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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
6 September 2013 (06.09.2013)

WIPO | PCT

(10) International Publication Number
WO 2013/128459 A1

(51) International Patent Classification:
*B65H 45/00* (2006.01) *B29C 65/18* (2006.01)
*B65D 83/04* (2006.01)

(21) International Application Number:
PCT/IL2013/050185

(22) International Filing Date:
28 February 2013 (28.02.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/605,223 1 March 2012 (01.03.2012) US
61/747,441 31 December 2012 (31.12.2012) US

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, 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, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Declarations under Rule 4.17**:

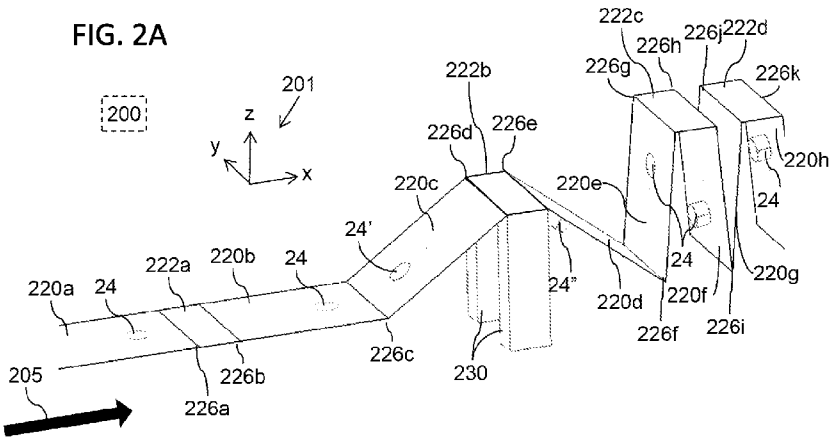
— *of inventorship (Rule 4.17(iv))*

**Published**:

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

(54) Title: FOLDED BLISTER CHAIN, FOLDING MACHINE AND FOLDING METHOD

FIG. 2A




(57) Abstract: A method and system are provided for folding a blister chain. The blister chain may optionally be folded into an arbitrary length stack of blister sheets. During folding adjacent sheets may be folded back to back and/or front to front. Sheets may be interconnected for example by joints and/or spacers. The folding may optionally include moving an interconnector of the blister chain out of a plane of advancement of the chain. The folded output may optionally be stacked and/or transported and/or inserted into a secondary package. The folded output may optionally be in the form of a stack and/or a wallet. The folded stack and/or wallet may optionally be formed from convention blister materials without added backing and/or connecting materials. The foldable blister chain may optionally be produced on conventional blister manufacturing machinery.

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# FOLDED BLISTER CHAIN, FOLDING MACHINE AND FOLDING METHOD

## RELATED APPLICATION/S

This application claims the benefit of priority under 35 USC §119(e) of U.S. Provisional Patent Application No. 61/605,223 filed 1 March 2012 and Provisional Patent Application No. 61/747,441 filed 31 Dec. 2012, the contents of which are incorporated herein by reference in their entirety.

## FIELD AND BACKGROUND OF THE INVENTION

The present invention, in some embodiments thereof, relates to a method and system folding a blister chain and, more particularly, but not exclusively, to a method and system for mass producing a continuous folded blister chain.

United States Patent No. 6,253,920 to Kallgren discloses a blister pack, comprising at least a first and a second parallel row of blisters, and of the type in which a base foil formed with blisters is connected to a substantially flat lid foil wherein between the at least first and second rows of blisters, an intermediate part having at least one folding line parallel to said first and second rows is defined, said pack being foldable along said folding line, and that said blisters of said first row being so offset relative to the blisters of said second row that after folding the blisters in the rows engage between each other.

According to Kallgren '920 the foldable blister packs described therein may be advantageous over conventional blister packs which are bulky and voluminous owing to the construction of the blisters, and therefore the package must be voluminous. The voluminous package involves heavy expenses, e.g. heavy expenses for the handling and transport and heavy stock-keeping expenses. Furthermore, due to its measures, e.g. large sides, the voluminous package will be rather unstable, which will also render the manufacturing and handling of the package difficult.

United States Patent No. 3,659,706 to Serrel discloses a pharmacal package construction wherein a pair of blister sheets are closed by respective backing sheets and arranged with the blisters in proximate relation so that the backing sheets are outermost, the blister sheets being provided with detachably inter-fitting formations, to releasably

retain the blister sheets and their backing sheets in position defining a package effectively protected by the backing sheets.

United States Patent No. 6,024,222 to Friberg discloses a blister pack comprising at least one blister assembly including two blister parts, each having a set of blisters and being of the type in which a base foil formed with blisters is connected to a substantially flat lid foil, the blister parts being interconnected and foldable towards each other, the blisters of one blister part being so offset relative to the blisters of the other blister part that, after folding, the blisters of the two blister parts engage between each other.

International Patent Application Publication No. WO/2010/004566 to the same inventor discloses a medicament dispensing device comprises at least one container adapted for accommodating and dispensing at least one elongate packagible elongate blister pack carrying a plurality of blisters containing the medicament; transporting means adapted for transporting the blister pack toward opening of the container; dispensing means adapted for releasing a fragment of the blister pack bearing a predetermined number of the blisters from the container through the opening to a patient; and controlling means adapted for identifying the patient before dispensing the blister to the patient, activating the dispensing means, recording actions of dispensing. The blister pack is foldable and configured to be folded within the container. The dispensing means is adapted to cut off the blister bearing fragment. The dispensing means is adapted to cut off the blister bearing fragment such that the blisters remain intact.

Additional background art includes United States Patent No. 3,743,084; United States Patent No. 8,251,219; United States Patent No. 4,340,141; United States Published Application No. 2004/0026293; and United States Published Application No. 2006/0042988.

## SUMMARY OF THE INVENTION

According to an aspect of some embodiments of the present invention there is provided a method of folding a chain of a blisters sheets including: supplying a continuous chain of blisters sheets; folding together pair of sheets of the continuous chain and simultaneously moving a pair of sheets or an interconnector between the pair of sheets out of a plane or path the chain during the folding.

According to some embodiments of the invention, the pair of sheets remain connected to the chain during the folding.

According to some embodiments of the invention, the method further includes stacking the pair of sheets along a path of advancement.

According to some embodiments of the invention, the stacking is of at least two substantially parallel layers.

According to some embodiments of the invention, the folded chain includes at least 6 adjacent sheets and the stacking is into at least six substantially parallel layers.

According to some embodiments of the invention, the moving includes buckling the interconnector out of the plane or path of advancement.

According to some embodiments of the invention, the moving includes advancing the interconnector over an edge.

According to some embodiments of the invention, the moving includes pulling the interconnector out of the plane or path of advancement.

According to some embodiments of the invention, the moving includes pressing the interconnector out of the plane or path of advancement.

According to some embodiments of the invention, the folding further includes advancing a trailing end of the pair of sheets faster than a leading end of the two sheets.

According to some embodiments of the invention, during the moving a leading end of the two sheets and a trailing end of the two sheets remain in the path of advancement.

According to some embodiments of the invention, the moving is performed by an arm moving in a continuous orbit.

According to some embodiments of the invention, the method further includes restraining the continuous chain from twisting.

According to an aspect of some embodiments of the present invention there is provided a system for folding a continuous blister chain including: a feeder configured to feed the continuous chain of blister sheets to an out of plane folder configured for folding an interconnector between two of the blister sheets out of a plane or path of advancement of the feeder to form the continuous chain into a stack of connected blister sheets.

According to some embodiments of the invention, the system further includes a presser for pressing the interconnector out of the plane.

According to some embodiments of the invention, the system further includes a puller for pulling the interconnector out of the plane.

According to some embodiments of the invention, the system further includes an edge and wherein the folding occurs over the edge.

According to some embodiments of the invention, the system further includes an advancer, and wherein the folding results from the advancer advancing a trailing edge of the two blisters sheets toward a leading edge thereby bucking the sheets across the interconnector.

According to some embodiments of the invention, the folder is configured to fold the two sheets into substantially parallel connected layers, substantially perpendicular to the plane of advancement.

According to some embodiments of the invention, the folder is synchronized with the feeder.

According to some embodiments of the invention, the folder is configured receives the chain continuously.

According to some embodiments of the invention, the system further includes a stacker for stacking at least three of the sheets as connected layers, the layers substantially perpendicular to the plane of advancement.

According to some embodiments of the invention, the system further includes a guide preventing twisting of the chain.

According to an aspect of some embodiments of the present invention there is provided a continuous blister chain packaged for distribution including a plurality of blister containing sheets wherein the sheets are folded to form substantially parallel layers, and at least one blister protrudes from both sides of at least one of the sheets, wherein the distance between the layers is less than the height of the at least one blister.

According to some embodiments of the invention, blisters of at least two of the layers mesh together.

According to some embodiments of the invention, the blister chain includes at least three of the sheets folded into at least three of the layers.

According to some embodiments of the invention, the blister chain includes at least five of the sheets folded into at least five of the layers.

According to some embodiments of the invention, the blister chain includes at least one blister protruding from only one side of at least one of the sheets.

According to some embodiments of the invention, the at least one blister protruding from at least one side has a lesser height than the at least one blister protruding from both sides.

According to some embodiments of the invention, the at least one blister protruding from at least one side and the at least one blister protruding from both sides are both on a single sheet of the sheets.

According to an aspect of some embodiments of the present invention there is provided a continuous blister chain packaged for distribution including: a plurality of sheets containing blister, the sheets folded to form layers of a stack, and one or more spacers interconnecting between two of the sheets and wherein the spacers include at least one blister.

According to some embodiments of the invention, the blister chain includes at least three of the layers.

According to some embodiments of the invention, the blister chain includes at least two of the spacers.

According to some embodiments of the invention, the blister chain includes at least five of the layers.

According to some embodiments of the invention, the blister chain includes at least two of the spacers.

According to some embodiments of the invention, the layers are substantially parallel.

According to some embodiments of the invention, each of the blisters contains a medicament dose.

According to some embodiments of the invention, the blisters on the spacers contain of first of the medicament doses.

According to some embodiments of the invention, a space between two of the layers is less than twice the height of a blister of the blisters.

According to some embodiments of the invention, a space between two of the layers is less than the height of a blister of the blisters of the sheets.

According to an aspect of some embodiments of the present invention there is provided a method of adapting a blister producing machine to produce a foldable blister chain. The method may include setting up a pocket forming unit to emboss a plurality of folding lines into a continuous strip of blister substrate, the folding lines demarcating a continuous chain of connected blister sheets, and setting up a cutting unit to trim an edge of the continuous strip of blister substrate while the continuous chain of sheets remains intact.

According to an aspect of some embodiments of the present invention there is provided a method of producing a foldable blister chain using a conventional blistering machine including a pocket forming unit and cutting unit. The method may include embossing a plurality of folding lines into a continuous strip of blister substrate with the pocket forming unit, the folding lines demarcating a continuous chain of connected blister sheets, and trimming an edge of the continuous strip of blister substrate with the cutting unit without severing the continuous chain.

According to some embodiments of the invention, the folding lines include at least one element of the group consisting of a 90° folding line and a 180° folding line.

According to some embodiments of the invention, the continuous chain further includes a plurality of spacers, the length of at least one spacer being substantially the height of a blister.

According to some embodiments of the invention, at least one of the folding lines is configured to fold in an opposite direction of at least one other of the folding lines.

According to some embodiments of the invention, a spacer surrounded by two 90° folding lines alternates with a 180° folding line, folding in the opposite direction.

According to some embodiments of the invention, a spacer surrounded by two 90° folding lines alternates with a spacer surrounded by two 90° folding lines folding in the opposite direction.

According to some embodiments of the invention, a method of producing a foldable blister chain may further include excising a cut out from the blister chain with the cutting unit.

According to some embodiments of the invention, a method of producing a foldable blister chain may further include folding the continuous blister chain according claim.

According to an aspect of some embodiments of the present invention there is provided a system for producing a blister chain. The system may include a pocket forming unit set up for embossing a plurality of folding lines into a continuous strip of blister substrate, the folding lines demarcating a continuous chain of connected blister sheets, and a cutting unit set up for trimming an edge of the continuous strip of blister substrate without severing the continuous chain.

According to some embodiments of the invention, a system for producing a foldable blister chain may further include a system for folding the continuous blister chain.

According to an aspect of some embodiments of the present invention there is provided a method of packaging a stack of blister sheets. The method may include supplying a continuous folded stack of at least six blister sheets, and inserting the continuous folded stack into a secondary package.

According to some embodiments of the invention, the stack may include at least 10 blister sheets.

According to some embodiments of the invention, the method may further include supplying a user opening to the secondary package. A plane of the user opening may be directed parallel to a folding line of the stack.

According to some embodiments of the invention, the method may further include supplying a user opening to the secondary package, the user opening being configured such that unfolding a blister sheet from the stack causes the blister sheet to extend out of the opening.

Unless otherwise defined, all technical and/or scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which the invention pertains. Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of embodiments of the invention, exemplary methods and/or materials are described below. In case of conflict, the patent specification, including definitions, will control. In addition, the materials, methods, and examples are illustrative only and are not intended to be necessarily limiting.

BRIEF DESCRIPTION OF THE DRAWINGS

Some embodiments of the invention are herein described, by way of example only, with reference to the accompanying drawings. With specific reference now to the drawings in detail, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion of embodiments of the invention. In this regard, the description taken with the drawings makes apparent to those skilled in the art how embodiments of the invention may be practiced.

In the drawings:

FIG. 1 is a Flow chart illustrating an exemplary method of folding a continuous blister chain in accordance with an embodiment of the present invention;

FIG. 2A is a schematic perspective view of an exemplary embodiment of a continuous blister chain folder in accordance with an embodiment of the present invention;

FIG. 2B is a schematic side view illustrating the exemplary embodiment of a continuous blister chain folder of FIG. 2A in accordance with an embodiment of the present invention;

FIG. 2C is a schematic side view of the exemplary embodiment of a continuous blister chain folder of FIG. 2B in a later stage of folding in accordance with an embodiment of the present invention;

FIG. 3A is a schematic perspective view of an alternative exemplary embodiment of a folder in accordance with an embodiment of the present invention;

FIG. 3B is a schematic perspective view of an alternative exemplary embodiment of a folder in accordance with an embodiment of the present invention;

FIG. 3C is a schematic perspective view of an alternative exemplary embodiment of a folder in accordance with an embodiment of the present invention;

FIG. 3D is a schematic view of an exemplary embodiment of a puller in accordance with an embodiment of the present invention;

FIG. 3E is a schematic view of an alternative exemplary embodiment of a puller in accordance with an embodiment of the present invention;

FIG. 4A is a schematic perspective view of an exemplary alternative embodiment of a guide wheel in accordance with an embodiment of the present invention;

FIG. 4B is a schematic perspective view of an exemplary embodiment of a guide flange in accordance with an embodiment of the present invention;

FIG. 5A is a schematic perspective view of an exemplary embodiment of a stacker in accordance with an embodiment of the present invention;

FIG. 5B is a schematic perspective view of an exemplary alternative embodiment of a stacker in accordance with an embodiment of the present invention;

FIG. 6A is a schematic perspective view of an exemplary embodiment of an output channel in accordance with an embodiment of the present invention;

FIG. 6B is a schematic perspective view of an exemplary alternative embodiment of an output channel in accordance with an embodiment of the present invention;

FIG. 6C is a schematic perspective view of an exemplary alternative embodiment of an output channel in accordance with an embodiment of the present invention;

FIGs. 6D-F are perspective views of an exemplary embodiment of packing and dispensing a folded continuous blister strip in a secondary package in accordance with an embodiment of the present invention;

FIGs. 6G-I are perspective views of another exemplary embodiment of packing and dispensing a folded continuous blister strip in a secondary package in accordance with an embodiment of the present invention;

FIGs. 7A-H are schematic perspective views of an exemplary embodiment of a complete folding system at different stages of the folding process in accordance with an embodiment of the present invention;

FIG. 8A is a schematic view of an exemplary embodiment of five sheets of a foldable blister chain in accordance with an embodiment of the present invention;

FIG. 8B is a schematic cutaway side view of an exemplary embodiment of a folded layer blister stack in accordance with an embodiment of the present invention;

FIG. 9A is a schematic view of an exemplary alternative embodiment of five sheets of a foldable blister chain in accordance with an embodiment of the present invention;

FIG. 9B is a schematic cutaway side view of an exemplary alternative embodiment of a folded blister stack in accordance with an embodiment of the present invention;

FIG. 10 is a schematic view of an exemplary alternative embodiment of five sheets of a foldable blister chain in accordance with an embodiment of the present invention;

FIG. 11A is a schematic view of an exemplary embodiment of a chain of four sheets of an unfolded blister stack configured for folding into wallets in accordance with an embodiment of the present invention;

FIG. 11B is a schematic cutaway side view of an exemplary embodiment of a portion of a blister stack folded into a two layer wallet in accordance with an embodiment of the present invention;

FIG. 11C is a schematic top view of an exemplary embodiment of a portion of a blister stack folded into a two layer wallet in accordance with an embodiment of the present invention;

FIG. 12A is a schematic view of an exemplary embodiment of a chain of four sheets of an unfolded blister stack configured for folding into wallets in accordance with an embodiment of the present invention;

FIG. 12B is a schematic cutaway side view of an exemplary embodiment of a portion of a blister stack folded into a two layer wallet in accordance with an embodiment of the present invention;

FIG. 12C is a schematic top view of an exemplary embodiment of a portion of a blister stack folded into a two layer wallet in accordance with an embodiment of the present invention;

FIG. 13A is a schematic view of an alternative exemplary embodiment of six sheets of an unfolded blister chain in accordance with an embodiment of the present invention;

FIG. 13B is a schematic side cutaway view of an exemplary embodiment of an alternative folded blister chain in accordance with an embodiment of the present invention;

FIG. 13C is a schematic overhead view of an exemplary embodiment of an alternative folded blister chain in accordance with an embodiment of the present invention;

FIG. 14A is a schematic view of an alternative exemplary embodiment of a chain of four sheets of an unfolded blister stack configured for folding into wallets in accordance with an embodiment of the present invention;

FIG. 14B is a schematic cutaway side view of an alternative exemplary embodiment of a portion of a blister stack folded into a two layer wallet in accordance with an embodiment of the present invention;

FIG. 14C is a schematic top view of an alternative exemplary embodiment of a portion of a blister stack folded into a two layer wallet in accordance with an embodiment of the present invention;

FIG. 15A is a schematic view of an alternative exemplary embodiment of six sheets of an unfolded blister chain in accordance with an embodiment of the present invention;

FIG. 15B is a schematic side view of an alternative exemplary embodiment of an alternative folded blister chain in accordance with an embodiment of the present invention;

FIG. 15C is a schematic side view of an alternative exemplary embodiment of an alternative folded blister chain in accordance with an embodiment of the present invention;

FIG. 16A is a schematic view of an alternative exemplary embodiment of six sheets of an unfolded blister chain in accordance with an embodiment of the present invention;

FIG. 16B is a schematic side view of an alternative exemplary embodiment of an alternative folded blister chain in accordance with an embodiment of the present invention;

FIG. 17A is a schematic view of an alternative exemplary embodiment of a foldable blister chain in accordance with an embodiment of the present invention;

FIGs. 17B-C are schematic views of an alternative exemplary embodiment of a reconfigurable foldable blister chain in an unfolded and folded configuration respectively in accordance with an embodiment of the present invention;

FIG. 18 is a perspective view of an exemplary embodiment of a standard blister machine;

FIG. 19 is a flow chart illustration of an exemplary embodiment of a method of producing a foldable continuous blister chain in accordance with an embodiment of the present invention;

FIG. 20 is a perspective view of an exemplary embodiment of a blister producing and folding system in accordance with an embodiment of the present invention;

FIGs. 21A,A',B,B' are schematic views of exemplary embodiments of folding lines for 180° folds in accordance with an embodiment of the present invention;

FIGs. 22A,A',B,B' are schematic views of exemplary embodiments of folding lines for 90° folds in accordance with an embodiment of the present invention;

FIGs. 22C,D are schematic views of the orientation of folding lines for two exemplary embodiments of a folding blister chain in accordance with an embodiment of the present invention;

FIGs. 23A-E are schematic views of exemplary steps in a method of folding a blister chain in accordance with an embodiment of the present invention, and

FIGs. 24A-H' are schematic views of exemplary steps in an alternative method of folding a blister chain in accordance with an embodiment of the present invention.

## DESCRIPTION OF SPECIFIC EMBODIMENTS OF THE INVENTION

The present invention, in some embodiments thereof, relates to a method and system folding a blister chain and, more particularly, but not exclusively, to a method and system for mass producing a continuous folded blister chain.

## OVERVIEW

An aspect of some embodiments of the current invention relates to folding and packaging blister strips in a way which may reduce the volume of secondary packaging. The secondary packaging may be reduced by, for example, between 10% to 50%. Such a reduction could possible save billions of dollars on storage and/or shipment and/or packaging materials. Alternatively or additionally, when secondary packing includes cardboard boxes, the more compact packaging may decrease the emission of the pollutant CO2.

An aspect of some embodiments of the current invention relates to carrying out the new process of folding a continuous blister strip. The continuous blister strip may

include a specially configured chain of blister sheets. The chain may optionally be produced on line with a blistering machine. Optionally the blistering machine may be a standard blistering machine. Optionally the standard blistering machine may be specially set up to form the chain. The folding may optionally be continuous and/or on line with production of the blister strip. Optionally, the system may produce a folded continuous strip. For example the system of folding the blisters may be located on the standard blistering machines, immediately after the blister cutting unit. Optionally the blisters may include one or more of cold form blisters and/or thermoform blisters and/or tropicalised blisters and/or blisters created by another technology.

An aspect of some embodiments of the current invention relates to adapting a conventional blister forming system to produce a foldable chain of blister sheets. For example, a conventional pocket forming unit (cavity forming machine) may be set up to produce folding lines. In some embodiments, the pocking forming unit may be adapted so that, upon folding, the blisters of opposite pages mesh together. Folding lines may be embossed into the substrate for example of cold forming and/or thermoforming. The substrate may include for example one or more of Polyvinyl Chloride (PVC) and/or Polychlorotrifluoro ethylene (PCTFE) and/or polyethylene (PE) and/or Cyclic olefin copolymers (COC) and/or Cyclic olefin polymers (COP) and/or polypropylene (PP) and/or glycol-modified polyethylene terephthalate (PETg) and/or a foil (for example aluminum).

A conventional cutting unit may optionally be set up to cut blister sheets in a continuous strip. Optionally, the format enables folding the blisters in continuous manner.

An aspect of some embodiments of the current invention relates to loading a folded blister chain into a secondary container. For example, a boxer apparatus may optionally insert a folded blister chain including a stack of connected blister sheets into a box. The box may be configured such that when a user opens the box blisters sheets of the chain may be removed one at a time and cut off without removing the entire stack from the box. Insertion of the blister stack may include for example pushing the stack into the box and/or suspending the stack on a track and inserting it into the box. In some embodiments, the interconnection between blister sheets may stabilize the stack and facilitate loading. For example, this may allow loading a larger stack than conventional

loading of loose blister sheets, which may become disordered during loading. For example, in some embodiments, the current invention a stack of between 10 and 30 blisters sheets may be loaded into a secondary package. In some embodiments the length of the unfolded blister strip may be greater than 20 cm. In some embodiments the length of the unfolded blister strip may be greater than 30 cm. In some embodiments the length of the unfolded blister strip may be greater than 70 cm. For example a stack of more than 20 blister sheets or in some examples more than 30 blister sheets may be loaded into a secondary package.

A package containing a large number of stacked blister sheets may be distributed for example to a hospital and/or a pharmacists and/or a patient. In some embodiments, a stack a blister sheets will be packaged in an alternative container. For example, a stack of blister sheets may be packaged in one or more of a foil pack and/or a bag and/or a wrapping (for example in shrink wrap and/or foil and/or paper) and/or a plastic box and/or a delivery machine and/or another kind of container. In some embodiments a folded blister chain may be packaged in multiple containers, for example a foil pack inside of a cardboard box. A possible advantage of the folded blister strip over a loose stack of blister pages is the ease of refolding. Optionally restacking may be facilitated for a blister chain of current invention. For example, if a loose stack of blister sheets becomes disheveled it may be difficult for a user to orient and restack the sheets such that they can be returned to their package. For example, in the case of a folded strip, even after unfolding the blister sheets may optionally retain their orientation. Refolding may be particularly advantageous when a stack of blisters is packed in two packages, for example a foil pack inside a box. Upon opening a user may optionally wish to remove the blisters from the inner pack and restack them into the outer pack. In the case of loose blister sheets, this may be difficult. For a folding blister pack, restacking along the original folds may be facilitated.

**Fold strip to produce continuous folded stack**

An aspect of some embodiments of the current invention relates to mass producing a continuous folded chain of blister sheets. The production may be continuous and/or intermittent. Optionally an input feed including a continuous blister strip and an output including a folded stack of blister sheets may advance along a single path without turning out of the path. In some embodiments, a system may fold, stack and package the

strips in-line. In some embodiments, the direction of advancement may be substantially perpendicular to the folding lines of the blister chain.

In some embodiments, a pair of connected blister sheets may be folded out of the plane or path of advancement of the input feed. Optionally the pair may be folded in line while still connected to the rest of the chain. Optionally the pair blister sheets may include an interconnected. For example the interconnection may include a hinge between the adjacent blister sheets. Alternatively or additionally the adjacent blister sheets may be interconnected by one or more spacers and one or more joints may connect the spacers to the adjacent blisters sheets and/or the joints may connect two adjacent spacers. Optionally folding may be achieved by moving the interconnection out of the plane or path of advancement. Optionally a leading and/or following edge of the pair of blister sheets may remain in the plane or path of advancement. Optionally, an interconnection may be moved out of the plane or path by buckling the pair of blister sheets. For example, buckling may include pushing together a trailing edge and a leading edge of a pair of blister sheets. Alternatively or additionally, an interconnection may be moved out of the plane or path by pressing or pulling the interconnection. In some embodiments advancement may be along a curved path. The plane of advancement and/or the path of advancement may change during processing of the blister chain. Optionally, a spacer may include a blister protruding from either and/or both sides.

**Continuous chain of blister sheets**

An aspect of some embodiments of the current invention relates to a foldable continuous chain blister chain. The chain may include a plurality of blister sheets configured for folding into stacked in substantially parallel layers. Optionally, blisters may protrude from either and/or both sides of each sheet.

In some embodiments the foldable blister chain may be made of conventional blister strip materials without adding extra backing and/or connecting material. Alternately, backing and/or connecting material may be added to a blister strip.

In some embodiments, after folding, layers may alternate between adjacent layers connected by an intrinsic hinge and facing layers connected by one or more spacers. In some embodiments an intrinsic hinges may connect one or more of adjacent sheets of blisters and/or a blister sheet and an adjacent spacer and/or a pairs of adjacent spacers one to another. Optionally, the blister sheets and/or spacers may have a generally

rectangular shape and/or may have rounded corners and/or cut out portions. The hinges may optionally be configured to fold preferentially in a particular direction. The direction of folding of hinges in a blister chain may optionally reverse at various points along the chain, for example for folding in a zigzag manner.

In some embodiments the input blister strip may be configured to facilitate folding. Optionally, the input strip may be configured by adding an intrinsic hinge. For example, an intrinsic hinge may be formed including one or more of a line of perforations and/or a scored line and/or a cut out and/or a line embossed in a continuous blister strip. Optionally the input strip may be configured by adding a spacer. For example, a spacer may include a cut out portion. Optionally, a blister sheet and/or a cut out portion may include a rounded edge.

In some embodiments blisters in facing layers may be arranged to mesh together. Optionally after folding, the distance between facing sheets may be the substantially the height of a single blister and/or half the height of a single blister. Optionally, blisters in adjacent sheets may be aligned back to back. Alternatively or additionally blisters in adjacent sheets may not be aligned.

In some embodiments, the blister chain may be configured for various packing options. Some packaging options may save packing materials and/or space in transport and/or be more convenient for consumers and/or be configured for use in automatic dispensing devices. For example, a blister chain may be configured for packaging in a large folding chain. Alternatively or additionally a chain may be configured for cutting into wallets of 2, 3, 4, 5 or more blister sheets. A single blister sheet and/or different blister sheets within a single chain may include one or more than one medication. A blister chain may be configured for cutting into fragments, each fragment containing a predetermined dose of one or more medicines. The fragments may optionally be cut along joints of the blister chain and/or within a single sheet. A blister chain may be configured for access directly by user and/or the chain may be configured for loading into an automated distribution machine.

A blister chain may optionally include one or more of a cut out and/or a guide hole and/or a rounded corner and/or perforations and/or a scored line and/or an embossed line. Guide holes may be used for example for stringing a blister sheet on a track. Perforations may be used for example for marking a folding line and/or a tear line

(tearing off and/or separating a fragment of the chain) and/or as a track for a cogwheel). Score lines may be used, for example, to mark folding lines and/or tearing lines.

**Machine to produce blister chains**

An aspect of some embodiments of the current invention relates to mass producing a folded blister chain. Optionally, the system may include one or more of an in-line folder and/or an output channel and/or a boxer and/or a stacker.

In some embodiments, the system may include an in-line folding apparatus. The folding apparatus may optionally include a presser and/or a puller. For example, a presser may optionally press an interconnection out of the plane or path of advancement of the blister strip. For example, a puller may optionally pull an interconnection out of the plane or path of advancement of the blister strip. Alternatively or additionally, the folding apparatus may include an advancer. The advancer may for example advance a trailing end of a pair of blister sheets. Optionally the system may include a detainer. For example detain may hold back a leading edge of a pair of sheets. The advancing and or detaining may cause the pair of sheets to buckle and/or fold along the interconnection. Alternatively or additionally, a folding apparatus may include a brink. For example, a joint may fold and/or buckle over the brink.

In some embodiments, a blister folding system may include a stacker. A stacker may, for example, included one or more of an advancer and/or a pusher and/or a detainer and/or a resistor to push together a leading edge and a trailing edge of a pair of adjacent blister sheets until they are stacked in nearly parallel layers. The pair of sheets may for example be interconnected by a hinge and/or the pair of sheets may for example be interconnected by one or more spacers. Optionally, the adjacent layers may be stacked back to back and/or face to face and/or face to back. As used herein, the phrase face of a blister sheet means a side of a blister sheet from which a blister protrudes. As used herein, the phrase back of a blister sheet means a side of a blister sheet from which no blister protrudes.

In some embodiments, a blister folding system may include an output channel. An output channel may optionally include an advancer and a resister. The advancer may, for example, push a stack of folded blisters along path of advancement. The resister may optionally keep pressure on the stack so that it doesn't open. Alternatively or additionally, the stack may be pushed into the box out of the plane of advancement.

Alternatively or additionally, a box may be placed around the stack. The opening of the box may optionally be parallel to the layers of the stack and/or perpendicular to the layers of the stack.

## DETAILED EMBODIMENTS

Before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not necessarily limited in its application to the details of construction and the arrangement of the components and/or methods set forth in the following description and/or illustrated in the drawings and/or the Examples. The invention is capable of other embodiments or of being practiced or carried out in various ways.

### Method of producing a folded blister chain

Referring now to the drawings, Figure 1 illustrates an exemplary method of producing a continuous folded blister chain. Steps in producing and folding the chain are illustrated. In the method, a pair of adjacent blister sheets may optionally be folded out of the plane of advancement of the chain. The folding may optionally be done while the pair of folded sheets remains connected to the rest of the chain. Optionally the folded chain may be stacked and/or transported and/or boxed in-line. More detailed examples of some of the steps in the method are described in some of the embodiments herein below.

In some embodiments the method may start by supplying **102** a chain of blister sheets. The blisters in the sheets may optionally be arranged to mesh together upon folding. As used herein, the term mesh together may mean for example that blisters are intermeshed and/or adjacent as illustrated herein below. Optionally, the chain supplied as input to the folder may include empty areas, for example to serve as spacers between some of the sheets.

In some embodiments, the blister chain may be trimmed **103**. Trimming **103** may include, for example, one or more of cutting away extra material near the edges of the chain and/or excising a cut out area in the chain and/or perforating the chain and/or scoring the chain, for example, scoring may be used to mark folding lines and/or cutting lines on the chain.

In some embodiments, two adjacent blister sheets may be folded together **104**. Optionally the folding may be carried out while the two blister sheets are still connected to the blister chain. Optionally, the folding may be performed while the leading and trailing edges of the two blister sheets remain in the line of advancement of the blister chain.

In some embodiments folding **104** may include, for example, by moving **105** an interconnection out of the plane or path of advancement of the blister chain. Optionally, moving **105** the interconnection may cause blisters sheets on either side of the interconnection to fold together. Optionally, the interconnection may join the two adjacent blister sheets and/or the interconnection may include one or more spacers blister sheets.

In some embodiments, folding **104** may include buckling **108** the pair of adjacent blister sheets. Optionally, an advancer may advance a first end of the pair towards the second end. Optionally, the second end may be held up by a detainer. In the example, as the two ends are brought together, the middle may buckle out of the plane or path of advancement of the blister chain, perpendicular to the face of the blister sheets, as the adjacent blister sheets fold together. For example the advancer may advance the trailing end of the pair of blister sheets longitudinally along the path of advancement while the detainer holds up the leading end. Optionally, a guide may be supplied to prevent the blister chain from twisting during the buckling. Additionally or alternatively, a guide may prevent the blister chain from buckling sideways (along the face of the blisters).

In some embodiments, the blister sheets of a folded blister chain may be stacked **109**. Optionally, the blisters sheets may be stacked **109** in substantially parallel layers. For example, pairs of blister sheets may be stacked **109** alternating face to face and back to back. Optionally, a pair of face to face stacked blister sheets may be joined by a spacer. For example, the length of the spacer may be about the height of a single blister. Optionally, the distance between a stacked pair of face to face blisters sheets may be the height of one blister. Optionally, a pair of back to back blisters may be connected by a hinge. Optionally the backs of a stacked pair of back to back blisters may be adjoining and or butt up against each other.

Optionally, the stack may continue to be transported **110** in the direction of advancement of the blister chain. During transport the stack may optionally be held

together. For example there may be a track and/or resistors. A track may for example direct the stack along the path of advance. Resistors may, for example, keep the stack from unfolding during transport **110**.

In some embodiments a stack of blister sheets may be boxed **111**. Boxing may optionally be done on-line. For example, a box may be supplied with an opening in the path of advancement of the stacked blister chain. Optionally, as the stack of blister chains advances it may enter the box. Alternatively and or additionally, once the stack gets big enough, a section of the stack may be boxed.

In some embodiments pairs of blisters will continue **112** to be folded and/or stacked and/or transported and/or boxed until a section of the stack is cut off **114**. A box containing the cut off section may optionally be closed. The process may then continue processing the next box **116**. Alternatively, the process may end **118**. Cutting off **114** of a section of the blister chain may optionally be done after the section is boxed **111** and/or before the section is boxed **111** and/or after the section is transported **110** and/or before the section is transported **110**.

**Folding**

Referring now to the drawings, Figure 2A-C illustrate an exemplary embodiment **200** of a system and method of folding a continuous blister chain. Steps in producing and folding the chain are illustrated in the sequence of Figures 2A-C. For orientation, a coordinate axes **201** are depicted. In the method, a pair of adjacent blister sheets may optionally be folded out of the plane of advancement of the chain (in the illustration the direction of advance **205** is in the positive *x* direction as illustrated by the arrow and the plane or path of advance is the *x-y* plane). The plane of the chain and/or the plane of advancement may include the shared plane of the blisters sheets (for example sheets **220a,b** and spacer **222a**) before folding. In embodiment **200** direction of advance **205** is perpendicular to the folding lines of joints **226a-k.** Folding may optionally be done while the pair of folded sheets remains connected to the rest of the chain. Optionally the folded chain may be stacked and/or packaged into a secondary package in-line. The folding lines may optionally demark the boundary of a blister sheet (for example lines **226b,c** demark blister sheet **220b** and/or lines may demark the border of a spacer, for example lines **226a,b** demark spacer **222a**).

In some embodiments the folding and/or stacking may be achieved without adding extra material to the chain, for example backing material and/or connecting material. This may save material in production and/or space in shipment.

In some embodiments the chain may be folded and/or stacked in-line. For example the folding and/or stacking may be achieved without separating the folded sheets from the rest of the chain. Alternatively and/or additionally, the folding may be achieved while the ends of the folded pair remained aligned with the direction of advancement of the chain. Alternatively or additionally, the folding may occur without interrupting the advance of the chain.

In some embodiments an unfolded blister chain may serve as input to a folding machine. The input blister chain may optionally be may be made with standard blister making materials and equipment. For example, the input chain may include a blister layer having blisters stamped into it and a cover layer. The blister layer and/or the cover layer may be made of for example PVC and/or aluminum. In exemplary embodiment **200**, the input blister chain includes, for example, blister sheets **220a** and **220b** and corresponding blisters **24**.

In some embodiments, a blister chain may include spacers and/or joints. For example, spacer **222a** and joints **226a,b c**onnect sheets **220a** and **220b**. For example, joint **226c c**onnect sheets **220b** and **220c**. The spacers and/or joints may optionally be intrinsic to the blister chain in that they may include no added material extrinsic to the original chain. For example, joints **226a,b,c** are formed by scoring a conventional blister. For example, spacer **222a** is formed by scoring its boundaries, joints **226a,b**. A joint between two blister sheets may serve as an intrinsic hinge. For example, joint **226c** acts and an intrinsic hinge between sheets **220b,c**. Alternatively or additionally, spacers and/or joints may be formed by cutting out parts of a blister sheet and or by embossing an indented and/or a protruding line across the blister chain. Optionally, in embodiment **200**, blisters sheets **220a-h** and spacers **222a-d** may have a generally rectangular form.

In exemplary embodiment **200**, a pair of pressers **230** pushes a interconnection including spacer **222b** and joints **226d** and **226e** in the positive *z*-direction up and out of the *x-y* plane of advancement of the blister chain. As spacer **222b** moves upward the pair of blister sheets **220c** and **220d** is optionally folded together face to face. The corresponding facing blisters **24'** and **24"** optionally fold into the space between pressers

**230**. For example, in embodiment **200**, blisters **24'** and **24"** are arranged in an alternating staggered pattern along facing blister sheets **220c,d**. Optionally, upon folding blister sheets **220c,d** face each other at a distance of approximately the height of a single blisters **24**. Blisters **24'** and **24"** which are associated to the facing sheets **220c,d** may optionally mesh together.

Exemplary embodiment **200** is an intermittent production system. Optionally, as presser **230** press spacer **222b** out of the plane of advancement, they also move forward in direction of advancement (the positive *x*-direction). This motion is illustrated, for example, in the sequence of Figs. 2A and 2B. The forward movement may optionally pull the feed chain (for example sheets **220a,b**) forward. Alternatively and/or additionally, forward movement may optionally push forward a folded stack in the output chain (for example sheets **220e,f,g,h**, spacers **222c,d**, and joints **226f,g,h,i,j,k**) forward. For example, while folding a pair of sheets (for example sheets **220c,d**), pressers **230** may pull the input chain forward a distance equal to the length of a pair of blister sheets and their connector, for example a distance equal to blister sheets **220a,b** and spacer **222a.** For example, while folding a pair of sheets (for example sheets **220c,d**), pressers **230** may push the output stack forward a distance equal to a single layer (for example, the space between facing layers which may optionally be equal to the height of spacer **222a** and/or the height of a blister **24**). Optionally, the output stack may be pushed forward at the end of folding. Optionally, after folding sheets **220c,d**, pressers may be pulled downward and backward and return to fold the next pair of blister sheets **220a,b**.

Alternatively or additionally, embodiment **200** may be a continuous feed system. For example, the input feed may move at a constant rate and movement of pressers **230** may be timed to fold blister sheets **220c,d** and advance the output stack in a manner coordinated to the continuous input feed.

In some embodiments, as illustrated for example in the output stack of embodiment **200**, blisters on facing layers (for example blisters **24'** and **24"**as described above) may be staggered. Additionally or alternatively, blisters on back to back layers may optionally be aligned. For example, blisters **24** of folded blister sheets **220f** and **220g** fall back to back directly opposite each other.

Referring now to the drawings, Figure 3A illustrates an alternative exemplary embodiment **300a** of a folding system. Exemplary embodiment **300a** does not include an optional presser.

Optionally, in embodiment **300a**, when a joint **326a'** between two blister sheets **320a'** and **320a"** reaches an edge **342** of a conveyer **332a'**, the forward blister sheet **320"** folds downward over the edge under the force of gravity. In the exemplary embodiment, as sheet **320a"** folds, the interconnection between sheets **320a''** and **320a'''** moves downward out of the place of advancement of the input feed (for example the plane of sheet **320a'**). In exemplary embodiment **300a**, the interconnection includes a spacer **322a'** and joints **326a'**. As spacer **322a'** moves downward, the pair of blister sheets **320a"**and **320a'''** optionally fold together face to face. Spacer **322a'** continues to descend until it reaches a second conveyer **332a''**. Optionally spacer **322a'** reaches the second conveyer next to stacked pacers **322a**. Optionally sheets **320a''** and **320a'''** are folding into the output stack along with sheets **320a**. The output stack may continue along a path of advance which continues in the same direction along a different plane. Alternatively or additionally, the path of advancement may be curved. In some embodiments, the path advancement of the blister chain may be continuous.

Referring now to the drawings, Figure 3B illustrates an alternative exemplary embodiment **300b** of a folding system. For example in embodiment **300b** a pair of blister sheets **320b** is optionally squeezed between an optional advancer **338** and an optional detainer **334** until an interconnection, for example joint **326b',** buckles up out of the plane of advancement. Optionally, as joint **326b'** buckles sheets **320b** to fold together.

In exemplary embodiment **300b**, the buckling may optionally be started by a presser **330b** that presses up slightly on joint **326b'**. Exemplary embodiment **300b**, may include optional spacers **322b'** and **322b"** and/or joints **326b** at the leading and trailing edges respectively of the pair of blisters sheets **320b**. Spacers **322b'** and **322b"** may optionally, include cut portions **336b'** and **336b"** respectively. For example advancer **338** may optionally extend through cut portion **336b'** to advance the trailing edge of the pair of sheets **320b.** For example detainer **334** may extend through cut portion **336b"** to hold up the leading edge of sheets **320b.** Optionally folded blisters are stacked into a track **346** for transport to the next step in processing (for example a boxer).

Referring now to the drawings, Figure 3C illustrates an alternative exemplary embodiment **300c** of a folding system. For example in embodiment **300c** an optional spacer **322c'** interconnecting a pair of blister sheets **320c'** and **320c"** is optionally pulled by an optional puller **330c'** until sheets **320c'** and **320c"** to fold together.

Figure 3D illustrates an optional embodiment of puller **330c**. Puller **330c** optionally includes two spurs **339d** and/or two legs **337c** and/or a cross bar **335.** For example, legs **337c** may be squeezed together and inserted into optional cut out **336c'**. Then legs **337c** are optionally freed to spread apart. Spurs **339d** may optionally catch the bottom of spacer **322c'**. Pulling puller **330c** then may optionally pull spacer **322c'** out of the plane of advancement of the blister chain, optionally folding the chain along joints **326c** and/or folding together pair of blister sheets **320c'** and **320c"**.

Figure 3E illustrates an alternate exemplary embodiment of a puller **330e**. Optionally puller **330e** may grasp a blister chain from the outside. For example a puller may optionally have spurs **339e** on the inside of its legs **337e**. To grasp the blister chain legs **337d** may for example open and straddle the blister chain. Then the legs may close, inserting spurs **339e** under the outside edges of the chain, allowing puller **330e** to pull the chain.

Exemplary embodiment **300c** and/or **300d** may optionally include spacers **322c** and/or joints **326c** and/or blister pages **320c** and/or cut portions **336c**.

## Guiding

Referring now to the drawings, Fig. 4A illustrates an exemplary embodiment of **400a** of guides **440a** to prevent twisting on an input feed blister chain. Guides **440a** include optional guide wheels. Optionally, as sheets **20** roll over conveyer **432**, guides **440a** hold the edges of a sheet **20** flat against conveyer **432**. For example, guide **440a** may hold sheet **320a** flat against conveyer **432**. For example this may prevent the blister chain from twisting out of a plane tangent to conveyer **432**.

Referring now to the drawings, Fig. 4B illustrates an exemplary embodiment of **400b** of a guide **440b** that prevents twisting on an input feed blister chain. Optionally, as sheets **20** are fed to a folding apparatus, guide **440b** holds the edges of the sheets **20** flat. Optionally guide **440b** may include a rail. For example, the rail prevents the chain from twisting out of the *x*-direction of advancement. For example guide **440b** may include a groove. For example, the groove may prevent the chain from twisting and/or buckling

out of the *x-y* plane of advancement. In Figure 4B there are also marked joints **26**, a spacer **22**, and a cut out section **36**.

Alternatively or additionally, guides may be provided at various parts of a blister folding machine, for example on the output stack and/or in folding area. For example guides may hold a spacer and/or a joint while it is being moved by a presser and/or a puller. Optionally, guides may include walls and/or ceilings to limit movement of the blister chain. For example output guides may include a channel, an example of which is described below.

**Stacking**

Referring now to the drawings, Figures 5A and 5B illustrates exemplary embodiments **500a** and **550b** of a stacker. Optionally, a stacker may push together a partially folded blister chain until the sheets stack as nearly vertical layers.

In exemplary embodiment **500a** (Fig. 5A) of a stacker, an optional advancer **538** advances a trailing edge of a pair of blister sheets **520'** along the direction of advancement of an output stack. Optionally the leading end of the stack is held back by a resister **545**, for example a spring. The result is a stack of nearly parallel layers of blister sheets **520'**.

Referring now to the drawings, Figure 5B illustrates an alternative exemplary embodiment **500b** of a stacker. In embodiment **500b** an optional advancer **38** advances a trailing end of a blister pair towards a leading end which is held up by an optional detainer **34**. The pair of sheets between advancer **38** and detainer **34** may be pushed together until they stand up as parallel layers.

In exemplary embodiment **500b** advancer **38**, optionally includes two upright members. The two upright members push on opposite sides on the trailing blister sheet keeping progress of both sides even. Even movement of the two sides may optionally prevent the blister chain from twisting. Optionally, each advancer **38** advances the majority of the height of the trailing blister sheet. Pushing along a large portion of the height of the sheet may in some embodiments hold the trailing blister sheet straight.

**Transport blister stack**

Referring now to the drawings, Figure 6A,B,C illustrate exemplary embodiments **600a,b,c** of a transporter for a folded blister stack. A transporter optionally includes a

conveyer to move the stack forward and/or a resister to keep the blister sheets stacked together tightly and/or a track to direct movement of the stack. The track and/or the resistor may be stationary and/or mobile.

Figure 6A illustrates exemplary embodiment **600a** of a transporter. Embodiment **600a** may include an optional track **646a**. For example, track **646a** is a rectangular channel. Optionally, the channel walls direct the blister stack and keep it from twisting. Track **646a** optionally includes resisters **650a**, for example in the form of nubbles on the inside walls of the channel. A row or multiple rows of nubbles may be located one or both sides of track **646a** and/or on the ceiling and or floor of track **646a**. In the example of embodiment **600a**, three rows of nubbles are provided on each side of track **646a**. Optionally the nubble are the rows on one side of the track are located directly opposite those on the opposite side. Optionally, a blister sheet is pushed down track **646a** by the preceding sheet. As the first sheet moves forward, the two sides of the sheet are detained by a set of nibbles until pressure from the preceding sheet pushes it past the first set of nubbles to the next set of nubbles. Thus, the nubbles keep the sheets directed vertically along the track and/or pressed together. Track **646a** and the resistors **650a** (the nubbles) are an example of a stationary track and resistors. The track and resistor remain stationary as the blister stack moves along. Embodiment **600a** may optionally include an advancer, for example similar to advancer **38** of Figure 4B. An advancer may optionally serves as a conveyer, pushing the stack along track **646a**.

Figure 6B illustrates alternate exemplary embodiment **600b** of a transporter. Embodiment **600b** includes an optional conveyer **632**. Conveyer **632** may optionally transport a blister stack towards a resistor **650b**. For example resistor **650b** may be a plate pushed by a spring **645**. Conveyer **632** may optionally include guide **658** for positioning blister sheets **620** and/or spacers **22**.

In some embodiments optional box **654b** may be provided. For example, when a blister stack reaches the end of conveyer **632** it may optionally push resistor **650b** back to its fully retracted position. A cutter **656** may optionally be released cutting off, for example the last six blister sheets **620'**. Cutter **656** may optionally act as a detainer, holding up the rest of the blister stack. Box **654b** may then optionally be lowered over the six cut-off blister sheets **620'**. Blister sheets **620'** and box **654b** may then optionally be taken away. Then spring **645** may be released to push resistor **650b** up against cutter

**656**. Cutter **656** may then optionally be retracted and the next set of six blisters sheets **620** may be conveyed forward to be boxed.

Figure 6C illustrates an alternate embodiment **600c** of a transporter. Embodiment **600c** includes a notched track **646c** which may have form, for example of one or more notched bars. Blister sheets **20** may include optional guide holes for example similar to holes **868** of Figure 8A). When blister sheets **20** are stacked, the guide holes may line up. The folded stack may then optionally be strung on bars (for example track **646c**). Optional notches serve as resistors **650c**. When the stack is static, each blister sheet **20** may optionally settle into a notch. Spaces between notches are optionally approximately equal to the width of a spacer **22** of the blister chain. Track **646c**, may optionally hold the blister sheets a vertical layers of a stack.

In some embodiments, an advancer **638c** may convey the stack along track **646c**. Optionally as advancer **638c** pushes the back of the stack, each blister sheet **20** pushes the sheet **20** ahead of it. When the force is sufficient, each blister sheet is forced up out of its notch and conveyed along track **646c** until it settles into the next notch. The notches may optionally keep blister sheets **20** together as a stack while being conveyed.

One advantage of track **646c** is that it may optionally be inserted into a box **654c** and/or the box may be placed around track **646c**. Blister sheets **20** may be optionally conveyed as a stack along track **646c** directly into box **654c**. Alternatively or additionally, track **646c** may be slide into a box with blister sheets are already suspended. When box **654c** is full, the end of the stack inside the box may optionally be cut off. The full box may optionally be retracted and replaced with an empty box and/or track **646c** may be retracted from the box. The remaining stack of blisters may then optionally be conveyed forward for filling the new box etc.

Tracks **646a,b,c** are illustrated as straight. Optionally a track may be curved and/or have any convenient shape. Tracks and/or resistors may be stationary (as illustrated for example in embodiments **600a,c**) and/or mobile (as illustrated for example in embodiment **600b**).

Figure 6D-F illustrate an exemplary embodiment **600d** of a continuous folded blister chain and a cardboard medicine box **645d** configured for holding and dispensing the folded chain. Fig. 6D illustrates loading the chain into box **645d** and Figs. 6E,F

illustrate dispensing of a blister sheet **20** from box **645d**. In the example of Figs. 6E-F, blisters sheets **20** can optionally be folded out of the box **654d** one at a time.

Referring now to the drawings, in Fig. 6D, an advancer **638d** pushes a continuous folded stack of blister sheets **20** in to box **654d**. In the example of Fig. 6D, the stack may optionally be pushed into box **654d** along the direction of advancement of a blister manufacturing machine and/or perpendicular to the folding lines **26** of the blister chain. Optionally, the interconnection between blister sheets **20** may stabilize the stack and facilitate loading into the box **654d**. For example, this may allow loading a larger stack than when loading loose blister sheets which may become disordered during loading. For example a stack of more than 10 blister sheets or in some examples more than 30 blister sheets may be loaded into a secondary package. Alternatively or additionally, the stack of blister sheets may be packaged in a bag and/or a foil pack and/or wrapped (for example in shrink wrap, plastic, paper and/or foil) and/or another secondary packaging. In some embodiments, a stack of blisters will be packaged with an instruction sheet and/or a package insert. For example, a package insert may be fully or partially wrapped around the stack during insertion into box **654d**.

Referring now to figures 6E and 6F, removal of a blister sheet **20** from box **654d** is illustrated. The opening **692d** of box **654d** is oriented such that as the chain unfolds, each blister sheet **20** exits opening **692d**. Optionally a sheet **20** can be unfolded and/or cut off without requiring removal of the entire chain. For example, the folding lines **26** of the blister chain may be parallel to the plane of opening **692d** such that as it is unfolded, a blister sheet **20** extends out of the opening **692d**.

In the example of Figs. 6D-F the same opening **692d** is used for filling box **654d** and dispensing blister sheets **20**. In some embodiments, the end of the blister stack opposite the opening **692d** may be fastened (for example, stapled and/or pasted) to the opposite end **696d** of box **654d** so that the remainder of the chain remains in the box during dispensing a blister sheet **20**.

Drawings 6G-I illustrate an alternative embodiment of loading a secondary package and dispensing blister sheets. An exemplary embodiment **600g** of a stack of blister sheets **20** is inserted into a secondary package (for example, box **654g**) through a loading opening **692g**. Once the package is loaded, loading opening **692g** may be sealed. Optionally, blisters sheets **20** may be dispensed through a user opening **694**. In

embodiment **600g** folding lines **26** of the stack are perpendicular to the plane of loading opening **692g** and parallel to the plane of dispensing opening **694**.

Referring now to the drawings, in Fig. 6G, an advancer **630** pushes a continuous folded stack of blister sheets in to box **654g**. In the example of Fig. 6G, the stack may optionally be pushed into box **654g** perpendicular to the direction of advancement of the blister producing machinery and/or parallel to the folding lines **26** of the blister chain. Optionally, the interconnection between blister sheets may stabilize the stack and facilitate loading into the box **654g**. For example, this may allow loading a larger stack than when loading loose blister sheets which may become disordered during loading. For example a stack of more than 10 blister sheets or in some examples more than 30 blister sheets may be loaded into a secondary package. Alternatively or additionally, the stack of blister sheets may be packaged in a bag or a foil pack or another secondary packaging. In some embodiments, a stack of blisters will be packaged with an instruction sheet or a package insert. For example, a package insert may be fully or partially wrapped around the stack during insertion into box **654g**.

Referring now to drawings 6H and 6I illustrate removal of a blister sheet **20** from box **654g**. Dispensing opening **694** of box **654g** is perpendicular to insertion opening **692g**. Dispensing opening **692g** is oriented such that as the chain unfolds, blister sheets **20** exits opening **694** individually. Optionally a sheet **20** can be unfolded and/or cut off without requiring removal of the entire chain. For example, the folding lines **26** of the blister chain may be parallel to the plane of opening **694** such that as it is unfolded, a blister sheet **20** extends out of the opening **694**.

**An exemplary integrated system**

Referring now to the drawings, Figures 7A-G illustrate an exemplary embodiment **700** of an integrated system for guiding, folding, stacking and conveying a blister chain. Optionally embodiment **700** may be powered by a simple rotary actuator moving at a constant rate. Embodiment **700** may optionally be operated in a continuous or intermittent mode.

Exemplary embodiment **700** optionally includes a rotary actuator **760**. Actuator **760** may optionally include a simple electric motor. Rotary motion of actuator **760** optionally turns a bent arm **763**. Optionally, bent arm **763** moves in a continuous circular orbit. Bent arm **763** optionally activates advancers **738** (see Figure 7B) and/or a presser

arm **762** which turns a pin **764** in a diagonal slot **756** to raise up a presser **730** (see Figure 7C) and/or a detainer **734**.

In some embodiments, actuator **760** may be powered by a driver **759**. Driver **759** may optionally be controlled by a controller **761**. Controller **761** and/or Driver **759** may optionally be synchronized with a blister producing machine that supplies an input blister chain to the folding system. Alternatively or additionally, actuator **760** may be connected to a transmission and may also supply power to a blister producing machine and/or a boxer. Optionally and output track may be supplied, for example output track **746**.

Figure 7A illustrates an optional first step in the folding process. A blister chain is optionally fed into the folding system through a guide **740** groove. The chain includes, for example, blister sheets **720** with rounded corners, spacers **722**, cutouts **736'** and **736''**, and joints **726**.

Figure 7B illustrates an optional further step in the folding process. As actuator **760** turns, advancers **738** may optionally be raised up through a trailing cut out **736'**. Optionally, at the same time, bent arm **763** may contact presser arm **762**.

Figure 7C illustrates an optional further step in the folding process. In Fig. 7C, the blister strip is not shown. As actuator **760** continues to turn, advancers **738** optionally move forward, squeezing a pair of blister sheets **720'** and **720''**between advancers **738** and detainers **734**. Detainers **734** are optionally protruding through leading cut out **736''**. Simultaneously, bent arm **763** pushes presser arm **764** forward, turning pin **764** up diagonal slot **766** pushing up presser **730**. Presser optionally presses upward on joint **726'** which interconnects sheets **720'** and **720''**. The squeezing pressure and the upwards pressing optionally cause the pair of sheets **720'** and **720''** to buckle along joint **726'**. Joint **726'** moves upward out of the plane of advancement of the blister chain.

Figure 7D illustrates an optional further step in the folding process. In Fig. 7D, the blister strip is not shown. As actuator **760** continues to turn, advancers **738** move forward and upward further folding the pair of blister sheets **720'** and **720''** and also steadying them to prevent them from twisting. Simultaneously, bent arm **763** clears presser arm **762** allowing presser **730** to retract and clear the way for further advancement of the blister chain.

Figure 7E illustrates an optional further step in the folding process. In Fig. 7E, the blister strip is not shown. As actuator **760** continues to turn, advancers **738** stack approximately vertically against detainer **734**.

Figure 7F illustrates an optional further step in the folding process. In Fig. 7F, the blister strip is not shown. As actuator **760** continues to turn, the base of advancers **738** optionally contact the base of detainers **734**. As advancers **738** move forward and/or retract downward, detainers **734** are retracted downward. Detainers **734** are optionally forced downward out of the way of the stack pair of blister sheets **720'** and **720"**. Advancers **738**, optionally push folded stacked blister sheets **720'** and **720"** into track **746**. Optionally blister sheets **720'** and **720"** may push the entire blister stack along track **746**.

Figure 7G illustrates optional details of the mechanism for retracting detainers **734**. In Fig. 7G, the blister strip is not shown. Bent arm **763** includes an optional bumper **749**. As bent arm **763** rotates after stacking a pair of sheets, bumper **749** optionally contacts a support arm **751** of detainers **734**. Pressure from bumper **749** optionally causes support arm **751** to rotate around an axis **747** retracting and lowering detainers **734**. After retracting detainers **734**, bent arm **763** optionally continues rotating, lowering bumper **749** below support arm **749**. Once free of bumper **734**, support arm is pulled back up by a spring **745**.

Figure 7H illustrates an optional further step in the folding process. As actuator **760** continues to turn, advancers **738** are optionally retracted downward. The system may optionally restart with a new pair of blister sheets **720'''** and **720''''**, for example as depicted for blisters sheets **720'** and **720''** in Figure 7A.

**Exemplary blister strip geometries**

Referring now to the drawings, Figure 8A-14C illustrate various exemplary embodiments of foldable blister chains. Blisters on facing layers of a folded blister chain may be optionally staggered so that they mesh together upon folding. After folding the distance between facing blisters sheets may be approximately the height of one blister. On sheets positioned back to back, the blisters may optionally be aligned directly opposite each other. Alternatively or additionally, on sheets positioned back to back, the blisters may optionally be intermeshed.

In some embodiments, a foldable blister chain may optionally be configured to be packaged as a wallet of two and/or three and/or more layers having a set number of doses, for example for a single treatment (for example ten tablets) and/or for a week (for example seven tablets). Each layer may optionally be configured to be separated from the stack. Alternatively, the stack may be configured to be divided every two and/or three and/or more layers. A foldable blister chain may optionally be configured to be packaged as a strip of an arbitrary number of layers. A foldable blister strip may include a single medicine and/or a single dosage and/or multiple medicines and/or multiple dosages. A blister sheet and/or a spacer may optionally include a cut out and/or a guide hole and/or a rounded corner and/or perforations and/or a scored line and/or an embossed line. Guide holes may be used for example for stringing a blister sheet on a track. Perforations may be used for example for marking a folding line and/or a tear line (tearing off and/or separating a fragment of the chain) and/or as a track for a cogwheel). Score lines may be used, for example, to mark folding lines and/or tearing lines. Embossed lines may serve for example as folding lines. Embossed lines may include for example indentations and/or projections.

Figures 8A,B illustrate an exemplary embodiment **800** of a foldable blister chain. Figure 8A illustrates five blister sheets **820, 820a,b,c,d,e** of embodiment **800** in an unfolded state. Optionally, each blister sheet **820a-e** includes four blisters **24**. Blister sheets **820a-e** are optionally interconnected by alternating spacers **822a,b** and intrinsic hinges (for example joints **826c** and **826f**). In embodiment **800**, adjacent sheets interconnected by an intrinsic hinge without a spacer are oriented back to back upon folding. In embodiment **800**, adjacent sheets interconnected by a spacer are oriented face to face upon folding. For example, sheet **820a** is interconnected to sheet **820b** by a spacer **822a** and two joints **826a,b**; as illustrated in Figure 8B, when the chain is folded, sheets **820a** and **820b** are optionally oriented face to face. For example, sheet **820b** is interconnected to sheet **820c** by an intrinsic hinge, joint **826c**; as illustrated in Figure 8B, when the chain is folded, sheets **820b** and **820c** are optionally oriented back to back. Each spacer **822a,b** includes an optional cut out **836**. Cut outs **836** and/or blister sheets **820a-e** optionally have rounded edges. Rounded edges may optionally protect users from cutting themselves of sharp edges. Joints **826a,b,c,d,e,f** may be made, for example, by scoring and/or perforating and/or folding the blister chain.

Embodiment **800** includes guide holes **868**. Guide holes may be used for stringing a blister chain on a track, for example as illustrated in Figure 6C.

In Figures 8A,B, blisters **24** are numbered to help clarify the geometric of the blisters in the folded and unfolded blister chain.

Figure 8B illustrates five blister sheets **820** and **820a-e** of embodiment **800** in a folded state. Optionally, blisters **24** of one sheet are arranged adjacent to blisters **24** of an adjacent sheet such that upon folding, the blisters mesh and do not interfere with each other. Optionally, facing sheets approach each other to within approximately one blister height. For example, upon folding along joints **826a,b**, blisters **24** of sheet **820a** (numbered 1-4) fall adjacent to blisters **24** of sheet **820b** (numbered 5-8).

In embodiment **800**, back to back blisters are aligned so that they fall on top of each other. Locating back to back blisters, one against the other may prevent accidental bursting of blisters if the stack is compressed.

Figures 9A,B illustrate an alternate exemplary embodiment of a foldable blister chain in an unfolded (Figure 9A) and a folded (Figure 9B) configuration. In the exemplary embodiment of Figure 9A,B, in the folded configuration, blisters **24** of facing blister sheets **20** are optionally intermeshed. Each blister sheet **20** of the embodiment of Figure 9A,B optionally includes a weekly dose of medicine (for example 7 tablets). Each folding line **26** of the embodiment of Figure 9A,B may optionally serve as a tear line. For example, a user may buy a box containing a chain of folding blister sheets. The user may, for example, separate one sheet each week and take a daily capsule from the sheet. In the embodiment of Figure 9A,B blisters on back to back sheets are optionally not aligned.

Figures 10 illustrate an alternate the exemplary embodiment of a foldable blister chain in an unfolded configuration. In the exemplary embodiment of Figure 10, each blister sheet optionally contains different kinds and/or doses of medicine in different shaped blisters **24**. Optionally, a single blister sheet may include multiple related medicines that are commonly taken together. Alternatively or additionally, a blister sheet may optionally include a custom set of medicines for a particular person's dosage regime.

Figures 11A,B,C illustrate an alternate exemplary embodiment of a foldable blister chain. Figure 11A illustrates four blister sheets **20** of the embodiment of Figure

11A,B,C in an unfolded state. The blister chain may optionally be of an arbitrary length. Figures 11B,C illustrate a pair of folded blister sheets **20** of the embodiment of Figure 11A,B,C in a folded state.

In embodiment of Figure 11A,B,C, facing pairs of blisters sheets are optionally configured to be cut out together. For example, the chain of Figure 11A is configured to be cut along line C-C. Optionally, a pair of blister sheets may be folded as a blister wallet **1170**, for example as illustrated in Figures 11B,C. A wallet may contain, for example ten doses of a medicine. Alternatively or additionally, a wallet may contain, for example, 7 doses and/or an arbitrary number of doses. In the folded configuration (as illustrated for example in Figures 11B,C) pages of blister wallet **1170** may optionally overlap. Alternatively or additionally, a blister wallet may include 3, 4, 5 and/or more sheets.

Figures 12A,B,C illustrate an alternate exemplary embodiment of a foldable blister chain. Figure 12A illustrates four blister sheets **20** of the embodiment of Figure 12A,B,C in an unfolded state; the blister chain may optionally be of an arbitrary length. Figures 12B,C illustrate a pair of folded blister sheets **20** of embodiment of Fig. 12A,B,C in a folded state.

In the embodiment of Figure 12A,B,C, facing pairs of blisters sheets are optionally configured to cut out together. For example, the chain of Figure 12A is configured to be cut along line D-D. Optionally, a pair of blister sheets may be folded as a blister wallet **1270**, for example as illustrated in Figures 12B,C. A wallet may contain, for example ten doses of a medicine. Alternatively or additionally, a wallet may contain, for example, 7 doses and/or an arbitrary number of doses. In the folded configuration (as illustrated for example in Figures 12B,C) pages of blister wallet **1270** may optionally be aligned without overlap.

Figures 13A,B,C illustrate an alternate exemplary embodiment of a foldable blister chain. Figure 13A illustrates six blister sheets **20** of the embodiment of Figure 13A,B,C in an unfolded state; the blister chain may optionally be of an arbitrary length. Figures 13B,C illustrate a pair of folded blister sheets **20** of the embodiment of Figure 13A,B,C in a folded state.

Figures 14A,B,C illustrate an alternate exemplary embodiment of a foldable blister chain. Figure 14A illustrates four blister sheets **20** of the embodiment of Figure

14A,B,C in an unfolded state; the blister chain may optionally be of an arbitrary length. Figures 14B,C illustrate a pair of folded blister sheets **20** of the embodiment of Figure 14A,B,C in a folded state. Optionally, the blister chain of the embodiment of Figure 14A,B,C can be folded into a wallet including multiple medicines and/or doses. Other embodiments, for example as illustrated above, may optionally contain one or more doses and/or kinds of medicines.

Figures 15A,B illustrate an alternate exemplary embodiment **1500** of a foldable blister chain. Each blister **1524** of embodiment **1500** optionally protrudes on both sides of its respective blister sheet **1520**. Each blister sheet **1520** has two faces and no back. Optionally, spacers **1522** of embodiment **1500** are shorter than the height of a blister **1524**. For example, a spacer may be approximately half the height of a blister **1524**. When stacked, the space between adjacent sheets **20** may optionally be less than the height of a blister **1524**. For example, the space may be about half the height of a blister **1524**.

Figure 15A illustrates four blister sheets **1520** of embodiment **1500** in an unfolded state; the blister chain may optionally be of an arbitrary length. Figure 15B illustrates a stack of six of folded blister sheets **1520** of embodiment **1500** in a folded state. Optionally, a sheet **1520** of the blister chain of embodiment **1500** may include multiple medicines and/or doses. Other embodiments, for example as illustrated in embodiments above and below, may optionally contain one or more doses and/or kinds of medicines. Alternatively or additionally a blister chain may include some sheets having blisters protruding from both sides and other sheets having blisters protruding from one said.

Referring now to the Figures, Fig. 15C illustrates a schematic side view of an alternate exemplary embodiment **1500'** of a blister chain. A blister sheet **1520** of the chain may including a blister **1524** protruding on both sides and another blister **1524'** protruding on only one side. Optionally, blister **1524** which protrudes on both sides may be taller than blister **1524'** which protrudes on only one side.

Figures 16A,B illustrate an alternate exemplary embodiment **1600** of a foldable blister chain. In exemplary embodiment **1600**, blisters **24** are optionally located on blister sheets **20** and also on spacers **1622**.

Figure 16A illustrates four blister sheets **20** of embodiment **1600** in an unfolded state; the blister chain may optionally be of an arbitrary length. Figure 16B illustrates a stack of six of folded blister sheets **20** of embodiment **1600** in a folded state. Optionally, a sheet **20** of the blister chain of embodiment **1600** may include multiple medicines and/or doses. Other embodiments, for example as illustrated above, may optionally contain one or more doses and/or kinds of medicines. Optionally, a blister may protrude from either and/or both sides of a spacer **1622**. In some embodiments the blisters on the spacers may have a different dose from the blisters on the sheets. For example, the sheets may contain large blisters while the spacers contain small blisters and/or vice versa etc.

Figure 17A illustrates an alternative exemplary embodiment of a blister chain. In some embodiments, each blister **1724, 1724'** in the blister chain contains a drug pills and/or tablet. Optionally, the drug cavity locations on the blisters surface are in a format that each blister cavity on a sheet fits in the space between two other blisters on an opposing blister sheet when the chain is folded. For example, sheet **1720** is folded opposite (face to face) with sheet **1720'** and the blisters **1724'** of sheet **1720'** fit between the blisters **1724** of sheet **1720**.

In some embodiments, adjacent blister sheets (for example sheets **1720** and **1720'**) may be separated by a spacer **22**. The width (**w**) of a spacer may optionally be approximately equal to the height of a pill cavity plus twice the thickness of the blister substrate. Optionally adjacent pages that fold opposite one another front to front (for example sheets **1720** and **1720'**) are separated one of the other by a spacer (for example spacer **22**) and/or two 90° joints (for example joints **1726** and **1726'**). Optionally adjacent pages that fold against one another back to back, (for example sheets **1720'** and **1720''**) are separated by a 180° joint (for example joint **1726''**).

Figure 17B illustrates an alternative exemplary embodiment of a blister chain in an unfolded form. In some embodiments each blister sheet **1720b** will be separated from the next blister sheet by a reconfigurable space **1722b**. In some embodiments, each reconfigurable spacer may have three optional folding lines **1726b**.

Figure 17C illustrates a side view of the blister chain of Fig. 17a after folding. Reconfigurable spacers **1722b** are optionally folded with 90° angles on the two outer folding lines **1726b** to make a spacer between two front to front blister sheets.

Reconfigurable spacer **1722b'** is folded with a 180° angle on the center folding line **1726b** to make a joint between two back to back blister sheets. Reconfigurable spacer **1722b''** is folded with 180° angles on each of the three fold lines **1726b** to make a joint between two back to back blister sheets. Thus each spacer **1722b, 1722b', 1722b''** may be reconfigured to a spacer and/or a joint and the form of the folded chain may also be reconfigured at will.

**Adapting a standard blistering system**

Figs. 18-20 illustrate a method of adapting a standard medicine blister system to produce a continuous folded blister chain. Optionally the method may include setting up a standard blister machine to produce a foldable blister chain. The chain may include, for example, a continuous chain of blister sheets and/or spacers and/or 90° joints and/or 180° joints. The foldable chain may optionally be folded and/or stacked and/or cut and/or packaged using devices, for example as described herein.

For purposes of better understanding some embodiments of the present invention, for example, as illustrated in Figures 19 and 20 of the drawings, reference is first made to the construction and operation of an example of a standard blister packaging system **1800** as illustrated in Figure 18.

In exemplary system **1800** a blister packaging process begins with a roll **1801** of substrate, for example of PVC (alternatively or additionally the substrate may include aluminum and/or other materials). The material continues to a pill/tablets pocket forming unit **1802**. Pill/tablets pocket forming unit **1802** makes cavities **1803** in the substrate for the pills. Cavities **1803** are then filled with the pill/tablets by a pill feeder **1805**. The PVC with the pill/tablet filled cavities **1806** is covered with a protective covering of, for example, aluminum foil **1807.** Fiol **1807** may optionally be ironed to the PVC by an ironing unit **1808**.

The output of ironing unit **1808** includes a continuous aluminum covered PVC blister strip **1809** with blisters containing the tablets. Blister sheets **1812** are then cut out of blister strip **1809** by a cutting unit **1810**. Each blister sheet **1812** falls separately into a boxing machine. Leftover material **1811** is rolled away **1814**. Blister sheets **1812** are then loaded into package, for example a cardboard patient drug box **1813**.

Fig. 19 is a flow chart illustration of an exemplary embodiment of method of adapting a convention a blister production system for producing a continuous foldable blister strip. The method starts by supplying **1971** a blister production system. The system may optionally include a standard blister system. Optionally, a standard blister system may include some or all of the components illustrated in Fig. 18, for example, a standard roll **1801** substrate, a standard pill/tablets pocket forming unit **1802**, a standard pill feeder **1805**, a standard ironing unit **1808**, and/or a standards cutting unit **1810**. The system may further include a folding unit (for example as illustrated in Figs. 2A-C, 3A-D, 7A-H, 20-24B) and/or a stacking unit (for example as illustrated in Figs. 5A,B and/or a packaging unit (for example as illustrated in Figs. 6A-I).

In some embodiments, method may include a special set up **1972** of the conventional parts of the system. For example a pocket forming unit may optionally be set up **1973a** to produce folding lines. For example, folding lines may include 180° and/or 90° joints (for example joints **26** of Figs. 9A-17, and more specifically for example 180° joint **826c** of Fig. 8A,B and/or joints **2126a,b** of Figs. 21A,B, for example 90° joints **826a,b,d,e** of Fig. 8A,B and/or joints **2226** Figs. 22A,B).

Set up **1972** may optionally include, for example, setting up **1973b** a cutting unit to cut off the edges and/or cut out portions from the blister chain (for example as illustrated for example in Figs. 8A-16B and/or 20) while leaving the blister sheets connected as a long chain.

In some embodiments, a folding line may be formed **1974.** Optionally, folding lines may be formed **1974** by a pocket forming unit. For example, a folding line could be formed as an indentation on one side of the blister substrate with a protrusion on the other side, for example as illustrated in Figs. 21A, 21A', 22A and 22A'. Alternatively or additionally, a folding line could be formed as indentation on both sides of the blister substrate Figs. 21B, and 22B.

In some embodiments, extra material will be trimmed **1975** from the blister chain. For example, excess material may be cut off the edges of the blister chain and/or cut outs could be formed within the blister chain. Alternatively or additionally, perforations may be made in the blister chain for example to facilitate separation of blister sheets by the end user. Optionally, a cutting unit may perform trimming **1975**.

In some embodiments the continuous blister chain may be folded **1976**. Optionally, folding **1976** may be performed by a folding apparatus.

In some embodiments connected blisters sheets of the continuous folded blister chain may be stacked **1977**. Optionally, stacking may be performed by a stacking unit.

In some embodiments the stacked chain of blister sheets may be packaged **1978**. Packaging **1978** may include for example, pushing a stack of connected blister sheets through a channel into a box. Alternatively or additionally, packing **1978** may include moving a track holding the blister sheets into a box and then removing the track. Alternatively or additionally packaging **1978** may include inserting the stack into another form of package such as a foil pack and or a bag.

Figure 20, illustrates an exemplary embodiment **2000** of a folding unit **2019** connected in line with a standard blister forming system.

In some embodiments, a standard pocket forming unit (for example unit **1802**) may be set up to form folding lines **26** and/or to place blisters that mesh when blister strip **1809** is folded.

In some embodiments, a cutting unit **2015** may be a standard cutting unit (for example cutting unit **1810**). Cutting unit **2015** may optionally be set up differently from the standard format (that separate the blister to the regular blister format as seen in Fig. 18). Some optional differences in the cutting format are explained in the explanation of Fig 19. For example, blisters sheets may not be cut apart, thereby forming a continuous chain **2018** of connected blister sheets (unseparated). Leftover materials **2017** may optionally be rolled away.

Optionally, folding unit **2019** may be located after cutting unit **2015**. The continuous chain **2018** of connected blister sheets may optionally enter folding unit **2019** which may optionally fold the continuous chain into a continuous folded stack **2020**. Stack **2020** may optionally be loaded into a package, for example cardboard patient drug box **2021**.

**Details of folding lines**

Figure 21A illustrates an exemplary embodiment of a folding line **2126a** for a 180° fold. For example, a folding line may include an indentation **2180a** and a protrusion **2181**. Indentation **2180a** and protrusion **2181** may optionally be on opposite

sides of the substrate. For a 180° fold, the length of protrusion **2181** may optionally be approximately twice the thickness (h) of the substrate. For example, the length of protrusion **2181** may range between 1.2 and 2.8 times the thickness (h) of the substrate. The length of indentation **2180a** may optionally be less than the length of protrusion **2181**.

Figure 21A' illustrates the substrate of Fig. 21A after folding. For example, folding may stretch the outer side of the substrate. Protrusion **2181** may be thinned out by stretching to form a rounded corner of. Protrusions **2181** may prevent the corner from thinning out/or and becoming brittle.

Figure 21B illustrates an alternative exemplary embodiment of a folding line **2126b** for a 180° fold.

For example, a folding line may include indentations **2180b** and **2180b'**. Indentations **2180b** and **2180b'** may optionally be on opposite sides of the substrate. For a 180° fold, the length of indentations **2180b,b'** may be approximately twice the thickness (h) of the substrate. For example, the length of indentations **2180b,b'** may range between 1.2 and 2.8 times the thickness (h) of the substrate.

Figure 21B' illustrates the substrate of Fig. 21B after folding. In some embodiments, indentations **2180b,b'** may make it easy to fold the substrate along line **2126b**. The corner may optionally thin out during folding.

Figure 22A illustrates an exemplary embodiment of a folding line **2226a** for a 90° fold. For example, a folding line may include an indentation **2280a** and a protrusion **2281**. Indentation **2280a** and protrusion **2281** may optionally be on opposite sides of the substrate. For a 90° fold, the length of protrusion **2281** may optionally be approximately the thickness (h) of the substrate. For example, the length of protrusion **2181** may range between 0.6 and 1.4 times the thickness (h) of the substrate. The length of indentation **2280a** may optionally be less than the length of protrusion **2281**. The length of indentation may optionally be approximately half the thickness of the substrate. For example, the length of indentation **2280a** may optionally ranges between 0.2 and 0.8 times the thickness of the substrate.

Figure 22A' illustrates the substrate of Fig. 22A after folding. For example, folding may stretch the outer side of the substrate. Protrusion **2281** may be thinned out

by stretching to form a rounded corner of. Protrusions **2281** may prevent the corner from thinning out and becoming brittle.

Figure 22B illustrates an alternative exemplary embodiment of a folding line **2226b** for a 90° fold. For example, a folding line may include indentations **2280b** and **2280b'**. Indentations **2280b** and **2280b'** may optionally be on opposite sides of the substrate. For a 90° fold, the length of indentations **2280b,b'** may be approximately the thickness (h) of the substrate. For example, the length of indentations **2280b,b'** may range between 0.6 and 1.4 times the thickness (h) of the substrate.

Figure 22B' illustrates the substrate of Fig. 22B after folding. In some embodiments, indentations **2280b,b'** may make it easy to fold the substrate along line **2226b**. The corner may optionally thin out during folding.

Figure 22C is a schematic view illustrating the orientation of folding lines in an exemplary continuous blister chain. The orientation of folding lines in Fig. 22C corresponds for example to embodiments **800**, **900**, and **1600**. In the exemplary embodiment of Fig. 22C, blister sheets **20** are alternatingly separated by a spacer **22** with two upward folding 90° joints **2226**, followed by a downwardly folding 180° joint **2126** (folding in the opposite direction).

Figure 22D is a schematic view illustrating the orientation of folding lines in an exemplary continuous blister chain. The orientation of folding lines in Fig. 22C corresponds for example to embodiment **1500**. In the exemplary embodiment, blister sheets **20** are alternatingly separated by a spacer **22** with two upward folding 90° joints **2226**, followed by a spacer **22** with two downwardly folding 90° joints **2226** (folding in the opposite direction from the previous pair of joints),Alternative embodiments of folding machines

Figs. 23A-E illustrate five exemplary steps of a process of folding a blister chain. The process may optionally repeat itself in a continuous manner.

Fig. 23A step-1, illustrates an exemplary starting configuration. For example, the drawing illustrates six blisters **2324a-f**; blisters **2324a-c** are already in folded position, and blisters **2324d-f** are on standby to be folded.

Fig. 23B, Step-2 illustrates an example of initiating folding. In step two an advancer **2338a** optionally advances a trailing spacer **2322a** while a second advancer

optionally retains a leading spacer **2322b** in place squeezing sheets containing blisters **2324d,e** between them. The squeezing buckles a joint **26**. For example, joint **26** and blisters **2324d,e** are buckled upward out of the plane of advancement of the blister chain. Optionally, a presser **2330** pushes joint **26** located between blisters **2324d,e** upward. Pushing joint **26** upward may for example help initiate folding on the correct line (joint **26**).

Fig. 23C, Step-3 illustrates an example of advancers **2338a,b** continuing to buckle joint **26** and blisters **2324d,e**. In the example presser **2330** has completed its job of initiating the folding and moves downward out of the path of advancement of the blister chain.

Fig. 23D, Step-4 illustrates an example of removal of advancer **2338b** so blister **2324d** can be stacked in position in front of blister **2324c**. Optionally, advancer **2338a** continues pressing blister **2324e** forward until blisters **2324d,e** are stacked in their places.

Fig. 23E, Step-5 illustrates the exemplary system completing a cycle and returning to the configuration of Fig. 23A except that now blisters **2324d,e** are in the same position that blisters **2324b,c** where in Fig. 23A. The folding cycle may optionally continue from step-1 (Fig. 23A) with blisters **2324f,g** on standby to be folded. Advancers **2338a,b** and presser **2330** have returned to their position as in Fig. 23A.

Figures 24A-H illustrate a side view of an alternative example of a folding machine and a method of folding a blister strip. Figs. 24A'-H' show a front view of the folding machine. In the exemplary method folding is done by a dual motion rotary presser **2430** while stacking is done by a two piece advancer **2338**.

In Fig. 24A for example, six sheets are shown each containing a blister **2424a-f**. Blisters **2424a-c** are already in their folded positions and blisters **2424d-f** are waiting to be folded. An advancer **2438** is located at the trailing end of the pair of sheets containing blisters **2424d,e**. As illustrated in Fig. 24A', advancer **2438** may optionally include of two separate parts. The plane of advancement **2490** of the blister chain is labeled. In Figs. 24A,A', a rotary presser **2430** is shown in a ready position parallel to plane of advancement **2490**.

Figs. 24B,B' illustrate an exemplary subsequent step in folding. Optionally advancer **2438** advances a trailing edge of blister pair **2424d,e** while presser **2430**

rotates, raising blisters **2424d,e** out of plane of advancement **2490**. As advancer **2438** moves forward it pulls along the trailing portion of the blister chain, for example blisters **2424f,g**.

Figs. 24C,C' illustrate an exemplary subsequent step in folding. Optionally advancer **2438** keeps advancing the trailing edge of blister pair **2424d,e** while presser **2430** continues to rotate, until presser **2430** is perpendicular to plane of advancement **2490** and blisters **2424d,e** are stacked up against blisters **2424a,b,c**.

Figs. 24D,D' illustrate an exemplary subsequent step in folding. Presser **2430** has been lowered out of the path of advancement of the blister stack.

Figs. 24E,E' illustrate an exemplary subsequent step in folding. Optionally advancer **2438** advances the blister stack pulling forward blisters **2424f,g** into a position ready to fold. In Figs. 24E,E' rotates back to be parallel to plane of advancement **2490**.

Figs. 24F,F' illustrate an exemplary subsequent step in folding. In Figs. 24F,F' presser **2430** has optionally be raised back to its ready position for folding a new pair of blisters **2424f,g**. Optionally, the two parts of advancer **2438** spread apart (as is seen in Fig. 24F') disengaging from the blister stack.

Figs. 24F,F' illustrate an exemplary subsequent step in folding. Advancer **2438** optionally returns to the trailing edge of blister pair **2424f,g**.

Figs. 24G,G' illustrate an exemplary subsequent step in folding. The two parts of Advancer **2438** optionally come back together (as illustrated for example in Fig. 24F') such that the apparatus is now ready to restart the process, folding blisters **2424f,g**.

It is expected that during the life of a patent maturing from this application many relevant technologies will be developed and the scope of the terms is intended to include all such new technologies *a priori*

As used herein the term “about” refers to ± 5%

The terms "comprises", "comprising", "includes", "including", “having” and their conjugates mean "including but not limited to".

The term “consisting of” means “including and limited to”.

The term "consisting essentially of" means that the composition, method or structure may include additional ingredients, steps and/or parts, but only if the additional ingredients, steps and/or parts do not materially alter the basic and novel characteristics of the claimed composition, method or structure.

As used herein, the singular form "a", "an" and "the" include plural references unless the context clearly dictates otherwise. For example, the term "a compound" or "at least one compound" may include a plurality of compounds, including mixtures thereof.

Throughout this application, various embodiments of this invention may be presented in a range format. It should be understood that the description in range format is merely for convenience and brevity and should not be construed as an inflexible limitation on the scope of the invention. Accordingly, the description of a range should be considered to have specifically disclosed all the possible subranges as well as individual numerical values within that range. For example, description of a range such as from 1 to 6 should be considered to have specifically disclosed subranges such as from 1 to 3, from 1 to 4, from 1 to 5, from 2 to 4, from 2 to 6, from 3 to 6 etc., as well as individual numbers within that range, for example, 1, 2, 3, 4, 5, and 6. This applies regardless of the breadth of the range.

Whenever a numerical range is indicated herein, it is meant to include any cited numeral (fractional or integral) within the indicated range. The phrases “ranging/ranges between” a first indicate number and a second indicate number and “ranging/ranges from” a first indicate number “to” a second indicate number are used herein interchangeably and are meant to include the first and second indicated numbers and all the fractional and integral numerals therebetween.

It is appreciated that certain features of the invention, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features of the invention, which are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable subcombination or as suitable in any other described embodiment of the invention. Certain features described in the context of various embodiments are not to be considered essential features of those embodiments, unless the embodiment is inoperative without those elements.

Although the invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, it is intended to embrace all such alternatives, modifications and variations that fall within the spirit and broad scope of the appended claims.

All publications, patents and patent applications mentioned in this specification are herein incorporated in their entirety by reference into the specification, to the same extent as if each individual publication, patent or patent application was specifically and individually indicated to be incorporated herein by reference. In addition, citation or identification of any reference in this application shall not be construed as an admission that such reference is available as prior art to the present invention. To the extent that section headings are used, they should not be construed as necessarily limiting.

WHAT IS CLAIMED IS:

1. A method of folding a chain of a blisters sheets comprising:

supplying a continuous chain of blisters sheets;

folding together pair of sheets of said continuous chain, and

simultaneously moving a pair of sheets or an interconnector between said pair of sheets out of a path of advancement of the chain during said folding.

2. The method of claim 1, wherein said two sheets remain connected to the chain during said folding.

3. The method of claim 1 further comprising:

stacking said pair of sheets along said path of advancement .

4. The method of claim 3, wherein said stacking is of at least two substantially parallel layers.

5. The method of claim 3, wherein said folded chain includes at least 6 adjacent sheets and said stacking is into at least six substantially parallel layers.

6. The method of claim 1, wherein said moving includes buckling said interconnector out of said path of advancement.

7. The method of claim 1, wherein said moving includes advancing said interconnector over an edge.

8. The method of claim 1, wherein said moving includes pulling said interconnector out of said path of advancement.

9. The method of claim 1, wherein said moving includes pressing said interconnector out of said path of advancement.

10. The method of claim 1, wherein said folding further comprises:

advancing a trailing end of said pair of sheets faster than a leading end of said two sheets.

11. The method of claim 1, wherein during said moving a leading end of said two sheets and a trailing end of said two sheets remain in said path of advancement.

12. The method of claim 4, wherein said moving is performed by an arm moving in a continuous orbit.

13. The method of claim 1, further comprising:

restraining said continuous chain from twisting.

14. A system for folding a continuous blister chain comprising:

a feeder configured to feed the continuous chain of blister sheets to

an out of plane folder configured for folding an interconnector between two of said blister sheets out of a plane of advancement of said feeder to form the continuous chain into a stack of connected blister sheets.

15. The system of claim 14, further comprising:

an edge and wherein said folding occurs over said edge.

16. The system of claim 14, wherein said folder is configured to fold said two sheets into substantially parallel connected layers, substantially perpendicular to said plane of advancement.

17. The system of claim 14, wherein said folder is synchronized with said feeder.

18. The system of claim 14, wherein said folder is configured receives the chain continuously.

19. The system of claim 14, further comprising:

a stacker for stacking at least three of said sheets as connected layers, said layers substantially perpendicular to said plane of advancement.

20. The system of claim 14, further comprising:

a guide preventing twisting of the chain.

21. A continuous blister chain packaged for distribution comprising:

a plurality of blister containing sheets wherein said sheets are folded to form substantially parallel layers, and

at least one blister protruding from both sides of at least one of said sheets, wherein the distance between said layers is less than the height of said at least one blister.

22. The blister chain of claim 21, wherein blisters of at least two of said layers mesh together.

23. The blister chain of claim 21, further comprising:

at least one blister protruding from only one side of at least one of said sheets.

24. The blister chain of claim 23, wherein a space between two of said layers is less than the height of a blister of said blisters of said sheets.

25. A continuous blister chain packaged for distribution comprising:

a plurality of sheets containing blister, said sheets folded to form layers of a stack, and

one or more spacers interconnecting between two of said sheets and wherein said spacers include at least one blister.

26. The blister chain of claim 25, including at least two of said spacers.

27. The blister chain of claim 25, wherein said layers are substantially parallel.

28. The blister chain of claim 25, wherein a space between two of said layers is less than twice the height of a blister of said blisters.

29. A method of adapting a blister producing machine to produce a foldable blister chain, the method comprising:

setting up a pocket forming unit to emboss a plurality of folding lines into a continuous strip of blister substrate, said folding lines demarcating a continuous chain of connected blister sheets, and

setting up a cutting unit to trim an edge of said continuous strip of blister substrate while said continuous chain of sheets remains intact.

30. A method of producing a foldable blister chain using a conventional blistering machine including a pocket forming unit and cutting unit, the method comprising:

embossing a plurality of folding lines into a continuous strip of blister substrate with said pocket forming unit, said folding lines demarcating a continuous chain of connected blister sheets, and

trimming an edge of said continuous strip of blister substrate with said cutting unit without severing said continuous chain.

31. The method of claim 30, wherein said folding lines include at least one element of the group consisting of a 90° folding line and a 180° folding line.

32. The method of claim 30, wherein said continuous chain further includes a plurality of spacers, the length of at least one said spacer being substantially the height of a blister.

33. The method of claim 30, wherein at least one of said folding lines is configured to fold in an opposite direction of at least one other of said folding lines.

34. The method of claim 31, wherein a spacer surrounded by two 90° folding lines alternates with a 180° folding line, folding in the opposite direction.

35. The method of claim 31, wherein a spacer surrounded by two 90° folding lines alternates with a spacer surrounded by two 90° folding lines folding in the opposite direction.

36. The method of claim 30, further comprising:

excising a cut out from said blister chain with said cutting unit.

37. The method of claim 30, further comprising:

folding said continuous blister chain according claim 1.

38. A system for producing a blister chain comprising:

a pocket forming unit set up for embossing a plurality of folding lines into a continuous strip of blister substrate, said folding lines demarcating a continuous chain of connected blister sheets, and

a cutting unit set up for trimming an edge of said continuous strip of blister substrate without severing said continuous chain.

39. The system of claim 38, wherein said folding lines include at least one element of the group consisting of a 90° folding line and a 180° folding line.

40. The system of claim 38, wherein at least one of said folding lines is configured to fold in an opposite direction of at least one other of said folding lines.

41. The system of claim 38, further comprising:

a system for folding said continuous blister chain according claim 14.

42. A method of packaging a stack of blister sheets comprising:

supplying a continuous folded stack of at least six blister sheets, and

inserting said continuous folded stack into a secondary package.

43. The method of claim 42, wherein said stack includes at least 10 blister sheets.

44. The method of claim 42, further comprising:

supplying a user opening to said secondary package, a plane of said user opening being directed parallel to a folding line of said stack.

45. The method of claim 42, further comprising:

supplying a user opening to said secondary package, said user opening being configured such that unfolding a blister sheet from said stack causes said blister sheet to extend out of said opening.

FIG. 1

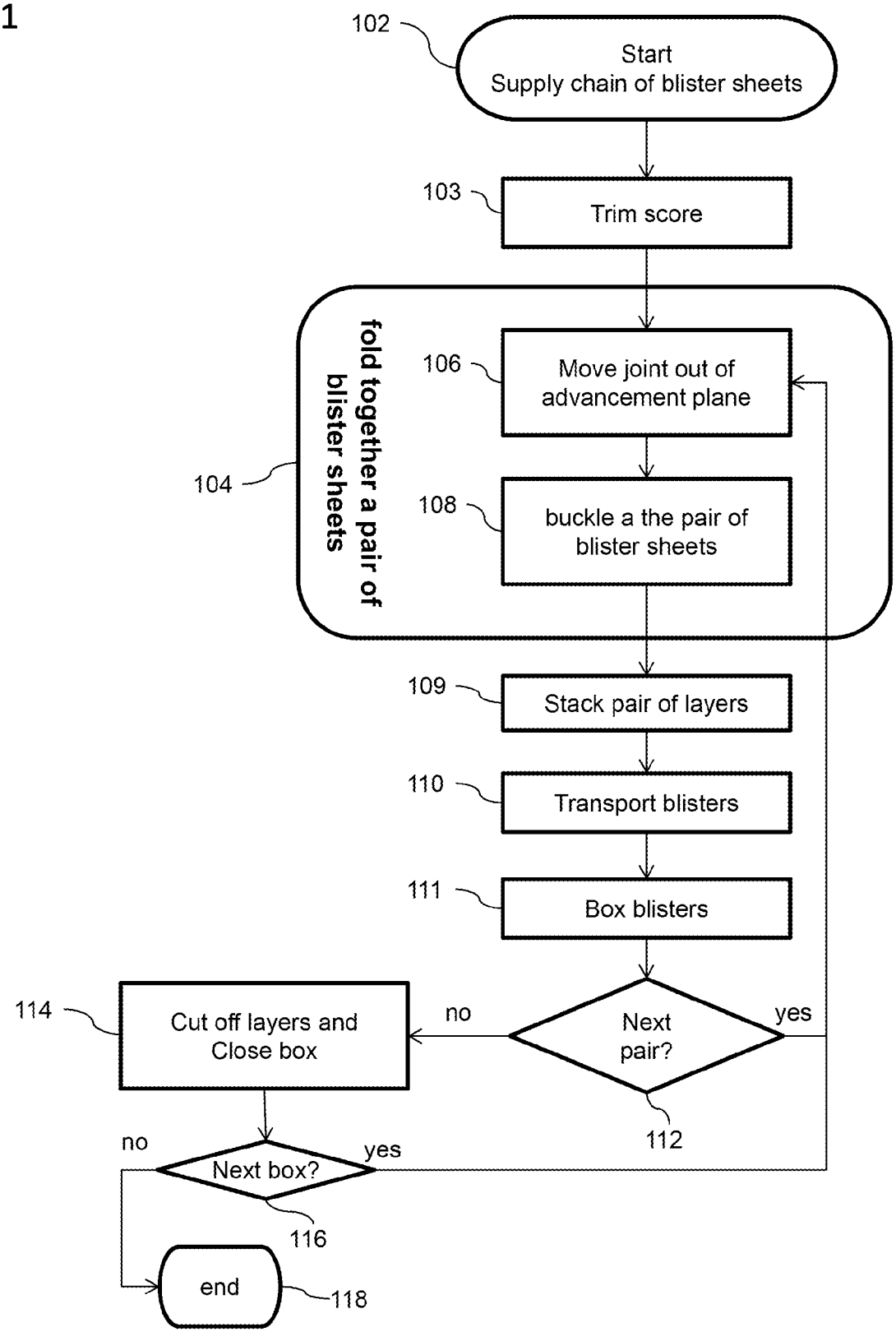

102
Start
Supply chain of blister sheets
103
Trim score
fold together a pair of blister sheets
104
106
Move joint out of advancement plane
108
buckle a the pair of blister sheets
109
Stack pair of layers
110
Transport blisters
111
Box blisters
Next pair?
112
no
yes
114
Cut off layers and Close box
Next box?
116
no
yes
end
118

FIG. 2A

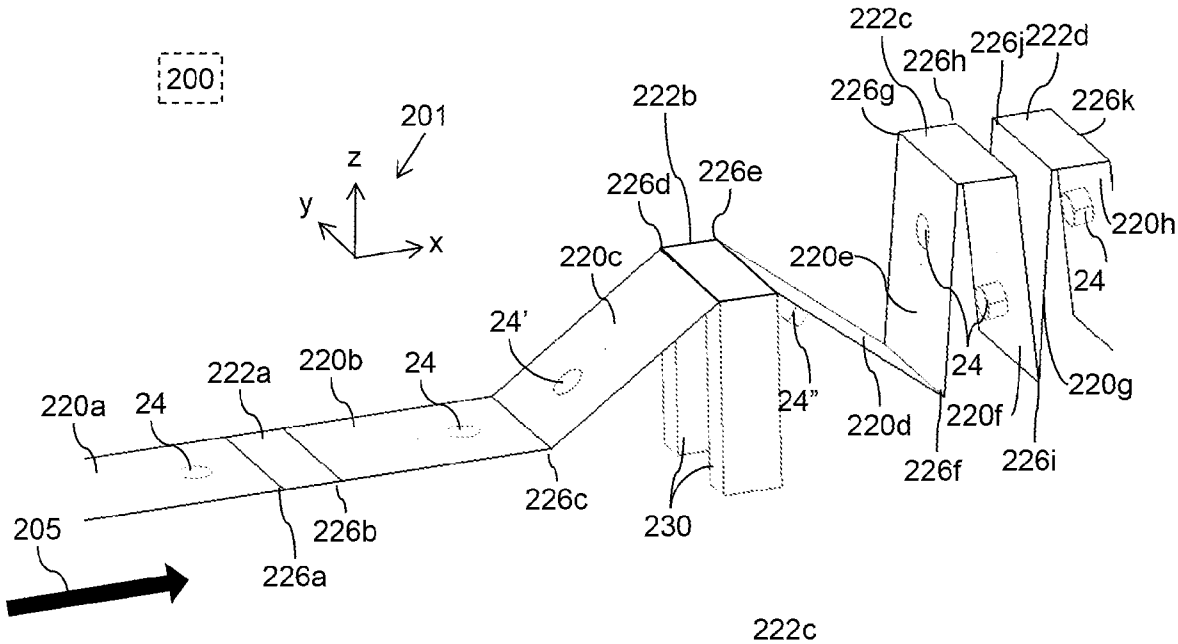



FIG. 2B

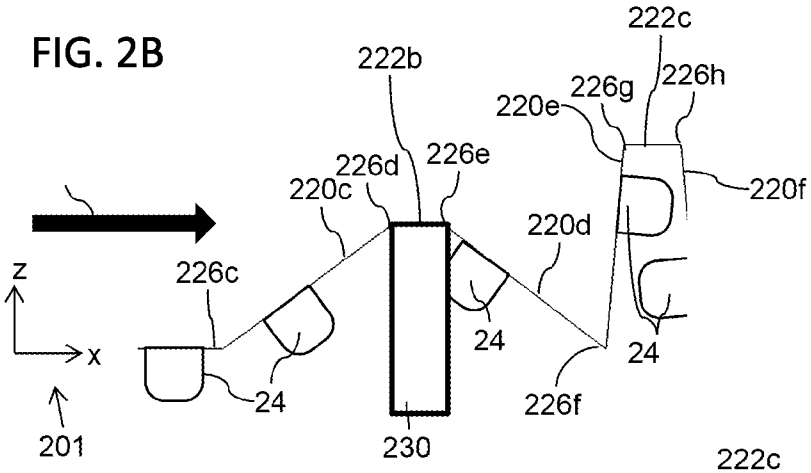
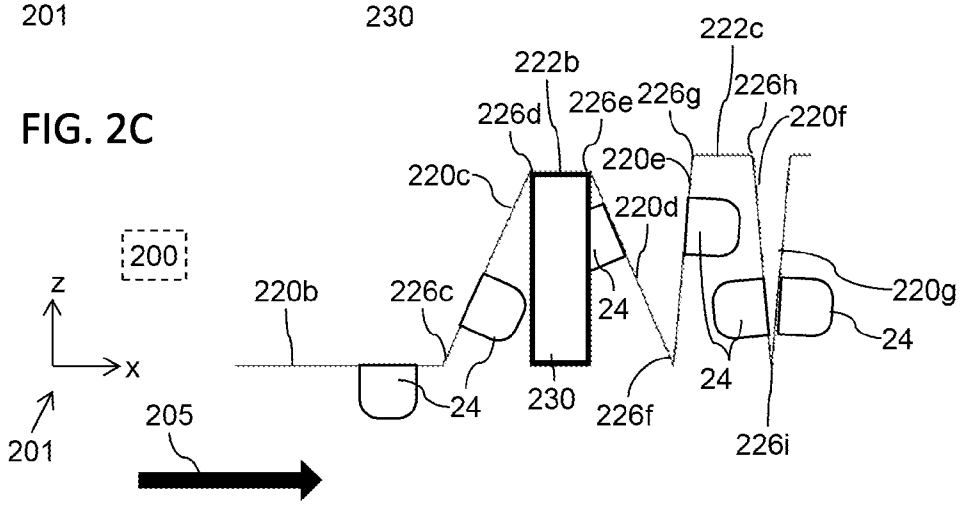



FIG. 2C



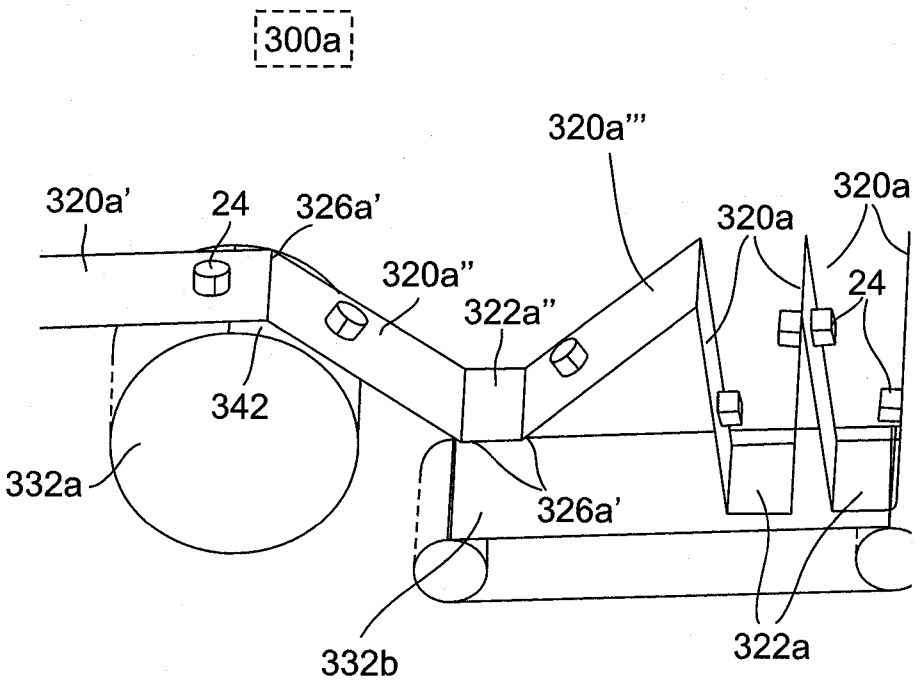

300a
320a'''
320a'
24
326a'
320a
320a
320a''
322a''
24
342
332a
326a'
332b
322a

FIG. 3A

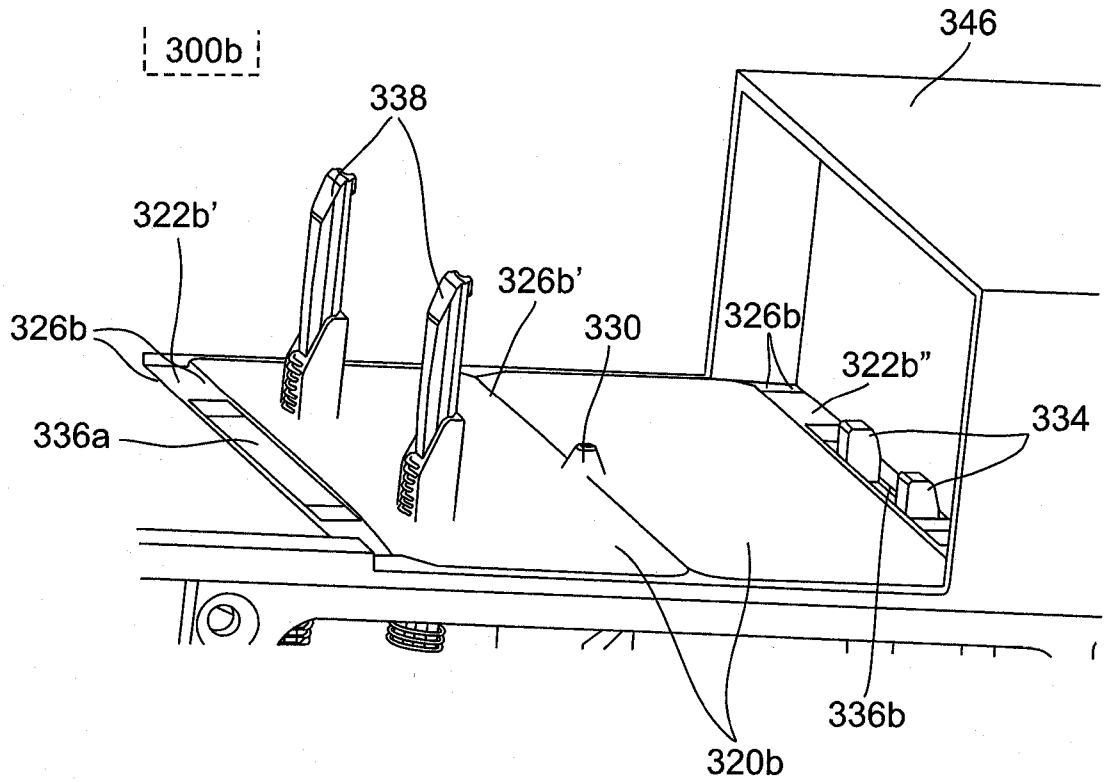

300b
346
338
322b'
326b'
326b
330
326b
322b''
334
336a
336b
320b

FIG. 3B

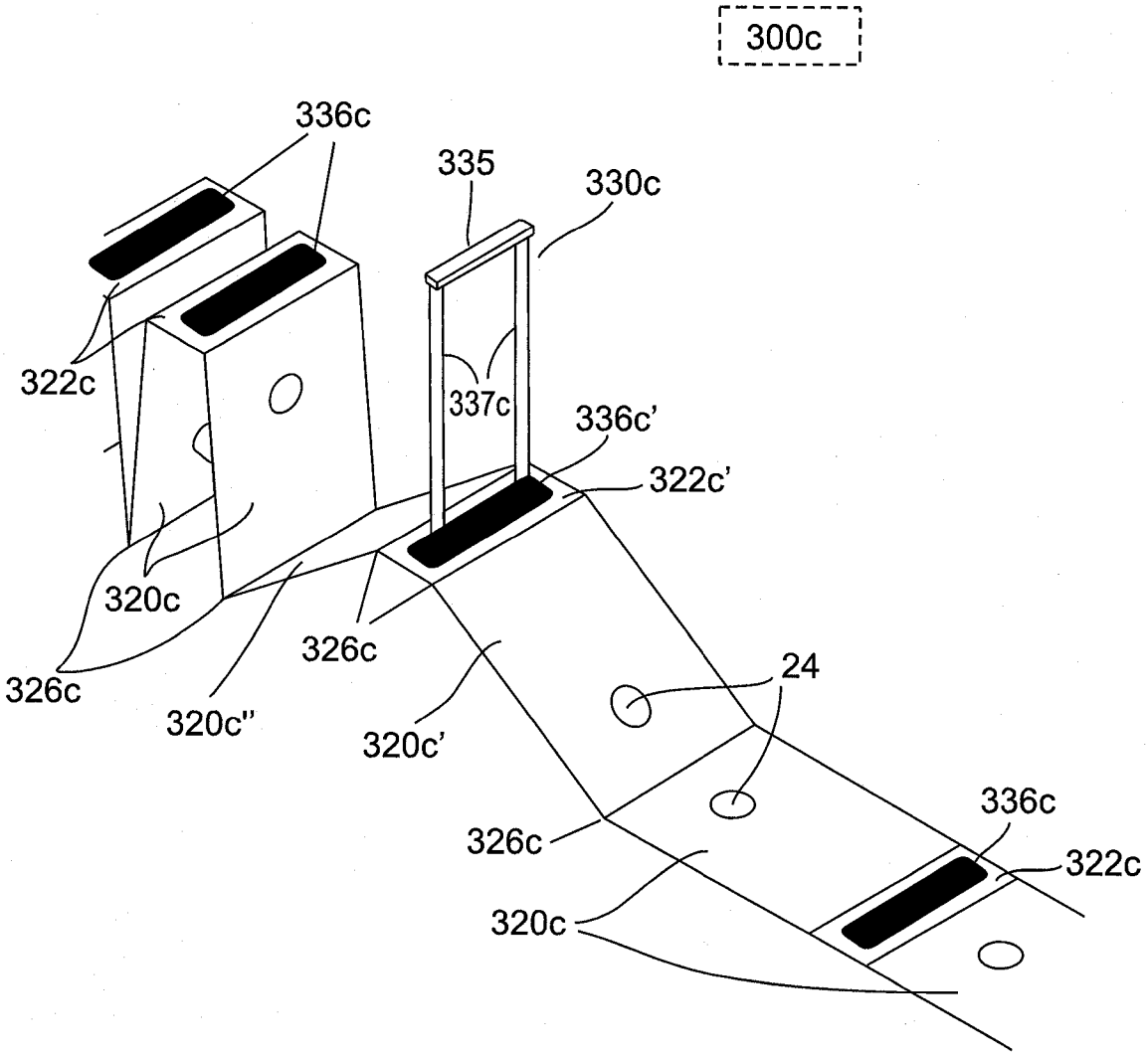



FIG. 3C

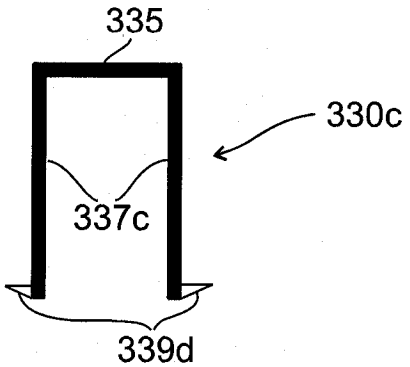



FIG. 3D

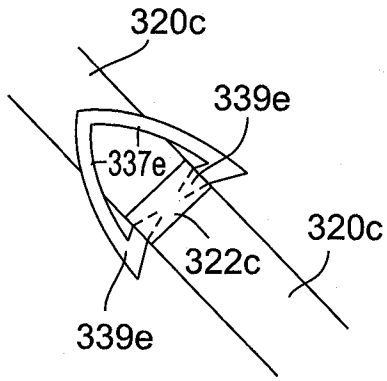



FIG. 3E

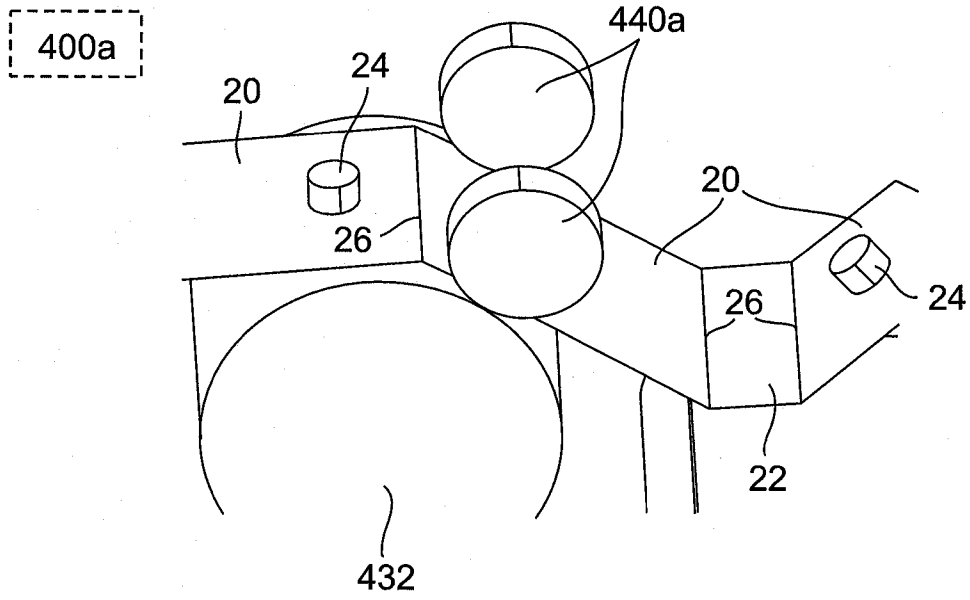



FIG. 4A

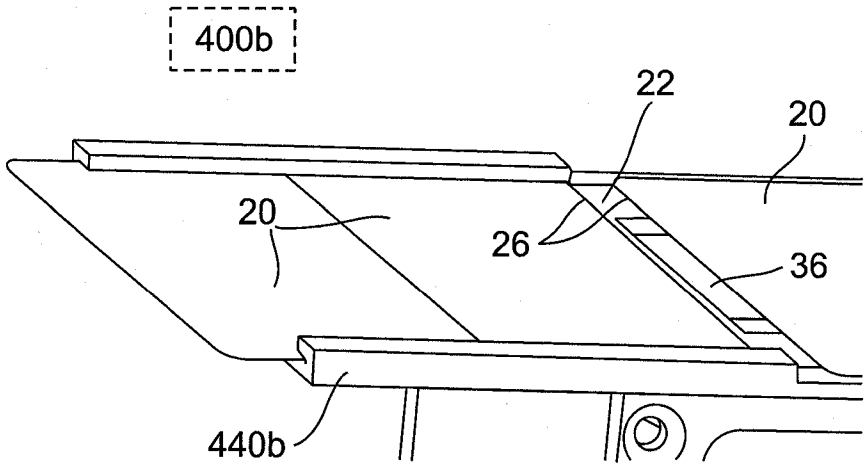



FIG. 4B

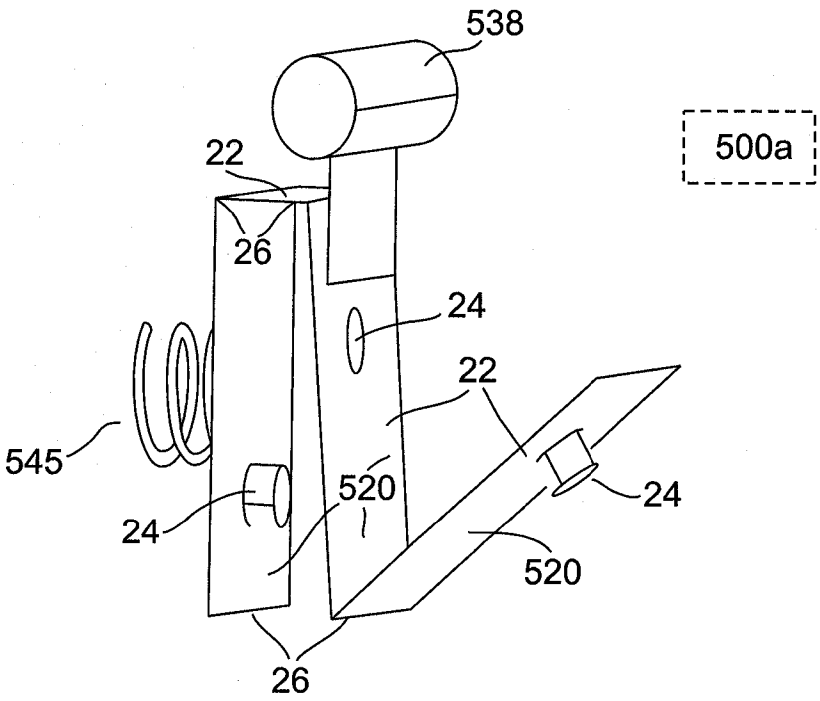



FIG. 5A

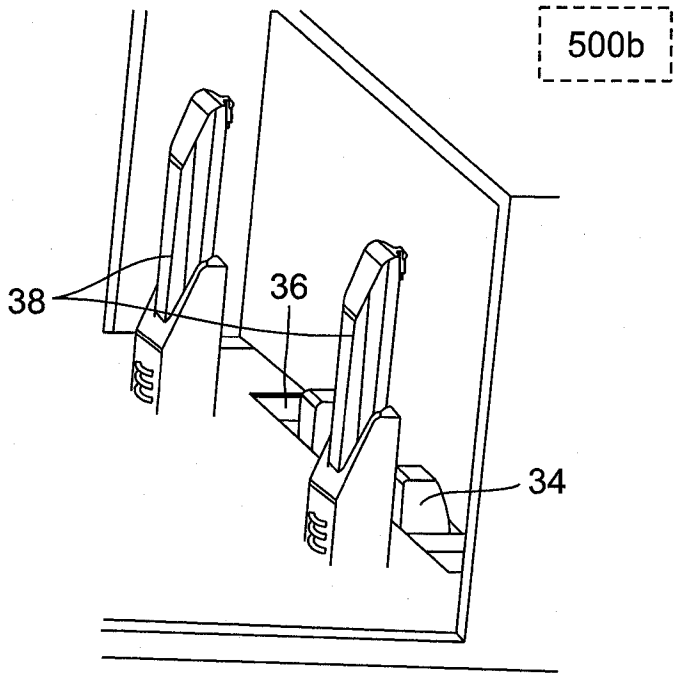



FIG. 5B

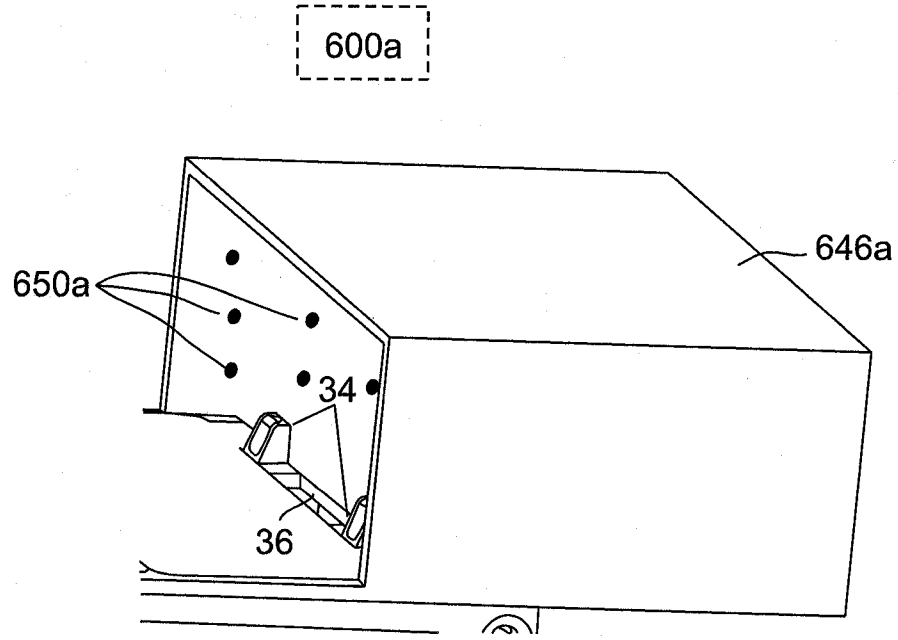

600a
650a
646a
34
36

FIG. 6A

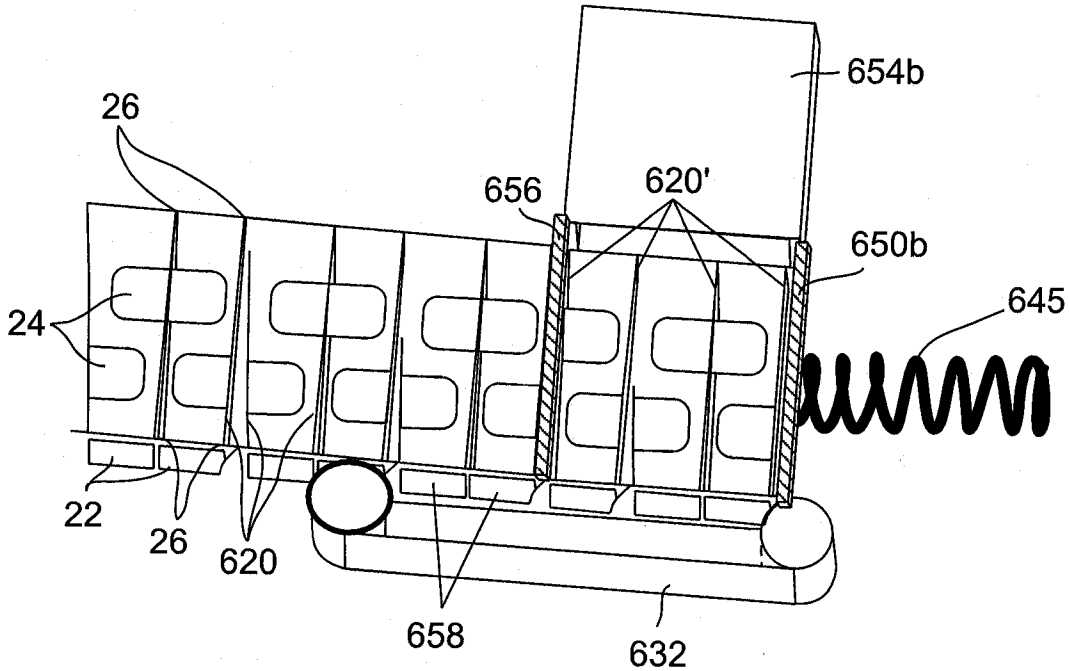

654b
26
656
620'
650b
645
24
22
26
620
658
632

FIG. 6B

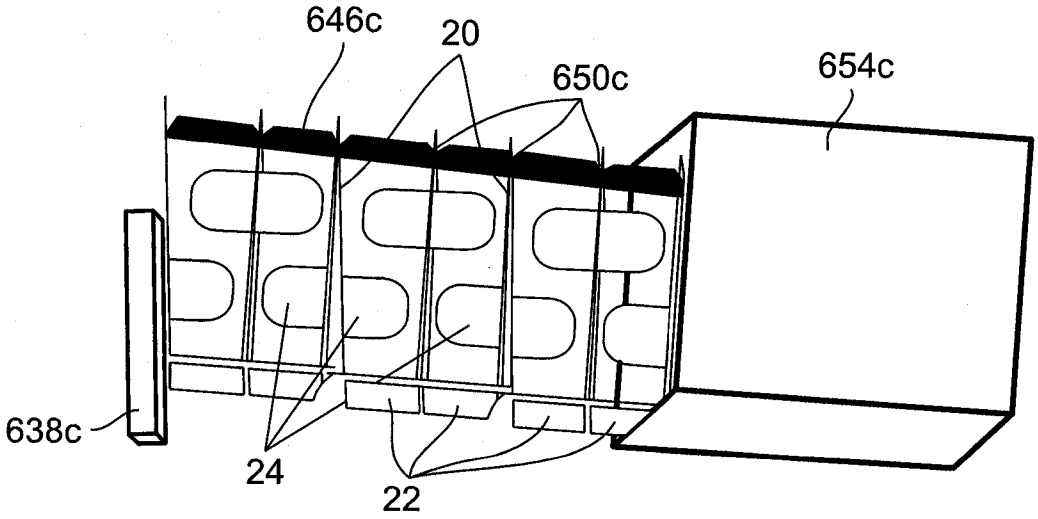

646c
20
650c
654c
638c
24
22

FIG. 6C

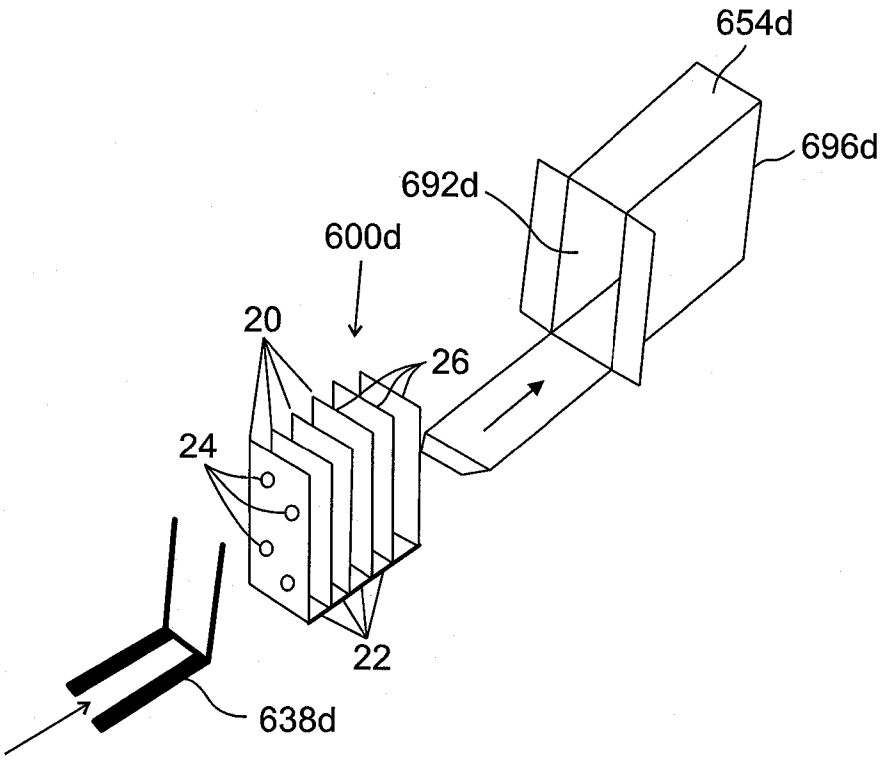

654d
696d
692d
600d
20
26
24
22
638d

FIG. 6D

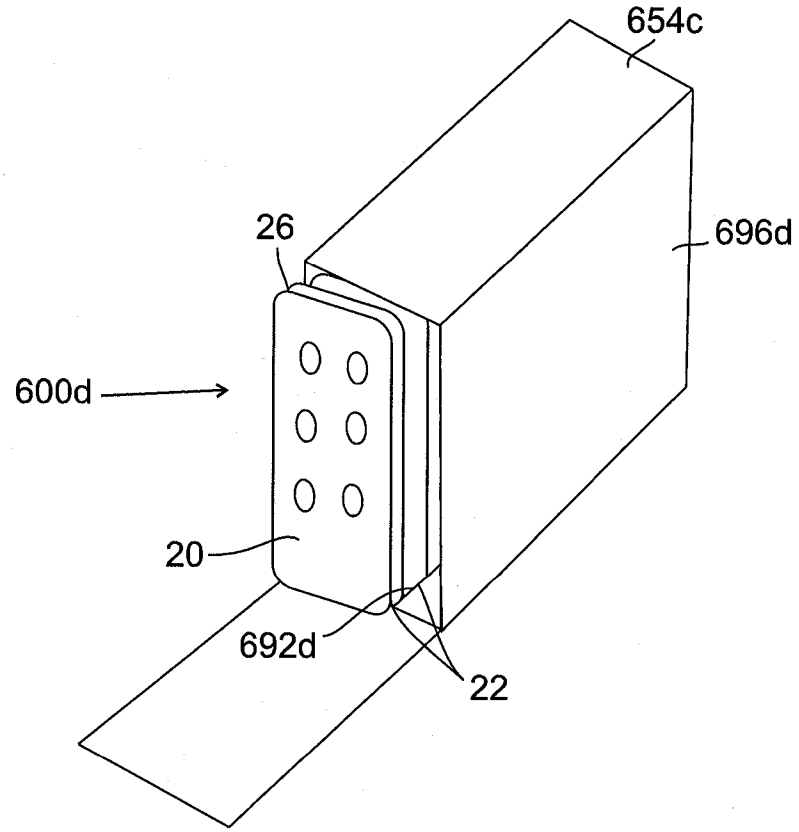



FIG. 6E

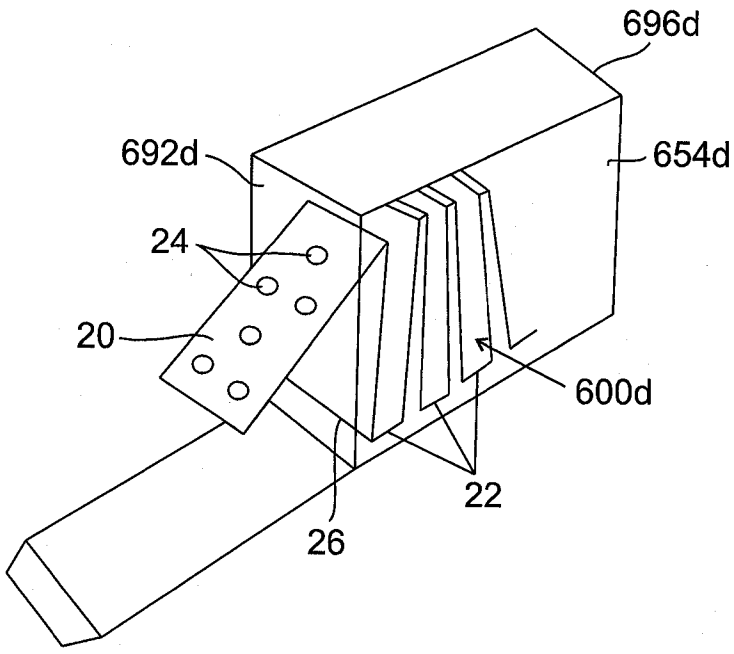



FIG. 6F

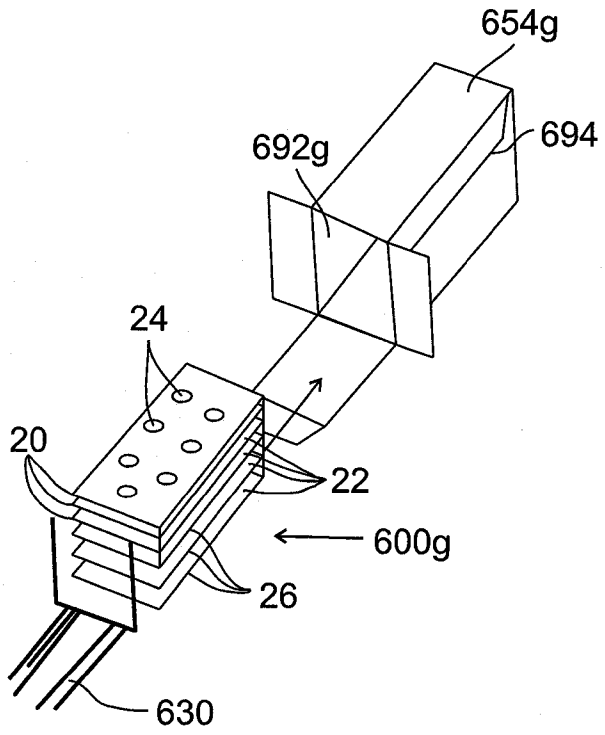



FIG. 6G

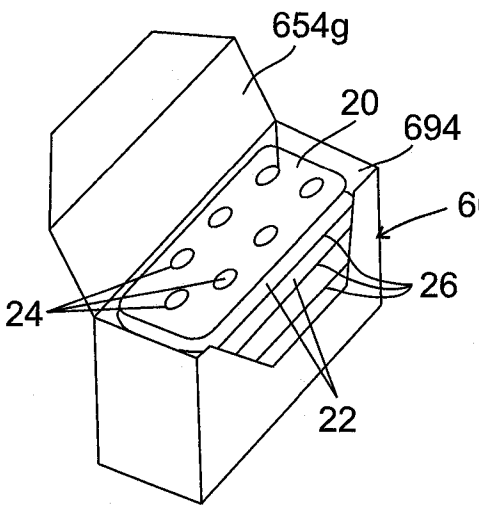



FIG. 6H

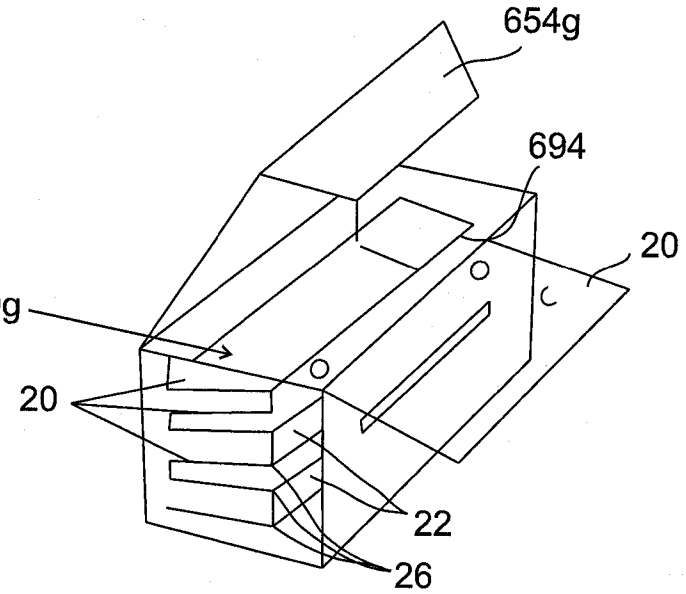



FIG. 6I

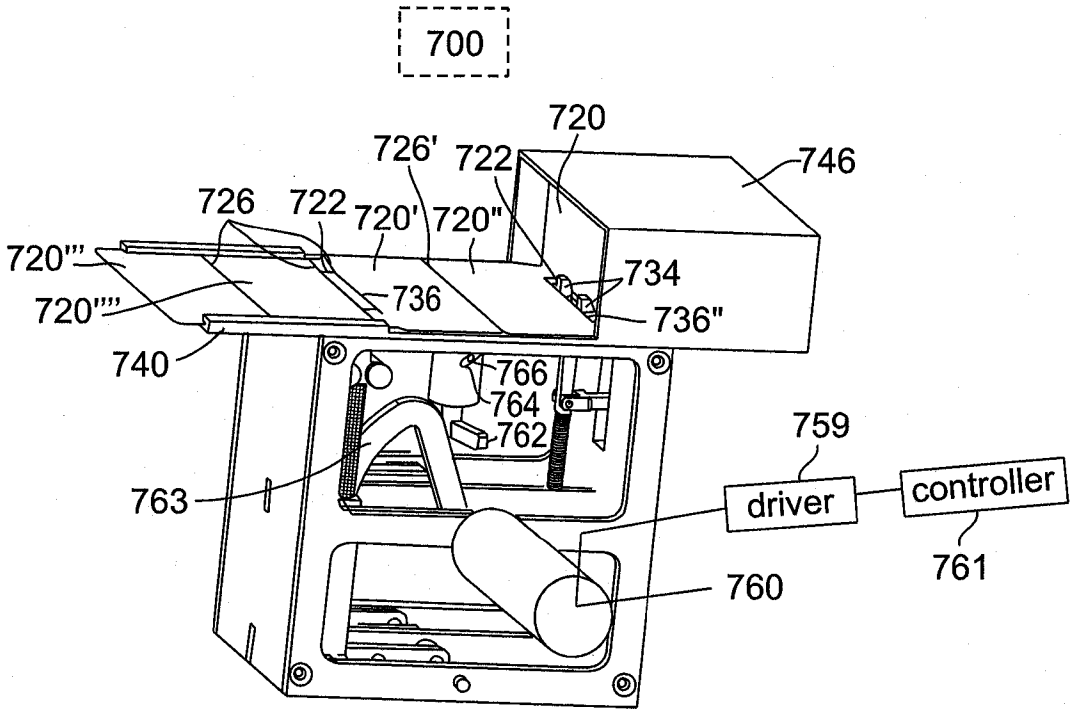

700
720
726'
722
746
726
722
720'
720"
720'''
734
720''''
736
736"
740
766
764
762
759
763
driver
controller
761
760

FIG. 7A

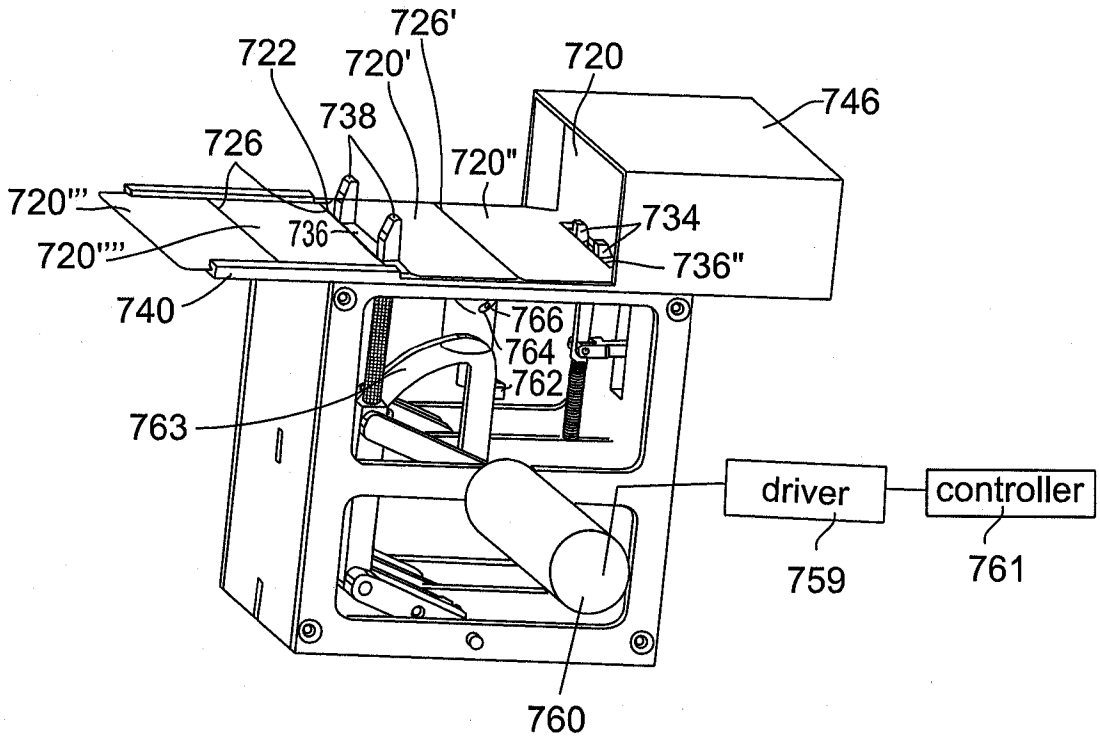

726'
722
720'
720
738
746
726
720"
720'''
734
736
720''''
736"
740
766
764
762
763
driver
controller
759
761
760

FIG. 7B

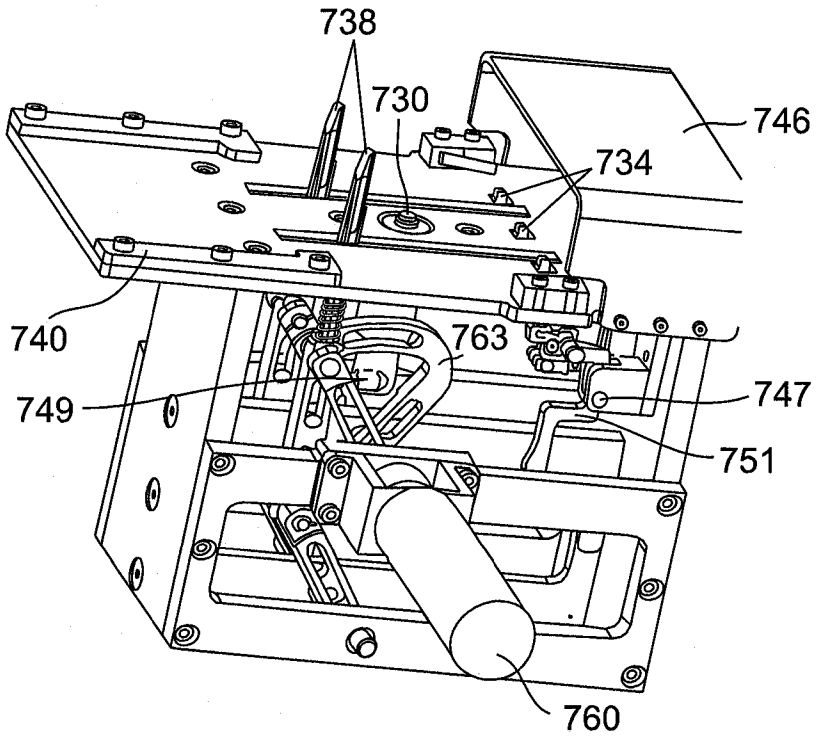

738
730
746
734
740
763
749
747
751
760

FIG. 7C

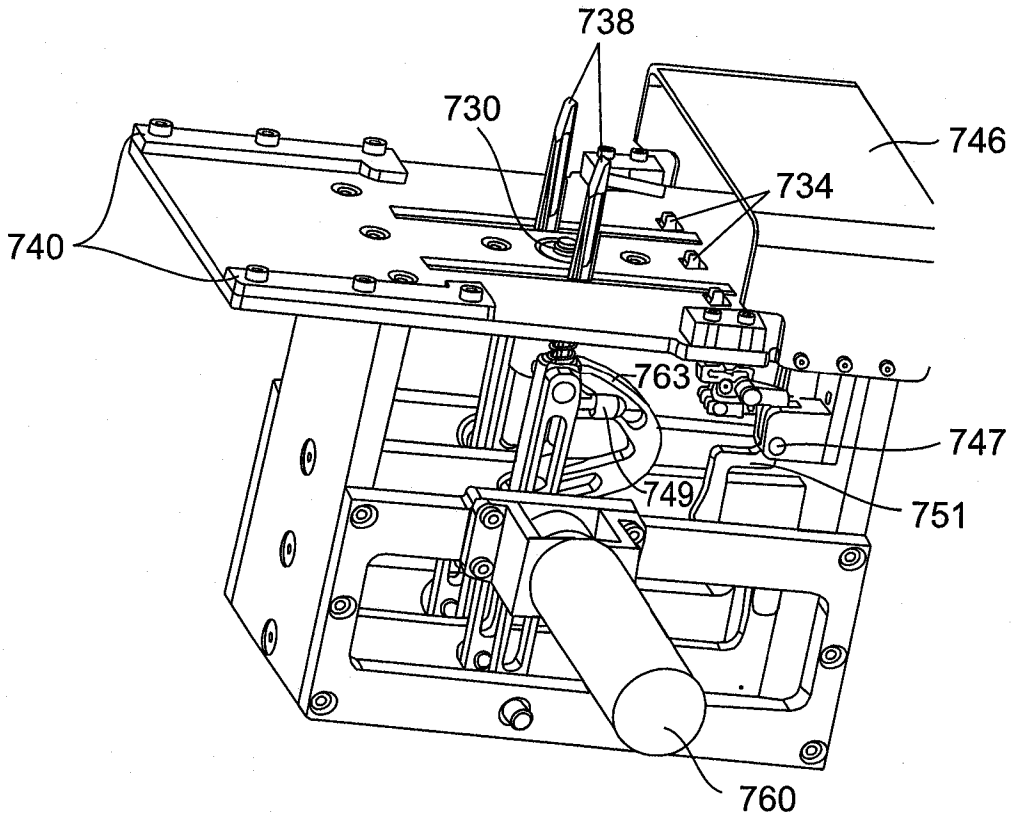

738
730
746
734
740
763
747
749
751
760

FIG. 7D

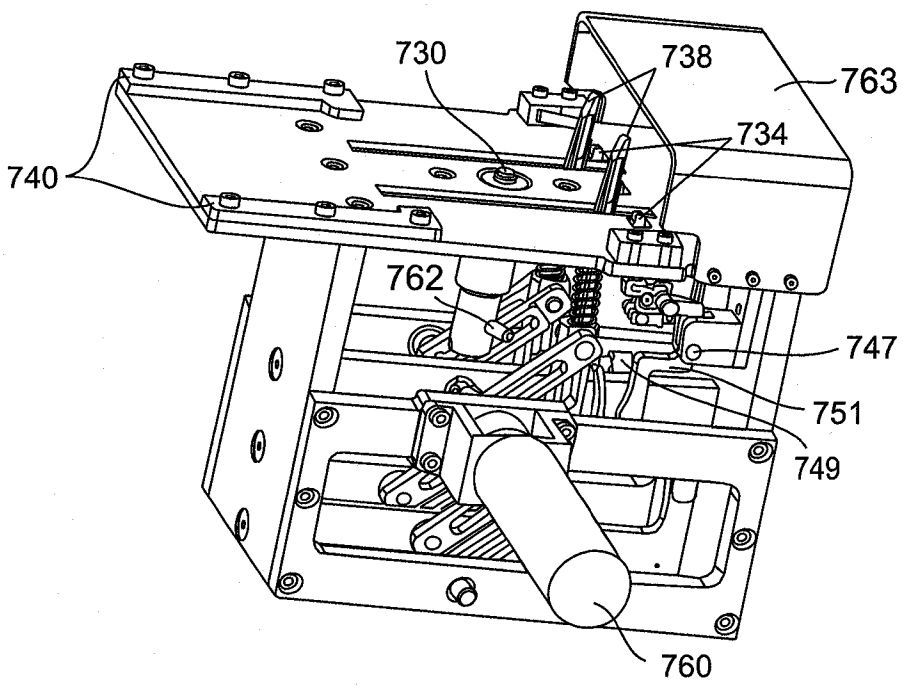

730
738
763
734
740
762
747
751
749
760

FIG. 7E

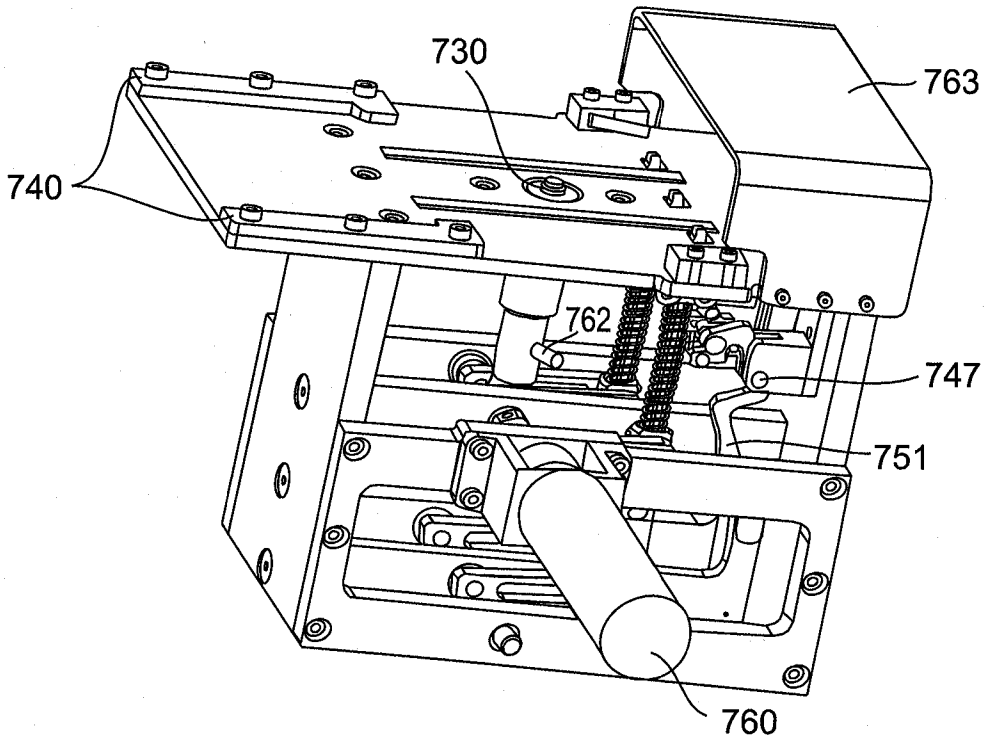

730
763
740
762
747
751
760

FIG. 7F

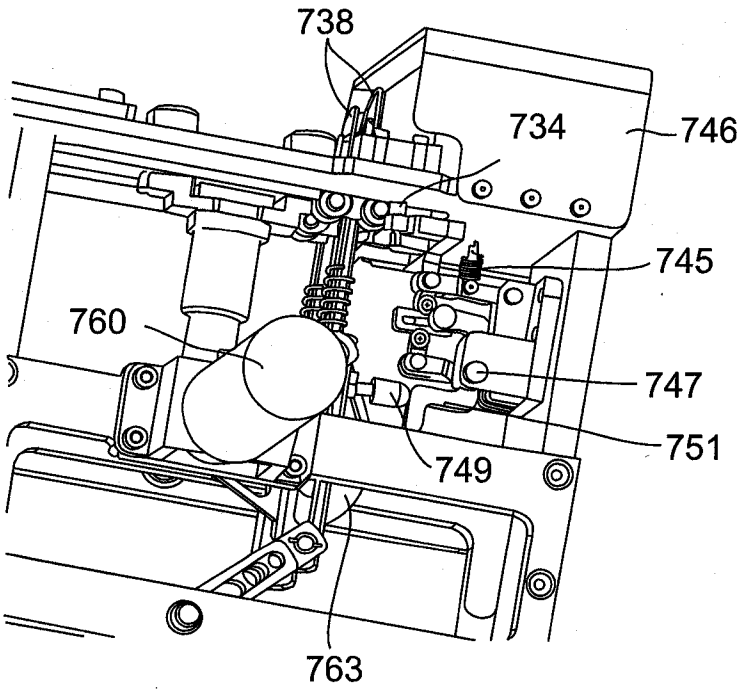

738
734
746
745
760
747
751
749
763

FIG. 7G

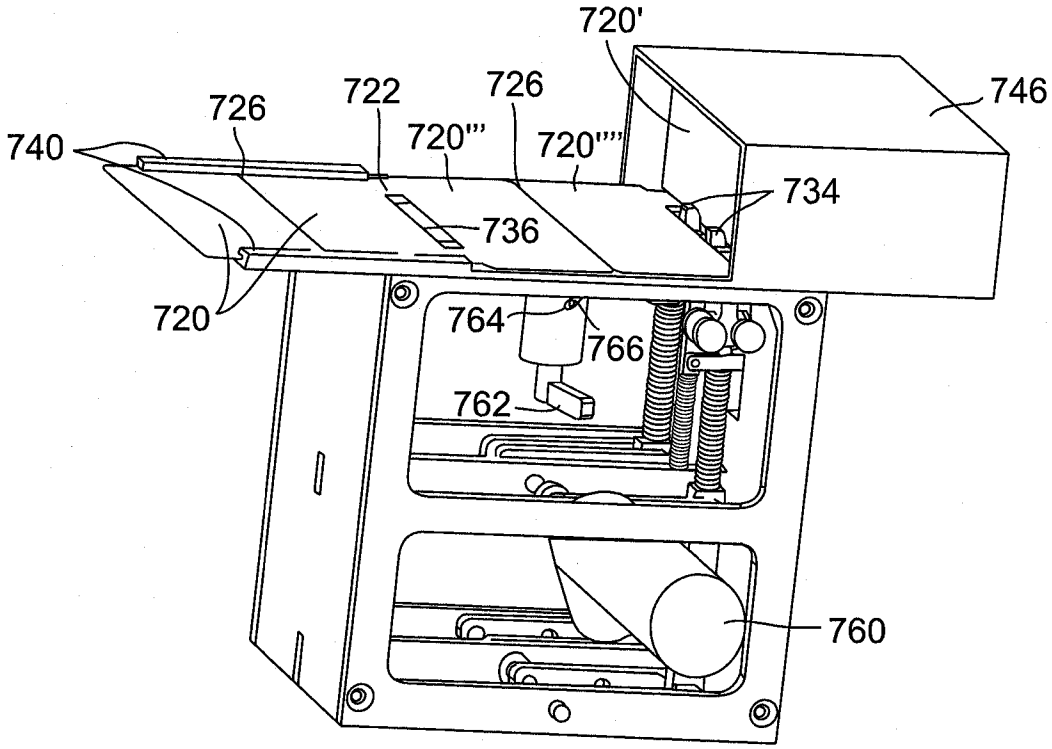
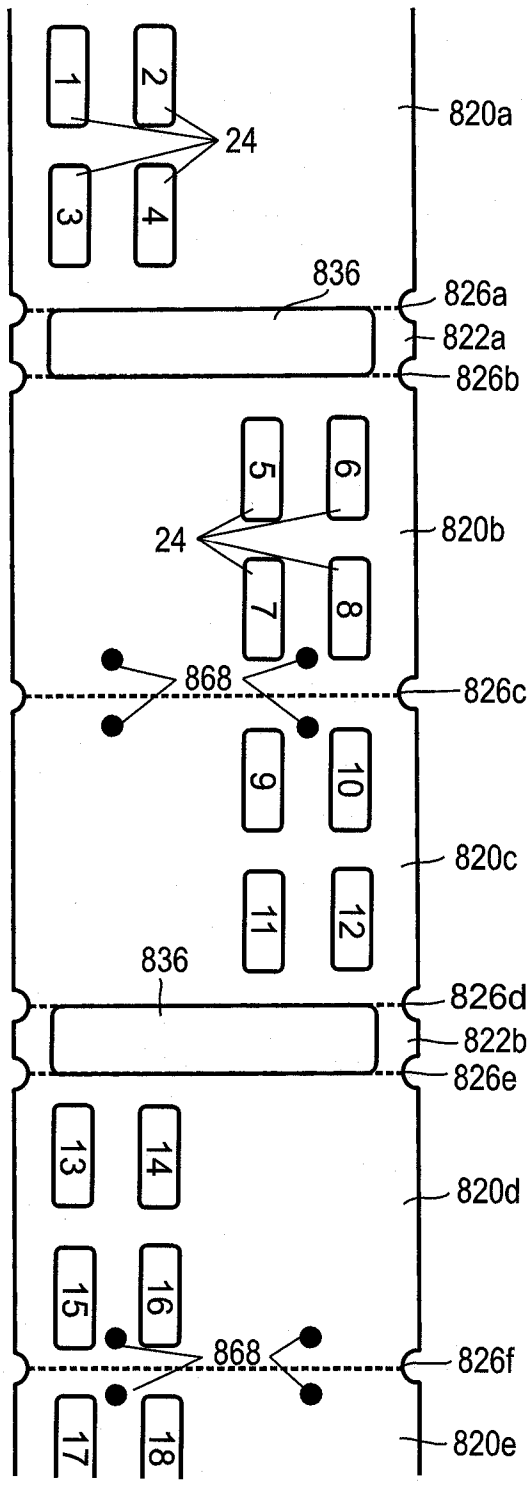

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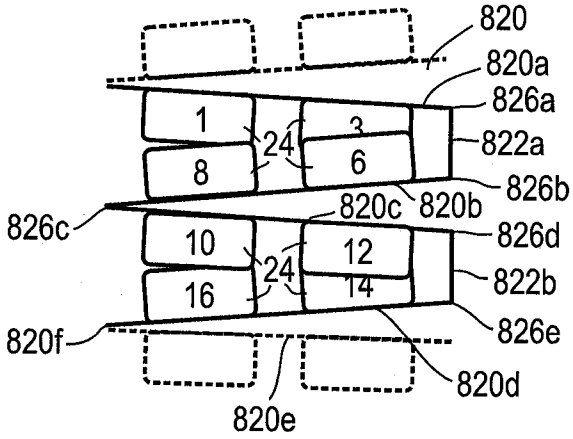
FIG. 7H

FIG. 8A




800

FIG. 8B




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FIG. 9B

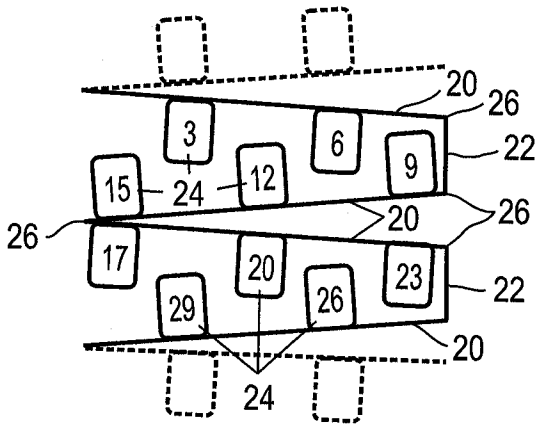


FIG. 9A

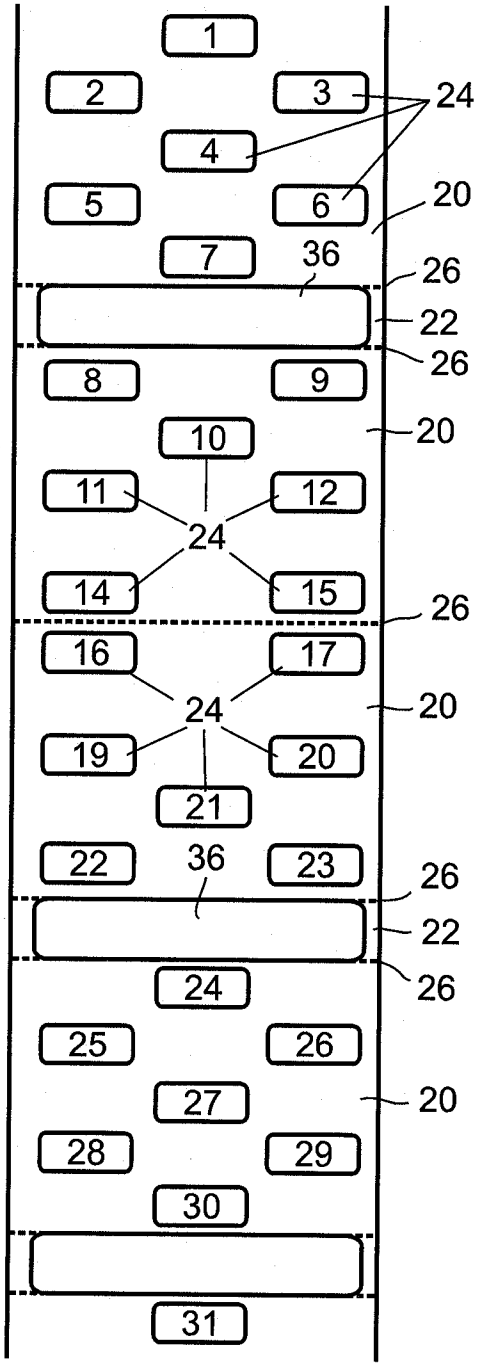

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FIG. 10

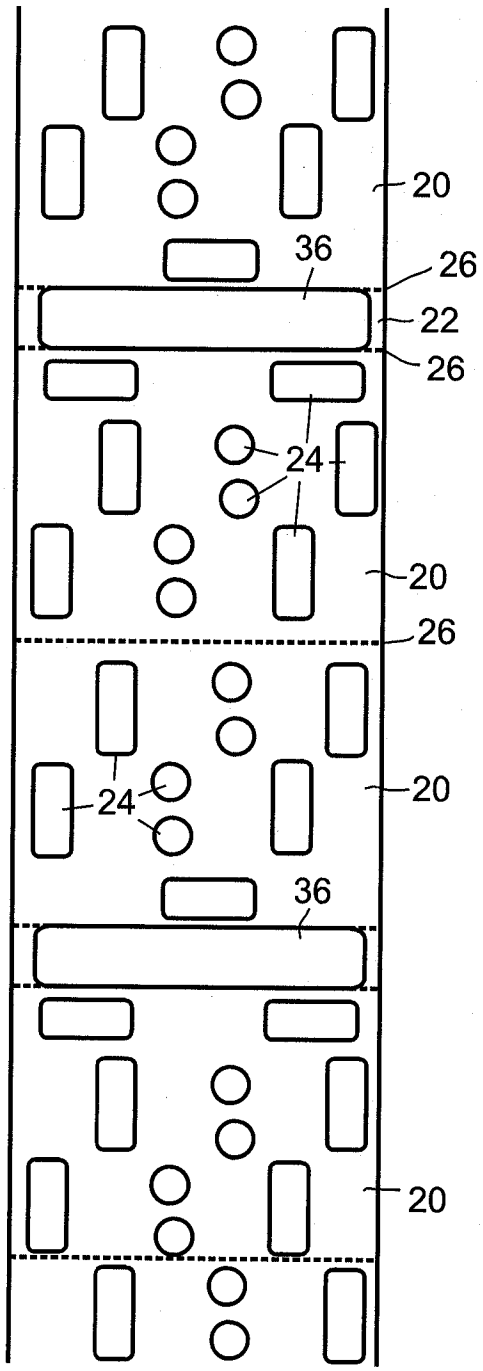

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FIG. 11A

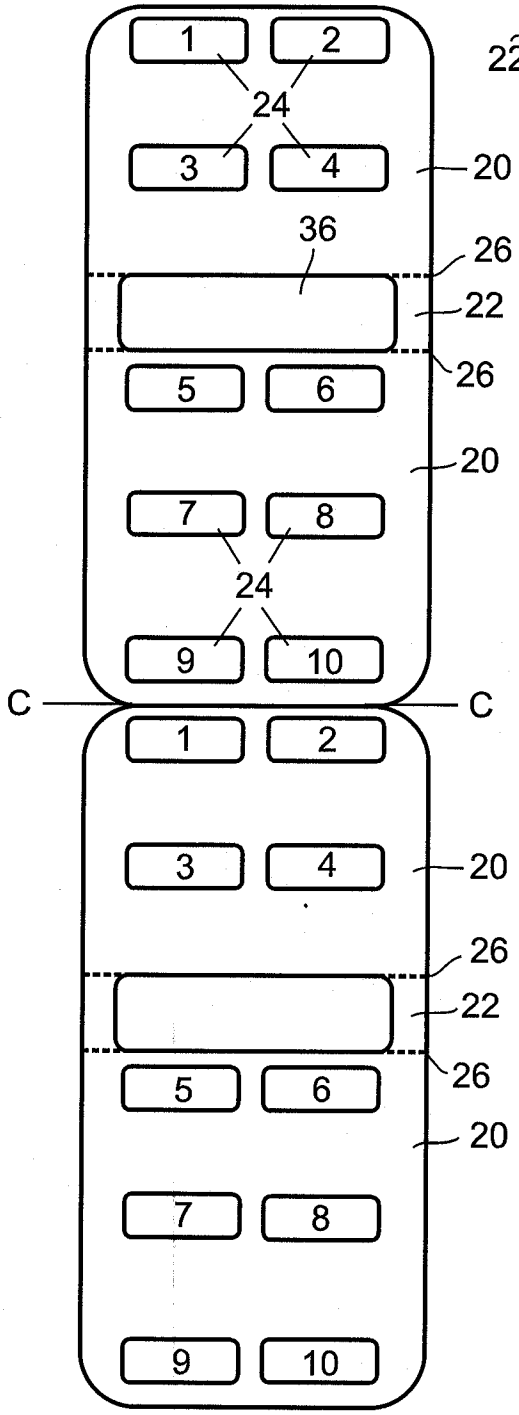



FIG. 11B

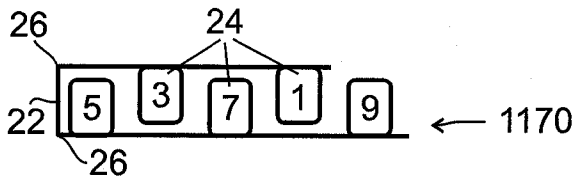



FIG. 11C

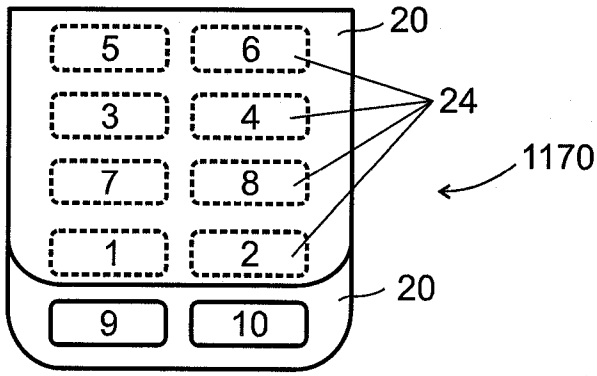


FIG. 12A

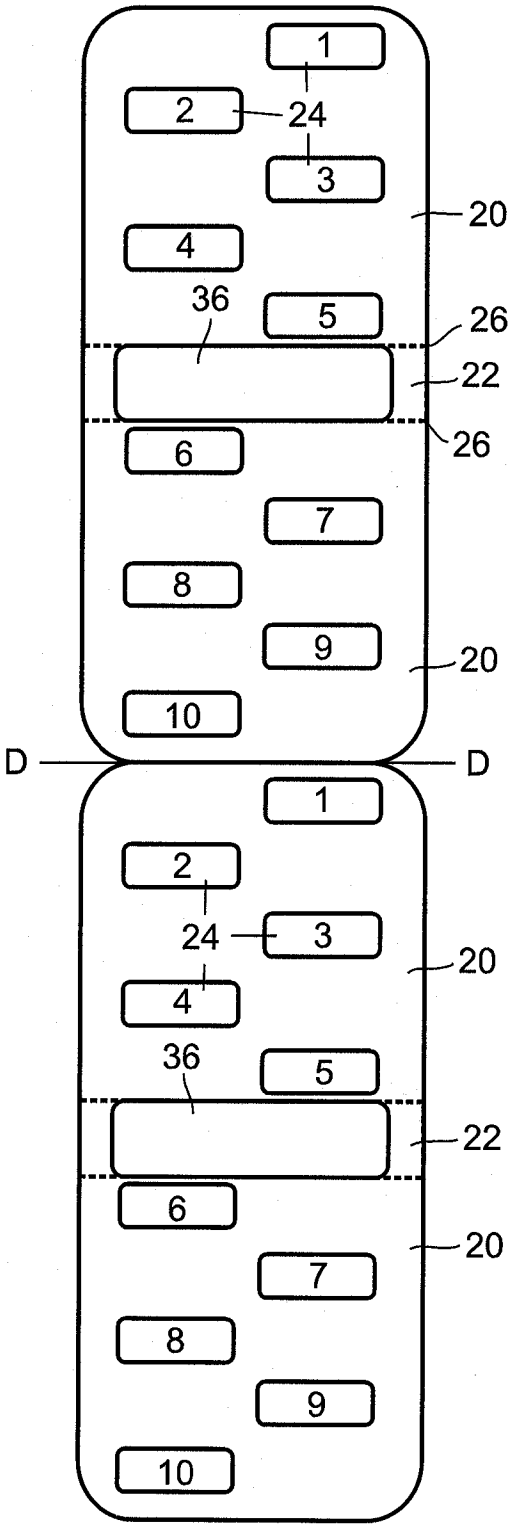



FIG. 12B

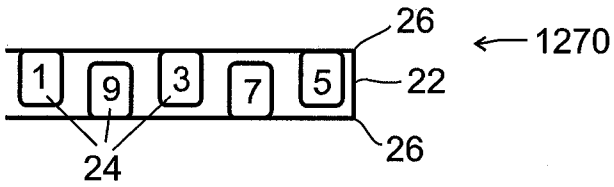
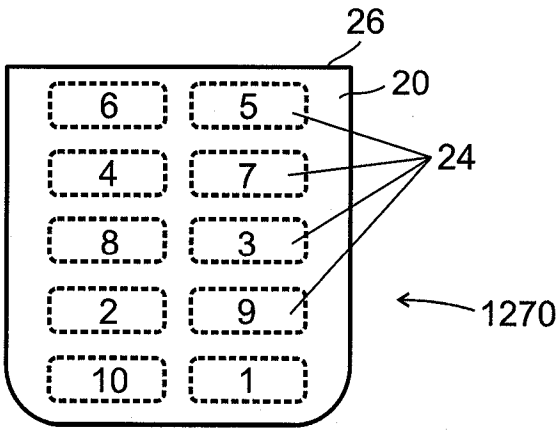



FIG. 12C



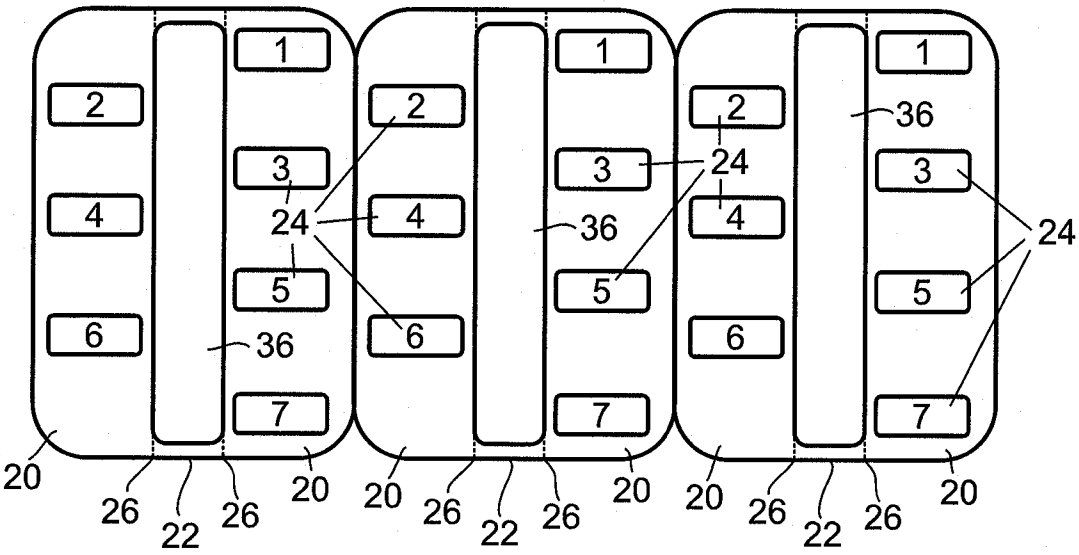



FIG. 13A

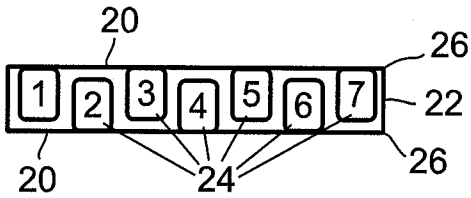



FIG. 13B

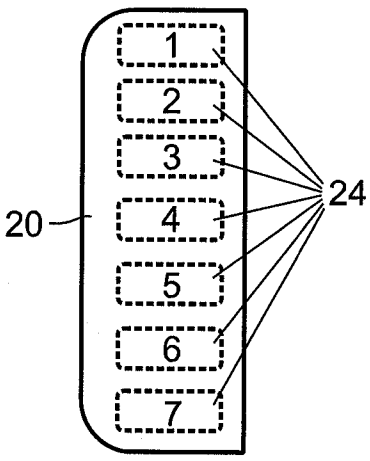



FIG. 13C

FIG. 14A

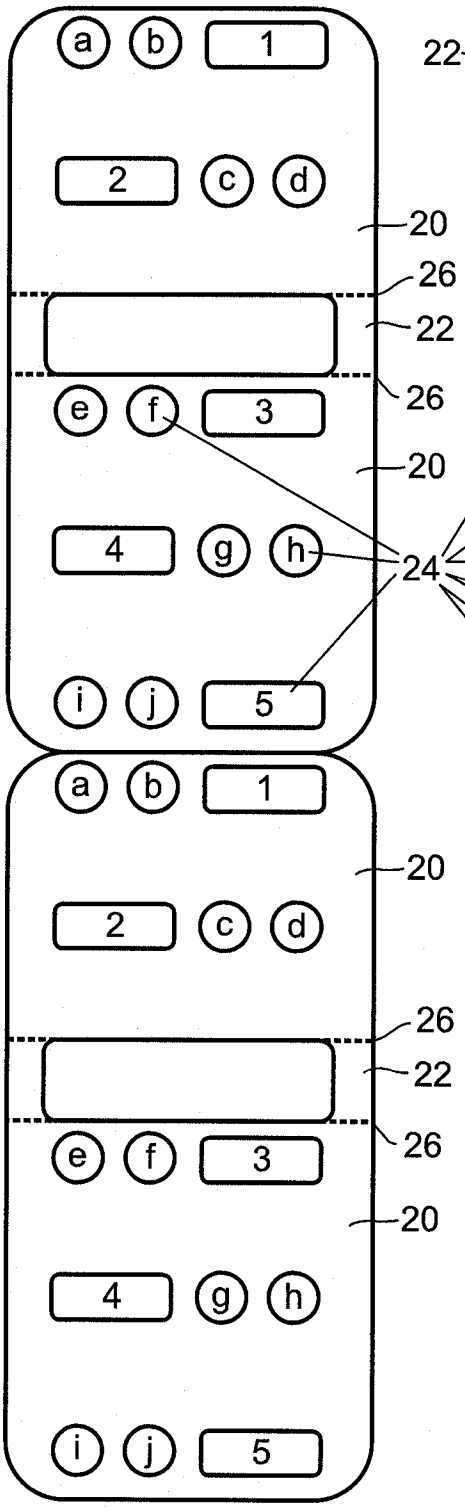



FIG. 14B

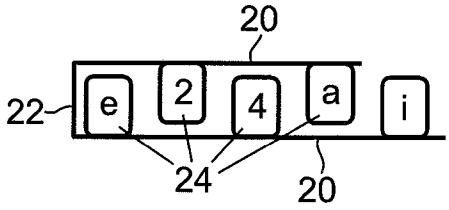
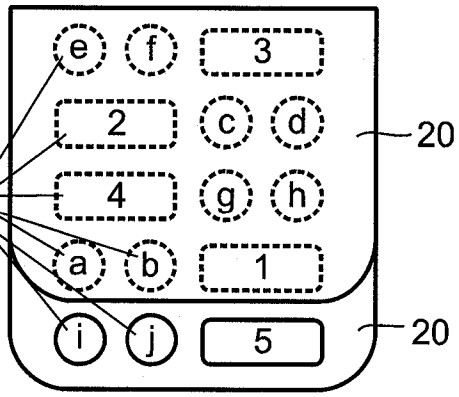



FIG. 14C



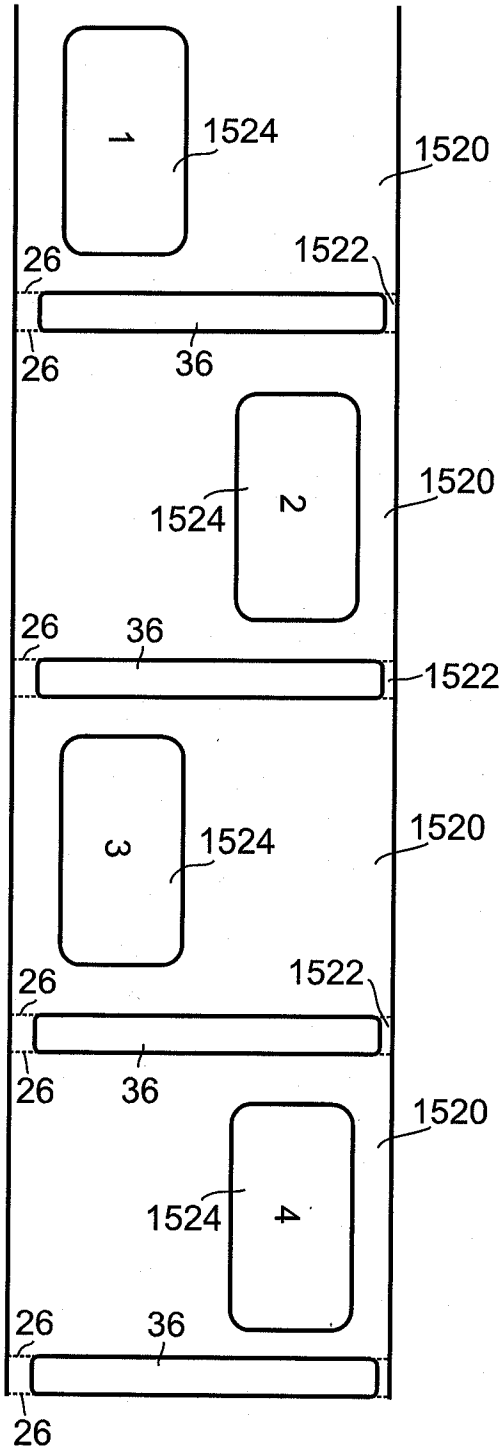



FIG. 15A

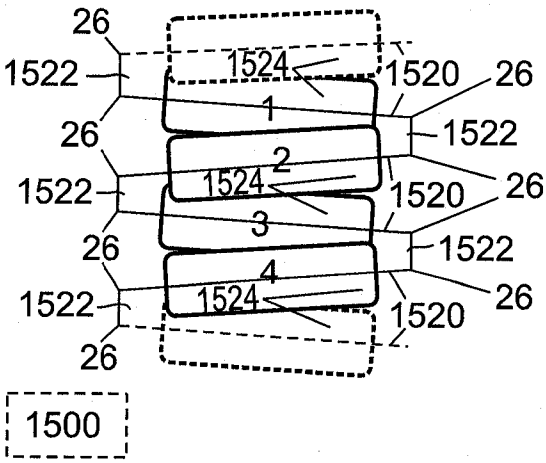



FIG. 15B

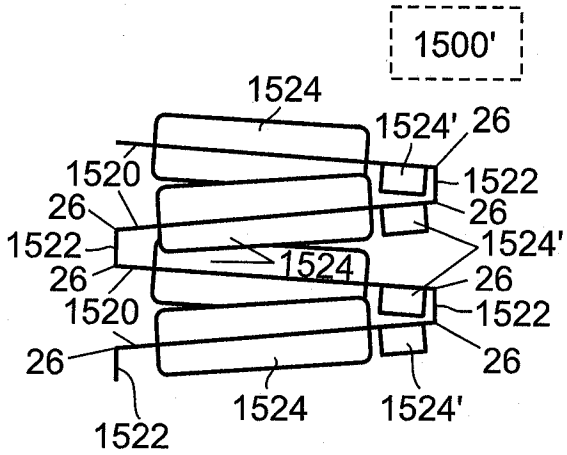



FIG. 15C

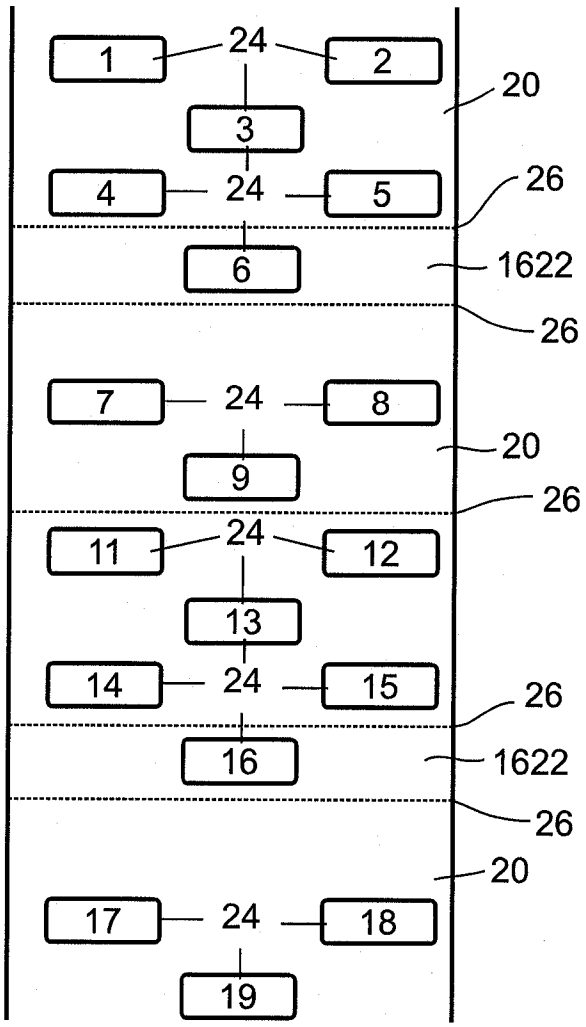



FIG. 16A

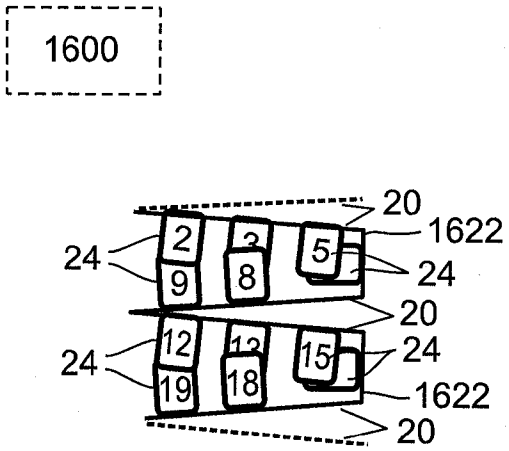



FIG. 16B

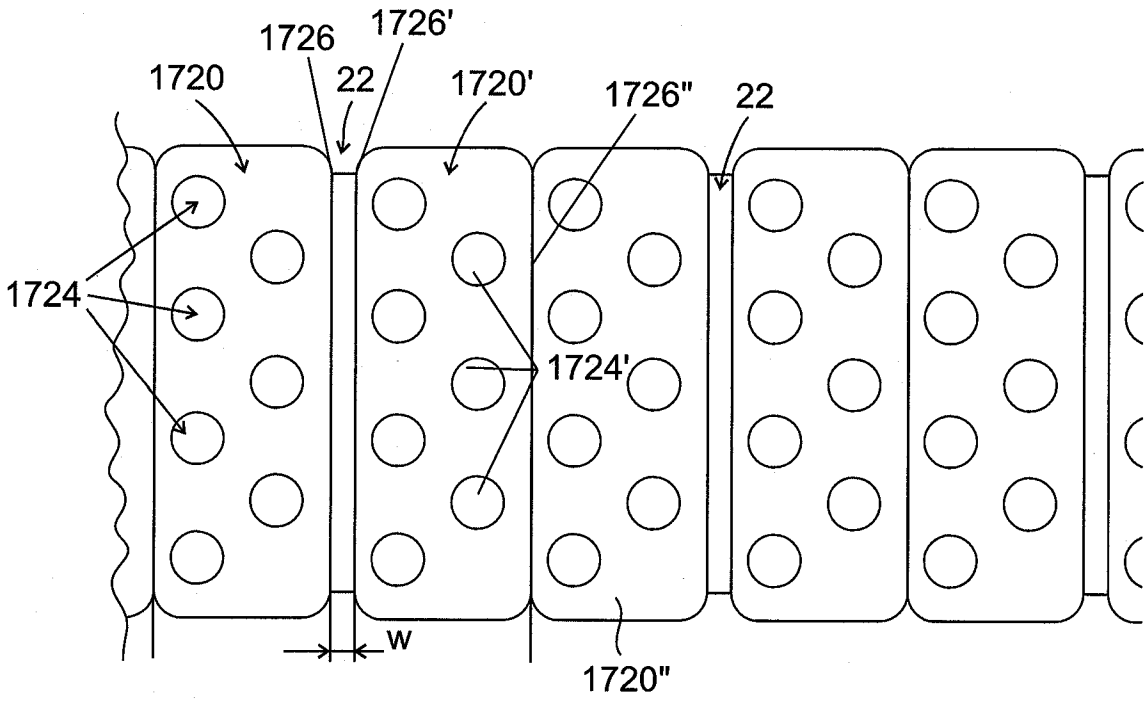



FIG. 17A

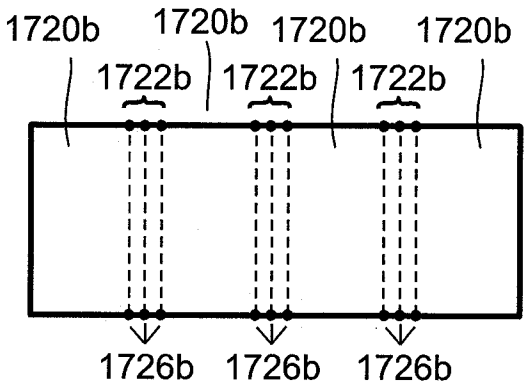



FIG. 17B

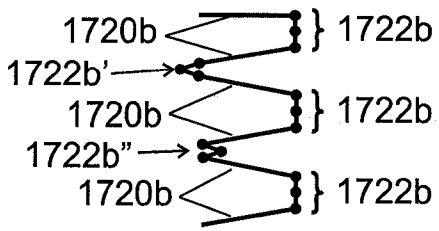



FIG. 17C

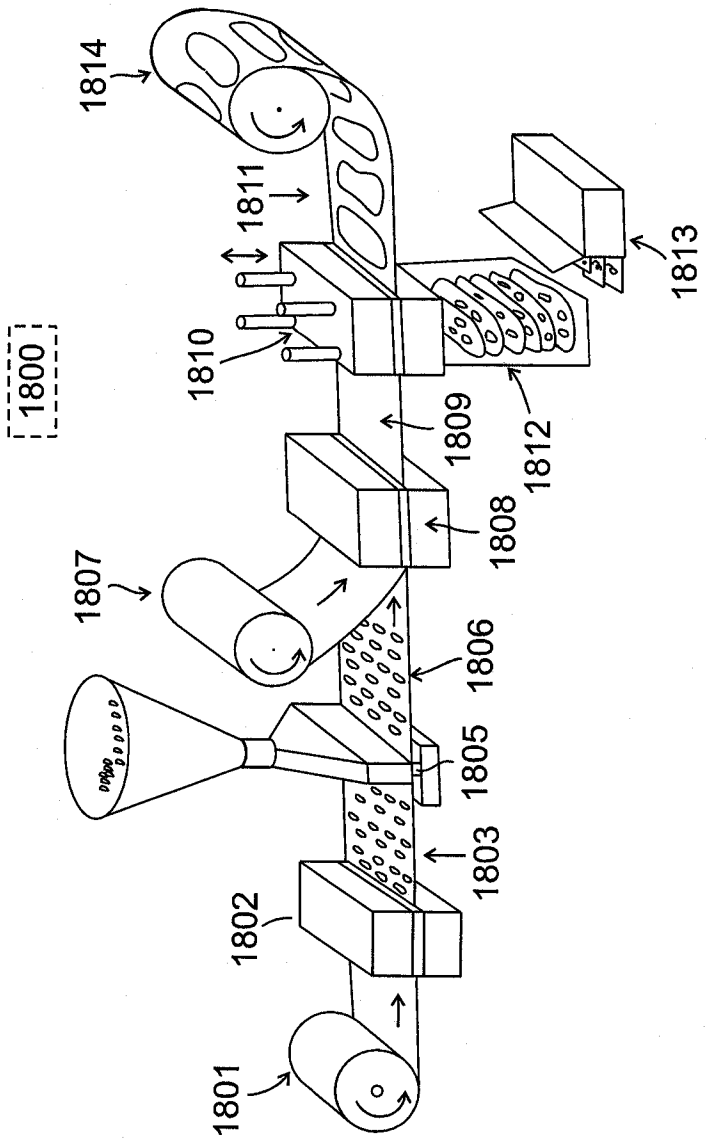
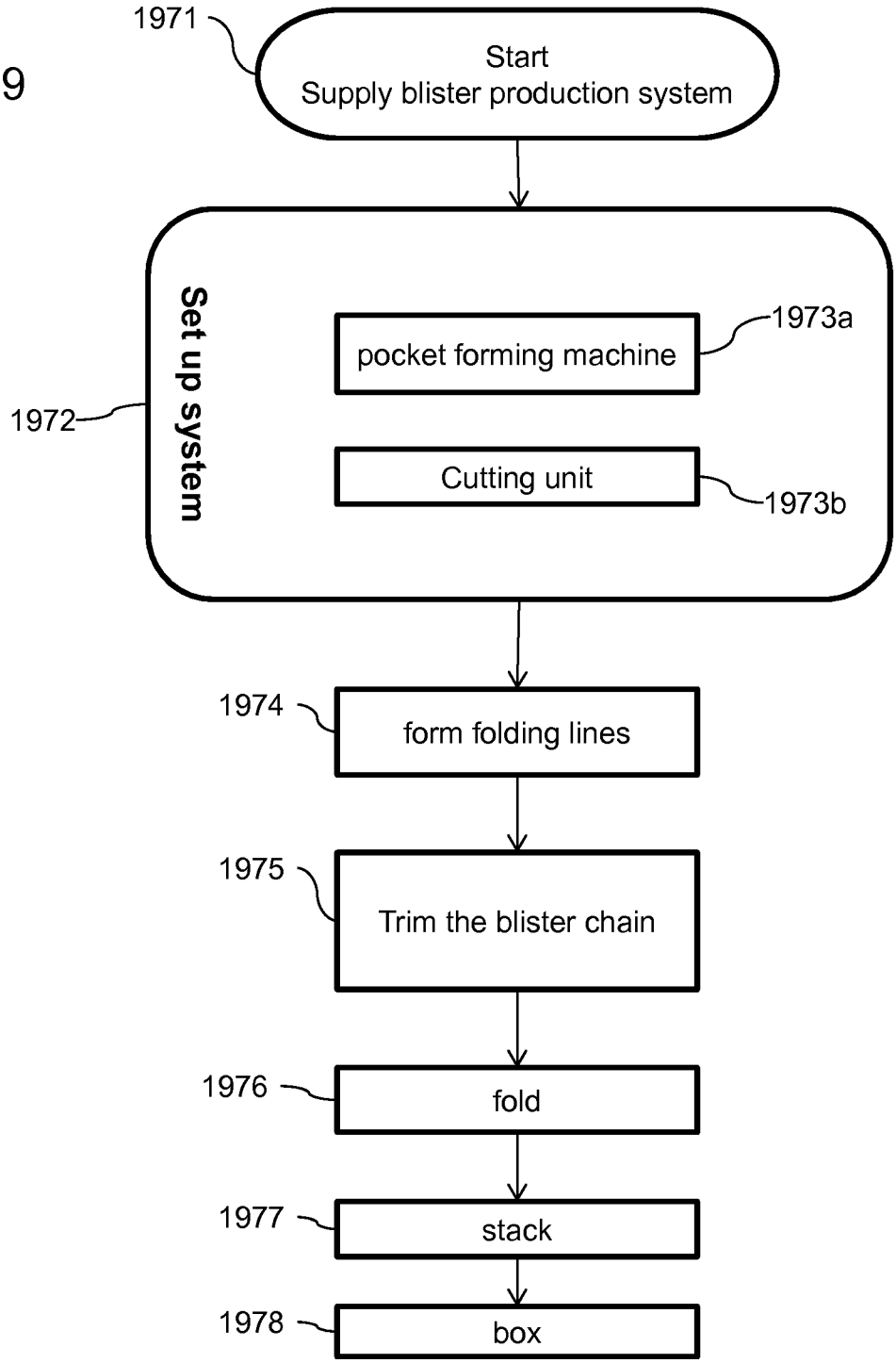

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FIG. 18

FIG. 19


1971
Start
Supply blister production system
Set up system
1972
pocket forming machine
1973a
Cutting unit
1973b
1974
form folding lines
1975
Trim the blister chain
1976
fold
1977
stack
1978
box

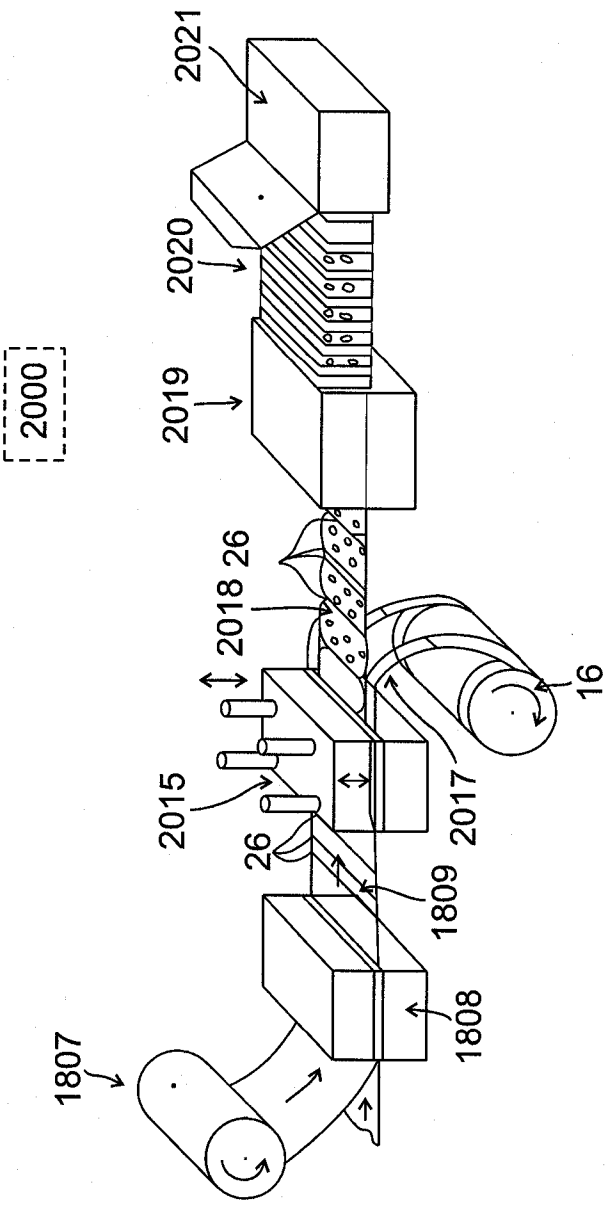



FIG. 20

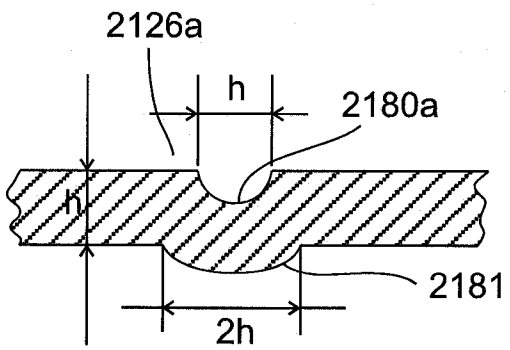



FIG. 21A

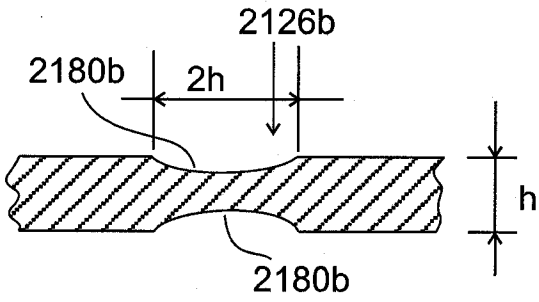



FIG. 21B

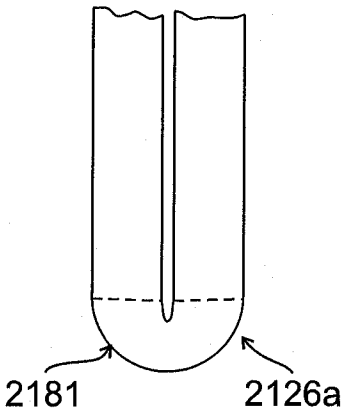



FIG. 21A'

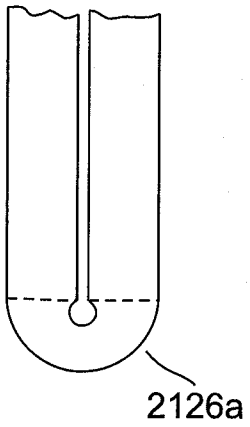



FIG. 21B'

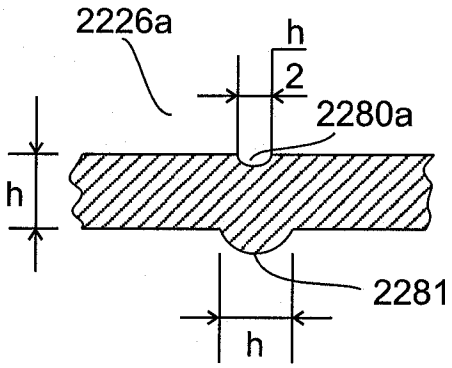



FIG. 22A

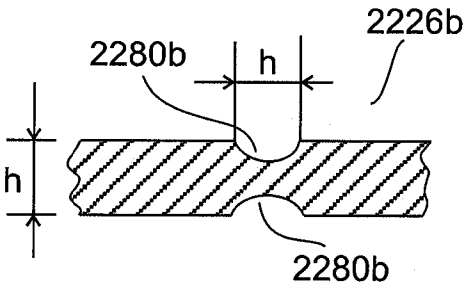



FIG. 22B

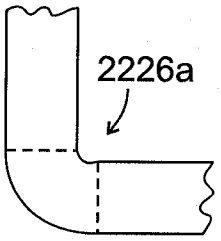



FIG. 22A'

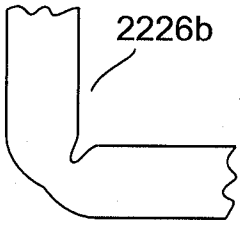



FIG. 22B'

FIG. 20

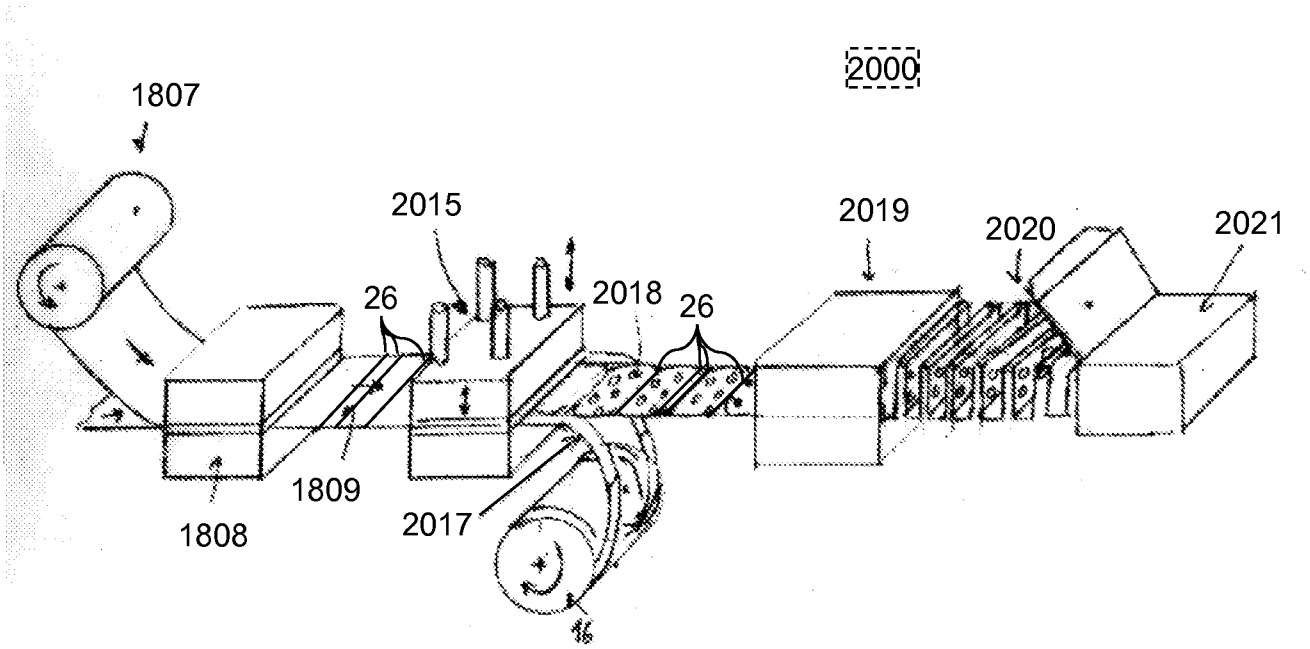


FIG. 21A

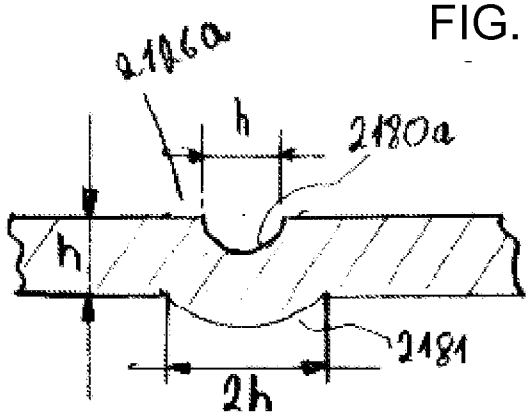



FIG. 21B

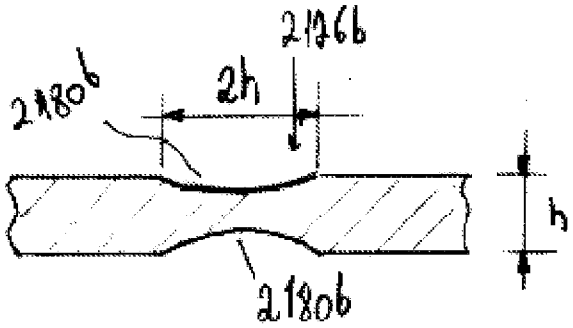



FIG. 21A'

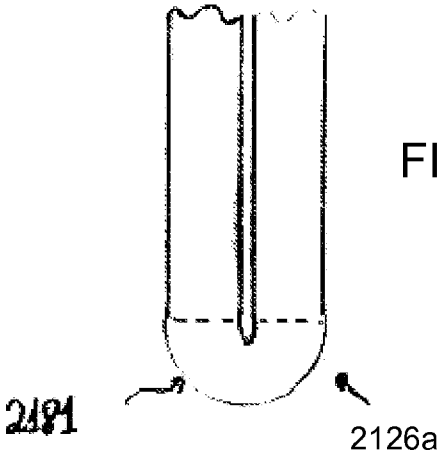



FIG. 21B'

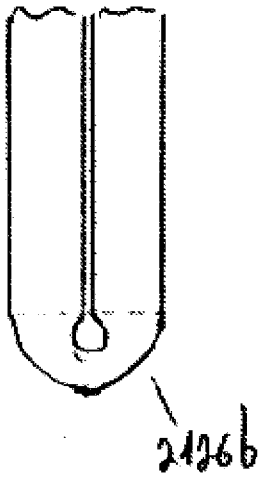


FIG. 22A

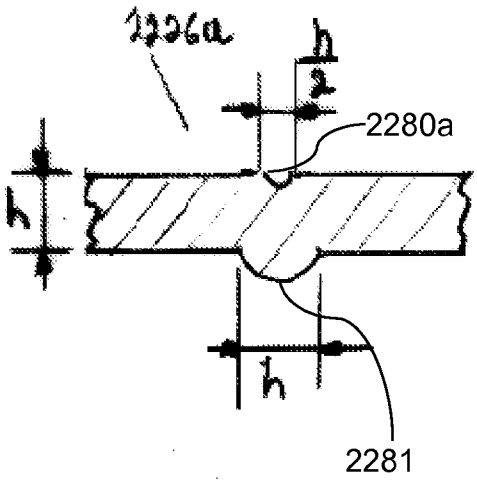
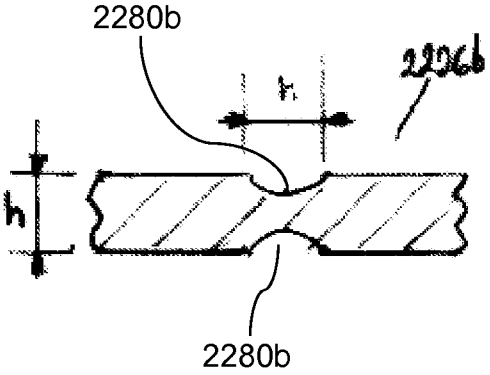



FIG. 22B



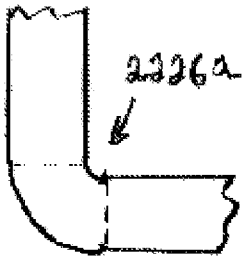




FIG. 22A'

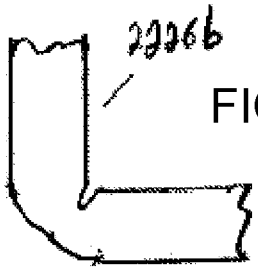



FIG. 22B'

FIG. 22C

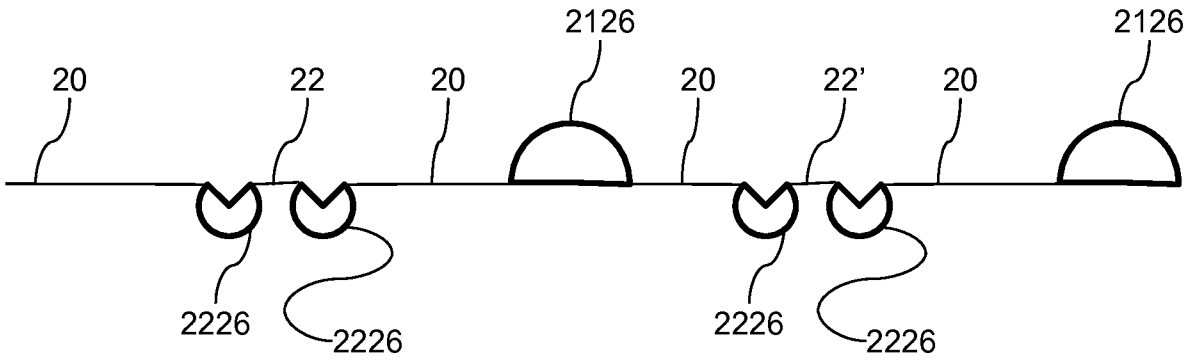
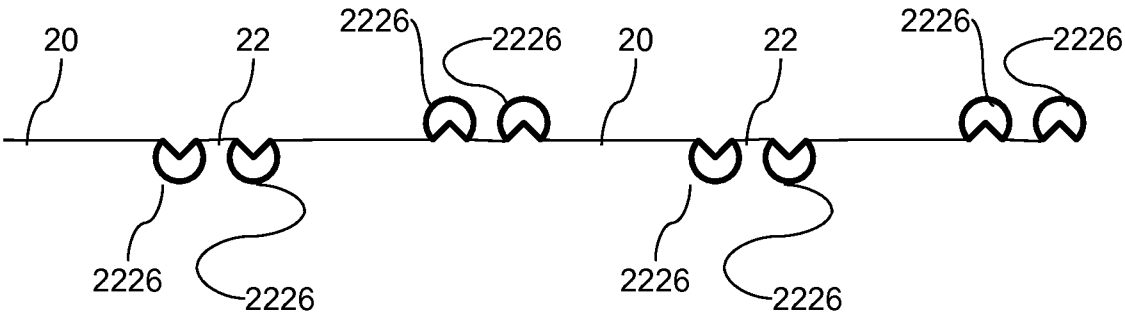



FIG. 22D



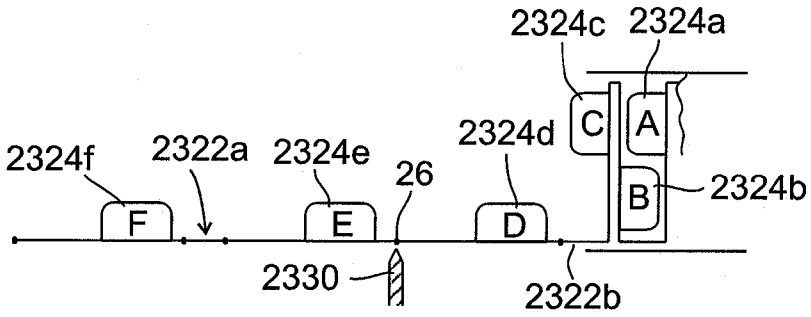



FIG. 23A

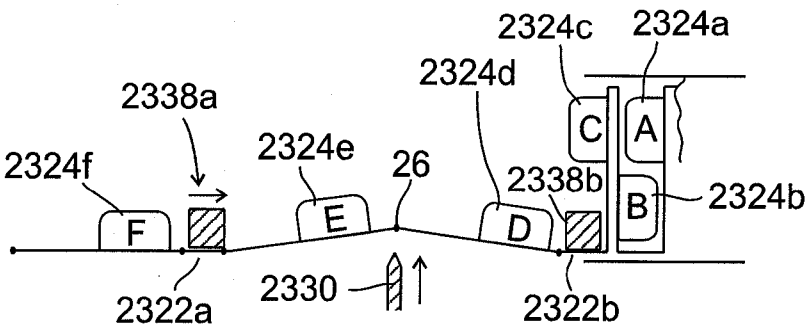



FIG. 23B

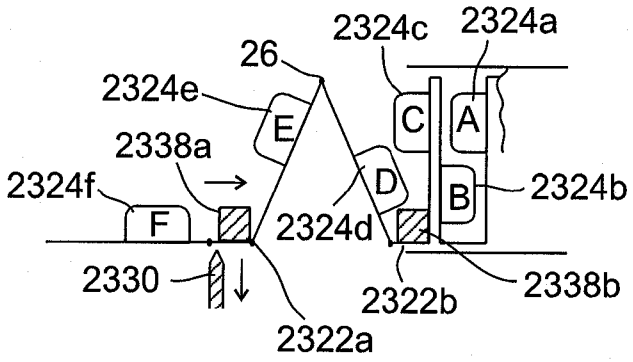



FIG. 23C

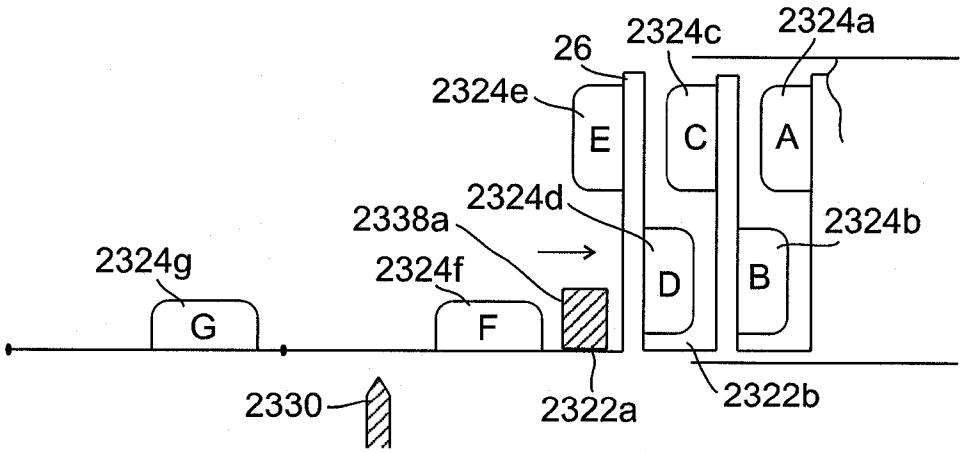



FIG. 23D

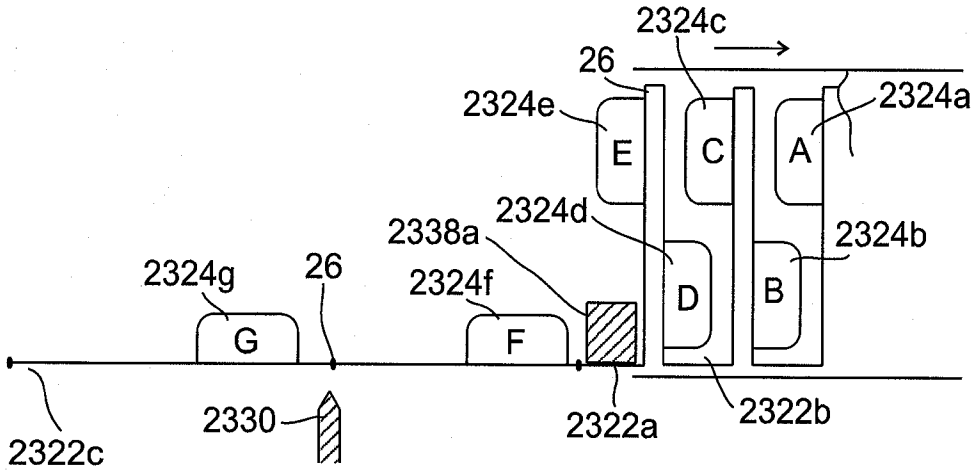



FIG. 23E

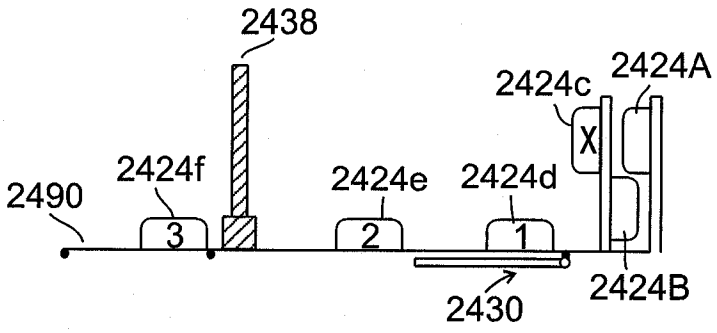



FIG. 24A

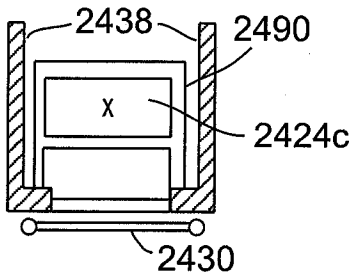



FIG. 24A'

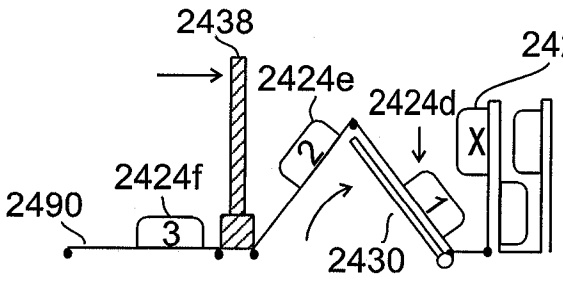



FIG. 24B

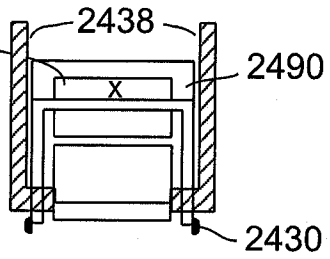



FIG. 24B'

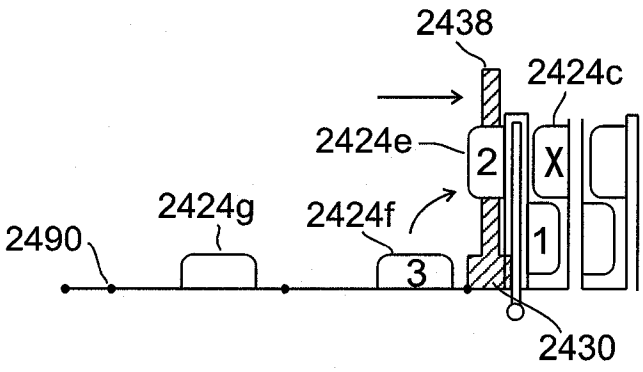



FIG. 24C

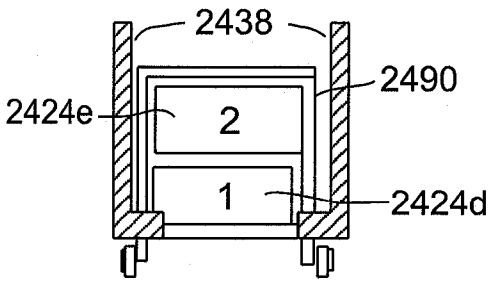



FIG. 24C'

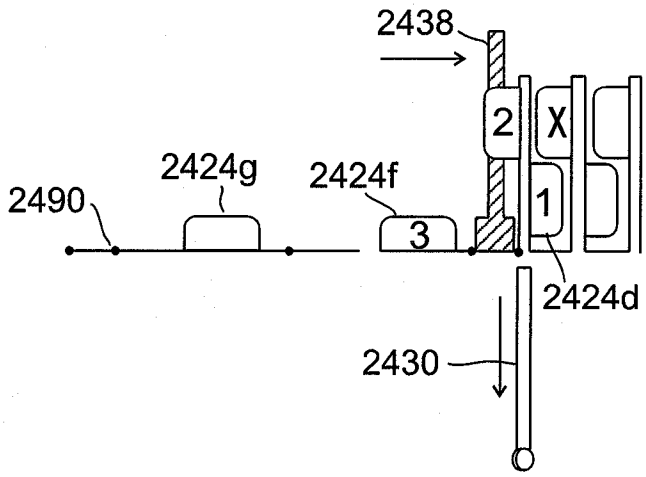



FIG. 24D

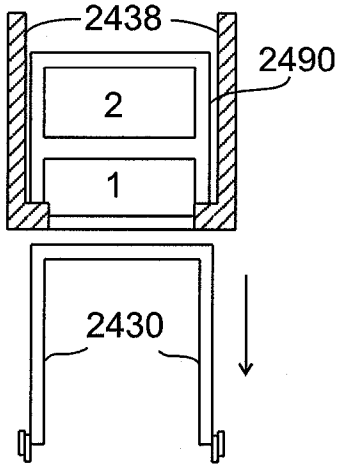



FIG. 24D'

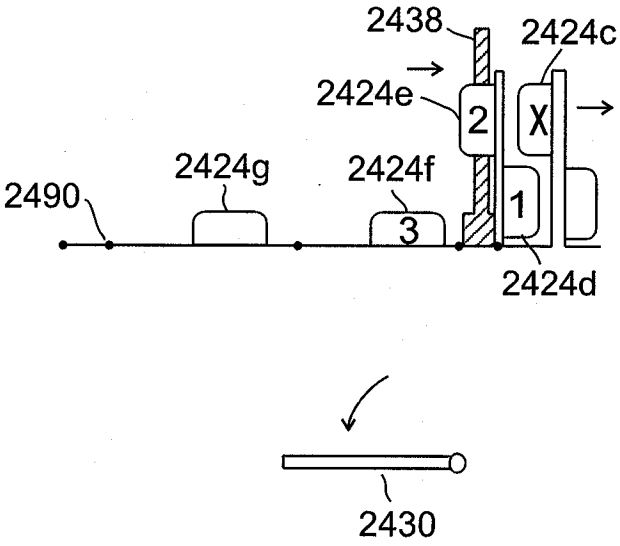



FIG. 24E

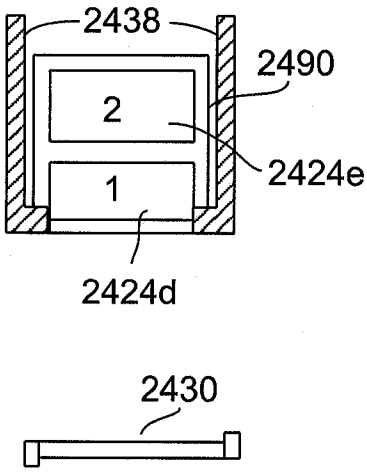



FIG. 24E'

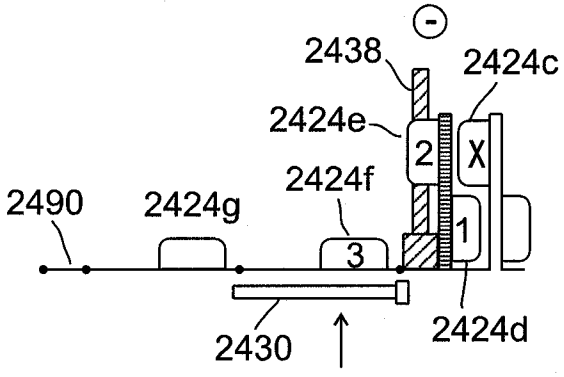



FIG. 24F

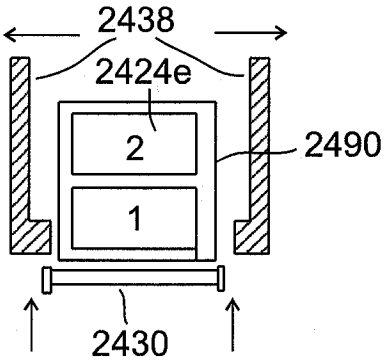



FIG. 24F'

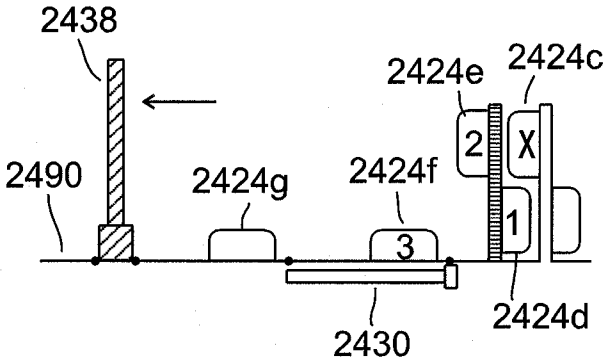



FIG. 24G

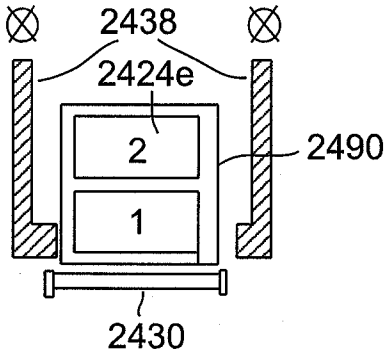



FIG. 24G'

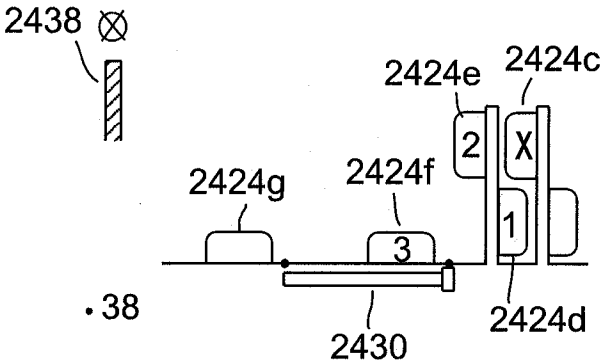



FIG. 24H

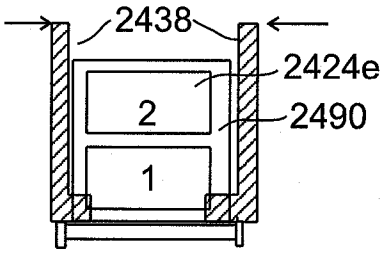



FIG. 24H'

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL2013/050185

A. CLASSIFICATION OF SUBJECT MATTER

IPC (2013.01) B65H 45/00, B65D 83/04, B29C 65/18

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC (2013.01) B65H 45/20, B65D, B29C, A61J, B31B, B65D

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

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

Databases consulted: PATENTSCOPE, USPTO, Esp@cenet, Google Patents

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | EP 1988042 A S.Ruediger<br>05 Nov 2008 (2008/11/05)<br>whole | 1-20,29,42-45 |
| Y | whole | 21-24,30-41 |
| A | whole | 25-28 |
| Y | US 6024222 B Assargren<br>15 Feb 2000 (2000/02/15)<br>abstract,figs | 21-24 |
| A | whole | 25-28 |
| Y | WO 2010004566 A Peer<br>14 Jan 2010 (2010/01/14)<br>whole | 21-24 |
| A | whole | 25-28 |

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 13 Jun 2013 | 16 Jun 2013 |
| Name and mailing address of the ISA:<br>Israel Patent Office<br>Technology Park, Bldg.5, Malcha, Jerusalem, 9695101, Israel<br>Facsimile No. 972-2-5651616 | Authorized officer<br>GUTKIN Solomon<br><br>Telephone No. 972-2-5651763 |

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL2013/050185

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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| A | whole | 25-28 |
| Y | US 3659706 B John<br>02 May 1972 (1972/05/02)<br>abstract,fig.12-15 | 21-24 |
| A | US 20080302695 A Patrick<br>11 Dec 2008 (2008/12/11)<br>whole | 1-45 |
| A | US 5542235 B Horst<br>06 Aug 1996 (1996/08/06)<br>whole | 1-45 |

**INTERNATIONAL SEARCH REPORT**
Information on patent family members

International application No.
PCT/IL2013/050185

| Patent document cited search report | Publication date | Patent family member(s) | Publication Date |
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| US 6024222 B | 15 Feb 2000 | NONE | |
| WO 2010004566 A | 14 Jan 2010 | NONE | |
| US 6253920 B | 03 Jul 2001 | NONE | |
| US 3659706 B | 02 May 1972 | NONE | |
| US 20080302695 A | 11 Dec 2008 | NONE | |
| US 5542235 B | 06 Aug 1996 | NONE | |