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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
27 September 2007 (27.09.2007)

PCT

(10) International Publication Number
WO 2007/109643 A2

(51) International Patent Classification:
B65G 63/02 (2006.01)

(21) International Application Number:
PCT/US2007/064352

(22) International Filing Date: 20 March 2007 (20.03.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/784,120 20 March 2006 (20.03.2006) US

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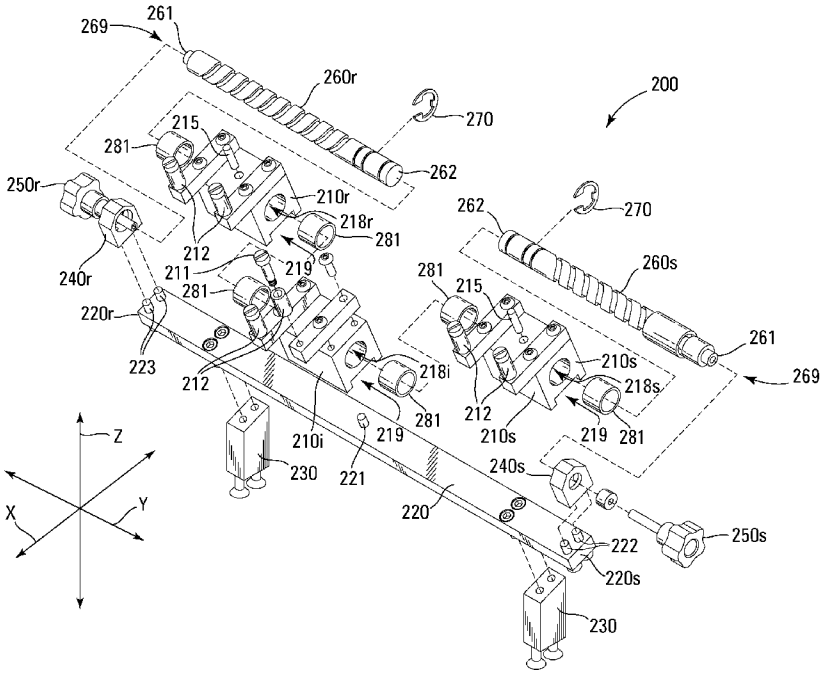
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, 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, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) **Title:** FEED BELT POSITIONING ASSEMBLY



(57) **Abstract:** An adjustment mechanism for use on a friction sheet feeding machine to permit selective lateral repositioning of one feed belt on the machine relative to at least one other feed belt on the machine.

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FEED BELT POSITIONING ASSEMBLY

[0001] This application claims the benefit of United States Provisional Application No. 60/784,120, filed March 20, 2006.

BACKGROUND OF THE INVENTION

[0002] A wide variety of friction sheet feeding machines are available for feeding individual sheets from the bottom of an essentially vertical stack of sheets. Exemplary friction sheet feeding machines are shown and described in United States Patents Nos. 4,991,831, 5,143,365, 5,244,198, 5,642,877, 5,772,199 and 6,932,338.

[0003] These machines typically include (i) a tray for holding a stack of sheets in an essentially vertical position, (ii) a nip for feeding a lowermost sheet from the stack, (iii) a driven friction roller or feed belt for contacting the downward facing major surface of the lowermost sheet in the stack and pulling the lowermost sheet from underneath the sheet stack towards the nip, and (iv) a friction retard surface positioned above the driven friction roller for contacting the leading edge(s) and any exposed upward facing major surface(s) of the sheet(s) positioned directly above the lowermost sheet for retarding advancement of the sheet(s) directly above the lowermost sheet and thereby facilitating separation of the lowermost sheet from the immediately overlying sheet prior to introduction of the lowermost sheet into the feed nip.

[0004] Friction sheet feeding machines need to be sufficiently versatile to feed sheets over a wide range of lengths and widths. In order to accommodate the feeding of sheets over a wide range of widths, the machines typically employ a plurality of laterally spaced and laterally adjustable feed belts. While generally effective for expanding the versatility of the machine, lateral adjustment of the conveyor belts tends to be awkward, cumbersome and potentially dangerous.

[0005] Accordingly, a need exists for a friction sheet feeding machine having a plurality of feed belts which may be quickly, easily and safely laterally repositioned for accommodating the feeding of sheets over a wide range of sheet widths.

SUMMARY OF THE INVENTION

[0006] A first aspect of the invention is a friction sheet feeding machine for feeding individual sheets from a stack of sheets in a longitudinal direction. The machine includes (i) a feed belt system, and (ii) an adjustment mechanism. The feed belt system includes a plurality of laterally spaced feed belts for feeding individual sheets from a stack of sheets in a longitudinal direction. The adjustment mechanism is effective for permitting selective lateral repositioning of at least one of the feed belts relative to at least one other feed belt.

[0007] A second aspect of the invention is a method of laterally repositioning at least one feed belt on a friction sheet feeding machine having a feed belt system for adjusting the effective width of the feed belt system.

[0008] A first embodiment of the second aspect of the invention comprises the steps of (i) obtaining a friction sheet feeding machine for feeding individual sheets from a stack of sheets in a longitudinal direction, comprising: (A) a feed belt system including a plurality of laterally spaced feed belts for feeding individual sheets from a stack of sheets in a longitudinal direction, and (B) an adjustment mechanism for permitting selective lateral repositioning of at least one of the feed belts relative to at least one other feed belt, and (ii) actuating the adjustment mechanism to laterally reposition at least one of the feed belts relative to at least one other feed belt.

[0009] A second embodiment of the second aspect of the invention comprises the steps of (i) obtaining a friction sheet feeding machine for feeding individual sheets from a stack of sheets in a longitudinal direction, comprising: (A) a feed belt system including a plurality of laterally spaced feed belts for feeding individual sheets from a stack of sheets in a longitudinal direction, and (B) an adjustment mechanism for permitting selective lateral repositioning of at least one of the feed belts relative to at least one other feed belt, (ii) loading a stack of sheets onto the machine, (iii) operating the machine to feed individual

sheets from the stack of sheets loaded onto the machine, and (iv) actuating the adjustment mechanism to laterally reposition at least one of the feed belts relative to at least one other feed belt while the machine is operating.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Figure 1 is a perspective view of one embodiment of the invention.

[0011] Figure 2 is an exploded view of the invention shown in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

Nomenclature

10 Friction Sheet Feeding Machine
10r Right Side of Friction Sheet Feeding Machine
10s Left Side of Friction Sheet Feeding Machine
20 Frame
21r Right Side Panel
21s Left Side Panel
26 Support Rod
30 Drive Assembly
40 Drive Belt
50 Friction Feed Roller
60 Friction Feed Belts (60i, 60r and 60s)
60i Intermediate Feed Belt
60r Right Side Feed Belt or Outside Feed Belt
60s Left Side Feed Belt or Outside Feed Belt
200 Lateral Spacing Adjustment Mechanism
210 Position Control Carriages or Carriages (210i, 210r and 210s)
210i Intermediate Carriage or Fixed Position Carriage
210r Right Carriage or Repositionable Carriage

210s Left Carriage or Repositionable Carriage

211 Guide Pins on Carriages

212 Sleeve over Guide Pins

215 Follower Pin

218 Lateral Bore Through Carriages (218i, 218r and 218s)

218i Lateral Bore Through Intermediate Carriage

218r Lateral Bore Through Right Side Carriage

218s Lateral Bore Through Left Side Carriage

219 Lateral Channel Along Bottom of Carriage

220 Guide Bar

220r Right End of Guide Bar

220s Left End of Guide Bar

221 Machine Screw

222r Set of Machine Screws

222s Set of Machine Screws

230 Mounting Block

240r Right Side Stanchion

240s Left Side Stanchion

250r Right Side Knob or Right Side Interface Device

250s Left Side Knob or Right Side Interface Device

260r Right Side Worm Screw

260s Left Side Worm Screw

261 Proximal End of Worm Screw

262 Distal End of Worm Screw

269 Threaded Bore in Proximal End of Worm Screw

270 E-Clip

281 Bearings

285 Spacer

x Longitudinal Direction

y Lateral Direction

z Transverse Direction

Construction

[0012] Friction sheet feeding machines **10** generally include a frame **20**, a tray assembly (not shown), a gating assembly (not shown) and a drive assembly **30**. The machines **10** are capable of serially feeding individual sheets (not shown) in a longitudinal direction **x** from the bottom (unnumbered) of a generally vertical stack of sheets (not shown) retained within the tray assembly (not shown).

[0013] **A** typical configuration of the frame **20** is a generally rectangular frame **20** having (i) a generally horizontal base plate (not shown), (ii) a right side panel **21r** extending upward from the base plate (not shown) and defining a right side **10r** of the machine **10**, (iii) a left side panel **21s** also extending upward from the base plate (not shown) and defining a left side **10s** of the machine **10**, (iv) a rear end plate (not shown) extending upward from the base plate (not shown) and laterally interconnecting the side panels **21r** and **21s**, (v) at least one lateral cross member (not shown) transversely spaced above the base plate (not shown) and interconnecting the side panels **21r** and **21s** for supporting the gating assembly (not shown), and (vi) a plurality of laterally extending support rods **26** extending between and interconnecting the side panels **21r** and **21s**. Other frame configurations may also be employed, such as a cross-beam construction rather than the plate construction shown in FIG. 1. Exemplary frames **20** suitable for use are shown and described in United States Patents Nos. 4,991,831, 5,143,365, 5,244,198, 5,642,877, 5,772,199 and 6,932,338.

[0014] The tray assembly (not shown) is effective for holding a stack of individual sheets (not shown) in a substantially vertical position with a slight biasing of at least the lower portion (unnumbered) of the stack (not shown) towards the gating assembly (not shown) and the drive assembly **30**.

[0015] One means for achieving the desired biasing of the stack (not shown), is to incline the floor (not shown) of the tray assembly (not shown) towards the gating assembly (not shown) and the drive assembly **30**. Other means are known and may also be employed, such as a transversely extending strip (not shown) positioned within the tray assembly (not shown) for supporting the trailing edges (not shown) of the sheets (not shown) in the stack (not shown) wherein the lower portion (unnumbered) of the support strip (not shown) is curved towards the gating assembly (not shown) and the drive assembly **30**. Suitable tray types,

styles and configurations are shown and described in United States Patents Nos. 4,991,831, 5,143,365, 5,244,198, 5,642,877, 5,772,199 and 6,932,338.

[0016] A typical gating assembly (not shown) includes a friction retard roller (not shown) driven by an auxiliary electric motor (not shown) for contacting the upward facing major surface (not shown) of sheets (not shown) as they approach the friction feed belts **60** for assisting in separation of a lowermost sheet (not shown) from the immediately overlying sheet (not shown) to prevent the simultaneous feeding of multiple sheets (not shown). Typical gating assemblies are shown and described in United States Patents Nos. 4,991,831, 5,143,365, 5,244,198, 5,642,877, 5,772,199 and 6,932,338.

[0017] Generally, the drive assembly **30** includes a primary drive motor (not shown) and a friction feed roller **50** driven by the primary drive motor (not shown). The friction feed roller **50** drives friction feed belts **60** which contact the sheets (not shown).

[0018] The drive assembly **30** on friction sheet feeding machines **10** typically includes a conveyor system (not shown) downstream from the friction feed belts **60** for receiving individual sheets (not shown) fed from the sheet stack (not shown) by the friction feed belts **60** and conveying the fed sheets (not shown) to the desired location, typically a conveyor belt (not shown) timed to receive and collate sheets (not shown) fed from several aligned friction sheet feeding machines **10**.

[0019] Referring generally to FIG 1, one embodiment of a suitable drive assembly **30** includes a primary drive motor (not shown), and a plurality of longitudinally **x** aligned laterally **y** spaced friction feed belts **60i**, **60r** and **60s**, each mounted onto a driven friction feed roller **50** and an idler roller (not shown) longitudinally **x** spaced from the friction feed roller **50**. The friction feed roller **50** is rotatably attached to the side panels **21r** and **21s**. Similarly, the idler roller (not shown) extend parallel with the friction feed roller **50** and is rotatably attached to the side panels **21r** and **21s**. The friction feed roller **50** is driven by the primary drive motor (not shown) via drive belt **40**.

[0020] Referring generally to FIGs 1 and 2, the friction sheet feeding machine **10** is provided with a lateral spacing adjustment mechanism **200** for permitting selective lateral **y** repositioning of one or more feed belts **60**. The specific embodiment depicted in FIGs 1 and

2 permits selective and independent lateral **y** repositioning of the outside feed belts **60r** and **60s**.

[0021] The lateral **y** position of each of the feed belts **60** is controlled by a position control carriage **210** (*i.e.*, the lateral **y** position of the intermediate feed belt **60i** is controlled by an intermediate carriage **210i**, the lateral y position of the right outside feed belt **60r** is controlled by a right carriage **210r** and the lateral y position of the left outside feed belt **60s** is controlled by a left carriage **210s**). Each carriage **210** has a pair of transversely **z** extending and laterally **y** spaced guide pins **211** carrying a rotatable sleeve **212**. The guide pins **211** project upward from the position control carriage **210** for accommodating passage of the return portion (unnumbered) of a respective feed belt **33** therebetween. When a sleeve **212** is moved into engagement with a side edge (unnumbered) of a feed belt **60,** the feed belt **60** is "pushed" away from the guide pin **211** and thereby laterally **y** repositioned along the length of the friction feed roller **50** and the idler roller (not shown).

[0022] Each position control carriage **210** has a laterally extending channel **219** along the bottom (unnumbered) of the carriage **210** for slidably engaging a laterally **y** extending guide bar **220**. The guide bar **220** extends between the side panels **21r** and **21s** and is mounted to the frame **20** via mounting blocks **230**.

[0023] The intermediate carriage **210i** is rigidly attached to the guide bar **220** by machine screw **221**, thereby preventing lateral **y** sliding of the intermediate control carriage **210i** along the guide bar **220**.

[0024] The repositionable carriages **210r** and **210s** each have a lateral bore **218** extending completely through the carriage **210r** and **210s**. A right worm screw **260r** extends completely through the lateral bore **218r** in the right carriage **210r** and a left worm gear **260s** extends completely through the lateral bore **218s** in the left carriage **210s**. The worm screws **260r** and **260s** are spirally threaded for cooperatively engaging a follower pin **215** extending into the lateral bore **218** in each of the repositionable carriages **210r** and **210s**, whereby rotation of the worm screw **260r** and **260s** causes the repositionable carriage **210r** and **210s** to travel along the length of the rotated worm screw **260r** and **260s**, respectively.

[0025] The distal ends **262** of the worm screws **260r** and **260s** are rotatably supported within a lateral bore **218i** in the intermediate carriage **210i**.

[0026] A threaded bore **269** is provided in the proximal ends **261** of each worm screw **260r** and **260s** for attachment of a corresponding knob **250r** and **250s**, for effecting independent manual rotation of the worm screws **260r** and **260s** by rotation of the corresponding knob **250r** and **250s**. The knobs **250r** and **250s** are rotatably supported by stanchions **240r** and **240s** mounted proximate the lateral **y** ends **220r** and **220s** of the guide bar **220** by machine screws **222r** and **222s** respectively.

[0027] Bearings **281** are preferably provided at each end (unnumbered) of each bore **219** through each carriage **210** to facilitate rotation of the worm screws **260r** and **260s** relative to the carriages **210**.

[0028] An e-clip **270** can be provided on each worm screw **260r** and **260s** proximate the distal end **262** of the worm screw **260r** and **260s** for serving as a stop to continued inward travel of the repositionable carriages **210r** and **210s** along the length of the corresponding worm screw **260r** and **260s**. Other mechanical stops are well known to those of routine skill in the art and may be substituted for the e-clip stop **270** shown and described.

Use

[0029] The friction sheet feeding machine **10** of the present invention is used to feed individual sheets (not shown) from the bottom (not shown) of an essentially vertical stack of sheets (not shown) by loading a stack of sheets (not shown) onto the tray (not shown) of the machine **10**, and (ii) rotating the right knob **250r** as necessary and appropriate to move the right carriage **210r** and thereby the right side feed belt **60r** so that the right side feed belt **60r** contacts the sheets (not shown) fed from the machine **10** along a right side margin (not shown) of the sheet (not shown), and (ii) rotating the left knob **250s** as necessary and appropriate to move the left carriage **210s** and thereby the left side feed belt **60s** so that the left side feed belt **60s** contacts the sheets (not shown) fed from the machine **10** along a left side margin (not shown) of the sheet (not shown). The repositionable carriages **210r** and **210s** can be repositioned before or during use of the machine **10** to feed sheets (not shown). Since the knobs **250r** and **250s** are located on the outside of the panels 21r and 21s respectively, and only interact with the drive assembly **30** via contact between the rotatable

sleeves **212** on the adjustable carriages **210r** and **210s** and the outside feed belts **60r** and **60s**, a user may safely interface with the knobs **250r** and **250s** and repositioned the outside feed belts **60r** and **60s** even while the machine **10** is operating.

We claim:

1. A friction sheet feeding machine for feeding individual sheets from a stack of sheets in a longitudinal direction, comprising:

(a) a plurality of laterally spaced feed belts for feeding individual sheets from a stack of sheets in a longitudinal direction, and

(b) an adjustment mechanism for permitting selective lateral repositioning of at least one of the feed belts relative to at least one other feed belt.

2. The friction sheet feeding machine of claim 1 wherein the machine further includes a position-control carriage in operable association with each feed belt for controlling lateral positioning of the associated feed belt, and the adjustment mechanism effects lateral repositioning of a given feed belt by laterally repositioning the position-control carriage associated with the given feed belt.

3. The friction sheet feeding machine of claim 1 wherein (i) the machine defines a right side and a left side, (ii) the machine includes at least three feed belts so as to define an outside feed belt on each side of the machine and at least one intermediate feed belt between the outside feed belts, and (iii) the adjustment mechanism is effective for laterally repositioning at least the outside feed belts.

4. The friction sheet feeding machine of claim 2 wherein (i) the machine defines a right side and a left side, (ii) the machine includes at least three feed belts so as to define an outside feed belt on each side of the machine and at least one intermediate feed belt between the outside feed belts, and (iii) the adjustment mechanism is effective for laterally repositioning at least the outside feed belts.

5. The friction sheet feeding machine of claim 3 wherein the outside feed belts are independently repositionable.

6. The friction sheet feeding machine of claim 4 wherein the outside feed belts are independently repositionable.

7. The friction sheet feeding machine of claim 1 wherein the machine defines a right side and a left side and further includes (i) panels on the right and left sides of the machine preventing side access to the feed belts, and (ii) at least one interface device located on the outside of a panel for effecting actuation of the adjustment mechanism.

8. The friction sheet feeding machine of claim 2 wherein the machine defines a right side and a left side and further includes (i) panels on the right and left sides of the machine preventing side access to the feed belts and position-control carriages, and (ii) at least one interface device located on the outside of a panel for effecting actuation of the adjustment mechanism.

9. The friction sheet feeding machine of claim 7 wherein the interface device is a manually rotatable knob.

10. The friction sheet feeding machine of claim 6 wherein the machine defines a right side and a left side and further includes (i) panels on the right and left sides of the machine preventing side access to the feed belts and position-control carriages, and (ii) a first interface device located on the outside of the right side panel for effecting actuation of the adjustment mechanism to laterally reposition the outside feed belt on the right side, and (iii) a second interface device located on the outside of the left side panel for effecting actuation of the adjustment mechanism to laterally reposition the outside feed belt on the left side.

11. A method of laterally repositioning at least one feed belt on a friction sheet feeding machine having a feed belt system for adjusting the effective width of the feed belt system, comprising the steps of:

(a) obtaining a friction sheet feeding machine for feeding individual sheets from a stack of sheets in a longitudinal direction, comprising: (i) a feed belt system including a plurality of laterally spaced feed belts for feeding individual sheets from a stack of sheets in a longitudinal direction, and (ii) an adjustment mechanism for permitting selective lateral repositioning of at least one of the feed belts relative to at least one other feed belt, and

(b) actuating the adjustment mechanism to laterally reposition at least one of the feed belts relative to at least one other feed belt.

12. The method of claim 11 wherein the adjustment mechanism is actuated while the feed belts are being driven in the longitudinal direction.

13. The method of claim 11 wherein the machine further includes a position-control carriage in operable association with each feed belt for controlling lateral positioning of the associated feed belt, and the adjustment mechanism effects lateral repositioning of a given feed belt by laterally repositioning the position-control carriage associated with the given feed belt.

14. The method of claim 11 wherein (i) the machine defines a right side and a left side, (ii) the machine includes at least three feed belts so as to define an outside feed belt on each side of the machine and at least one intermediate feed belt between the outside feed belts, and (iii) the adjustment mechanism is effective for laterally repositioning at least the outside feed belts.

15. The method of claim 11 wherein the machine defines a right side and a left side and further includes (i) panels on the right and left sides of the machine preventing side access to the feed belts, and (ii) at least one interface device located on the outside of a panel for effecting actuation of the adjustment mechanism.

16. A method of laterally repositioning at least one feed belt on a friction sheet feeding machine having a feed belt system for adjusting the effective width of the feed belt system, comprising the steps of:

(a) obtaining a friction sheet feeding machine for feeding individual sheets from a stack of sheets in a longitudinal direction, comprising: (i) a feed belt system including a plurality of laterally spaced feed belts for feeding individual sheets from a stack of sheets in a longitudinal direction, and (ii) an adjustment mechanism for permitting selective lateral repositioning of at least one of the feed belts relative to at least one other feed belt,

(b) loading a stack of sheets onto the machine,

(c) operating the machine to feed individual sheets from the stack of sheets loaded onto the machine, and

(d) actuating the adjustment mechanism to laterally reposition at least one of the feed belts relative to at least one other feed belt while the machine is operating.

17. The method of claim 16 wherein the machine further includes a position-control carriage in operable association with each feed belt for controlling lateral positioning of the associated feed belt, and the adjustment mechanism effects lateral repositioning of a given feed belt by laterally repositioning the position-control carriage associated with the given feed belt.

18. The method of claim 16 wherein (i) the machine defines a right side and a left side, (ii) the machine includes at least three feed belts so as to define an outside feed belt on each side of the machine and at least one intermediate feed belt between the outside feed belts, and (iii) the adjustment mechanism is effective for laterally repositioning at least the outside feed belts.

19. The method of claim 16 wherein the machine defines a right side and a left side and further includes (i) panels on the right and left sides of the machine preventing side access to the feed belts, and (ii) at least one interface device located on the outside of a panel for effecting actuation of the adjustment mechanism.

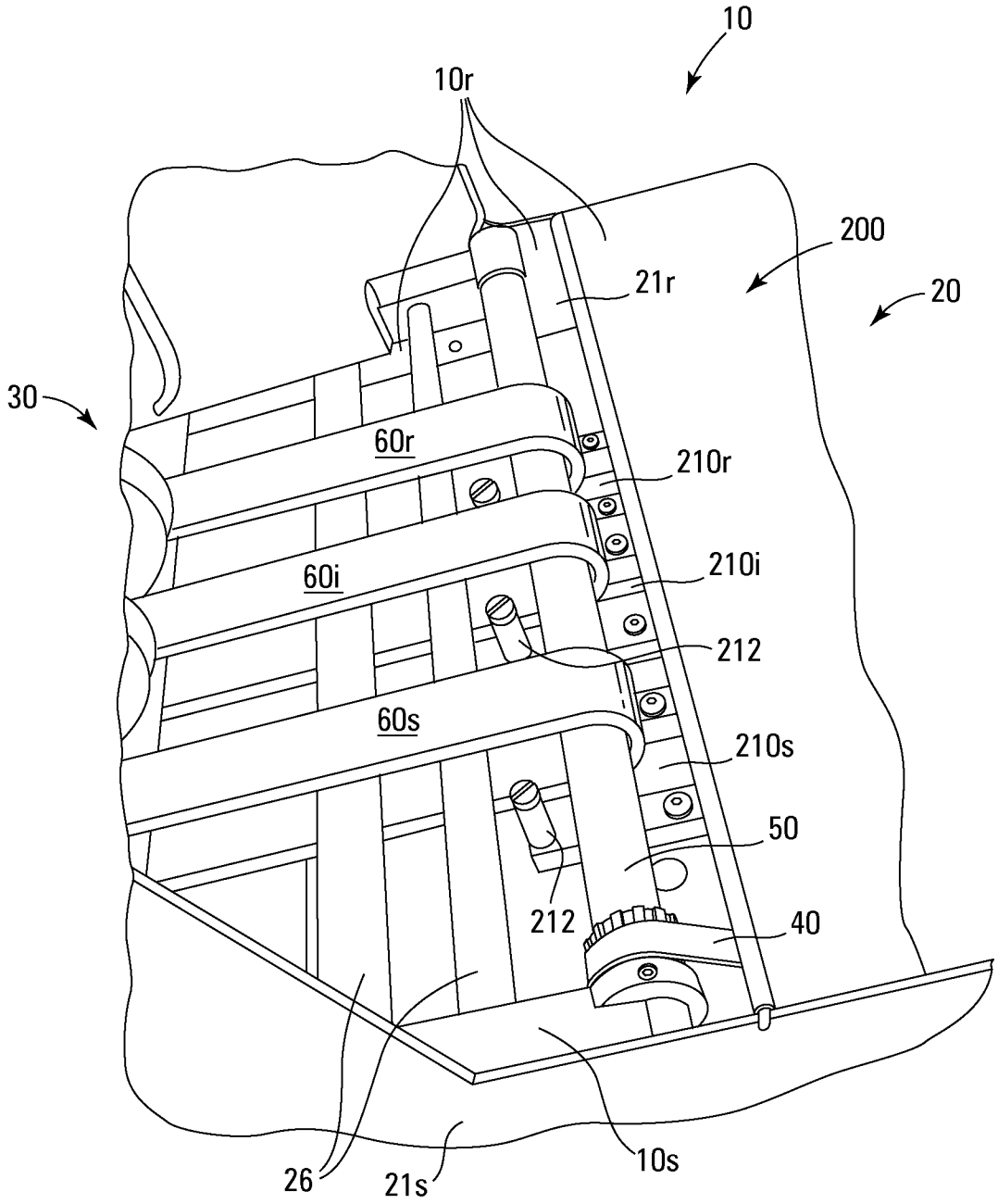
10
10r
200
21r
20
30
60r
210r
60i
210i
212
60s
210s
50
212
40
26
21s
10s

FIG. 1

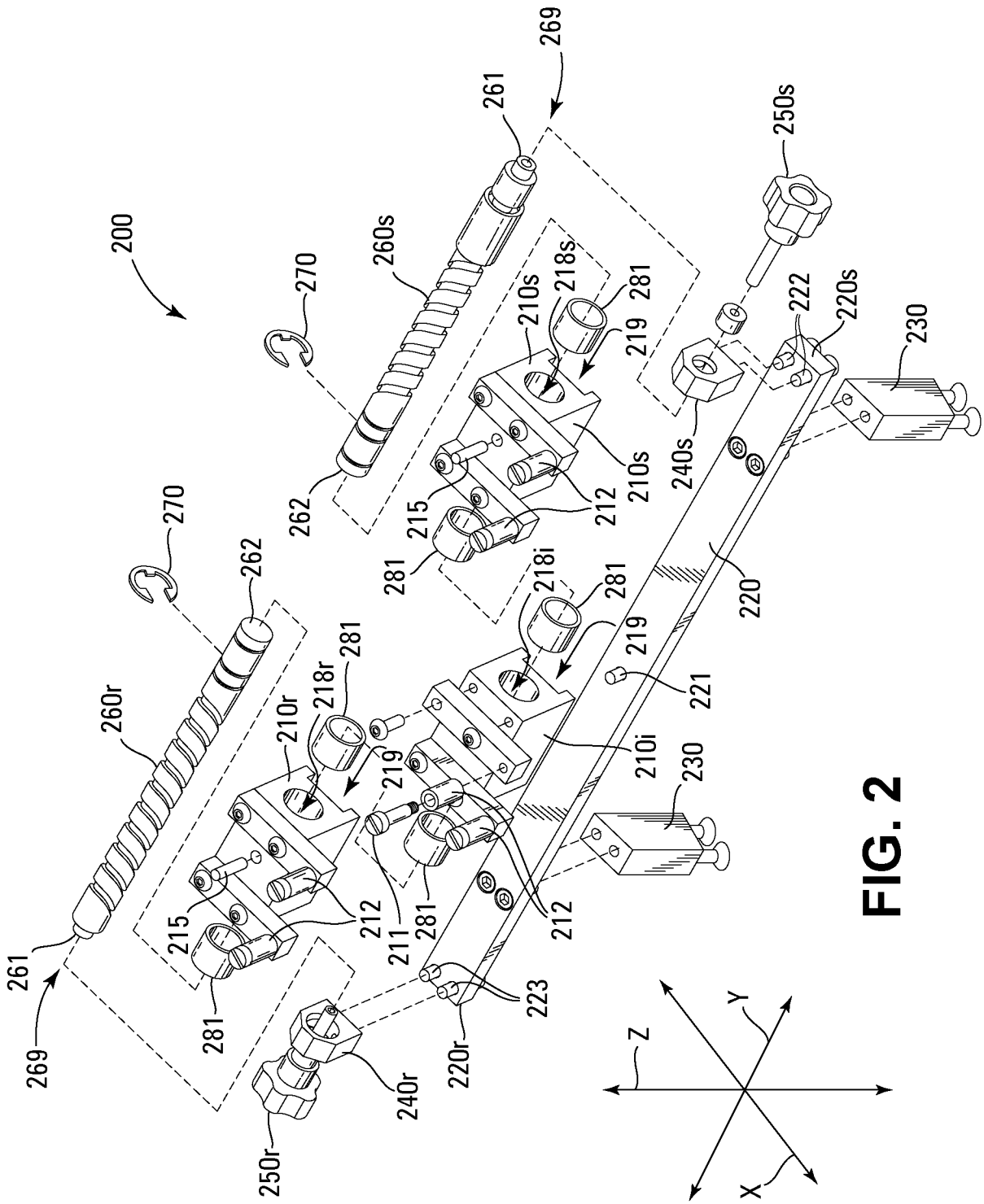
200
269
261
270
260s
262
210s
218s
281
219
212
215
240s
250s
222
220s
230
220
221
218i
210i
260r
218r
210r
211
223
240r
220r
250r
X
Y
Z

FIG. 2