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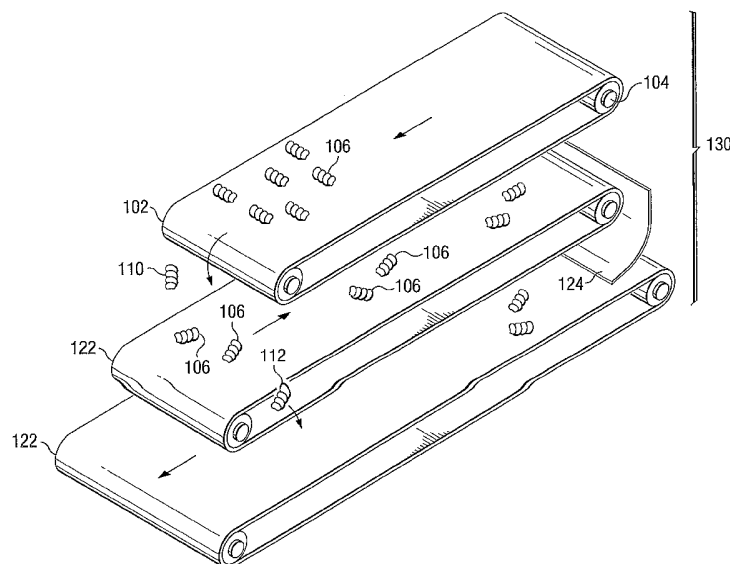
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[Continued on next page]

(54) Title: CONTAINMENT APPARATUS FOR MULTI-PASS OVENS



(57) Abstract: A containment apparatus for a multi-pass oven consisting of guide rails and tapered guide chutes having side rails. A tapered guide chute directs product pieces from one conveyor to the center of a receiving region of an underlying conveyor. Guide rails are placed along the sides of the receiving region of an underlying conveyor and maintain baking product pieces on the conveyor. Diverters on the distal end of each guide rail further move product pieces toward the center of the conveyor. Such diverters help ensure that pieces reach a subsequent guide chute or subsequent conveyor without falling off of the conveyor. Such guide rails, diverters, and guide chutes help prevent damage to, and loss of, product pieces while pieces pass through the oven. Guide rails, diverters, and guide chutes are particularly effective at maintaining round or cylindrical pieces within a multi-pass oven.

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CONTAINMENT APPARATUS FOR MULTI-PASS OVENS**BACKGROUND OF THE INVENTION**Technical Field

The present invention relates to improvements to multi-pass ovens and associated
5 conveyor systems. More particularly, the invention relates to product centering and handling components which may be added to such systems to facilitate their operation. A product-centering apparatus ensures that products are maintained on conveyors within multi-pass ovens. Flanged slides help guide comestible products moving from one conveyor down to another conveyor as product pieces passes through a multi-pass oven.

Description of Related Art

Snack pieces and other edible baked goods are known to be prepared with the use of multi-pass ovens. While in these ovens, pieces are moved about on conveyors and pass from one conveyor to another in various ways. Conveyors are usually stacked one above another and rotate in a counter-current direction. Generally, relatively flat pieces remain stationary
15 while being processed on such conveyors and while being handled and eventually packaged. No special handling is necessary to maintain the bulk of the product within the confines of process equipment. Such pieces remain on the equipment even when conveyors in an oven exhibit pronounced lateral movements due to irregular heating and other process imperfections.

20 However, certain product pieces are round or tubular and thus can move about during processing on conveyors, chutes and other equipment. These products have a stronger tendency to move around during processing as compared to relatively flat pieces. As conveyors continuously operate in a multi-pass arrangement, pieces reach the end of one conveyor and pass to an underlying subsequent conveyor by means of a chute or ramp. The
25 chute imparts a forward motion to pieces which allows them to escape the process by rolling or bouncing off the sides or end of prior art conveyors.

In other circumstances, a piece may become entangled in stationary parts at the edge of a conveyor as a result of such movement. Propelled pieces may also end up sufficiently close to the edge of a conveyor so as to be lost from the sides of a chute as such pieces reach the end of a conveyor and are impelled against a chute. In these circumstances, there is an elevated risk of losing product, causing a defect in a product, or worse, stopping the system because of a malfunction when pieces are passed vertically from one conveyor to the next. Lost pieces may even serve as a fire hazard within an oven as pieces are exposed to sufficient heat to cause self-combustion.

Figure 1 shows an embodiment of a prior art multi-pass oven. There are multiple conveyors **102**, **122** turning counter-currently in an oven. In a multi-pass arrangement of conveyors **130**, several conveyors **102** are stacked one above another. Each conveyor **102** turns around two or more axles **104**. Each conveyor **102** generally turns in a different direction from the one above or below it. With multiple conveyors **102** within an oven, product pieces **106** are able to reside longer within the oven. Alternatively, a higher rate of production is possible in a multi-pass oven as conveyors can operate faster while maintaining a desired bake time. Operating conveyors at higher speeds impels pieces with a higher velocity thereby increasing the risk of losing processing pieces.

With reference to **Figure 1**, once pieces **106** reach the end of a first conveyor **102**, they fall **110** or are guided by chutes **124** to a product-receiving region **108** of a subsequent conveyor **122**. Pieces passing to a subsequent conveyor **122** may end up traveling closer to the edge of a subsequent conveyor **122** and thus may be at a greater risk of eventually rolling or bouncing off of a subsequent conveyor **122**. After passing to a subsequent conveyor **122**, some pieces **112** may be immediately at risk for falling off of the conveyors.

A need exists for maintaining processing pieces **106** within the confines of conveyors within a multi-pass arrangement of conveyors. A need exists for guardrails or guide rails along the sides of a conveyor **102**. Such side guards would maintain conveyed product pieces

106 on a conveyor. Such guide rails would ensure that product pieces 106 which are prone to movement during processing are maintained in the most central region of each conveyor.

Further, a need exists for an improved chute. Such chutes would have guide rails which would help maintain product pieces within the confines of product chutes as product pieces

5 110 move from one conveyor to the next.

Such guide rails and improved chutes would substantially reduce the risk that conveyed pieces 106 are lost from, or cause a malfunction of, the conveyors during operation.

Such guide rails and chutes would also reduce damage that can occur to product pieces 106.

Such guide rails and chutes would not impede the movement of the conveyors and would be

10 able to adjust as the conveyors exhibited random and lateral movements during operation.

Such guide rails would not substantially impede monitoring of conveyed pieces and would be relatively inexpensive to produce and easy to install. Finally, such guide rails and chutes would substantially improve the safe operation of a multi-pass oven used to process product pieces which are prone to moving relative to a conveyor surface.

SUMMARY OF THE INVENTION

In accordance with the present invention, a containment apparatus consists of guide rails and guide chutes. Guide rails are placed along the sides of a conveyor within a multi-pass oven. Guide rails lie parallel to a conveyor and direct moveable baking product pieces toward the center region of it. Guide rails are attached to an undermount guide which allows the containment apparatus to track the lateral movements of an operating conveyor. Such guide rails can have narrowing protrusions or diverters toward the distal end of each guide rail. Guide chutes having guide rails direct product pieces to a subsequent underlying conveyor which generally turns in the opposite direction as the previous one. Such guide chutes direct product pieces toward the center of a subsequent conveyor. Such guide rails and guide chutes help prevent damage to, and loss of, product pieces while the pieces pass through the oven. Guide rails and guide chutes are particularly effective at preventing round or cylindrical pieces from migrating relative to conveyors during processing. Such guide rails and guide chutes provide increased safety to an operating multi-pass oven. The above as well as additional features and advantages of the present invention will become apparent in the following written detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives, and advantages thereof, will be best understood by reference to the following detailed description of illustrative embodiments when read in conjunction with the accompanying drawings, wherein:

Figure 1 is a perspective drawing of a multi-pass oven according to the prior art wherein several conveyors turn in a counter-current direction relative to one another;

Figure 2 is a perspective drawing of guide rails including extension oven guides and undermount guide and connecting links;

Figure 2a is a close-up perspective drawing of the linkage between guide rails and an eye nut connecting link; and,

Figure 3 is a perspective drawing of a guide chute having guide rails and a tapered discharge which facilitates the transfer of product pieces from one conveyor to the center region of another.

Reference Numerals

	102 conveyor
	104 conveyor axle
	106 product piece
20	108 product-receiving region of conveyor
	110 falling product piece
	112 at-risk product piece
	122 subsequent conveyor
	124 prior art chute
25	130 multi-pass arrangement of conveyors
	202 guide rails
	204 undermount guide
	210 vertical portion of guide rail
	212 eye nut connecting link
30	216 large socket head cap screw
	220 D shackle
	224 eye nut
	230 securing nut
	240 wear strip
35	250 extension link
	252 screw hole

- 254 threaded hole
- 256 socket head cap screw
- 260 extension oven guide
- 262 adjustable diverter
- 5 280 connecting link mounting bracket
- 290 conveyor frame
- 310 guide chute
- 312 connecting section of guide chute
- 314 chute handles
- 10 316 product guiding surface of guide chute
- 318 guide chute side rail
- 320 retaining lip
- 322 distal end of guide chute
- 324 proximal end of guide chute
- 15 330 guide chute support member

DETAILED DESCRIPTION

A containment apparatus in the form of guide rails and improved chutes optimally maintain product pieces on a set of multi-pass conveyors. Such a containment apparatus is particularly effective with product pieces which have a tendency to migrate during processing, such as but not limited to round or cylindrical pieces.

According to one embodiment of the invention, and with reference to **Figure 3**, product pieces are passed from a first conveyor **102** to subsequent conveyors **122** by a guide chute **310**. A guide chute **310** has improvements over the prior art. When product pieces **106** reach the distal end of a conveyor, the pieces **106** fall a certain distance before contacting a product guiding surface **316** of a guide chute **310**. Such a guide chute **310** directs falling pieces **110** onto the center region of a subsequent conveyor **122**. Preferably, there is at least one guide chute **310** at the end of each conveyor. However, multiple guide chutes **310** may be used to cover the entire width of a given conveyor. In one embodiment, a guide chute **310** has one or more handles **314** which facilitate installation and handling of guide chutes **310**. In addition, each guide chute **310** has a retaining lip **320** curled downward on which a guide chute **310** may be attached to a guide chute support member **330**. Such support member **330** can be attached to a conveyor frame **290** for support.

Each guide chute **310** further comprises a connecting section **312**, a product guiding surface **316**, and side rails **318**. The side rails **318** are of sufficient size so as to prevent nearly all product pieces from escaping the guide chute **310**. The length of a connecting section **312** and a product guiding surface **316** depend upon the preferences of the designers or fabricators of the guide chute **310**. The shapes and dimensions of a connecting section **312** and a product guiding surface **316** are arbitrary and may depend on several factors including, but not limited to, the type and shape of piece **106** processed in the oven, the size and width of each conveyor, the distance between conveyors, and the position and orientation of each guide chute **310** relative to the conveyors. In a preferred embodiment, a product guiding

surface **316** is curved. The amount of curvature of such product guiding surface **316**, and the dimensions and shape of guide chute side rails **318** are likewise arbitrary but may be optimized for production of a given product piece **106** and for a given multi-pass oven.

Some experimentation may be necessary to determine the optimal dimensions of each component of a guide chute **310**. Guide chute side rails **318** are generally perpendicular to the surface of a conveyor **122** but may be of an arbitrary shape and dimension. In a preferred embodiment, a guide chute **310** is made of metal; however, a guide chute **310** may be made of other materials that can persist in the elevated temperatures of an oven. The surface of a product guiding surface **316** may be smooth, textured, or shaped with surface features such as, but not limited to, ridges, bumps, or channels which facilitate the transfer, or alternatively, slow the transfer, of product pieces **106** from a guide chute **310** to a subsequent conveyor **122**. In a preferred embodiment, the top portion or proximal end **324** of a guide chute **310** is wider than the width of a conveyor **102**, and the distal end **322** of the product guiding surface **316** is narrower or smaller than the width of a subsequent conveyor **122**. Such tapering of a guide chute **310** more preferentially guides processed pieces **106** to the center region of a subsequent conveyor **122**. In one example, where the width of a conveyor is about 39 inches, the tapering is about two inches on each side of the guide chute **310**.

According to the present invention, after product pieces leave a guide chute, the pieces are maintained on a conveyor with guide rails. Guide rails according to one embodiment of the invention are shown in **Figure 2**. Guide rails **202** lie substantially parallel to a subsequent conveyor **122**. Guide rails **202** may be of any length, but preferentially lie adjacent to a product-receiving region **108** of a subsequent conveyor **122** whereupon product pieces **106** are first introduced to a subsequent conveyor **122** from a guide chute **310**. A product-receiving region **108** is about the distance necessary for a product piece **106** to lose its forward motion relative to a conveyor. Forward motion is received from the acceleration of gravity when a product piece **106** falls down a guide chute **310**. For example, in one

embodiment where the length of an entire conveyor is 17 feet, guide rails along a product-receiving region are about 3 to 4 feet in length. At the end of a product-receiving region **108**, a product piece **106** is again stationary on a conveyor and has almost no tendency to move. Guide rails **202** are preferably used along each conveyor in a multi-pass oven and preferably at a product-receiving region **108** of each conveyor.

Guide rails **202** are attached to an undermount guide **204**. An undermount guide **204** may be of any shape as long as it connects and provides stability to guide rails **202**. In one embodiment as shown in **Figure 2**, the undermount guide **204** is in the shape of an "H". An undermount guide **204** may have contact with a conveyor and may be exposed to wear over time. An undermount guide **204** allows guide rails **202** to track the lateral and other movements of a conveyor.

One or more wear strips **240** are attached with socket head cap screws **256** to the inside surface of the vertical portion **210** of each guide rail **202**. Threaded holes **254** in the wear strips **240** ensure that the socket head cap screws **256** remain in place. Wear strips **240** are in direct but loose or intermittent contact with the sides of a conveyor **102**. Intermittent and sometimes continuous contact with the conveyor **102** causes wear to wear strips **240**. After a certain time, worn wear strips **240** may be replaced with new ones. Wear strips **240** may be made of any material suitable for use in an oven and suitable to resist wear by contact with a conveyor **102**. In a preferred embodiment, wear strips **240** are made of low-grade carbon steel.

Extension oven guides **260** are attached to each end of each guide rail **202**. The vertical side of each extension oven guide **260** is sandwiched between an extension link **250** and a wear strip **240**. Extension links **250** can be made of metal or other strong, supportive material. Extension links **250** provide support and a means for attachment to an undermount guide **204**. Additional socket head cap screws **256** passing through holes **252** in each extension oven guide **260** ensure that each extension oven guide **260** remains firmly in place.

Each extension oven guide **260** has a diverter **262** angled inward to ensure that product pieces **106** passing near the edges on a conveyor **102** are pushed or guided toward the center of the conveyor **102**. The diverters **262** can be adjustable or bendable, if desired. The diverters **262** are made to protrude above the surface of a conveyor **102** such that they are not in contact
5 with the conveyor **102** but are sufficiently close so as to contact product pieces **106** within their reach. In a preferred embodiment, the combination of a guide chute **310**, a guide rail **202**, and a diverter **262** maintains product pieces **106** within a multi-pass oven.

With reference to **Figure 2**, a containment apparatus with guide rails **202** is maintained in close proximity to a conveyor **102** by placing an undermount guide **204**
10 beneath the conveyor **102**. Attached to the undermount guide **204**, usually by welding, are two guide rails **202**, one on each side the conveyor **102**. With reference to **Figure 2a**, an eye nut connecting link **212** is attached to each end of each guide rail **202**. Each eye nut connecting link **212** has an eye nut **224** by which the link **212** is connected by way of a D shackle **220** to a guide rail **202**. Each eye nut connecting link **212** is so attached to a guide
15 rail **202** by a large socket head cap screw **216** which holds a D shackle **220** and one or more spacers **208**. On the other end, each eye nut connecting link **212** is attached to the conveyor frame **290** by a connecting link mounting bracket **280**. The connecting link mounting bracket **280** is welded to the conveyor frame **290**. However, other connecting means may be used to connect each bracket **280** to the conveyor frame **290**, such as but not limited to a chain or
20 cable. Each connecting link mounting bracket **280** has similar connecting components as those used to connect the eye nut connecting link **212** to the containment apparatus. Specifically, a large socket head cap screw **216** passes through a connecting link mounting bracket **280** and such screw **216** holds a D shackle **220** and one or more spacers **208**.

Each securing nut **230** on each end of an eye nut connecting link **212** can be adjusted
25 so as to obtain an optimum amount of tension in each connection. The connection of the containment apparatus is optimum when it provides enough flexibility or slack for the

containment apparatus to track the lateral and other movements of an operating conveyor **102** while still maintaining the containment apparatus in a roughly stationary position relative to the conveyor **102**.

During operation, a conveyor **102** drifts laterally or side-to-side, thus a guide rail rigidly fixed to a conveyor frame **290** would not be preferred because the conveyor **102** could be damaged and could cause maintenance downtime if the conveyor **102** were to entangle itself with such a rigidly fixed guide rail. In the present invention, there is minimal risk that a conveyor would become entangled with a guide rail. Such entanglement would require shutdown and replacement of damaged parts. Also, such a rigidly-mounted guide rail would not always be in close enough proximity to maintain product pieces on a conveyor.

Further, it is not preferred to attach a guide rail to a conveyor frame **290** with a springing material which could maintain a guide rail against the side of a conveyor **102**. Many springing materials available for such an attachment of a guide rail would not allow free enough movement due to thermal expansion of the materials within the oven. Guide rails **202** according to the present invention have the ability and benefit to optimally track the lateral movement of a conveyor **102** without creating excessive friction and/or damage to the sides of the conveyor **102**. Such guide rails **202** do not leave gaps between a conveyor **102** and a guide rail **202** of such size through which product may be lost.

Some, and preferably most, of the weight of the containment apparatus is supported by the undermount guide **204**. The eye nut connecting links **102** are designed to be under a tension load as the conveyor **102** operates. Further, the eye nut connecting links **102** may be attached to the conveyor frame **290** at a point either above or below the plane of the conveyor **102**. In Figure 2, the attachments are shown above the plane of the conveyor **102**.

Through the use of a combination of one or more guide rails **202** and one or more guide chutes **310**, product pieces **106** are maintained on conveyors in a multi-pass oven. Without guide chutes **310**, guide rails **202**, and diverters **262**, there is a substantial likelihood

of losing product pieces **106** from the apparatus. Product pieces **106** which have fallen off of a conveyor **102** inside of a multi-pass oven have the potential to self-combust. If a sufficient amount of lost particles combust, there is a potential for starting a fire in the oven which can lead to a process emergency and loss of life. Guide rails **202**, guide chutes **310**, and diverters **262** are especially advantageous in the production of round or cylindrical process particles which have a tendency to migrate on conveyors during production.

While the invention has been particularly shown and described with reference to a preferred embodiment, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention.

CLAIMS:

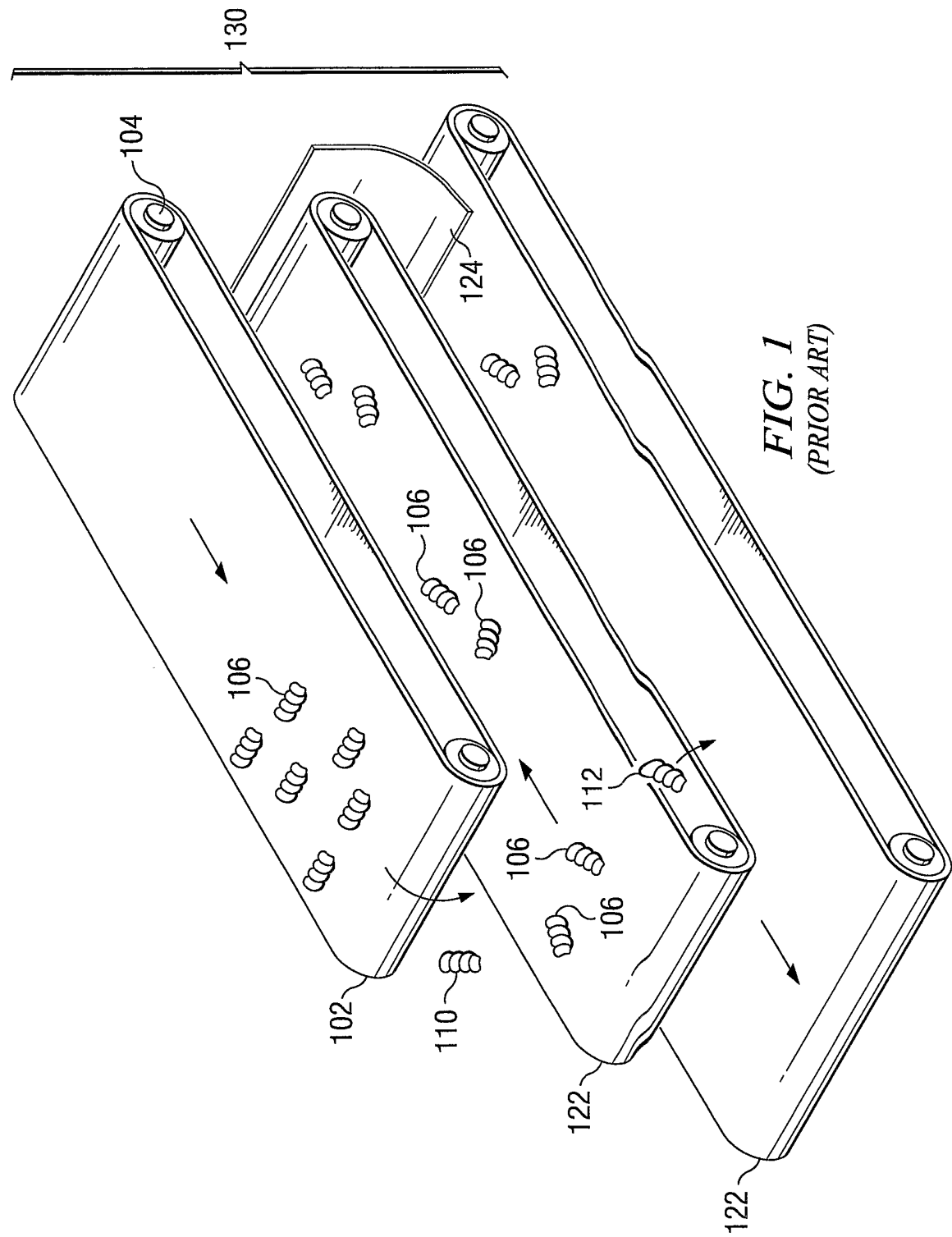
We claim:

1. A containment apparatus for a conveyor in a multi-pass oven comprising at least one guide rail wherein said guide rail is held in close proximity to said conveyor by an undermount guide, and further wherein said containment apparatus tracks the lateral movement of said conveyor.
2. The apparatus of claim 1 further comprising at least one wear strip attached to each of said guide rails.
3. The apparatus of claim 1 wherein said containment apparatus is held relatively stationary by a connecting member further wherein said connecting member is attached to said containment apparatus on one end, and attached to a stationary object on the other end.
4. The apparatus of claim 3 wherein said connecting member is an eye nut connecting link.
5. The apparatus of claim 3 wherein said connecting member is a chain.
6. The apparatus of claim 2 wherein said connecting member is a metal cable.
7. The apparatus of claim 1 further comprising an extension oven guide attached to at least one of said undermount guide or said guide rail.

8. The apparatus of claim 7 wherein said extension over guide has at least one diverter that can be extended over the surface of said conveyor.
9. The apparatus of claim 7 further comprising an extension link wherein one end of said extension link is attached to said extension over guide, and the opposing end of said extension link is attached to at least one of said undermount guide and said undermount guide.

10. A guide chute for a conveyor in a multi-pass oven comprising a tapered product guiding surface having a larger proximal end and a smaller distal end, and two side rails.
11. The apparatus of claim 10 wherein said product guiding surface is arcuate.
12. The apparatus of claim 10 wherein said product guiding surface is textured.
13. The apparatus of claim 10 wherein said product guiding surface has channels.
14. The apparatus of claim 10 further comprising at least one guide rail and at least one wear strip wherein said guide rail is held in close proximity to a conveyor by an undermount guide, and further wherein said guide rail tracks the lateral movement of said conveyor.

15. A multi-pass oven comprising:
- a) a first conveyor;
 - b) at least one subsequent conveyor;
 - c) at least one guide rail wherein said guide rail is held in close proximity to said
- 5 subsequent conveyor of step b), further wherein said guide rail is attached to an undermount guide, and further wherein said guide rail tracks the lateral movement of said conveyor; and,
- d) at least one guide chute having a tapered product guiding surface and at least one side rail.
16. The apparatus of claim 15 further comprising at least one wear strip attached to each of said guide rails.
17. The apparatus of claim 15 wherein said guide rail and said undermount guide are held relatively stationary by a connecting member further wherein said connecting member is attached to at least one of said guide rail and said undermount guide on one end, and attached to a stationary object on the other end.



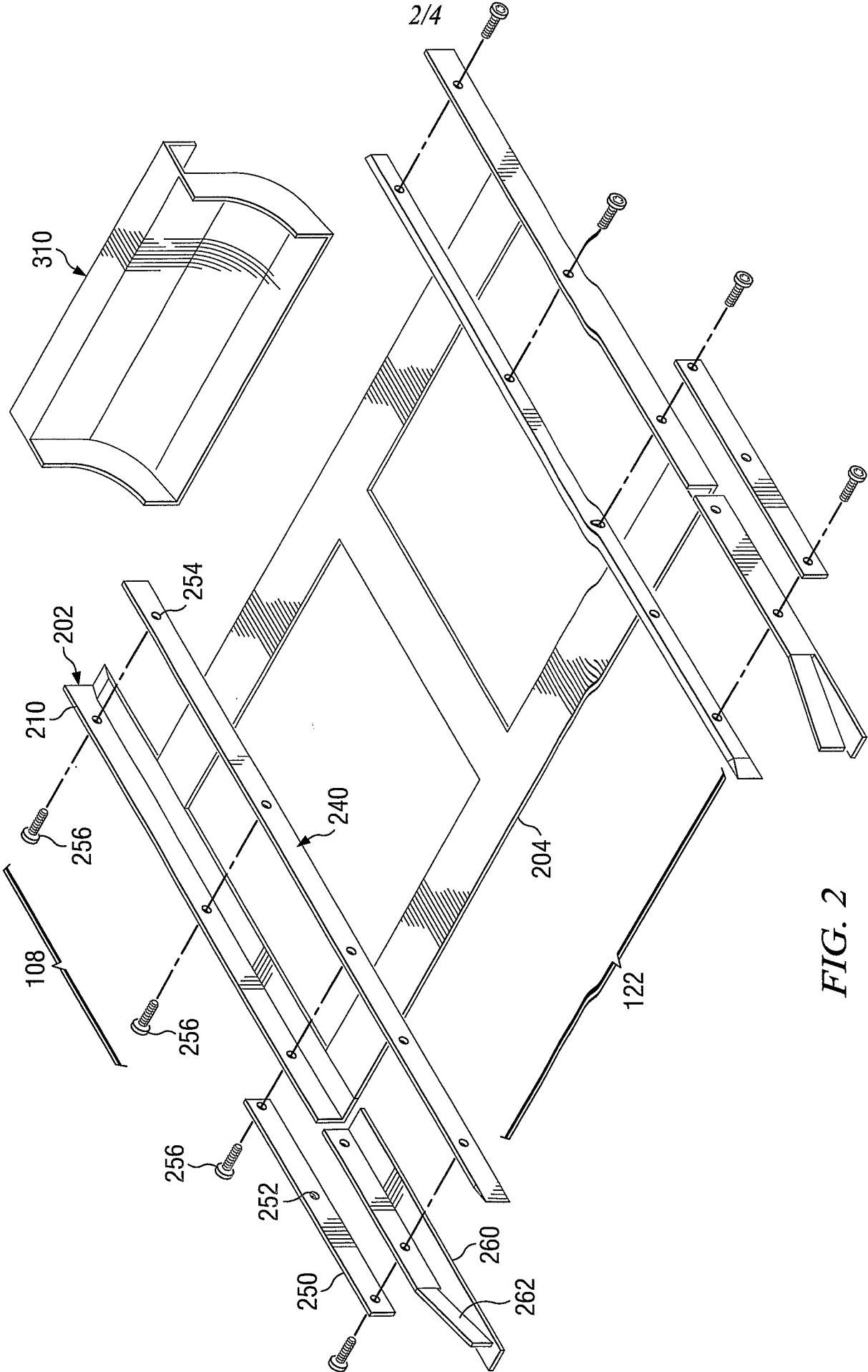


FIG. 2

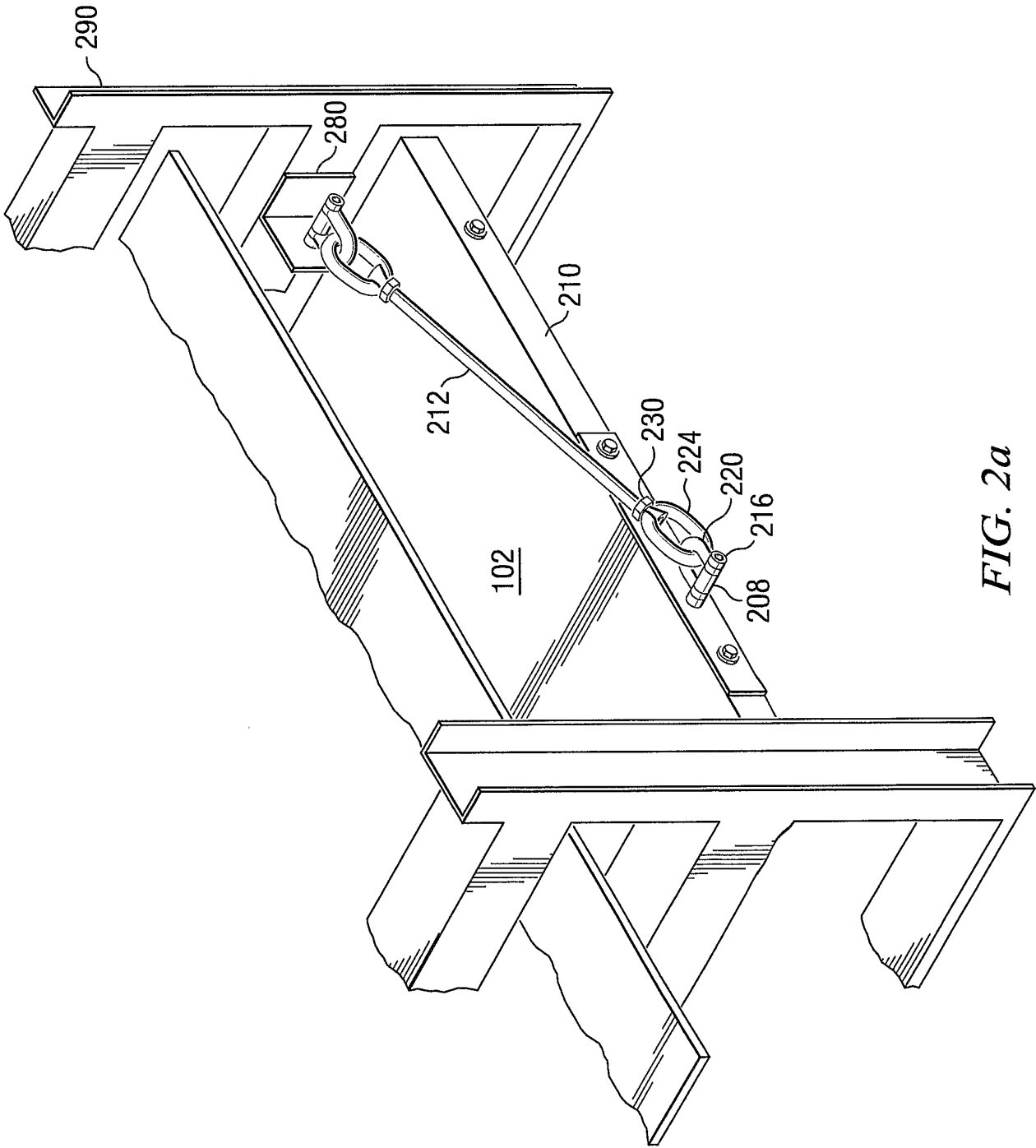


FIG. 2a

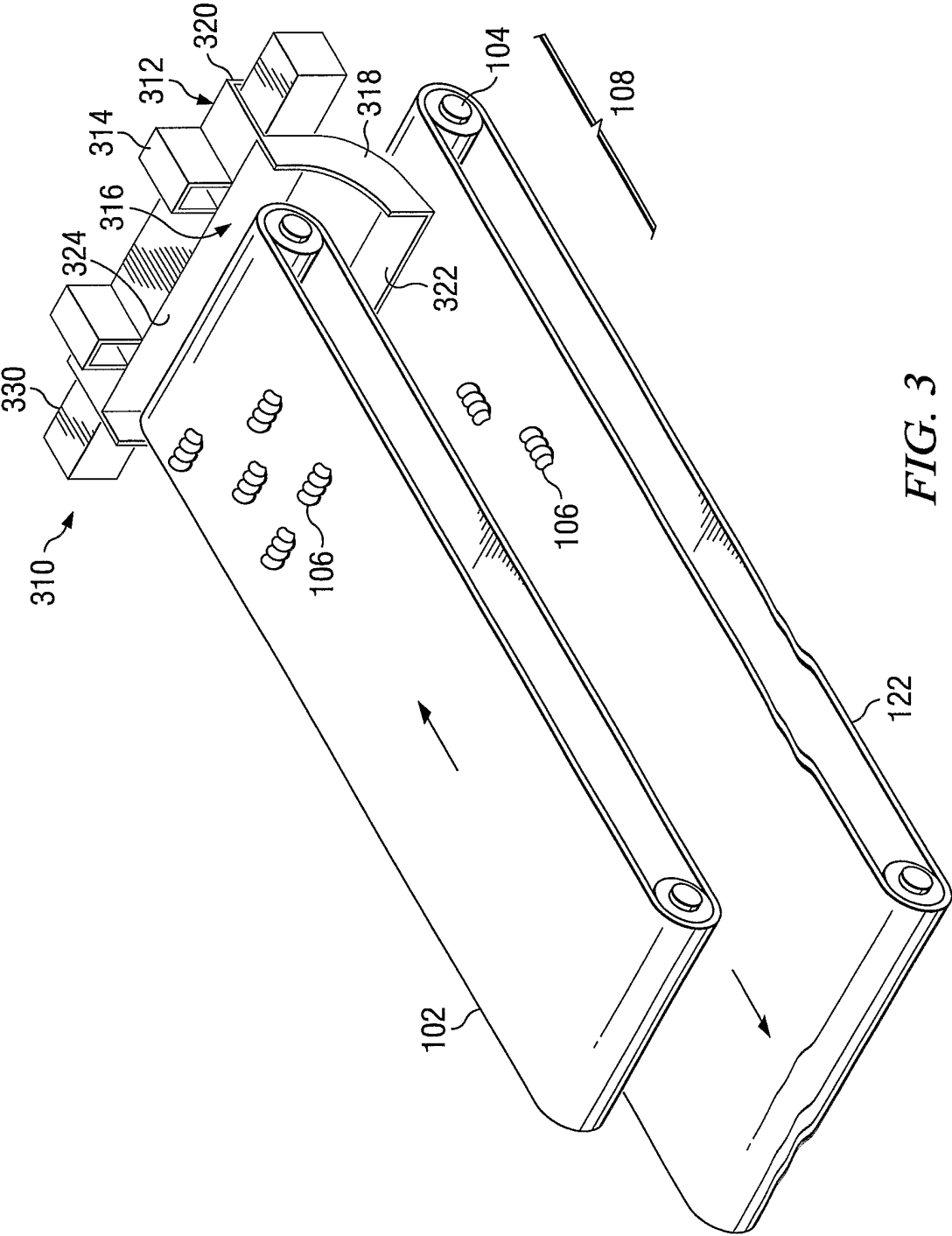


FIG. 3