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(54) **APPARATUS AND METHOD FOR PACKAGING SHEET MATERIAL**

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(57) **ABSTRACT**

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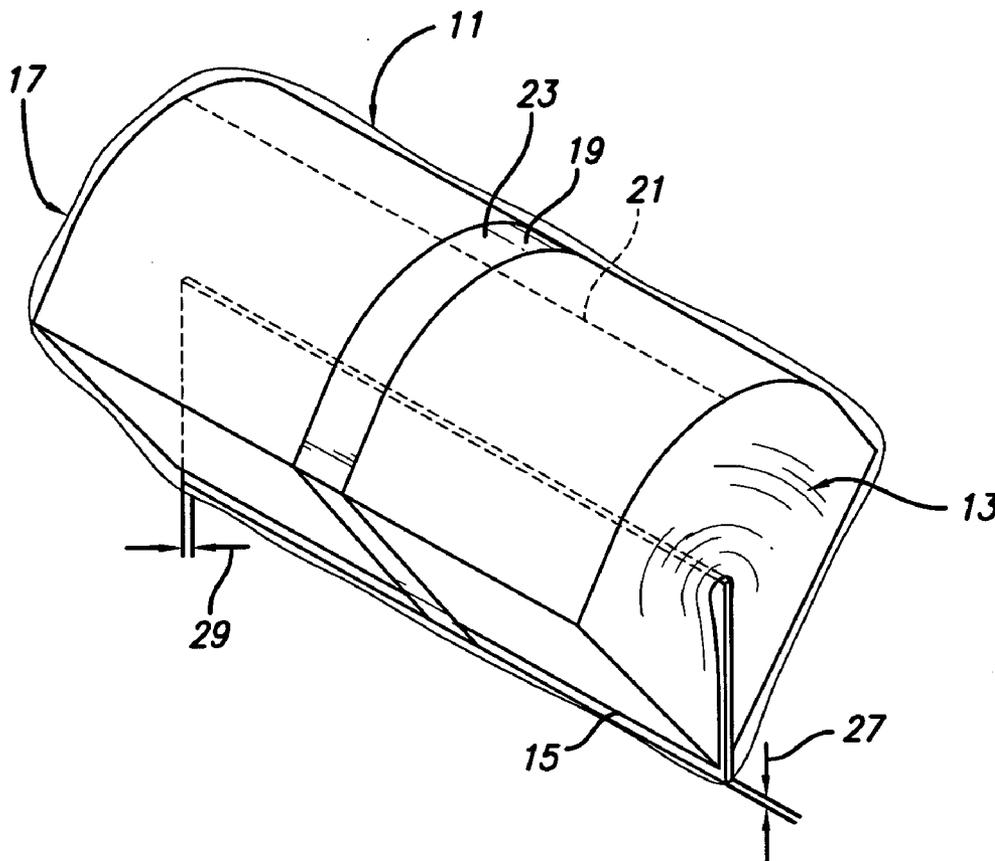
**Related U.S. Application Data**

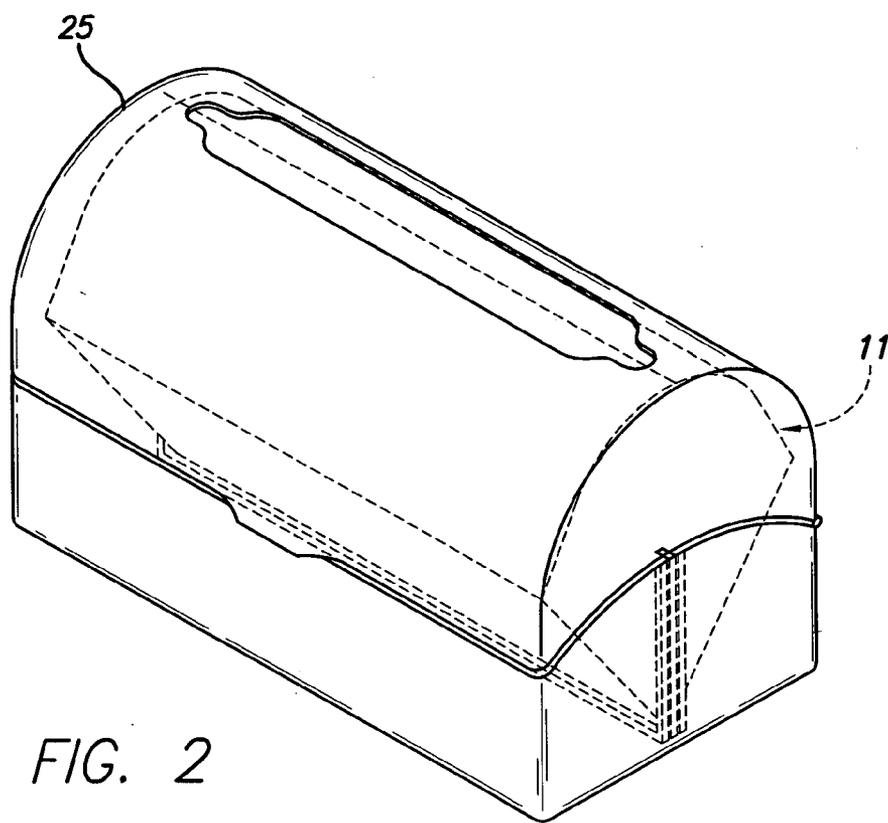
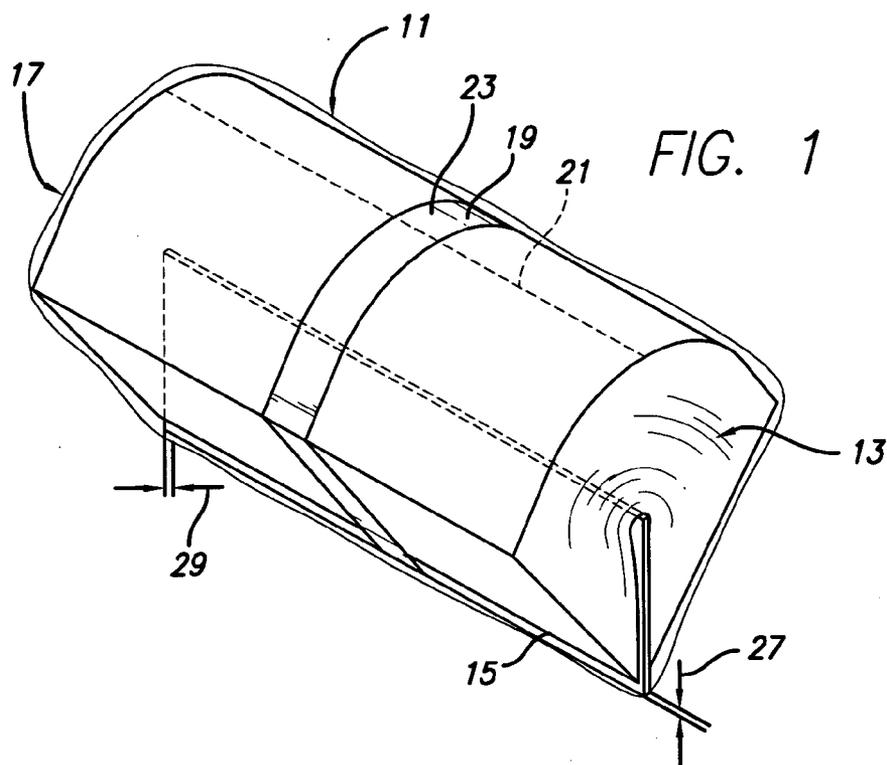
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An apparatus and method for packaging sheet material. The apparatus comprises a housing, a first forming guide, and a banding unit. The housing defines a cylindrical cavity which is open at both ends and includes a longitudinal opening which intersects the cylindrical cavity. The first forming guide is affixed to the housing adjacent the longitudinal opening and extends into the cylindrical cavity. The banding unit is disposed adjacent the downstream end of the cylindrical cavity. The method comprises imparting a U-shaped form upon a stack of sheet material by insertion of the stack into the upstream end of a cylindrical cavity. The U-shaped stack of sheet material is then moved toward and out of the downstream end of the cylindrical cavity. Finally, the U-shaped stack is banded as the stack emerges from the cylindrical cavity.





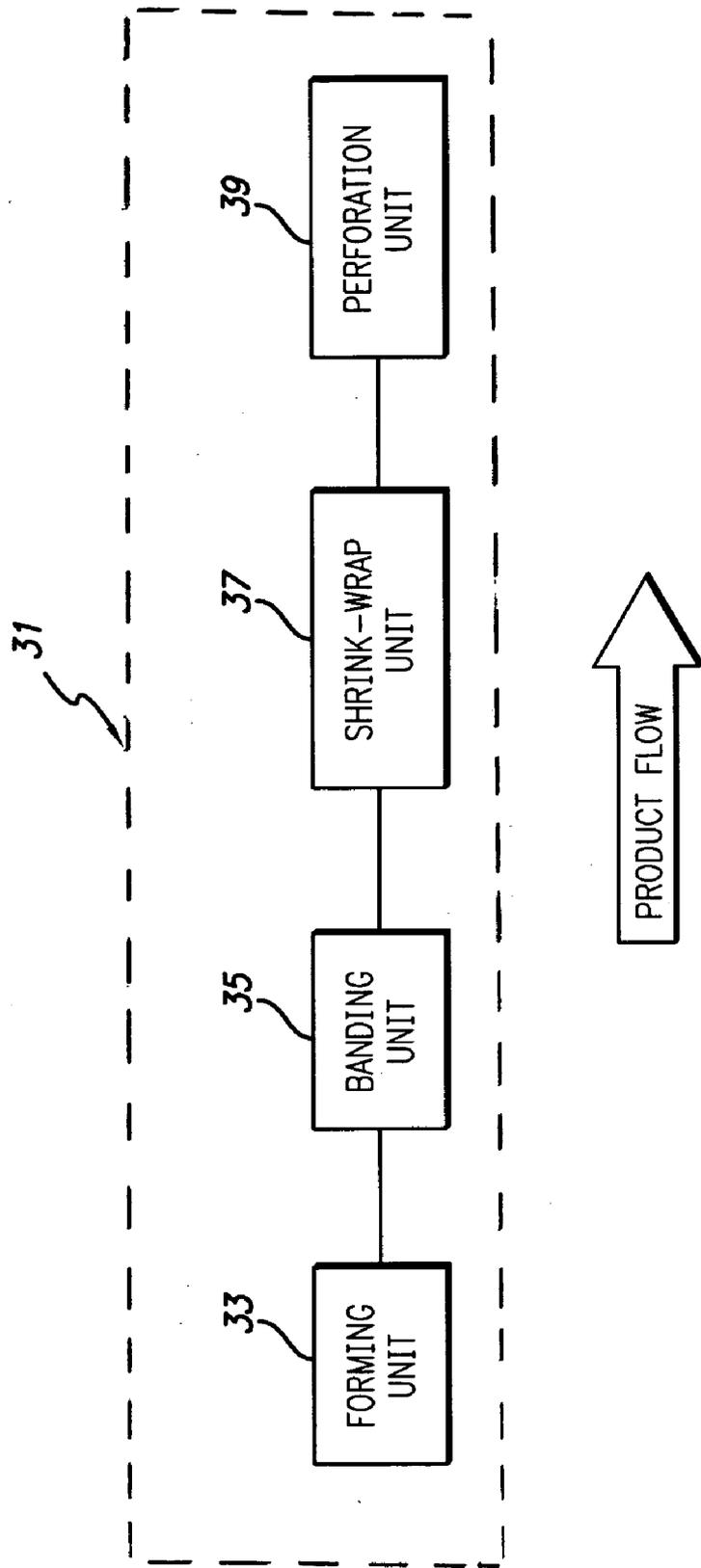


FIG. 3

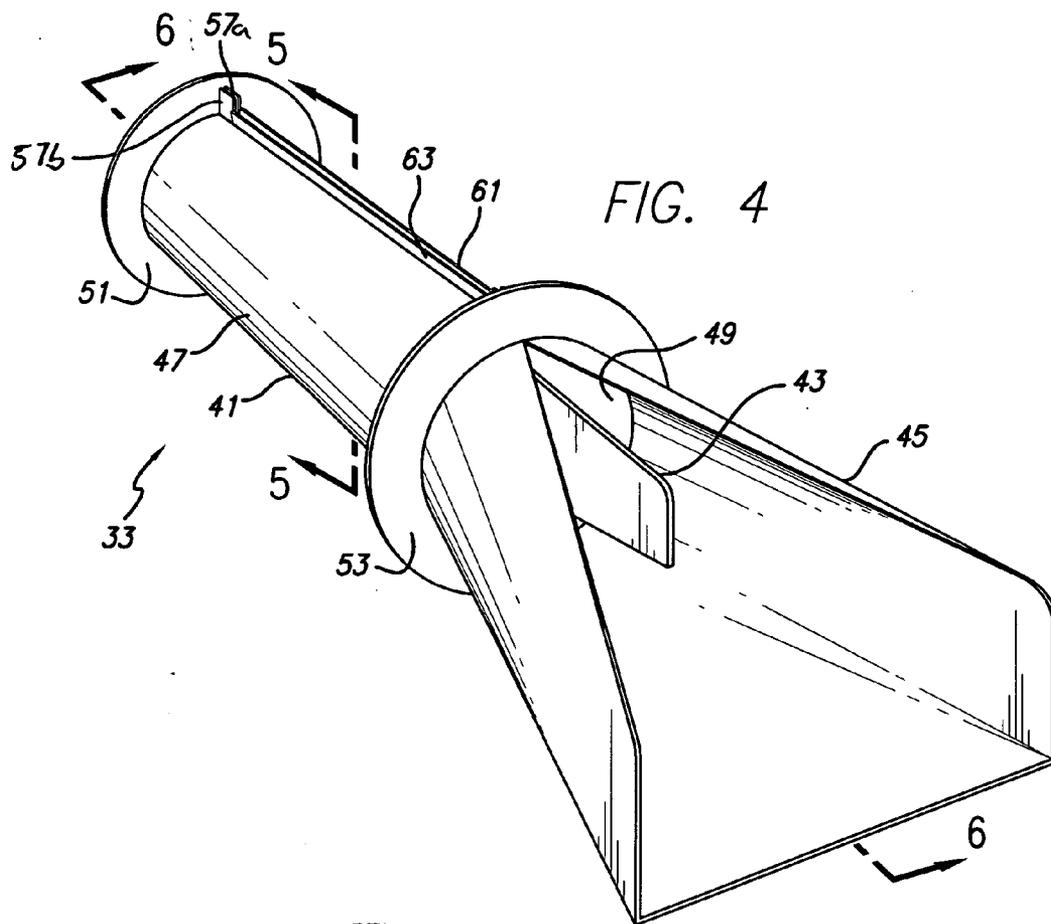


FIG. 4

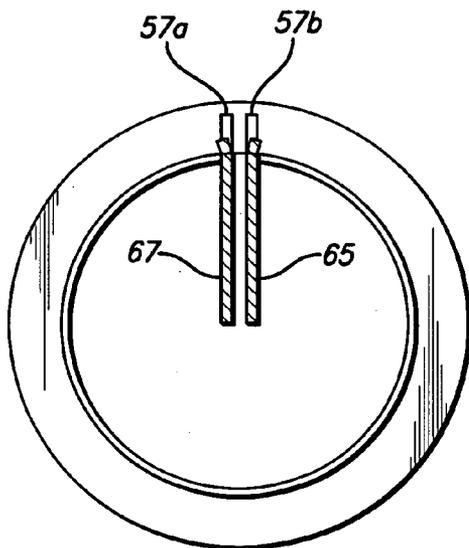


FIG. 5

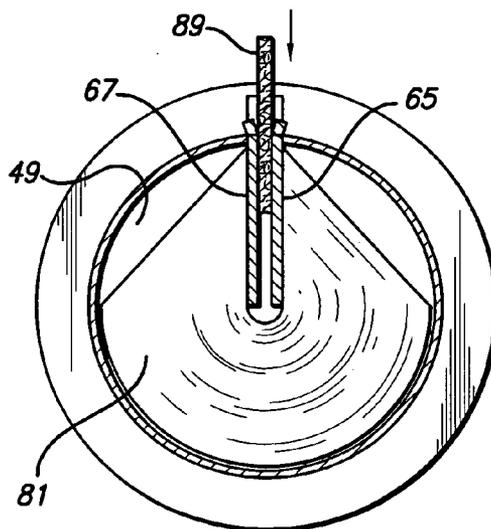


FIG. 8

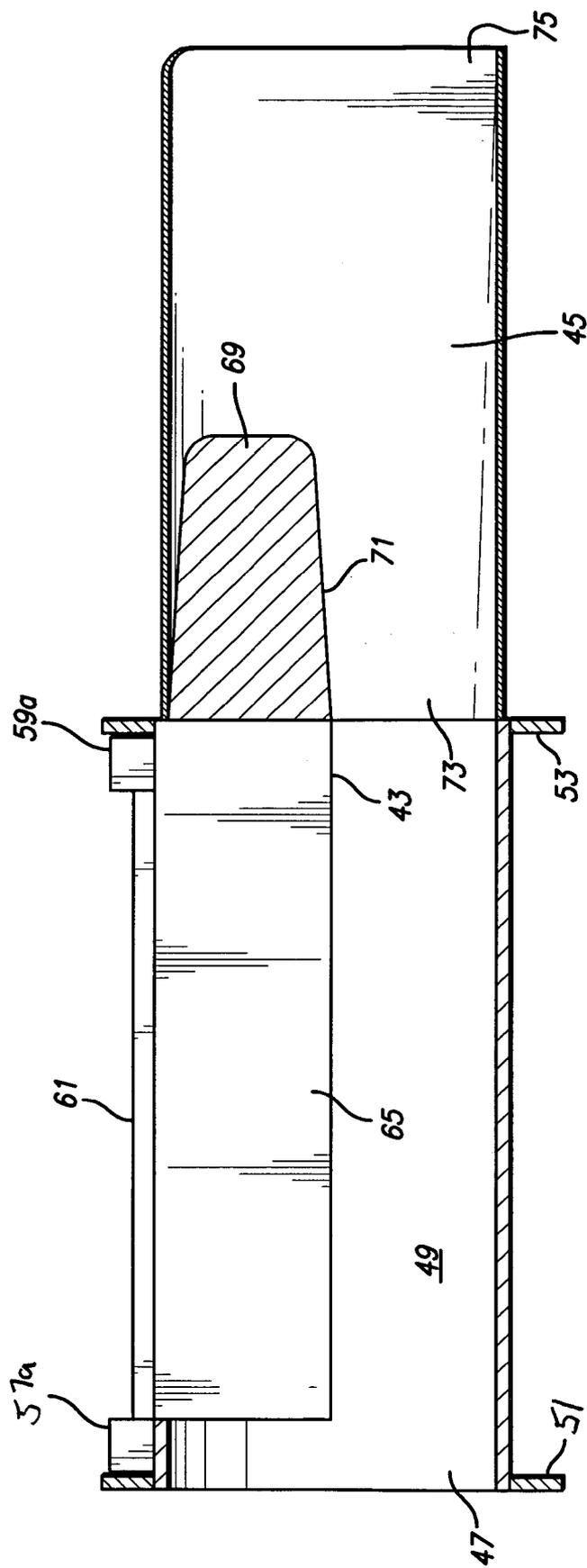
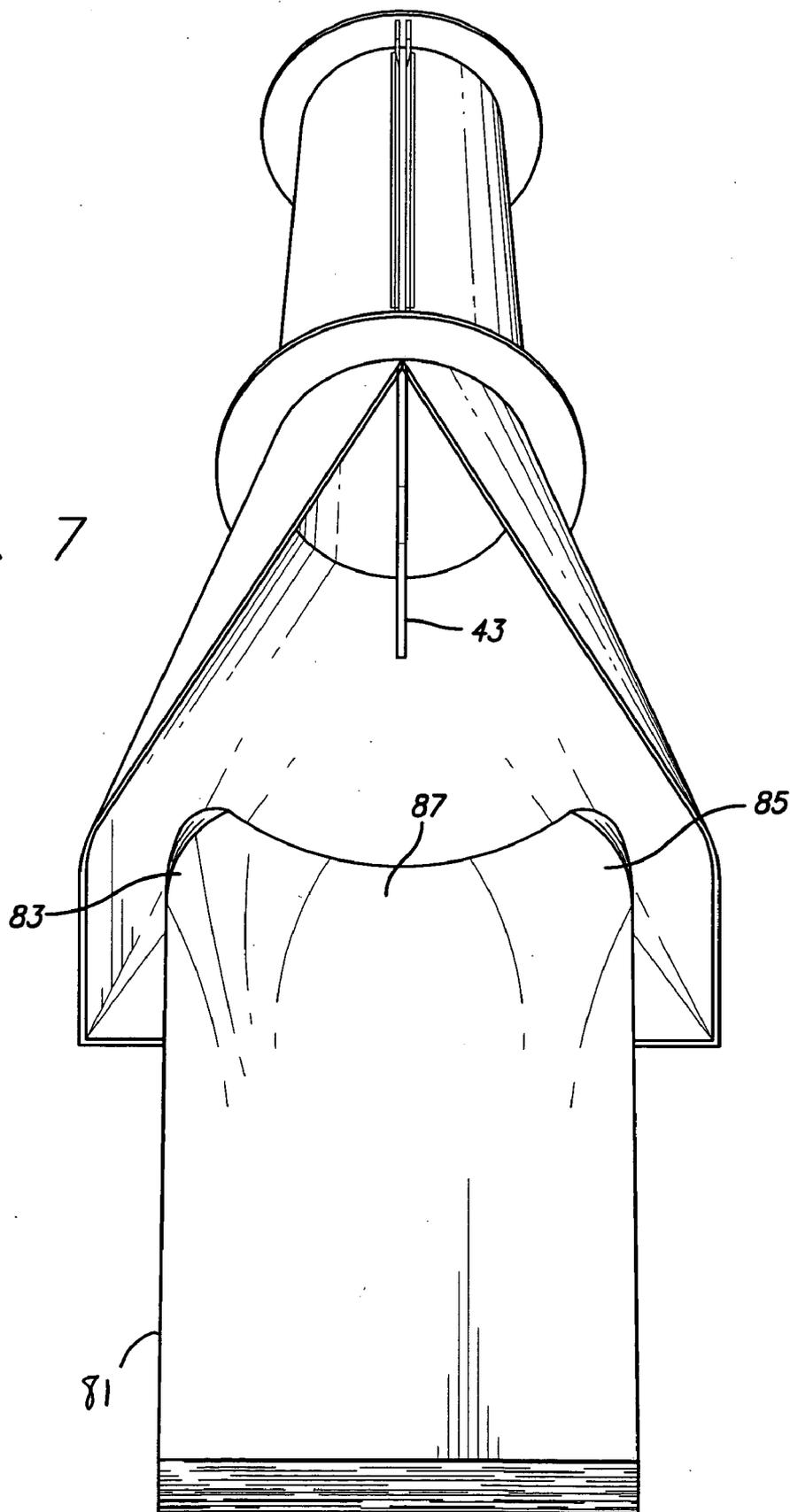
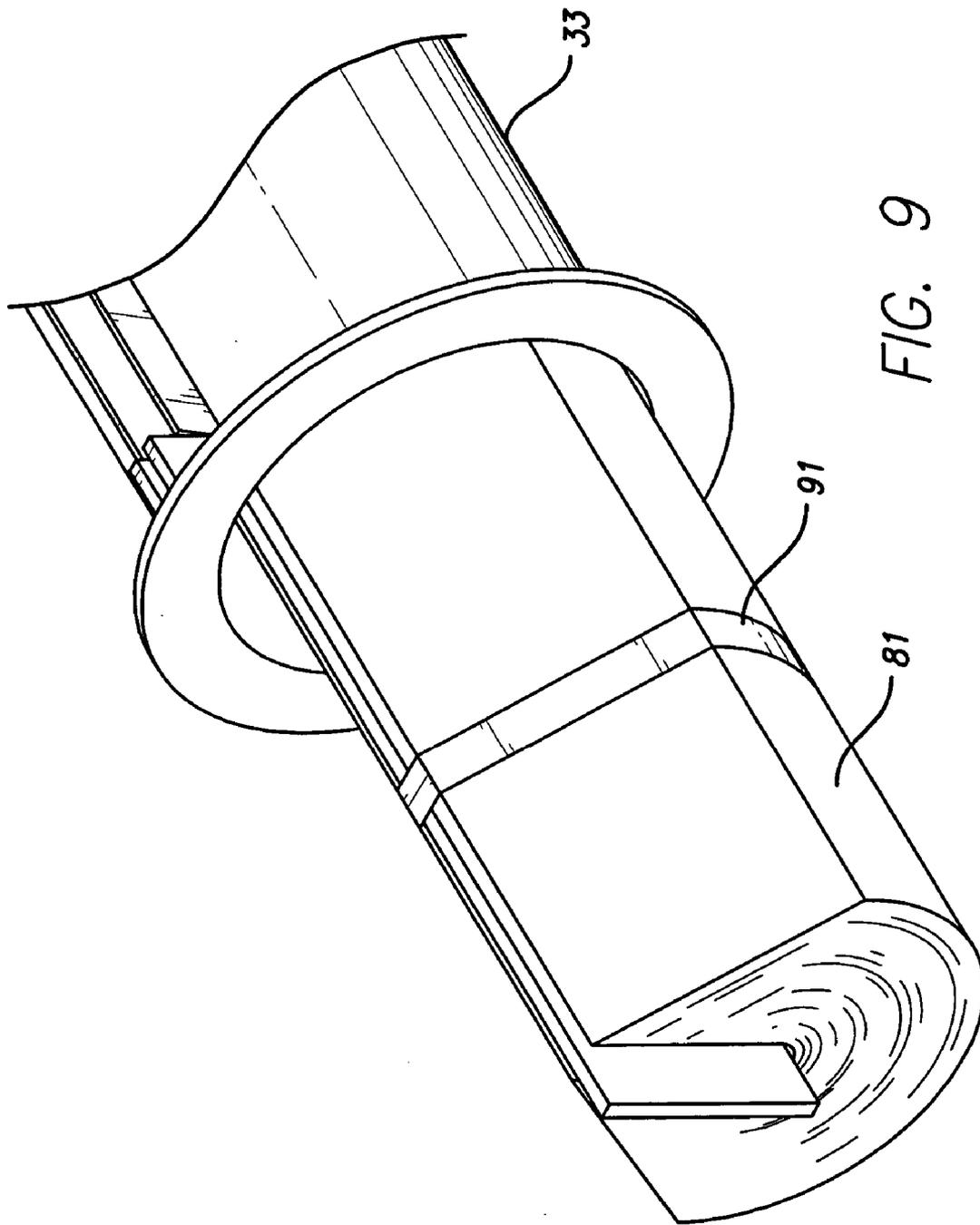


FIG. 6

FIG. 7





**APPARATUS AND METHOD FOR PACKAGING SHEET MATERIAL**

**PRIORITY**

[0001] Priority is claimed to U.S. Provisional Patent Application No. 60/524,773, filed Nov. 21, 2003, and to U.S. patent application Ser. No. 10/772,967, filed Feb. 5, 2004, which claims priority to U.S. Provisional Patent Application No. 60/446,293, filed Feb. 10, 2003. The disclosure of each of the aforementioned documents is incorporated herein by reference.

**BACKGROUND OF THE INVENTION**

[0002] 1. Field of the Invention

[0003] The field of the present invention is sheet material packaging equipment and methods. 2. Background

[0004] Dispensers for sheet material are well known to the art and come in different forms for dispensing a wide variety of sheet materials. In some cases, the packaging in which the sheet material is initially placed by the manufacturer also serves as the dispenser. In other instances, the sheet material is packaged to facilitate placement of the package in the dispenser and to facilitate dispensation therefrom.

[0005] One common aspect of many of these dispensing methods is that the sheet material is placed into a U-shaped form before being inserted into the packaging. Different methods of forming the sheet material into the U-shaped form are disclosed in U.S. Pat. No. 6,732,492 to Osborne et al. and U.S. Pat. No. 6,202,392 to Greenwell et al. Other methods, such as the one disclosed in U.S. Pat. No. 3,919,827 to Larson et al., which discloses an apparatus for folding a stack of bags into a "W" shape prior to packaging, are adaptable to place sheet material into a U-shaped form. The solutions provided in the aforementioned patents, however, may not be well suited for all types of stacked materials or for all packaging needs.

**SUMMARY OF THE INVENTION**

[0006] The present invention is directed towards an apparatus and method for packaging sheet material. Referring to the apparatus, a housing defines a cylindrical cavity which is open at both ends. A wall of the housing includes a longitudinal opening which intersects the cylindrical cavity. A first forming guide is affixed to the housing adjacent to the longitudinal opening and extends into the cylindrical cavity. A banding unit is disposed adjacent the downstream end of the cylindrical cavity. The first forming guide may extend longitudinally beyond the upstream end of the cylindrical cavity and may include parallel walls, each wall being disposed on an opposite side of the longitudinal opening. Optional features include a second forming guide which has a radially defined end affixed to the housing at the upstream end of the cylindrical cavity, a shrink-wrap unit disposed downstream of the banding unit, and a perforation unit disposed downstream of the shrink-wrap unit.

[0007] Turning to the method, a U-shaped form is imparted upon a stack of sheet material by insertion of the stack into a cylindrical cavity which has a diameter that is less than the width of the stack. The U-shaped stack is moved toward and out of the downstream end of the cylindrical cavity. The U-shaped stack is then banded as it

emerges from the cylindrical cavity. When in the cylindrical cavity, a support may be inserted into the U-shaped stack, with the support and the U-shaped stack being moved together toward and out of the cylindrical cavity. After banding, heat-shrinkable wrap may be placed on the banded stack, which may also be perforated following application of heat.

[0008] Accordingly, the present invention provides an improved apparatus and method for packaging sheet material. Other advantages of the invention will appear hereinafter.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0009] In the drawings, wherein like reference numerals refer to similar components:

[0010] **FIG. 1** is a perspective view of a package of sheet material;

[0011] **FIG. 2** is a perspective view of a package of sheet material within a dispenser;

[0012] **FIG. 3** is a schematic view of an apparatus for use in packaging sheet material;

[0013] **FIG. 4** is a perspective view of a forming unit for use in packaging sheet material;

[0014] **FIG. 5** is a cross-sectional along the line 5-5 of **FIG. 4**;

[0015] **FIG. 6** is a cross-sectional along the line 6-6 of **FIG. 4**;

[0016] **FIG. 7** is a perspective view of the upstream end of the forming unit of **FIG. 4**;

[0017] **FIG. 8** is a cross-sectional view of the forming unit of **FIG. 4** with a stack of sheet material passing there-through; and

[0018] **FIG. 9** is a perspective view of the downstream end of the forming unit of **FIG. 4** with a stack of sheet material emerging therefrom.

**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

[0019] Turning in detail to the drawings, **FIG. 1** illustrates a cartridge **11** of sheet material which is a product which may be generated using the following apparatus and method. The cartridge includes a U-shaped stack of sheet material **13**, a supporting insert **15**, a heat-shrunken wrap **17**, and a band **19**. The heat-shrunken wrap **17** and the band **19** both include perforations **21**, **23**, respectively, to enable easy access to the sheet material **13** when the cartridge **11** is placed in the dispenser **25** shown in **FIG. 2**. The bottom of supporting insert **15** extends below the ends of the U-shaped stack of sheet material **13** by a small distance **27** to provide stability to the cartridge **11** within the dispenser **25**. The longitudinal ends of the supporting insert **15** also extend beyond the longitudinal ends of the U-shaped stack of sheet material **13** by a small distance **29** to provide further stability to the cartridge **12** within the dispenser **25**. The overall size of the support may vary as desired or as needed to suit a particular dispenser.

[0020] **FIG. 3** schematically illustrates a packaging apparatus **31** in which product flows in the direction indicated,

with the forming unit being at the upstream end of the apparatus. A flat stack of sheet material (not shown), preferably interfolded, initially passes into the forming unit 33. The forming unit 33 imparts a U-shaped form upon the stack of sheet material and allows the support to be inserted into the U-shaped stack. The banding unit 35 is disposed downstream of the forming unit 33 and places a band around the U-shaped stack of sheet material, preferably as the U-shaped stack emerges from the forming unit 33. The band is preferably perforated prior to being placed around the stack and is preferably constructed from a thin sheet of paperboard material, although other suitable materials may also be used. A shrink wrap unit 37 is disposed downstream of the banding unit 35. This shrink wrap unit 37 places a heat shrinkable wrap about the banded stack of sheet material and heats the heat shrinkable wrap so that the shrink wrap snugly fits about the form of the U-shaped stack of sheet material. Lastly, the newly packaged sheet material passes to the perforation unit 39, where the perforations are made in the shrink-wrap as shown in FIG. 1.

[0021] The banding unit 35, the shrink wrap unit 37, and the perforation unit 39 are each of a type that are commonly used throughout the packaging industry and are thus known to those skilled in the packaging arts. As such, the details relating to these downstream units are not discussed further herein.

[0022] A forming unit 33 is illustrated in FIGS. 4-6. Referring to FIG. 4, the forming unit 33 has three primary parts: the housing 41, the first forming guide 43, and the second forming guide 45. The housing includes a cylindrical tube 47, the interior of which forms the cylindrical cavity 49, and two annular rings 51, 53 affixed to the cylindrical tube 47, one at the upstream end near the second forming guide 45 and the second at the downstream end. The cylindrical cavity 49 has a diameter less than the width of the stack of sheet material that is to be packaged. The annular rings 51, 53 facilitate introduction of the forming unit 33 into a production line with other equipment, such as the banding unit, shrink wrap unit, and perforation unit. Specifically, the annular rings 51, 53 provide a convenient surface with which to mechanically attach the forming unit to other equipment.

[0023] As can be seen in FIGS. 5-6, an opening extends longitudinally in the wall of the cylindrical tube 47, spanning from the upstream end to the downstream end. A set of flanges 57a, 57b are attached to the cylindrical tube 47 at the downstream end thereof, one on either side of the longitudinal opening. The flanges 57a, 57b are secured together to help maintain the shape of the cylindrical tube 47. A second set of flanges is similarly attached to the upstream end of the cylindrical tube 47 (FIG. 6 shows one flange 59a of this second set). Two longitudinal flanges 61, 63 are also affixed to the exterior of the cylindrical tube 47, one on either side of the longitudinal opening. These longitudinal flanges 61, 63 are angled slightly away from the longitudinal opening to help guide the support into and through the longitudinal opening as discussed below.

[0024] The configuration of the first forming guide 43 is best seen in FIGS. 5 and 6. Referring to FIG. 5, which shows the cross-sectional view of the forming unit 33, the first forming guide 43 is constructed of parallel walls 65, 67, each affixed to the cylindrical tube 47 on opposite sides of

the longitudinal opening. The combination of the gap in the cylindrical tube 47 and the parallel walls 65, 67 of the first forming guide 43 allow insertion of the support into the formed stack of sheet material as the stack passes through the forming unit 33. As can be seen in FIG. 6, the two parallel walls of the first forming guide merge to form an integral extension 69 which protrudes beyond the upstream end of the cylindrical tube 47. The lower portion 71 of this extension 69 is tapered to facilitate the passage of a stack of sheet material.

[0025] FIGS. 4 and 6 best illustrate the second forming guide 45. The second forming guide 45 includes a radially defined end 73 which is affixed to the upstream end of the housing 41. The inner radius of the radially defined end 73 is approximately equal to the inner radius of the cylindrical tube to allow a stack of sheet material to easily transition from the second forming guide 45 into the cylindrical tube 47. The opposite end 75 of the second forming guide 45 is linearly defined, having an approximately rectangular shape with three physical sides. The side walls of the second forming guide 45 at the rectangular end 75 are set apart at least as wide as the stack of sheet material. The rectangular end 75 of the second forming guide 45 enables a flat stack of sheet material to be conveyed from standard packaging equipment directly onto the second forming guide 45 without significant, if any, modification to the standard equipment. Between the two opposing ends of the second forming guide 45, the walls of the second forming guide smoothly transform from the rectangular shape at the rectangular end 75 to the circular shape at radially defined end 73.

[0026] With the forming guides configured thusly, when a flat stack of sheet material passes into the rectangular end of the second forming guide and is pushed towards the radially defined end, the outer edges of the flat stack curl about either side of the extension of the first forming guide. The two forming guides thus guide the stack of sheet material into the U-shaped form that allows the stack to pass into the cylindrical cavity and is desired for the final product.

[0027] Referring to FIGS. 7-9, the process of passing a stack of sheet material through the forming unit is illustrated. In FIG. 7, a stack of sheet material 81 is shown entering the second forming guide 45. The stack 81 is moving toward the radially defined end 73 of the second forming guide 45. At this point, the flat stack of sheet material 81 is beginning to take on the U-shaped form that is desired for the final product. In particular, both sides 83, 85 of the stack 81 are being curled upward by the second forming guide 45 to form the legs of the U-shaped form, while as the stack 81 moves forward, the middle portion 87 of the stack 81 will be held down by the lower edge of the first forming guide 43. FIG. 8 shows the stack of sheet materials 81 within the cylindrical cavity 49. The support 89 for the final packaged product is being inserted through the longitudinal opening in the cylindrical tube 47. The parallel walls 62, 65 of the first forming guide allow the support to be inserted into the center of the U-shaped form of the stack of sheet material 81. Once the support 89 is inserted into the stack of sheet material 81, the stack 81 and support 89 are pushed or guided out of the downstream end of the cylindrical cavity. FIG. 9 shows the stack 81 emerging from the forming unit 33 after it has already had a band 91 placed about it by the banding unit. At this point, the stack is ready

to be passed to the shrink-wrap unit and then to the perforation unit, thereby forming the cartridge **11** shown in **FIG. 1**.

[0028] Thus, an apparatus and a method for packaging sheet material are disclosed. While embodiments of this invention have been shown and described, it will be apparent to those skilled in the art that many more modifications are possible without departing from the inventive concepts herein. The invention, therefore, is not to be restricted except in the spirit of the following claims.

1. An apparatus for packaging sheet material comprising:
  - a housing defining a cylindrical cavity open at both ends and including a longitudinal opening in a wall of the housing, the longitudinal opening intersecting the cylindrical cavity;
  - a first forming guide affixed to the housing adjacent to the longitudinal opening and extending into the cylindrical cavity; and
  - a banding unit disposed adjacent a downstream end of the cylindrical cavity.
2. The apparatus of claim 1 further comprising a second forming guide having a radially defined end affixed to the housing at an upstream end of the cylindrical cavity.
3. The apparatus of claim 1, wherein the first forming guide extends longitudinally beyond an upstream end of the cylindrical cavity.
4. The apparatus of claim 1, wherein the first forming guide includes parallel walls, each being disposed on opposite sides of the longitudinal opening.
5. The apparatus of claim 1 further comprising a shrink-wrap unit disposed downstream of the banding unit.
6. The apparatus of claim 5 further comprising a perforation unit disposed downstream of the shrink-wrap unit.
7. An apparatus for packaging sheet material comprising:
  - a housing defining a cylindrical cavity open at both ends and including a longitudinal opening in a wall of the housing, the longitudinal opening intersecting the cylindrical cavity;
  - a first forming guide affixed to the housing and extending into the cylindrical cavity, the first forming guide including parallel walls, each being disposed on opposite sides of the longitudinal opening; and
  - a second forming guide having a radially defined end affixed to the housing at an upstream end of the cylindrical cavity; and
  - a banding unit disposed adjacent a downstream end of the cylindrical cavity.
8. The apparatus of claim 7, wherein the first forming guide extends longitudinally beyond an upstream end of the cylindrical cavity.
9. The apparatus of claim 7 further comprising a shrink-wrap unit disposed downstream of the banding unit.
10. The apparatus of claim 9 further comprising a perforation unit disposed downstream of the shrink-wrap unit.
11. An apparatus for packaging sheet material comprising:
  - a housing defining a cylindrical cavity open at both ends and including a longitudinal opening in a wall of the housing, the longitudinal opening intersecting the cylindrical cavity;

- a first forming guide affixed to the housing, extending longitudinally beyond an upstream end of the cylindrical cavity, and extending radially into the cylindrical cavity, the first forming guide including parallel walls, each being disposed on opposite sides of the longitudinal opening; and
  - a second forming guide having a radially defined end affixed to the housing at an upstream end of the cylindrical cavity;
  - a banding unit disposed adjacent a downstream end of the cylindrical cavity;
  - a shrink-wrap unit disposed downstream of the banding unit; and
  - a perforation unit disposed downstream of the shrink-wrap unit.
12. An apparatus for packaging sheet material comprising:
    - a housing defining a cylindrical cavity open at both ends; means for causing a stack of sheet material to take on a U-shaped form, wherein the cylindrical cavity is adapted to allow passage of the U-shaped form of the stack of sheet material therethrough;
    - means for inserting a support into the stack of sheet material as the U-shaped stack of sheet material passes through the cylindrical cavity; and
    - a banding unit disposed adjacent a downstream end of the cylindrical cavity.
  13. A method of packaging sheet material comprising:
    - imparting a U-shaped form upon a stack of sheet material by insertion of the stack into an upstream end of a cylindrical cavity, a diameter of the cylindrical cavity being less than a width of the stack;
    - moving the U-shaped stack toward and out of a downstream end of the cylindrical cavity; and
    - banding the U-shaped stack as the stack emerges from the downstream end of the cylindrical cavity.
  14. The method of claim 13 further comprising
    - placing a heat-shrinkable wrap about the banded stack; and
    - heating the heat-shrinkable wrap.
  15. The method of claim 14 further comprising perforating the heat-shrinkable wrap.
  16. The method of claim 13, wherein imparting the U-shaped form upon the stack includes imparting the U-shaped form using a first forming guide extending into the cylindrical cavity from a wall defining the cylindrical cavity.
  17. The method of claim 13, wherein imparting the U-shaped form upon the stack includes guiding the stack into the cylindrical cavity with a second forming guide having a radially defined end affixed to an upstream wall defining the cylindrical cavity.
  18. The method of claim 13, wherein moving the U-shaped stack toward and out of the downstream end of the cylindrical cavity comprises:
    - inserting a support through an opening in a wall defining the cylindrical cavity and into the U-shaped stack; and

moving the support and the U-shaped stack toward and out of the downstream end of the cylindrical cavity.

**19.** A method of packaging sheet material comprising:

imparting a U-shaped form upon a stack of sheet material by insertion of the stack into an upstream end of a cylindrical cavity, a diameter of the cylindrical cavity being less than a width of the stack, wherein a first forming guide extends into the cylindrical cavity from a wall defining the cylindrical cavity and a second forming guide is affixed to an upstream end of the wall defining the cylindrical cavity;

moving the U-shaped stack toward and out of a downstream end of the cylindrical cavity; and

banding the stack as the stack emerges from the downstream end of the cylindrical cavity.

**20.** The method of claim 19 further comprising

placing a heat-shrinkable wrap about the banded stack after; and

heating the heat-shrinkable wrap.

**21.** The method of claim 20 further comprising perforating the heat-shrinkable wrap.

**22.** The method of claim 19, wherein moving the U-shaped stack toward and out of the downstream end of the cylindrical cavity comprises:

inserting a support through an opening in a wall defining the cylindrical cavity and into the U-shaped stack; and

moving the support and the U-shaped stack toward and out of the downstream end of the cylindrical cavity.

**23.** A method of packaging sheet material comprising:

imparting a U-shaped form upon a stack of sheet material by insertion of the stack into an upstream end of a cylindrical cavity, a diameter of the cylindrical cavity being less than a width of the stack, wherein a first forming guide extends radially into the cylindrical cavity from a wall defining the cylindrical cavity and a second forming guide is affixed to an upstream end of the wall defining the cylindrical cavity;

inserting a support through an opening in the wall defining the cylindrical cavity and into the U-shaped stack; and

moving the support and the U-shaped stack toward and out of the downstream end of the cylindrical cavity; and

banding the stack as the stack emerges from the downstream end of the cylindrical cavity;

placing a heat-shrinkable wrap about the banded stack; and

heating the heat-shrinkable wrap.

**24.** The method of claim 23 further comprising perforating the heat-shrinkable wrap.

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