United States Patent	12391019
Kind Code	B2
Date of Patent	August 19, 2025
Inventor(s)	Cho; Mun Fei et al.

Container and dispensing system for expanded slit paper

Abstract

A dispensing system includes a container, a roll of slit paper, and a passive tension mechanism. The container includes panels and one of the panels includes a dispensing aperture. The slit paper on the roll is in an unexpanded state. The slit paper can be transformed from the unexpanded state to an expanded state by exerting a longitudinal pulling force on the slit paper. The passive tension mechanism is in the container and arranged such that a path of the slit paper from the roll to the dispensing aperture passes through the passive tension mechanism. The passive tension mechanism is configured to induce tension in the slit paper along the path between the roll of the slit paper and the dispensing aperture such that the slit paper transforms from the unexpanded state to the expanded state along the path between the roll of the slit paper and the dispensing aperture.

Inventors: **Cho; Mun Fei (Singapore, SG), Gu; Jun (Singapore, SG), Lim; Szu Hui (Singapore, SG), Yap; Chee Keong (Singapore, SG), Guicas; George (West Melbourne, AU)**

Applicant: **FAGERDALA SINGAPORE PTE LTD** (Singapore, SG)

Family ID: **1000008766493**

Assignee: **FAGERDALA SINGAPORE PTE LTD (Singapore, SG)**

Appl. No.: **18/266300**

Filed (or PCT Filed): **December 07, 2021**

PCT No.: **PCT/SG2021/050766**

PCT Pub. No.: **WO2022/124990**

PCT Pub. Date: June 16, 2022

Prior Publication Data

Document Identifier	Publication Date

Foreign Application Priority Data

SG 10202012358Y Dec. 10, 2020

Publication Classification

Int. Cl.: **B31D5/00** (20170101); **B65H16/00** (20060101); **B65H23/26** (20060101)

U.S. Cl.:

CPC **B31D5/0065** (20130101); B65H2301/4127 (20130101); B65H2301/5124 (20130101); B65H2801/63 (20130101)

Field of Classification Search

CPC: B31D (5/0065); B65H (2301/4127); B65H (2301/5124); B65H (2801/63)

References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
5667871	12/1996	Goodrich et al.	N/A	N/A
5688578	12/1996	Goodrich	N/A	N/A
5782735	12/1997	Goodrich	83/175	B31D 1/0031
D735488	12/2014	Page et al.	N/A	N/A
D749871	12/2015	Page et al.	N/A	N/A
9376280	12/2015	Page et al.	N/A	N/A
10226907	12/2018	Goodrich	N/A	N/A
2014/0027553	12/2013	Page	242/159	B65H 23/06
2018/0222665	12/2017	Goodrich	N/A	B65D 5/02
2018/0236742	12/2017	Cheich	N/A	B31D 5/0065
2018/0281336	12/2017	Cheich	N/A	B31D 5/0065
2019/0112125	12/2018	Goodrich	N/A	B65D 5/42
2019/0193366	12/2018	Goodrich	N/A	N/A
2020/0039720	12/2019	Goodrich et al.	N/A	N/A
2020/0230908	12/2019	Goodrich	N/A	B31D 1/0031

FOREIGN PATENT DOCUMENTS

Patent No.	Application Date	Country	CPC
2877415	12/2016	EP	N/A
2017074535	12/2016	WO	N/A

Primary Examiner: Kinsaul; Anna K

Assistant Examiner: Igbokwe; Nicholas E

Background/Summary

BACKGROUND

(1) The present disclosure is in the technical field of dispensers for slit paper. More particularly, the present disclosure is directed to dispensers for slit paper having passive tension mechanisms that induce tension in the slit paper to expand the slit paper as the slit paper is dispensed.

(2) Consumers frequently purchase goods from mail-order or internet retailers, which package and ship the goods to the purchasing consumer via a postal service or other carrier. Millions of such packages are shipped each day. These items are normally packaged in small containers, such as a box or envelope. To protect the items during shipment, they are typically packaged with some form of protective dunnage that may be wrapped around the item or stuffed into the container to prevent movement of the item and to protect it from shock.

(3) Various forms of cushioning and/or void fill material have been developed, including pre-sealed air cellular materials (e.g., BUBBLEWRAP air cellular material sold by Sealed Air Corporation), inflatable air cellular materials (e.g., NEW AIR I.B. air cellular material sold by Sealed Air Corporation), low-density paper cushioning materials (e.g., paper pads formed by PROPAD paper cushioning systems sold by Sealed Air Corporation), and the like. It would be advantageous to provide dispensers of cushioning and/or void fill materials for packers to use when packaging containers for shipping.

SUMMARY

(4) This summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This summary is not intended to identify key features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

(5) In a first embodiment, a dispensing system includes a container, a roll of slit paper, and a passive tension mechanism. The container has a plurality of panels and a first panel of the plurality of panels includes a dispensing aperture. The slit paper on the roll is in an unexpanded state. The slit paper is capable of being transformed from the unexpanded state to an expanded state by exerting a longitudinal pulling force on the slit paper. The passive tension mechanism is located in the container and arranged such that a path of the slit paper from the roll of the slit paper to the dispensing aperture passes through the passive tension mechanism. The passive tension mechanism is configured to induce tension in the slit paper along the path between the roll of the slit paper and the dispensing aperture such that the slit paper transforms from the unexpanded state to the expanded state along the path between the roll of the slit paper and the dispensing aperture.

(6) In a second embodiment, the passive tension mechanism of the first embodiment is configured to induce a substantially constant amount of tension in the slit paper regardless of the amount of the slit paper remaining on the roll of the slit paper.

(7) In a third embodiment, the passive tension mechanism of any of the previous embodiments is a tortuous path tension mechanism.

(8) In a fourth embodiment, the passive tension mechanism of any of the previous embodiments includes a first rod and a second rod. The first rod is arranged such that the path of the slit paper passes around the first rod in a first direction. The second rod is arranged such that the path of the slit paper passes around the second rod in a second direction that is opposite the first direction after passing around the first rod.

(9) In a fifth embodiment, the first and second rods of the fourth embodiment are static rods that do not rotate with respect to the container.

(10) In a sixth embodiment, the first and second rods of the fourth embodiment are rollers that are configured to rotate with respect to the container.

(11) In a seventh embodiment, the dispensing system of any of the fourth to sixth embodiments is configured such that a distance between an axis of the first rod and the first panel of the container is less than or equal to a distance between an axis of the second rod and the first panel of the container.
(12) In an eighth embodiment, the dispensing system of any of the previous embodiments further includes an insertion assembly configured to be inserted into the container. The insertion assembly is configured to hold the roll of the slit paper in the container.
(13) In a ninth embodiment, the insertion assembly of the eighth embodiment includes first and second roll guides configured to hold sides of a core around which the roll of the slit paper is wound.
(14) In a tenth embodiment, the insertion assembly of the ninth embodiment comprises endcaps inserted through holes in the first and second roll guides and into the sides of the core of the roll of the slit paper.
(15) In an eleventh embodiment, each of the endcaps of the tenth embodiment includes a shaft having a proximal end and a distal end, a collar located at the proximal end of the shaft, and a plurality of slits that are parallel to an axis of the shaft and are spaced apart circumferentially around the distal end of the shaft. The distal end has a larger diameter than the proximal end. The distal end is configured to be inserted into one of the ends of the core of the roll of the slit paper. The collar is configured to abut one of the first and second roll guides.
(16) In a twelfth embodiment, the dispensing system of any of the tenth to eleventh embodiments is configured such that an outer diameter of a shaft of the endcap and an inner diameter of the core of the roll of the slit paper are dimensioned such that the endcap and the core of the roll of the slit paper have an interference fit.
(17) In a thirteenth embodiment, the dispensing system of any of the ninth to eleventh embodiments further includes a roll of interleaf paper located in the container.
(18) In a fourteenth embodiment, the insertion assembly of the thirteenth embodiment includes slots in the first and second roll guides. The slots are configured to configured to receive and hold ends of a core around which the interleaf paper is wound. The slots are further configured to permit the core of the interleaf paper to rotate with respect to the roll guides.
(19) In a fifteenth embodiment, the interleaf paper of any of the thirteenth to fourteenth embodiments is narrower than the slit paper. The insertion assembly further includes at least one spacer located on the roll of the interleaf paper and positioned between the interleaf paper and one of the first and second roll guides.
(20) In a sixteenth embodiment, the at least one spacer of the fifteenth embodiment positions the interleaf paper such that the interleaf paper is substantially centered with respect to the slit paper.
(21) In a seventeenth embodiment, the insertion assembly of the thirteenth embodiment includes slots in the first and second roll guides and a shaft extending between the slots in the first and second roll guides. A core of the roll of the interleaf paper is located around the shaft and the core of the roll of the interleaf paper is configured to rotate with respect to the shaft.
(22) In an eighteenth embodiment, the insertion assembly further includes at least one spacer located on the shaft and positioned between the roll of the interleaf paper and one of the first and second roll guides.
(23) In a nineteenth embodiment, each of the first and second roll guides and the container of any of the ninth to eighteenth embodiments are made from a fiber-based material.
(24) In a twentieth embodiment, the dispensing system of any of the previous embodiments further includes a roll of interleaf paper located in the container. A path of the interleaf paper from the roll of the slit paper to the dispensing aperture passes around the passive tension mechanism.
(25) In a twenty first embodiment, the interleaf paper and the slit paper of the twentieth embodiment are configured to be pulled through the dispensing aperture to simultaneously dispense the slit paper in the expanded state and the interleaf paper.

(26) In a twenty second embodiment, the dispensing system of any of the previous embodiments is configured such that (i) the first panel is a front panel of the container, and (ii) the plurality of panels further comprises a bottom panel, a back panel, two side panels, and a top panel.
(27) In a twenty third embodiment, the front panel of the twenty second embodiment includes a dispensing flap formed by perforated lines along the bottom and sides of the dispensing flap, and wherein the dispensing flap is configured to be pulled out to open the dispensing aperture.
(28) twenty third embodiment, the front panel of the twenty second embodiment includes a dispensing flap formed by perforated lines around a perimeter of the dispensing flap, and wherein the dispensing flap is configured to be removed to open the dispensing aperture.

Description

BRIEF DESCRIPTION OF THE DRAWING
(1) The foregoing aspects and many of the attendant advantages of the disclosed subject matter will become more readily appreciated as the same become better understood by reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein:
(2) FIG. **1** depicts an embodiment of slit paper material in an unexpanded state;
(3) FIGS. **2**A and **2**B depict front and side views, respectively, of an embodiment of the slit paper material shown in FIG. **1** in an expanded state;
(4) FIG. **3** depicts a perspective view of an embodiment of a dispensing system capable of dispensing expanded slit paper, in accordance with the embodiments disclosed herein;
(5) FIG. **4** depicts an exploded perspective view of the embodiment of the dispensing system shown in FIG. **3**, in accordance with the embodiments disclosed herein;
(6) FIG. **5**A depicts an embodiment of an endcap that is usable in the dispensing system shown in FIGS. **3** and **4**, in accordance with the embodiments disclosed herein;
(7) FIG. **5**B depicts another embodiment of an endcap that is usable in the dispensing system shown in FIGS. **3** and **4**, in accordance with the embodiments disclosed herein;
(8) FIG. **6**A depicts a front cross-sectional view of the dispensing system shown in FIGS. **3** and **4**, including the insertion assembly after having been inserted into the container, in accordance with the embodiments disclosed herein;
(9) FIG. **6**B depicts a partial front cross-sectional view of the insertion assembly shown in FIG. **6**A, in accordance with the embodiments disclosed herein;
(10) FIG. **6**C depicts a partial front cross-sectional view of another embodiment of an insertion assembly, in accordance with the embodiments disclosed herein;
(11) FIG. **7** depicts a side cross-sectional view of the dispensing system shown in FIGS. **3** and **4** and an embodiment of the paths of the slit paper and the interleaf paper from their respective rolls to the dispensing slot, in accordance with the embodiments disclosed herein;
(12) FIG. **8** depicts a side cross-sectional view of an alternative embodiment of the dispensing system shown in FIGS. **3** and **4** and another embodiment of the paths of the slit paper and the interleaf paper from their respective rolls to the dispensing slot, in accordance with the embodiments disclosed herein;
(13) FIG. **9** depicts a perspective view of the dispensing system shown in FIGS. **3** and **4** while the slit paper and the interleaf paper are being dispensed through the dispensing slot, in accordance with the embodiments disclosed herein;
(14) FIG. **10** depicts a partially-hidden perspective view of the dispensing system shown in FIGS. **3** and **4** while the slit paper and the interleaf paper are being dispensed through the dispensing slot, in accordance with the embodiments disclosed herein;
(15) FIG. **11** depicts a perspective view of an embodiment of a dispensing system capable of

dispensing expanded slit paper with the dispensing system in a closed condition, in accordance with the embodiments disclosed herein; and

(16) FIG. **12** depicts a perspective view of the dispensing system shown in FIG. **11** with the dispensing system in an open condition, in accordance with the embodiments disclosed herein.

DETAILED DESCRIPTION

(17) FIG. **1** depicts an embodiment of slit paper material **10** in an unexpanded state. The slit paper material **10** includes a web **12** of paper or other fiber-based material. In some embodiments, the web **12** is a web of kraft paper. The slit paper material **10** includes rows of slits **14**. The slits **14** extend generally in a transverse direction (labelled as the direction t in the drawing) and the slits **14** are arranged in rows that also extend generally in the transverse direction. In the depicted embodiment, each row of slits **14** is offset from the adjacent rows to form a pattern of the rows that repeats generally in the longitudinal direction (labelled as the direction/in the drawing). In the unexpanded state, the slit paper material **10** is generally flat and the slit paper material **10** can be stored in a compact configuration. For example, the slit paper material **10** can be wound into a roll (e.g., around a core), fanfolded into a fanfolded stack, and the like.

(18) The slit paper material **10** can also be in an expanded state. FIGS. **2**A and **2**B depict front and side views, respectively, of an embodiment of the slit paper material **10** in an expanded state. In some embodiments, the expanded slit paper material **10** is transformed from the unexpanded state to the expanded state by exerting a longitudinal force **16** on the slit paper material **10**. The longitudinal force **16** causes the slits **14** to expand to form open cells **18**. The expansion of the slits **14** into the open cells **18** causes the web **12** to buckle and take a three-dimensional shape, as seen in FIG. **2**B. The expansion of the slits **14** into the open cells **18** also causes the length of the web **12** to expand in the longitudinal direction and the width of the web **12** to shrink in the transverse direction.

(19) After the slit paper material **10** is in the expanded state, the slit paper material **10** can be wrapped around an object. When wrapped around an object, the slit paper material **10** tends to remain in the expanded state as the wrapping of the object causes at least some portions of the slit paper material **10** to interlock and resist retraction of the slit paper material to the unexpanded state. In some embodiments, an interleaf paper material is layered over the slit paper material **10** and wrapped around the object with the slit paper material **10** to deter retraction of the slit paper material **10**. As used herein, an “object” may comprise a single item or a grouping of several distinct items. Further, an object may include any accompanying informational items, such as a packing slip, tracking code, a manifest, an invoice, a machine-readable identifier (e.g., a bar code or a quick response (QR) code) that can be sensed by a reader (e.g., a bar code scanner or a camera), or any other informational item.

(20) The use of expandable slit paper material as a cushioning material is well known. For example, U.S. Pat. No. 5,667,871, issued Sep. 16, 1997, describes the use of slit paper to package objects. In particular, the slit paper is rolled into a roll in its unexpanded state, the roll is placed in a contain, and the slit paper is pulled out of the container. As the slit paper is pulled out of the container, the longitudinal force from pulling the slit paper causes the slit paper to convert from the unexpanded state to the expanded state so that the expanded slit paper can be used as a cushioning material to wrap an object.

(21) When pulling slit paper from a roll in a container, the amount of tension in the slit paper affects the expansion of the slit paper. In one example, too little tension in the slit paper will allow the slit paper to be pulled from the roll in the unexpanded roll. In another example, too much tension in the slit paper will not permit the slit paper to be pulled from the roll without tearing the slit paper. This problem is exacerbated by the use of a roll to hold the slit paper. The amount of resistance needed in the roll to provide the appropriate amount of tension in the slit paper will vary depending on the radius of the roll. However, the radius of the roll varies based on the amount of slit paper remaining on the roll. To address this problem, variable tension devices have been

developed to vary the amount of tension in the roll. U.S. Patent Application Publication No. 2019/0193366 A1 provides an example of such a variable tensioning device.

(22) The use of variable tensioning devices in slit paper dispensers can be problematic. First, such variable tensioning devices typically require a user to manually change the level of resistance appropriately based on the amount of slit paper remaining on the roll. This requires training for a user and experience to have the appropriate skill level to properly set the level of resistance, and any such manual operation is subject to user error. Second, variable tensioning can be complex to manufacture and install on a dispenser. Such complexity can be expensive and increase the chances of failure. Third, the materials used in variable tensioning devices are typically not easily recyclable (e.g., curbside recyclable). Having such materials on a dispenser may make the dispenser itself not easily recyclable. It would be advantageous to have a slit paper dispenser that avoids the problems with variable tensioning devices in slit paper dispensers.

(23) FIGS. **3** and **4** depict perspective and exploded perspective views, respectively, of an embodiment of a dispensing system **100** capable of dispensing expanded slit paper. The dispensing system **100** includes a container **110**. In the depicted embodiment, the container **110** is a box that includes a front panel **112**, a back panel **114**, left and right panels **116** and **118**, a bottom panel **119**, and a top panel **120**. In the depicted embodiment, the top panel **120** includes a flap **122** such that, when the top panel **120** is closed, the flap **122** can be slid behind the front panel **112** to close the container **110**. The front panel **112** also includes a tab **124** that can be inserted into a slot between the top panel **120** and the flap **122** when the top panel **120** is closed to deter opening of the top panel **120**. The front panel **112** also includes a dispensing flap **126**. In some embodiments, the dispensing flap **126** is defined by perforated lines in the front panel **112** and an end user pulls the dispensing flap **126** open (e.g., to the open position shown in FIGS. **3** and **4**) by pulling on the dispensing flap **126** to break the perforated lines. When the dispensing flap **126** is in the open position shown in FIGS. **3** and **4**, the front panel **112** has a dispensing aperture **128** through which webs (e.g., a web of slit paper) can be dispensed from the inside of the container **110**, through the dispensing aperture **128**, to the outside of the container **110**.

(24) The container **110** is configured to hold a supply of slit paper **130** in an unexpanded state. In the depicted embodiment, the container **110** holds a supply of slit paper **130** in the form of a roll of the slit paper **130**. In other embodiments, the supply of slit paper **130** can be in other forms, such as a fanfolded stack of the slit paper **130**. In some cases, it may be advantageous for the container **110** to hold another web that can be dispensed with the slit paper **130**. For example, in the depicted embodiment, the container **110** is configured to hold a supply of interleaf paper **132**. As discussed in greater detail below, the container **110** can be used to simultaneously dispense the slit paper **130** and the interleaf paper **132**. In the depicted embodiment, the roll of slit paper **130** is located on a core **134** and the roll of interleaf paper **132** is located on a core **136**. In some embodiments, the interleaf paper **132** can have information printed thereon, such as custom-printed information (e.g., advertisements, messages, logos, etc.).

(25) In the depicted embodiment, the dispensing system **100** includes an insertion assembly **140** configured to be inserted into the container **110**. The insertion assembly **140** is configured to hold the supply of slit paper **130**. In embodiments where the dispensing system **100** is also used to dispense the interleaf paper **132**, as is the case in the depicted embodiment, the insertion assembly **140** is also configured to hold the supply of interleaf paper **132**. In some embodiments, the insertion assembly **140** include roll guides **142**. The roll guides **142** are configured to hold the sides of the cores **134** and **136**. In the depicted embodiment, the roll guides **142** each include a hole through which endcaps **144** are inserted to engage the ends of the core **134**. The endcaps **144** are configure either to rotate with respect to the roll guides **142** and/or to permit the core **134** to rotate with respect to the endcaps **144** such that the slit paper **130** can be withdrawn from the roll by rotating the roll with respect to the roll guides **142** and the container **110**. In some embodiments, the endcaps **144** are configured to provide resistance (e.g., frictional resistance) to the rotation of

the core **134** such that the roll of the slit paper **130** does not rotate completely freely. Also in the depicted embodiment, the roll guides **142** include slots **146** that are configured to receive the ends of the core **136**. The slots **146** in the roll guides **142** are configured to permit the core **136** to rotate with respect to the roll guides **142** such that the interleaf paper **132** can be withdrawn from the roll by rotating the roll with respect to the roll guides **142** and the container **110**.

(26) In some embodiments, the interleaf paper **132** is narrower than the slit paper **130**. In some embodiments, it may be advantageous for the interleaf paper **132** to be centered with respect to the slit paper **130**. In the depicted embodiment, the insertion assembly **140** includes spacers **148** located around the core **136**. Each of the spacers **148** is located between the roll of the interleaf paper **132** and one of the roll guides **142**. In the depicted embodiment, the spacers **148** have substantially the same width such that the roll of the interleaf paper **132** is centered with respect to the slit paper **130**. It will be apparent that the spacers **148** could have different widths such that the interleaf paper **132** is not centered with respect to the slit paper **130**. It will be also understood that only one spacer could be used such that the roll of the interleaf paper **132** is side-justified with respect to the slit paper **130**.

(27) FIG. **5**A depicts an embodiment of one of the endcaps **144** that is usable in the dispensing system **100**. The endcap **144** includes a collar **150** and a shaft **152** extending from the collar **150**. In use, the shaft **152** of the endcap **144** can be pushed through the hole in the roll guide **142** until the collar abuts the roll guide **142** and the shaft **152** of the endcap **144** can be inserted into the core **134** of the roll of the slit paper **130**. In the depicted embodiment, the distal end of the shaft **152** (i.e., the end opposite the collar **150**) is larger in diameter than the proximal end of the shaft **152** (i.e., the end at the collar **150**). The proximal end of the shaft **152** includes ridges **153** configured to engage the hole in the roll guides **142** to deter rotational movement of the endcap **144** with respect to the roll guides **142** after the endcap **144** is inserted into the hold in the roll guides **154**. The distal end of the shaft **152** also has slits **154** that parallel to an axis of the shaft **152** and are spaced apart circumferentially around the distal end of the shaft **152**. The portions of the shaft **152** between the slits **154** are tension fingers **156**. When the tension fingers **156** engage the inner surface of the core **134**, the tension fingers **156** exert a tension force on the core **134** to deter respective movement of the core **134** and the endcap **144** and to increase friction between the core **134** and the endcap **144**. In some cases, the outer diameter of the shaft **152** of the endcap **144** and the inner diameter of the core **134** are dimensioned such that the endcap **144** and the core **134** have an interference fit.

(28) FIG. **5**B depicts another embodiment of an endcap **144′** that is usable in the dispensing system **100**. The endcap **144′** includes a collar **150′** and a shaft **152′** extending from the collar **150′**. In use, the shaft **152′** of the endcap **144′** can be pushed through the hole in the roll guide **142** until the collar abuts the roll guide **142** and the shaft **152′** of the endcap **144′** can be inserted into the core **134** of the roll of the slit paper **130**. In the depicted embodiment, the distal end of the shaft **152′** (i.e., the end opposite the collar **150′**) is larger in diameter than the proximal end of the shaft **152′** (i.e., the end at the collar **150′**). The proximal end of the shaft **152′** includes ridges **153′** configured to engage the hole in the roll guides **142′** to deter rotational movement of the endcap **144′** with respect to the roll guides **142′** after the endcap **144′** is inserted into the hold in the roll guides **154′**. The distal end of the shaft **152′** also has slits **154′** that parallel to an axis of the shaft **152′** and are spaced apart circumferentially around the distal end of the shaft **152′**. The portions of the shaft **152′** between the slits **154′** are tension fingers **156′**. When the tension fingers **156′** engage the inner surface of the core **134′**, the tension fingers **156′** exert a tension force on the core **134** to deter respective movement of the core **134** and the endcap **144′** and to increase friction between the core **134** and the endcap **144′**.

(29) In the depicted embodiment, the shaft **152′** includes a narrow section **158′** configured to increase the tension applied by the tension fingers **156′** to the core **134**. In some cases, the core **134** into which the endcap **144′** is inserted has deformities in shape (e.g., dents). In some cases, having a greater number of tension fingers **156′** (e.g., eight tension fingers **156′** instead of the six tension

fingers **156** in the endcap **144**) can allow the endcap **144′** to be inserted into the core **134** while the greater number of tension fingers **156′** allows the tension fingers **156′** to independently adjust to accommodate the deformities in the core **134**.

(30) FIGS. **6**A and **7** depict front cross-sectional and side cross-sectional views, respectively, of the dispensing system **100**, including the insertion assembly **140** after having been inserted into the container **110**. In the depicted embodiment, the insertion assembly **140** is arranged such that the roll of the slit paper **130** and the roll of the interleaf paper **132** are substantially aligned in the front-to-back direction (i.e., the direction shown from right to left when viewing FIG. **7**). For example, the axes of the rolls of the slit paper **130** and the interleaf paper **132** are the same distances from the front panel **112** and the axes of the rolls of the slit paper **130** and the interleaf paper **132** are the same distances from the back panel **114**. It will be understood that the axes of the rolls of the slit paper **130** and the interleaf paper **132** could be offset from each other in the front-to-back direction. For example, the axis of the roll of the interleaf paper **132** could be farther away from the back panel **114** and closer to the front panel **112** than the axis of the roll of the slit paper **130**.

(31) FIG. **6**B depicts a partial front cross-sectional view of the insertion assembly **140**. In the depicted embodiment, the core **136** is wider than the interleaf paper **132** and extends into the slots **146** of the roll guides **142**. The spacers **148** are located around the core **136** of the interleaf paper **132**. In this embodiment, the interleaf paper **132** is unwound by pulling on the interleaf paper **132** to cause the core **136** to rotate with respect to the slots **146** and the roll guides. FIG. **6**C depicts a partial front cross-sectional view of another embodiment of an insertion assembly **140′**. The insertion assembly **140′** is similar to the insertion assembly **140** except that the insertion assembly **140′** includes a core **136′** of the interleaf paper **132** that had a similar width to the interleaf paper **132** itself. The insertion assembly **140′** also includes a shaft **137** that extends into the slots **146** of the roll guides **142**. The core **136′** of the interleaf paper **132** is located around the shaft **137** and the core **136′** is configured to rotate with respect to the shaft **137**. The spacers **148** are also located around the shaft **137**. In this embodiment, the interleaf paper **132** is unwound by pulling on the interleaf paper **132** to cause the core **136′** to rotate with respect to the shaft **137**. In some cases, the arrangement of the insertion assembly **140′** may be preferable because it may be easier to properly align the interleaf paper **132** on the core **136′** because they have substantially similar widths than to align the interleaf paper **132** on the core **136** when they have substantially different widths.

(32) An embodiment of the paths of the slit paper **130** and the interleaf paper **132** from their respective rolls to the dispensing aperture **128** is depicted in FIG. **7**. In the depicted embodiment, the slit paper **130** is withdrawn from the bottom of the roll and the slit paper **130** passes through a passive tension mechanism **160** before the slit paper **130** passes through the dispensing aperture **128**. The passive tension mechanism **160** is arranged to induce tension in the slit paper **130** as the slit paper **130** passes through the passive tension mechanism **160**. In some embodiments, the passive tension mechanism **160** is configured to induce a substantially constant amount of tension in the slit paper **130** regardless of the amount of the slit paper **130** remaining on the roll. In some embodiments, the term “passive” is used to mean one or more of an unpowered tension mechanism, a non-variable tension mechanism, and/or a tension mechanism that is not adjustable by an end user of the dispensing system.

(33) In some embodiments, the passive tension mechanism **160** is a tortuous path tension mechanism. In the depicted embodiment, the passive tension mechanism **160** includes a rod **162** and a rod **164**. The slit paper **130** is fed from the bottom of the roll of the slit paper **130** around the back, top, and front of the rod **162** in a first direction (e.g., clockwise when viewing FIG. **7**). The slit paper **130** is then fed around the back and bottom of the rod **164** in a second direction that is opposite the first direction (e.g., counterclockwise when viewing FIG. **7**) before passing to and through the dispensing aperture **128**. The tortuous path through the passive tension mechanism **160** causes tension to be induced in the slit paper **130** such that the slit paper expands from an unexpanded state to an expanded state during and/or after the slit paper **130** passes through the

passive tension mechanism **160**. In this way, the slit paper **130** is in the expanded state when the slit paper **130** passes through the dispensing aperture **128**. In the depicted embodiment, the profile of the tortuous path is an "S" shape.

(34) In the depicted embodiment, the rods **162** and **164** of the passive tension mechanism **160** are formed as a part of the insertion assembly **140**. In this way, as the insertion assembly **140** is inserted into the container **110**, the passive tension mechanism **160** is also inserted into the container **110**. In other embodiments, the rods **162** and **164** of the passive tension mechanism **160** can be formed as a part of the container **110** such that the passive tension mechanism **160** is not inserted into or removed from the container **110** as the insertion assembly **140** is inserted into and removed from the container **110**. In some embodiments, the rods **162** and **164** can be hollow paper core structures, such as curbside recyclable hollow paper core structures.

(35) In embodiments where the passive tension mechanism **160** includes the rods **162** and **164**, the rods **162** and **164** can take a variety of forms. In some embodiments, the rods **162** and **164** are static rods that do not rotate with respect to the container **110** and/or the insertion assembly **140**. Where the rods **162** and **164** are static rods, the movement of the slit paper **130** over the rods **162** and **164** causes friction between the slit paper **130** and the rods **162** and **164**. This friction as the slit paper **130** is being pulled induces the tension in the slit paper **130**. In some embodiments, the rods **162** and **164** are rollers that rotate with respect to the container **110** and/or the insertion assembly **140**. In some examples, the rollers rotate substantially freely with respect to the container **110** and/or the insertion assembly **140**. When the rods **162** and **164** are rollers, there will be less friction between the slit paper **130** and the rods **162** and **164** as the slit paper **130** is pulled through the passive tension mechanism **160**. However, the tortuous path of the passive tension mechanism **160** still induces tension in the slit paper **130** as the slit paper **130** is pulled through the passive tension mechanism **160**.

(36) In the embodiment shown in FIG. **7**, the axes of the rods **162** and **164** are substantially aligned in the front-to-back direction (the direction from right to left when viewing FIG. **7**). For example, the axes of the rolls of the rods **162** and **164** are the same distances from the front panel **112** and the axes of the rolls of the rods **162** and **164** are the same distances from the back panel **114**. This arrangement can provide sufficient tension in the slit paper **130** to cause the slit paper to expand to the expanded state before the slit paper **130** passes through the dispensing aperture **128**.

(37) The interleaf paper **132** is fed to the dispensing aperture **128** without inducing a significant amount of tension in the interleaf paper **132**. In the depicted embodiment, the interleaf paper **132** comes off of the bottom of the roll and proceeds on a path around the roll of the slit paper **130** and around the passive tension mechanism **160** before passing through the dispensing aperture **128**. In the depicted embodiment, the interleaf paper **132**, on its path from the roll of the interleaf paper **132** to the dispensing aperture **128**, contacts both the roll of the slit paper **130** and the portion of the slit paper **130** that passes around the rod **162**. The path of the interleaf paper **132** allows the slit paper **130** and the interleaf paper **132** to be pulled through the dispensing aperture **128** together while sufficient tension is induced in the slit paper **130** to expand the slit paper and while the interleaf paper **132** does not receive enough tension to tear or damage the interleaf paper **132**.

(38) FIG. **8** depicts a side cross-sectional view of another embodiment of the dispensing system **100**. The embodiment shown in FIG. **8** is similar to the embodiment shown in FIG. **7**, except for the positioning of the rods **162** and **164** and the path of the interleaf paper **132** from the roll of the interleaf paper **132** to the dispensing aperture **128**. In the embodiment shown in FIG. **8**, the rods **162** and **164** are not substantially aligned in the front-to-back direction. In particular, the rod **162** is located closer to the front panel **112** than the rod **164** is located to the front panel. The arrangement of the rods **162** and **164** in this embodiment (as compared to the arrangement of the rods **162** and **164** in the embodiment shown in FIG. **7**) provides an even more tortuous path for the slit paper **130** through the passive tension mechanism **160**. Such an arrangement can increase the tension induced in the slit paper **130** and/or provide greater consistency in the tension induced in the slit paper **130**.

(39) In FIG. **8**, the interleaf paper **132** feeds off of the top of the roll of the interleaf paper **132**. The interleaf paper **132** is fed around the passive tension mechanism **160** to the dispensing aperture **128**. On the path from the roll of the interleaf paper **132** to the dispensing aperture **128**, the interleaf paper **132** contacts the portion of the slit paper **130** that passes around the rod **162**, but the interleaf paper **132** does not contact the roll of slit paper. This path of the interleaf paper **132** also causes the rolls of the slit paper **130** and the interleaf paper **132** to counterrotate as the slit paper **130** and the interleaf paper **132** are withdrawn from the rolls.
(40) FIGS. **9** and **10** show perspective and partially-hidden perspective views, respectively, of the dispensing system **100** while the slit paper **130** and the interleaf paper **132** are being dispensed through the dispensing aperture **128**. The slit paper **130** and the interleaf paper **132** are being dispensed through the dispensing aperture **128** as shown in FIGS. **9** and **10** using both the embodiment of the passive tension mechanism **160** shown in FIG. **7** and the embodiment of the passive tension mechanism **160** shown in FIG. **8**. To dispense the slit paper **130** and the interleaf paper **132**, a user can grasp the ends of the slit paper **130** and the interleaf paper **132** and pull them through the dispensing aperture **128**. As this pulling force is applied, the combination of the pulling force and the tension induced by the passive tension mechanism **160** causes the slit paper **130** exiting the container **110** through the dispensing aperture **128** to be in the expanded state. The pulling force can also pull the interleaf paper **132** without ripping or tearing the interleaf paper **132**. When the user determines that sufficient amounts of the slit paper **130** and the interleaf paper **132** have been pulled out for packaging an object, the user can tear or cut both the slit paper **130** and the interleaf paper **132** to break off the slit paper **130** and the interleaf paper **132** from the webs of the slit paper **130** and the interleaf paper **132**.
(41) The embodiments of dispensing systems depicted herein include both a roll of slit paper and a roll of interleaf paper. It will be understood that, while the inclusion of the interleaf paper may be advantageous in certain circumstances, slit paper can be used without interleaf paper. Thus, the interleaf paper in all of the embodiments depicted and discussed herein will be understood to be an optional feature of the dispensing system. It will also be understood that any of the dispensing systems described herein could be modified such that the only roll held within the dispensing system is a roll of slit paper.
(42) One of the advantages of using slit paper **130** as a cushioning material is that the slit paper **130** is easily recyclable for end consumers. In many jurisdictions (e.g., municipalities, counties, etc.), slit paper can be recycled by an end user by simply placing the slit paper in curbside recycling bins. This ease of recyclability is appealing to suppliers and consumers alike who want to lessen the impact of their packaging materials on the environment. In some cases, it would also appealing not only for the slit paper itself to be easily recyclable but also for the dispenser itself to be made from easily-recyclable materials. For example, in the embodiment of the dispensing system **100**, each of the container **110**, the cores **134** and **136**, the roll guides **142**, and the spacers **148** can be made from fiber-based materials, such as cardboard, paperboard, kraft paper, cardstock, and the like. Cardboard materials may comprise corrugated cardboard, such as any of single-wall B-flute, C-flute, and/or E-flute corrugated cardboard, B/C double-wall corrugated cardboard, E/B double-wall corrugated cardboard, or any combination thereof. In this way, when the rolls of the slit paper **130** and the interleaf paper **132** are exhausted, most parts of the dispensing system **100** can be recycled in the same way that paper products are recycled. While most parts of the dispensing system **100** can be made from fiber-based materials, some of the part can be made from other materials. For example, one or more parts (e.g., the endcaps **144**) can be formed from another materials. In some embodiments, the endcaps **144** are made from plastic. In some embodiments, the rods **162** and **164** are made from one of a fiber-based material, a wood material, and/or a metal material. In some embodiments, not all components of the dispensing system **100** can be made from fiber-based materials. For example, the endcaps **144** may not work as desired if they are made from fiber-based materials. In those cases, it may be advantageous to use a polymer material that is easily recyclable

and/or formed from recycled materials, such as polypropylene. In other cases, the endcaps **144** can be omitted, such as in the case where the core **134** of the slit paper **130** extends beyond the ends of the slit paper **130** to directly engage the roll guides **142** (e.g., similar to how the core **136** of the interleaf paper **132** directly engages the roll guides **142**).

(43) In some embodiments, it may also reduce waste for the container **110** to be used to ship and/or distribute the slit paper **130** and, when included, the interleaf paper **132**. For example, the container **110** can be made from cardboard and form a cardboard box. The container can be closed for shipping and/or distributing the dispensing system **100**. The dispensing flap **126** can be formed in the front panel by perforated lines along the bottom and sides of the dispensing flap **126**. When an end user receives the dispensing system, the user can break the perforated lines of the dispensing flap **126** and pull the dispensing slot to the position shown in FIGS. **9** and **10** in order to open the dispensing aperture **128**. In some embodiments, it may be advantageous for the end of the slit paper **130** (and the end of the interleaf paper **132**, when included) to be releasably connected (e.g., taped) to the inside of the dispensing flap **126**. In this way, when the user opens the dispensing aperture **128**, the end of the slit paper **130** and/or the end of the interleaf paper **132** can easily be released and pulled through the dispensing aperture **128** to begin dispensing the slit paper **130** and/or the interleaf paper **132**. The user can then dispense the slit paper **130** until the roll is exhausted, at which point any of the recyclable materials of the dispensing system **100** can be recycled.

(44) FIGS. **11** and **12** depict perspective of an embodiment of a dispensing system **100′** capable of dispensing expanded slit paper in closed and open conditions, respectively. The dispensing system **100′** includes a container **110′**, which is a variation of the container **110**. In the depicted embodiment, the container **110′** is a box that includes the front panel **112**, the back panel **114**, the left and right panels **116** and **118**, the bottom panel **119**, the top panel **120**, and the flap **122**. In FIG. **11**, the container **110′** is in a closed condition with the top panel **120** closed. In FIG. **12**, the container **110′** is in an open condition with the top panel **120** open. The front panel **112** also includes tabs **124′** that are inserted into slots between the top panel **120** and the flap **122** when the top panel **120** is closed to deter opening of the top panel **120**. It will be apparent that any number of tabs **124′** can be used in any of the embodiments described herein.

(45) The front panel **112** also includes a dispensing flap **126′**. In some embodiments, the dispensing flap **126′** is defined by perforated lines in the front panel **112** and an end user removes the dispensing flap **126′** from the front panel **112** by tearing the perforated lines. FIG. **11** shows the dispensing flap **126′** with perforated lines around the perimeter of the dispensing flap **126′**. FIG. **12** shows the dispensing flap **126′** in the process of being removed from the front panel **112**. When the dispensing flap **126′** is full removed from the front panel **112**, the front panel **112** has a dispensing aperture **128′** through which a web of slit paper and/or a web of interleaf paper can be dispensed from the inside of the container **110′**, through the dispensing aperture **128′**, to the outside of the container **110′**. In the depicted embodiment, the dispensing system **100′** includes the supply of slit paper **130**, the supply of interleaf paper **132**, and the insertion assembly **140**.

(46) For purposes of this disclosure, terminology such as “upper,” “lower,” “vertical,” “horizontal,” “inwardly,” “outwardly,” “inner,” “outer,” “front,” “rear,” and the like, should be construed as descriptive and not limiting the scope of the claimed subject matter. Further, the use of “including,” “comprising,” or “having” and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. Unless limited otherwise, the terms “connected,” “coupled,” and “mounted” and variations thereof herein are used broadly and encompass direct and indirect connections, couplings, and mountings. Unless stated otherwise, the terms “substantially,” “approximately,” and the like are used to mean within 5% of a target value.

(47) The principles, representative embodiments, and modes of operation of the present disclosure have been described in the foregoing description. However, aspects of the present disclosure which are intended to be protected are not to be construed as limited to the particular embodiments disclosed. Further, the embodiments described herein are to be regarded as illustrative rather than

restrictive. It will be appreciated that variations and changes may be made by others, and equivalents employed, without departing from the spirit of the present disclosure. Accordingly, it is expressly intended that all such variations, changes, and equivalents fall within the spirit and scope of the present disclosure, as claimed.

Claims

1. A dispensing system, comprising: a container having a plurality of panels, wherein a first panel of the plurality of panels includes a dispensing aperture; a roll of slit paper, wherein the slit paper on the roll is in an unexpanded state, and wherein the slit paper is capable of being transformed from the unexpanded state to an expanded state by exerting a longitudinal pulling force on the slit paper; and a passive tension mechanism located in the container and arranged such that a path of the slit paper from the roll of the slit paper to the dispensing aperture passes through the passive tension mechanism; wherein the passive tension mechanism is configured to induce tension in the slit paper along the path between the roll of the slit paper and the dispensing aperture such that the slit paper transforms from the unexpanded state to the expanded state along the path between the roll of the slit paper and the dispensing aperture; wherein the passive tension mechanism includes: a first rod arranged such that the path of the slit paper passes around the first rod in a first direction, and a second rod arranged such that the path of the slit paper passes around the second rod in a second direction that is opposite the first direction after passing around the first rod; wherein the first and second rods are static rods that do not rotate with respect to the container.
2. The dispensing system of claim 1, wherein the passive tension mechanism is configured to induce a substantially constant amount of tension in the slit paper regardless of the amount of the slit paper remaining on the roll of the slit paper.
3. The dispensing system of claim 1, wherein the passive tension mechanism is a tortuous path tension mechanism.
4. The dispensing system of claim 1, wherein a distance between an axis of the first rod and the first panel of the container is less than or equal to a distance between an axis of the second rod and the first panel of the container.
5. The dispensing system of claim 1, further comprising: an insertion assembly configured to be inserted into the container, wherein the insertion assembly is configured to hold the roll of the slit paper in the container.
6. The dispensing system of claim 5, wherein the insertion assembly comprises: first and second roll guides configured to hold sides of a core around which the roll of the slit paper is wound.
7. The dispensing system of claim 6, wherein the insertion assembly comprises endcaps inserted through holes in the first and second roll guides and into the sides of the core of the roll of the slit paper.
8. The dispensing system of claim 7, wherein each of the endcaps includes: a shaft having a proximal end and a distal end, wherein the distal end has a larger diameter than the proximal end; a collar located at the proximal end of the shaft; and a plurality of slits that are parallel to an axis of the shaft and are spaced apart circumferentially around the distal end of the shaft; wherein the distal end is configured to be inserted into one of the ends of the core of the roll of the slit paper; and wherein the collar is configured to abut one of the first and second roll guides.
9. The dispensing system of claim 6, wherein each of the first and second roll guides and the container are made from a fiber-based material.
10. The dispensing system of claim 1, further comprising: a roll of interleaf paper located in the container; wherein a path of the interleaf paper from the roll of the slit paper to the dispensing aperture passes around the passive tension mechanism.
11. The dispensing system of claim 1, wherein: the first panel is a front panel of the container; and the plurality of panels further comprises a bottom panel, a back panel, two side panels, and a top

panel.
12. The dispensing system of claim 11, wherein the front panel includes a dispensing flap that is formed by one of: perforated lines along the bottom and sides of the dispensing flap, wherein the dispensing flap is configured to be pulled out to open the dispensing aperture, or perforated lines around a perimeter of the dispensing flap, wherein the dispensing flap is configured to be removed to open the dispensing aperture.
13. A dispensing system, comprising: a container having a plurality of panels, wherein a first panel of the plurality of panels includes a dispensing aperture; a roll of slit paper, wherein the slit paper on the roll is in an unexpanded state, and wherein the slit paper is capable of being transformed from the unexpanded state to an expanded state by exerting a longitudinal pulling force on the slit paper; a passive tension mechanism located in the container and arranged such that a path of the slit paper from the roll of the slit paper to the dispensing aperture passes through the passive tension mechanism; and a roll of interleaf paper located in the container; wherein the passive tension mechanism is configured to induce tension in the slit paper along the path between the roll of the slit paper and the dispensing aperture such that the slit paper transforms from the unexpanded state to the expanded state along the path between the roll of the slit paper and the dispensing aperture; wherein the insertion assembly comprises: slots in the first and second roll guides, and a shaft extending between the slots in the first and second roll guides, wherein a core of the roll of the interleaf paper is located around the shaft and the core of the roll of the interleaf paper is configured to rotate with respect to the shaft; wherein the insertion assembly further comprises: at least one spacer located on the shaft and positioned between the roll of the interleaf paper and one of the first and second roll guides.
14. The dispensing system of claim 13, wherein the slots are configured to permit the core of the interleaf paper to rotate with respect to the roll guides.
15. The dispensing system of claim 13, wherein the interleaf paper is narrower than the slit paper.
16. The dispensing system of claim 15, wherein the at least one spacer positions the interleaf paper such that the interleaf paper is substantially centered with respect to the slit paper.