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Web product folding and stacking machine, web product folding and stacking method using same

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ABSTRACT OF THE DISCLOSURE

A web product folding and stacking machine includes two folding line making wheels, two folding fingers, a first carrier unit, a stoppage unit and a holder. The folding line making wheels and the folding fingers are operated to fold up web products on the first carrier unit to form a stack of interfolded web products. When a stack of a predetermined number of interfolded web products is finished, the stoppage unit is extended out to isolate the interfolded web products. Further, a retractable member of the stoppage unit is extended out to hold down the finished stack of interfolded web products when the stoppage unit is lowered to carry the finished stack of interfolded web products with the holder, keeping the finished stack of interfolded web products in integrity.

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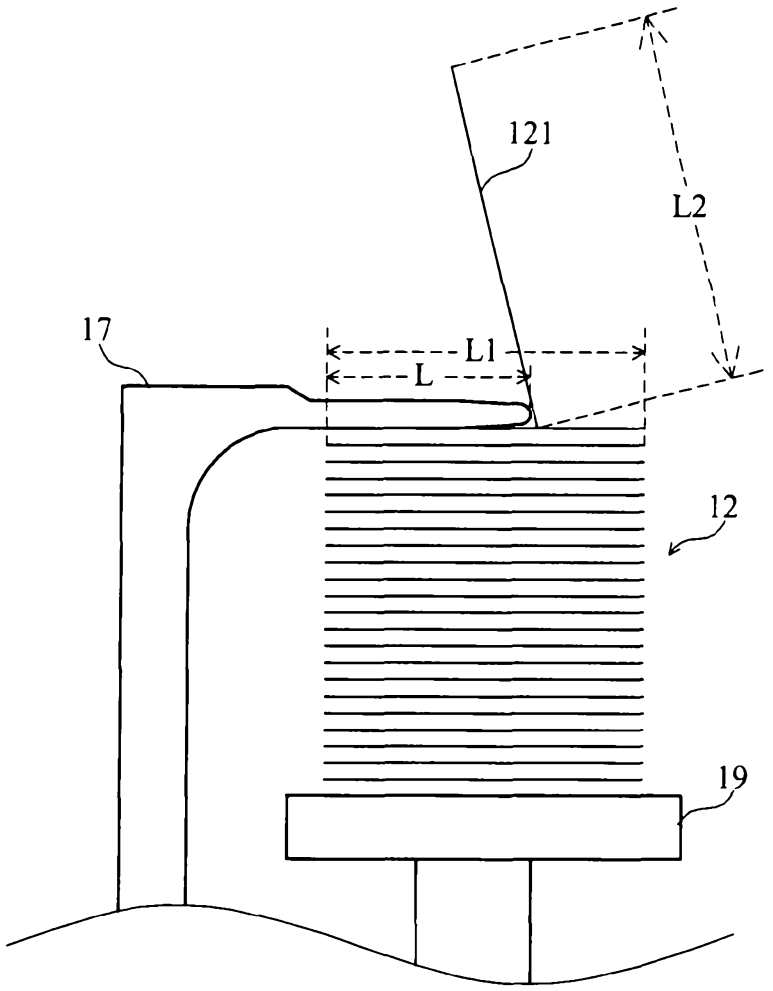

FIG.1A
(PRIOR ART)

WEB PRODUCT FOLDING AND STACKING MACHINE, WEB PRODUCT FOLDING AND STACKING METHOD USING SAME

BACKGROUND OF THE INVENTION

1. Technical Field

The present invention relates to a folding machine, and more particularly to a web product folding and stacking machine, used for benefiting to keep the interfolded web products in integrity.

2. Description of the Prior Art

Please refer to FIG. 1. A conventional web product folding and stacking machine **10** is shown comprising two folding line making wheels **11**, two folding fingers **13**, a first carrier unit **15**, a stoppage unit **17** and a holder **19**. The two folding line making wheels **11** are rotatable in reversed directions to cause each web product **12** to form a folding line. The folding fingers **13** are adapted to stack up folded web product **12** on the first carrier unit **15** for enabling the web products **12** to be stacked up in an interfolded condition.

The stoppage unit **17** is adapted to isolate the interfolded web product **12**, and the stoppage unit **17** and the holder **19** can be adapted to deliver the interfolded web product **12**. When the stoppage unit **17** and the holder **19** are moved downwards, one web product **121** will be exposed to the outside of the stoppage unit **17**. Normally, the length **L** of the stoppage unit **17** is smaller than the width **L1** of the interfolded web products **12**. Thus, the stoppage unit **17** cannot holds down the web product **121**

entirely. When this situation occurs, the width **L2** of the web product **121** that is exposed to the outside will be greater than the width **L1** of the interfolded web products **12**, resulting in unkempt stack of interfolded web products **12**, as shown in FIG. 1A.

If the length **L3** of the stoppage unit **17** is approximately equal to the width **L1** of the interfolded web products **12**, the stoppage unit **17** will be able to hold down one web product **121** that is exposed to the outside, enabling the width **L2** of the exposed web product **121** to be approximately equal to the width **L1** of the interfolded web products **12** after folding. Thus, interfolded web products **12** can be kept in integrity. However, when the length **L3** of the stoppage unit **17** is increased, the extending stoppage unit **17** will pierce the web products **12**. For example, the extending path **R** of the stoppage unit **17** will intersect with the web products **12** at the folding line making wheels **11** or the folding fingers **13**, thereby damaging the structure of the web products **12**, as shown in FIG. 1B.

SUMMARY OF THE PRESENT INVENTION

It is, therefore, the main object of the present invention to provide a web product folding and stacking machine, which has a retractable member mounted in the stoppage unit thereof and controllable to extend out of the stoppage unit to hold down interfolded web products effectively when the stoppage unit is moved to carry the finished interfolded web products downwards.

It is another object of the present invention to provide a web product folding and stacking machine, which has an air blower unit, which is adapted to blow air toward

the web products at the stoppage unit, keeping the web product that exposed to the outside of the stoppage unit to be closely adhered to the top side of the stoppage unit.

It is another object of the present invention to provide a web product folding and stacking machine, which keeps the retractable member inside the stoppage unit when the stoppage unit extends and isolates interfolded web products, avoiding accidental damage to the interfolded web products.

It is still another object of the present invention to provide a web product folding and stacking machine, which has a flexible pad arranged on the top surface of the first carrier unit to impart an upward pressure to the web products stacked thereon so as to extend the contact time between the folding fingers and the stacked folded web products, facilitating making of a neat stack of interfolded web products.

It is still another object of the present invention to provide a web product folding and stacking machine, which has a suction device mounted in the first carrier unit for sucking one web product to have the web product be positively secured to the bottom surface of the first carrier unit.

It is another object of the present invention to provide a web product folding and stacking machine, which has a first folding unit and a second folding unit arranged below the first carrier unit and adapted to fold up the web product that suspends from the first carrier unit.

To achieve these and other objects of the present invention, a web product folding and stacking machine comprises two folding line making wheels arranged in

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proximity to each other for transferring web products and causing each web product to form a folding line thereon, two folding fingers adapted to fold up each web products along the folding line thereof for enabling the web products to be stacked up in an interfolded condition, a first carrier unit adapted to carry the web products folded by the folding fingers, a stoppage unit movable in a first direction and adapted to isolate interfolded web products, a retractable member mounted in said stoppage unit and movable in and out of said stoppage unit, and a holder being movable in the first direction and adapted to hold interfolded web products.

The invention further provides a web product folding and stacking method used in the web product folding and stacking machine. The method includes the steps of: forming a folding line on each of a plurality of web products and folding each web product on the first carrier unit immediately after formation of the folding line, operating said stoppage unit to isolate the interfolded web products when the number of the interfolded web products reaches a predetermined amount; moving said stoppage unit ands aid holder to deliver the interfolded web products to a predetermined location; and extending said retractable member out of said stoppage unit.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic structural view of a web product folding and stacking machine according to the prior art.

FIG. 1A is a schematic view of a part of the prior art design, showing the operation of the prior art web product folding and stacking machine.

FIG. 1B is a schematic view of another part of the prior art design, showing the

operation of the prior art web product folding and stacking machine.

FIG. 2 is a schematic structural view of a web product folding and stacking machine in accordance with the present invention

FIG. 2A is a schematic enlarged partial view of the web product folding and stacking machine in accordance with the present invention.

FIG. 2B is a schematic enlarged partial view of the web product folding and stacking machine in accordance with the present invention.

FIG. 3 is a schematic structural view of an alternate form of the web product folding and stacking machine in accordance with the present invention

FIG. 3A is a schematic enlarged partial view of the alternate form of the web product folding and stacking machine in accordance with the present invention.

FIG. 3B is a schematic enlarged partial view of the alternate form of the web product folding and stacking machine in accordance with the present invention.

FIG. 4A~4G illustrate the operation flow of the web product folding and stacking machine in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Please refer to FIG. 2. A web product folding and stacking machine **20** in accordance with the present invention is shown comprising two folding line making wheels **21**, two folding fingers **23**, a first carrier unit **25**, a stoppage unit **27** and a holder **29**. Subject to the use of the web product folding and stacking machine **20**, web products **22** can be folded and stacked up neatly.

The stoppage unit **27** has a retractable member **271** adapted to separate interfolded web products **22**. In actual application, the amount of interfolded web

products **22** can be known subject to the number of operation cycles of the folding fingers **23**. When the number of interfolded web products **22** reaches the set value, the stoppage unit **27** is extended out to isolate the interfolded web products **22**. The length of the stoppage unit **27** must be limited, for example, the length **L** of the stoppage unit **27** can be shorter than the width **L1** of the interfolded web products **22**, avoiding damage to the web products **22** by the outwardly extending stoppage unit **27**. The holder **29** is adapted to hold the interfolded web products **22** and to match with the stoppage unit **27** for enabling the interfolded web products **22** to be delivered to a predetermined location.

After extension of the stoppage unit **27** to separate interfolded web products **22**, the stoppage unit **27** is moved with the holder **29** downwardly in the first direction **X** to a predetermined location. Because the length **L** of the stoppage unit **27** is shorter than the width **L1** of the interfolded web products **22**, the width **L2** of the part of the web products **221** that is exposed to the outside of the stoppage unit **27** will be greater than the width **L1** of the interfolded web products **22**, thus, the web products **221** may be not neatly stacked up, as shown in FIG. 2A.

The retractable member **271** is movable in and out of the stoppage unit **27**. According to this embodiment, the retractable member **271** is extended out after displacement of the stoppage unit **27**, thereby extending the length of the stoppage unit **27**. For example, after movement of the stoppage unit **27** with the holder **29** downwardly in the first direction **X** to a predetermined location, the retractable member **271** is extended out of the stoppage unit **27** slowly. It is to be understood that the retractable member **271** may be provided at the top or bottom side of the stoppage unit **27** and movable in and out of the stoppage unit **27**.

After movement of the retractable member **271** out of the stoppage unit **27**, the length of the stoppage unit **27** is increased. At this time, the retractable member **271** can be pressed on the web product **221**, causing the width **L3** of the part of the web product **221** that is exposed to the outside of the stoppage unit **27** to become approximately equal to the width **L1** of the interfolded web products **22**, and therefore the web product **221** can be folded up and neatly stacked up. In another embodiment of the present invention, the web product folding and stacking machine **20** further comprises an air blower unit **255** controllable to blow air toward the part of the last piece of the interfolded web products **22** exposed to the outside of the stoppage unit **27**, causing the last web product **22** to be folded on the stoppage unit **27**. The air blower unit **255** can be, for example, arranged below the first carrier unit **25**, as shown in FIG. 2B.

The two folding line making wheels **21** include a first folding line making wheel **211** and a second folding line making wheel **213**, and rotatable in two reversed directions to cause each transferring web product **22** to form a folding line for folding and stacking. The two folding fingers **23** comprise a first folding finger **231** and a second folding finger **233** to fold up each web products **22** along the folding line thereof. For example, the folding line can be formed on the central line of web product **22**. Further, the web products **22** can be toilet paper, facial tissues, paper towels, wet tissues or the like. Thus, a predetermined number of interfolded web products **22** can be packed in a commercial pop-up tissue box.

In one embodiment of the present invention, the stoppage unit **27** and the holder **29** are connected together and movable along the first direction **X** to deliver web products **22**. For example, the holder **29** can be used to hold interfolded web products

22, enabling interfolded web products **22** to be delivered by the stoppage unit **27** and the holder **29** to a conveyer **30**.

FIG. 3 shows an alternate form of the web product folding and stacking machine in accordance with the present invention. According to this embodiment, the web product folding and stacking machine **201** comprises two folding line making wheels **21**, two folding fingers **23**, a first carrier unit **25**, a stoppage unit **27** and a holder **29**. By means of operating the web product folding and stacking machine **201**, web products **22** can be interfolded neatly.

The folding line making wheels **21** include a first folding line making wheel **211** and a second folding line making wheel **213**. The first folding line making wheel **211** has a plurality of longitudinal protrusions **2111** and a plurality of longitudinal grooves **2113** alternatively arranged around the periphery thereof. Similar to the first folding line making wheel **211**, the second folding line making wheel **213** has a plurality of longitudinal protrusions **2131** and a plurality of longitudinal grooves **2133** respectively alternatively arranged around the periphery thereof.

The first folding line making wheel **211** and the second folding line making wheel **213** are arranged in a parallel manner in proximity to each other such that the longitudinal protrusions **2111** of the first folding line making wheel **211** can be engaged into the longitudinal grooves **2133** of the second folding line making wheel **231**; the longitudinal protrusions **2131** of second folding line making wheel **213** can be engaged into the longitudinal grooves **2113** of the first folding line making wheel **211**. The first folding line making wheel **211** and the second folding line making wheel **213** are rotatable in reversed directions, for example, the first folding line

making wheel **211** is rotatable in clockwise direction and the second folding line making wheel **213** is rotatable in counter clockwise direction. When one web product **22** is being transferred through the gap in between the first folding line making wheel **211** and the second folding line making wheel **213** during rotation of the first folding line making wheel **211** and the second folding line making wheel **213** in reversed directions, the web product **22** will be squeezed by one longitudinal protrusion **2111** or **2131** of the first folding line making wheel **211** or second folding line making wheel **213** and one corresponding longitudinal groove **2133** or **2113** of the second folding line making wheel **213** or first folding line making wheel **211**, thereby causing formation of a folding line on the web product **22**.

Suction holes **2115** and **2135** are respectively formed in the first folding line making wheel **211** and the second folding line making wheel **213** corresponding to the respective longitudinal protrusions **2111** and **2131** and the respective longitudinal grooves **2133** and **2113** for sucking in air such that the folding line making wheels **21** can suck or release the web product **22**. Further, the folding fingers **23** include a first folding finger **231** and a second folding finger **233** respectively pivotally supported on a respective pivot member **235** or **237** at a lower elevation relative to the folding line making wheels **21**. Thus, the first folding finger **231** and the second folding finger **233** can be turned about the respective pivot member **235** or **237** within a predetermined angle to fold the web product **22** along its folding line, as shown in FIG. 3A.

Further, the first carrier unit **25** has a pad **26** arranged on the top surface **251** thereof for carrying the web products **22** that are interfolded by the folding line making wheels **21** and the folding fingers **23** in a stack. Further, when the thickness of interfolded web products **22** reaches a certain extent, the first carrier unit **25** will be

lowered slowly in the first direction **X**. The pad **26** is made from an elastic material. For example, the pad **26** can be made from rubber, silicon rubber, sponge, paper sheet or cloth that is capable of imparting an upward return force **F** to the web product **22** and/or the folding fingers **23** during downward stroke of the folding fingers **23**, thereby extending the contact time between the folding fingers **23** and the respective web product **22** and facilitating accurate stacking of the interfolded web products **22**.

The first carrier unit **25** is adapted to hold web products **22**, therefore the first carrier unit **25** is not deformable. If only a limited number of web products **22** has been stacked on the first carrier unit **25**, the web products **22** cannot provide sufficient upward return force **F** to the folding fingers **23**, the contact time between the folding fingers **23** and the newly fed web product **22** will be short, causing flying of the web products **22** during folding and resulting in poor alignment of the stacked web product **22** on the first carrier unit **25**.

The first carrier unit **25** further has a suction device **24** arranged thereon. The suction device **24** has a nozzle hole **241** located on the bottom surface **253** of the first carrier unit **25** for sucking in air, thereby securing a web product **221**.

In one embodiment of the present invention, the web product folding and stacking machine comprises a first folding unit **281** and a second folding unit **283** adapted to fold up the web product **223** suspending from the first carrier unit **25**. The first folding unit **281** and the second folding unit **283** can be arranged at different elevations. An overlap region is formed when the first folding unit **281** and the second folding unit **283** are being moved toward each other in a second direction **Y** perpendicular to the first direction **X**, thereby folding up the web product **223** that

suspends from the first carrier unit **25**, as shown in FIG. 3A. When the first folding unit **281** and the second folding unit **283** are moved apart, the suction device **24** sucks the folded web product **221**, thereby securing the folded web product **223** to the bottom surface **253** of the first carrier unit **25**, as shown in FIG. 3B.

Normally, the first folding unit **281** and the second folding unit **283** are controlled to fold up the web product **22** at one quarter from the edge, and the user can conveniently pup up the first (top) piece of a stack of interfolded web products.

FIGS. 4A through 4G illustrate the operation of the web product folding and stacking machine **20**. When the web product folding and stacking machine **20** is started, the holder **29** is moved to a predetermined position, and then the folding line making wheels **21** and the folding fingers **23** are operated to fold web products **22** into a stack of interfolded web products **22** on the holder **29**, as shown in FIG. 4A.

When the number of the interfolded web products **22** on the holder **29** reaches a predetermined quantity, the stoppage unit **27** is extended out to isolate the interfolded web products **22**, and then the stoppage unit **27** is moved with the interfolded web products **22** and the holder **29** in the first direction **X** to a predetermined location for delivery.

When the stoppage unit **27** and the holder **29** are started to deliver the interfolded web products **22**, the retractable member **271** of the stoppage unit **27** is extended out. Further, when the stoppage unit **27** is extended out, the first carrier unit **25** is simultaneously extended out. The first carrier unit **25** has the pad **26** mounted thereon. Thus, the folding line making wheels **21** and the folding fingers **23** can continuously

fold up web products **22** on the pad **26** at the first carrier unit **25** after finish of one stack of interfolded web products **22** on the holder **29**, as shown in FIG. 4B.

Further, as stated above, the pad **26** is arranged on the first carrier unit **25** at the top side and has an elastically deformable characteristic. When only a limited number of web products **22** has been stacked up on the pad **26**, the pad **26** can impart an upward return force **F** through the web products **22** to the folding fingers **23**, thereby effectively extending the contact time between the folding fingers **23** and the web products **22** to facilitate formation of a neat stack of interfolded web products **22**.

During delivery of the finished stack of interfolded web products **22** by the stoppage unit **27** and the holder **29** in the first direction **X**, the finished stack of interfolded web products **22** is separated from the first carrier unit **25**, and one web product **221** will be exposed to the outside of the stoppage unit **27** and another web product **223** will suspend from the first carrier unit **25**. The stoppage unit **27** comprises a retractable member **271**. When the stoppage unit **27** and the holder **29** are moved in the first direction **X** to deliver web products **22**, the retractable member **271** is extended out of the stoppage unit **27**.

The folding line making wheels **21** and the folding fingers **23** keep operating to make another stack of interfolded web products **22**, and the first folding unit **281** that is arranged below the first carrier unit **25** will be extended out slowly. Following increasing of the thickness of the interfolded web products **22** being stacked on the first carrier unit **25**, the first carrier unit **25** will be lowered along the first direction **X**. The web product folding and stacking machine **20** further comprises an air blower unit **255** adapted to blow air toward the web product **221** above the stoppage unit **27**,

enabling the web product **221** to be folded on the stoppage unit **27**, as shown in FIG. 4C.

After extension of the first folding unit **281**, the second folding unit **283** which is disposed between the first carrier unit **25** and the first folding unit **281** is extended out. The first folding unit **281** and the second folding unit **283** are movable in the second direction **Y** that is perpendicular to the first direction **X**. When the second folding unit **283** and the first folding unit **281** are overlapped, the suspending web product **223** is folded up on the first carrier unit **25**. The extending order of the first folding unit **281** and the second folding unit **283** may be changed, or both the first folding unit **281** and the second folding unit **283** can be extended out at the same time. Further, after delivery of interfolded web products **22** to a predetermined location by the stoppage unit **27** and the holder **29**, a push unit **31** is operated to push the interfolded web products **22** away from the holder **29** to the conveyer belt **30** for further delivery, as shown in FIG. 4D.

After folding of web product **223**, the first folding unit **281** and the second folding unit **283** are retracted slowly. Moreover, the suction device **24** at the first carrier unit **25** is operated to suck the folded web product **223**. After delivery of the interfolded web products **22**, the stoppage unit **27** and the holder **29** are moved upwards in the first direction **X**, and the retractable member **271** is retracted inside the stoppage unit **27**, facilitating the stoppage unit **27** to perform a next web product separation operation, as shown in FIG. 4E.

In one embodiment of the present invention, the web product folding and stacking machine **20** further comprises a second carrier unit **35** adapted to receive a

stack of interfolded web products **22** from the first carrier unit **25**. The second carrier unit **35** can be extended out along, for example, the second direction **Y**. The first carrier unit **25** will be retracted when the second carrier unit **35** is extended out, enabling the duly finished stack of interfolded web products **22** to be placed on the second carrier unit **35**. When the duly finished stack of interfolded web products **22** is transferred from the first carrier unit **25** to the second carrier unit **35**, the folding line making wheels **21** and the folding fingers **23** keep operating. Following increasing of the number of interfolded web products **22**, the second carrier unit **35** is lowered along the first direction **X**, as shown in FIG. 4F.

After delivery of one finished stack of interfolded web products **22** to the assigned location, the stoppage unit **27** and the holder **29** are moved upwards along the first direction **X**. When the holder **29** reaches the set position, the second carrier unit **35** is retracted along the second direction **Y** for enabling the holder **29** to receive folded web products **22** from the second carrier unit **35**, and the stoppage unit **27** stands by for further web product separation operation. Further, following increasing of the thickness of the stack of interfolded web products **22** on the holder **29**, the holder **29** is lowered along the first direction **X**, as shown in FIG. 4G. In another embodiment of the present invention, the web product folding and stacking machine **20** eliminates the aforesaid second carrier unit **35** and uses the holder **29** to receive the finished stack of interfolded web products **22** from the first carrier unit **25** directly.

In actual application, the folding line making wheels **21** and the folding fingers **23** can be operated to fold and stack web products **22** on the second carrier unit **35** and to let the finished stack of interfolded web products **22** be placed on the holder **29**. Thus, the folding line making wheels **21** and the folding fingers **23** will fold up web

products **22** on the holder **29** by means of continuously repeating the steps of FIGS. 4A~4G. Further, when the stoppage unit **27** is extended out to separate interfolded web products **22**, the retractable member **271** is kept inside the stoppage unit **27**, avoiding accidental damage to the interfolded web products **22**. When the stoppage unit **27** is moved to deliver interfolded web products **22**, the retractable member **271** is extended out of the stoppage unit **27** to hold down interfolded web products **22**, keeping interfolded web products **22** neatly in a stack.

In actual application, the folding fingers **23**, the first carrier unit **25**, the stoppage unit **27** and/or the second carrier unit **35** can be fingers and be alternatively arranged at different elevations, facilitating folding, stacking, separation and/or delivery of web products **22**.

Although particular embodiments of the invention have been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the invention. Accordingly, the invention is not to be limited except as by the appended claims.

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CLAIMS

What is claimed is:

1. A web product folding and stacking machine, comprising:

two folding line making wheels arranged in proximity to each other for transferring web products and causing each web product to form a folding line;

two folding fingers adapted to fold up each web products along the folding line thereof for enabling the web products to be stacked up in an interfolded condition;

a first carrier unit adapted for carrying the interfolded web products;

a stoppage unit adapted to isolate the interfolded web products, said stoppage unit being movable in a first direction;

a retractable member mounted in said stoppage unit and movable in and out of said stoppage unit;

a holder adapted to hold the interfolded web products, said holder being movable in said first direction; and

wherein said retractable member is extended out of said stoppage unit after movement of said stoppage unit along said first direction.

2. The web product folding and stacking machine as claimed in Claim 1, further comprising an air blower unit adapted to blow air toward one said web product above said stoppage unit.

3. The web product folding and stacking machine as claimed in Claim 1, wherein said first carrier unit has a suction device mounted therein for sucking one said web product, said suction device having a nozzle hole located on the bottom surface of said first carrier unit.

4. The web product folding and stacking machine as claimed in Claim 3, further comprising a first folding unit and a second folding unit adapted to fold up one said web product that suspends from said first carrier unit.

5. The web product folding and stacking machine as claimed in Claim 1, further comprising a second carrier unit adapted for receiving said web product from said first carrier unit.

6. The web product folding and stacking machine as claimed in Claim 5, wherein said holder is adapted for holding the interfolded web products from said second carrier unit.

7. The web product folding and stacking machine as claimed in Claim 1, wherein said first carrier unit has a pad mounted on a top surface thereof for carrying the interfolded web products.

8. The web product folding and stacking machine as claimed in Claim 7, wherein said pad is elastic.

9. The web product folding and stacking machine as claimed in Claim 1, wherein said holder is adapted to hold the interfolded web products from said first carrier unit.

10. A web product folding and stacking method used in the web product folding and stacking machine as claimed in Claim 1, comprising the steps of: forming a folding line on each of a plurality of web products and folding each said web product on said first carrier unit immediately after formation of the folding line; operating said stoppage unit to isolate the interfolded web products when the number of the interfolded web products reaches a predetermined amount; moving said stoppage unit ands aid holder to deliver the interfolded web products to a predetermined location; and extending said retractable member out of said stoppage unit after movement of said stoppage unit along said first direction.

11. The web product folding and stacking method as claimed in claim 10, further comprising a sub-step of operating an air blower unit to blow air toward one said web product above said stoppage unit.

12. The web product folding and stacking method as claimed in claim 10, further comprising a sub-step of moving said holder to receive the interfolded web products from said first carrier unit.

13. The web product folding and stacking method as claimed in Claim 10, further comprising a first sub-step of using a second carrier unit to receive a stack of

interfolded web products from said first carrier unit and a second sub-step of moving said holder to receive the stack of interfolded web products from said second carrier unit.

14. The web product folding and stacking method as claimed in Claim 10, wherein said first carrier unit has a pad mounted on a top side thereof.

15. The web product folding and stacking method as claimed in Claim 10, wherein said first carrier unit has mounted therein a suction device for sucking one said web product.

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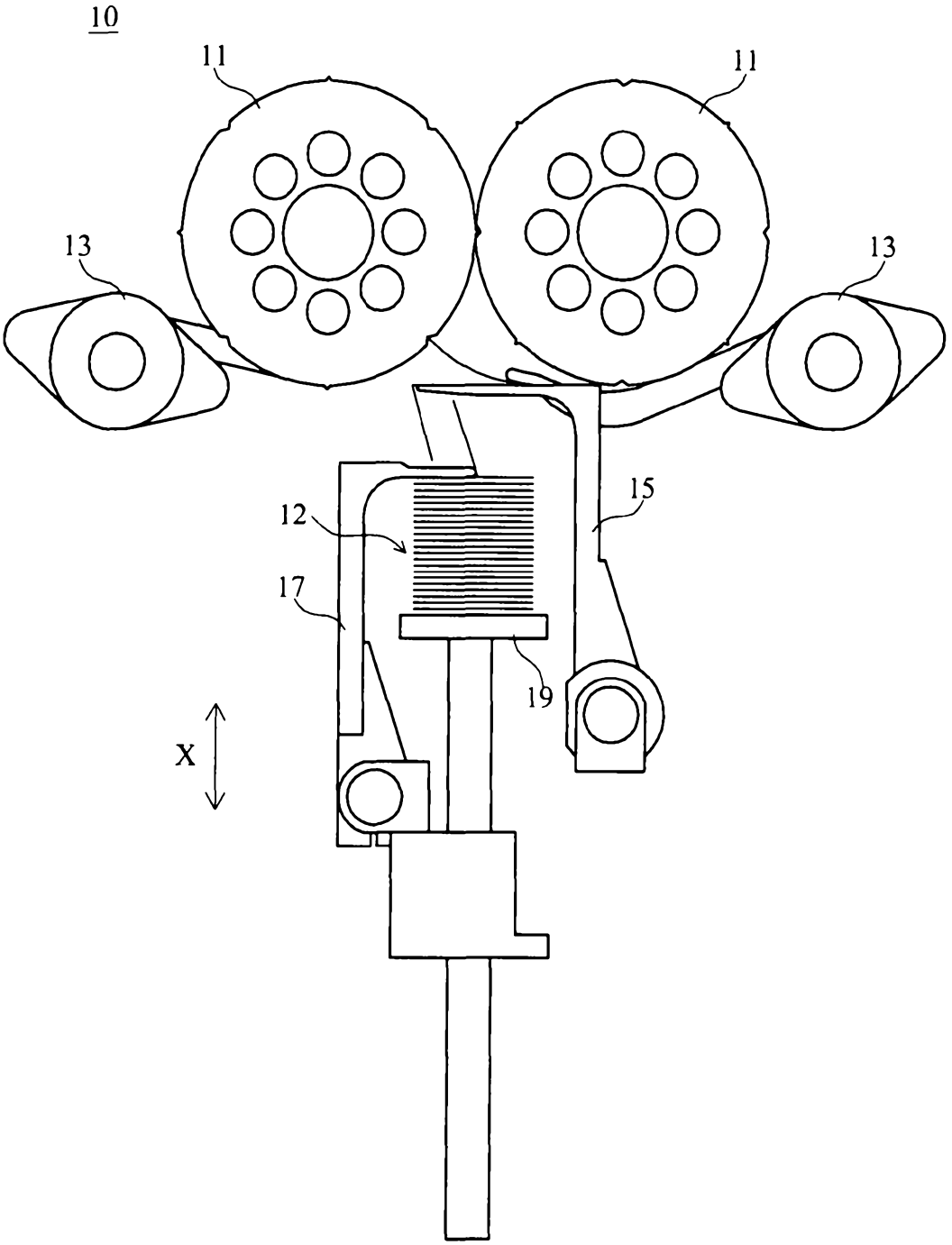

FIG.1
(PRIOR ART)

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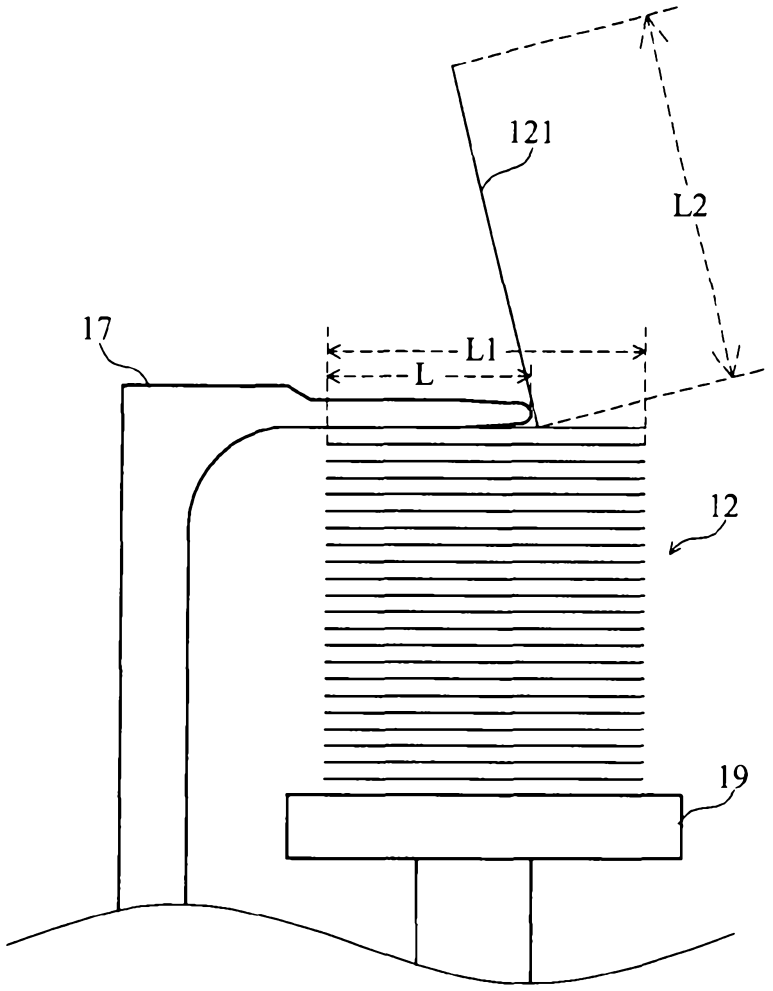

FIG.1A
(PRIOR ART)

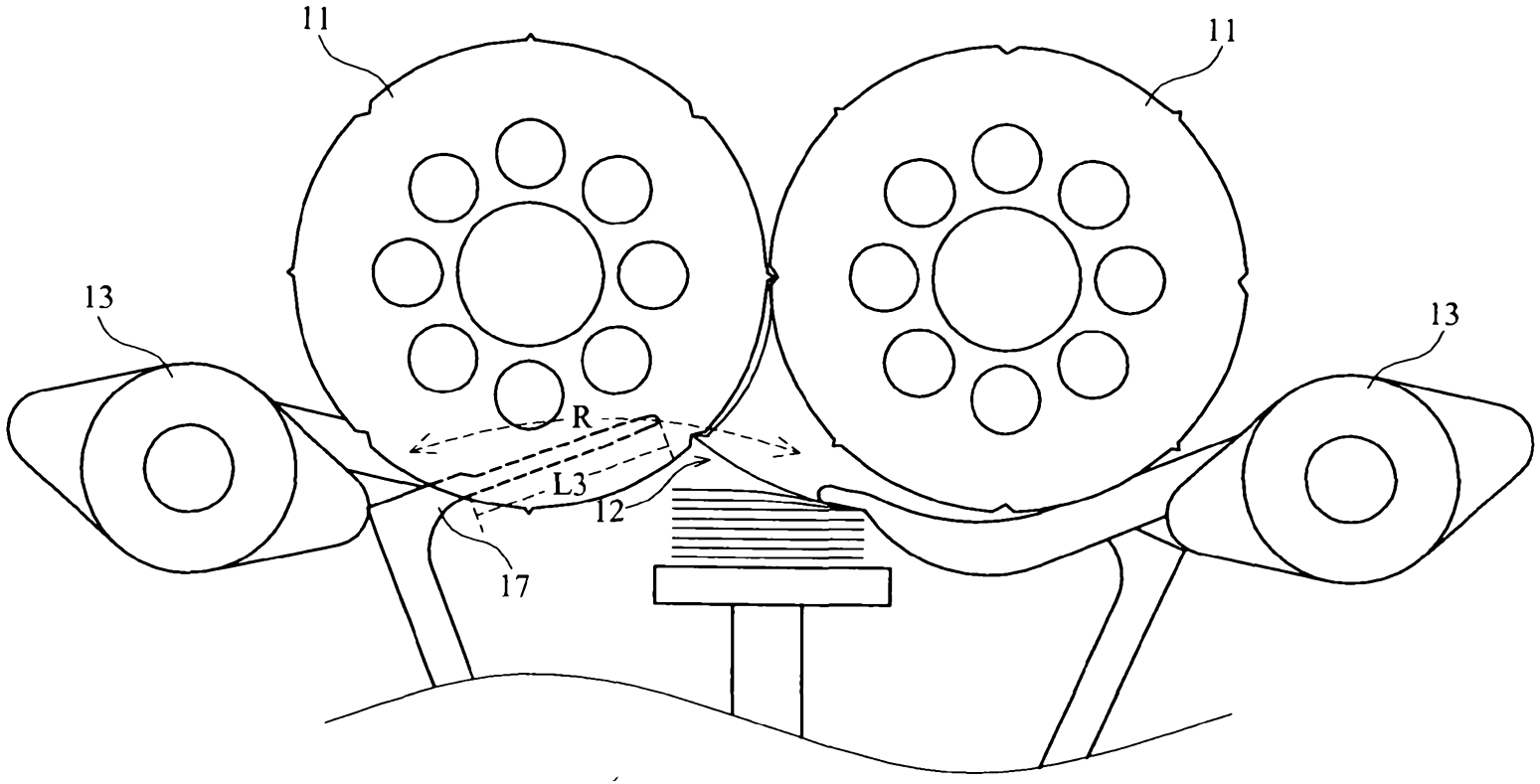

FIG.1B
(PRIOR ART)

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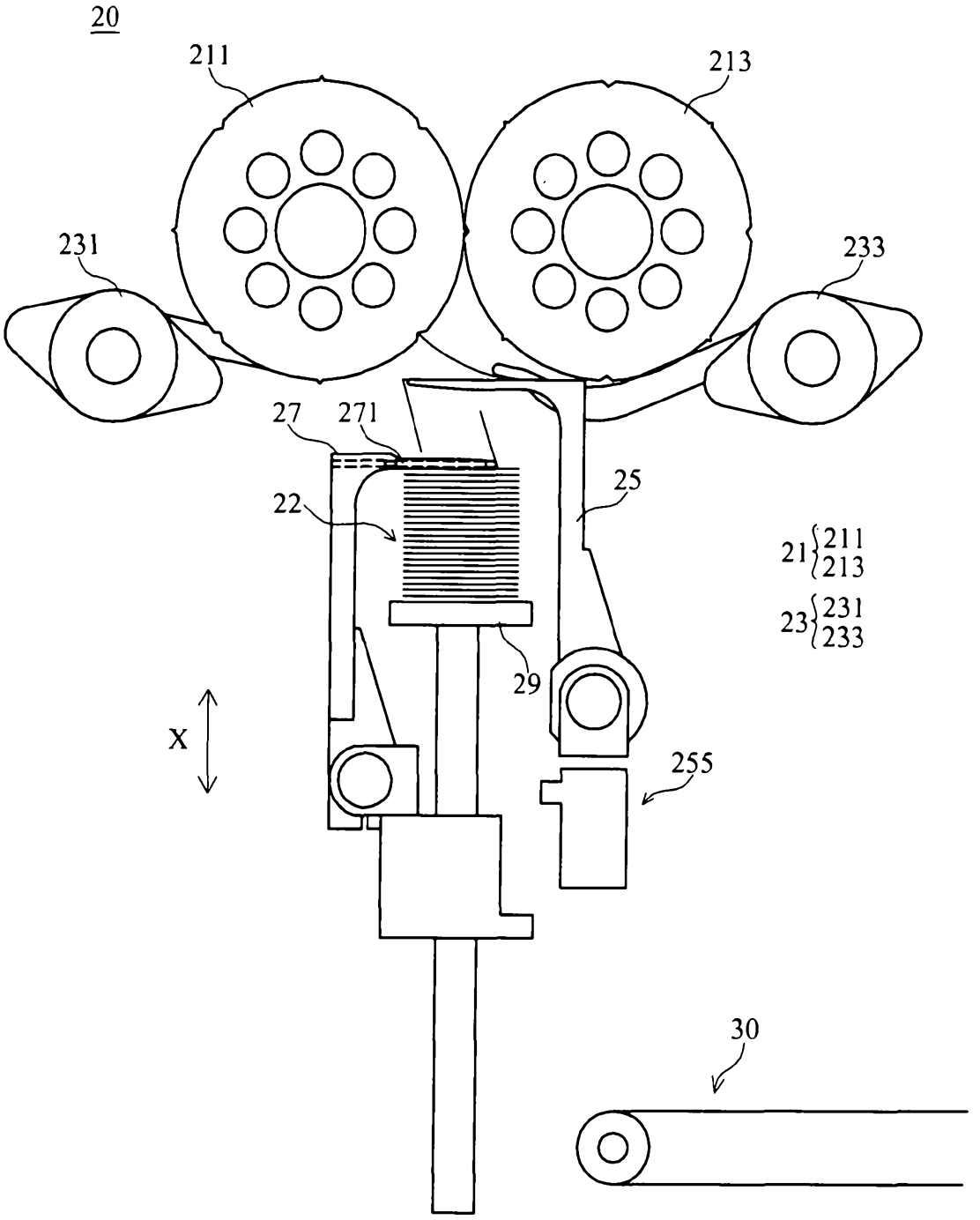

FIG.2

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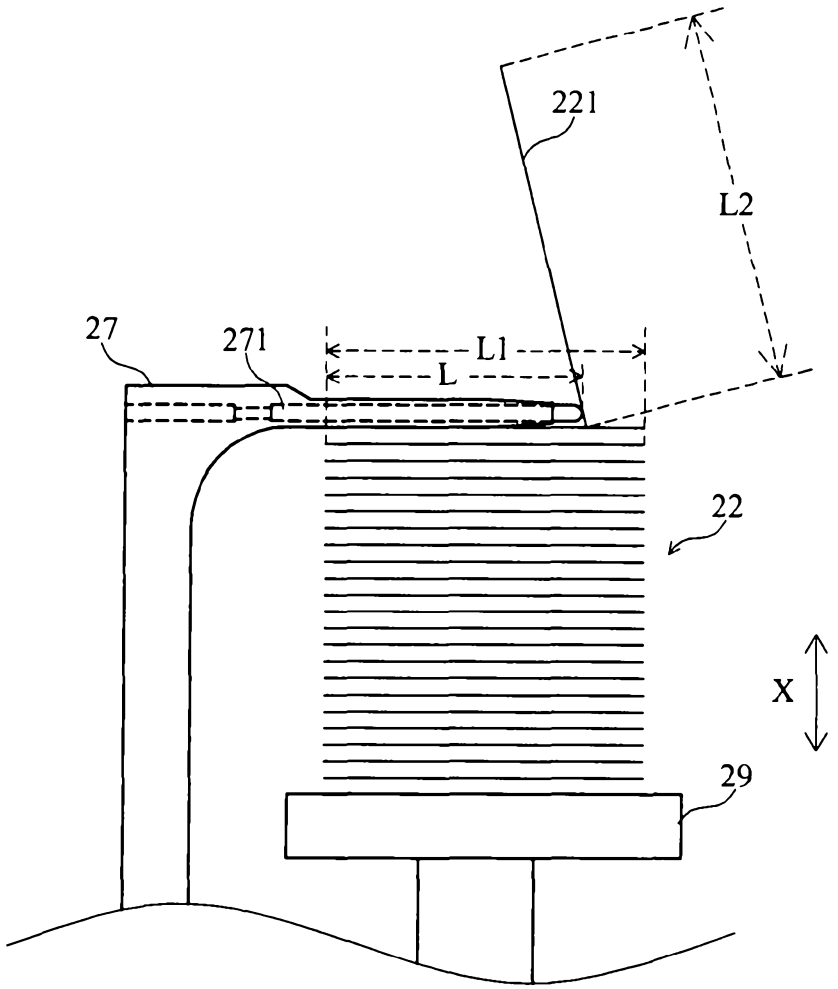

FIG.2A

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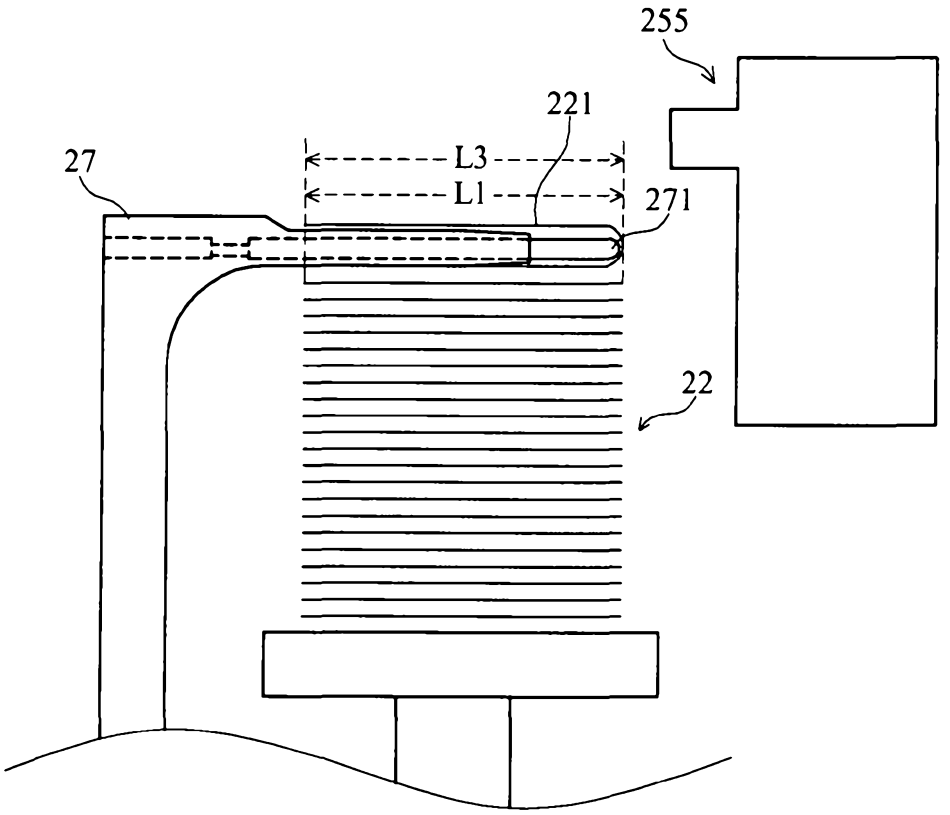
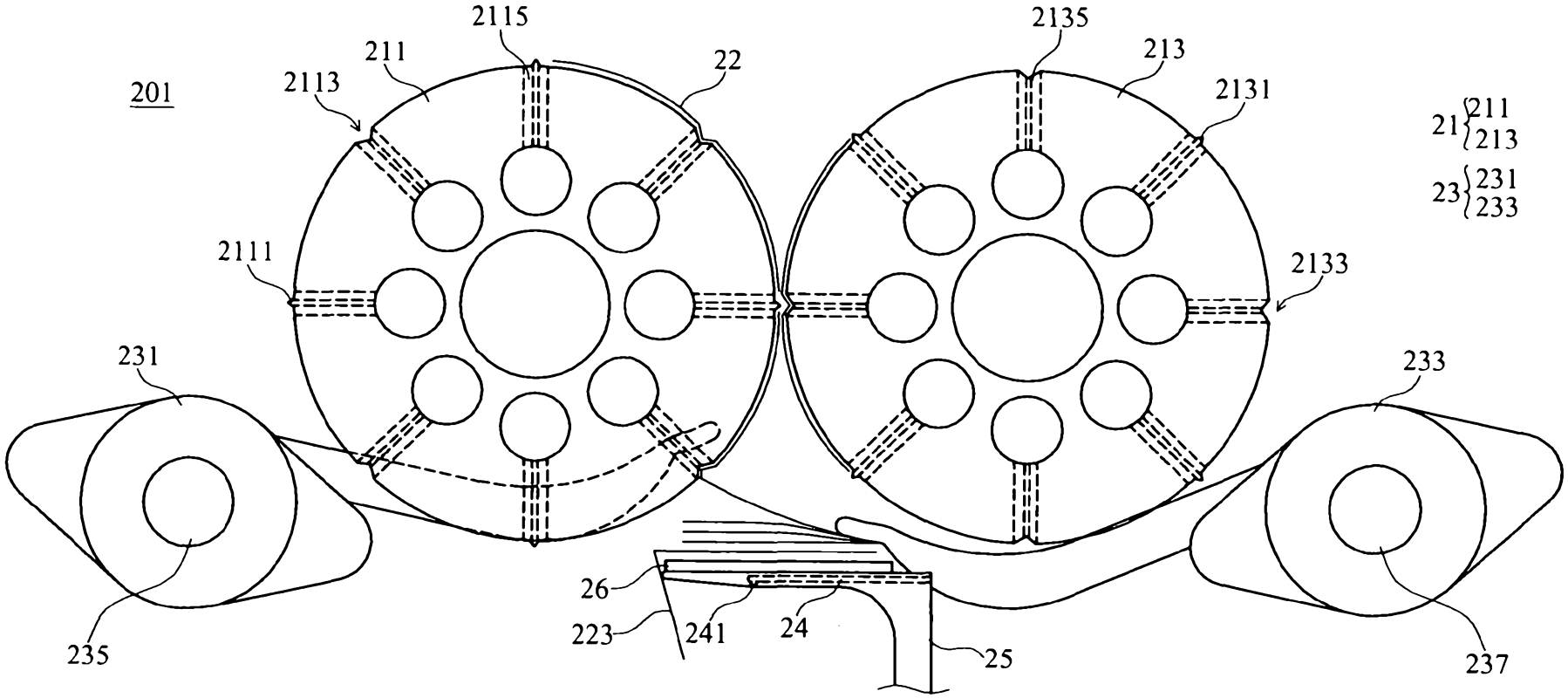


FIG.2B


201
2115
211
2113
22
2135
213
2131
21 211 213
23 231 233
2111
2133
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237

FIG.3

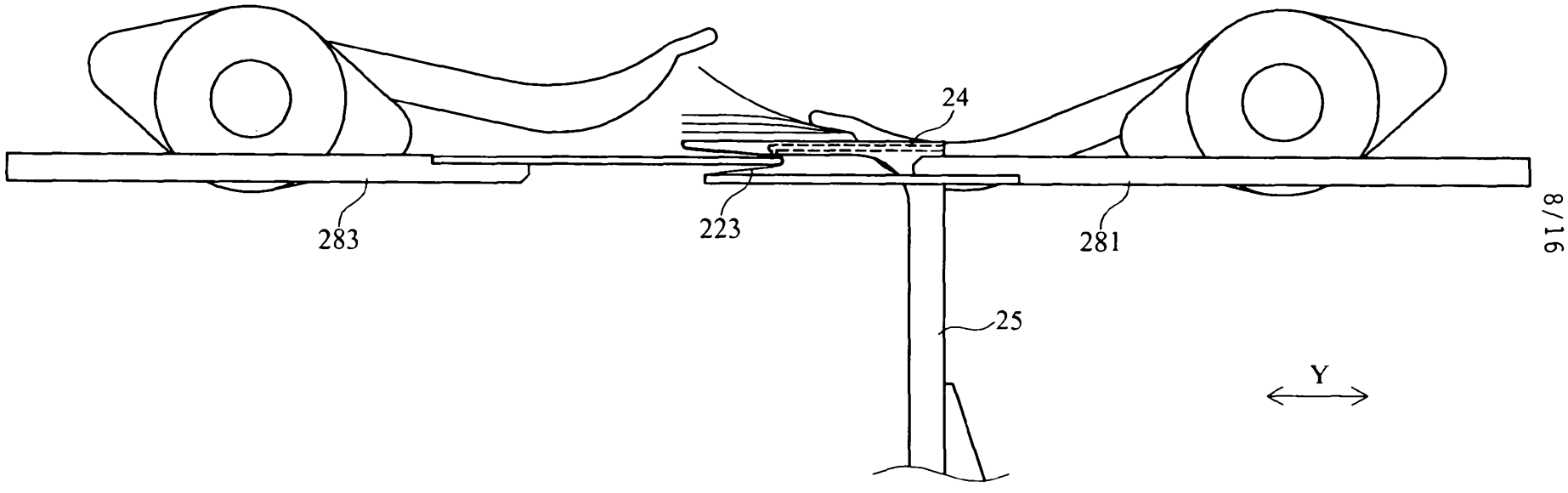

FIG.3A

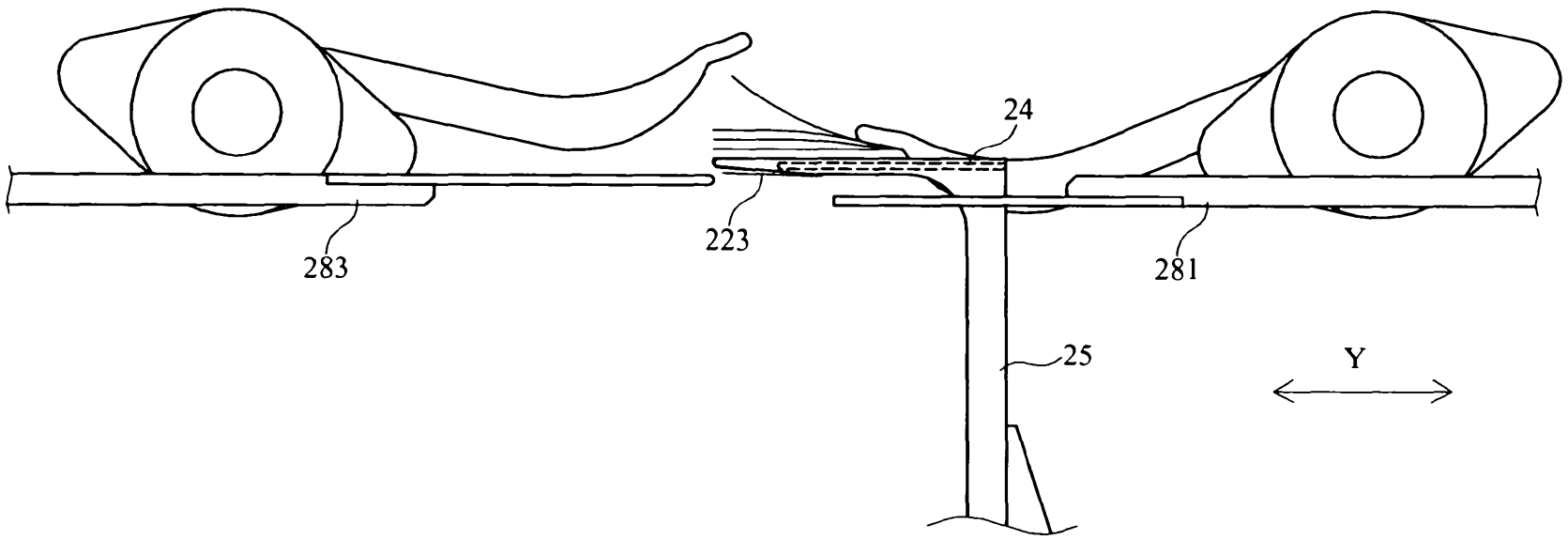

FIG.3B

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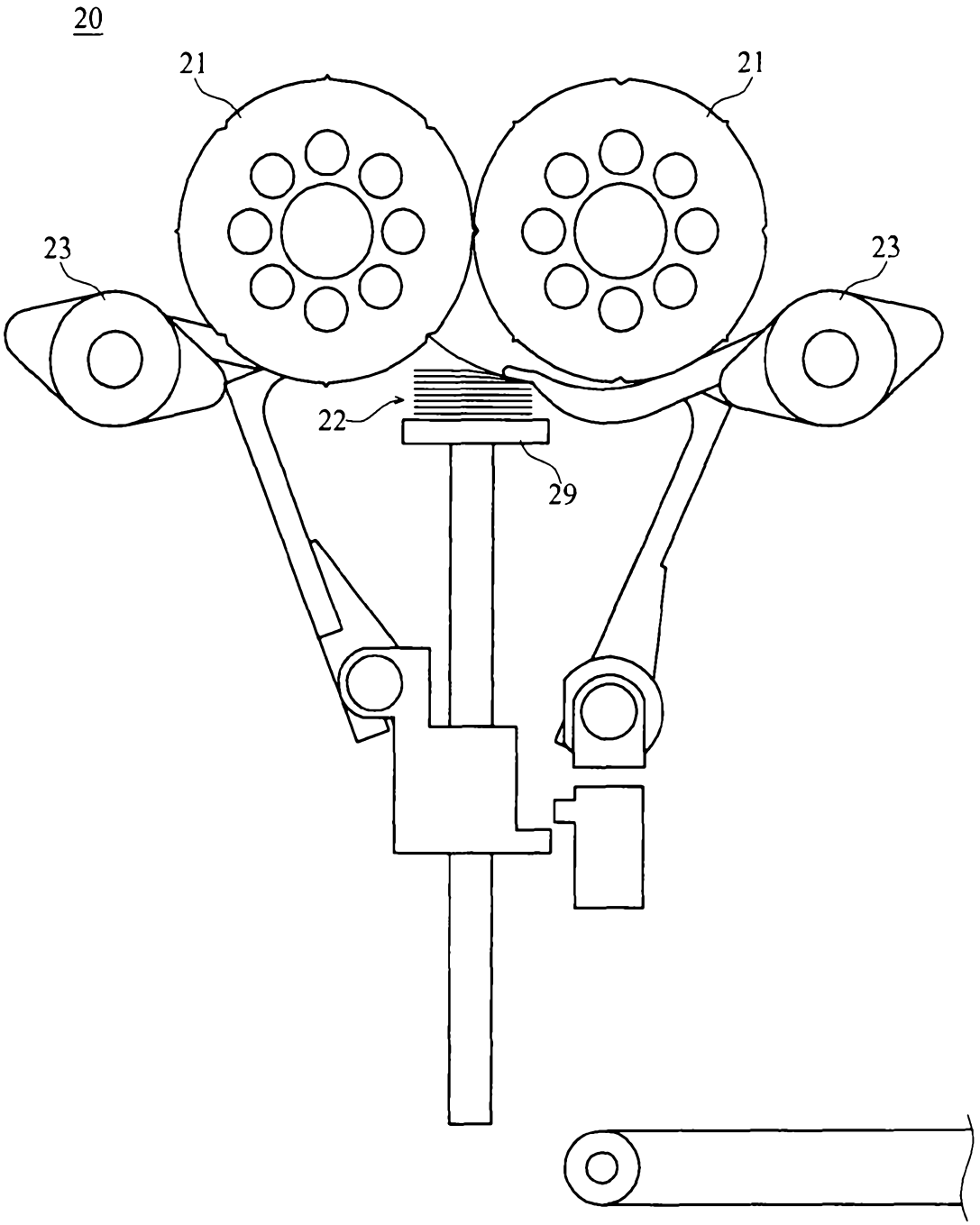

FIG.4A

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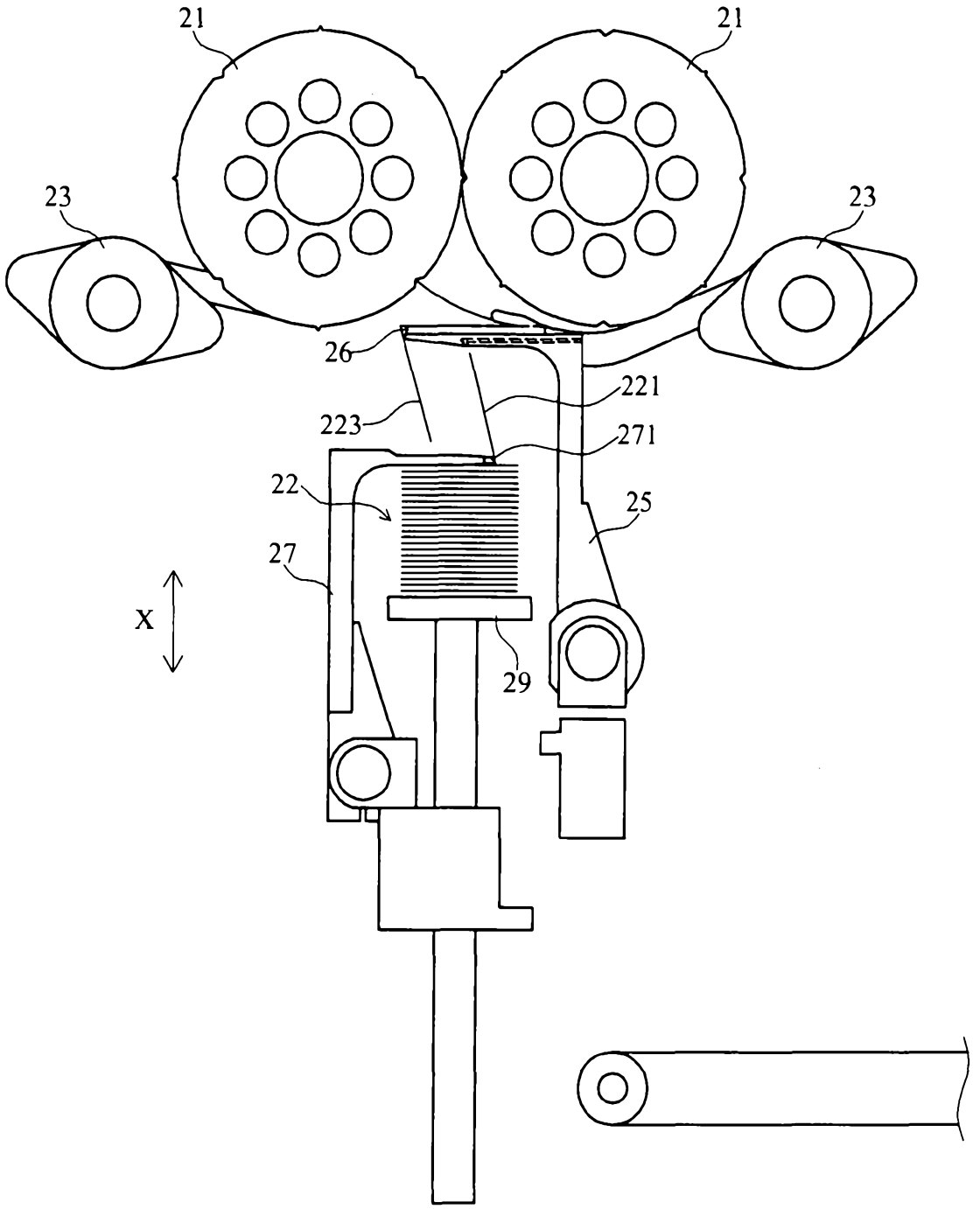

FIG.4B

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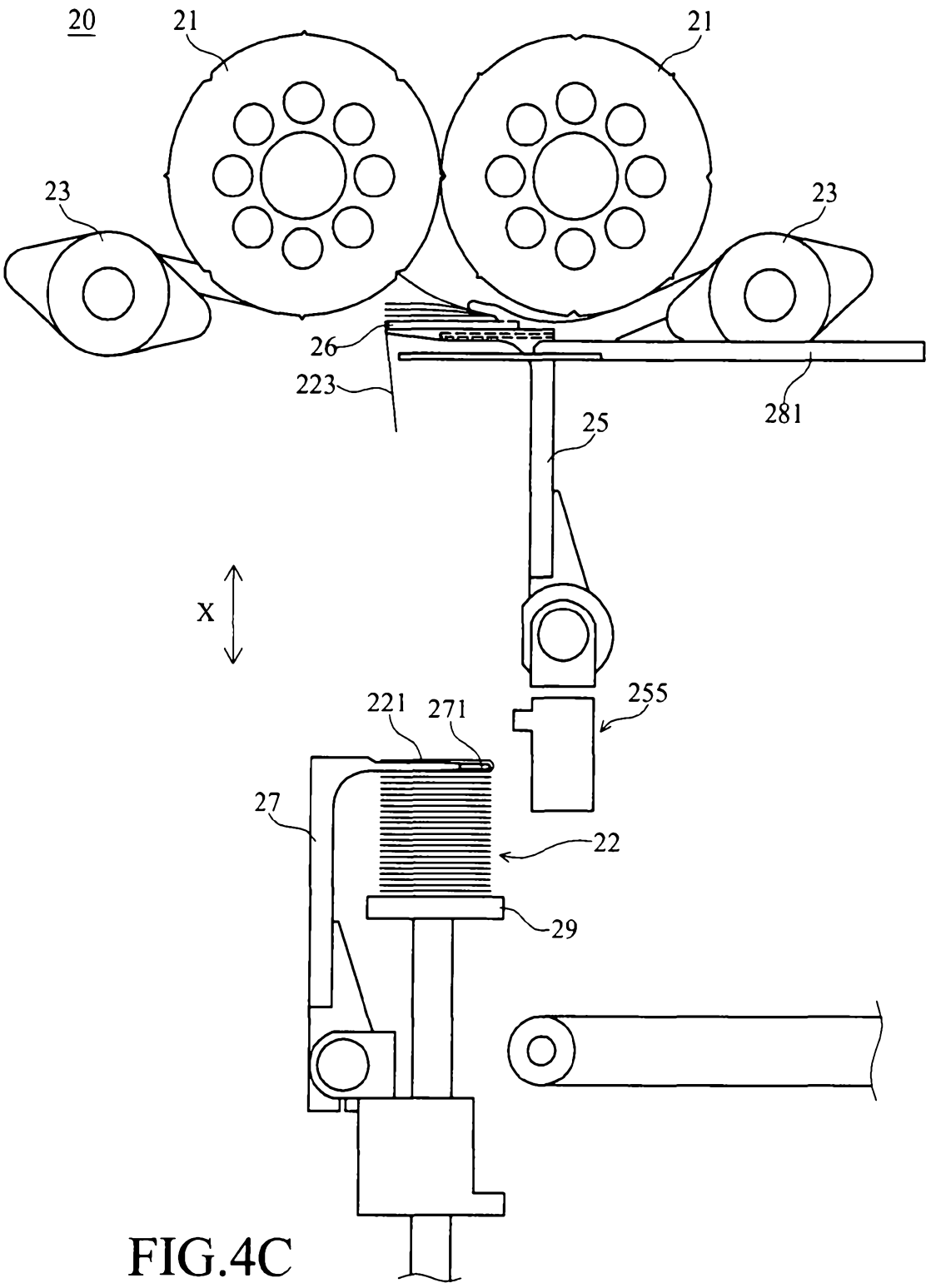

FIG.4C

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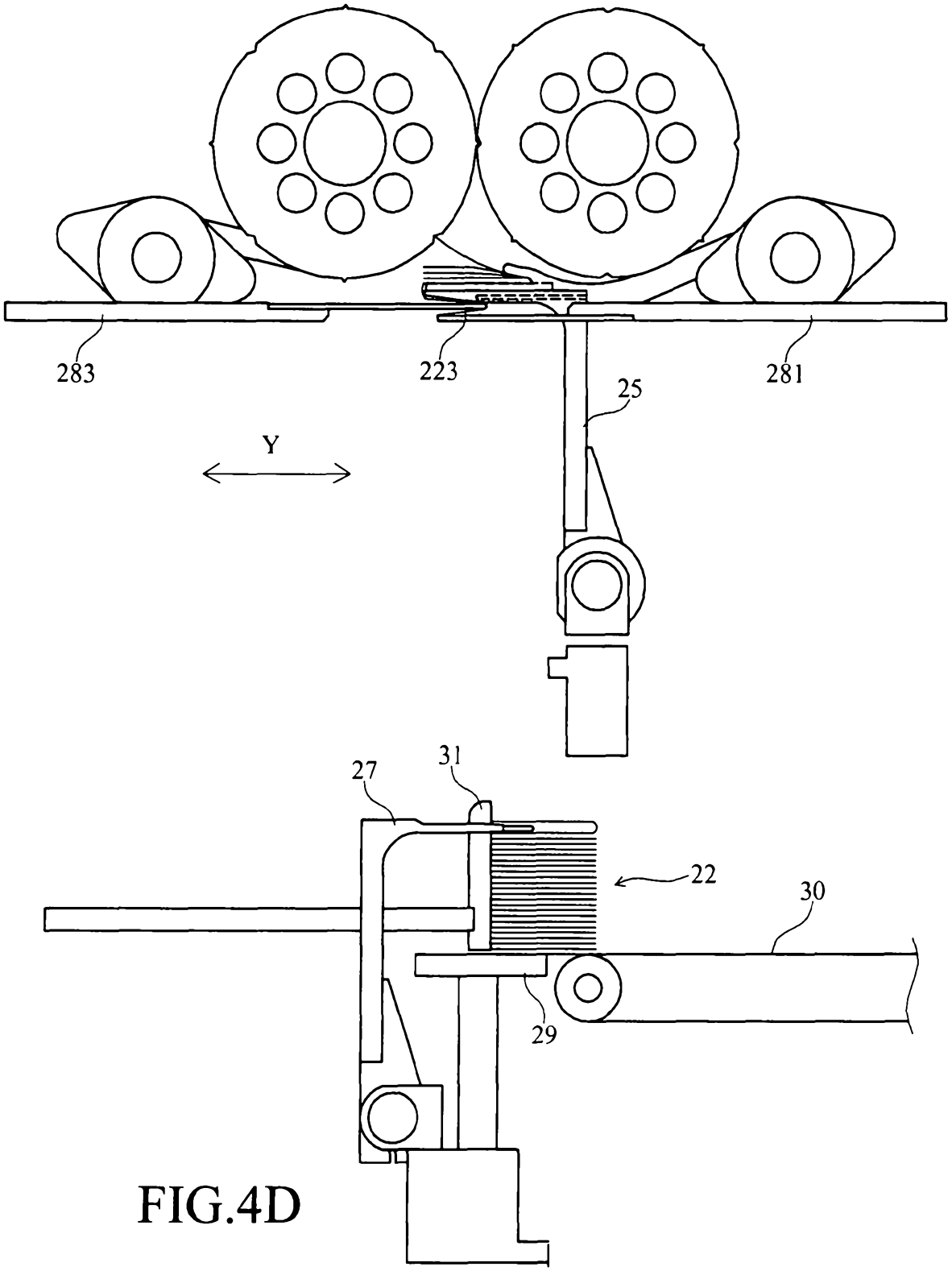

FIG.4D

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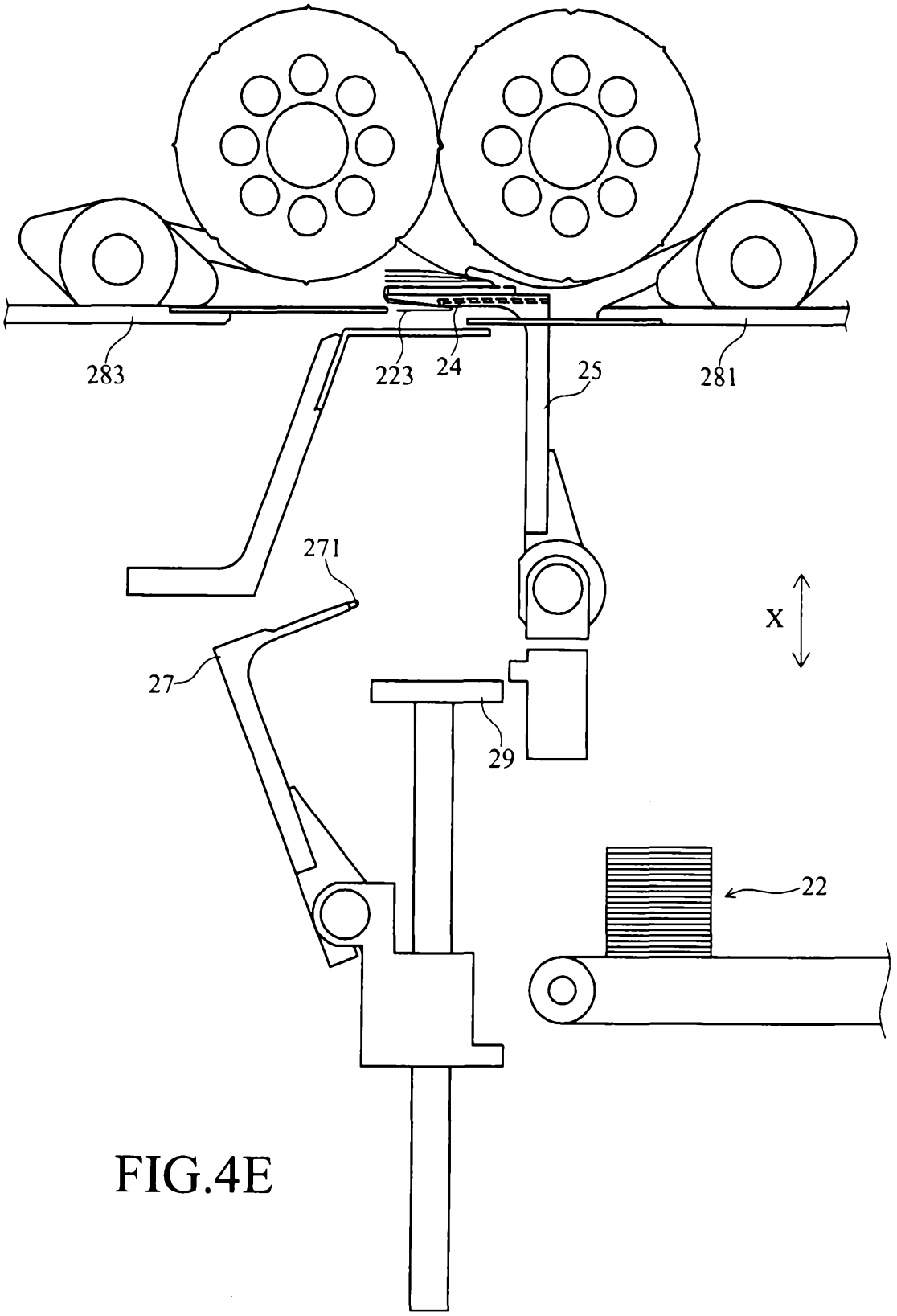

FIG.4E

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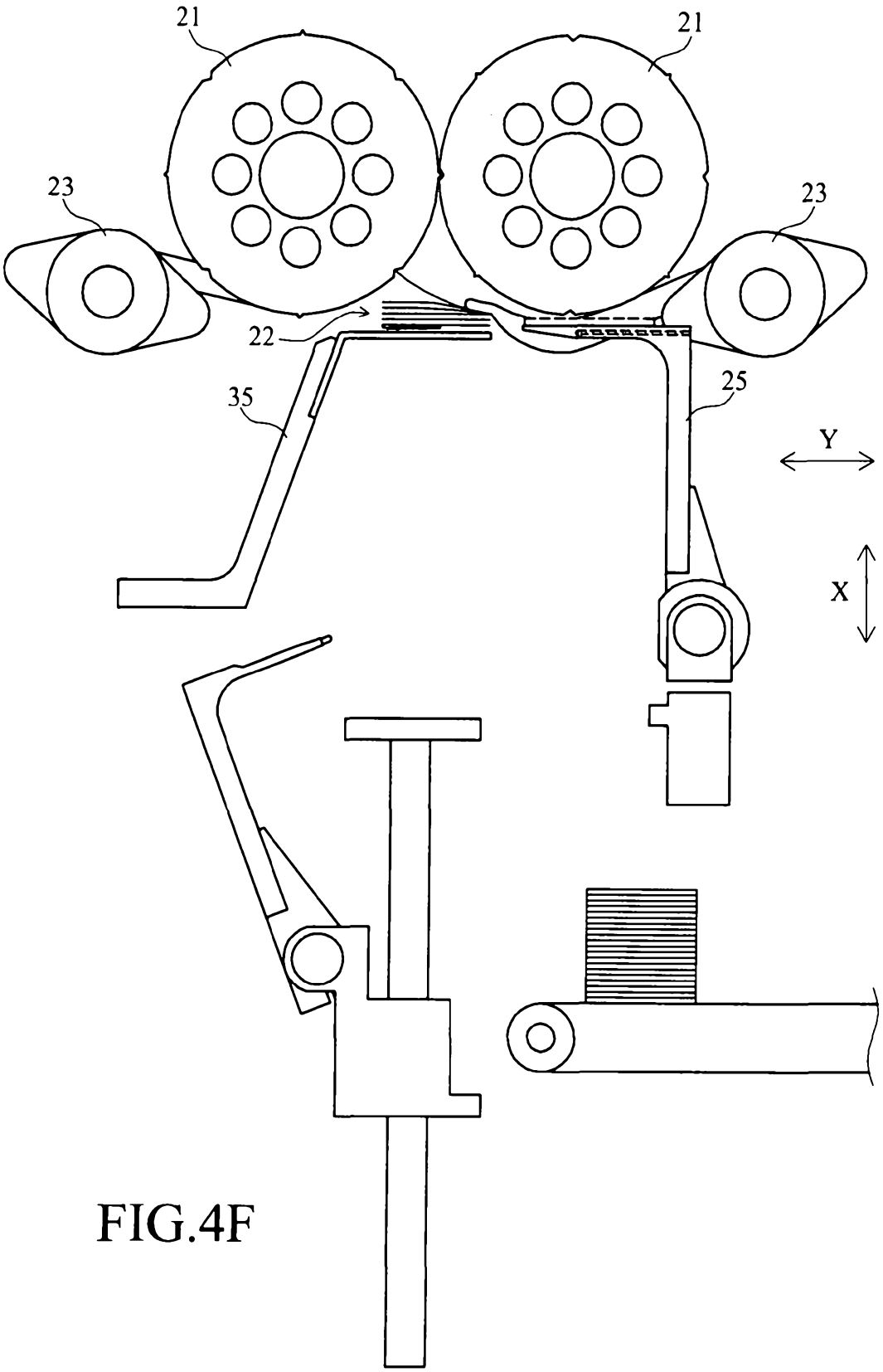

FIG.4F

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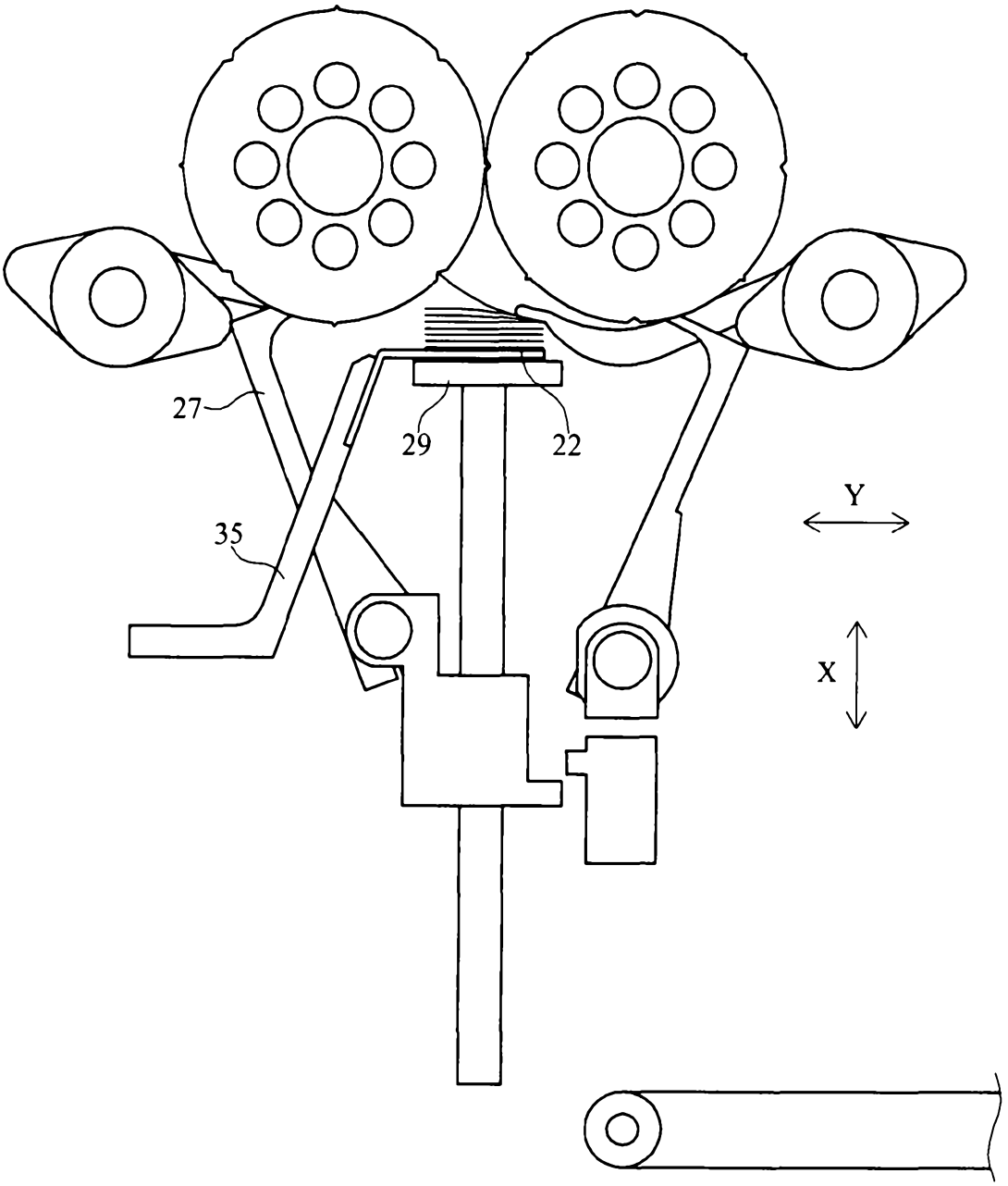

FIG.4G