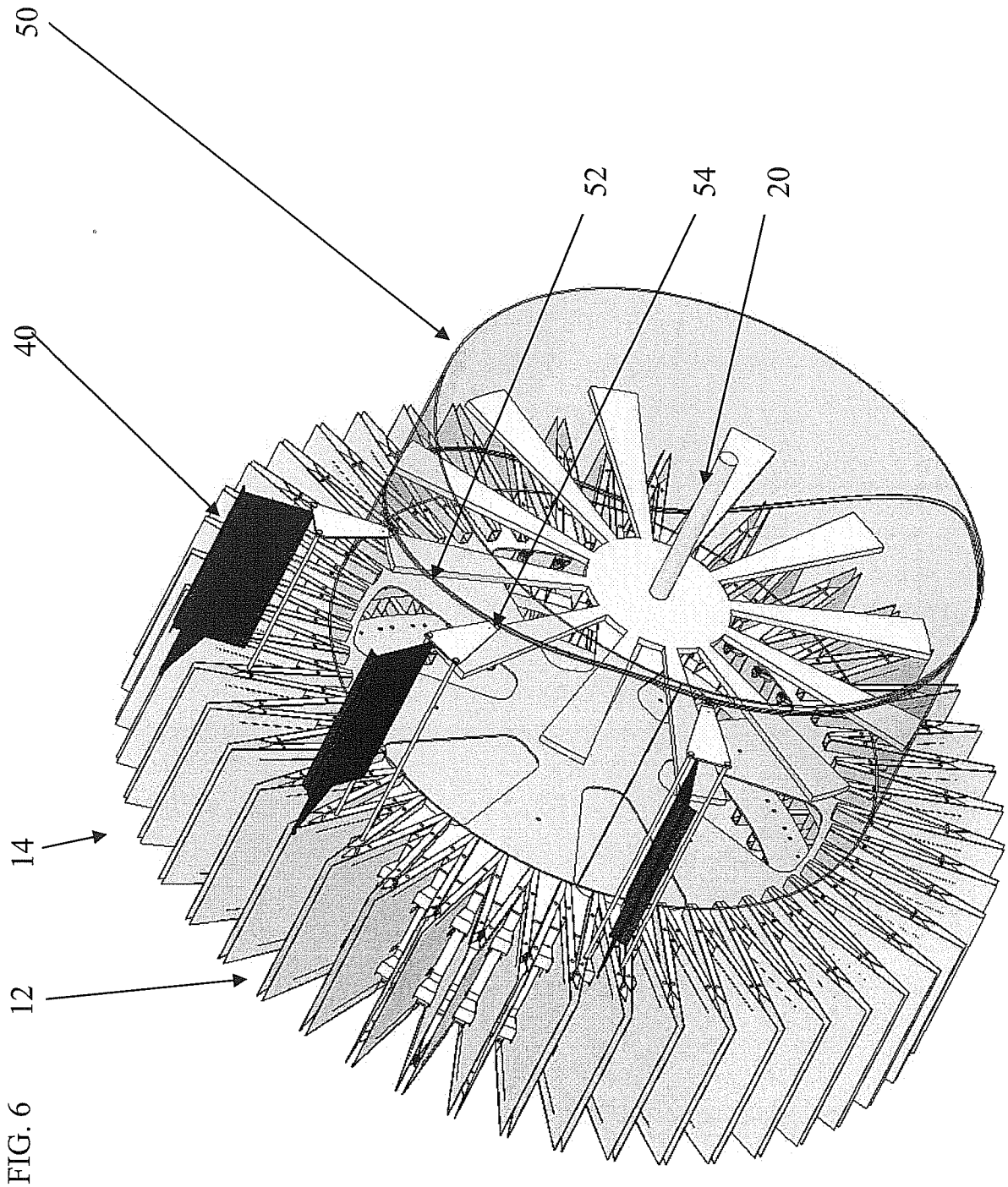


FIG. 6

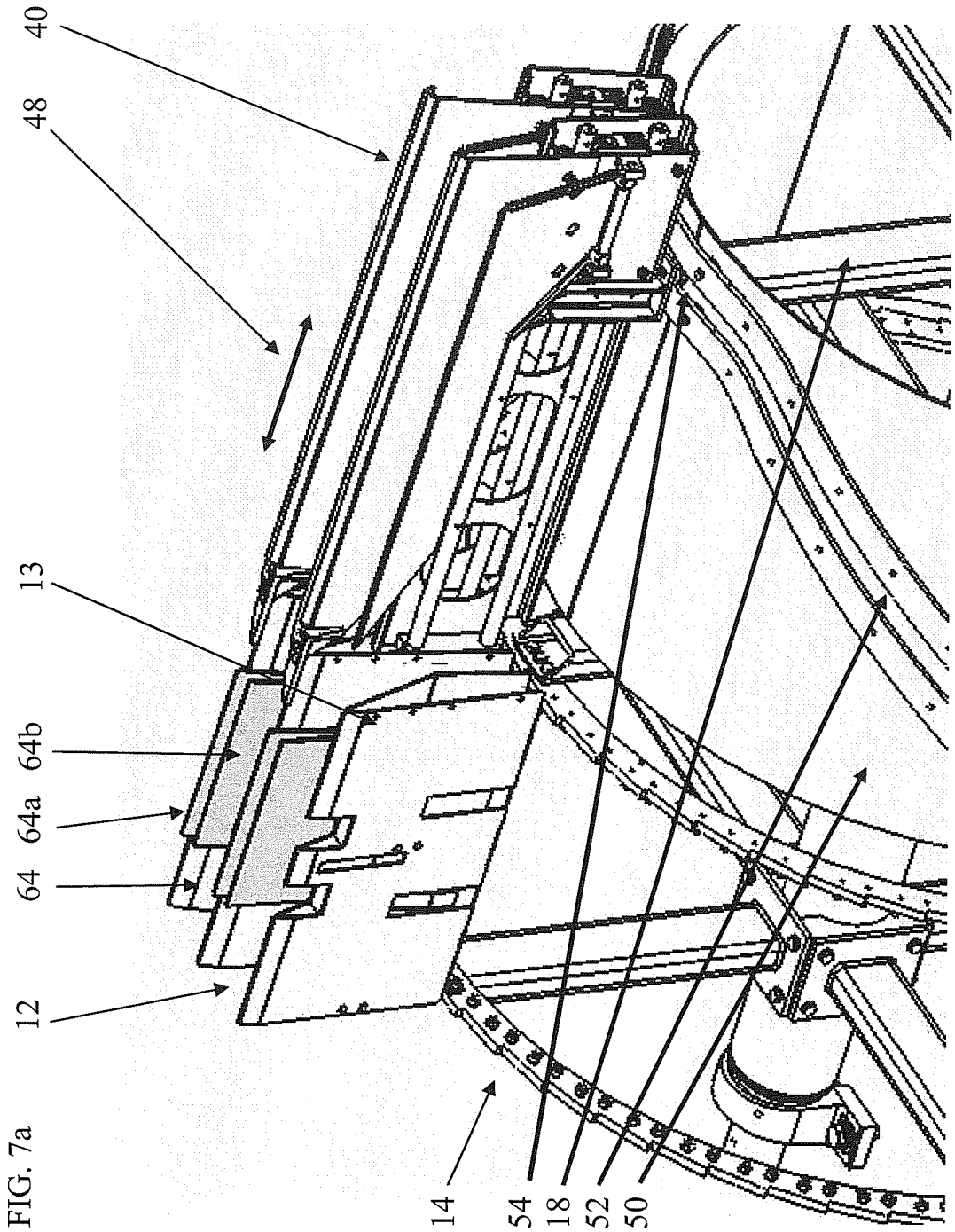


FIG. 7a

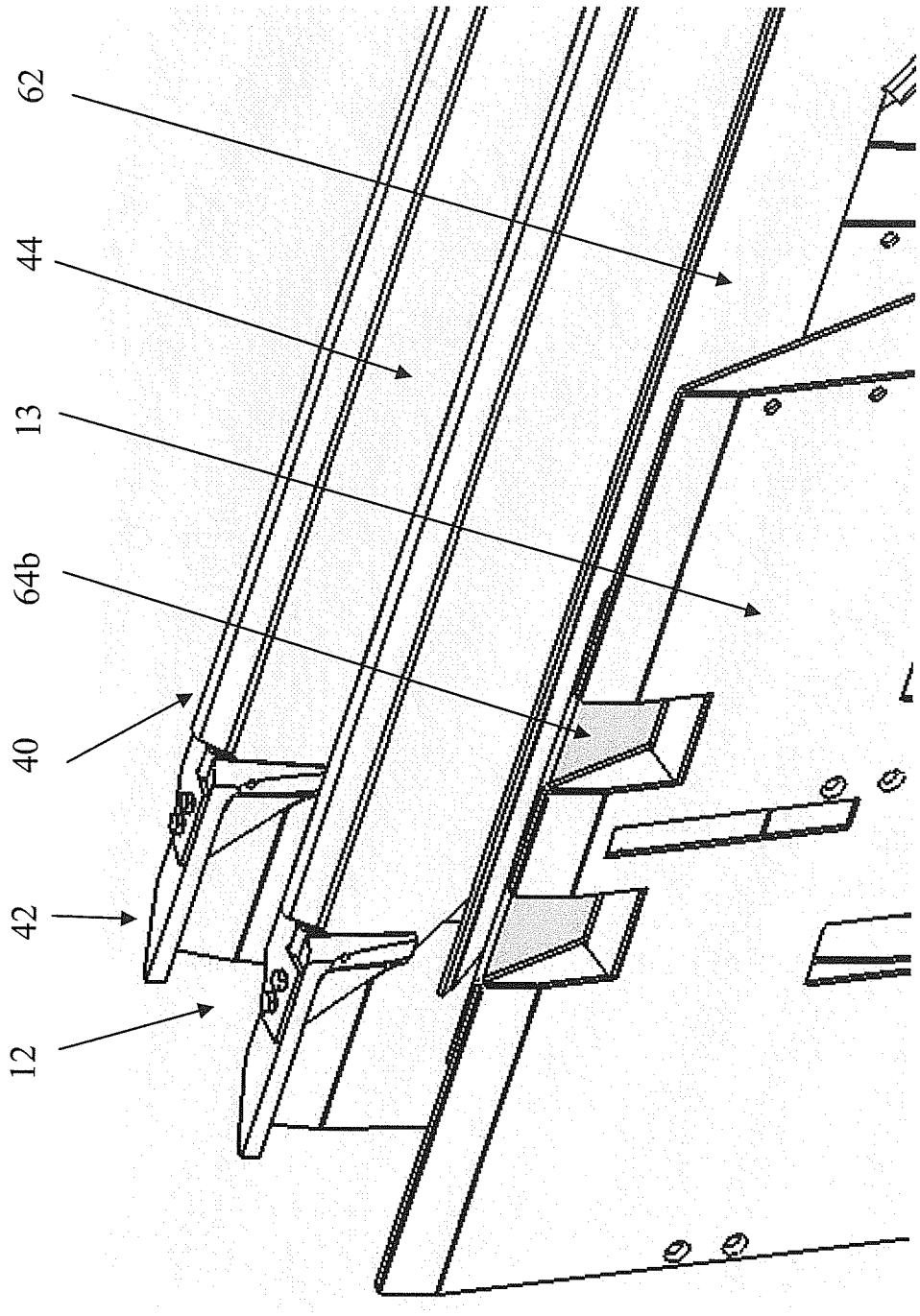


FIG. 7b

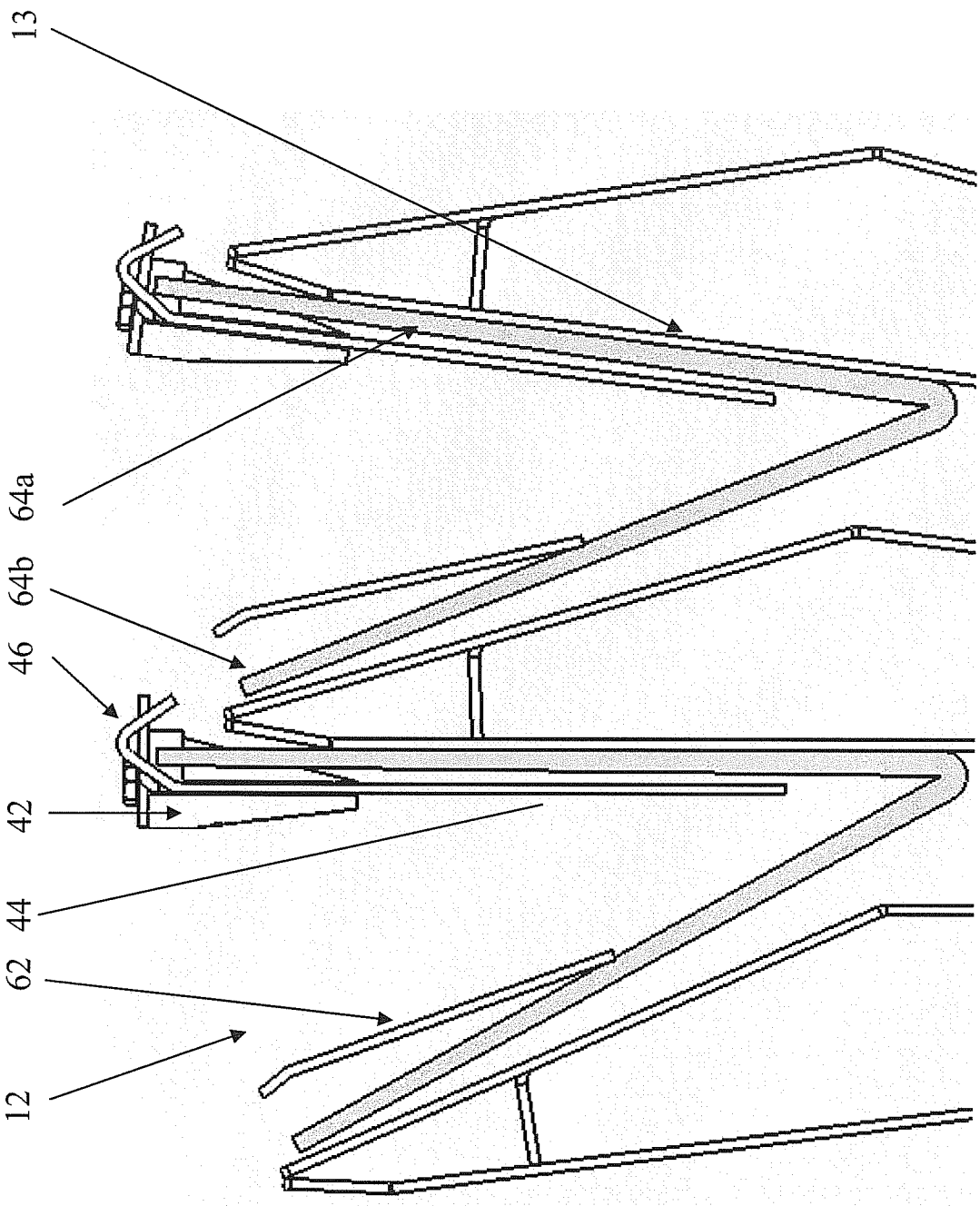


FIG. 7c

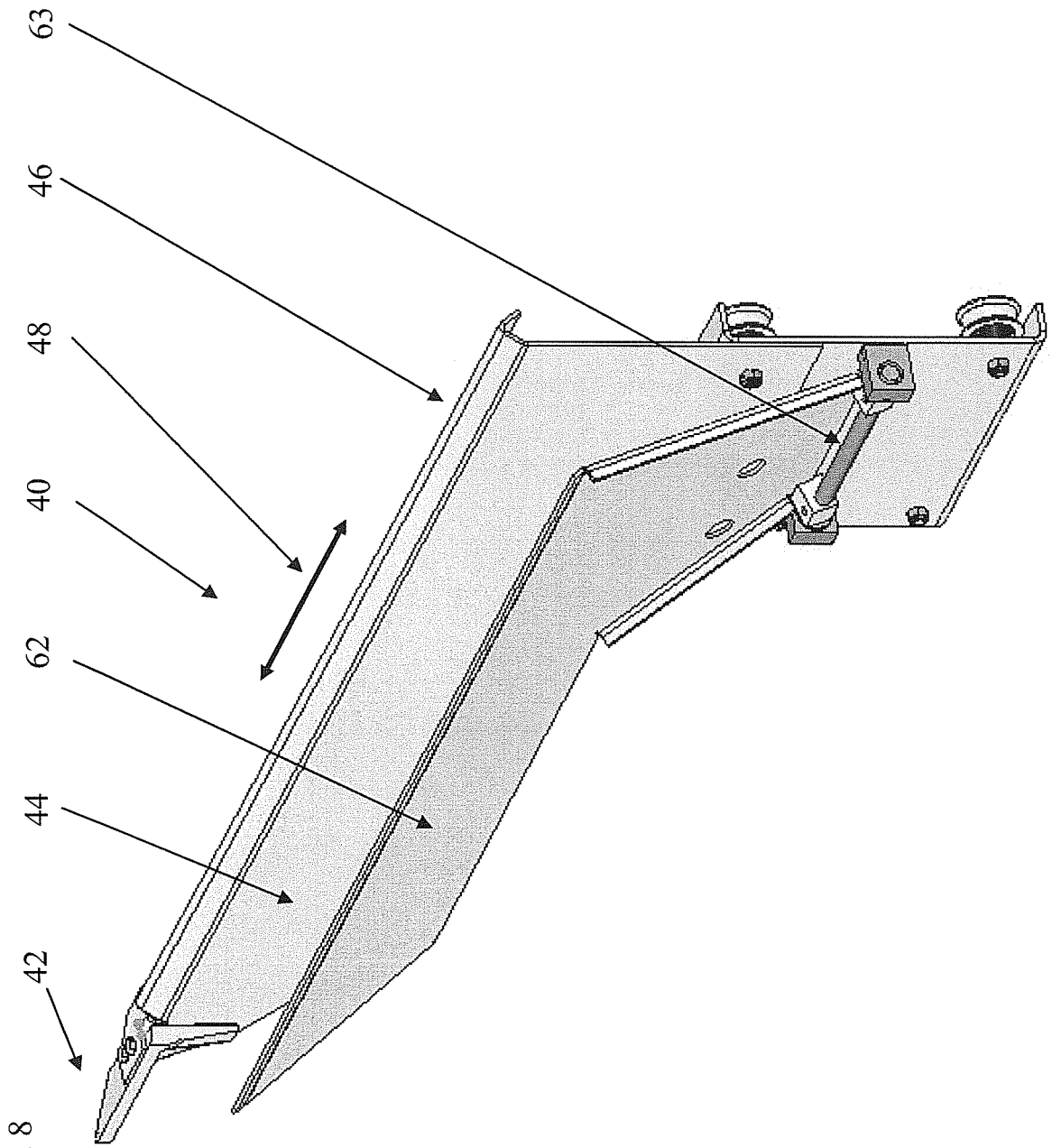


FIG. 8

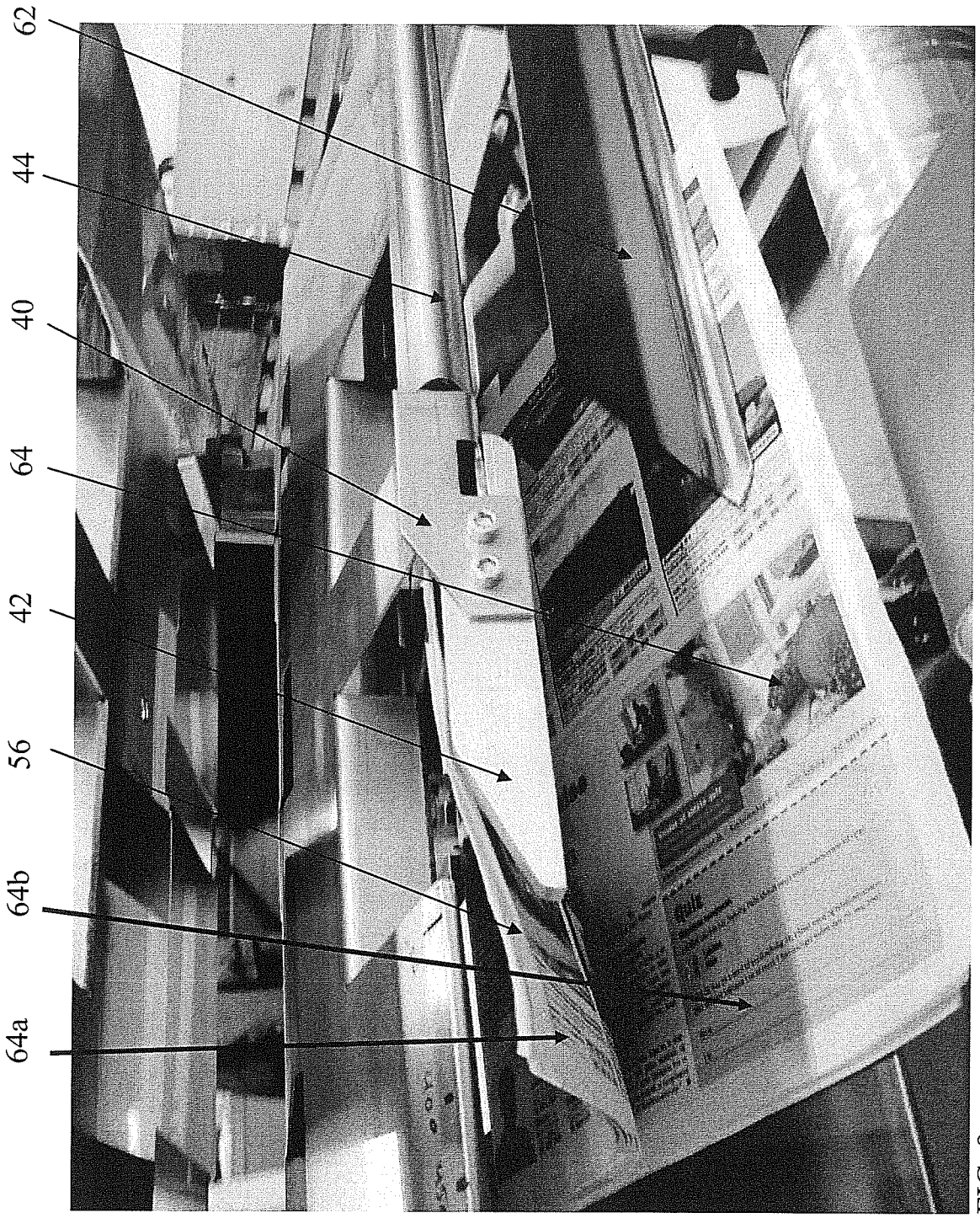


FIG. 9

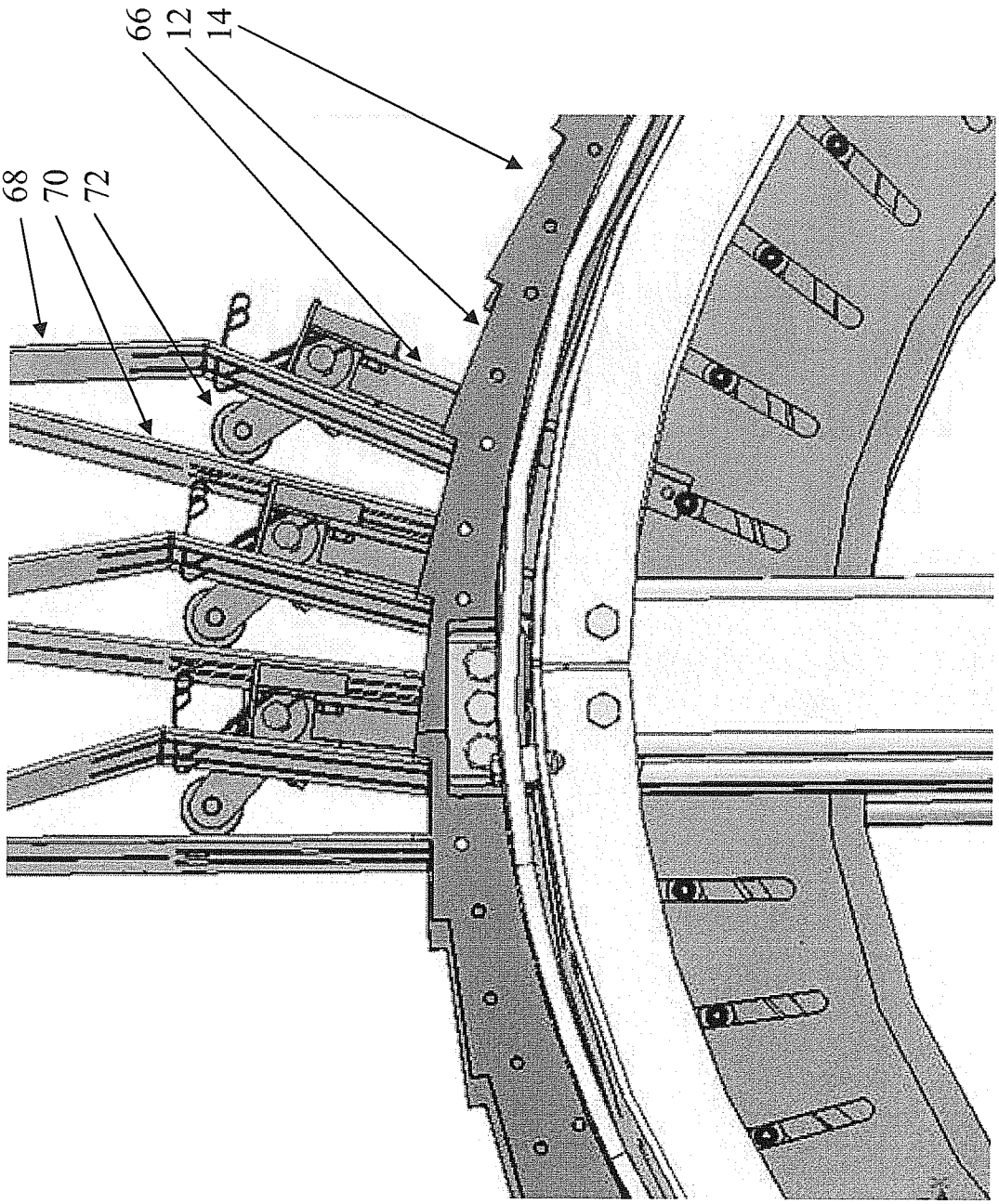


FIG. 10

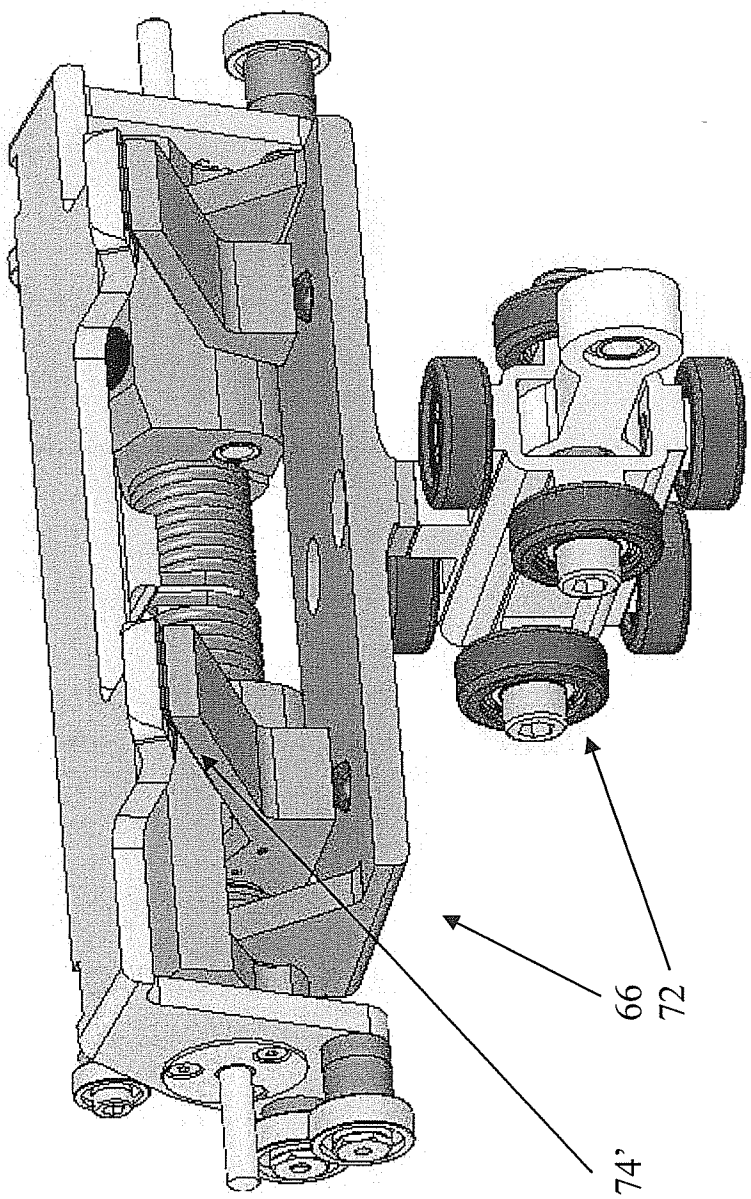


FIG. 11

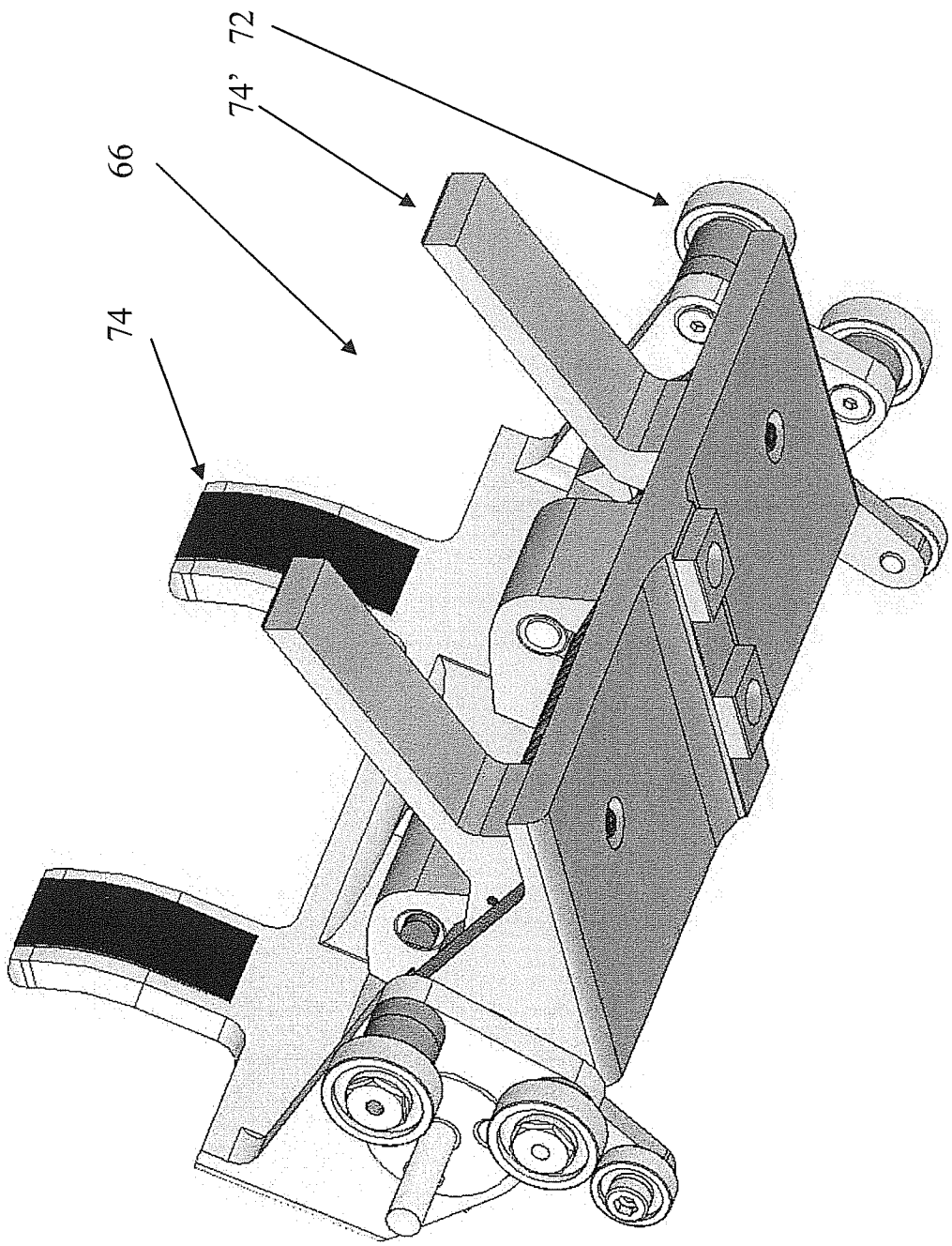


FIG. 12

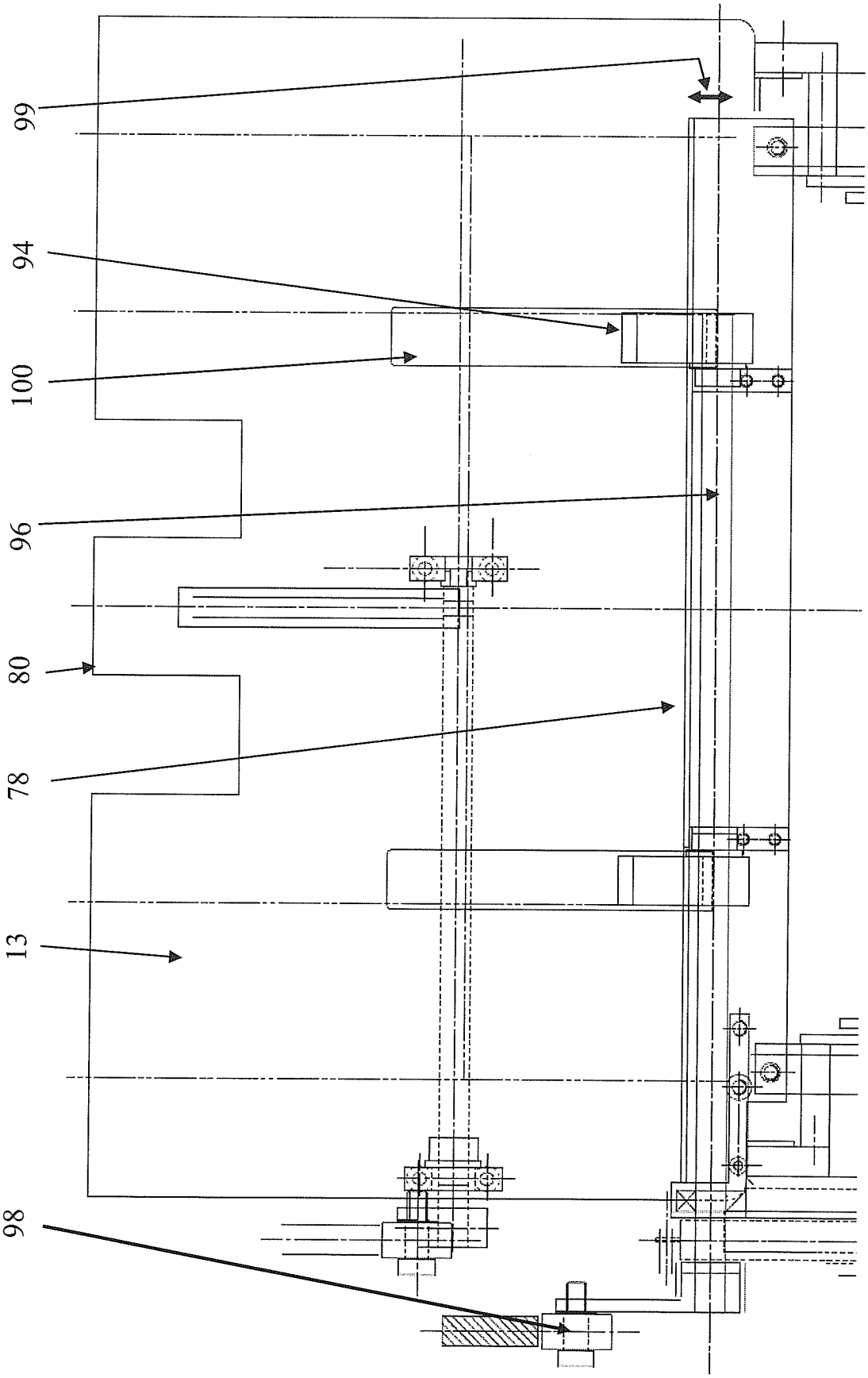


FIG. 13

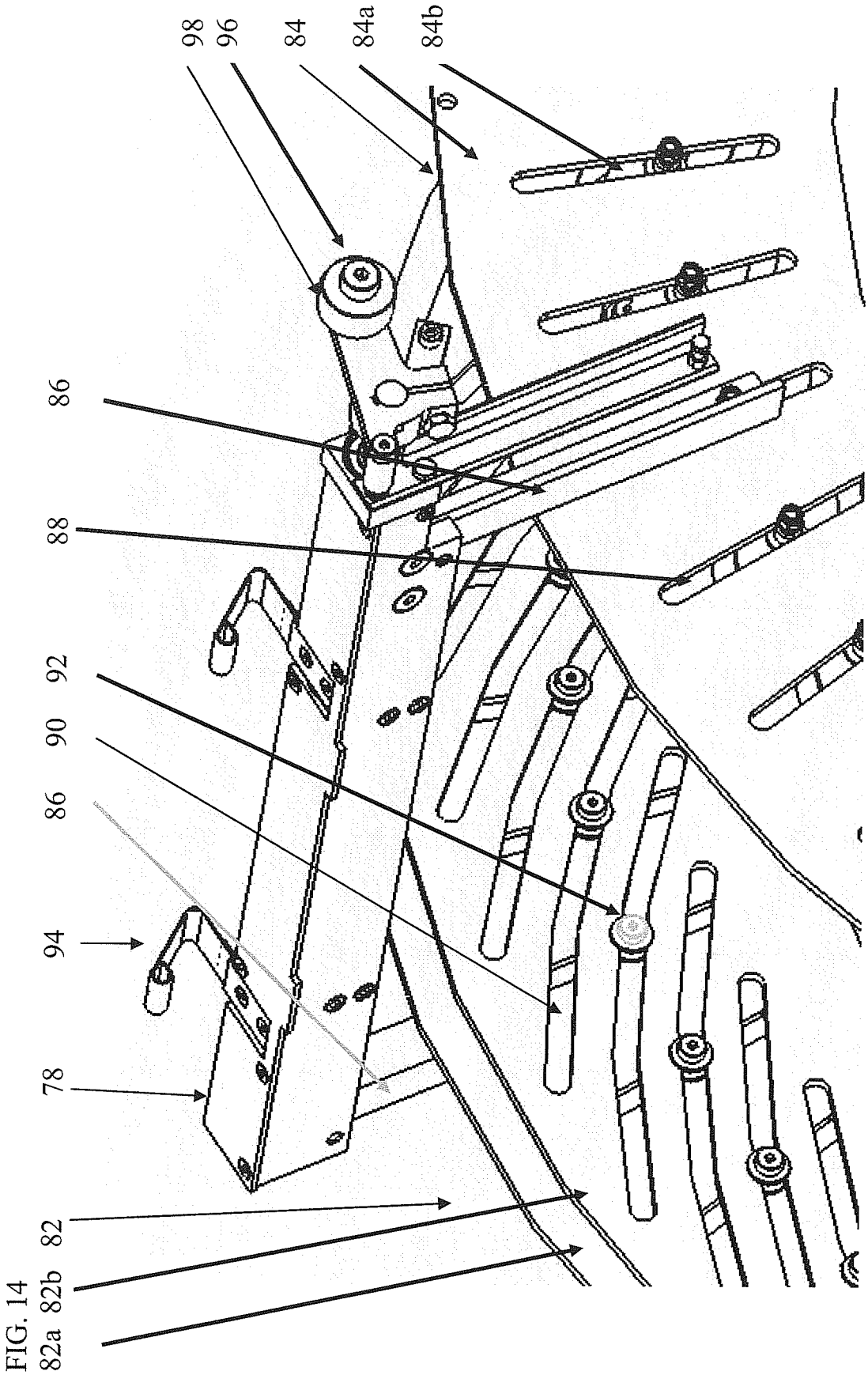


FIG. 14

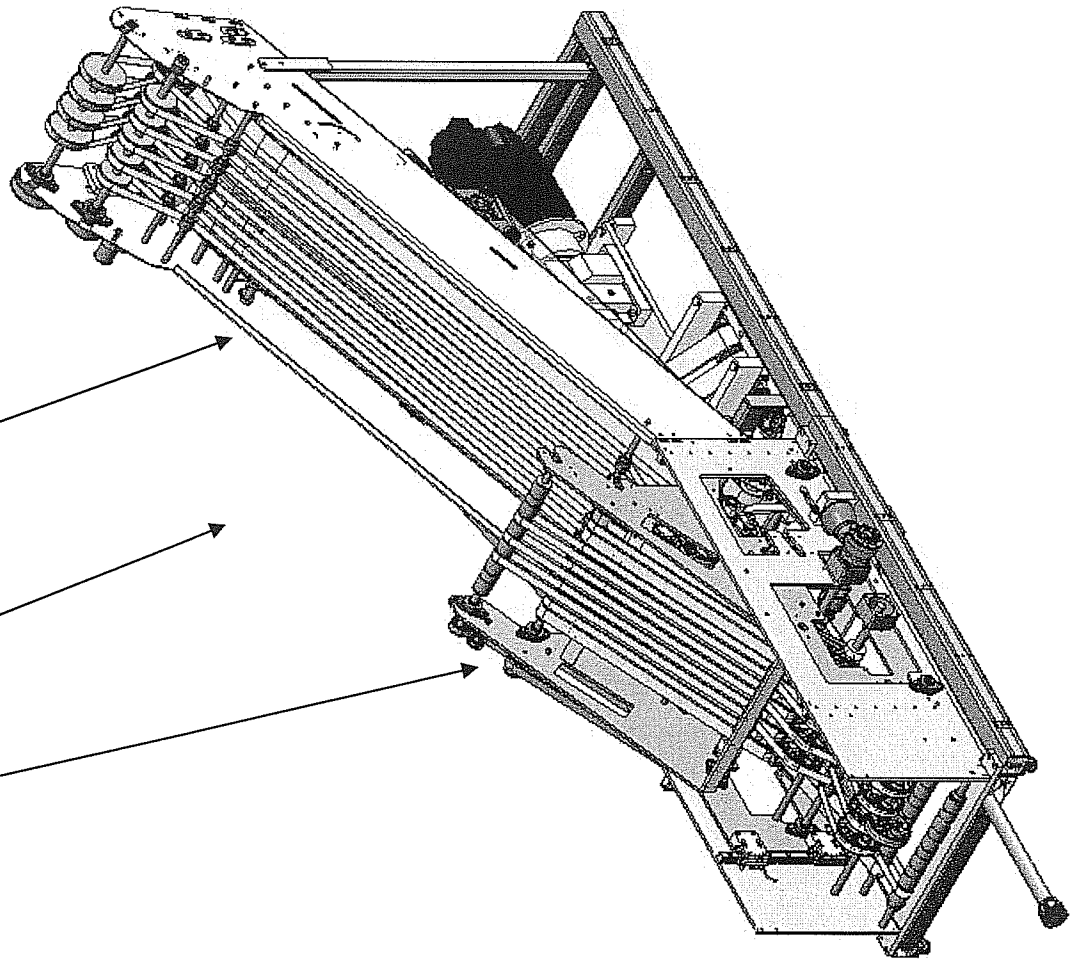


FIG. 15

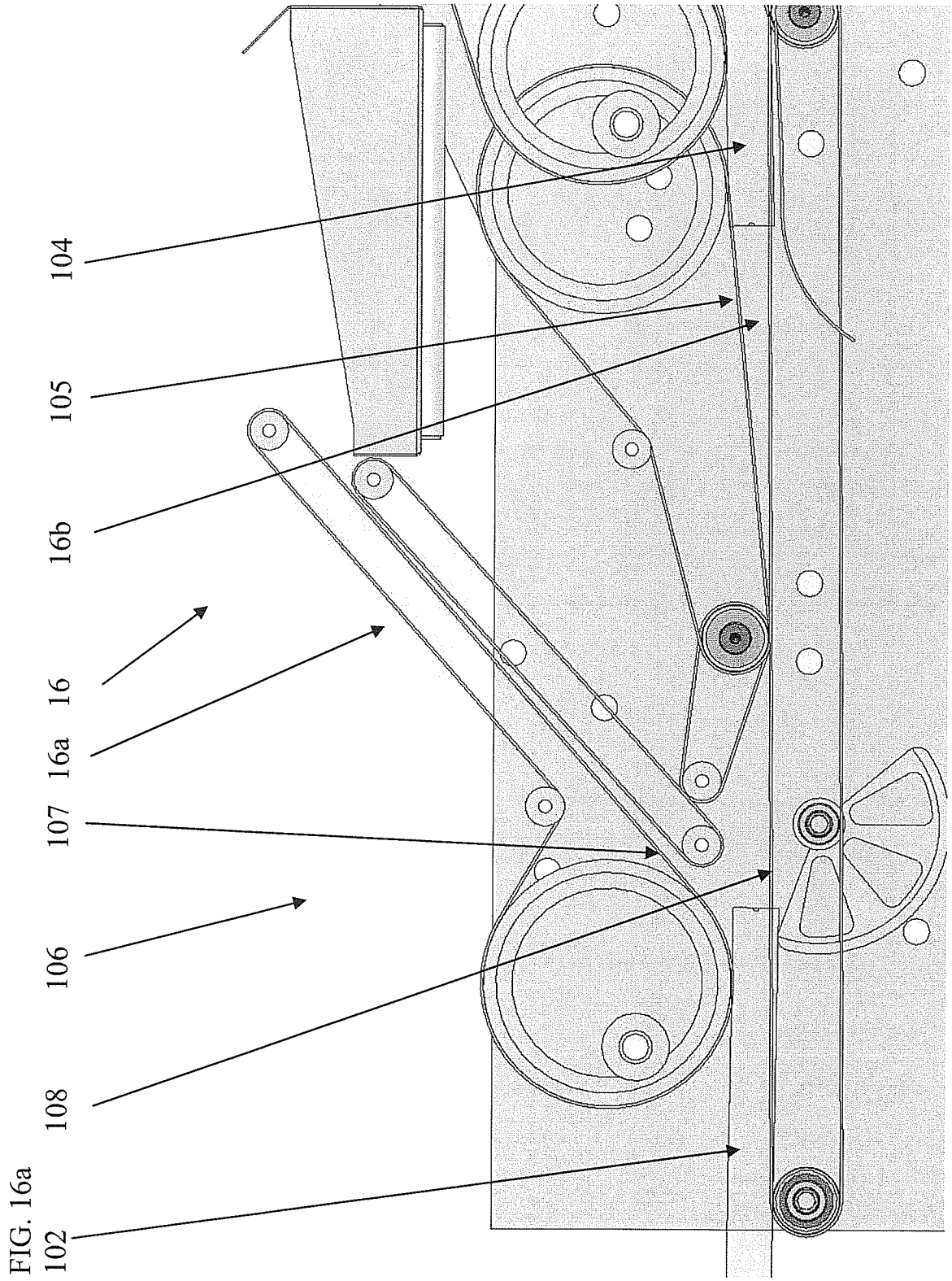


FIG. 16a

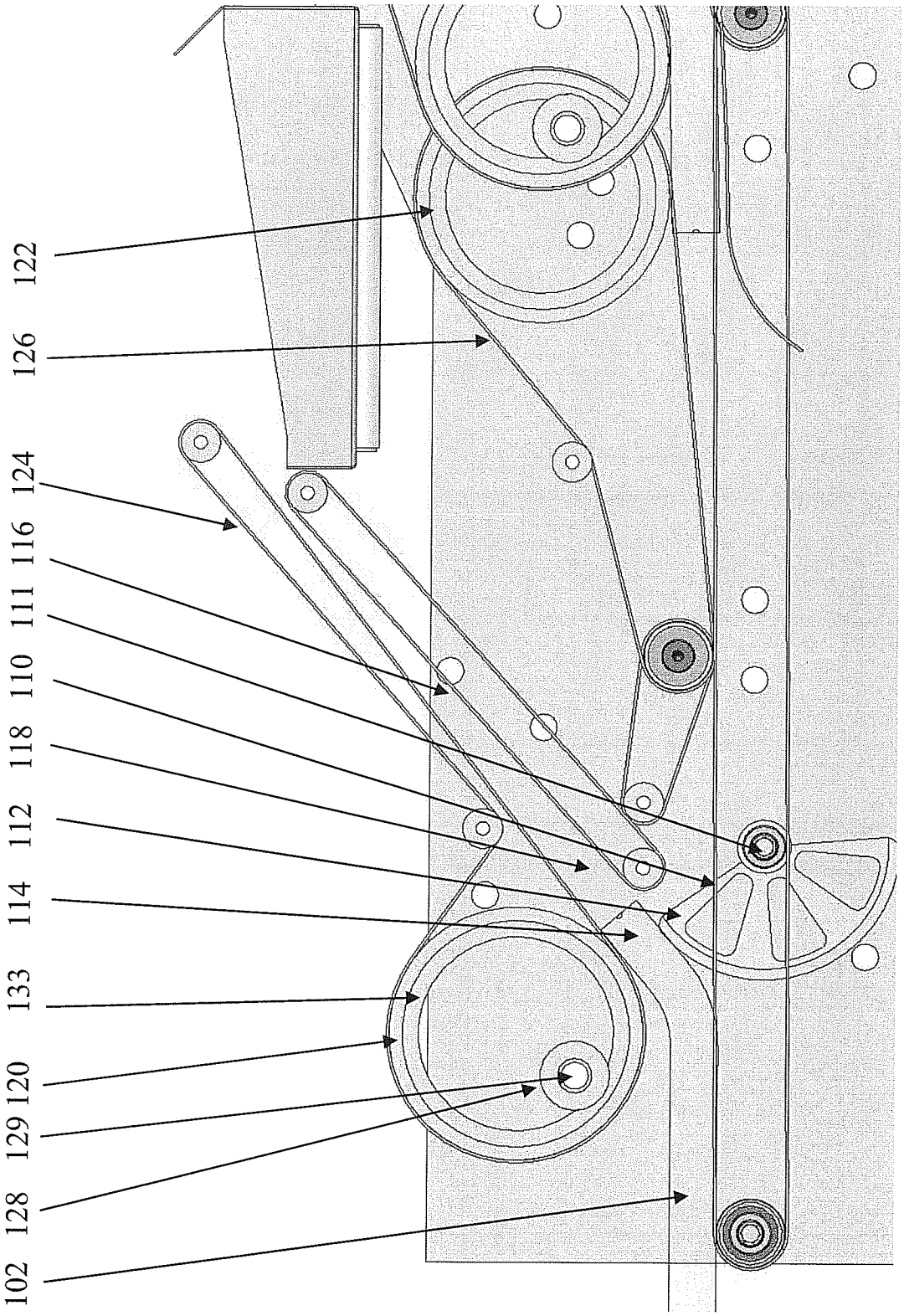


FIG. 16b

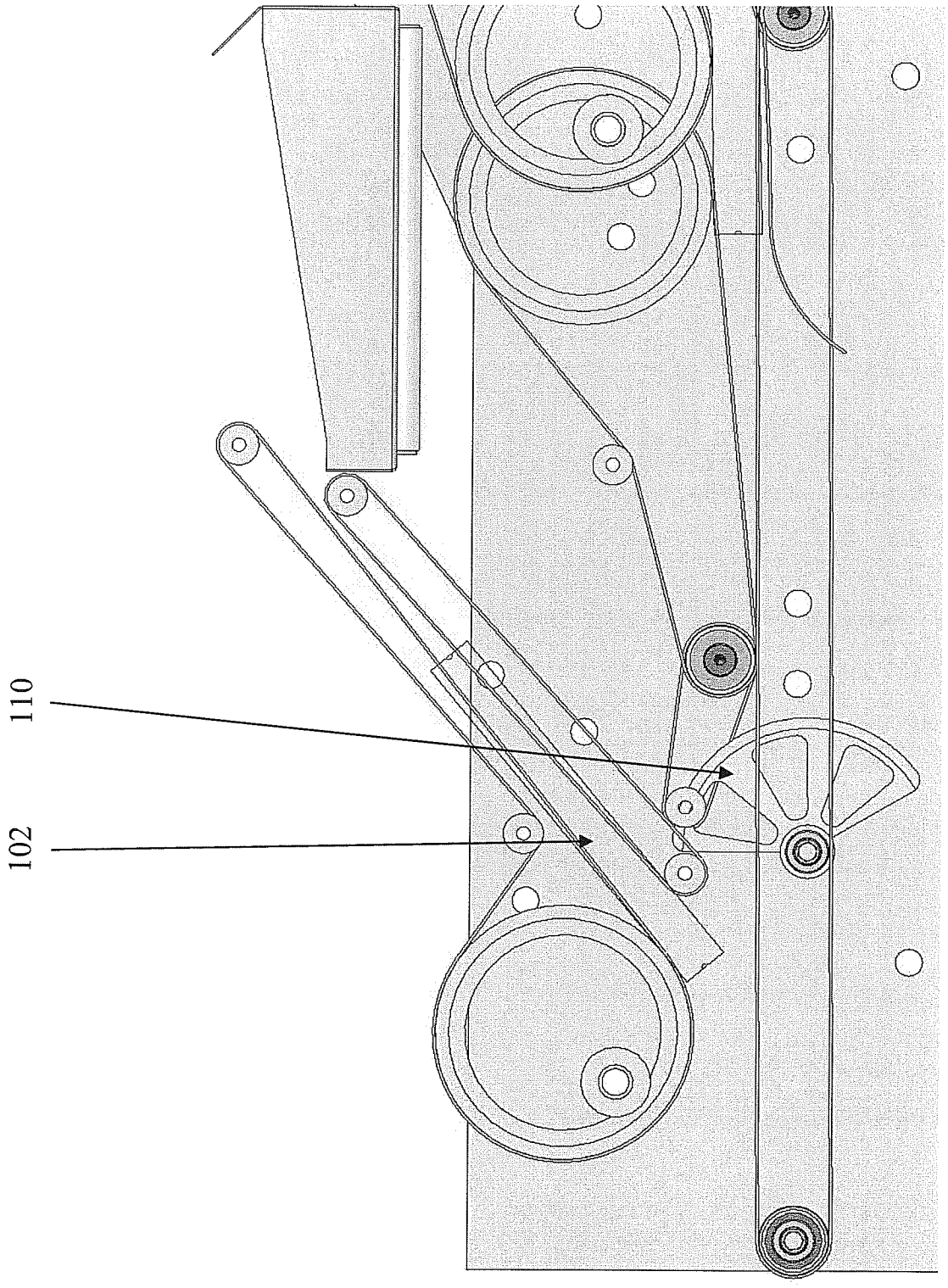


FIG. 16c

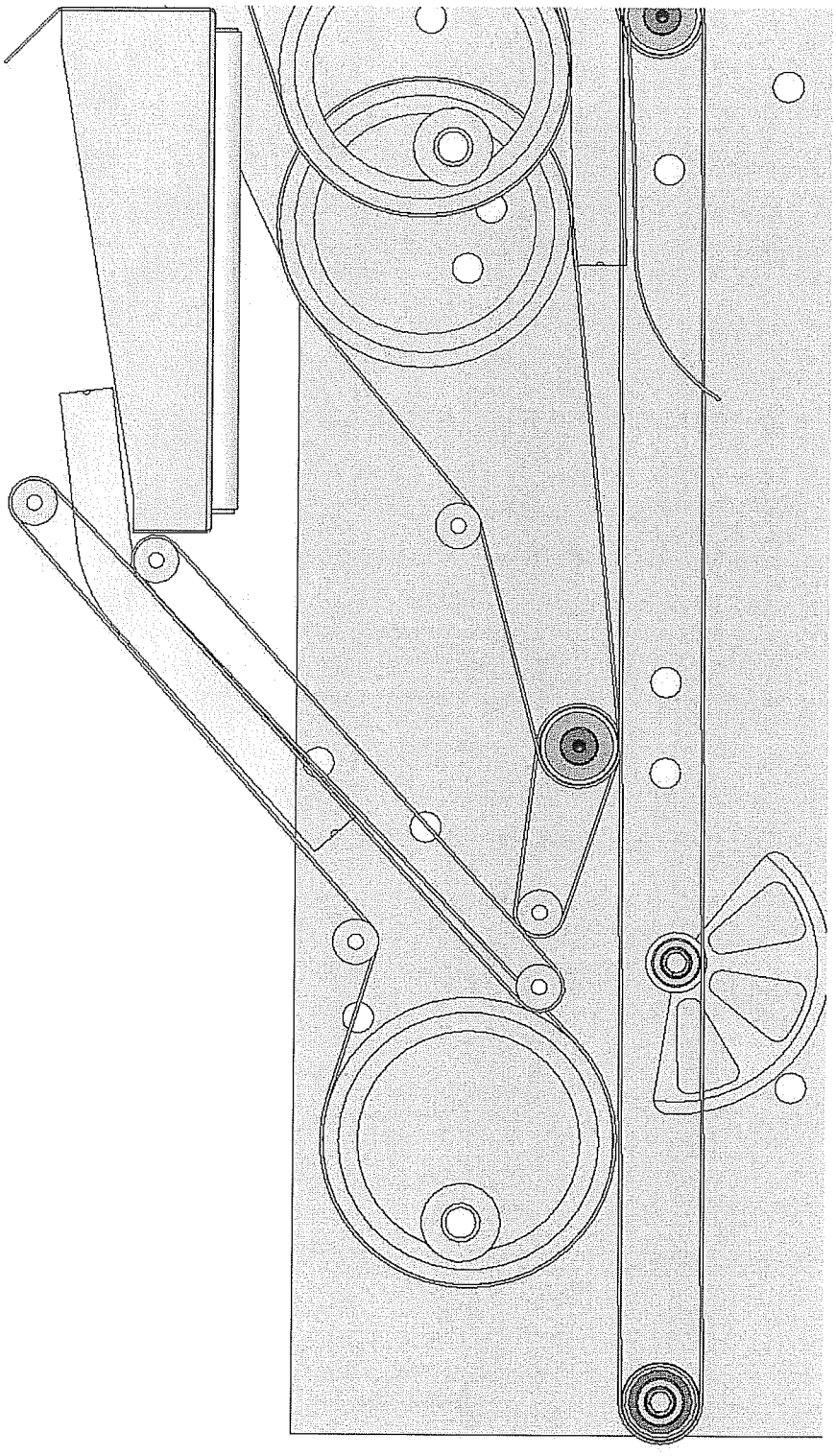


FIG. 16d

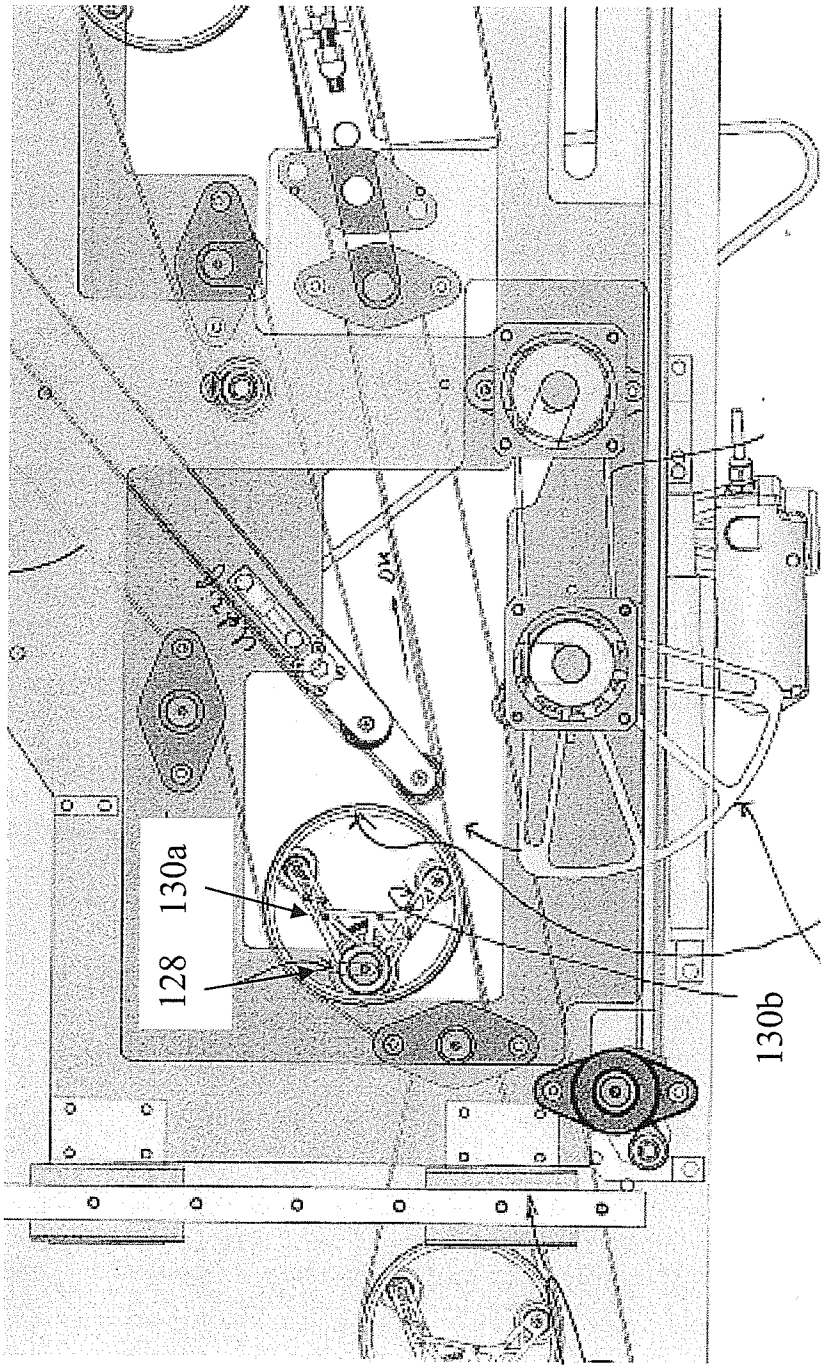


FIG. 17a

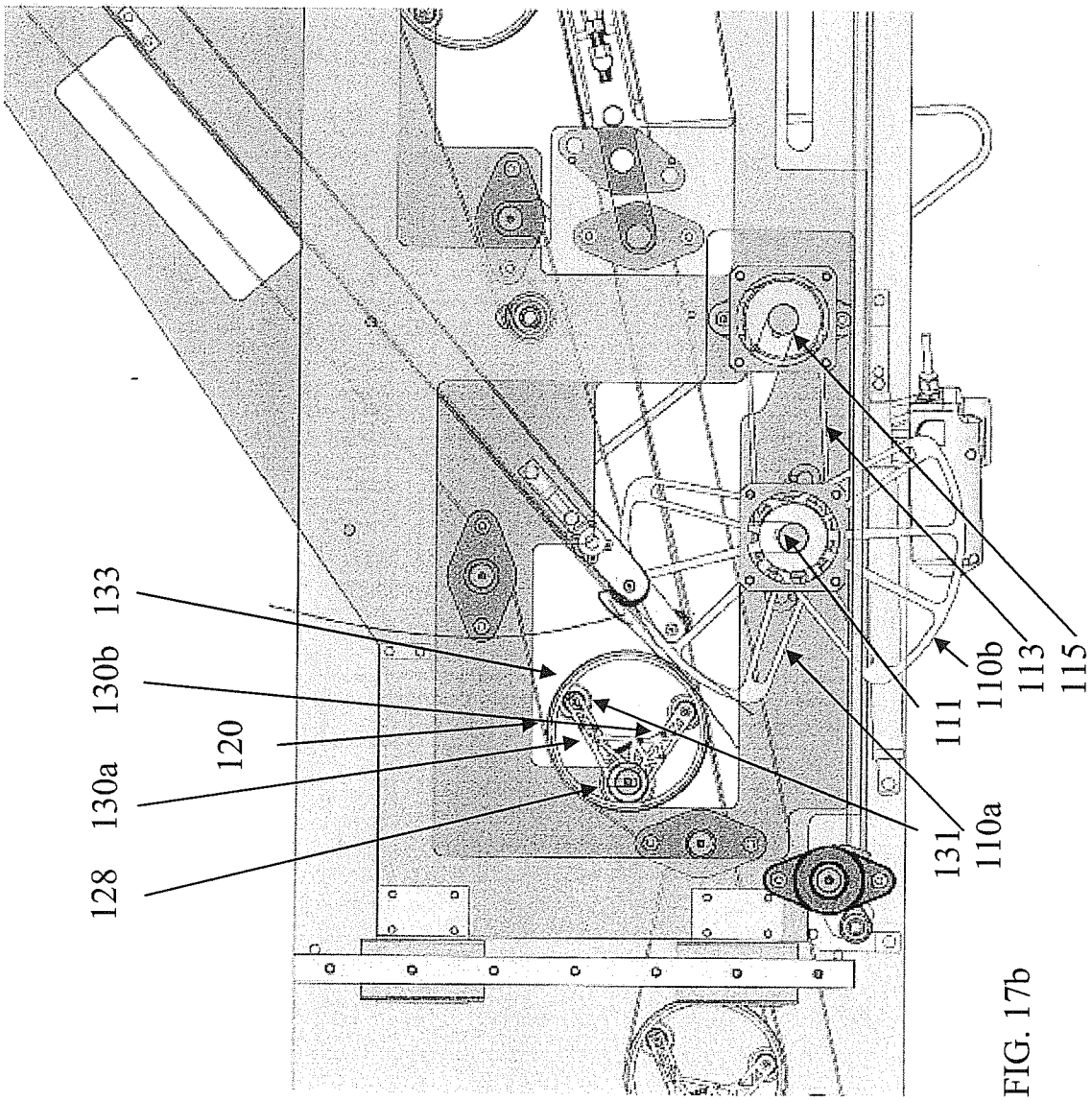


FIG. 17b

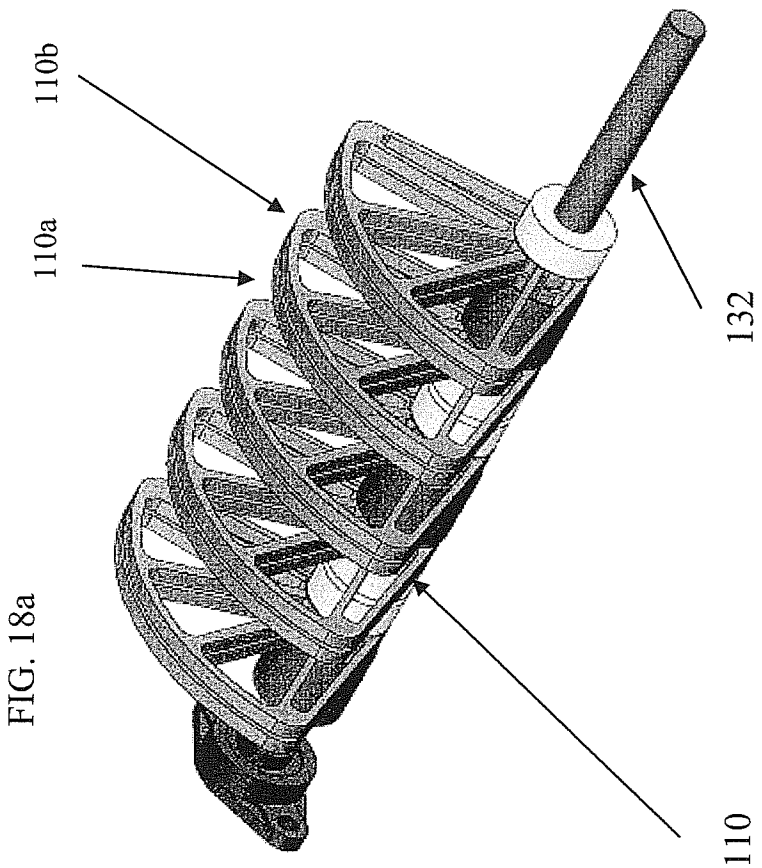


FIG. 18a

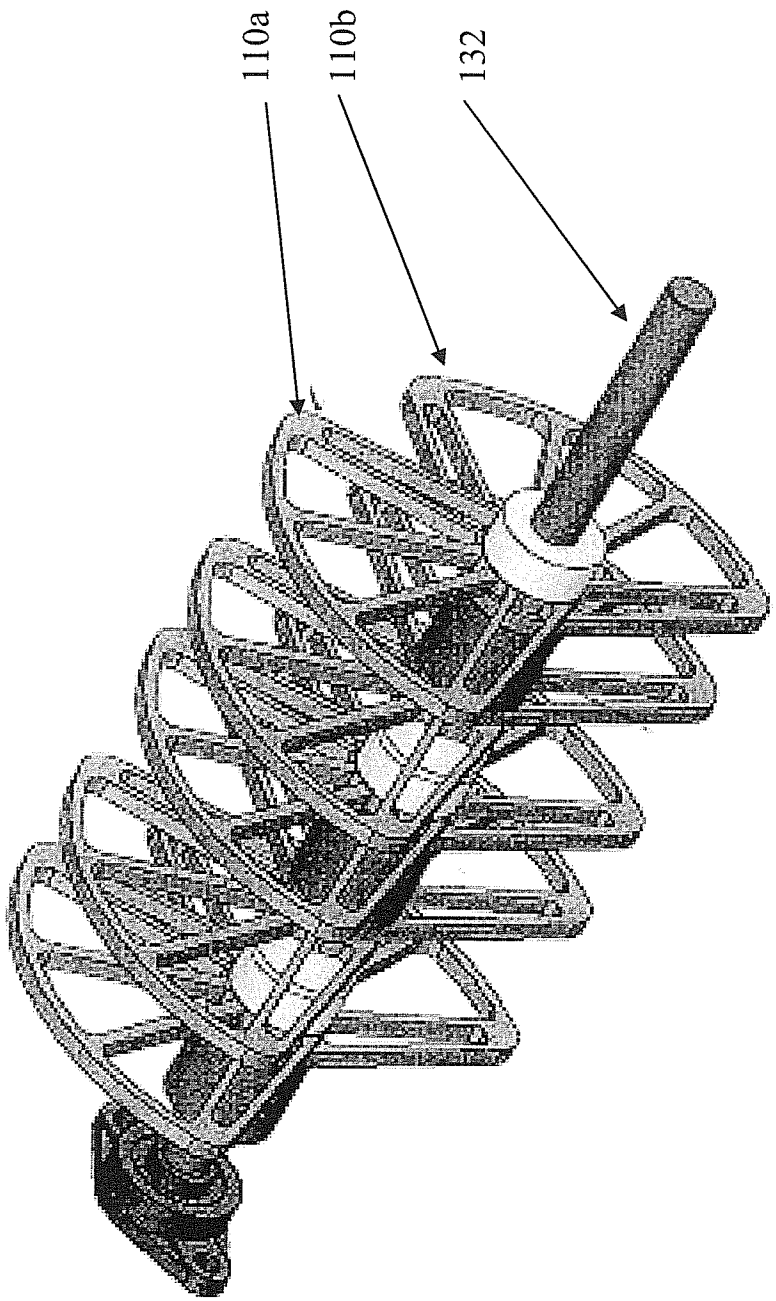


FIG. 18b

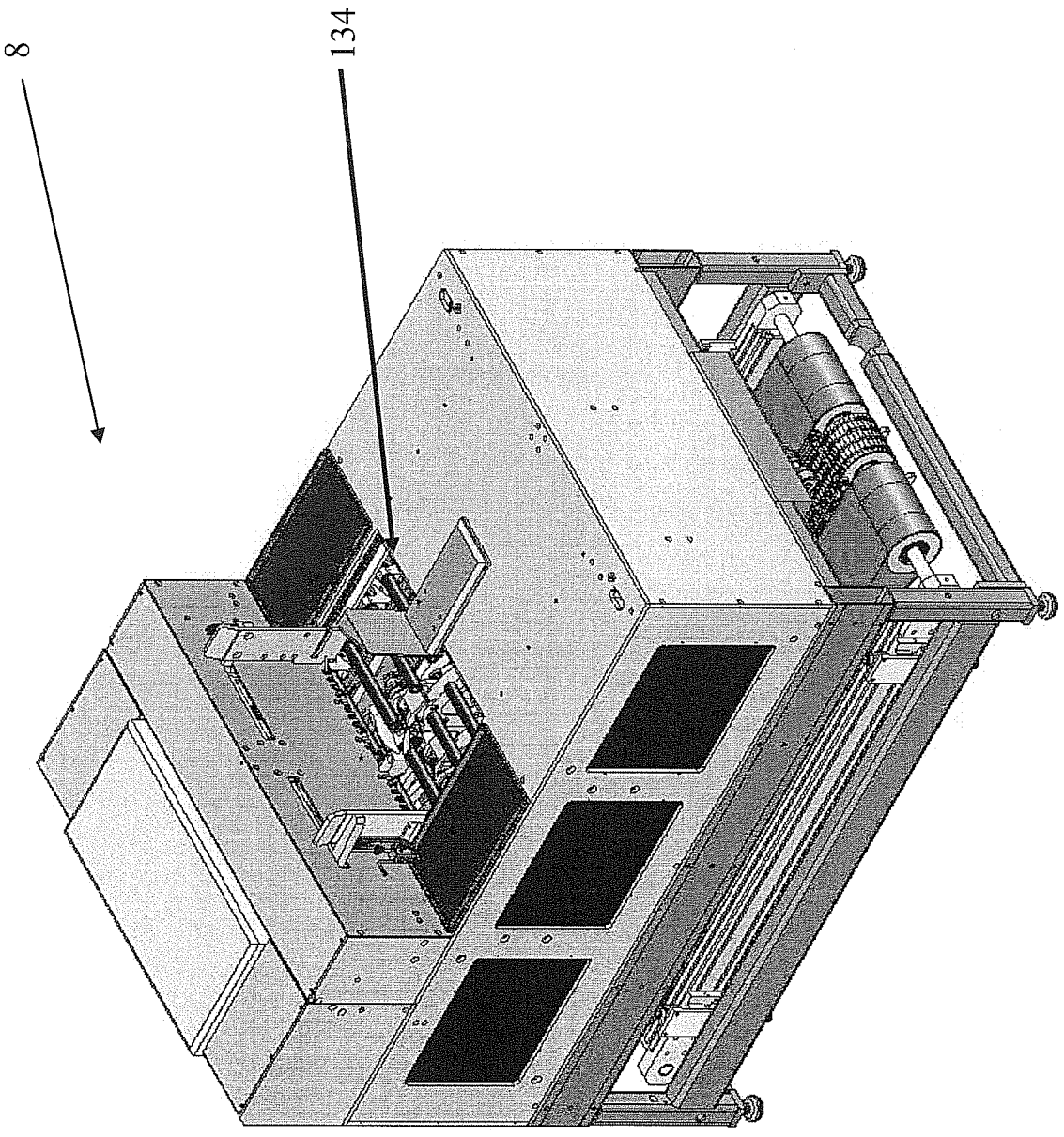


FIG. 19a

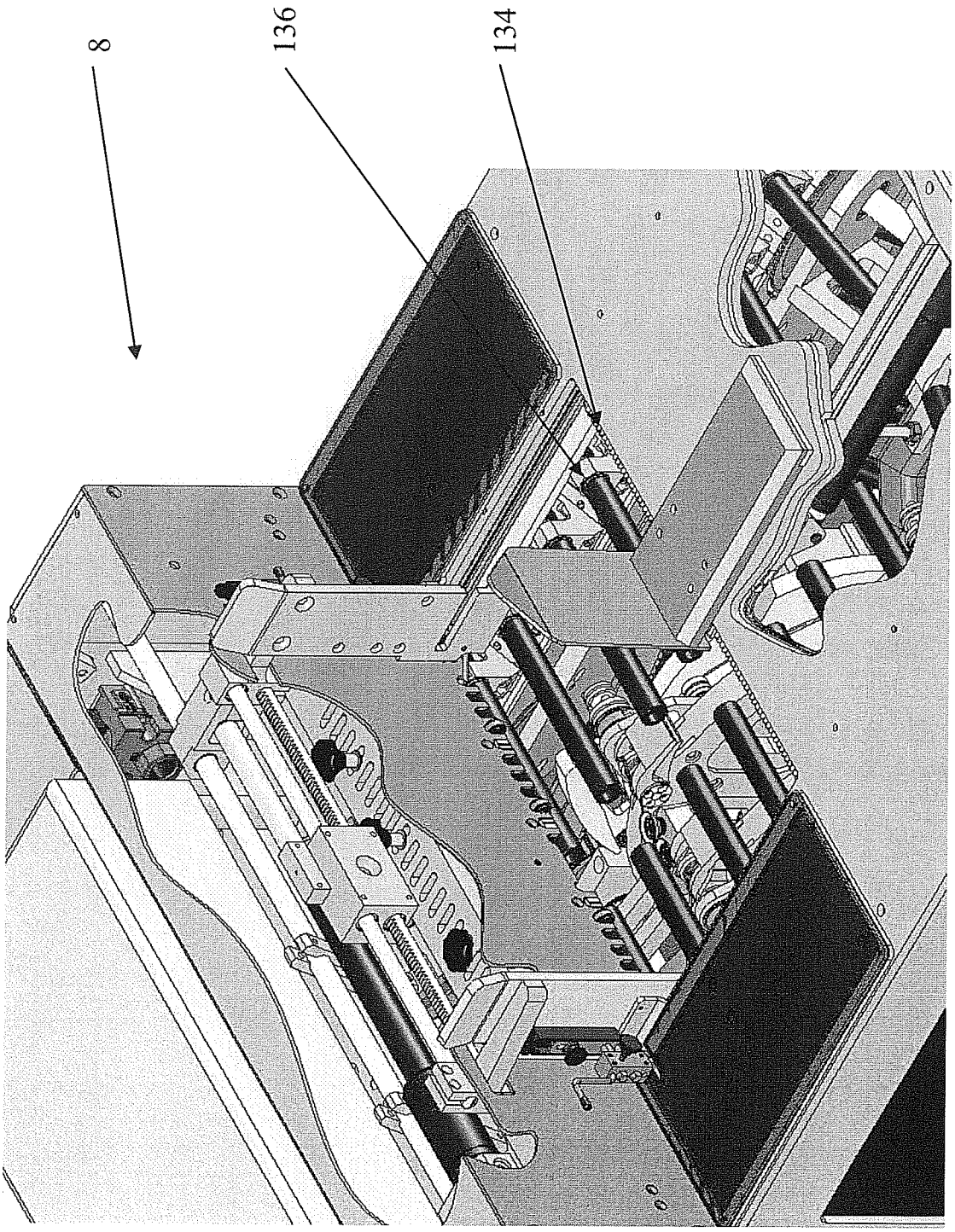


FIG. 19b

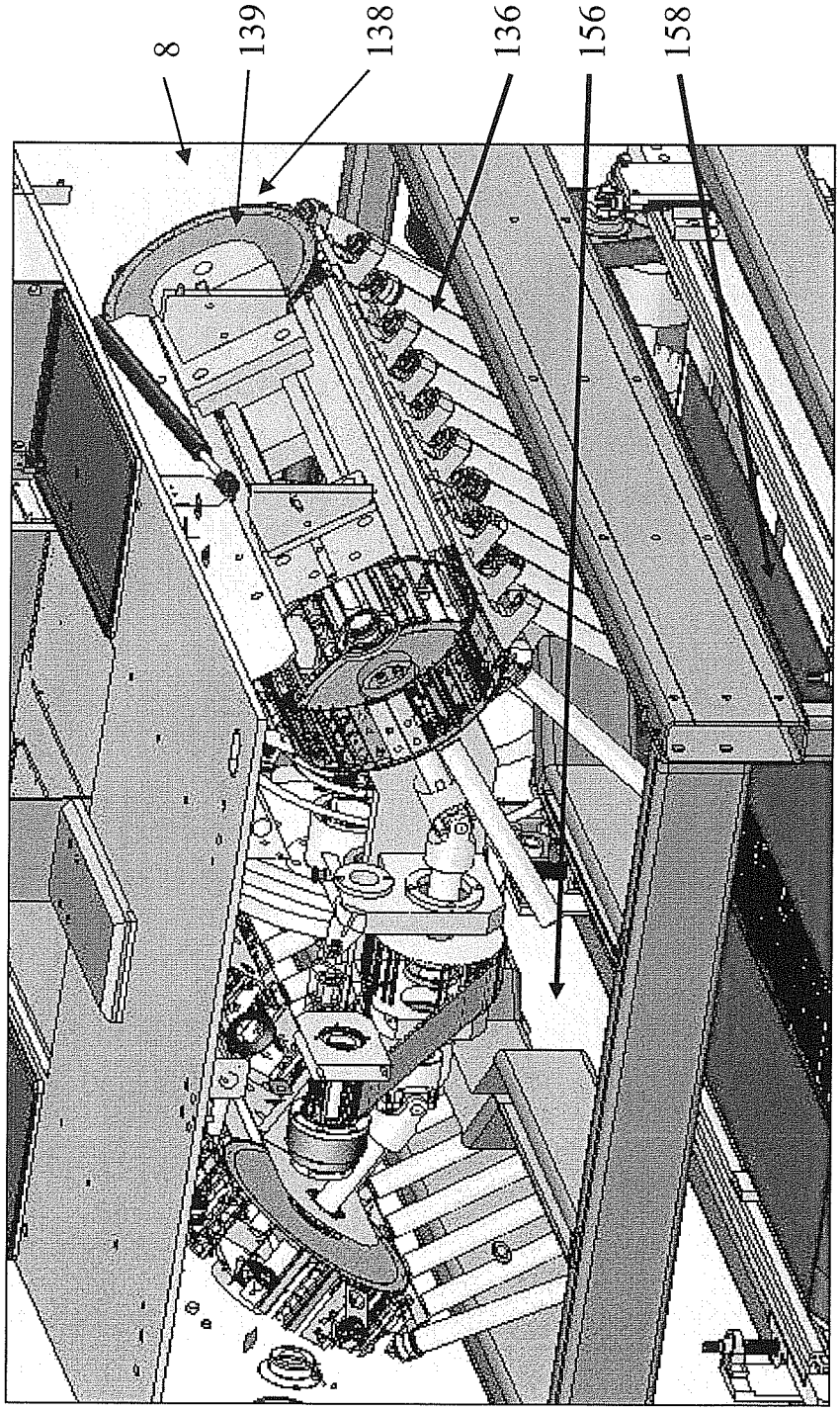


FIG. 19c

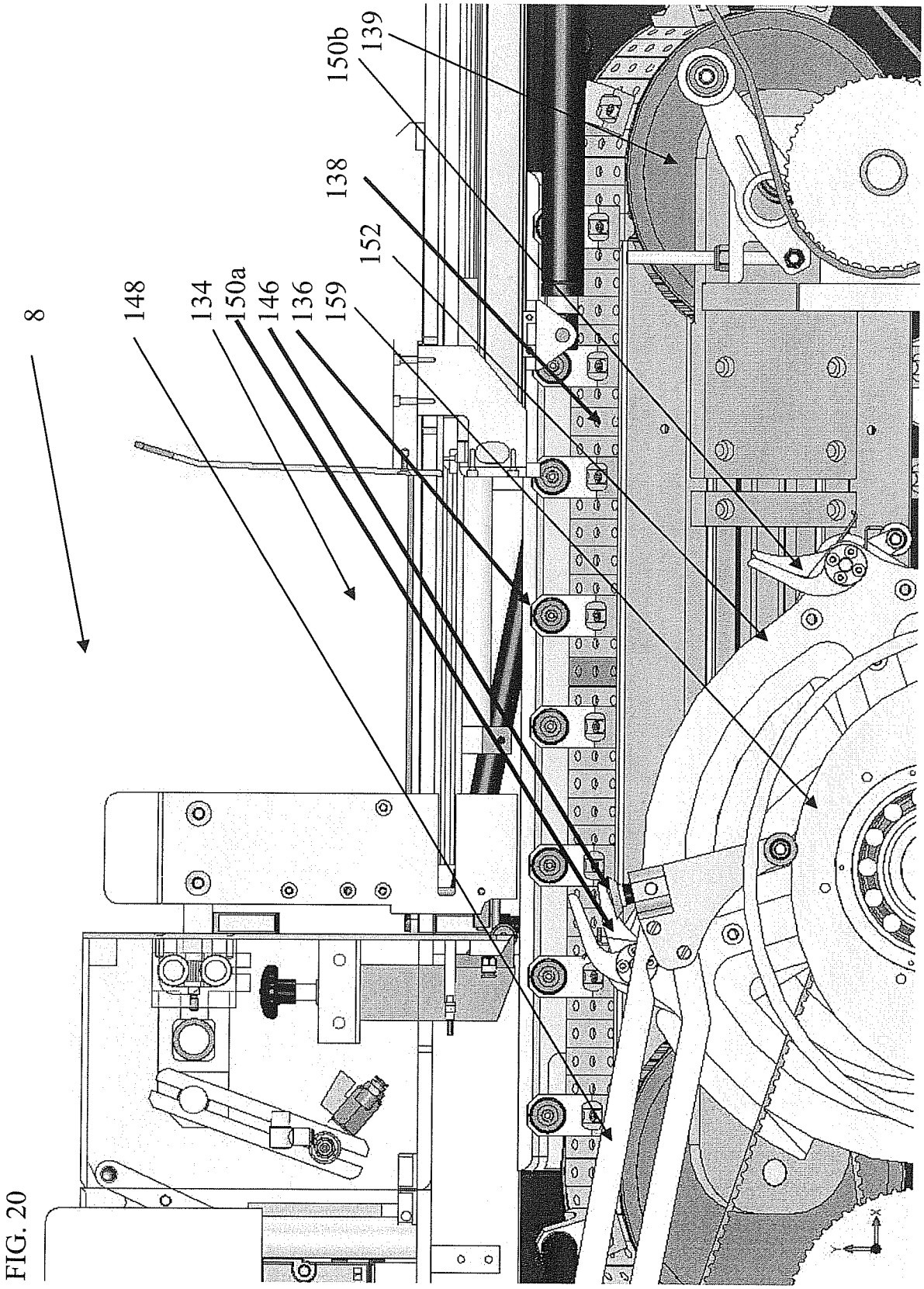


FIG. 20

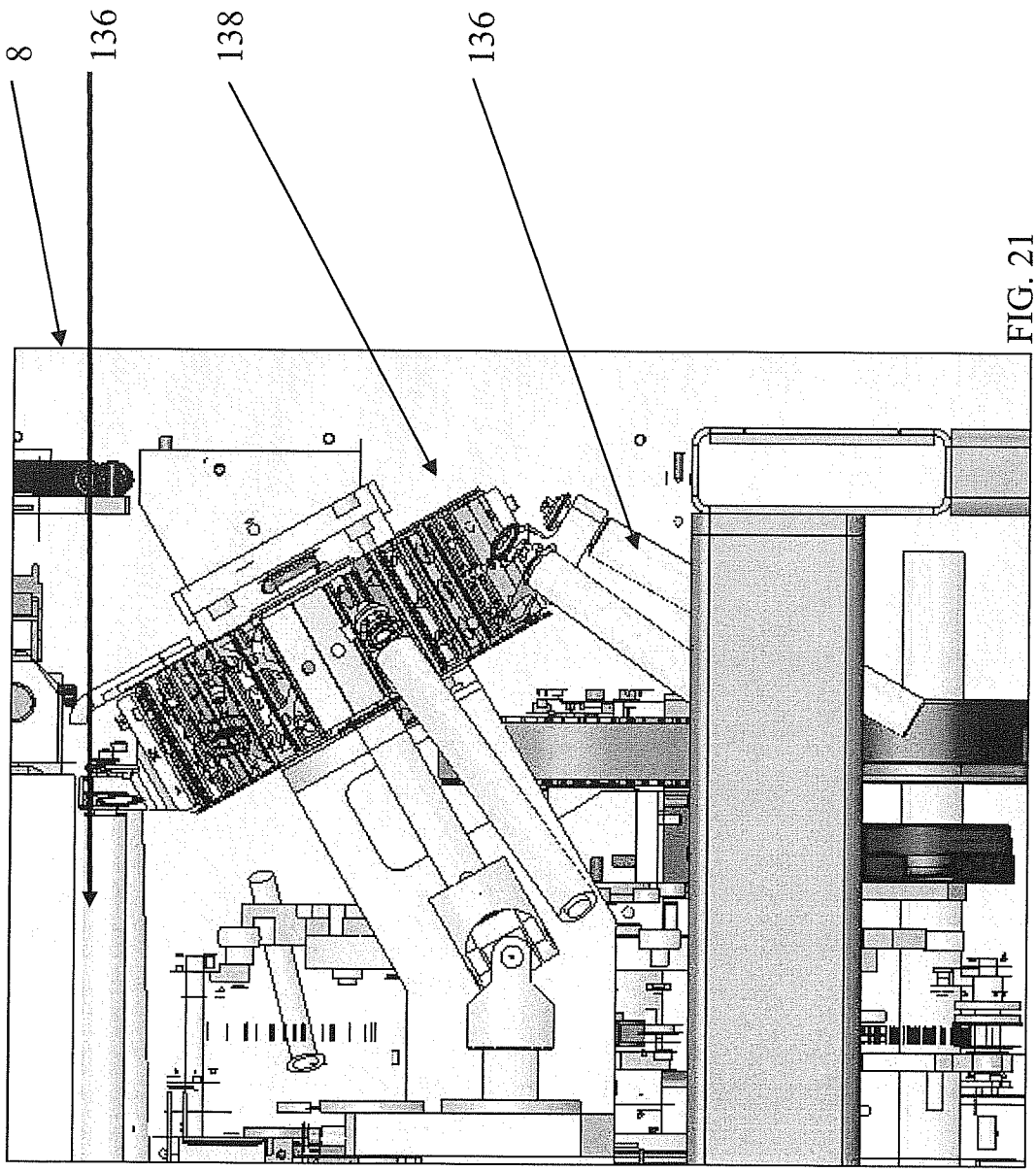


FIG. 21

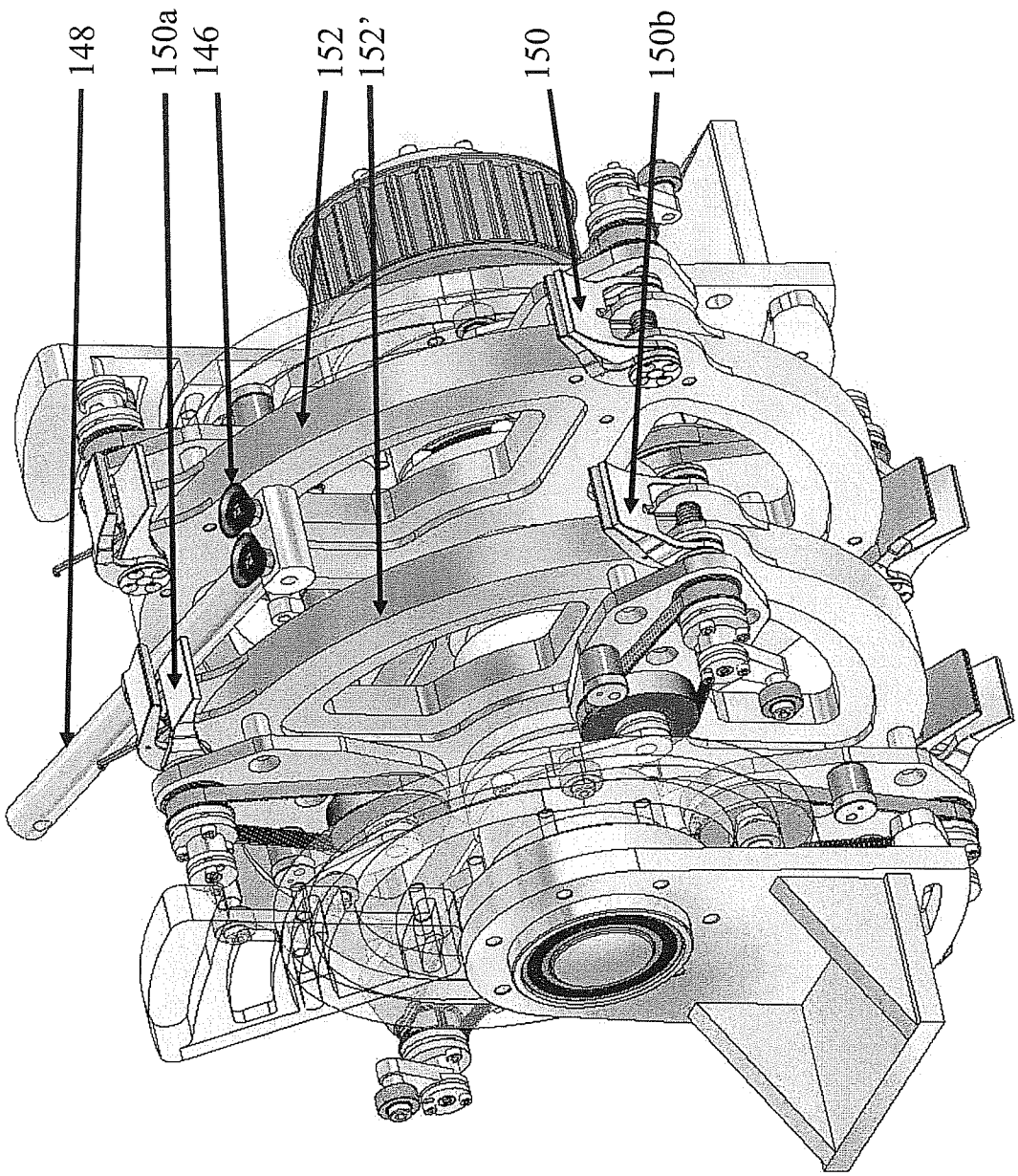


FIG. 22

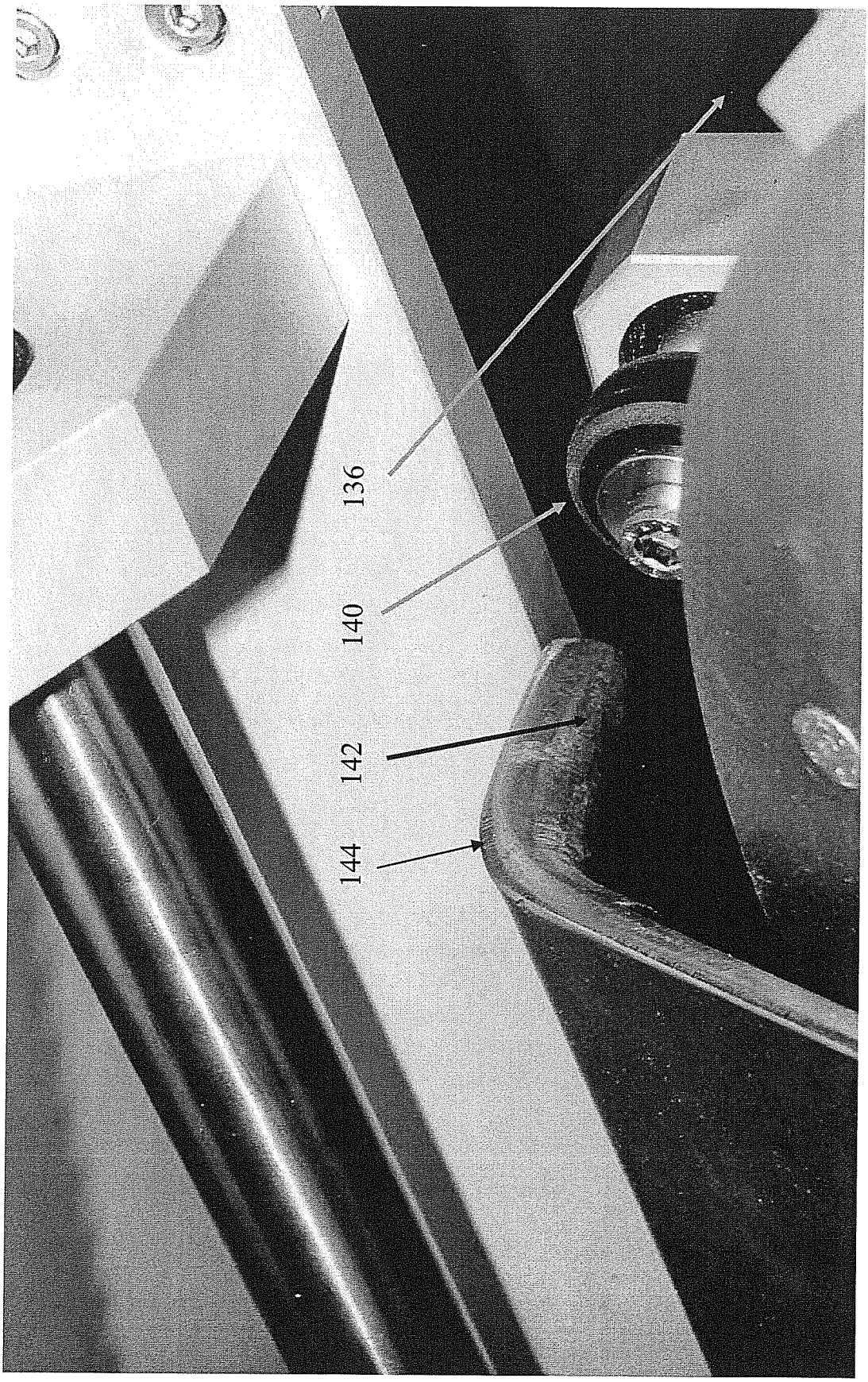


FIG. 23

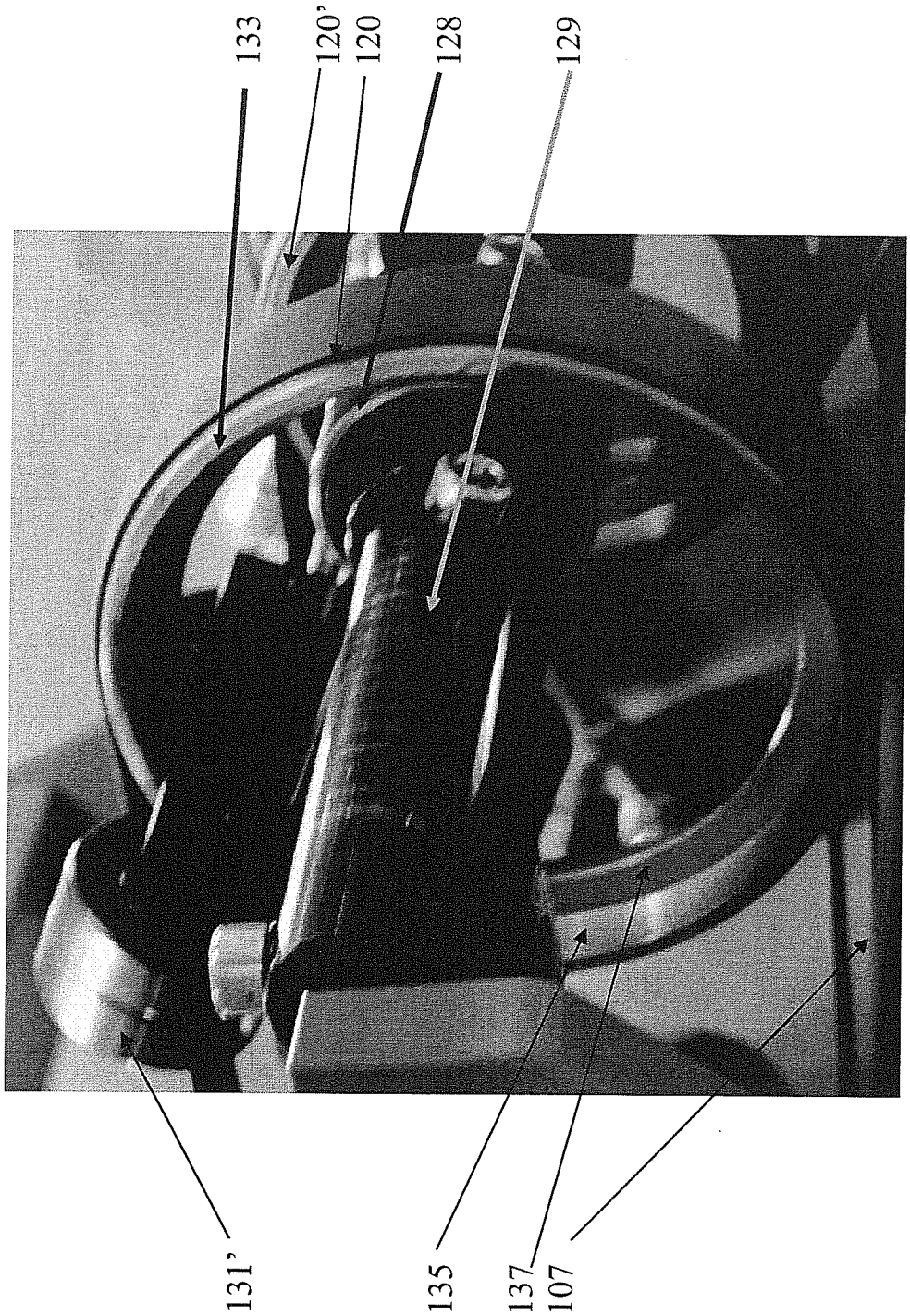


FIG. 24

INTERNATIONAL SEARCH REPORT

International application No
PCT/DK2008/050247

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65H39/065 B65H5/30

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)
B65H

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 050 851 A (GRAPHA HOLDING AG [CH]) 24 September 1991 (1991-09-24) column 9, line 6 - column 10, line 42; figures	1
A	DE 25 08 194 A1 (SCHICK GUENTHER DR ING) 9 September 1976 (1976-09-09) cited in the application the whole document	1-6

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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

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"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)

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 January 2009	14/01/2009

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

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/DK2008/050247

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5050851 A	24-09-1991	CH 674511 A5	15-06-1990
		DE 58900970 D1	23-04-1992
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