

11-17-1998

Process for making and incorporating acquisition/ distribution inserts into absorbent cores

Nicholas Albert Ahr

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US005837087A

United States Patent [19]

[11] Patent Number: **5,837,087**

Ahr

[45] Date of Patent: **Nov. 17, 1998**

[54] **PROCESS FOR MAKING AND INCORPORATING ACQUISITION/DISTRIBUTION INSERTS INTO ABSORBENT CORES**

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[75] Inventor: **Nicholas Albert Ahr**, Cincinnati, Ohio

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[21] Appl. No.: **693,679**

[22] Filed: **Aug. 13, 1996**

Related U.S. Application Data

[62] Division of Ser. No. 341,503, Nov. 17, 1994, Pat. No. 5,591,297.

[51] **Int. Cl.⁶** **B32B 31/00**

[52] **U.S. Cl.** **156/250; 156/221; 156/293; 156/567; 604/358**

[58] **Field of Search** 156/521, 517, 156/264, 293, 98, 108, 221, 222, 514, 556, 250, 567; 604/358, 385.1, 378, 379, 368, 369

Primary Examiner—James Engel

Attorney, Agent, or Firm—Marshall, O'Toole, Gerstein, Murray & Borun

[57] ABSTRACT

An apparatus and process for assembling a first member and a second member is provided. The first member comprises a fluid distribution part and the second member comprises an absorbent core member having a window portion therein. The assembling apparatus comprises a conveyer mechanism for forming a transport path, a first deposition mechanism for placing a series of one of the first and second members in spaced apart relation on the conveyer mechanism, and a drum mechanism rotatably mounted adjacent the conveyer mechanism for carrying the other of the first and second members and for depositing the same onto one of the first or second members already placed on the conveyer mechanism. The apparatus further includes a second deposition mechanism for placing a series of the other of the first and second members on the drum mechanism in spaced apart relation and a drive mechanism for the conveyer and the drum mechanism for moving in timed relation the first and second members together on the conveyer mechanism and for positioning a portion of the first member in the window portion of the second member.

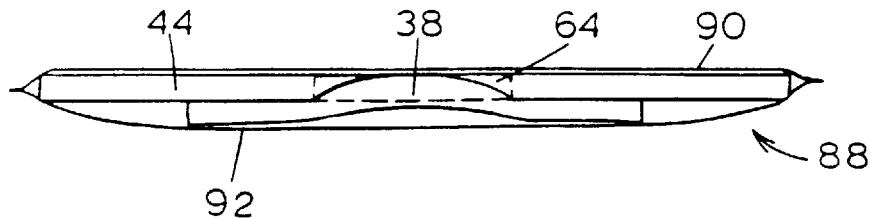
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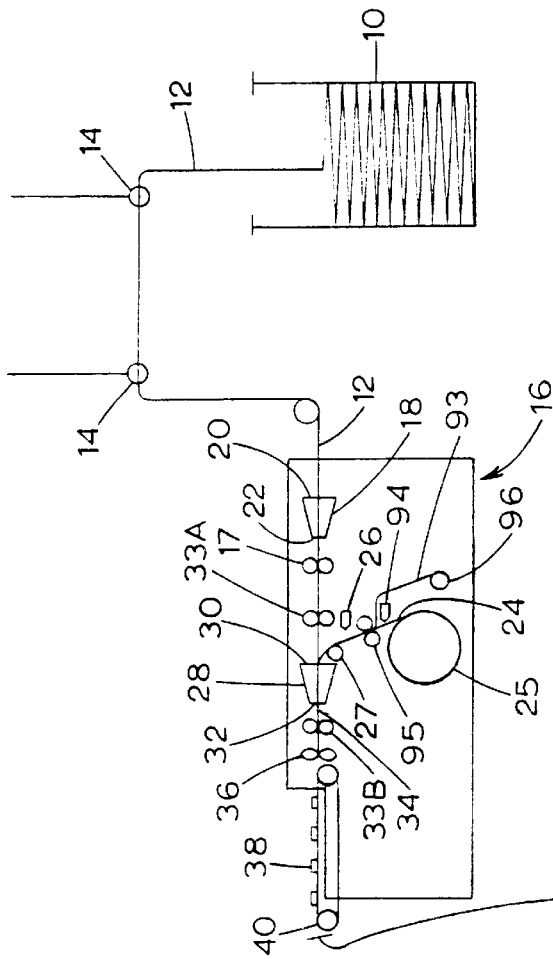


FIG. 1

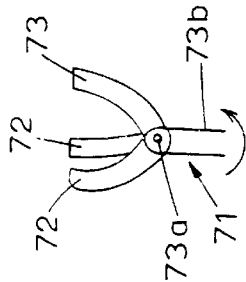
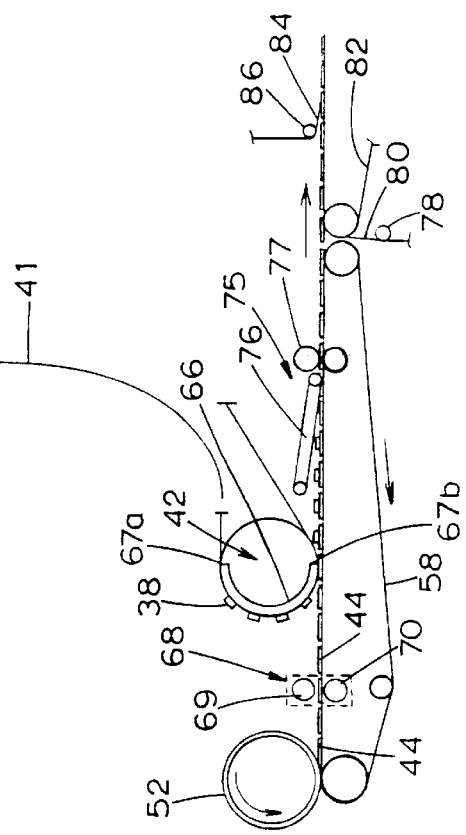


FIG. 3



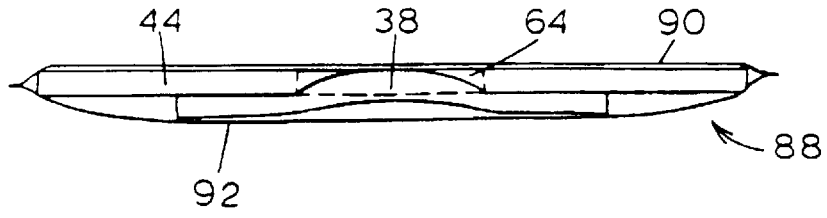


FIG. 9

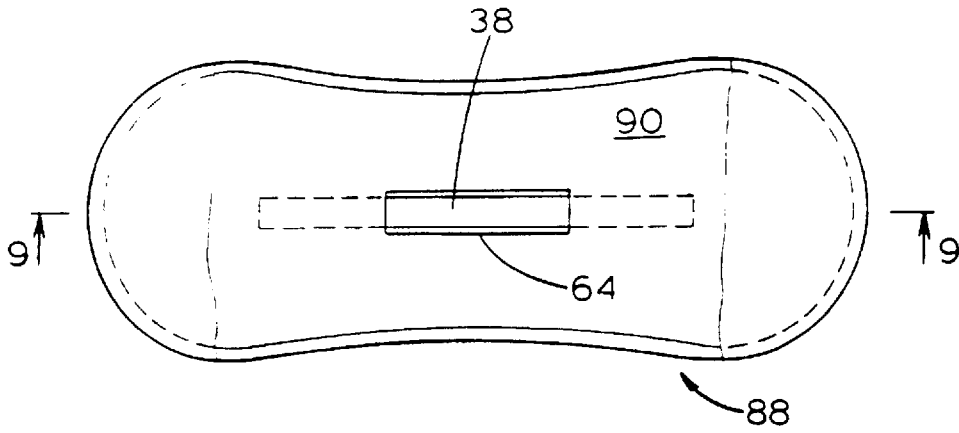


FIG. 8

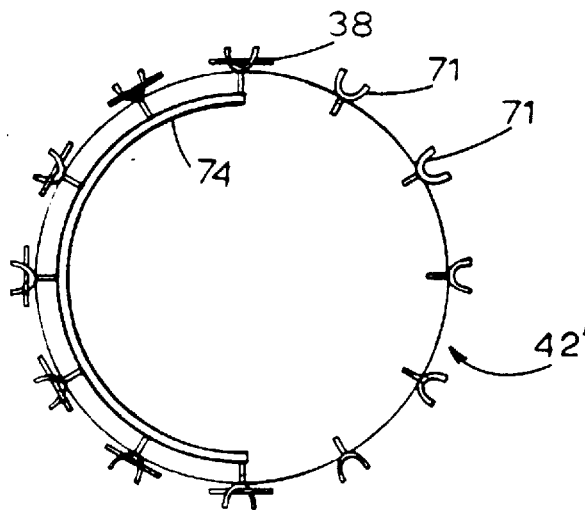


FIG. 2

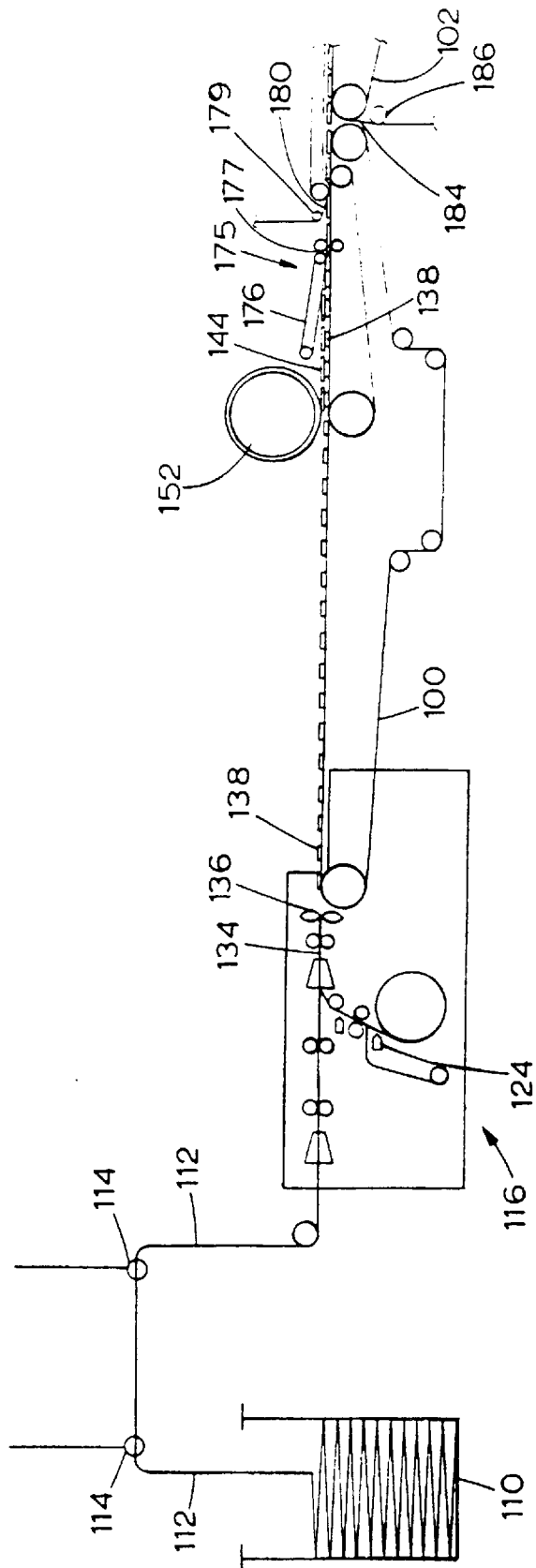


FIG. 4

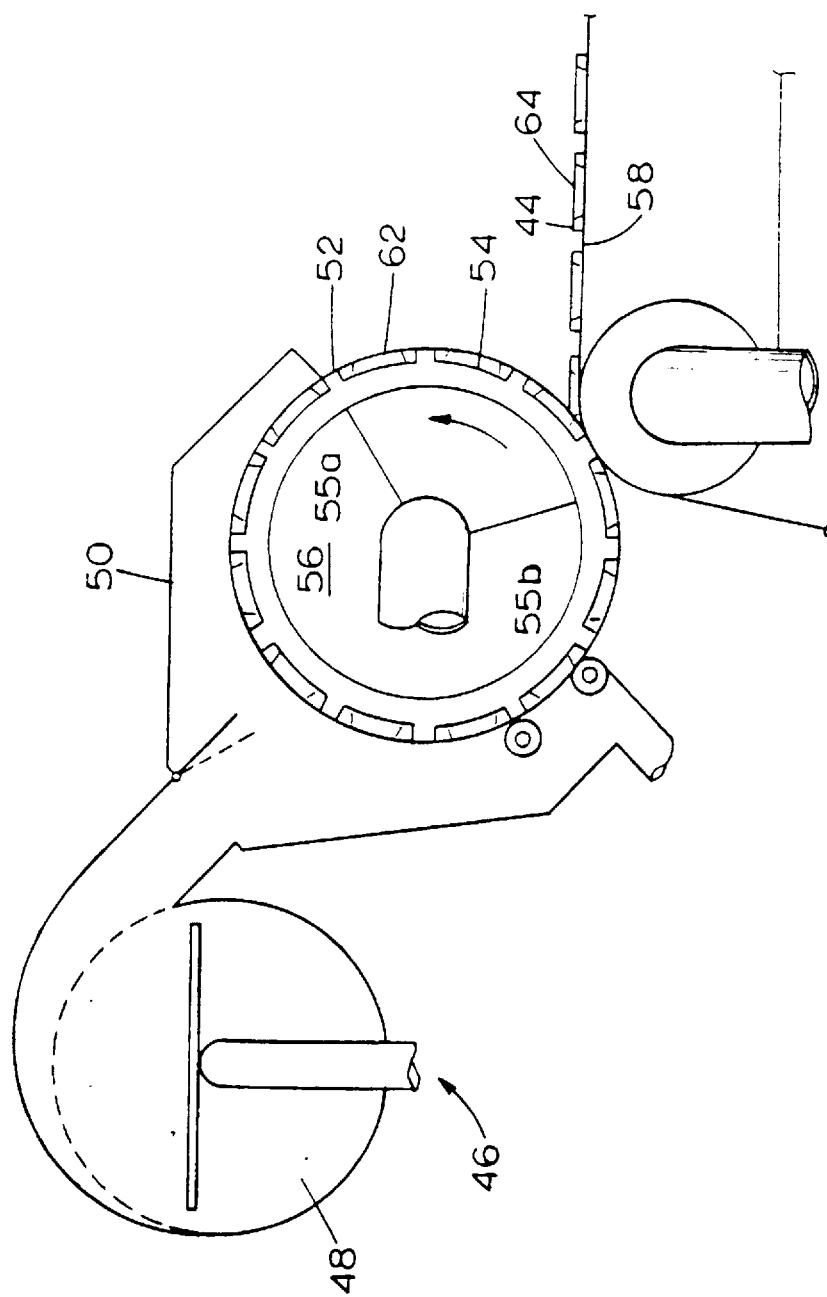


FIG. 5

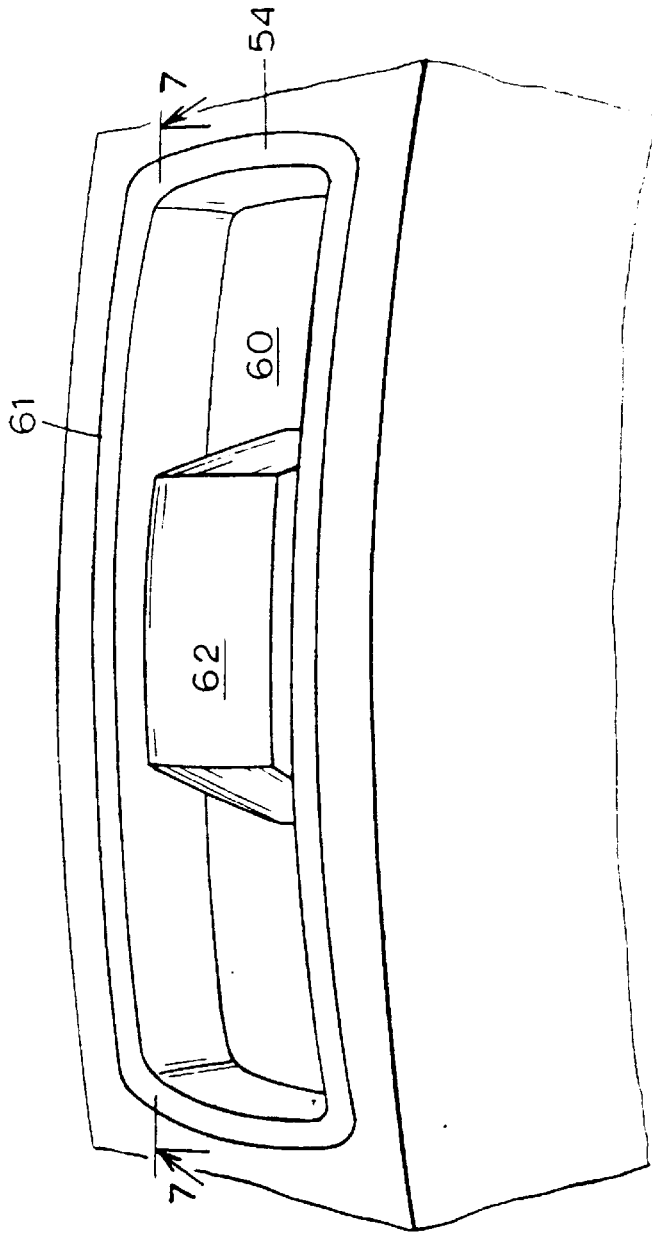


FIG. 6

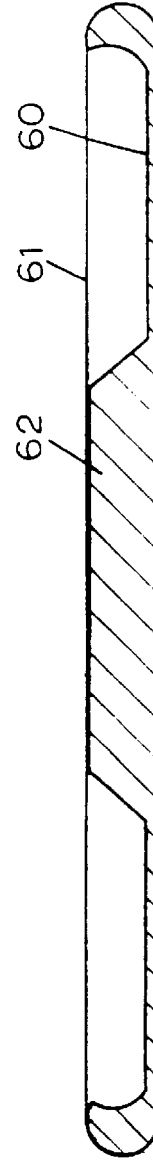


FIG. 7

**PROCESS FOR MAKING AND
INCORPORATING ACQUISITION/
DISTRIBUTION INSERTS INTO ABSORBENT
CORES**

This is a divisional of U.S. application Ser. No. 08/341,503, filed Nov. 17, 1994 now U.S. Pat. No. 5,591,297.

FIELD OF THE INVENTION

This invention pertains to an apparatus and process for forming absorbent cores, such as for catamenial sanitary napkins and/or disposable diapers. More particularly, this invention pertains to an apparatus and process for forming and incorporating acquisition/distribution inserts into an absorbent core.

BACKGROUND OF THE INVENTION

A wide variety of types of structures for disposable absorbent articles used to collect body fluids are known in the art. Commercial absorbent articles include, for example, diapers, adult incontinence products, catamenials and bandages. Disposable products of this type comprise components for receiving, absorbing and retaining fluids. Typically, such articles include a liquid permeable topsheet, an absorbent core and a liquid impermeable backsheet.

Improving the performance of absorbent articles such as sanitary napkins continues to be a formidable undertaking, although a number of improvements have been made in both their materials and structures. A number of efforts have been directed to providing sanitary napkins with the ability to remain in contact with the wearer's body and to acquire body exudates immediately upon leaving the body and then to distribute the exudates throughout the absorbent core of the napkin.

Examples of such sanitary napkins are disclosed in PCT International Publication Nos. WO 93/01779 and WO 93/02251 which disclose sanitary napkins employing fibers having intra-fiber capillary channels (which may be referred to as the "Capillary Channel Fiber" patent application); and in WO 93/01780 to WO 93/01783 which disclose the use of capillary channel fibers that may be arranged in the form of a tufted bundle (or "bun") on a curved, body-shaped absorbent article (and, as a result may be referred to as the "Curved Bun" patent applications); and in WO 93/01785 and WO 93/01786 which disclose extensible and stretchable sanitary napkins; the disclosure of all of which are incorporated by reference herein.

While the sanitary napkins described in the above patent publications work quite well, the search for improved, as well as alternative, sanitary napkins (particularly to those described in the "Capillary Channel Fiber" and "Curved Bun" patent applications), however, has continued.

In addition, a need exists for a sanitary napkin that is at least as easy to construct, or preferably even easier to construct, as those sanitary napkins described in the above "Capillary Channel Fiber" and "Curved Bun" patent publications.

The present invention provides a method and apparatus to easily and efficiently fabricate disposable absorbent articles having the ability to acquire bodily exudates immediately upon leaving the body and then to distribute the exudates throughout the absorbent core of the article.

SUMMARY OF THE INVENTION

In accordance with a principle aspect of the invention, an apparatus is disclosed for assembling a first member,

referred to as an acquisition/distribution member or tube, and a second member, referred to as an absorbent core member, having a window for receiving the first member, for use in absorbent products. The assembling apparatus comprises a conveyer means for forming a transport path, a first deposition means for placing a series of one of the first and second members in spaced apart relation on the conveyer means, and a drum means rotatably mounted adjacent the conveyer means for carrying the other of the first and second members and for depositing the same onto one of the first or second members already placed on the conveyer means. The apparatus further includes a second deposition means for placing a series of the other of the first and second members onto the drum means in spaced apart relation and a drive means for the conveyer means and the drum means for moving in timed relation the first and second members together on the conveyer means and for positioning a portion of the first member in the window portion of the second member.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood from the following detailed description taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a schematic view of an apparatus constructed in accordance with a first embodiment of the present invention;

FIG. 2 is a schematic view of a mechanical tube pick-up and lay-down deposition drum in accordance with a second embodiment of the invention;

FIG. 3 is an enlarged schematic illustration of a retention/deposition member of the pickup and laydown drum of FIG. 2.

FIG. 4 is a schematic illustration of an apparatus in accordance with a third embodiment of the present invention;

FIG. 5 is a schematic fragmentary side elevational view of an absorbent core member forming apparatus;

FIG. 6 is an enlarged, fragmentary side elevational view of a deposition cavity disposed on the periphery of the deposition drum of apparatus shown in FIG. 5;

FIG. 7 is a cross sectional view taken generally along line 7—7 of FIG. 6;

FIG. 8 is a top view of a catamenial product having an absorbent core made by the apparatus and process of the present invention; and

FIG. 9 is a cross-sectional view taken generally along line 9—9 of FIG. 8.

**DETAILED DESCRIPTION OF THE
INVENTION**

Shown schematically in FIG. 1, is an apparatus for making and incorporating an acquisition/distribution insert or tube into an absorbent core member. The apparatus includes a supply container 10 for a long tow or sliver 12. This container 10 can typically be a barrel with a spool or roll having the tow 12 wound on it. The tow 12 comprises a bundle of loose fibers, typically a bundle of 1000 or more fibers.

The fibers forming the tow 12 are preferably comprised of a material that is more resilient than comminuted wood pulp which is generally referred to as airfelt (often used as an absorbent core material). Suitable materials include, but are not limited to: capillary channel fibers, chemically modified, cross-linked cellulosic fibers, superabsorbent fibers,

polyesters, rayons, orlons, foams, and surfactant treated polyolefin fibrous materials.

Preferably, the tow includes capillary channel fibers. Capillary channel fibers are fibers which have intra-fiber capillary channels, especially on their outer surface.

Suitable capillary channel fibers are described in EPO Patent Application 0 391 814 published Oct. 10, 1990; U.S. Continuation-In-Part Application entitled "Fibers Capable of Spontaneously Transporting Fluids", Ser. No. 07/736,267, published as PCT WO 93/02235 on Feb. 4, 1993, filed in the name of Phillips, et al. on Jul. 23, 1991, U.S. Pat. No. 5,200,248 entitled "Open Capillary Channel Structures, Improved Process for Making Capillary Channel Structures, and Extrusion Die for Use Therein" issued in the name of Thompson, et al. on Apr. 6, 1993; and, U.S. Pat. application Ser. No. 07/918,174 entitled "Spinnerette Orifices and Filament Cross-Sections With Stabilizing Legs Therefrom", filed in the name of Phillips, et al. on Jul. 23, 1992.

Suitable capillary channel fibers are also described in the following patent applications which were filed on Jul. 23, 1991: U.S. Pat. application Ser. No. 07/734,404 filed in the name of Thompson, et al.; U.S. Pat. application Ser. No. 07/734,392 filed in the name of Thompson, et al.; and, U.S. Pat. application Ser. No. 07/734,405 filed in the name of Buenger, et al. These patent applications may be referred to collectively as the "Capillary Channel Fiber" patent applications. The disclosure of all of the above patent applications and patent publications are incorporated herein by reference.

To make the tow **12** easier to handle and to transport, the tow **12** is moved through a machine **16**, which may be similar to conventional machines for forming filters for cigarettes, for wrapping the fibers of the tow **12** into a tube. Referring again to FIG. **1**, the tow **12** of loose fibers is drawn from the container **10** through a set of guide eyelets **14** and fed into the tube forming machine **16** by a pair of feed rollers **17**. In the machine **16**, the loose fibers of the tow **12** are formed into a cylindrical shape by a compressing element **18** which is funnel or horn-shaped and has first and second openings **20** and **22**. The first opening **20**, which is at the upstream end, has a larger diameter than the second opening **22**. The size of the smaller second opening **22** determines the diameter of the tow **12** exiting the compressing element **18**.

After the tow **12** has been compressed it is wrapped with a wrapping material **24** such as a non toxic tissue or other wrapping material, preferably a non-woven wrapping material, such as Unicorn Spunbond, non woven, low basis weight polypropylene manufactured by Fiberweb North America of Washaugal, Wash. As shown in FIG. **1**, a supply roll **25** of sheet-like wrapping material **24** is provided in the tube forming machine **16**. An adhesive is applied by a glue applicator **26** to one longitudinal edge of the wrapping material **24**. A particularly useful adhesive is a construction hot melt adhesive made by Findley Adhesive, Inc. of Milwaukee, Wis., product identification number 672-334-07. The wrapping material **24** is passed over a guide roller **27** and then moved closely adjacent the tow **12** and into a tube or cylinder former **28**. The cylinder former **28** is a conventional device for wrapping the tissue around the tow **12**, and is preferably shaped like a G-shaped horn having a larger diameter upstream end **30** and a smaller diameter downstream end **32**. The wrapping material **24** and the tow **12** are fed to the cylinder former **28** which forms or rolls the wrapping material **24** into a wrapped cylinder **34** around the tow. The edge with adhesive is overlapped with and adhered to the other longitudinal edge by the adhesive to maintain the

wrapped cylinder **34** in cylindrical form so that the tow can be more easily handled.

The forming machine **16** also includes a second and a third pair of feed rollers **33A**, **33B** for pulling the tow **12** through the machine. As the tow **12** of fibers is wrapped in the cylinder former **28**, it is maintained under tension or compression by adjusting the speed of the first, second and third pair of feed rollers **17**, **33A** and **33B**. Preferably the second and third pair of feed rollers **33A**, **33B** rotate at about the same speed which is about two to about ten percent faster than the first pair of feed rollers **17**. This causes the fibers of the tow **12** to be stretched and tensioned between the first and second pair of feed rollers **17**, **33A**. The fibers of the tow **12** are maintained and controlled under tension during the wrapping process by having the third pair of feed rollers **33B** pull the wrapped cylinder **34** at about the same speed as the second pair of feed rollers **33A** pulls the tow **12**. The wrapping material **24** of the wrapped cylinder **34** then maintains the fibers of the tow **12** under tension until, as discussed in a greater detail below, the tension is released for in use purposes.

After the wrapped cylinder **34** leaves the cylinder former **28**, it is fed to and cut into shorter length sections by a conventional cutting element **36** to form individual cylindrical acquisition/distribution tubes **38**. While a variety of cutting devices may be used, the cutting element **36** preferably includes a two blade cutter in the shape of a propeller device which rotates about an axis parallel to the length or direction of movement of the tow **12**. The speed of the element **36** is determined by the desired length of the acquisition/distribution tubes **38** and the rate of movement of the wrapped cylinder **34**. The cutting element **36** can also be a three or four blade propeller device if additional cutting speed is required. The cutting element typically cuts the acquisition/distribution tubes **38** to lengths between three and four inches, but of course other lengths may be provided depending on the requirements of the end product.

After the acquisition/distribution tubes **38** are cut, they are deposited onto a vacuum conveyer belt **40** travelling at a higher speed than the wrapped cylinder **34** moving to the cutting element **36**. As discussed further below, this increased rate of speed allows for achieving desired spacing between acquisition/distribution tubes **38** as they travel on the vacuum conveyer belt **40**.

The vacuum belt **40** transports the acquisition/distribution tubes **38** to a rotatable pick-up and lay-down drum **42**. A connection **41** in FIG. **1** is a schematic illustration of a conveyor connecting the conveyor **40** and the drum **42**. The connection **41** may include a single vacuum conveyor belt as shown or a series of vacuum conveyor belts. The pick-up and lay-down drum **42** individually picks the acquisition/distribution tubes **38** off the connection **41**, rotates and carries the acquisition/distribution tubes **38** about its periphery in an angularly spaced relation and individually deposits each tube **38** onto the top surface of an absorbent core member **44** (see FIGS. **8** and **9**) previously formed.

The absorbent core member **44** can be made in any conventional way. The absorbent core member **44** is capable of absorbing or retaining liquids such as vaginal fluids (e.g., menses) and other body exudates. The absorbent core member **44** may be manufactured in a wide variety of sizes and shapes (e.g., rectangular, oval, hourglass, dog bone, asymmetric, etc.) and from a wide variety of liquid-absorbent materials commonly used in sanitary napkins and other absorbent articles.

Suitable materials for the absorbent core member **44** include but are not limited to: comminuted wood pulp,

which is generally referred to as airfelt; crepe cellulose wadding; tissue including tissue wraps and tissue laminates; synthetic fibers, especially polymeric fibers, such as crimped polyester fibers; meltblown polymers including coform; chemically stiffened, modified or cross-linked cellulosic fibers; fibers having intra-fiber capillary channels preferably on their exterior surfaces (capillary channel fibers); peat moss; absorbent foams; absorbent sponges; superabsorbent hydrogel-forming polymeric gelling agents; or any equivalent materials or combination of materials, or mixtures of these materials.

If the absorbent core member **44** is comprised of airfelt or other similar material, the apparatus described in U.S. Pat. No. 4,592,708 to Feist et al., the disclosure of which is incorporated herein by reference, can be used to form the absorbent core member **44**. As shown in FIG. 5, an absorbent core member former machine **46** is provided. The former machine **46** includes, for example, a disc-type hammermill **48**, a hood **50**, a deposition drum **52** having a plurality of deposition cavities **54** disposed in circumferentially equi-spaced relation about its outer periphery, and an internal vacuum drum **56**. The cavities **54** are formed of a porous or screen-like material, and the vacuum drum **56** holds the fibers in the cavities **54** from the line **55a** to the line **55b**.

Briefly, the hammermill **48** disassociates a drylap web (a web of wet laid, then dried cellulose fibers, not shown) and discharges a stream of entrained fibers to a short circumferential span of the periphery of the drum **52** where they are injected into the deposition cavities **54** and maintained in the cavities **54** by the vacuum drum **56** which exerts a vacuum force on the inner sides of the cavities **54**. The deposition drum rotates and deposits the formed mass of fibers in each cavity **54** onto a vacuum conveyer belt **58** as an absorbent core member **44**. The operation of the absorbent core former **46** is discussed in much greater detail in U.S. Pat. No. 4,592,708, referred to above.

The absorbent core members **44** are provided with an open area, or a window, generally free of fibers. In the specific example described herein, as shown in FIGS. 6 and 7, the deposition cavities **54** on the periphery of the drum **52** include a floor **60**, an upper end **61** and a window forming portion **62**. The window forming portion **62** is generally rectangular and projects up from a central portion of the floor **60** to a height substantially equal to the upper end **61** and occupies a given volume of the deposition cavity **54**. The window forming portion **62** prevents fibers from the hammermill **48** from being deposited in the central portion of the cavities **54**. This ensures that the central portion of absorbent core member **44** is essentially free of fibers and has an open area or a window **64** (see FIGS. 8 and 9) in its central portion. The window forming portion **62** may have a variety of dimensions preferably has a length of between 1½ to 2 inches and a width of between ½ to ¾ inch which produces a window **64** of essentially similar dimensions. The window forming portion may, of course, have other dimensions depending on the application. Also, though the window forming portion **62** is rectangular, it could have alternate configurations. For example, it could be rectangular with rounded corners, oval, elliptical or cigar shaped to produce similarly shaped windows.

Referring back to FIG. 1, if the core members **44** are not formed with a window, the machine may be provided with means (shown in dashed lines) to punch out or otherwise cut a window. In this instance, the absorbent core members **44** without a window are deposited by the deposition drum **52** onto the conveyer belt **58**. To provide the absorbent core

members **44** with a window, the deposited absorbent core members **44** are transported on the conveyer belt **58** to a cutout knife mechanism or section **68**. This section **68** comprises a cutting roller **69** having conventional cutting means for cutting the window **64** in the absorbent core member **44** and an anvil roller **70** for supporting the absorbent core member **44** while the window is being cut. Conveyer belt **58** is preferably constructed of stainless steel or other strong material that is resistant to the cutting force of the cutting roller **69**. Additionally, though not shown, instead of one conveyer belt **58**, two conveyer belts which do not pass between the cutting roller **69** and the anvil roller **70**, one feeding the absorbent core member **44** to the cutoff section **68** and one removing the absorbent core member **44** (now having a window **64**) from cutoff section **68**, can be used. This allows belts to be constructed of less cut resistant material. If the absorbent core member **44** is deposited on the conveyer belt with a window **64**, the cutoff section **68** is not present.

The absorbent core members **44** having windows **64** are then transported on conveyer belt **58** to the pick-up and lay-down drum **42** which deposits an acquisition/distribution tube **38** onto the surface of each absorbent core member **44** so that a portion of the acquisition/distribution tube **38** overlies the entire length of the window **64**.

The pick-up and lay-down drum **42**, as shown in FIG. 1, may be a vacuum drum wherein a vacuum is applied by an arcuate internal vacuum member **66** along a span of the drum starting near the point **67a** where the drum **42** picks up the acquisition/distribution tubes **38** from the connection **41** and ending near the point **67b** where the acquisition/distribution tubes **38** are deposited onto the top surface of the absorbent core member **44**. This span is generally illustrated by the arcuate member **66**.

FIGS. 2 and 3, show an alternatively constructed pick-up and lay-down drum **42'**. The pick-up and lay-down drum **42'** includes a plurality of mechanical finger like clamps **71** disposed in a circumferentially equi-spaced relation about its outer periphery.

As best shown in FIG. 3, each of the clamps **71** has two fixed or stationary fingers **72** and a single moveable opposable thumb **73**. The thumb **73** is pivotably mounted on the frame of the drum **42'** by a pin **73a** and it includes a radially inwardly extending part **73b**. The pick-up and lay-down drum **42'** also includes a stationary arcuate cam mechanism **74** which is engageable with the part **73b** as the drum rotates, and thereby causes the moveable thumb **73** to pivot toward the two stationary fingers **72** to pick-up and hold an acquisition/distribution tube **38** in the clamp **71** as the clamp **71** rotates on the periphery of the rotating drum **42'**. The cam mechanism **74** also causes the moveable thumb **73** to move away from the two stationary fingers **72** to release and deposit the acquisition/distribution tube **38** onto the surface of the absorbent core member **44**.

The clamps **71** are preferably rotatable at least about ninety degrees about a radial line of the pick-up and lay-down drum **42'**. This permits the clamp **71** to properly align the acquisition/distribution tube **38** over the window **64** of the absorbent core member **44**. The cam mechanism **74** may include a portion (not illustrated) for turning the clamps **71** through a desired angle, if such turning is deemed necessary. For the best longitudinal distribution of body exudate throughout the absorbent core member **44**, the acquisition/distribution tube **38** is deposited so that its long dimension (its length) aligns with the long dimension (the length) of the absorbent core member **44** so that a center portion of the

tube **38** overlies the window **64**. If the length of the absorbent core member **44** and the length of the acquisition/distribution tube **38** will not coincide at time of deposition, the clamp **71** can be rotated to provide for proper alignment at deposition.

After an acquisition/distribution tube **38** has been properly deposited onto the surface of an absorbent core member **44**, the absorbent core member **44** with the acquisition/distribution tube **38** on its upper surface is transported on belt **58** to a compression or calendering mechanism **75** which includes a feed alignment belt **76** and a pair of compression rolls **77** (see FIG. 1). As the absorbent core member **44** and acquisition/distribution tube **38** pass through the mechanism **75**, the feed alignment belt **76** first aids in maintaining the acquisition/distribution tube **38** in alignment with absorbent core member **44** and begins to compress the acquisition/distribution tube **38** into the absorbent core member **44** and then the compression rolls **77** further compress and calender the two parts together to force a portion of the acquisition/distribution tube **38** deeper into the window **64** of the absorbent core member **44**.

The belt **58** preferably includes a vacuum device (not shown) for providing enough suction force to hold the tube **38** in place over the window **64** of absorbent core member **44** as they travel together on the belt **58**. If desired, pockets for the members **44** may be provided on the belt.

The tubes **38** are timed to be deposited over the window of the absorbent core member **44** by what may be referred to as a cut and space process. As discussed above, the conveyer belt **40** is running at a speed faster than the speed the wrapped cylinder **34** is being fed to the cutting element **36** to enable the cut acquisition/distribution tubes **38** to be spaced from one another. The rate of rotation of the drum and the spacing of the clamps **71** must be synchronized with the tubes **38** moving on the belt **40** and with the core members **44** moving on the belt **58**, so that the tubes are picked up and transferred by the drum to the core members **44**. Preferably the speed of conveyer belt **40** spaces the tubes **38** at a distance substantially equal to the distance between the equi-spaced cavities **54** of the deposition drum **52** plus the difference between the length of the acquisition/distribution tube **38** and the length of the cavity **54**. This allows the deposition drum **52**, the pick-up and lay-down drum **42**, the belt **40**, the connection **41** and the belt **58** to be run at the same linear speed by a single drive timing mechanism such that the pick-up and lay-down drum **42** can properly deposit an acquisition/distribution tube **38** over the window **64** of the absorbent core member **44**.

If the mechanical pick-up and lay-down drum **42'** is utilized, the clamps **71** are preferably circumferentially spaced apart one from another by the same distance as the centers of the adjacent acquisition/distribution tubes **38** are spaced on the belt **40** so that the pick-up lay-down drum **42'** can travel (like drum **42**) at the same linear speed as belt **40**, connection **41**, belt **58** and deposition drum **52** and be controlled by a single drive timing mechanism. If the clamps **71** are not able to be spaced about the periphery of the drum **42'** at this distance, the single drive timing mechanism may include a gearing mechanism to enable the pick-up and lay-down drum **42'** to travel at a different speed than the above-enumerated apparatus elements to pick-up the acquisition/distribution tube **38** off connection **41** and properly deposit the same on an absorbent core member **44**.

FIG. 1 illustrates an apparatus which manufactures absorbent products, containing the absorbent core member **44** and the acquisition/distribution tube **38**, with the moisture acqui-

sition side facing down. An absorbent product of the type described typically comprises a topsheet, a backsheet and an absorbent core sandwiched between the backsheet and topsheet. The topsheet is the acquisition side and is closest to the wearer's body and is located on what is referred to as the body facing surface of the absorbent product. The backsheet is furthest from the body or located on what is referred to as the garment facing surface of the product. As seen in FIG. 1, a topsheet unwind **78** is provided which carries a roll of liquid porous topsheet material **80**. The topsheet material **80** is fed to a conveyer belt **82** so that the compressed absorbent core member **44** and acquisition/distribution tube **38** are deposited from conveyer belt **58** onto the topsheet material **80** and joined thereto by conventional means (not shown).

Conveyer belts **58** and **82** are spaced closely together so that the compressed absorbent core member **44** and acquisition/distribution tube **38** can pass from belt **58** to the belt **82** and not fall in the gap between the two belts. If necessary, a dead plate pan (not shown) may be placed between the two belts **58** and **82** to provide proper transfer between the belts and to prevent the core member **44** and the acquisition/distribution tube **38** from falling into the gap. After the compressed acquisition/distribution tube **38** and absorbent core member **44** have been deposited onto the topsheet material **80**, a sheet **84** of liquid impervious backsheets material is fed from a supply roll, around an idler roll **86** and joined by conventional means (not shown) to the top of the absorbent core member **44**, acquisition/distribution tube **38** and topsheet material **80**. Downstream from the roll **86** are conventional devices (not illustrated) for sealing the topsheet and backsheet material together around the periphery of the core member **44** and then cutting the completed assembly into individual absorbent products such as those shown in FIGS. 8 and 9. Suitable topsheet and backsheet materials are described in co-pending U.S. Pat. application Ser. No. 08/084,048, filed in the name of Doak, et al. on Jun. 28, 1993 and entitled "Absorbent Article Having a Window With a Body-Conforming Element Positioned Therein".

As seen in FIGS. 8 and 9, a sanitary napkin **88** has a topsheet **90** made from the topsheet material **80**, and a backsheet **92** made from the backsheet material **84**. Disposed between the topsheet **90** and backsheet **92** is an acquisition/distribution tube **38** and an absorbent core member **44** having a window **64**. A center portion of the acquisition/distribution tube **38** is pressed into the window **64** and the end portions of the tube are between the garment facing backsheet **92** and the absorbent core member **44**.

For improved body exudate fluid handling, a portion of the wrapping material **24** of the acquisition/distribution tube **38** is predisposed to open in the window **64** and release a portion of the fibers of the tow **12** into the window **64**. Prior to opening, the portion of the fibers maintained in the acquisition/distribution tube **38** are stretched and held, as discussed above, under compression. The fibers are thus maintained at a given density. When the acquisition/distribution tube **38** is opened, the compression is released and the fibers of the tow **12** spread out into the window **64**. The density of the released fibers is lower than the density of the fibers previously maintained in the unopened acquisition/distribution tube **38**. Since the window **64** is typically designed to be located at or near the point of body exudate deposition, the lower density fibers provide an excellent acquisition zone and conform well to the wearer's body. Fluid handling characteristics of absorbent cores having similar acquisition/distribution members is discussed in much greater detail in the previously referred to co-pending U.S. Pat. application Ser. No. 08/084,048, filed in the name

of Doak, et al. on Jun. 28, 1993 and entitled "Absorbent Article Having a Window With a Body-Conforming Element Positioned Therein".

It is preferred in use that only a portion of the tube **38** is opened and that only a portion of the fibers contained in the acquisition/distribution tube **38** are released into the window **64**. The fibers that remain in the acquisition/distribution tube **38** have a higher density than the fibers that are released. If the fibers of the tow **12** are comprised of capillary channel fibers, the intrafiber capillary channels of the capillary channel fibers along with this density gradient helps wick the body exudate deposited in the window **64** containing the lower density released fiber to the higher density fibers remaining in the unopened portion of the acquisition/distribution tube **38** and consequently to the longitudinal ends of the absorbent core member **44**.

The wrapping material **24** of the acquisition/distribution tube **38** can be pre-disposed to open for or during use of the product in a variety of ways. For example, as shown in FIG. **1**, a moisture sensitive string **93** has portions permanently attached to the wrapping material **24** so that the string runs along the length of the wrapping material **24** and extends along the length of the acquisition/distribution tube **38**. The string may be attached by most any means including a non-water soluble adhesive which may be the same hot-melt adhesive as the adhesive applied by the glue gun applicator **26** to the wrapping material **24**. As shown in FIG. **1**, a glue applicator **94** sprays glue spots on the wrapping material **24** immediately upstream of a pair of compression feed rolls **95**. These rolls **95** draw both the wrapping material **24** from the roll **25** and the string **93** from its roll **96** and compress and adhere portions of the string **93** to the sprayed glue spots on the wrapping material **24** leaving a portion of the string **93** unattached. The moisture sensitive string **93** may be most any string which contracts upon exposure to moisture such as body exudate or to exposure to humidity from a wearer's body. This contraction either aids in or causes the wrapping material **24** to rupture allowing the release of fibers of the tow into the window.

Alternatively, or in addition, the wrapping material **24** can be pre-scored prior to being wrapped around the tow **12** to enable the portion of the acquisition/distribution tube **38** that is scored to be opened by body motion which in use or manually by the wearer prior to use. The wrapping material **24** may be pre-scored prior to being placed on supply roll **25**. Alternatively, the feed compression rollers **95** may be equipped with cutting means to produce or cut a series of generally parallel and substantially equal length score lines at proper intervals in the wrapping material **24**. This enables an acquisition/distribution tube **38** to be formed having a plurality of generally parallel score lines extending around at least a portion of its periphery, the score lines being located over the window **64** of the absorbent core member **44**. Preferably, the score lines generally have the same length which is substantially equal to the length of the window **64**.

The wrapping material **24** may also be comprised of a low or no wet strength material which will rupture upon exposure to moisture or humidity and expose the fibers contained in the acquisition/distribution tube **38**. Preferably the wrapping material has a wet tensile strength equal to or less than 10 grams per linear inch in the cross machine direction as measured by Tappi Method T 456 om-87.

Additionally or alternatively, the adhesive of the applicator **26** used in the tube forming machine **16** to form and maintain the wrapped cylinder **34** can also be a water-soluble adhesive that when put in a high humidity atmo-

sphere or contacted with body exudate will not maintain its bond, causing the acquisition/distribution tube **38** to open along the overlap of the two longitudinal edges of the wrapping material **24** and release the fibers contained therein. A particularly useful water-soluble adhesive is manufactured by Findley Adhesive, Inc. of Milwaukee, Wis. having product designation 9087-05.

If the water-soluble adhesive application is the sole method of predisposing the wrapping material **24** to open, it is preferred that the overlapped edges of the wrapping material **24** of the acquisition/distribution tube **38** face the window **64** when the acquisition/distribution tube **38** is deposited onto the surface of the absorbent core member **44**. This will ensure that the fibers in the acquisition/distribution tube **38** will be released into the window **64**, rather than released away from the window **64** when the acquisition/distribution tube opens along the overlapped edges. The overlapped edges are properly positioned, for instance, by first forming and placing the acquisition/distribution tube **38** with its overlapped edge facing away from belt **40** and using the vacuum forces of belt **40** and connection **41** to maintain the proper positioning until the acquisition/distribution tube **38** is picked up from the respective pick-up and lay-down drum **42** or **42'** being utilized.

In addition to forming the absorbent product in an acquisition side down manner wherein the acquisition/distribution tube **38** is placed on the absorbent core member **44**, an alternative embodiment of the present apparatus is shown in FIG. **4**, where the absorbent product is made with the acquisition side up and wherein the core member is laid on top of the tube. Like the apparatus in FIG. **1**, a tow **112** of fibers is drawn from a container **110** through a set of guide eyelets **114** and into a tube forming machine **116**, similar to the machine **16**, where it is wrapped with a wrapping material **124** to form a wrapped cylinder **134** and cut by a cutting element **136** into individual acquisition/distribution tubes **138** as described in connection with the apparatus and process of FIG. **1**.

The acquisition/distribution tubes **138** are deposited in spaced relation onto a vacuum conveyer belt **100** which transports the acquisition/distribution tubes **138** to the deposition drum **152** of the absorbent core member former, similar to the machine **46** shown in FIG. **5**. The drum **152** may be identical to the drum **52** and has a plurality of equi-spaced deposition cavities about its periphery. The drum **152** deposits an absorbent core member **144** with a window from a cavity onto each acquisition/distribution tube **138**, rather than the acquisition/distribution tube being deposited on the absorbent core member as in the embodiment of FIG. **1**. Like the embodiment shown in FIG. **1** utilizing the vacuum pick-up and lay-down drum **42**, the vacuum belt **100** is moved at a speed greater than that of the wrapped cylinder **134** which is fed to the cutting element **136**, to space the acquisition/distribution tubes **138** apart from one another. Preferably, the speed of the belt **100** is set to space the tubes **138** at a distance substantially equal to the distance between the cavities in the drum **152** plus the difference between the length of the acquisition/distribution tubes **138** and these cavities. This enables the belt **100** and the drum **152** to run at the same linear speed so that the drum **152** can properly place the window of absorbent core member **144** onto the acquisition/distribution tube **138**. Preferably, a single drive mechanism controls the speed of the belt **100** and the drum **158**.

After the absorbent core member **144** has been deposited on the acquisition/distribution tube **138**, the two members are transported on conveyer belt **100** to a calendering

mechanism **175**, similar to mechanism **75**, which includes a feed alignment belt **176** and a pair of compression rolls **177** which compress the two members together and press a portion of the acquisition/distribution tube **138** into the window of the absorbent core member **144**. After the acquisition/distribution tube **138** and absorbent core member **144** have been compressed, a sheet **180** of topsheet material is fed from a supply roll, around an idler roll **179** onto the top of absorbent core member **144** and the acquisition/distribution tube **138**. Downstream of idler roll **179**, a sheet **184** of backsheet material is fed from a supply roll around another idler roll **186** under the composite consisting of the sheet **180** of topsheet material, the absorbent core member **144** and the acquisition/distribution tube **138**. The composite acquisition/distribution tube **138** and absorbent core member **144** sandwiched between the sheets **180, 184** of topsheet and backsheet materials travel together on conveyer belt **102** to conventional combining and cutting devices to combine and cut the composite into individual absorbent products like those seen in FIGS. **8** and **9**. The wrapping material **124** can be predisposed to open by the apparatus and methods discussed above.

Numerous modifications and alternative embodiments of the invention will be apparent to those skilled in the art in view of the foregoing description. Accordingly, this description is to be construed as illustrative only and is for the purpose of teaching those skilled in the art the best mode of carrying out the invention. The details of the structure may be varied substantially without departing from the spirit of the invention, and the exclusive use of all modifications which come within the scope of the appended claims is reserved.

What is claimed is:

1. A process of assembling an absorbent article formed of an absorbent core member and a distribution member, the core member having a window opening therein, comprising the steps of:

- a) placing a series of one of said members on a moveable conveyer in spaced relation;
- b) rotating a drum in timed relation with movement of said members on said conveyer, said drum being located above said conveyer and a series of the other of said members being located on a periphery of said drum, said timed relation being such that said other of said members are deposited onto said members while said members are on said conveyer with at least a portion of said distribution member adjacent said window;
- c) depositing said other of the members from said drum onto said members such that at least a portion of said distribution member is adjacent said window;
- d) compressing a portion of said distribution member into said window to combine said members; and
- e) disposing said combined members between a liquid pervious topsheet and a liquid impervious backsheet.

2. The process of claim **1**, further including injecting fibers into a deposition cavity of said drum to form said absorbent core member.

3. The process of claim **1**, further including cutting a wrapped cylinder to form said distribution member and placing said distribution member on said drum.

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