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(54) **FEEDER WITH DOUBLE DRIVE**

(57) The present invention relates to a feeder module for a converting machine. The he feeder module comprises a loading surface (24) configured to receive a stack of sheets and a sheet discharge mechanism comprising at least a first discharge conveyor and a second discharge conveyor, connected to a first drive shaft (33a)

and a second drive shaft (33b). Each drive shaft is configured to be driven independently from each other and at a different speed. The feeder module further comprises a sensing arrangement and a control unit is configured to receive detection signals from the sensing arrangement and determine a rotational error of each sheet.

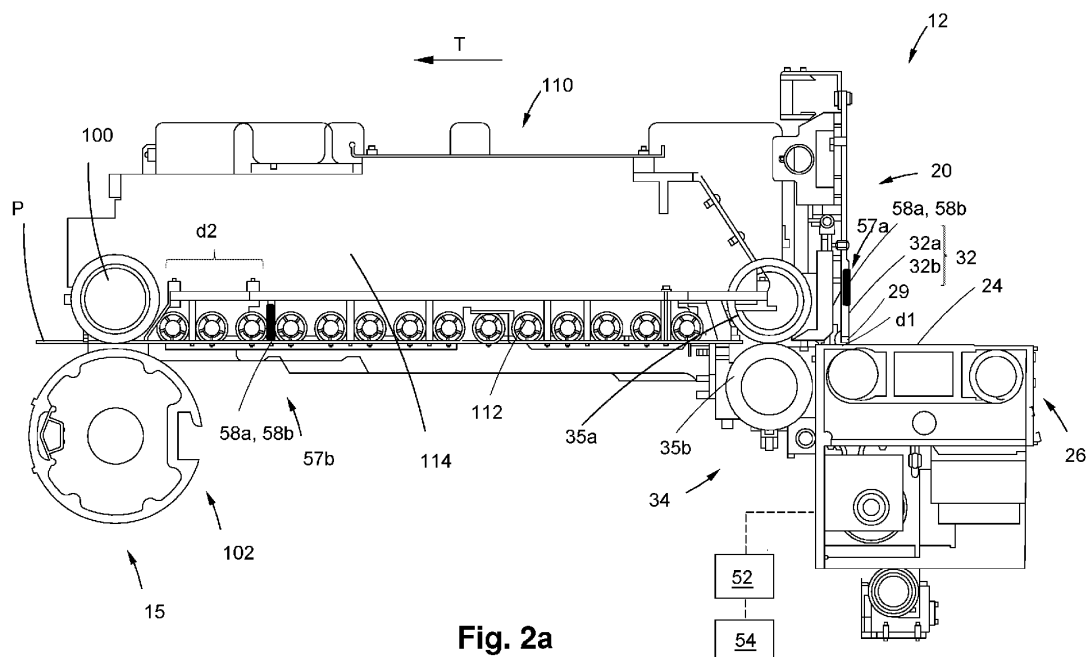


Fig. 2a

Description

Field of the invention

[0001] The present invention relates to a feeder module for a converting machine, such as a rotary printing press or a converting machine configured to print and cut sheets to produce packaging elements.

Background

[0002] Converting machines are used in the production of packaging elements such as flat-packed and folding boxes. Sometimes, the same converting machine is configured to print, cut and crease, and fold the sheet to form a packaging element.

[0003] However, it is also common to use several types of converting machines when producing a packaging element. For instance, a first machine in the form of a printing press will print the substrate, a second machine in the form of a die-cutting machine will shape the sheet to a cut-to-shaped blank and may also glue and fold the packaging element.

[0004] A common module for most converting machines is a feeder module. The feeder module comprises a loading surface onto which a stack of sheets or cut-to-shaped blanks can be placed. The feeder module is configured to discharge the sheets or blanks one by one into the converting machine and at a precise timing.

[0005] The sheets need to be discharged with a precise timing and conveyed with the front edge perpendicular to the direction of transportation. If the sheet becomes skewed, the printed motif will be applied on an incorrect position on the sheet.

[0006] However, there are variations in the sheet geometry, such as warps which may cause the front edge of the sheet to not be perfectly straight. Also, there is a variation depending on the position each stack is positioned on the feeder loading surface.

Summary

[0007] It is an object of the present invention to improve the accuracy of a feeder module and to discharge sheets in a straight manner such as to avoid that skewed sheets reach the printing units.

[0008] This object is solved by a feeder module according to claim 1.

[0009] According to a first aspect of the present invention, there is provided a feeder module for a converting machine, the feeder module comprises:

- a loading surface configured to receive a stack of sheets,
- at least a first discharge conveyor and a second discharge conveyor, and
- a drive mechanism configured to drive the first and second discharge conveyors, characterized in that

the drive mechanism comprises a first drive shaft and a second drive shaft, wherein the first discharge conveyor is connected to the first drive shaft and the second discharge conveyor is connected to the second drive shaft, and wherein each drive shaft is configured to be driven independently from each other and at a different speed, and wherein the feeder module further comprises a sensing arrangement comprising a first sensor and a second sensor, the first and second sensors being arranged at a distance from each other in the lateral direction, and wherein each sensor is configured to detect the passage of the sheet, and wherein a control unit is configured to receive detection signals from the sensing arrangement, determine a rotational error of each sheet and provide a rotational correction to each sheet by driving the first and second discharge conveyors at a different relative speed.

[0010] The invention is based on a realization that feeder can discharge the sheet in a straight manner by providing a rotation correction with the discharge conveyor. This is achieved by using a loading surface with a first and a second left and a right side which can be driven at different speeds.

[0011] Within the context of this application, the term "converting machine" includes machines which are only configured to print a sheet substrate or converting machines which further comprise cutting and shaping modules such as rotary die-cutters, slotting modules and folding modules.

[0012] The difference in speed is preferably a momentary acceleration or a deceleration.

[0013] In an embodiment, the first and second motors are located laterally of the loading surface. In another embodiment, the first and second motors are located in the center under the loading surface.

[0014] Each discharge conveyor comprises a plurality of transportation elements, wherein a first group of transportation elements are attached to the first drive shaft and a second group of transportation elements are attached to the second drive shaft. The group of transportation elements may be an assembly of belt conveyors or rollers.

[0015] The transportation elements may be in the form of an assembly comprising a plurality of belt conveyors, whereby each discharge conveyor comprises a separate assembly of belt conveyors. In another embodiment, the transportation elements may be in the form of an assembly comprising a plurality of rollers, whereby each discharge conveyor comprises a separate assembly of rollers.

[0016] The sensing arrangement is preferably located between the loading surface and a printing module. In an embodiment, the first sensor and second sensor are arranged laterally of a first gauge and a second gauge. The first and the second sensors may be respectively attached to the first and second gauges.

[0017] In an embodiment, a sensing arrangement may be arranged downstream of the feeder gauge and upstream of a printing unit. The printing unit is preferably a flexographic printing unit.

[0018] In an embodiment, both a first sensing arrangement and a second detector are provided, and wherein each detector comprises a first sensor and a second sensor.

[0019] In an embodiment, the control unit is configured to calculate a rotational error of each sheet and provide a correction to each sheet by providing a correction corresponding to the rotational error. The correction can be characterized as a "dynamic correction".

[0020] In an embodiment, a flexographic printing cylinder is provided with a connection end which is movable by a displacement member such that the axis of the printing cylinder is rotated.

[0021] Additionally, or alternatively the feed roll assembly may be configured to provide an angled correction to each sheet.

[0022] The vacuum transfer comprises a first and a second lateral side, and wherein the transportation elements lateral sides are configured to provide an angled correction to each sheet. The transportation elements may be belt conveyors or rollers.

[0023] The control unit is configured to determine a tendency rotation error for a sample of sheets. and wherein the tendency rotation error is preferably determined for each stack.

[0024] The tendency rotation error may be determined with a sample. In a variant, the tendency may be continuously calculated by continuously determining an average for a sample of sheets. Alternatively, the tendency may be determined at a specific occasion, such as in a calibration phase of the converting machine. The calibration phase may be initiated when a loader charges a new stack into the converting machine. Alternatively, the tendency may be continuously calculated as a moving average.

[0025] The sample may for instance contain between 5 and 10 sheets.

[0026] The tendency rotation is determined from the detection signals from a sensing arrangement located between the feeder gauge and the first printing unit.

[0027] The control unit is further configured to provide a tendency correction in the form of a momentary or constant speed difference of the first and second drive shafts, said tendency correction being the same for a plurality of sheets.

Brief description of the drawings

[0028] The invention will now be described with reference to the appended drawings, in which like features are denoted with the same reference numbers and in which:

- Figure 1 is a schematic perspective view of a converting machine in the configuration of a flexographic

printing press;

- Figure 2a is a schematic cross-sectional view of a feeder module according to an embodiment of the present invention;
- Figure 2b is a detailed view of a stack of sheets on the feeder loading surface;
- Figure 3 is a schematic cross-sectional view of a loading surface of the feeder module according to an embodiment of the present invention;
- Figure 4 is a schematic top view of a loading surface of figure 3;
- Figures 5a and 5b are schematic cross sectional views of a sheet discharge mechanism according to an embodiment of the present invention;
- Figure 6 is a schematic cross-sectional view a loading surface according to another embodiment of the present invention;
- Figure 7 is a schematic partially cut-away of the loading surface and the discharge conveyor according to an embodiment of the present invention;
- Figure 8 is a cross-sectional schematic view of displacement mechanism of a flexographic printing cylinder according to an embodiment of the present invention; and

Detailed description

[0029] Referring to the figures and in particular to figure 1 which illustrates a converting machine 1 in the form of printing press machine. Even if not illustrated, the present invention can be used for other converting machines such as flatbed die-cutters, rotary die cutters or flexo-folder gluers which further comprise a converting unit comprising a slotter assembly or a rotary-die cutting assembly. These machines may be provided with the same feeder module which will be described in the following.

[0030] As illustrated in figure 1, the converting machine may comprise successively in a direction of transportation T: a loader 10 for automatically loading stacks of sheets 2, a feeder module 12, a printing module 14 comprising plurality of printing units 15, and a delivery module 16 which may include a stacker device 17, a bundler and a palletizer module. Optionally, the converting machine 1 may further comprise a digital printing module (not illustrated).

[0031] A main operator interface 18 may also be provided in the proximity of the converting machine.

[0032] As illustrated in figures 2a, 2b and 3, the feeder module 12 comprises an upper feeder assembly 20 and a

lower feeder assembly 22. The upper feeder assembly 20 and the lower feeder assembly 22 are mounted to a common chassis 37 of the feeder module 10.

[0033] The lower feeder assembly 22 comprises a loading surface 24, a first discharge conveyor 25a, a second discharge conveyor 25b. The loading surface 24 is configured to receive a stack S of sheets 2 and the discharge conveyors 25a, 25b are configured to drive the sheets 2 one by one into the converting machine 1 in the direction of transportation T.

[0034] The upper feeder assembly 20 comprises a gauge 32. The gauge 32 has a distal vertical end 29 which is arranged at distance d1 from the loading surface 24. The distance d1 between the distal vertical end 29 and the loading surface 24 defines a clearance through which the lowermost positioned sheet 2 in the stack S can pass.

[0035] The loading surface 24 is a flat surface which is configured to receive stacks S of sheets 2. The stack of sheets S can be placed on the loading surface 24 by a loader module 10 as the one described in document EP2408698B1. The loading surface 24 is attached to the chassis 37 of the feeder module.

[0036] The first and the second discharge conveyors 25a, 25b may comprise transportation elements 30 in the form of at least one belt conveyor 30 or a plurality of rollers 30. The first and the second discharge conveyors 25a, 25b respectively comprises at least one belt conveyor 30. In an advantageous embodiment illustrated in figures 3, 4, 5a, 5b and 7, each discharge conveyor 25a, 25b comprises an assembly comprising a plurality of belt conveyors 30 arranged side by side.

[0037] As illustrated in figure 4, the loading surface 24 may comprise a plurality of elongated surfaces 42. The elongated surfaces 42 are spaced apart from each other in the lateral direction L, such that a slot 44 is formed in-between each elongated surface 42. The belt conveyors 30 are located in the slots 44.

[0038] Alternatively, as illustrated in figure 6, the first and the second discharge conveyors 25a, 25b may respectively comprise a first assembly of drive rollers and a second assembly of drive rollers 30. Each discharge conveyor 25a, 25b comprises a plurality of drive rollers 30.

[0039] In the embodiment comprising drive rollers 30, the drive rollers 30 are located in apertures 41 in the loading surface 24. The apertures 41 have a dimension corresponding to the size of the drive rollers 41.

[0040] As best seen in figure 3, the first and second discharge conveyors 25a, 25b may be arranged in a suction box 36. The suction box 36 may comprise a plurality of suction compartments 38. The compartments 38 may be separated from each other by partition walls 40.

[0041] In an embodiment, the partition walls 40 are arranged such that suction compartments 38 are symmetric in relation to a center axis A of the loading surface 24. In an embodiment, there may be two suction com-

partments 38 located on each side of the center axis A. Each suction compartment 38 may be connected to a separate vacuum pump. In another embodiment (non-illustrated), there may be three suction compartments, in the form of a central suction compartment 38 and a first lateral suction compartment 38 and a second lateral suction compartment 38. The central suction compartment 38 may be connected to a first suction pump and the first and the second lateral suction boxes may be both connected to a second suction pump.

[0042] Alternatively, each suction compartment 38 may be connected to a separate vacuum pump.

[0043] Referring back to figure 2a, the feeder module 12 further comprises a feed roll assembly 34. The feed roll assembly 34 is located on a downstream side of the gauge 32 and is configured to grasp each sheet 2 and pull the sheet 2 from the loading surface 24. The feed roll assembly 34 comprises an upper feed roller 35a and a lower feed roller 35b.

[0044] The first printing unit 15 located after the feeder module 12 may comprise a flexographic printing assembly configured to print on a bottom side of the sheet 2. The first printing unit 15 may thus comprise an anvil 100 arranged vertically above the printing cylinder 102. The anvil 100 may be stationary mounted in a chassis of the printing unit 15.

[0045] Alternatively, the first printing unit 15 located after the feeder module 12 may comprise a flexographic printing assembly configured to print on a top side of the sheet 2.

[0046] Alternatively, the first printing unit 15 may be a digital printing unit. It is also possible that the first printing unit 15 is a flexographic printing unit configured to print on a top side of the sheet.

[0047] A transfer unit 110 is located between the feed roll assembly 35 and the first printing unit 15. The transfer unit 110 comprises drive elements 112 such as rollers or conveyor belts which are configured to drive the sheet 2 forward in the direction of transportation T. The drive elements 112 are preferably located in a suction box 114 provided with suction openings around the drive elements. The suction apertures are configured to make the sheet adhere to the drive elements 112. A vacuum suction pump is connected to the suction box 114.

[0048] In an embodiment (not illustrated), the loading surface 24 may be vertically movable and the belt conveyors 30 of the first and second discharge conveyors 25a, 25b are stationary. In such a way, the loading surface moves up and down to bring the sheets 2 into and out of contact with the discharge conveyors 25a, 25b.

[0049] In another embodiment, as illustrated in figures 2, 4, 5a and 5b, the loading surface 24 is stationary while a sheet discharge mechanism 26 move the belt conveyors 30 of the discharge conveyors 25a, 25b move in unison between a discharge position DP in which the discharge conveyors 25a, 25b are located vertically above the loading surface 24, and a clearing position CP in which the discharge conveyors are located under-

neath the loading surface 24.

[0050] In the discharge position DP, the lowermost positioned sheet 2 in the stack S is brought into contact with the belt conveyors 30 which drives the sheet 2 forward in the direction of transportation T.

[0051] As best seen in figure 7, each discharge conveyor 25a, 25b is connected to a separate first and second drive mechanisms 31a, 31b. The first and second drive mechanisms 31a, 31b each comprise a respective drive shaft 33a, 33b and a respective motor 39a, 39b.

[0052] As best seen in the embodiment of figure 7, there is at least one belt conveyor 30 connected to each of the first and second drive shafts 33a, 33b. Preferably, a first belt assembly is connected to a first drive shaft 33a and a second belt assembly is connected to a second drive shaft 33b. Each belt assembly comprises a plurality of belt conveyors 30. A drive roller 56 of each belt conveyor 30 is connected to the belt drive mechanism 31a, 31b.

[0053] In the embodiment of figure 5, a first and second assemblies of the drive rollers 30 can be connected to a respective first and second motors 39a, 39b via a plurality of transfer mechanisms such as pulleys (not illustrated).

[0054] The first drive mechanism 31a and second drive mechanism 31b may further comprise a first drive pulley 37a. Similarly, the second drive mechanism 31b may further comprise a second drive pulley 37b. The drive pulleys 37a, 37b are transferring a rotation from the motors 39a, 39b to each of the respective drive shafts 33a, 33b. It may also be possible for each drive shaft 33a, 33b to be connected to two or more drive pulleys. Alternatively, each of the drive shafts 33a, 33b may be connected directly to each respective motor 39a, 39b.

[0055] In such a way, the first and second discharge conveyors 25a, 25b can be driven independently from each other. The first and second motors 39a, 39b can be driven at different speeds which allows a different transportation speed of the first and second discharge conveyors 25a, 25b. The speed difference can be a momentary speed difference such as an acceleration or a deceleration. Alternatively, the speed difference may be a constant speed difference.

[0056] The first and second motors 39a, 39b can be located under the loading surface 24. In another variant (non-illustrated), the first and the second motors 39a, 39b may be located on opposite exterior lateral sides of the loading surface 24.

[0057] Hence, the driving connection from each respective motor 39a, 39b and to each respective drive shaft 33a, 33b can be located the center of the loading surface. Alternatively, the driving connection between each respective motor 39a, 39b to each drive shaft 33a, 33b can be in an exterior portion of the loading surface 24.

[0058] As best seen in figure 2a, the feeder module 12 further comprises a skewing detection system 50 configured to detect a rotation error of each sheet 2 as it is

conveyed in or released from the feeder module 12. The rotation may be an error measured as a positive or negative angle α .

[0059] The skewing detection system 50 comprises a control unit 52, a memory 54, at least one sensing arrangement 57a, 57b configured to detect the passage of the sheet 2.

[0060] The at least one sensing arrangement 57a, 57b comprises a first sensor 58a and a second sensor 58b. The first and second sensors 58a, 58b are preferably optical sensors configured to detect a contrast or a difference in reflected light. Examples of such sensors include photoelectric cells and laser scanners.

[0061] The first and second sensors 58a, 58b are arranged at a distance from each other in the lateral direction. The lateral direction L is perpendicular to the direction of transportation T. In such a way, the first sensor 58a provides a first detection signal and the second sensor 58b provides a second detection signal each time a sheet 2 passes the sensing arrangement 57a, 57b. From the time of each detection signal, the control unit 52 may calculate a rotation error of the sheet 2. The rotation error occurs when there is a time difference in the detection signals.

[0062] Preferably the sensors 58a, 58b are configured to detect the passage of the leading edge of the sheet 2.

[0063] The sensing arrangement 57a, 57b is located between the loading surface 24 and a first printing module 15 in the direction of transportation T. The first sensor 58a and second sensor 58b may be arranged laterally of a first gauge 32a and a second gauge 32b. For instance, the first and the second sensors 58a, 58b may be respectively attached to the first and second gauges 32a, 32b. Alternatively, the sensors 58a, 58b may be attached to the feeder chassis 37.

[0064] In another embodiment, the first and second sensors 58a, 58b may be arranged between the feeder gauges 32a, 32b and a first printing unit 15 in the direction of transportation. Hence, the first and second sensors 58a, 58b are arranged downstream of the feeder gauges 32a, 32b. The first and second sensors 58a, 58b may be arranged at a distance d_2 upstream of the first printing unit 15.

[0065] The control unit 52 is further configured to calculate a correction Δc in the form of a required speed acceleration or deceleration of at least one of the discharge conveyors 25a, 25b. By applying the correction Δc , the sheet 2 is rotated such that the leading edge becomes perpendicular to the direction of transportation T. The correction equals the amount of the rotation error Δr .

[0066] The correction Δc can be a dynamic correction, or a tendency correction which is common for a number of sheets 2. Alternatively, the correction Δc can be both a dynamic correction and a tendency correction.

[0067] The dynamic correction can be provided to each sheet 2. The dynamic correction is performed by determining the specific rotation error of each sheet 2 and

providing a corresponding correction. The dynamic correction may be different for each sheet 2.

[0068] The dynamic adjustment can be performed on all sheets 2. Alternatively, a correction is only performed if a tolerance threshold of the rotation error is exceeded.

[0069] For the dynamic correction, the sensing arrangement 57a is preferably positioned at the feeder gauges 32a, 32b. This allows an early detection of the rotation error.

[0070] The dynamic correction is effectuated by modifying the sheet transportation on one or both lateral sides of the transportation path P. The dynamic correction may be performed by a relative speed difference between the first and second discharge conveyors 25a, 25b.

[0071] The dynamic correction with the first and second discharge conveyors 25a, 25b can be effectuated in different way such as any of the following:

- The correction can be provided by only accelerating the speed of one discharge conveyor 25a, 25b.
- The correction can be provided by accelerating both the first and the second discharge conveyors 25a, 25b but to different amounts.
- One of the discharge conveyors 25a, 25b can be accelerated while the other one is decelerated 25a, 25b. This allows a distribution of the rotation error may results in a faster and larger possible correction.

[0072] In an embodiment, the converting machine 1 may be configured to provide at least two operating modes. In a first operating mode O1, both discharge conveyors 25a, 25b are accelerated when providing a correction. In a second operating mode, a first discharge conveyor 25a, 25b is accelerated while the second discharge conveyor 25a, 25b is decelerated. The correction mode may be selected based on the amount of correction needed, i.e. a tendency error variation of the sheets 2 in the same stack S. Alternatively, it can be selected based on the geometry and material characteristics of the sheets 2.

[0073] The rotation error of the sheets 2 in the same stack S is often similar. An average rotation error may be referred to as a tendency rotation error. The tendency rotation error may depend on variations in the sheet geometry, such as warps and the variation in the position of each stack S on the feeder loading surface 12.

[0074] The tendency rotation is preferably determined from control signals of a sensing arrangement 57b located in a position where the sheet 2 is no longer in the feeder module 12. The position is preferably located at a distance d2 from the first printing unit 15. This position allows measurement of the sheet skew at a more stabilized transportation speed of the sheet 2 and thus allow for a precise and reliable measurement.

[0075] The tendency rotation error is an average error determined for a number of sheets 2 in a sample.

[0076] The tendency rotation error may be determined for a sample of sheets 2 in a calibration phase of the

converting machine 1. A calibration phase may be initiated when a loader 10 charges a new stack into the converting machine 1.

[0077] Alternatively, the tendency rotation error may be continuously calculated for a sample of sheets. The sample of sheets may include between 5 and 30 sheets. The tendency error can thus be continuously calculated during the entire production batch of the converting machine 1.

[0078] The control unit 52 is configured to determine the tendency rotation and to provide a tendency correction in the form of a momentary acceleration/deceleration of at least one of the first and second discharge conveyors 25a, 25b. The tendency correction is the same for a plurality of sheets and is performed until a new tendency correction is determined by the control unit.

[0079] In an embodiment, both the first and second discharge conveyors 25a, 25b may be driven at an operating speed which is lower than the theoretical transportation speed. The theoretical transportation speed corresponds to the tangential speed of rotary tools and printing cylinders in the converting machine 1. In such a way, both discharge conveyors 25a, 25b can be provided with a momentary acceleration to provide a correction to the sheet 2. Alternatively, only one of the discharge conveyors 25a, 25b is driven at an operating speed which is lower than the theoretical transportation speed.

[0080] Alternatively, a speed difference in the form of a new constant transportation speed is calculated. The control unit 52 is configured to drive the first and the second discharge conveyors with a different relative speed such that a tendency correction in the form of a rotational displacement correction is provided to all sheets 2

[0081] Additionally, or alternatively, the correction can be provided by the modules located between the feeder gauge 32a, 32b and the first printing unit 15.

[0082] A dynamic correction or tendency correction may be provided by the feed roll assembly 34. The axis of the feed roll assembly 34 may be mounted such as to provide an angled correction to each sheet 2. The feed roll assembly 34 can be moved by a piston actuator which replaces a lateral connection end of the feed roller.

[0083] Additionally, or alternatively, a dynamic correction may be provided by the vacuum transfer 110. The vacuum transfer 110 may be provided with a first and second drive conveyors located side by side. The relative speed of the first and second discharge conveyors may be adapted such as to provide a rotational displacement correction to each sheet 2.

[0084] Additionally, or alternatively, a tendency correction may also be provided by the flexographic printing cylinder 102. A connection end 104 to the flexographic printing cylinder 102 can be moved by a piston actuator 106 such as to modify the axis of the flexographic printing cylinder 102. The correction to the flexographic printing cylinder 102 does not change the trajectory of the sheet but changes the position of where the print is applied to

the sheet 2.

Claims

1. A feeder module for a converting machine, the feeder module comprises:

- a loading surface (24) configured to receive a stack of sheets,
- at least a first discharge conveyor (25a) and a second discharge conveyor (25b), and
- a drive mechanism (31a, 31b) configured to drive the first and second discharge conveyors,

characterized in that the drive mechanism comprises a first drive shaft (33a) and a second drive shaft (33b), wherein the first discharge conveyor is connected to the first drive shaft and the second discharge conveyor is connected to the second drive shaft, and wherein each drive shaft is configured to be driven independently from each other and at a different speed, and wherein the feeder module further comprises a sensing arrangement (57a, 57b) comprising a first sensor (58a) and a second sensor (58b), the first and second sensors being arranged at a distance from each other in the lateral direction, and wherein each sensor is configured to detect the passage of the sheet, and wherein a control unit is configured to receive detection signals from the sensing arrangement, determine a rotational error of each sheet and provide a rotational correction to each sheet by driving the first and second discharge conveyors at a different relative speed.

2. The feeder module according to claim 1, wherein the difference in speed is a momentary acceleration or a deceleration.
3. The feeder module according to the preceding claim, wherein the drive mechanism (31a, 31b) comprises a first motor (39a) and a second motor (39b).
4. The feeder module according to the preceding claim, wherein a driving connection between the first and second drive shafts (33a, 33b) and each respective motor (39a, 39b) is located at an exterior side of the loading surface.
5. The feeder module according to claim 3, wherein a driving connection between the first and second drive shafts (33a, 33b) and each respective motor (39a, 39b) is located in the center of the loading surface.
6. The feeder module according to any one of the preceding claims, wherein each discharge conveyor

comprises a plurality of transportation elements (30), wherein a first group of transportation elements are attached to the first drive shaft (33a) and a second group of transportation elements are attached to the second drive shaft (33b).

7. The feeder module according to any one of the preceding claims, wherein the sensing arrangement (57a, 57b) is located between the loading surface and a first flexographic printing module.
8. The feeder module according to any one of the preceding claims, wherein the first sensor and second sensor are arranged laterally of a first gauge and a second gauge.
9. The feeder module according to any one of claims 1 to 7, wherein the sensing arrangement is arranged downstream of the feeder gauge and upstream of a flexographic printing unit.
10. The feeder module according to any one of the preceding claims, wherein a first sensing arrangement (57a) and a second sensing arrangement are provided (57b), and wherein each sensing arrangement comprises a first sensor (58a) and a second sensor (58b).
11. The feeder module according to claim 5 or 7, wherein the flexographic printing cylinder (102) is provided with a connection end (104) which is movable by a displacement member (106) such that the axis of the printing cylinder is rotated.
12. The feeder module according to any one of the preceding claims, wherein a feed roll assembly (34) is configured to provide an angled correction to each sheet.
13. The feeder module according to any one of the preceding claims, wherein the vacuum transfer (110) comprises a first and a second lateral side, and wherein transportation elements in each lateral side are configured to provide an angled correction to each sheet.
14. The feeder module according to any one of the preceding claims, wherein the control unit is configured to determine a tendency rotation error for a sample of sheets.
15. The feeder module according to claim 14 or 15, wherein the tendency rotation is determined from the detection signals from a sensing arrangement located between the feeder gauge and the first printing unit.
16. The feeder module according to claim 12 or 13,

wherein the control unit is further configured to provide a tendency correction in the form of a momentary or constant speed difference of the first and second drive shafts, said tendency correction being the same for a plurality of sheets.

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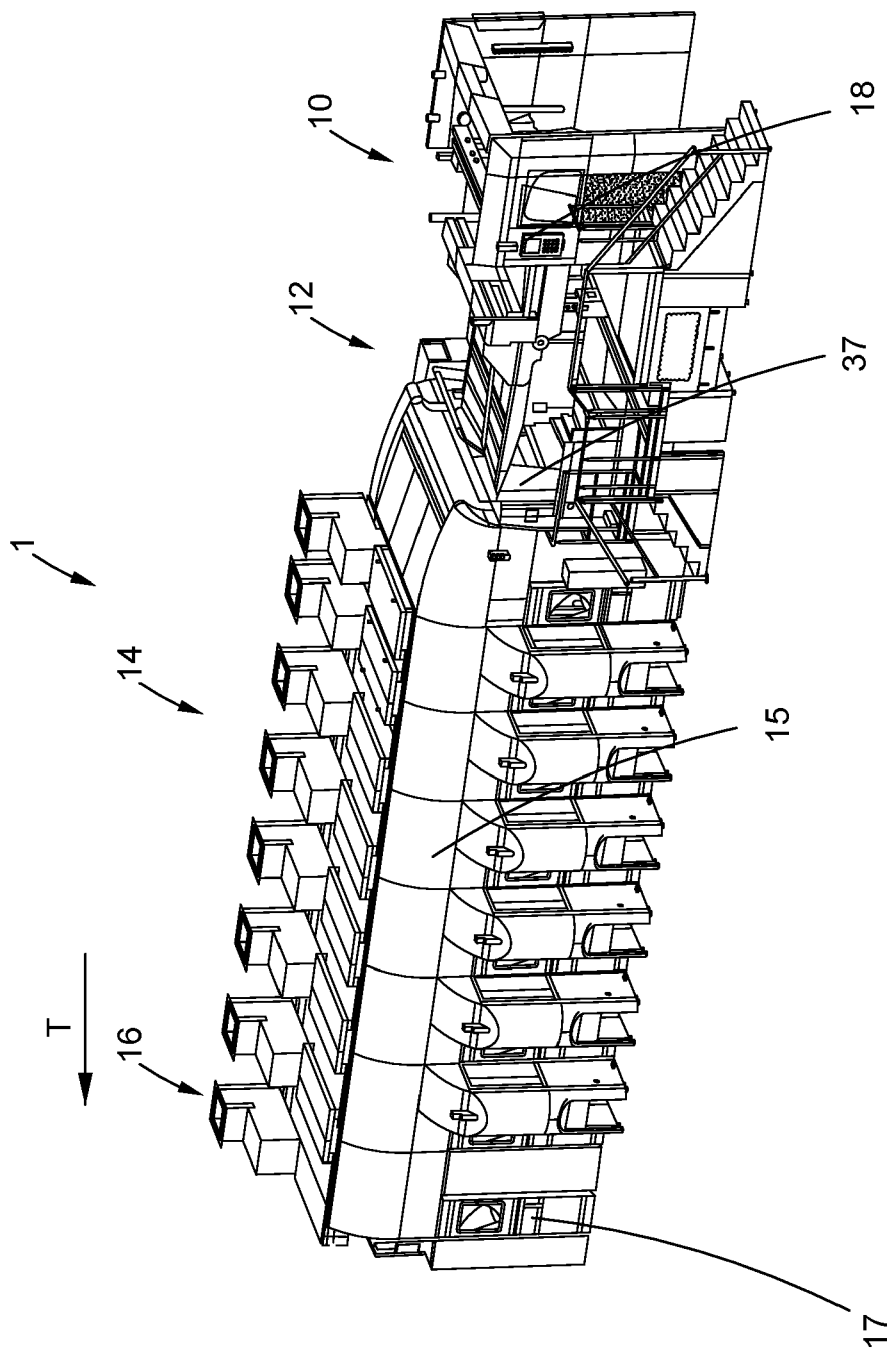


Fig. 1

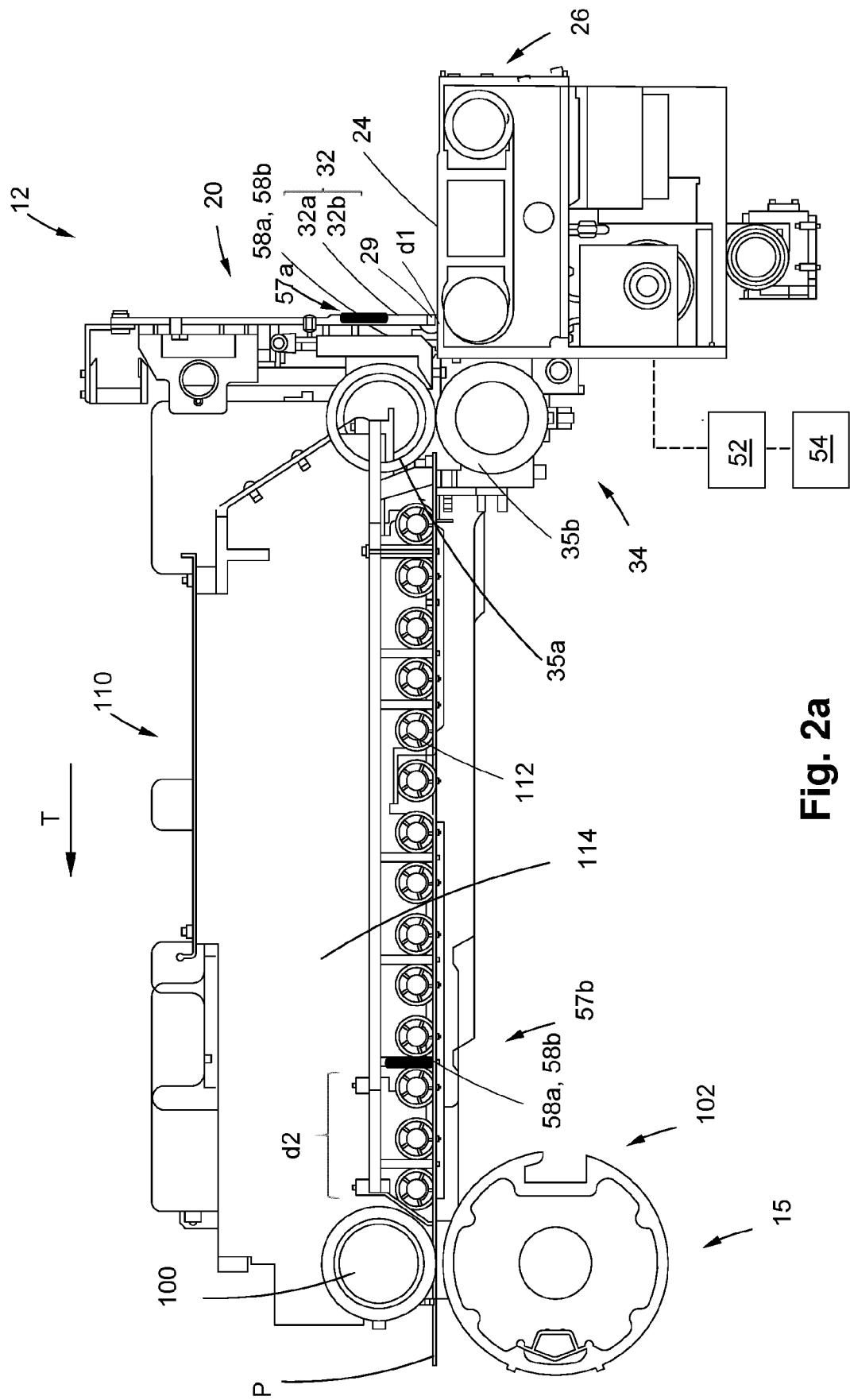


Fig. 2a

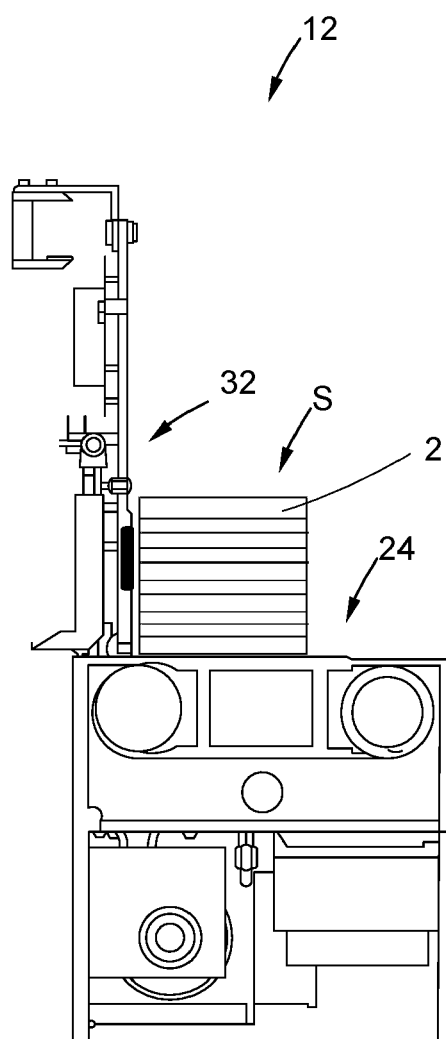


Fig. 2b

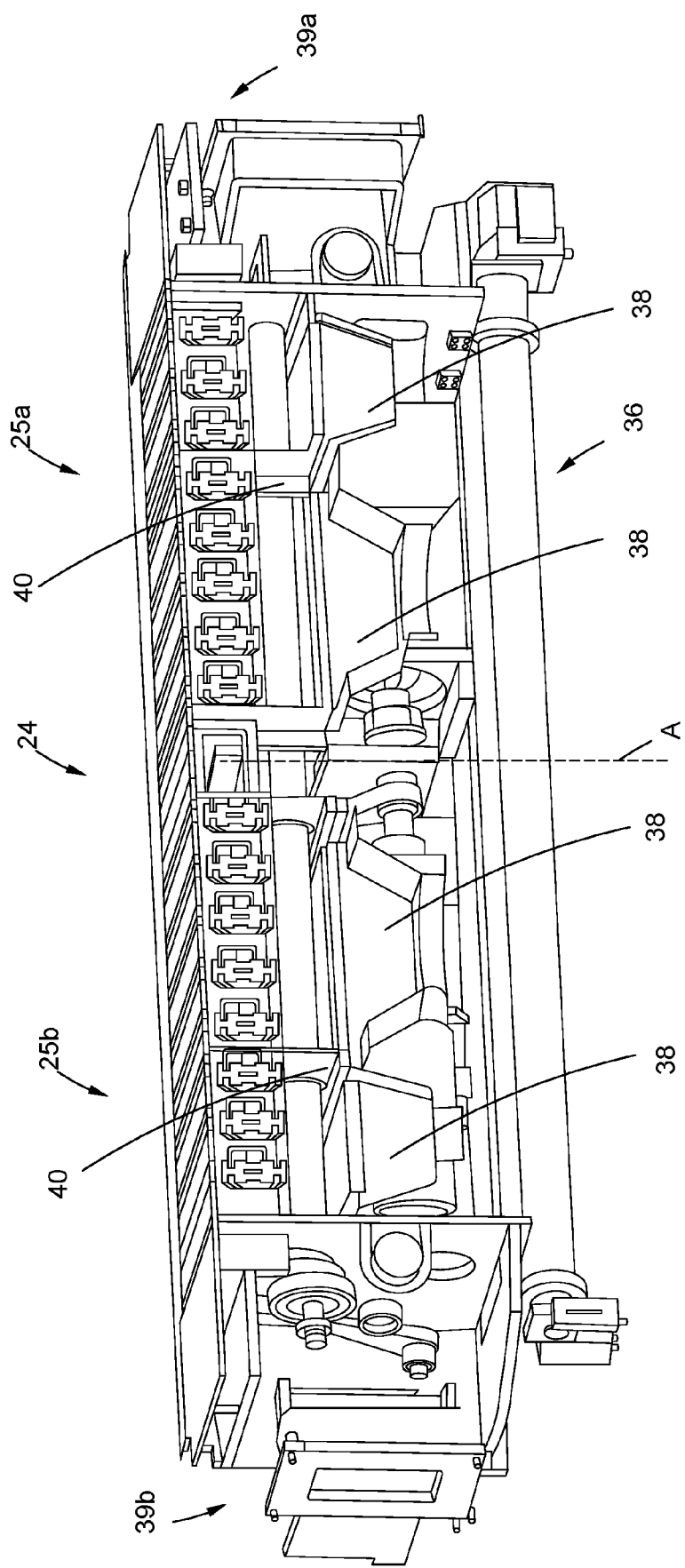


Fig. 3

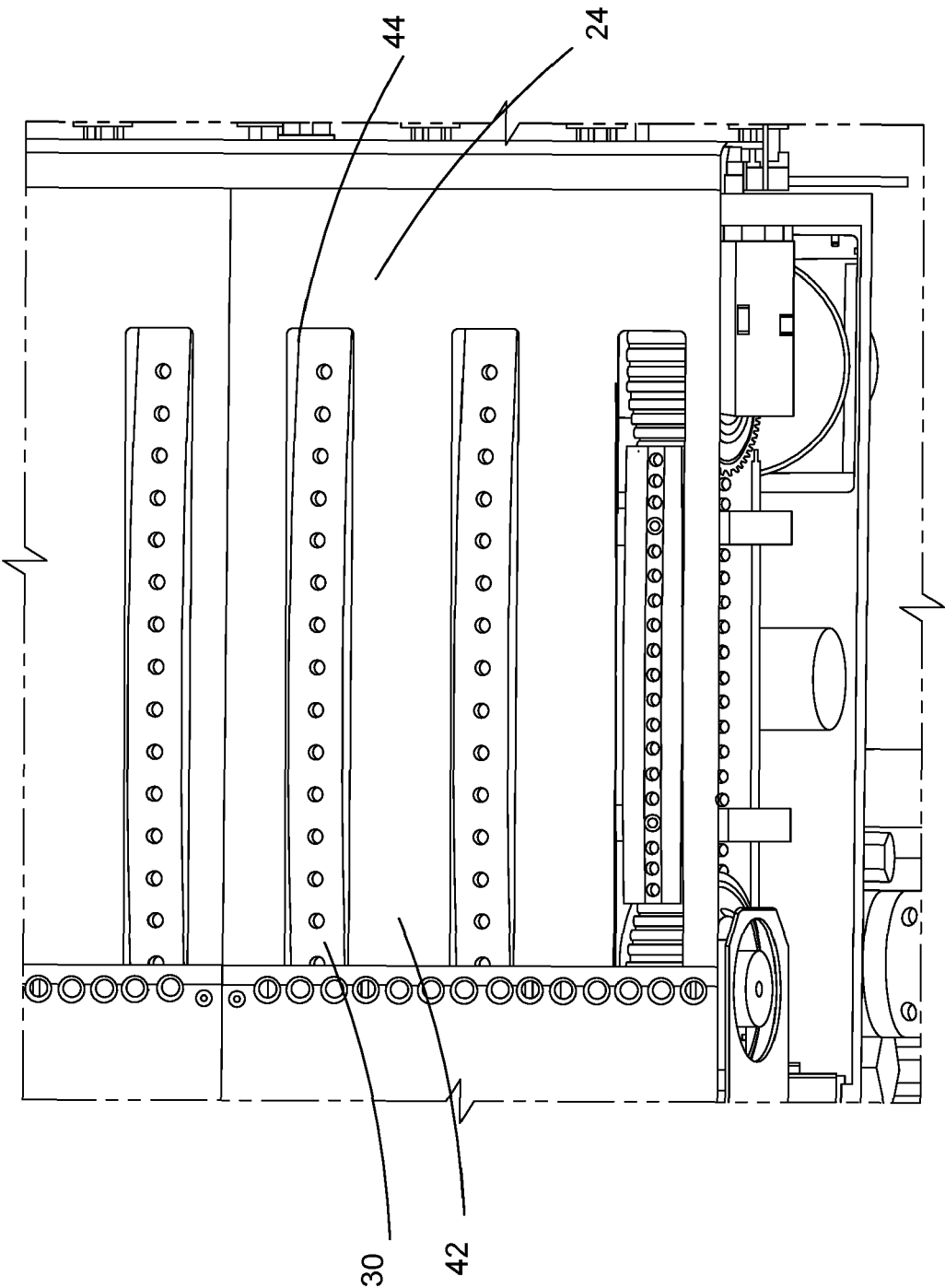


Fig. 4

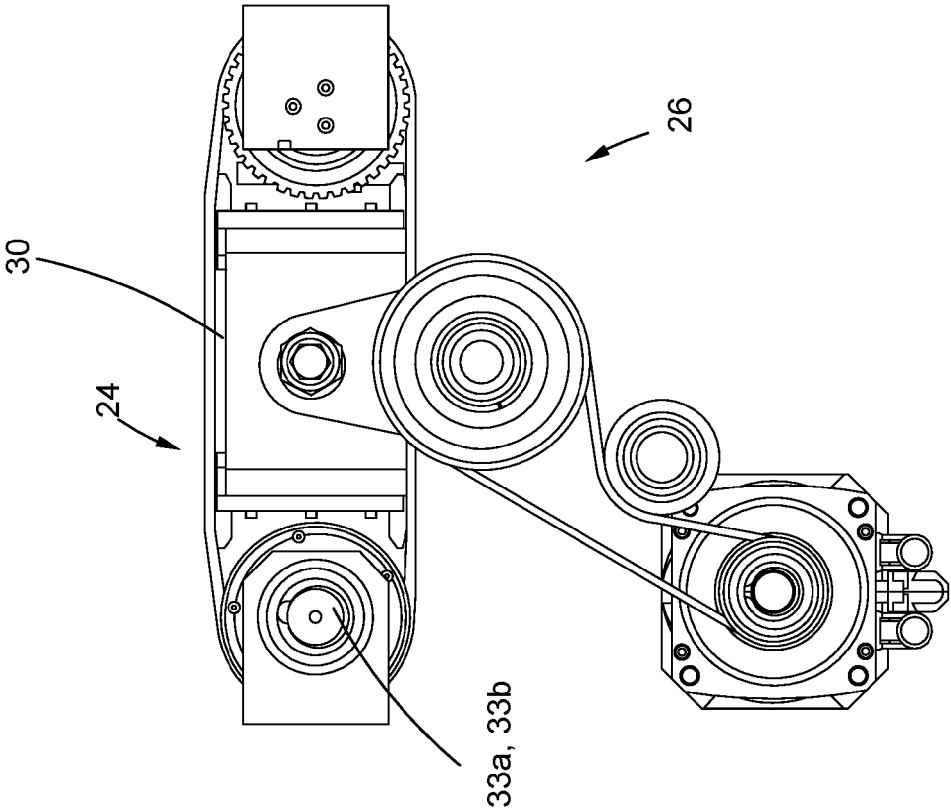


Fig. 5a

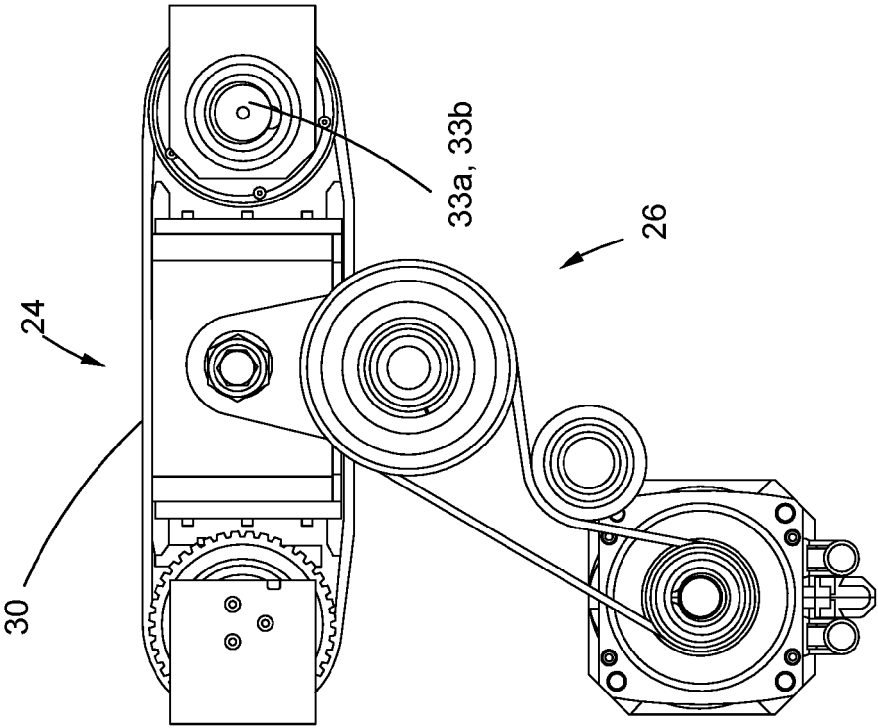
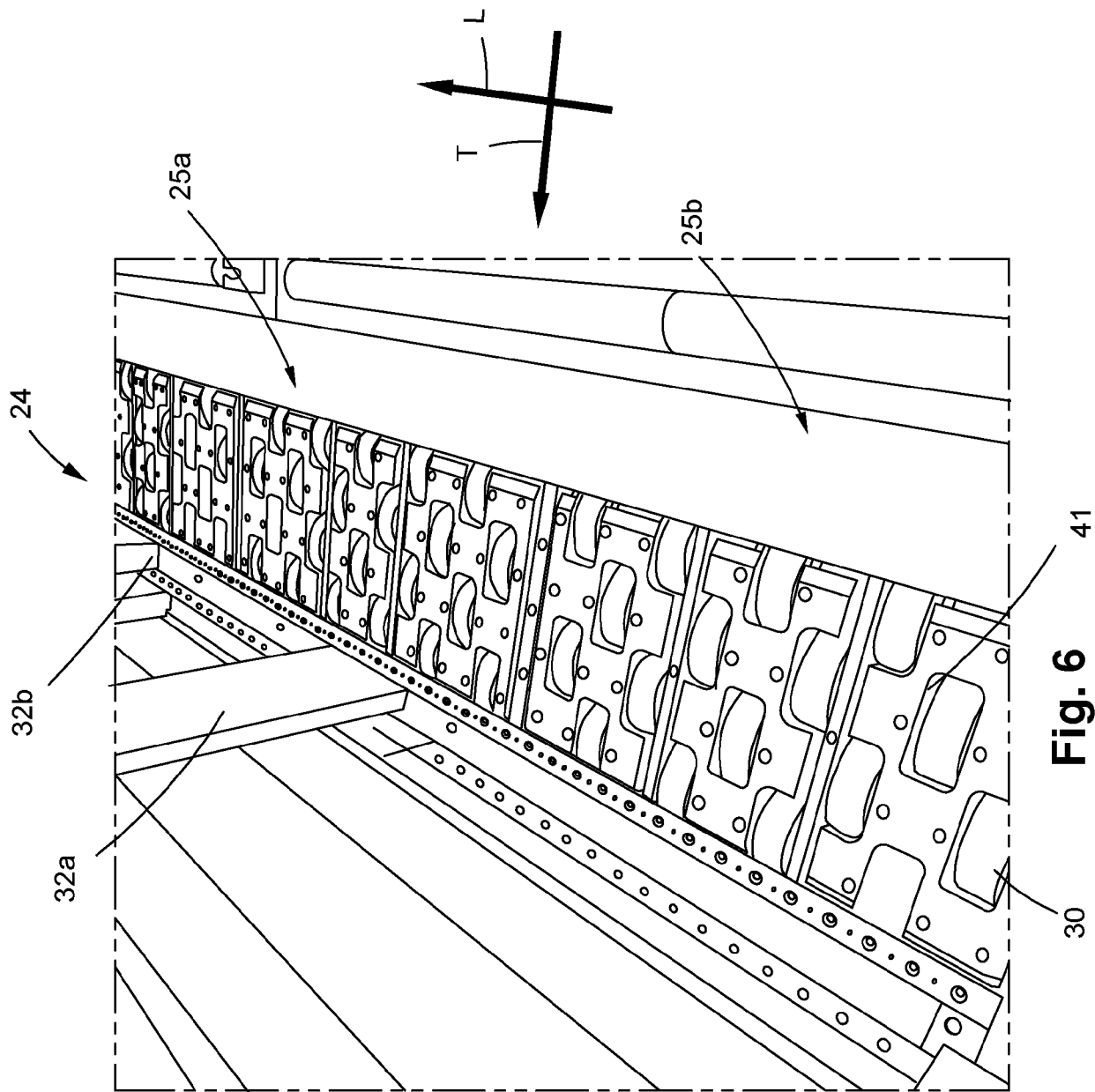


Fig. 5b



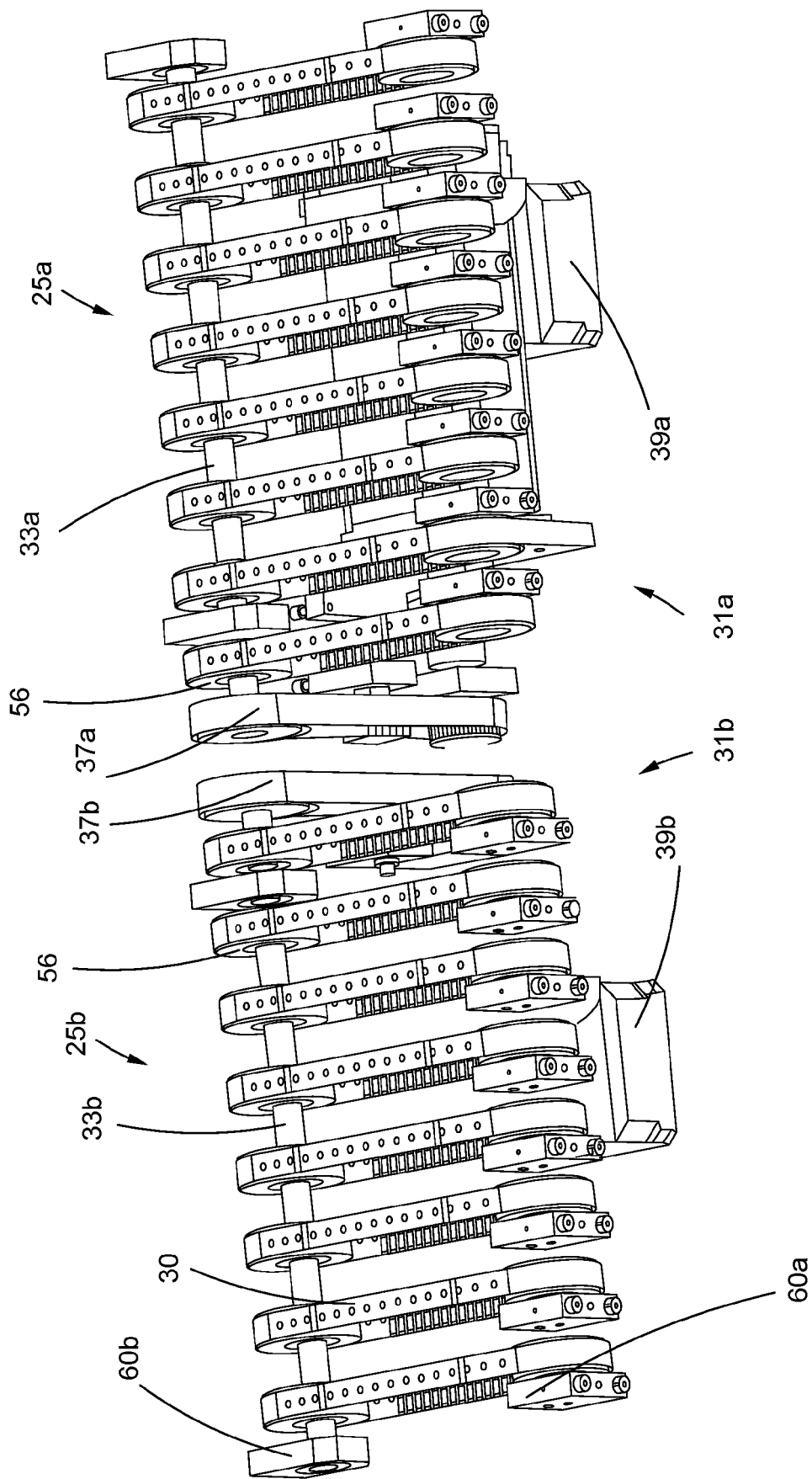


Fig. 7

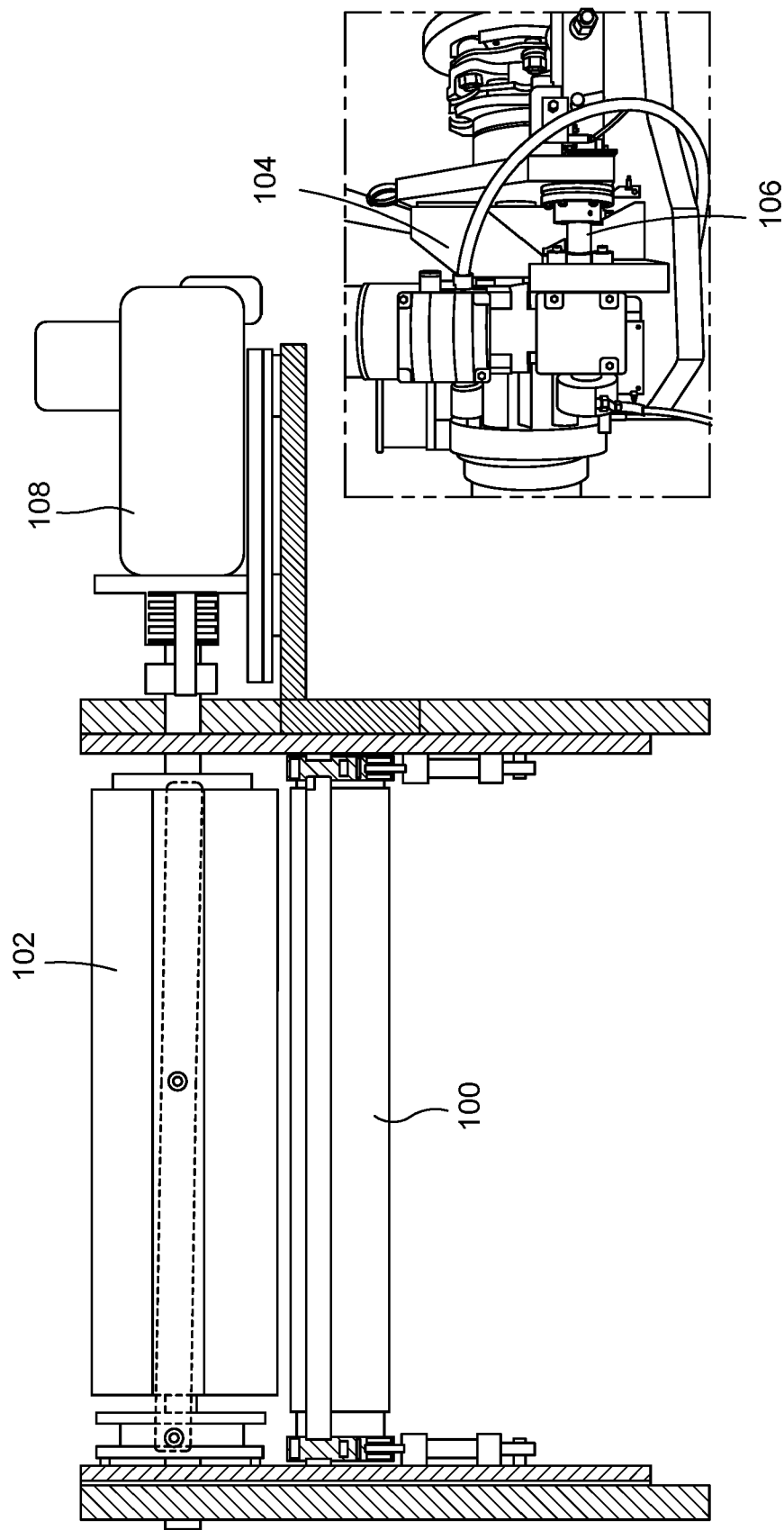


Fig. 8



EUROPEAN SEARCH REPORT

Application Number

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