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None

DESCRIPTION

Background of the Invention

[0001] The invention disclosed herein relates to an apparatus for folding pieces traveling on a production line. Although the description provided relates to diaper manufacturing, the apparatus and method are easily adaptable to other applications. Although the description provided relates to forming side panels of diapers, the apparatus and methods are easily adaptable to other products, other disposable products, other diaper types and other portions of diapers.

[0002] Generally, diapers comprise an absorbent insert or patch and a chassis, which, when the diaper is worn, supports the insert proximate a wearer's body. Additionally, diapers may include other various patches, such as tape tab patches, reusable fasteners and the like. The raw materials used in forming a representative insert are typically cellulose pulp, tissue paper, poly, nonwoven web, acquisition, and elastic, although application specific materials are sometimes utilized. Usually, most of the insert raw materials are provided in roll form, and unwound and applied in assembly line fashion.

[0003] In the creation of a diaper, multiple roll-fed web processes are typically utilized. To create an absorbent insert, the cellulose pulp is unwound from the provided raw material roll and pulverized by a pulp mill. Discrete pulp cores are formed by a core forming assembly and placed on a continuous tissue web. Optionally, superabsorbent powder may be added to the pulp core. The tissue web is wrapped around the pulp core. The wrapped core is debulked by proceeding through a calendar unit, which at least partially compresses the core, thereby increasing its density and structural integrity. After debulking, the tissue-wrapped core is passed through a segregation or knife unit, where individual wrapped cores are cut. The cut cores are conveyed, at the proper pitch, or spacing, to a boundary compression unit.

[0004] The diaper is built by sandwiching the formed core between a backsheet and a topsheet, and the combined web receives ears for securing the diaper about the waist of a baby.

[0005] Most products require some longitudinal folding. Folding of webs can be combined with elastic strands to make a cuff. Folding can be used to overwrap a stiff edge to soften the feel of the product. It can also be used to convert the final product into a smaller form to improve the packaging.

[0006] Diapers are typically formed in a machine direction in a generally flat condition. Formed diapers require folding both longitudinally to tuck the ears and associated tape or hook applicators into the diaper, and also cross-folded generally at a crotch region to stack the diapers prior to packaging. Larger portions of diapers, such as side portions of the front and

rear panels of pant type diapers also require folding for compactness and packaging.

[0007] The folded product is then passed downstream to a packaging machine where the diapers are stacked and packaged and shipped for sale.

[0008] US 2013/0130879 discloses an apparatus and method for folding a pant-like, disposable garment that includes first and second waist side regions, a waist center region positioned therebetween and a crotch region longitudinally below the waist center region. In a particular embodiment, the garment is folded along a transversely extending fold line so as to bring the crotch region into superposed relation with the waist center region. The waist side regions are folded over the waste center region by placing the waste center region of the garment in a trough and, while the garment is in the trough, folding the garment along longitudinally extending first and second fold lines so as to position the first and second waist side regions, respectively, over the waist center region. In one embodiment, the folding is accomplished by a pair of folding blades that extend into the trough through slots. The motion of the blades brings them into contact with the waste side regions to fold the waste side regions over the waste center region.

[0009] US 3,076,460 discloses an apparatus for folding over the tabs of sanitary napkins. The apparatus comprises a pair of vertically mounted, oppositely rotating shafts to which are attached flat folding blades that are semi-circular in shape and horizontally positioned.

[0010] US 3,116,920 discloses an apparatus for the continuous folding of articles, such as sanitary napkins. The apparatus comprises a conveyor fed folding mechanism having two pairs of folding blades that are mounted for rotation toward the direction of conveyor travel.

Summary of the Invention

[0011] According to the present invention, there is provided an apparatus for folding an article according to claim 1.

[0012] A system for folding is provided. At least one rotary blade is passed under an intended target of the folding, and the blade folds the intended target and passes the intended target downstream for further processing.

[0013] Importantly, the methods taught in the present application are applicable not only to diapers and the like, but in any web based operation. The folding techniques taught herein can be directed at any discrete component of a manufactured article, i.e., the methods taught herein are not product specific. For instance, the present methods can be applied as easily with respect to diaper components as they can for feminine hygiene products.

[0014] Apparatus and methods are described for folding discrete items such as diapers at high speeds. In an embodiment, discrete items are conveyed, preferably by a vacuum conveyor, in

a machine direction toward a pair of rotating blades. The intended target of folding, for instance a right portion of front and back panels of a diaper, travels up a ramp, raising the level of the intended target. A rotating blade passes under the intended target of folding, and folds the right portion of front and back panels of a diaper over. If desired, another intended target of folding, for instance a left portion of front and back panels of a diaper, travels up a second ramp, raising the level of the intended target. A rotating blade passes under the intended target of folding, and folds the left portion of front and back panels of a diaper over. The folded diaper then exits the folding system and travels downstream for further processing as desired.

Brief Description of the Drawings

[0015]

Fig. 1 is a top view of a representative web folding system, showing a single diaper product riding on a conveyor toward a pair of folding blades;

Fig. 2 is a side view of a folding system of the present invention;

Fig. 3 is a top view of a representative web folding system, showing a single diaper product riding on a conveyor toward a pair of folding blades, with a right panel portion of the diaper riding up a ramp and approaching a rotating blade;

Fig. 4 is a top view of the right panel portion of the diaper being folded by a rotating blade;

Figs. 5 and 6 are top views of a representative web folding system, showing a folded over right panel portion, and showing a left panel portion of the diaper riding up a second ramp and approaching a second rotating blade;

Figs. 7 and 8 are top views of the left panel portion of the diaper being folded by a rotating blade;

Fig. 9 is top view of the folded diaper exiting the folding system and being passed downstream for further processing;

Fig. 10 is a top view of an alternate embodiment of the folding system shown in Fig. 1, the alternate embodiment including a tucker bar to maintain the first fold, and a tucker roller to maintain the first and second folds intact during downstream passage;

Fig. 11 is a side view of the folding system shown in Fig. 10;

Figs. 12a-c are top views of alternate blade configurations.

Description of the Preferred Embodiment

[0016] Although the disclosure hereof is detailed and exact to enable those skilled in the art to practice the invention, the physical embodiments herein disclosed merely exemplify the invention which may be embodied in other specific structures. While the preferred embodiment has been described, the details may be changed without departing from the invention, which is defined by the claims.

[0017] It is noted that the present folding techniques and apparatus are described herein with respect to products such as diapers, but as previously mentioned, can be applied to a wide variety of processes in which components are required to be folded. The present methods can be used to fold a portion of a web, or discrete portions, as desired. The same apparatus and techniques can be used for ears, panels, hook materials, or any other situation in which folding is desired.

[0018] Importantly, the methods taught in the present application are applicable not only to diapers and the like, but in any web based operation. The folding techniques taught herein can be directed at any component of a manufactured article desired to be folded, i.e., the methods taught herein are not product specific. For instance, the present methods can be applied as easily with respect to diaper components as they can for feminine hygiene products.

[0019] Referring now to Fig. 1, a top view of a representative web folding system is shown. A diaper product 10 riding on a conveyor 18, preferably a vacuum conveyor with vacuum commutation ports 18a, is conveyed toward a pair of folding blades 22.

[0020] Vacuum conveyor ports 18a can extend the entire length of vacuum conveyor 18, or extend for selected portions of conveyor 18, such as shown, or extend for an entire product length. In pant-type diapers, typically an absorbent core section 16 is contained in a midsection of diaper 10. Left side of panel 12 consists of both the front and rear left portions of panels of a previously formed diaper 10. Right side of panel 14 consists of both the front and rear left portions of panels of a previously formed diaper 10. Intended fold lines L for the left panel 12 and R for the right panel 14 are acted upon by the system.

[0021] The first intended target of the folding, fold line R for the right panel 14 is seen traveling onto ramp 20, the ramp 20 comprising three sections, a conveyor level 20a, a sloped midsection 20b, and a blade clearance level 20c. Two ramps 20 are provided, one for each of the intended fold lines L for the left panel 12 and R for the right panel 14.

[0022] Blade 22, with blade lobes 22a and 22b, is driven in the direction shown by rotor 24. Preferably, two independent, servo controlled blades 22 are programmed to aid in actively folding each part of the product 10.

[0023] Conveyor 18 travels in the machine direction at a first speed. The rotational speeds of blade 22 can match the conveyor speed (first speed), but in some instances, the rotational speeds of blade 22 are seen to have positive effects by having a rotational speed greater than

or less than the conveyor speed.

[0024] Still referring to Fig. 1, the previous description describes a horizontal conveying surface 18 at a first elevation carrying at least a first portion 14 of an article 10 to be folded. The present invention is not limited to horizontal conveying surfaces 18, but also contemplates vertical or sloped conveying surfaces 18 (not shown). When the term elevation is used, the term is not to be limited to a vertical spacing relative to the conveying surface 18, but instead should be considered a spacing in any direction away, relative to conveying surface 18, e.g., for a vertical conveyor 18, the ramp 20 would actually elevate the first portion 14 of the article 10 in a horizontal direction relatively away from the vertical conveyor 18.

[0025] Referring now to Fig. 2, a side view of a folding system of the present invention is shown. In this view, the ramp 20 comprising three sections, the conveyor level 20a, the sloped midsection 20b, and the blade clearance level 20c can be seen. Referring to the first ramp in the system (upstream), right panel 14 is shown entering onto the ramp 20 at the conveyor level 20a. As the right panel 14 travels downstream, the right panel 14 travels up ramp 20 via sloped midsection 20b, raising the level of the intended target, right panel 14. As the right panel travels onto blade clearance level 20c, as shown in Fig. 3, first rotating blade 22 passes under the intended target of folding, right panel 14, and passes under blade clearance level 20c. As lobe 22a of blade 22 rotates while the right panel 14 is carried by the blade clearance level 20c, blade 22 contacts the underside of right panel 14 and folds the right panel 14 of diaper 10 over along line R, as shown in Fig. 4.

[0026] Referring now to Fig. 5, with fold line R achieved, the half-folded diaper 10 is passed downstream. Left panel 12 enters onto the second ramp 20 at the conveyor level 20a. As the left panel 12 travels downstream, it travels up ramp 20 via sloped midsection 20b as shown in Fig. 6, raising the level of the intended target, left panel 12. As the left panel travels onto blade clearance level 20c, second rotating blade 22 passes under the intended target of folding, left panel 12, and passes under blade clearance level 20c. As lobe 22a of blade 22 rotates while the left panel 12 is carried by the blade clearance level 20c (Fig. 6), blade 22 contacts the underside of left panel 12 and folds the left panel 12 of diaper 10 over along line L, as shown in Figs. 7 and 8. The diaper 10 is passed downstream as shown in Fig. 9, for further processing (e.g., folding or packaging) as desired.

[0027] Referring now to Fig. 10, a top view of an alternate embodiment of the folding system shown in Fig. 1 is shown. In this embodiment, a tucker bar 26 is provided at or above the blade clearance level 20c, as shown in cross section in Fig. 11. The tucker bar 26 maintains the first fold R in position while the diaper is passed downstream to the second rotating blade 22 to achieve the second fold as described previously. A tucker roller 28 is optionally provided to maintain the first and second folds R and L intact during downstream passage.

[0028] Referring to Figs. 12a-c top views of alternate blade configurations are shown. In Fig. 12a, an oblong ear shaped blade 122 is shown. In Fig. 12b, a circular blade 222 is shown. In Fig. 12c, a bow-tie shaped blade 322 is shown. Blade shapes can be altered to improve folding

performance. In addition, the web contacting surfaces of the blades 22, whether the web contacting surface be the top or the bottom of the blades 22, can be provided with varying coefficient-of-friction features. For instance, one portion of the blade, 22a could be provided with increased coefficient-of-friction features relative to a second portion of the blade, 22b. Alternatively, if as in Fig. 1, upstream and downstream blades 22 are used, the upstream blade 22 could be provided with increased or decreased coefficient-of-friction features relative to the downstream blade 22.

[0029] The foregoing is considered as illustrative only of the principles of the invention. Furthermore, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described. While the preferred embodiment has been described, the details may be changed without departing from the invention, which is defined by the claims.

REFERENCES CITED IN THE DESCRIPTION

Cited references

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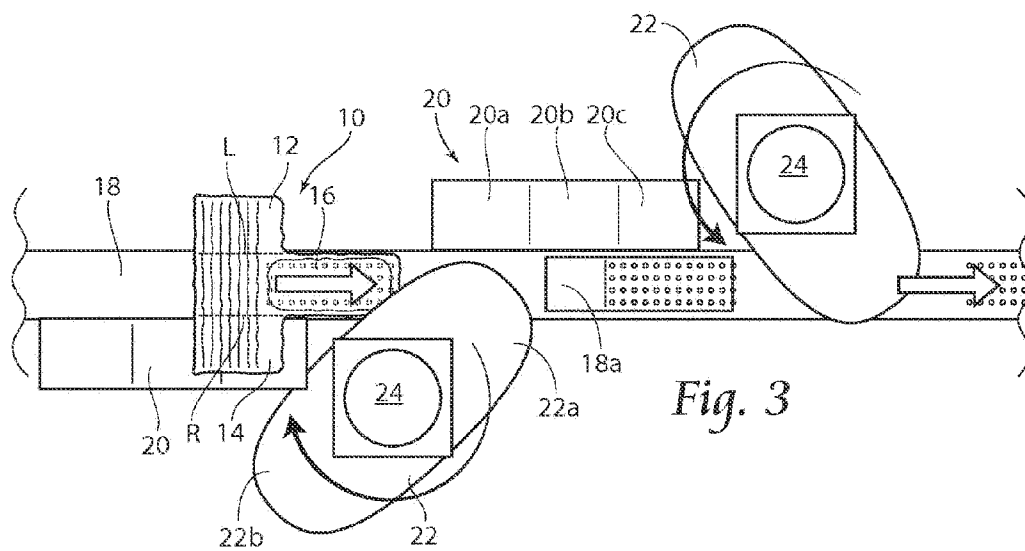
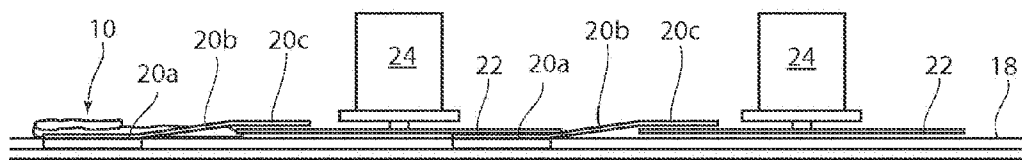
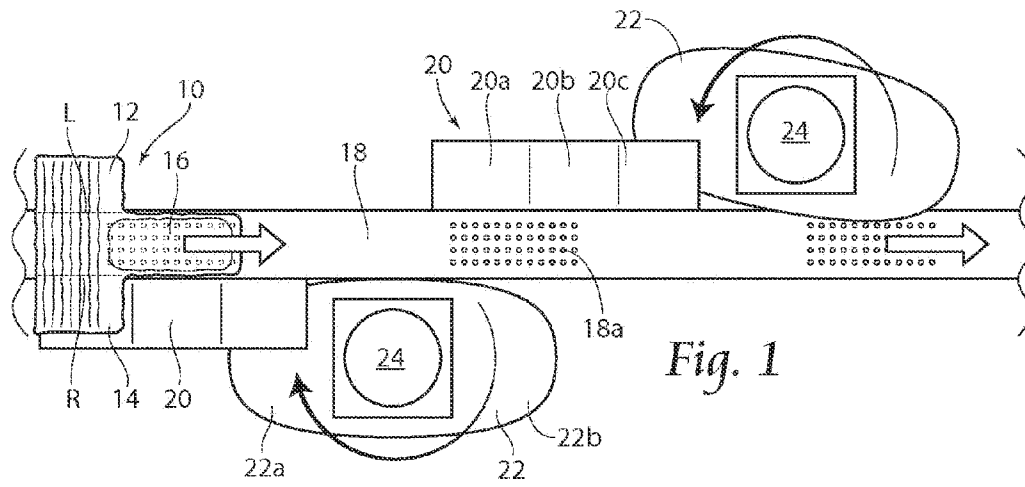
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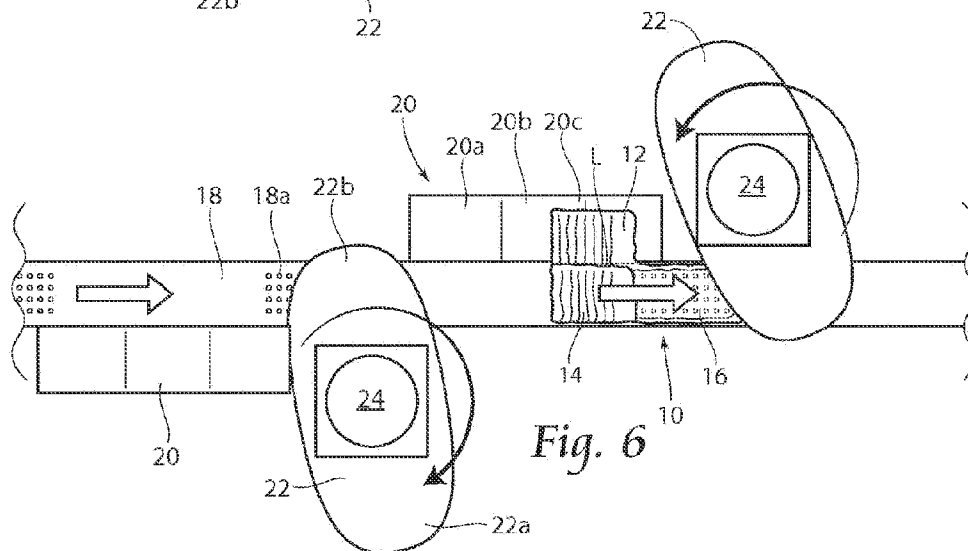
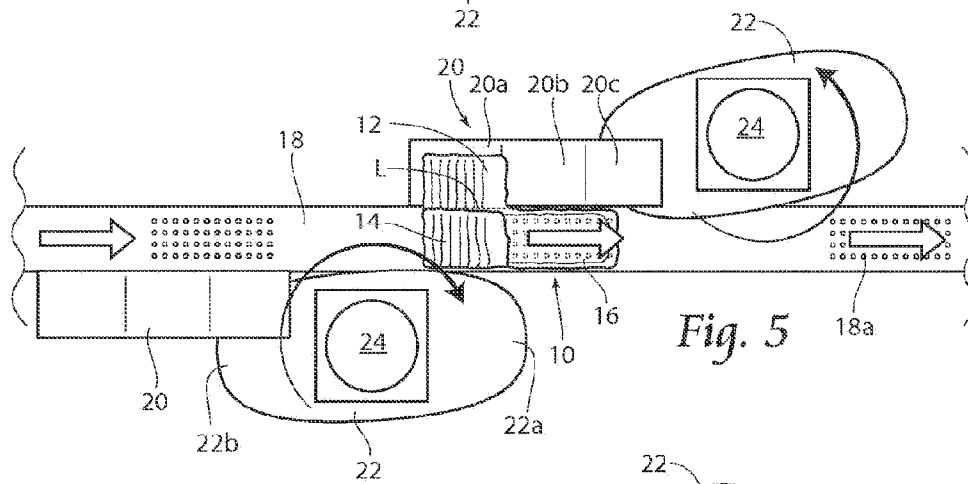
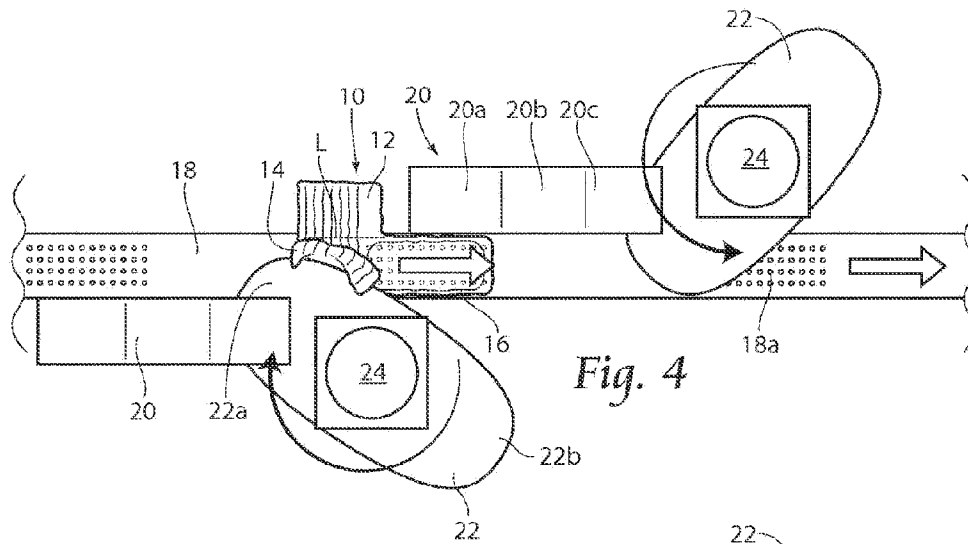
APPARAT OG FREMGANGSMÅDE TIL FOLDNING**PATENTKRAV:**

- 5 1. Et apparat til at folde en artikel (10), hvor apparatet omfatter:
- en frembringende overflade (18) på et første niveau til at bære mindst en første del (16) af artiklen (10), som skal foldes, og til at bringe artiklen frem i en maskinretning;
- en bærende overflade (20) til at bære mindst en anden del (14) af nævnte artikel
- 10 fra det første niveau til et andet niveau med afstand fra det første niveau i en retning vinkelret på maskinretningen, hvor nævnte bærende overflade omfatter et første afsnit (20a) på det første niveau, et andet afsnit (20c) på det andet niveau og et hældende midterafsnit (20b) mellem det første og det andet niveau;
- et første blad (22) på et tredje niveau mellem nævnte første og andet niveau,
- 15 hvor nævnte første blad er konfigureret til at folde over mindst en del af nævnte anden del af nævnte artikel langs en første foldelinie (R) parallel med nævnte maskinretning og ned på nævnte første del af nævnte artikel.
2. Et apparat i overensstemmelse med krav 1, hvor nævnte apparat yderligere omfatter:
- 20 en anden bærende overflade (20) til at bære mindst en tredje del (12) af nævnte artikel (10) på et fjerde niveau;
- et andet blad (22) på et femte niveau mellem nævnte første og fjerde niveau, hvor nævnte andet blad folder over mindst en del af nævnte tredje del af nævnte artikel ned på mindst én af nævnte første del (16) og anden del (14) af nævnte artikel.
- 25 3. Et apparat i overensstemmelse med krav 2, hvor nævnte tredje og femte niveau er lige store.
4. Et apparat i overensstemmelse med krav 2, hvor nævnte andet og fjerde niveau er lige
- 30 store.
5. Et apparat i overensstemmelse med krav 2, hvor nævnte andet blad (22) roterer til kontakt med nævnte tredje del (12) af nævnte artikel.

6. Et apparat i overensstemmelse med krav 2, hvor nævnte andet blad (22) folder over nævnte tredje del (12) af nævnte artikel (10) ned på nævnte anden del (14) af nævnte artikel.
- 5 7. Et apparat i overensstemmelse med krav 2, hvor nævnte andet blad (22) er udstyret med en første zone (22a), som har en første friktionskoefficient, og en anden zone (22b), som har en anden friktionskoefficient forskellig fra nævnte første friktionskoefficient.
- 10 8. Et apparat i overensstemmelse med krav 2, hvor nævnte første og andet blad (22) er udstyret med forskellige friktionskoefficienter.
9. Et apparat i overensstemmelse med krav 1, hvor nævnte første blad (22) roterer til kontakt med nævnte anden del (14) af nævnte artikel (10).
- 15
10. Et apparat i overensstemmelse med krav 1, hvor nævnte første blad (22) er udstyret med en første zone (22a), som har en første friktionskoefficient, og en anden zone (22b), som har en anden friktionskoefficient forskellig fra nævnte første friktionskoefficient.
- 20
11. Et apparat i overensstemmelse med krav 1, hvor nævnte første blad (22) rammer nævnte anden del (14) af nævnte artikel (10) med en hastighed større end en hastighed af nævnte frembringende overflade (18).

DRAWINGS





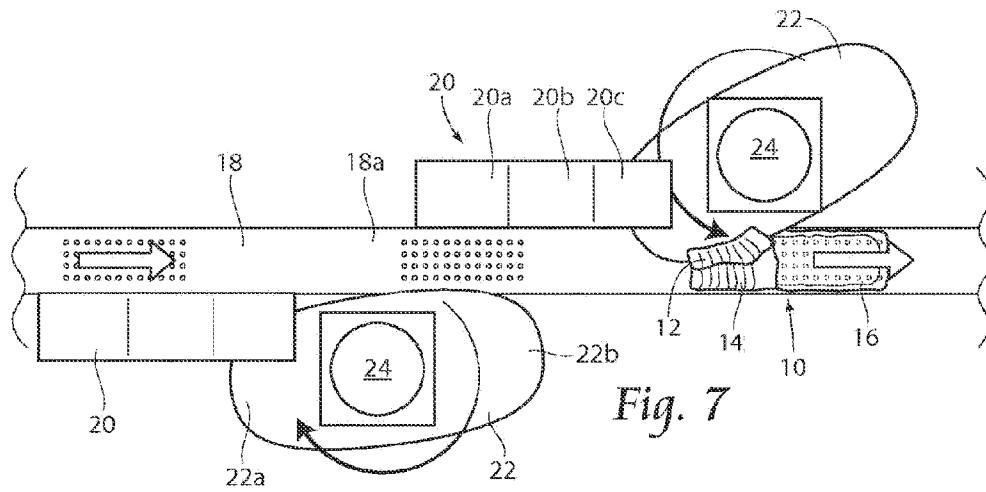


Fig. 7

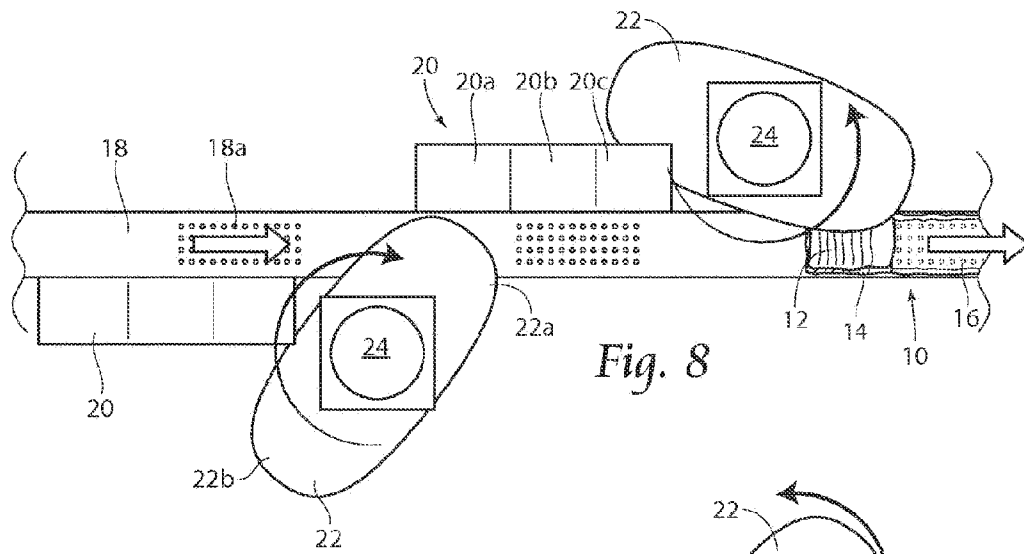


Fig. 8

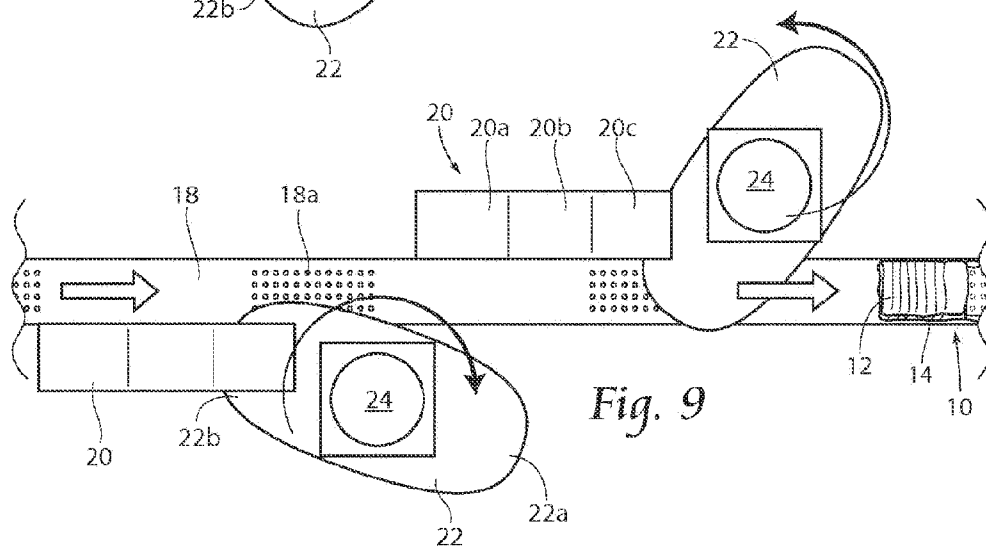


Fig. 9

