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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
08 April 2021 (08.04.2021)

WIPO | PCT

(10) International Publication Number
WO 2021/066832 A1

(51) International Patent Classification:
B41J 11/00 (2006.01) *B41J 25/308* (2006.01)

(21) International Application Number: PCT/US2019/054459

(22) International Filing Date: 03 October 2019 (03.10.2019)

(25) Filing Language: English

(26) Publication Language: English

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(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,

(54) **Title:** PRINTHEAD TO PRINT MEDIUM SPACING ADJUSTING SYSTEM

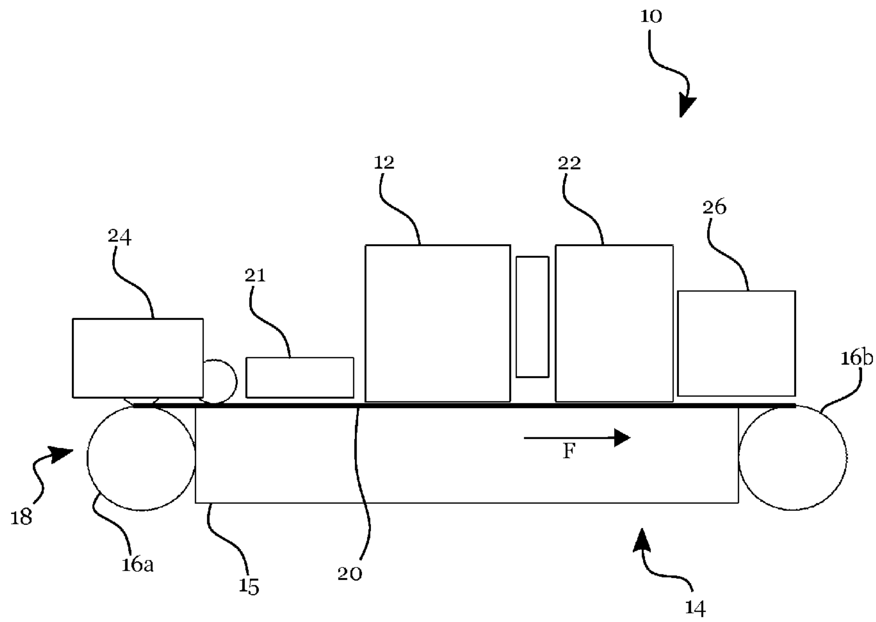

Fig. 1

(57) **Abstract:** An adjusting system for a spacing between a printhead and a print medium, the adjusting system comprising a static support structure, a pair of beams movably coupled to the static support structure to adjust the spacing, a medium support structure to support the print medium, wherein the medium support structure is supported by the pair of beams, and a pair of actuators coupled to a first beam of the pair of beams, wherein the pair of actuators is driven to adjust a position of the first beam with respect to the static support structure and to thereby adjust the spacing.

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TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:
— *as to the identity of the inventor (Rule 4.17(i))*
— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:
— *with international search report (Art. 21(3))*

PRINTHEAD TO PRINT MEDIUM SPACING ADJUSTING SYSTEM

BACKGROUND

[0001] Printers can be used to generate predefined structures on a print medium by depositing a printing material, such as a printing fluid, on a substrate. The geometry of the structure can be defined by a relative movement between a printhead ejecting the printing material and a substrate holder.

[0002] To print on the substrate, the printhead is commonly moved back and forth while the printing material is controllably ejected when the position of the printhead coincides with an element of the predefined structure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] The following detailed description will best be understood with reference to the drawings, wherein:

[0004] Fig. 1 illustrates a schematic cross section of a print zone of a printer according to an example.

[0005] Fig. 2 illustrates an example of a displacement assembly for a printhead.

[0006] Fig. 3 is a schematic view of a printer according to another example.

[0007] Fig. 4 is a partial view of an example of an assembly for supporting a print medium.

[0008] Fig. 5 illustrates an actuator of an adjusting system for a medium support structure of a printer according to an example.

[0009] Fig. 6 is a section view of an adjusting system for a medium support structure of a printer according to an example.

[0010] Fig. 7A illustrates an example of a supporting structure of a medium support structure of a printer.

[0011] Fig. 7B illustrates a feeding mechanism for a medium support structure of a printer according to an example.

[0012] Fig. 8 illustrates an adjusting system for a medium support structure of a printer according to a further example.

DETAILED DESCRIPTION

[0013] Fig. 1 illustrates a schematic cross section of a print zone of a printer 10 according to an example. The printer 10 comprises a printhead 12 facing a medium support structure 14 comprising a central supporting panel 15. The print medium support 14 further comprises an input roller 16a and an output roller 16b which may be arranged at opposite sides of the central supporting panel 15. The input roller 16a and the output roller 16b may constitute elements of a feed mechanism 18 and may be driven with a rotating motion to position or orient a print medium 20. During printing, the print medium 20 may be supported by the central supporting panel 15. In some embodiments, a belt (not shown) may be located around the input roller 16a and the output roller 16b to form a conveying feed mechanism 18 for the print medium 20, wherein a motion of the belt may be translated to the print medium 20 to feed the print medium 20 to a location between the medium support structure 14 and the printhead 12 along a medium feed direction F.

[0014] The print medium 20 may be any substrate on which a printing material can be applied. In the following, the functionality of printers 10 will be described according to examples suitable for substrates having physical properties similar to a sheet of paper; however, any suitable substrate may be used. For example, the substrate may be or comprise paper and/or paper-based material, such as cardboard, textiles, leather, polymers, glass and/or combinations thereof, etc. The substrate may be rigid or flexible, transparent, semi-transparent or light absorbing, and the dimensions of the substrate may generally be selected from a wide range of thicknesses, widths or lengths.

[0015] The printhead 12 may eject a printing material, such as a printing fluid or a build material, onto the print medium 20. The printing material for printing on the print medium 20 may be any appropriate material suitable to generate a printed image or shaped element on the substrate, such as by means of ink. The printed image and/or shaped element may be or comprise text, lines, shapes, letters, numerals, signs, symbols or a combination of these in an arbitrary color, alignment or shape. Depending on the printing material used, a corresponding service element 21 may be installed with or close to the printhead 12, such as a spittoon for preventing clogging of an inkjet printhead 12.

[0016] The printhead 12 or the medium support structure 14 can be mounted on a displacement assembly allowing the relative displacement of the printhead 12 and the medium support structure 14 along linear or complex paths to control a deposition process of the printing material. In some examples, a displacement of the print medium 20 is controlled by the feed mechanism 18, e.g., by controllably displacing the print medium 20 along the feed direction F to advance the print medium 20 during the deposition process. In combination with the displacement assembly of the printhead 12, two-dimensional relative displacement between the print medium 20 and the printhead 12 may be achieved to generate arbitrary shapes or images on the print medium 20.

[0017] In the print zone beneath or close to the printhead 12, a position or flatness of the print medium 20 may be adjusted by means of a vacuum source (not shown) acting on the print medium 20 via the medium support structure 14. For example, a vacuum chamber (not shown) may be arranged in the medium supporting structure 14 and may act on the print medium 20 via openings in the central supporting panel 15 facing the printhead 12, or in a belt of the feed mechanism 18 located in the print zone. Additionally, an airflow generator 22 may face the medium support structure 14 to generate a flow of air to act on the print medium 20 prior to or during printing. Moreover, further print medium displacement assemblies, such as a media input feeder 24 or a media output pinching mechanism 26, may be provided to further guide or constrain an advance of the print medium 20.

[0018] An appropriate spacing between the print medium 20 and the printhead 12, in the context of printers 10 also referred to as the pen-to-paper spacing, may be provided for a printing process. To accommodate print media 20 of different thicknesses, the spacing between the printhead 12 and the medium support structure 14 may be adjusted.

[0019] Fig. 2 illustrates an example of a displacement assembly 28 for a printhead 12. The displacement assembly 28 comprises a guide rail 30 and a carriage 32 slidably mounted onto the guide rail 30 and linearly displaceable along an extension direction D of the guide rail 30. The printhead 12 (not shown in Fig. 2) may be mounted onto the carriage 32 to be displaced back and forth along the extension direction D of the guide rail 30 during printing. An action of the printhead 12 may then be controlled to generate a pattern of the printing material on a print medium 20 (not shown in Fig. 2) placed below the printhead 12.

[0020] A vertical position of the printhead 12 with respect to a print medium 20 can be controlled by driving a pair of lifters 34 supporting the guide rail 30, wherein driving the lifters 34 displaces the guide rail 30 and the printhead 12 slidably mounted thereon along the vertical direction V, thereby allowing a spacing between the printhead 12 and the medium support structure 14 to be adjusted, such as to accommodate print media 20 with different media thicknesses.

[0021] For complex printer designs, e.g. printers including additional components located above the print medium 20, such as the airflow generator 22, spittoon 21, media input feeder 24 or media output pinching mechanism 26 shown in Fig. 1, additional modifications may be made, such as providing movable support to the additional components, which may however influence a complexity of the displacement assembly 28 or introduce additional mechanical wear.

[0022] To accommodate print media 20 with a range of different thicknesses, such as a thickness varying by more than 5 mm or more than 10 mm, other displacement techniques may be employed to provide accurate and stable positioning of the print medium 20.

[0023] Fig. 3 illustrates a printer 10 comprising an adjusting system for a relative spacing between a printhead 12 and a print medium 20 according to an example. The adjusting system comprises a static support structure 36 and a pair of beams 38, 40 movably coupled to the static support structure 14 to adjust the spacing. The adjusting system further comprises a medium support structure 14 to support the print medium 20, wherein the medium support structure 14 is supported by the pair of beams 38, 40. A pair of actuators 42 is coupled to a first beam 38 of the pair of beams 38, 40, wherein the pair of actuators 42 can be driven to adjust a position of the first beam 38 with respect to the static support structure 36 and to thereby adjust the spacing between the printhead 12 and the print medium 20.

[0024] The adjusting system illustrated in Fig. 3 may accommodate a complex printer assembly above the medium support structure 14 supporting the print medium 20 while maintaining flexibility to provide a range of different spacings between the printhead 12 and the print medium 20. The pair of actuators 42 may be driven to adjust a position of the medium support structure 14 with respect to the static support structure 36, while the vertical position of the printhead 12 may remain fixed in some examples. However, in addition to the adjusting system shown in Fig. 3, the position of the printhead 12 may further be adjustable with an additional mechanism, such as by means of the lifters 34 shown in the example of Fig. 2.

[0025] Supporting the print medium 20 is considered to refer to supporting at least a portion of the print medium 20 against a weight of the print medium 20 and thereby guide and/or position the print medium 20 in the printer 10.

[0026] The beams 38, 40 may provide structural support for the medium support structure 14 and may prevent obliquity or surface irregularities of the medium support structure 14 along their respective extension direction E. The extension direction E of the beams 38, 40 may relate to the principal physical extension direction of the respective beams.

The beams 38, 40 may extend across a lateral extension of the print medium 20, such as a width of the print medium 20 along a displacement direction D of the printhead 12. Hence, the beams 38, 40 may act as structural support of the print medium 12 or may define the spacing between the print medium 20 and the printhead 12 across the width of the print medium 20 along their respective extension direction E, which can be aligned or matched with the displacement direction D of the printhead 12.

[0027] In some examples, the pair of actuators 42 is spaced along an extension direction E of the first beam 38, wherein the pair of beams 38, 40 is spaced perpendicularly to the extension direction E of the first beam 38.

[0028] For example, the pair of beams 38, 40 may be aligned in parallel and spaced perpendicularly to their common extension direction E. A plane spanned by the first beam 38 and the second beam 40 of the pair of beams 38, 40 may define an orientation of the medium support structure 14.

[0029] In some examples, the extension direction E of the first beam 38 and the second beam 40 extends transversely to a feed direction F of the print medium 20, or in other words, the first beam 38 and the second beam 40 may constitute a first transverse beam 38 and a second transverse beam 40, respectively, oriented transversely to the feed direction F.

[0030] When the printhead 12 is linearly displaced perpendicularly to the feed direction F of the print medium 20, the extension direction E of the first beam 38 or the second beam may be parallel to a displacement direction D of the printhead 12. Hence, an obliquity of the medium support structure 14 with respect to the printhead 12 may be controlled with the pair of actuators 42.

[0031] In some examples, the adjusting system further comprises a second pair of actuators associated with the second beam 40 of the pair of beams 38, 40, wherein the second pair of actuators is driven to adjust a position of the second beam 40 with respect to the static support structure 14.

[0032] The first pair of actuators and the second pair of actuators 42, 44 may be individually driven to separately adjust a position of the first beam 38 and of the second beam 40 with respect to the static support structure 14, respectively, such as to independently adjust a relative position of the first beam 38 and of the second beam 40 to the static support structure 14.

[0033] Fig. 4 is a partial view of an example of an assembly for supporting a print medium 20 comprising a first beam 38 and a second beam 40 each supported by a respective pair of actuators 42, 44 (only one actuator shown for each pair). The first beam 38 extends along a transverse direction E and the second beam 40 extends parallel to the first beam 38. A print medium support 14 is supported on the first beam 38 and the second beam 40 to support the print medium 20 (not illustrated in Fig. 4) in a position defined by the first beam 38 and the second beam 40. The pairs of actuators 42, 44 are spaced along the transverse direction E of the respective beam 38, 40. A first pair of actuators 42 movably couples the first beam 38 of the pair of beams 38, 40 to the static support structure 36, and a second pair of actuators 44 movably couples the second beam 40 of the pair of beams 38, 40 to the static support structure 36. The first pair of actuators 42 and the second pair of actuators 44 may be driven to adjust a position of the first beam 38 and the second beam 40, respectively.

[0034] The static support structure 36 may comprise a pair of static support beams 36a, 36b respectively associated with the pair of beams 38, 40. A first static support beam 36a may movably couple the first pair of actuators 42 to the first beam 38 and a second static support beam 36b may movably couple the second pair of actuators 44 to the second beam 40.

[0035] As further illustrated in Fig. 4, the print medium support 14 supported on the first beam 38 and the second beam 40 may comprise a medium feed mechanism 18 and a platen supported by the first beam 38 and the second beam 40, wherein the medium feed mechanism 18 supplies the print medium 20 to the platen, wherein the platen faces a printhead 12 and supports the print medium 20 during printing.

[0036] In some examples, the feed mechanism 18 feeds the print medium 20 to a location between the medium support structure 14 and the printhead 12 along a medium feed direction F, the feed mechanism 18 being supported by the pair of beams 38, 40.

[0037] The platen may be formed as part of the feed mechanism 18, such as by providing a support panel 46 arranged below a belt 48 to support a print medium 20 on an upper side of the belt 48. The belt 48 may be displaced along the feed direction F by the input roller 16a and the output roller 16b arranged at opposite sides of the support panel 46. The belt 48 may have a contour defined by the support panel 46 to provide a planar support for the print medium 20 at a location facing a printhead 12.

[0038] As illustrated in the example of Fig. 4, the feed mechanism 18 may comprise a plurality of openings facing the print medium 20. For example, the belt 48 or the support panel 48 may comprise slits or holes to provide a vacuum connection at the backside of the print medium 20. A vacuum source may connect to or be arranged in the print medium support 14 to controllably generate a vacuum to reinforce a contact of the print medium support 14 and the print medium 20, which may assist in positioning the print medium 20 or defining the spacing between the printhead 12 and the print medium 20 supported by the belt 48.

[0039] In some examples, the medium feed mechanism 18 is jointly moved with the medium support structure 14 supporting the print medium 20 by the actuators 42, 44, such as to reliably feed the print medium 20 to a print zone below the printhead 12 irrespective of the current positions of the first beam 38 or the second beam 40 supporting the medium support structure 14.

[0040] For example, the first pair of actuators 42 and the second pair of actuators 44 may be jointly driven to translate the medium support structure 14. As part of the translation, the feed mechanism 18 may be jointly translated to provide continuous alignment between the feed mechanism 18 and the printhead 12. An input feeder 24 may be coupled to the feed mechanism 18 to feed a print medium 20 to a print zone in different positions of the medium support structure 14. For example, the input feeder 24 may be aligned with the printhead 12 at a fixed height or may be movably coupled to the feed mechanism 18, such as to maintain an alignment of the print medium 20 and the feed mechanism 18 for a given thickness of the print medium 20.

[0041] The spacing between the printhead 12 and the medium support structure 14 may be varied in a range accommodated by the adjusting system, which may be defined by a range of motion of the pairs of actuators 42, 44. The actuators 42, 44 may comprise linear actuators, such as a combination of an actuating motor, e.g. a servomotor or torque generating motor, and a linear encoder, to provide a linear range of displacement for the beams 38, 40.

[0042] A transmission of the actuators 42, 44 to transfer an actuating drive of the actuators 42, 44 may be selected to provide a given range of displacements, such as a range of more than 5 mm or more than 10 mm, with a predefined precision of translation in combination with the actuating motor, such as a precision of less than 100 μm or less than 50 μm. For example, when the actuating motor is a servomotor, one advance of the servomotor may induce a translation of the medium support structure 14 by less than 50 μm.

[0043] In some examples, the actuators 42, 44 comprise a self-locking transmission to lock the position of the first beam 38 or the second beam 40 in the absence of a driving force provided by the pair of actuators 42, 44.

[0044] Fig. 5 shows an actuator 42, 44 for an adjusting system according to an example. The actuator 42, 44 comprises a transmission 50, which may be a self-locking transmission 50, coupling an actuating motor 52 to a beam 38, 40 supporting the medium support structure 14 via a linear encoder 54.

[0045] As shown in the illustrated example, the transmission 50 may comprise a worm 56 coupled to the actuating motor 52 to receive a torque generated by the actuating motor 52 when the actuator 42, 44 is driven to adjust a position of the beam 38, 40. The worm 56 meshes with a worm gear 58 to transfer the torque generated by the actuating motor 52 at a relative angle of about 90° and at a gear ratio given by the geometry of the worm 54 and the worm gear 56. The transmission 50 may reduce a rotation angle generated by the actuating motor 52 to a smaller transmitted rotation angle of the worm gear 56 according to the gear ratio.

[0046] The worm gear 56 can couple a transmitted torque of the actuating motor 52 to the linear encoder 58 to induce a linear motion of the beam 38, 40. The linear encoder 58 transfers the transmitted torque into a linear force to displace the beam 38, 40. For example, a pin 60 in a non-rotationally-symmetric arrangement with a shaft (not shown) and coupled to the worm gear 56 may contact a contact point 62 of the beam 38, 40 to transfer a rotational motion of the worm gear 56 to a linear motion of the contact point 62. In some examples, the pin 60 and the contact point 62 may form a slotted link mechanism, e.g. a scotch yoke, wherein the pin 60 engages a slot of the beam 38, 40 to transfer the transmitted torque into a linear force to displace the beam 38, 40. However, the actuator 42 may also be mounted on the beam 38, 40 and may movably couple the beam 38, 40 with a static support structure 36 via a contact point 62 on the static support structure 36.

[0047] Depending on the lead angle of the worm 54, the transmission 50 may be self-locking with respect to a force induced by a weight of the medium support structure 14. For example, a lead angle of the transmission 50 may be smaller than 4° to produce a self-locking transmission. Hence, in the absence of a driving force provided by the actuating motor 52, the position of the beam 38 defined by a state of the transmission 50 may remain constant.

[0048] The adjusting system may further comprise a calibration mechanism 64 to calibrate a relative position of the beam 38, 40 and the static support structure 36 via the linear encoder 58 according to a reference state. For example, the calibration mechanism 64 may comprise an encoding feature 66 and a detector 68 to detect a relative position of the static support structure 36 and the beam 38, 40 based on information encoded in the encoding feature 66. The relative position of the beam 38, 40 and the static support structure 36 may be calibrated regularly during service to maintain an accurate spacing between the beam 38, 40 and the static support structure 36 for a range of set points for the actuator 42, 44.

[0049] In some examples, the calibration mechanism 64 comprises an optical detector 68 coupled to the beam 38, 40 to detect an optical feature 66 mounted on the static support structure 36 to determine a relative position of the static support structure 36 and the beam 38, 40. However, the optical detector 68 may also be mounted on the static support structure 36, and the optical feature 66 may be coupled to the beam 38, 40.

[0050] Additionally or alternatively, the calibration mechanism 64 may comprise magnetic or mechanical features 66, such as mechanical endstops or magnetically detectable features, and corresponding detectors 68 to calibrate a relative position of the static support structure 36 and the beam 38, 40 which may be arranged at the beam 38, 40 and the static support structure 36, respectively, or may be part of the transmission 50 or the actuating motor 52.

[0051] Based on the detection of the encoding feature 66 by the detector 68, the state of the actuator 42, 44 may be inferred to calibrate a relative position of the static support structure 36 and of the beam 38, 40 or the medium support structure 14.

[0052] To control the position of the beam 38, 40, the adjusting system may further comprise guiding or biasing structures between the pair of beams 38, 40 and the static support structure 36.

[0053] Fig. 6 is a section view of an adjusting system according to an example. The adjusting system comprises a beam 38, 40 movably coupled to a static support structure 36 and supporting a medium support structure 14 comprising a support plate 46 to face a printhead 12 and to support a print medium 20.

[0054] The adjusting system further comprises an alignment assembly 70 to guide a motion of the beam 38, 40 or to align the static support structure 36 and the beam 38, 40 along a transverse direction T, transverse to a spacing between the printhead 12 and the medium support structure 14 or the print medium 20.

[0055] The alignment assembly 70 may comprise a protruding feature 72 protruding from the static support structure 36 towards the beam 38, 40. The beam 38, 40 comprises an alignment bracket 74 to receive the protruding feature 72, wherein the alignment bracket 74 allows relative displacement of the protruding feature 72 along a guiding path G, such as to guide a relative displacement of the beam 38, 40 and the static support structure 36 along the guiding path G, such as a linear guiding path G. The alignment bracket 74 may comprise clamping elements 76 to laterally clamp the protruding feature 72, wherein an elastic element 78 coupled to the clamping element 76 may provide an aligning force along the transverse direction T, such as to align or to center the protruding feature 72 in the alignment bracket 74.

[0056] Each beam 38, 40 movably coupled to the static support structure 36 may be associated with a pair of alignment assemblies 70 spaced along the extension direction E of the beam 36, 40, such as arranged at opposite sides of the beam 36, 40, to align the beam 36, 40 or to limit skew or mechanical strain on the actuators 42, 44.

[0057] In some examples, the adjusting system may further comprise an elastic biasing element 80, the elastic biasing element 80 providing a biasing force between the first beam 38 or the second beam 40 of the pair of beams 38, 40 and the static support structure 36.

[0058] The elastic biasing element 80 may bias a transmission 50 of a movable coupling between the beam 38, 40 and the static support structure 36 to engage corresponding flanks of gears, such as the flanks of the worm 54 and the worm gear 56 of the example shown in Fig. 5. A biased transmission 50 may limit mechanical vibration of the medium support structure 14 with respect to the printhead 12.

[0059] In some examples, the adjusting system comprises a plurality of elastic biasing elements 80 to provide a biasing force between the medium support structure 14 and the static support structure 36, wherein a total biasing force produced by the plurality of elastic biasing elements 80 is a fraction of the weight of the medium support structure 14 movably coupled to the static support structure 36, such as between 20% and 80% of the weight of the medium support structure 14, e.g. 50% of the weight of the medium support structure 14, such as to limit mechanical vibration of the medium support structure 14.

[0060] Fig. 7A and 7B illustrate elements of a medium support structure 14, such as the medium support structure 14 shown in Fig. 4, to movably couple to a static support structure 36 of a printer 10 and to support a print medium 20 during printing according to examples.

[0061] Fig. 7A illustrates an example of a supporting panel array 15 of a medium support structure 14, the supporting panel array 15 comprising a plurality of regularly spaced support panels 46 supported by a plurality of ribs 82, 84, wherein adjacent support panels 46 share a common rib 84. The supporting structure 14 may be supported by a pair of beams 38, 40 via the ribs 82, 84, e.g. by connecting the ribs 82, 84 and the supporting beams 38, 40.

[0062] In some examples, two ribs 82, 84 connect the pair of beams 38, 40, wherein the medium support structure 14 is coupled to the pair of beams 38, 40 via the ribs 82, 84.

[0063] For example, a first end of each of the two ribs 82, 84 may be supported by a first beam 38 of the pair of beams 38, 40, and a second end of each of the two ribs 82, 84 may be supported by a second beam 40 of the pair of beams 38, 40, such that the ribs 82, 84 may connect the pair of beams 38, 40.

[0064] The ribs 82, 84 may couple to the pair of beams 38, 40 via adjusting features 86 to adjust a position of the ribs 82, 84 with respect to the pair of beams 38, 40.

[0065] The adjusting features 86 of the ribs 82, 84 may serve to adjust an orientation or a position of a support panel 46 connected to the respective rib 82, 84. For example, the adjusting feature 86 may comprise a set mechanism, such as a set screw, to provide an adjustable mechanical coupling between the rib 82, 84 and a beam 38, 40 of the pair of beams 38, 40 or a support panel 46 connected to the rib 82, 84. When the adjusting feature 86 is operated, one side or portion of a support panel 46 connected to the respective rib 82, 84 may be translated relative to the beam 38, 40 with the rib 82, 84.

[0066] Each rib 82, 84 to may be coupled to the first beam 38 and the second beam 40 with a first adjusting feature 86 and a second adjusting feature 86, respectively. Hence, an orientation of the rib 82, 84 with respect to the first beam 38 and second beam 40 may be adjusted by individually operating the first adjusting feature 86 and the second adjusting feature 86 connected to different beams 38, 40 of the pair of beams 38, 40.

[0067] In some examples, the adjusting system comprises two ribs 82, 84 extending between the first beam 38 and the second beam 40, the ribs 82, 84 defining the spacing between the medium support structure 14 and the printhead 12 at their respective positions along the extension direction E of the first beam 38 or the second beam 40.

[0068] The support panels 46 of the support panel array 15 may directly or indirectly support the print medium 20 in position facing the printhead, such that adjusting a state of the adjusting feature 86 of a rib 82, 84 may allow a local adjustment of the spacing between the medium support structure 14 and the printhead 12, e.g. to tune an absolute value, an obliquity or an irregularity of the spacing via the adjusting features 86.

[0069] Fig. 7B illustrates a feeding mechanism 18 according to an example which may be nested with the support panel array 15 illustrated in Fig. 7A to provide a medium support structure 14 with an integrated feeding mechanism 18. The feeding mechanism 18 comprises an input roller 16a and an output roller 16b which may be supported on the pair of beams 38, 40 to follow a relative displacement of the pair of beams 38, 40 with respect to the static support structure 36.

[0070] A belt 48 may be wound around both the input roller 16a and the output roller 16b to provide a conveying belt to feed the print medium 20 along the feeding direction F of the feeding mechanism 18.

[0071] In some examples, a supporting panel array 15 is nested between the input roller 16a and the output roller 16b, such that an upper side of the belt 48 supporting the print medium 20 is located close to or rests on an upper surface of the supporting panel array 15. Hence, the supporting panel array 15 may provide support for the print medium 20 resting on the belt 48.

[0072] The belt 48 and the supporting panel array 15 may comprise corresponding openings, such as slots or holes, to connect a vacuum of a vacuum mechanism (not shown) integrated with or below the supporting panel array 15 to the print medium 20 on the belt 48 or a support plate 46. In some examples, an area of the openings in the support panel array 15 is larger than an area of the openings in the belt 48 in a location where the belt 48 and the support panel array 15 overlap to maintain a vacuum connection of the vacuum mechanism to the print medium 20 or to promote a physical contact between the supporting panel array 15 and the belt 48.

[0073] As illustrated in Fig. 7B, the belt 48 may further be sectioned along a transverse direction with respect to the feeding direction F of the feeding mechanism 18, wherein ribs 82, 84 may be arranged between adjacent sections of the belt 48 to at least partially nest the supporting panel array 15 between the input roller 16a and the output roller 16b of the feeding mechanism 18. Thus, a compact medium support structure 14 may be provided for supporting the print medium 20 in a print zone with an integrated feeding mechanism 18.

[0074] Fig. 8 illustrates an adjusting system for a printer 10 according to a further example. The adjusting system comprises a plurality of beams 38, 40 to couple to a support panel array 15 to support a print medium 20 via the beams 38, 40. Each of the beams 38, 40is movably coupled to a static support structure 36 (not shown in Fig. 8) via a respective pair of actuators 42, 44 which may be arranged at opposite ends of the beams 38, 40.

[0075] As shown in Fig. 8, the beams 38, 40may constitute structural elements of a medium support structure 14, wherein support plates 46 connect adjacent beams 38, 40to form a supporting panel array 15 for a print medium 20.

[0076] The supporting panel array 15 may be nested with a feeding mechanism 18, such as a feeding mechanism 18 comprising an input roller 16a and an output roller 16b arranged at opposite sides of the beams 38, 40. A belt 48 may connect the input roller 16a and the output roller 16b to form a feeding mechanism 18, such as the feeding mechanism 18 shown in the example of Fig. 7B. A feeding direction F of the print medium 20 may hence extend parallel with respect to the extension direction E of the beams 38, 40.

[0077] Driving the pair of actuators 42, 44 movably coupling the respective beam 38, 40 to the static support structure 36 may individually adjust a spacing between the medium support structure 14 and a printhead 12 facing the medium support structure 14 in a printer 10. Jointly driving the pairs of actuators 42, 44 of each beam 38, 40 may translate print medium 20 arranged on the medium support structure 14 with respect to the printhead 12, such as to accommodate print media 20 having different thicknesses. Individually driving an actuator 42 of a pair of actuators 42 may allow locally adjusting a position or an orientation of the print medium 20 with respect to the printhead 12.

[0078] Any of the aforementioned alternatives or examples may be implemented in combination unless otherwise mentioned, and are not considered to exclude further additions to the respective systems. The examples discussed above are further considered illustrative and should not be construed as limiting. Rather, the scope of protection is to be determined by the scope of the appended claims.

CLAIMS

1. An adjusting system for a spacing between a printhead and a print medium, the adjusting system comprising:
   - a static support structure,
   - a pair of beams movably coupled to the static support structure to adjust the spacing,
   - a medium support structure to support the print medium, wherein the medium support structure is supported by the pair of beams, and
   - a pair of actuators coupled to a first beam of the pair of beams, wherein the pair of actuators is driven to adjust a position of the first beam with respect to the static support structure and to thereby adjust the spacing.

2. The adjusting system of claim 1, wherein the pair of actuators is driven to adjust a position of the medium support structure with respect to the static support structure.

3. The adjusting system of claim 1, further comprising two ribs connecting the pair of beams, wherein the medium support structure is coupled to the pair of beams via the ribs.

4. The adjusting system of claim 3, further comprising adjusting features to adjust a position of the two ribs with respect to the pair of beams.

5. The adjusting system of claim 1, wherein the pair of actuators is spaced along an extension direction of the first beam, and wherein the pair of beams is spaced perpendicularly to the extension direction of the first beam.

6. The adjusting system of claim 1, wherein the pair of actuators comprise a self-locking transmission to lock the position of the first beam in the absence of a driving force provided by the pair of actuators.

7. The adjusting system of claim 1, further comprising an elastic biasing element, the elastic biasing element providing a biasing force between the first beam of the pair of beams and the static support structure.

8. The adjusting system of claim 1, further comprising a second pair of actuators associated with a second beam of the pair of beams, wherein the second pair of actuators is driven to adjust a position of the second beam with respect to the static support structure.

9. A printer comprising a printhead, a medium support structure and an adjusting system to adjust a spacing between the printhead and a print medium supported by the medium support structure, the adjusting system comprising:
   - a static support structure,
   - a pair of beams movably coupled to the static support structure to adjust the spacing, wherein the medium support structure is supported by the pair of beams, and
   - a first pair of actuators to movably couple a first beam of the pair of beams to the static support structure,
   - a second pair of actuators to movably couple a second beam of the pair of beams to the static support structure,
   - wherein the first pair of actuators and second pair of actuators are driven to adjust a position of the first beam and the second beam, respectively, to thereby adjust the spacing.

10. The printer of claim 9, wherein the adjusting system further comprises two ribs extending between the first beam and the second beam, the ribs defining the spacing between the medium support structure and the printhead at their respective positions along the extension direction of the first beam or the second beam.

11. The printer of claim 9, further comprising a feed mechanism to feed the print medium to a location between the medium support structure and the printhead along a medium feed direction, the feed mechanism being supported by the pair of beams.

12. The printer of claim 11, wherein the medium feed direction is transverse to the orientation of the first beam or the second beam.

13. An apparatus for supporting a print medium comprising
   - a static support structure,
   - a first beam extending along a direction,
   - a second beam extending parallel to the first beam,
   - a print medium support supported on the first beam and the second beam to support the print medium in a position defined by the first beam and the second beam,
   - a first pair of actuators to movably couple the first beam of the pair of beams to the static support structure,
   - a second pair of actuators to movably couple a second beam of the pair of beams to the static support structure,

- wherein the first pair of actuators and the second pair of actuators are driven to adjust a position of the first beam and the second beam, respectively.

14. The adjusting system according to claim 13, wherein the first pair of actuators and the second pair of actuators are jointly driven to translate the print medium support.

15. The adjusting system according to claim 13, wherein the print medium support comprises a medium feed mechanism and a platen supported by the first beam and the second beam, wherein the medium feed mechanism supplies the print medium to the platen, wherein the platen faces a printhead and supports the print medium during printing.

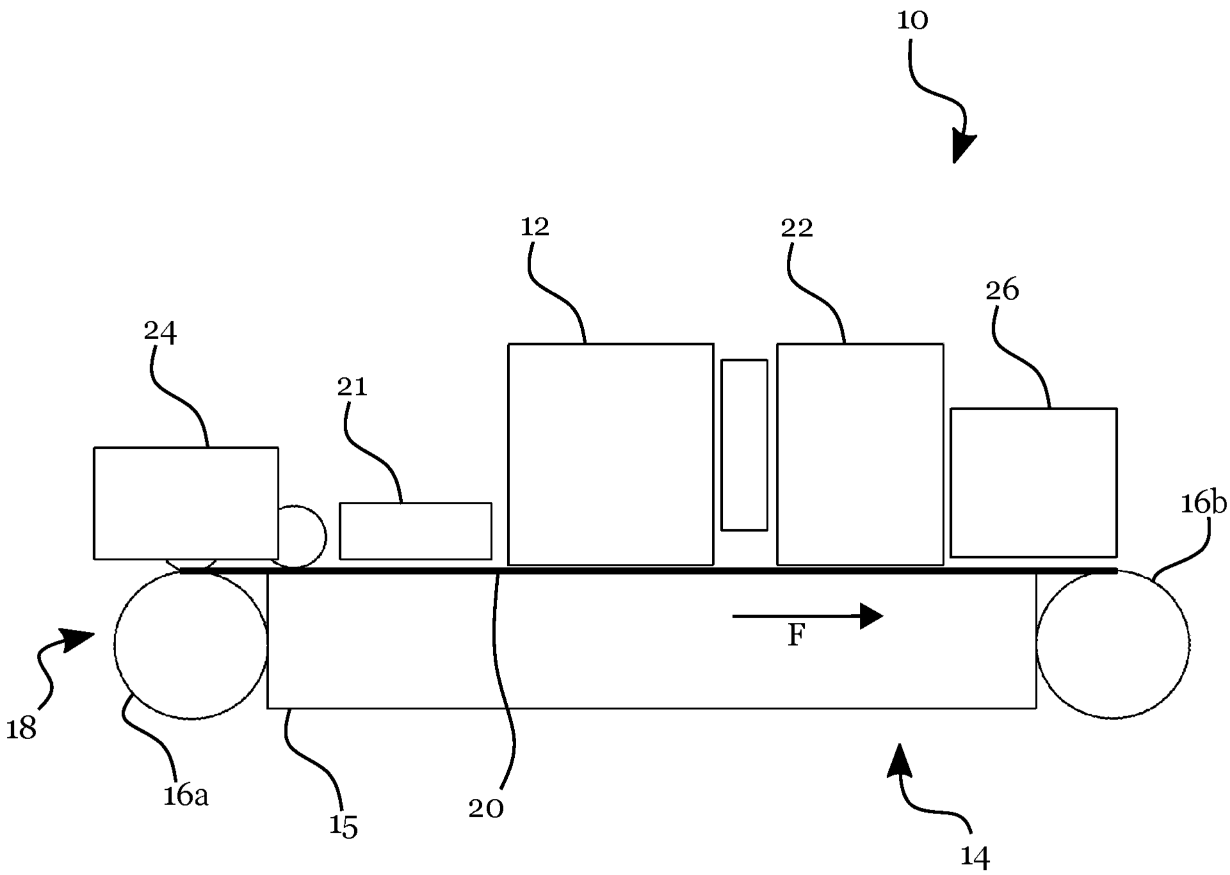

Fig. 1

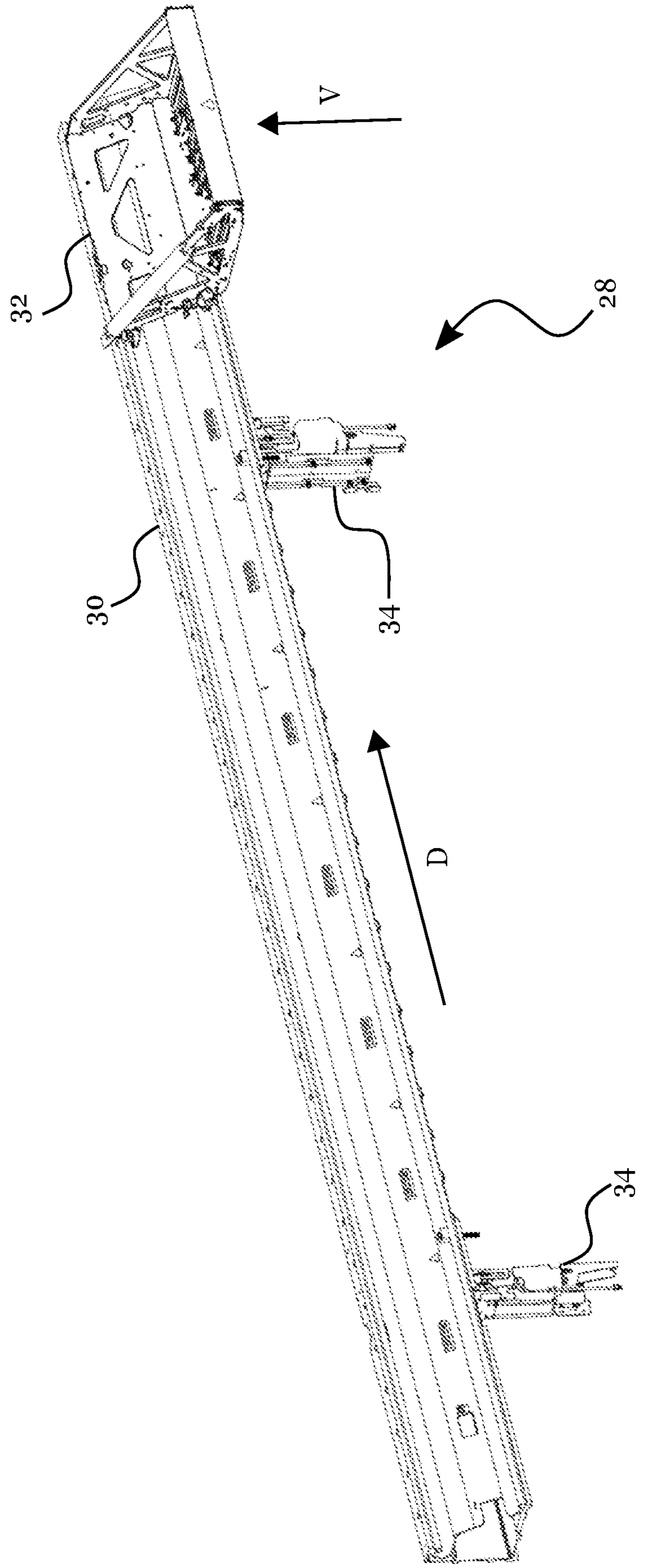

Fig. 2

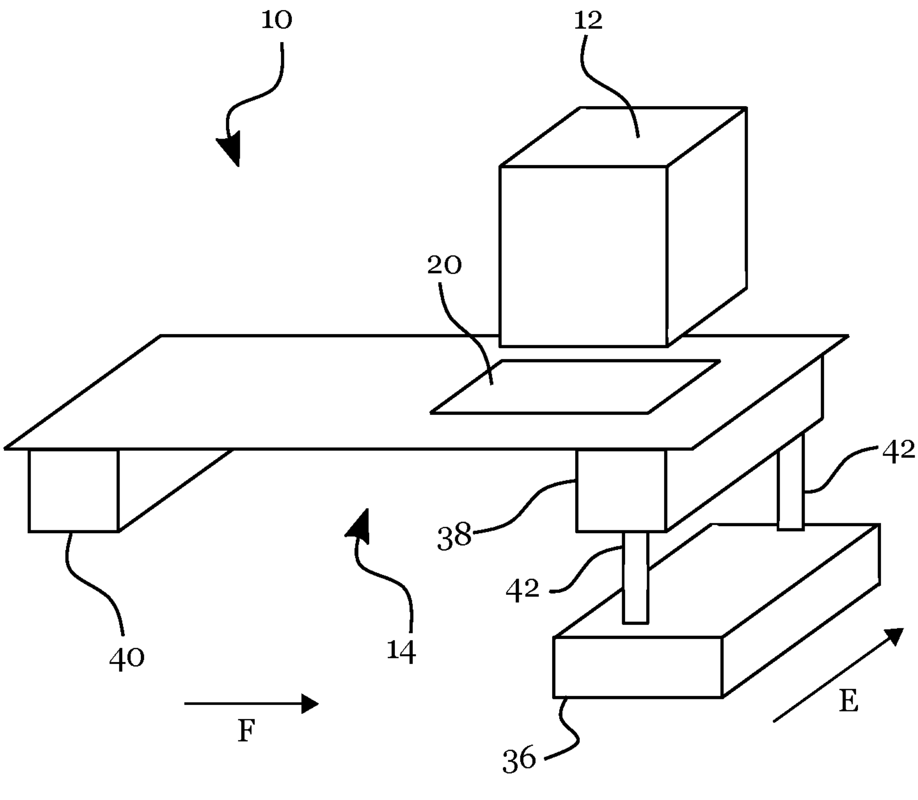

Fig. 3

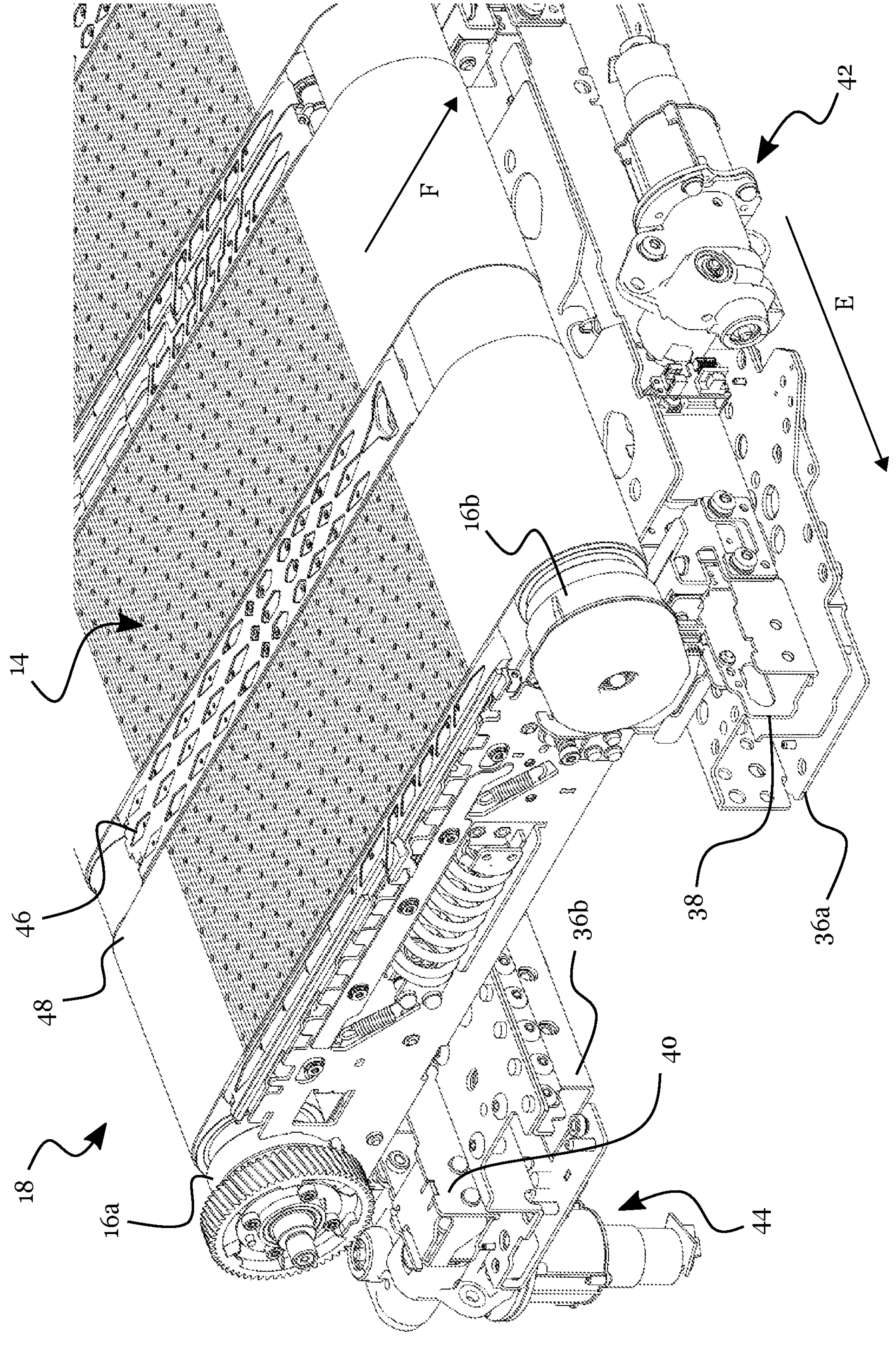

Fig. 4

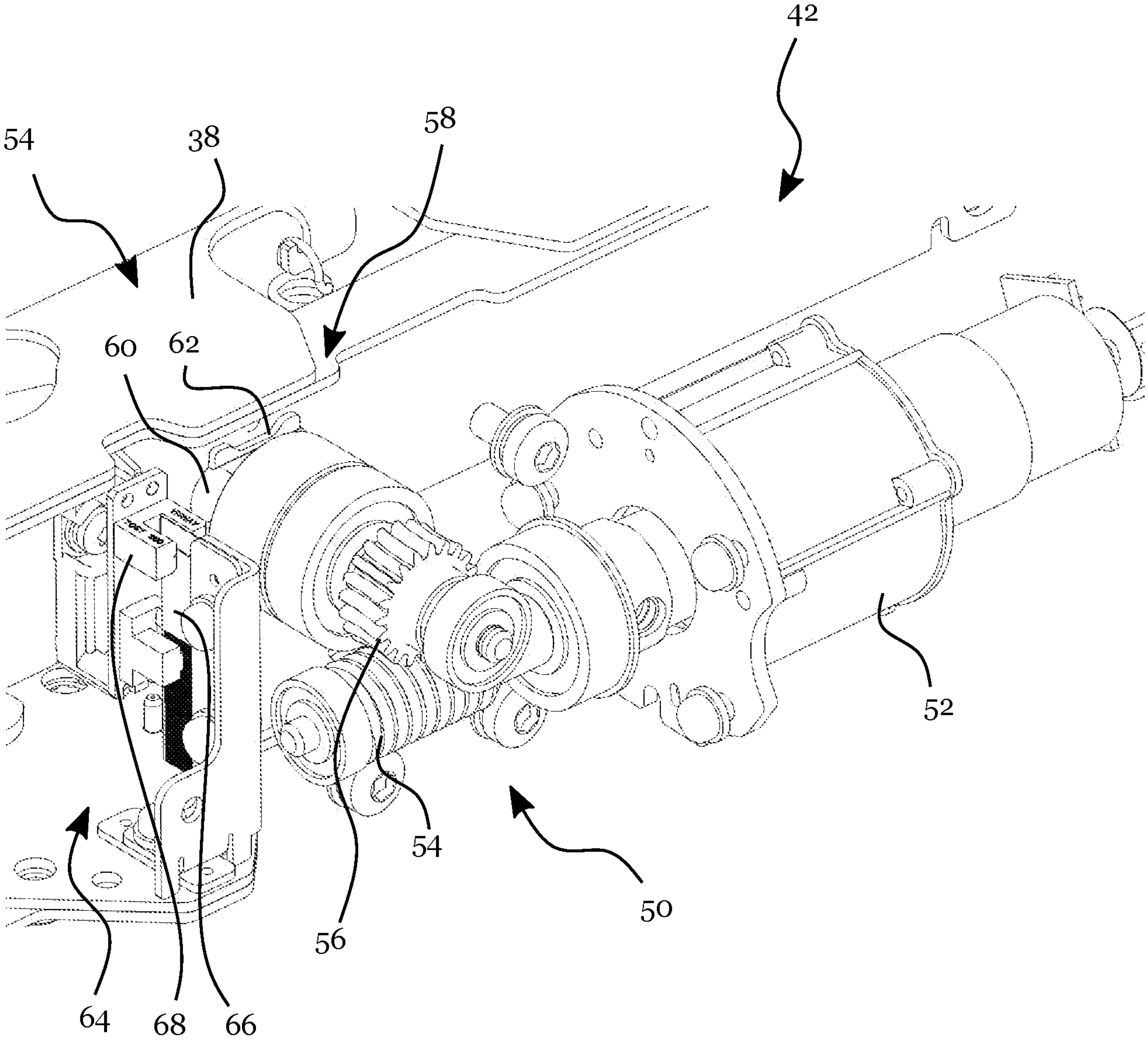

Fig. 5

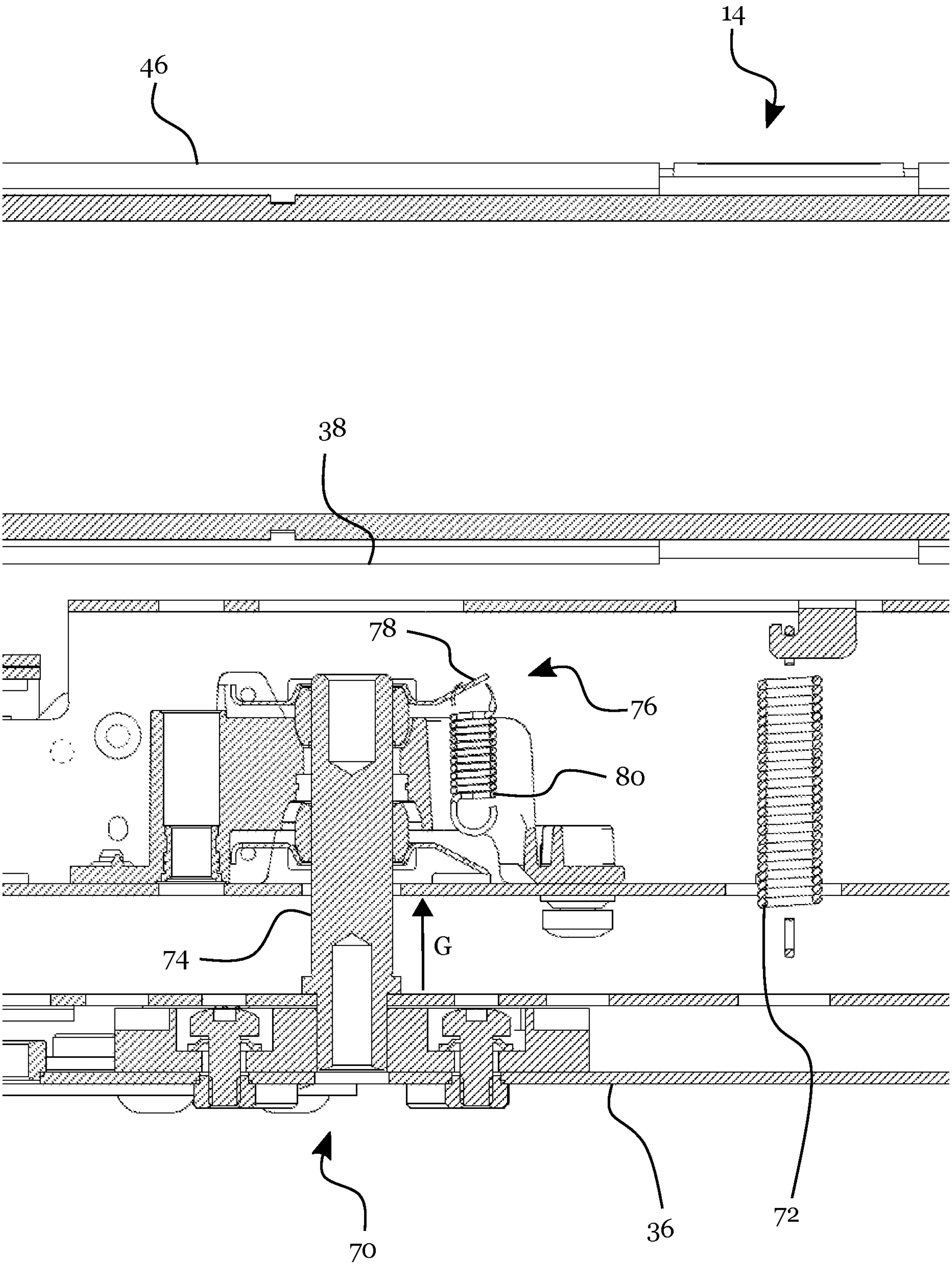

Fig. 6

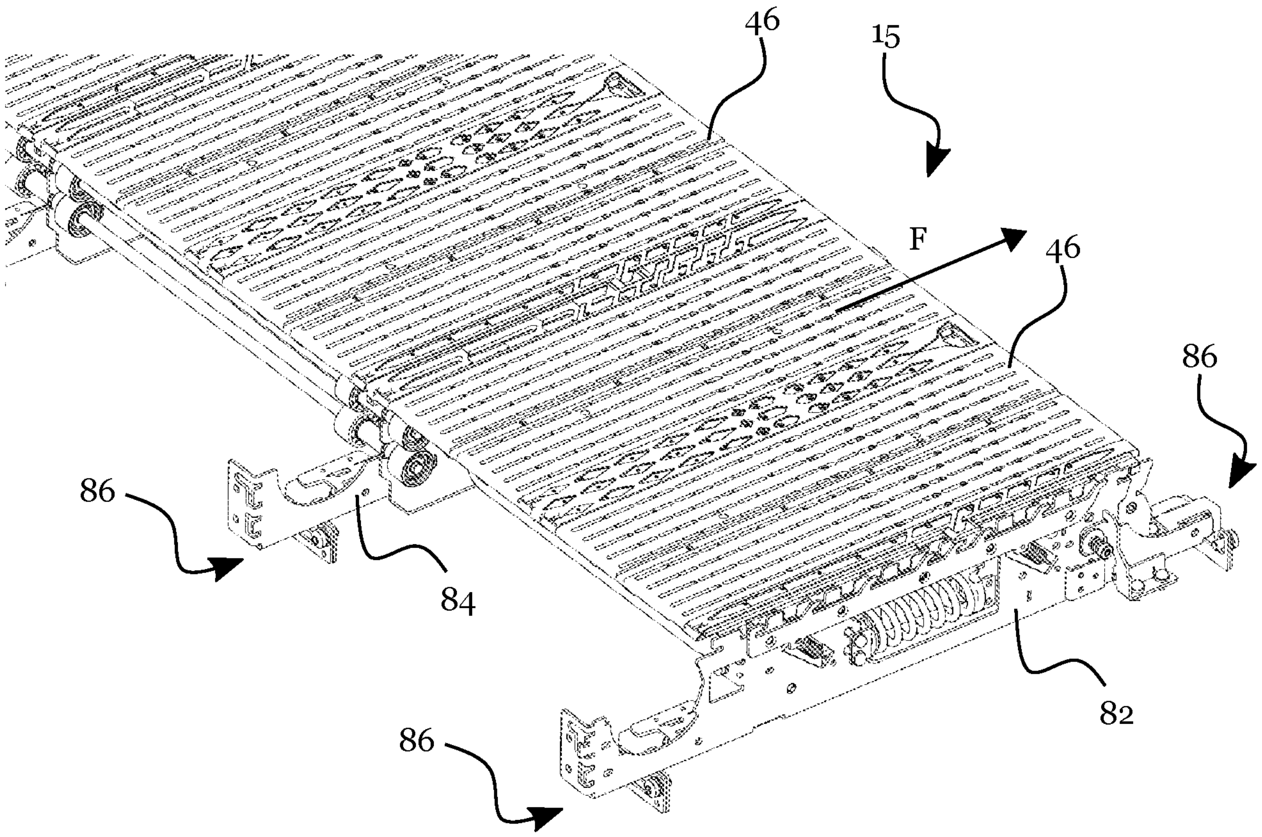

Fig. 7A

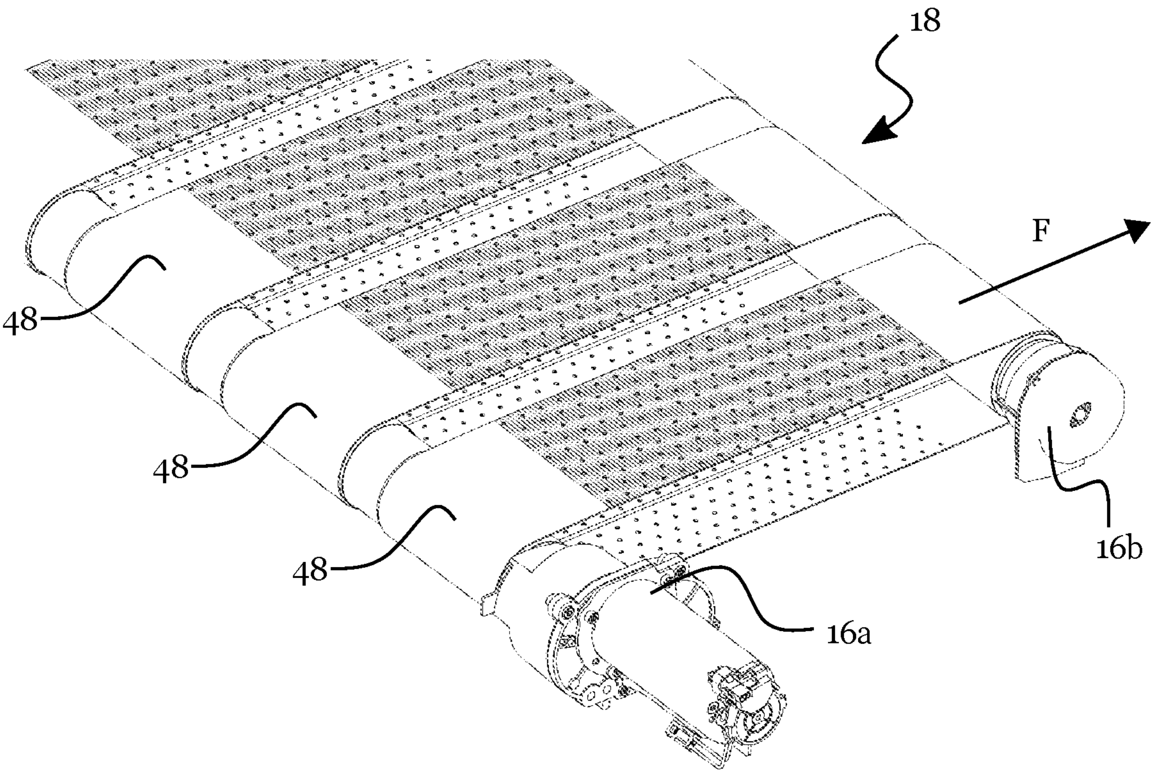

Fig. 7B

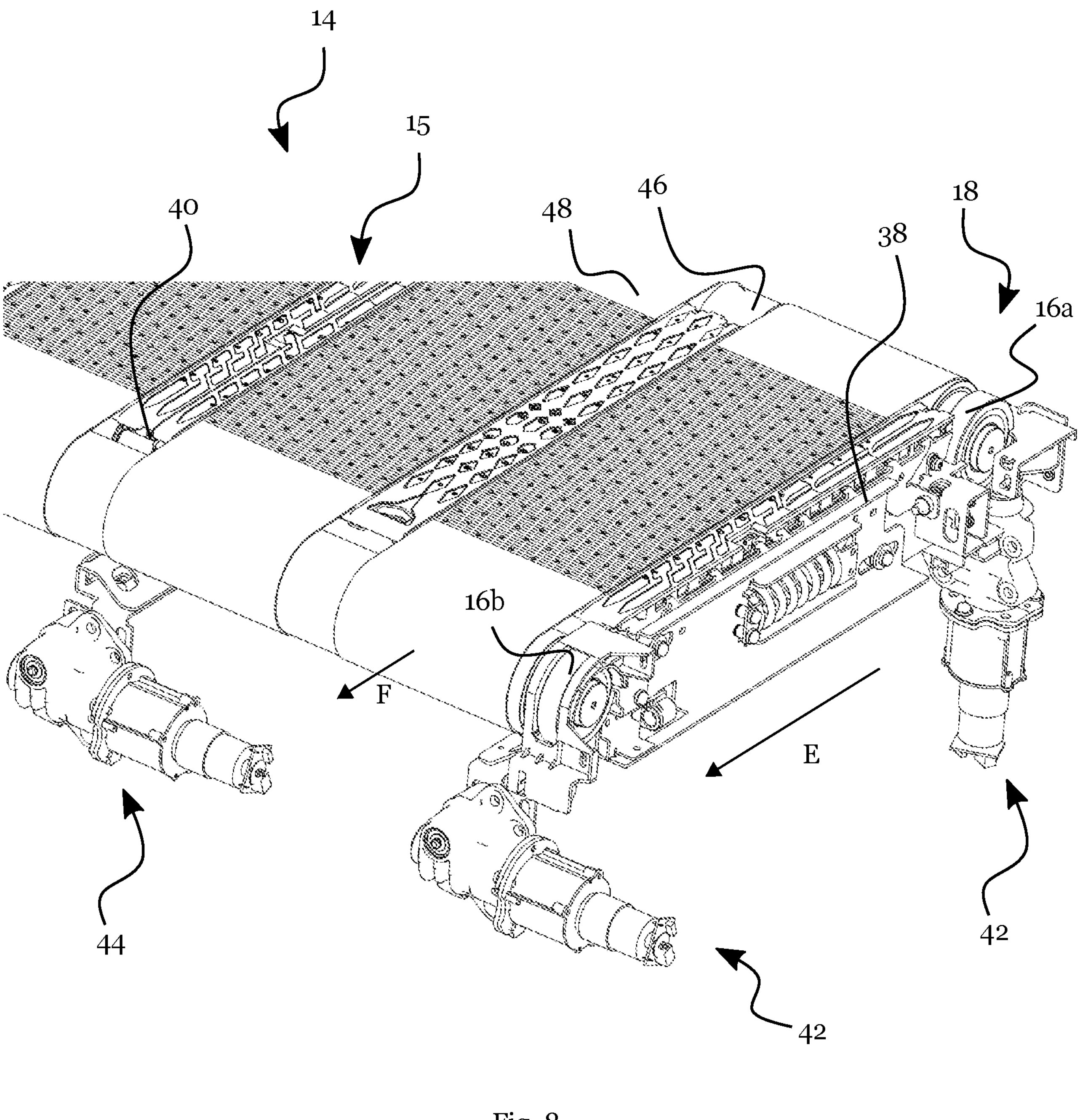

Fig. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2019/054459

A. CLASSIFICATION OF SUBJECT MATTER

B41J 11/00 *(2006.01)*
B41J 25/308 *(2006.01)*

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B41J 25/308, 11/00, B29C 67/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PatSearch (RUPTO Internal), USPTO, PAJ, Espacenet, Information Retrieval System of FIPS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	US 2004/0017456 A1 (FRANZ OBERTEGGER et al.) 29.01.2004, abstract, paragraphs [0107], [0108], claims 65, 66, fig. 7	1, 2, 8 3-7 9-15
Y	US 5854643 A (CANON KABUSHIKI KAISHA) 29.12.1998, abstract, fig. 7, 5, 11	3-7
A	US 2015/0147424 A1 (CHARLES BIBAS) 28.05.2015	1-15
A	EP 2934859 B1 (STRATASYS, INC) 06.02.2019	1-15

[X] Further documents are listed in the continuation of Box C.

[ ] See patent family annex.

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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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 March 2020 (26.03.2020)	23 April 2020 (23.04.2020)

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2019/054459

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 102012000664 B4 (JOVANOVIC MIRJANA et al.)10.07.2014	1-15
A	US 9333709 B2 (VOXELJET AG) 05.10.2016	1-15