ESCOBAR – URIBE ASOCIADOS
A B O G A D O S
Carrera 11A No. 94-76 - Of.305 - P.O. Box 94948, Bogotá, D.C. - Colombia
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123

As. 2724/P.

**SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO**
**DIVISIÓN DE NUEVAS CREACIONES**
**E. S. D.**

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
Rad: 04-084674 -00002-0000 Fec: 2006-04-03 14:14:24
Dep. 2020 NUECREACIONES
Tra: 2 PATENTES Eta: 1 REGDEPOSITO
Act: 698 PETICION Folios: 3

Ref.: Expediente No. **04-084.674**
Solicitud de Patente a nombre de
**McNeil-PPC, Inc.**

Yo, **JIMENA ESCOBAR URIBE**, identificada como aparece al pie de mi firma, domiciliada en Bogotá, en la Carrera 11 A No. 94-76 Of. 305, obrando como apoderada de la sociedad **McNeil-PPC, Inc.**, domiciliada en Skillman, New Jersey, Estados Unidos de América, solicitante de la patente de la referencia, pido a usted que se proceda a examinar si la invención, cuya patente se tramita en el expediente de la referencia, es patentable.

Adjunto al presente memorial los recibos Nos. 06 - 24,687 de 29 de marzo de 2006 y 06 - 24,688 de 29 de marzo de 2006, por la suma de $388.000.oo, con lo cual queda cubierta la tasa oficial correspondiente a dicho estudio.

Señor Superintendente,

*JIMENA ESCOBAR URIBE*
C.C. 39.779.452 de Usaquén
T.P. 68.228
Cod. 5376
JEU/ra.

2

2724
124

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

NIT : 800176089-2

RECIBO OFICIAL DE CAJA : 06 - 24,687
FECHA : MARZO 29 DE 2006

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
Rad: 04-044874--00002-0000 Fec: 2006-04-03 14:14:24
Dep. 2020 NUECREACIONES
Tra: 2 PATENTES Eje 1 REGDEPOSITO
Act 538 PETICION Folios: 3

##### C O N S I G N A C I O N #####

| DEPOSITANTE | TIPO PAGO | BANCO | CUENTA | No. PAGO | FECHA PGO | Vr. PAGO |
|---|---|---|---|---|---|---|
| ESCOBAR URIBE ASOCIADOS | CONSIGNACION | BANCO POPULAR | 050-00110-6 | 51162175 | 29/03/2006 | 8,899,500.00 |

##### C O N C E P T O #####

| CANT. | REMISTICO | CONCEPTO | TOTAL CONCEPTO |
|---|---|---|---|
| 1 | 50005-01-01 SOLICITUDES | 114 PTC CAP-II EXAMEN DE PATENTIBILID | 194,000.00 |
| | | TOTAL : $ | 194,000.00 |

SON: CIENTO NOVENTA Y CUATRO MIL PESOS

RESPONSABLE : _____

RECIBO DE CAJA APLICADO AL EXPEDIENTE NO. _____

2+24
125

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

NIT : 800176089-2

RECIBO OFICIAL DE CAJA : 06 - 24,589
FECHA : MARZO 29 DE 2006

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
Rad: 04-084874--00002-0000 Fec: 2006-04-03 14:14:24
Dep. 2020 NUEVCREACIONES
Tra: 2 PATENTES Eve 1 REGDEPOSITO
Act 538 PETICION Folios: 3

***** C O N S I G N A C I O N *****

| DEPOSITANTE | TIPO PAGO | BANCO | CUENTA | No. PAGO | FECHA PGO | Vr. PAGO |
|---|---|---|---|---|---|---|
| ESCOBAR URIBE ASOCIADOS | CONSIGNACION | BANCO POPULAR | 050-00110-6 | 51162175 | 29-03/2006 | 8,899,500.00 |

***** C O N C E P T O *****

| CANT. | REMISTICO | CONCEPTO | TOTAL CONCEPTO |
|---|---|---|---|
| 1 | 50005-01-01 SOLICITUDES | 114 PTE CAP-II EXAMEN DE PATENTIBILID | 194,000.00 |
| | | TOTAL : $ | 194,000.00 |

SON: CIENTO NOVENTA Y CUATRO MIL PESOS

RESPONSABLE : _____

RECIBO DE CAJA APLICADO AL EXPEDIENTE No._____

PB 126

Industria y Comercio
SUPERINTENDENCIA

**DIVISION DE NUEVAS CREACIONES**

RADICACIÓN EXPEDIENTE No. **04-84674**

EL EXTRACTO DE LA PRESENTE SOLICITUD DE **PATENTE DE INVENCI N** FUE PUBLICADO EN LA GACETA DE PROPIEDAD INDUSTRIAL No **557**, DE FECHA **31** DE **OCTUBRE** DE **2005**, EL TERMINO HABIL SEÑALADO POR LA LEY EXPIRA EL **27** DE **ENERO** DE **2006**.

NOTA: Dentro del plazo de los seis (6) meses siguientes a partir de la fecha de publicación en la gaceta de Propiedad Industrial, deberá solicitar y cancelar el examen de patentabilidad so pena de que la solicitud caiga en abandono, de acuerdo con lo establecido en el Artículo 44 de la Decisión 486/2000.

SE PRESENTARON OPOSICIONES POR PARTE DE TERCEROS.

SI ____ _____ NO ____ X _____

Carrera 13 No. 27-00 Piso 5 y 10
Conmutador: 334 12 21-2-3-4
Fax: 281 31 25 e-mail: info@sic.gov.co
Santa Fe de Bogotá D.C. - Colombia

**SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO**
**DIVISIÓN DE NUEVAS CREACIONES**

2020
Bogotá, D. C., 1 de Septiembre de 2006

Doctora
**JIMENA ESCOBAR URIBE**
Representante **MC NEIL - PPC, INC**

| | | |
|---|---|---|
| ASUNTO | Radicación No. | **04-54674** |
| | Trámite | 002 |
| | Evento | 001 |
| | Actuación | 430 |
| | Oficio | 06010151 |
| | Folios | 051 |

Como resultado del examen de fondo, realizado con fundamento en el artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le comunica

1) **Documentos estudiados:**

a) Para el presente estudio se tendrán en cuenta el capítulo descriptivo, comprendido en los folios 7 a 46 de la solicitud en estudio.

b) Para el presente estudio se tendrán en cuenta los dibujos comprendidos en el folio 53 de la solicitud en estudio.

c) Para el presente estudio se tendrá en cuenta el capítulo reivindicatorio que comprende 33 reivindicaciones en los folios 47 a 52 de la solicitud en estudio. Se aceptan las modificaciones realizadas por el solicitante a este capítulo ya que no implican ampliación de la solicitud inicial, conforme lo establece el artículo 34 de la Decisión 486.

d) Conforme lo establece los artículos 9, 10 y 11 de la decisión 486 de la Comisión de la Comunidad Andina, la presente solicitud en estudio fue presentada el 30 de agosto de 2004, y en el momento de la radicación **SI** se reclamo prioridad de la primera solicitud presentada en Estados Unidos US 10/652171

2) **Objeto de la Invención**

a) Las reivindicaciones 1 a 33 de la solicitud en estudio se refieren a una estructura absorbente que comprende: (a) un núcleo absorbente que tiene una superficie superior y una superficie inferior; (b) una capa de tejido que tiene una superficie superior y una superficie inferior; y (c) un aglutinante autoentrelazante, en donde la superficie inferior del primer núcleo absorbente está yuxtapuesta a la superficie superior del tejido, y el aglutinante está aplicado en la superficie inferior de la capa de tejido, de modo que el aglutinante penetra a través del tejido hacia el núcleo absorbente.

b) El anterior producto procedimiento busca mejorar las propiedades de artículos absorbentes desechables

c) Según la Clasificación Internacional de Patentes, la codificación para esta solicitud corresponde a: A 61 F 13/15

3) **Claridad de la Solicitud**

a) El artículo 28 de la Decisión 486 de la Comisión de la Comunidad Andina de Naciones establece

> *"La descripción deberá divulgar la invención de manera suficientemente clara y completa para su comprensión y para que una persona capacitada en la materia técnica correspondiente pueda ejecutarla"*

La descripción no es clara toda vez que presenta errores en la traducción y emplean términos que no corresponden al español técnico. Frases como "autoentrelazante", "macrofigura" entre otros, no pertenecen al lenguaje técnico usual. La solicitud deberá ser revisada por alguien que conozca del arte.

Existen referencias incompletas dentro de la solicitud. Por ejemplo en el folio 28 se hace alusión a un documento sin dar su identificación.

b) El artículo 30 de la Decisión 486 de la Comisión de la Comunidad Andina establece que

> *"Las reivindicaciones definirán la materia que se desea proteger mediante la patente. Deben ser claras y concisas y estar enteramente sustentadas por la descripción. Las reivindicaciones podrán ser independientes o dependientes. Una reivindicación será independiente cuando defina la materia que se desea proteger sin referencia a otra reivindicación anterior. Una reivindicación será dependiente cuando defina la materia que se desea proteger refiriéndose a una reivindicación anterior. Una reivindicación será dependiente cuando defina la materia que se desea proteger refiriéndose a una reivindicación anterior.- Una reivindicación que se refiera a dos o más reivindicaciones anteriores se considerará reivindicación dependiente múltiple."*

El capítulo reivindicatorio no es claro toda vez que:

i) Lo enunciado en el punto 3) a) es aplicable a este capítulo también.

ii) Palabras como "aproximadamente" deben ser eliminadas por ambiguas.

iii) No se precisa la materia sobre la cual se solicita protección. Cómo se explicará en el punto 4), la presente solicitud no posee unidad de invención, por lo que no está definida la materia sobre la cual se solicita protección.

De acuerdo a lo anterior, el capítulo reivindicatorio no cumple con el requisito de claridad de acuerdo a lo establecido en el Art. 30 de la Decisión 486.

4) **Evaluación de la Unidad de Invención**

El artículo 25 de la Decisión 486 de la Comisión de la Comunidad Andina establece

*"La solicitud de patente sólo podrá comprender una invención o un grupo de invenciones relacionadas entre sí, de manera que conformen un único concepto inventivo"*

La presente solicitud carece de unidad de invención toda vez que configura **cuatro** diferentes objetos. La definición de la materia que caracteriza a cada una de las reivindicaciones independientes es muy diferente entre sí. Esto permite afirmar que no se trata del mismo producto. Todo el problema radica en configurar varias reivindicaciones independientes con materia diferente. El solicitante debe establecer una sola reivindicación independiente dirigida al **producto** en la forma más simple de la solicitud de invención. Partiendo de allí establecer reivindicaciones dependientes que amplíen esa forma más simple hasta su forma más compleja.

De acuerdo a lo anterior, la presente solicitud no cumple con el requisito de unidad de invención de acuerdo al Art. 25 de la Decisión 486. De continuar con el impedimento, está oficina procederá a estudiar solo el primer grupo de invenciones que conformen un único concepto inventivo.

5) **Determinación del Estado de la Técnica**

El artículo 16 de la Decisión 486 de la Comisión establece:

*"El estado de la técnica comprenderá todo lo que haya sido accesible al público por una descripción escrita u oral, utilización, comercialización o cualquier otro medio antes de la fecha de presentación de la solicitud de patente o, en su caso, de la prioridad reconocida."*

*"Sólo para el efecto de la determinación de la novedad, también se considerará dentro del estado de la técnica, el contenido de una solicitud de patente en trámite ante la oficina nacional competente cuya fecha de presentación o de prioridad fuese anterior a la fecha de presentación o de prioridad de la solicitud de patente que se estuviese examinando, siempre que dicho contenido este incluido en la solicitud de fecha anterior cuando ella se publique o hubiese transcurrido el plazo previsto en el artículo 40."*

Consultadas las bases de datos y los archivos con que cuenta la entidad, especialmente bajo las clasificaciones **A 61 F 13/15** y las más cercanas a ellas, se encontró que antes del 29 de agosto de 2003 (fecha para determinar el estado de la técnica) habían sido publicados los documentos que se enumeran en la siguiente tabla los cuales se relacionan con artículos absorbentes desechables..

De acuerdo con o establecido en el artículo 16 se determinó el estado de la técnica y se encontró el siguiente antecedente:

| N° | *Documento* | *Título* | *Fecha de Publicación* |
|---|---|---|---|
| D1 | US 5562645 | Article with soft absorbent pulp sheet | 1996.10.08 |
| D2 | US 3837343 | Disposable diaper... | 1974.09.24 |
| D3 | US 5910137 | Layered absorbent products | 1999.06.08 |
| D4 | US 6569274 | Sealable nonwoven web | 2003.05.27 |
| D5 | US 4481250 | Vinyl acetate ethylene binder... | 1984.11.06 |
| D6 | US 5536555 | Liquid permeable quilted film laminates | 1996.07.16 |

**6) Evaluación de los requisitos de patentabilidad**

El artículo 14 de la Decisión 486 de la Comisión de la Comunidad Andina establece:

> *"Los Países Miembros otorgarán patentes para las invenciones, sean de producto o procedimiento, en todos los campos de la tecnología, siempre que sean nuevas tengan nivel inventivo y sean susceptibles de aplicación industrial".*

En cumplimiento con este artículo, se procedió a evaluar los requisitos de novedad, nivel inventivo y aplicación industrial con el fin de establecer la patentabilidad de la invención reivindicada en la solicitud en estudio.

a) Evaluación de la novedad y el del Nivel Inventivo

El art. 16 de la Decisión 486 de la Comisión de la Comunidad Andina establece:

> *"Una invención se considerará nueva cuando no está comprendida en el estado de la técnica." "El estado de la técnica comprenderá todo lo que haya sido accesible al público por una descripción escrita u oral, utilización comercialización o cualquier otro medio antes de la fecha de presentación de la solicitud de patente o, en su caso, de la prioridad reconocida."*

El art. 18 de la Decisión 486 de la Comisión de la Comunidad Andina establece:

> *"Se considerará que una invención tiene nivel inventivo, si para una persona del oficio normalmente versada en el arte en la materia técnica correspondiente, esa invención no hubiese resultado obvia ni se hubiese derivado de manera evidente del estado de la técnica".*

Las anterioridades citadas relacionan compuestos ligantes que cumplen exactamente la misma función que lo esbozado en la presente solicitud. Si se toma el documento D1 se encuentra que revela prácticamente la misma materia que el solicitante desea proteger. Obsérvense las columnas 16 y 17. Algunas características no esbozadas por D1, se encuentran en uno de los demás documentos citados, por lo que no aparecería la altura inventiva para que se le concediera el privilegio solicitado.

No cumpliría, por tanto, los requisitos de patentabilidad la presente solicitud.

b) Resumen

En conclusión los requisitos de patentabilidad de la presente solicitud se podrían ver afectados así:

| Nº | Documento | Reivindicaci nes afectadas | Requisito que afecta |
|---|---|---|---|
| D1 | US 5562645 | 1 - 33 | Novedad |
| | | | Nivel inventivo |
| D2 | US 3837343 | 1 - 33 | Novedad |
| | | | Nivel inventivo |
| D3 | US 5910137 | 1 - 33 | Novedad |
| | | | Nivel inventivo |
| D4 | US 6569274 | 1 - 33 | Novedad |
| | | | Nivel inventivo |
| D5 | US 4481250 | 1 - 33 | Novedad |
| | | | Nivel inventivo |
| D6 | US 5536555 | 1 - 33 | Novedad |
| | | | Nivel inventivo |

**7) Notificación**

En cumplimiento del artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le indica que dentro del término de sesenta días contados a partir de la fecha de la notificación de la presente comunicación debe responder a la notificación. En caso de no dar respuesta al presente requerimiento, o si a pesar de la respuesta subsistieran los impedimentos para la concesión, se denegará la patente.

Notifíquese el presente oficio conforme a lo dispuesto por el numeral 5.2, literal e) del capítulo quinto del título primero de la Circular Única Nº 10 de 2001

***ALIX CARMENZA CÉSPEDES DE VERGEL***
***Jefe División de Nuevas Creaciones***

El anterior requerimiento fue notificado por fijación en la lista, de fecha

07 SET. 2006.

| Concepto Técnico Nº | EXAMINADOR TÉCNICO Código No. | EXAMINADOR JURÍDICO Código No. |
|---|---|---|
| 1414 | 202003 | |

US005562645A

**United States Patent** [19]

Tanzer et al.

Patent Number: 5,562,645

[45] Date of Patent: Oct. 8, 1996

[54] ARTICLE WITH SOFT ABSORBENT PULP SHEET

[75] Inventors: Richard W. Tanzer; Neenah; Mark Robinson; Fang-Jun Chen, both Appleton; Richard Kemps, Wrightstown; Larry Ballon, Pine River, Wis.

[73] Assignee: Kimberly-Clark Corporation, Neenah, Wis.

[21] Appl. No.: 455,778

[22] Filed: May 31, 1995

[51] Int. Cl. ..... A61F 13/15; A61F 13/20

[52] U.S. Cl. ..... 604/387; 604/358; 604/361; 604/368; 604/372; 604/378

[58] Field Search ..... 604/358, 365–368, 604/372, 378, 383.

[56] References Cited

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| | | | |
|---|---|---|---|
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| | | |
|---|---|---|
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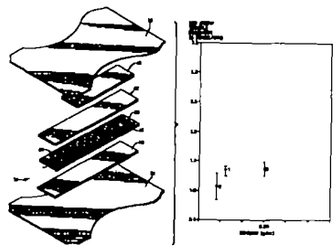
| 2254323 | 10/1992 | United Kingdom |
| WO8/01878 | 9/87 | WIPO |
| WO94/08802 | 3/1994 | WIPO |
| WO94/18854 | 9/94 | WIPO |

*Primary Examiner*—John Weiss
*Assistant Examiner*—F. Tamerself
*Attorney, Agent, Firm*—Paul Yee

[57] ABSTRACT

The present invention provides disposable articles which includes least one absorbent, fibrous web layer which substantially non-hydrostrengthed. The fibrous web layer can have basis weight least about 40 gsm, and density not more than about 0.25 gm/cc. The fibrous web layer can further have peak geometric mean tensile strength least about 250 grams-force per centimeter width, and can have fiber moisture which least about 90 the fibers are incorporated fibers having fiber length not more than about 0.4 inch (about mm). particular configurations, the article includes backsheet layer, and liquid permeable topsheet layer which disposed facing relation with the backsheet layer. An absorbent structure interposed between the backsheet layer and the topsheet layer, and the absorbent structure has overall absorbent capacity least about 300 grams saline.

23 Claims, Drawing Sheets





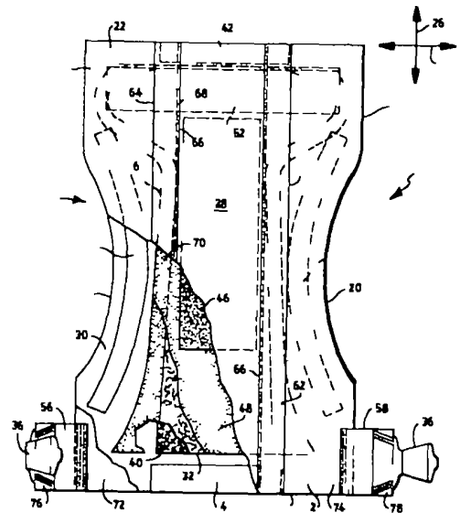



FIG 1

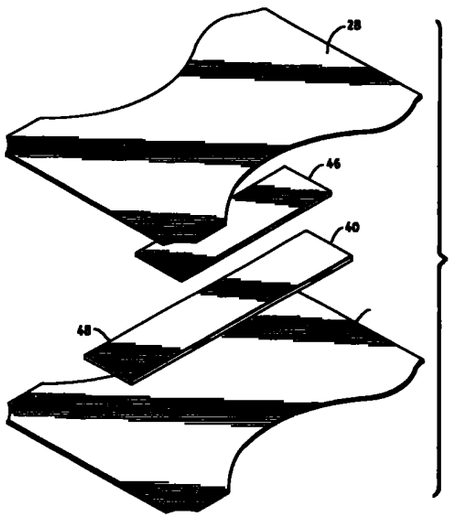



FIG 2

U.S. Patent Oct. 8, 996 Sheet of 13 5,562,645

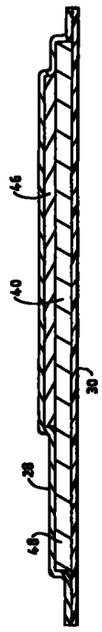



FIG 3

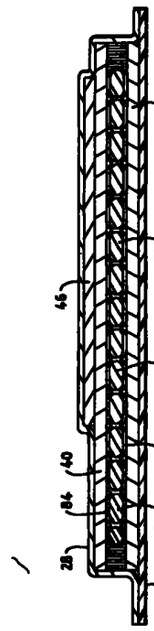



FIG 6

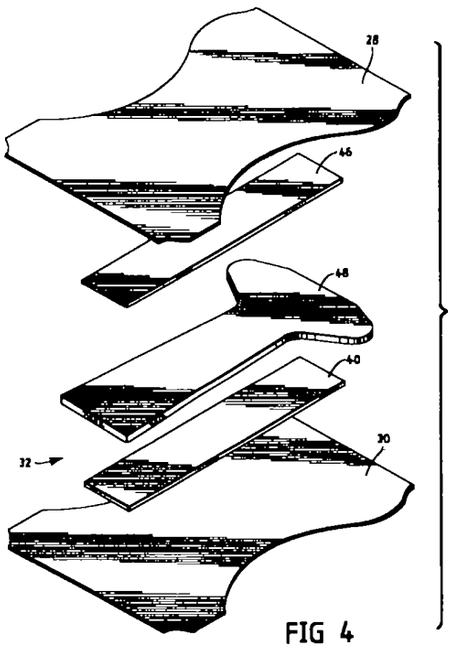



FIG 4

U.S. Patent Oct. 8, 1996 Sheet of 13 5,562,645

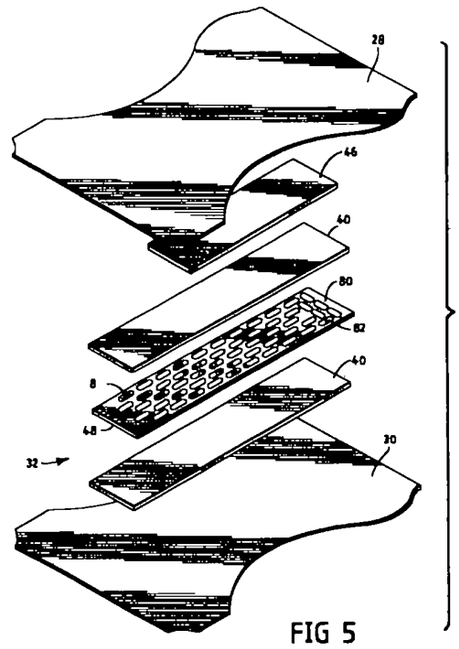



FIG 5

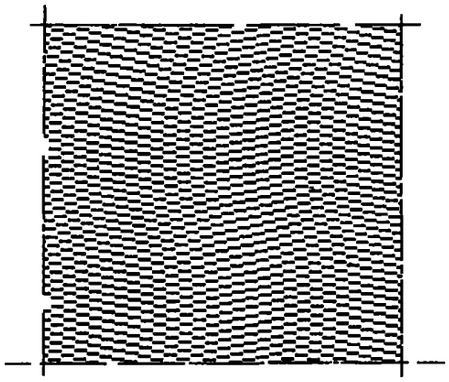


FIG 7

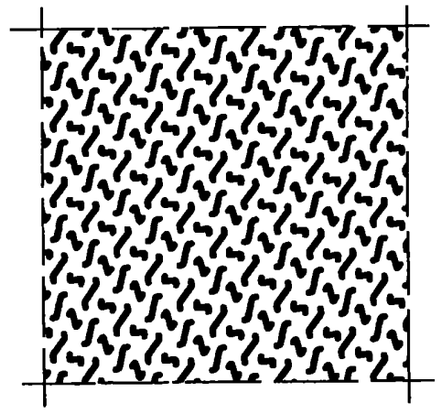


FIG 8

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| MATERIAL DESCRIPTIONS | | | | | COMPOSITION | | FIBER LENGTH | |
|---|---|---|---|---|---|---|---|---|
| No. | Material | Basis Wt./Per Sheet (gsm) | Density (g/cc) | Peak Gen. Stress Tensile Str./g Tense Area | % Cellulose | % Binder | Wt.% Fibers > 1cm | Wt.% Fibers > 3cm |
| 1 | Bleached Kraft wood pulp, fiberized | 222 | 0.11 | 23 | 100% | 0% | 0% | 0% |
| 2 | Creped tissue paper | 17 | 0.10 | 109 | 100% | 0% | 0% | 0% |
| 3 | BOUNTY® towel | 42 | 0.07 | 326 | 98% | 2% | 0% | 0% |
| 4 | HI DRI® towel | 34 | 0.04 | 228 | 99% | 1% | 0% | 0% |
| 5 | JOB SQUAD® towel | 55 | 0.09 | 191 | 97% | 3% | 0% | 0% |
| 6 | WORK HORSE® manufactured rags | 59 | 0.17 | 721 | 85% | 15% | 15% | 15% |
| 7 | HUGGIES® Baby Wipes basesheet(dry) | 75 | 0.07 | 201 | 65% | 35% | 20% | 10% |
| 8 | DEPEND® Undergarment absorbent core | 442 | 0.09 | 12 | 92% | 2% | 2% | 2% |
| 9 | HUGGIES® diaper absorbent core | 704 | 0.20 | 24 | 80% | 0% | 0% | 0% |
| 10 | Wet-pressed pulpboard basesheet | 275 | 0.45 | 4,109 | 100% | 0% | 0% | 0% |
| 11 | Wet-pressed pulpboard basesheet | 165 | 0.40 | 2,449 | 100% | 0% | 0% | 0% |
| 12 | Wet-pressed pulpboard microstrained sheet | 165 | 0.30 | 500 | 100% | 0% | 0% | 0% |
| 13 | Wet-pressed pulpboard basesheet | 260 | 0.30 | 2,266 | 100% | 0% | 0% | 0% |

FIG. 9A



| MATERIAL DESCRIPTIONS | | | | | COMPOSITION | | FIBER LENGTH | |
|---|---|---|---|---|---|---|---|---|
| No. | MATERIAL | Basis Wt./Per Sheet (gsm) | DENSITY (g/cc) | Peak Gen. Stress Tensile Str./g Tense Area | % Cellulose | % Binder | Wt.% Fibers > 1cm | Wt.% Fibers > 3cm |
| 14 | Through-air dried pulpboard basesheet | 467 | 0.14 | 2,329 | 100% | 0% | 0% | 0% |
| 15 | Wet-pressed pulpboard basesheet | 163 | 0.27 | 1,247 | 100% | 0% | 0% | 0% |
| 16 | Wet-pressed pulpboard microstrained sheet | 151 | 0.25 | 341 | 100% | 0% | 0% | 0% |
| 17 | Through-air dried pulpboard basesheet | 187 | 0.12 | 1,089 | 100% | 0% | 0% | 0% |
| 18 | Through-air dried pulpboard basesheet | 337 | 0.14 | 2,036 | 100% | 0% | 0% | 0% |
| 19 | Wet-pressed pulpboard microstrained sheet | 255 | 0.25 | 493 | 100% | 0% | 0% | 0% |
| 20 | Through-air dried pulpboard microstrained sheet | 326 | 0.18 | 539 | 100% | 0% | 0% | 0% |
| 21 | Through-air dried pulpboard microstrained sheet | 282 | 0.23 | 941 | 100% | 0% | 0% | 0% |
| 22 | Through-air dried pulpboard microstrained sheet | 178 | 0.22 | 310 | 100% | 0% | 0% | 0% |
| 23 | Through-air dried pulpboard microstrained sheet | 441 | 0.18 | 1,023 | 100% | 0% | 0% | 0% |

FIG. 9B

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| MATERIAL DESCRIPTIONS | | | | | | PROPERTIES | | | | | ABSORBENCY | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID No. | Base Sheet ID | Material | Softwood Fiber Content | | Basis Wt/Sht (gsm) | Density (g/cc) | Peak Geom. Mean Tensile Strnth. (g force/cm width) | Stiffness (BGU) | Thickness (mm) | Stiffness-Thickness (BGU/mm) | 45° Liquid Intake (g/g) | Blotter Test — Liquid Expressed (g/g) |
| | | | Untrtd | Cross linked | | | | | | | | |
| 10 | A-1 | Wet-pressed pulpboard basesheet | 100% | 0% | 278 | 0.45 | 4,108 | — | 1 | — | 2.4 | — |
| 11 | B-1 | Wet-pressed pulpboard basesheet | 100% | 0% | 168 | 0.40 | 2,449 | 1,780 | 0 | 4,272 | 2.6 | 2.4 |
| 12 | B-2 | Wet-pressed pulpboard microstrained sheet | 100% | 0% | 186 | 0.30 | 500 | 144 | 1 | 263 | 4.0 | 3.8 |
| 13 | C-1 | Wet-pressed pulpboard basesheet | 60% | 40% | 260 | 0.30 | 2,268 | 4,174 | 1 | 4,854 | 3.5 | 3.3 |
| 14 | H-1 | Through-air dried pulpboard basesheet | 60% | 40% | 467 | 0.14 | 2,329 | 15,804 | 3 | 4,885 | 6.6 | 6.5 |
| 15 | D-1 | Wet-pressed pulpboard basesheet | 60% | 40% | 183 | 0.27 | 1,247 | 1,808 | 1 | 2,711 | 3.5 | 3.3 |
| 16 | D-2 | Wet-pressed pulpboard microstrained sheet | 60% | 40% | 151 | 0.25 | 341 | 112 | 1 | 186 | 5.1 | 5.3 |
| 17 | E-1 | Through-air dried pulpboard basesheet | 60% | 40% | 167 | 0.12 | 1,069 | 2,128 | 1 | 1,471 | 7.3 | 7.5 |
| 18 | F-1 | Through-air dried pulpboard basesheet | 60% | 40% | 337 | 0.14 | 2,038 | 8,857 | 2 | 3,885 | 6.7 | 6.7 |

FIG. 10A



| MATERIAL DESCRIPTIONS | | | | | | PROPERTIES | | | | | ABSORBENCY | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID No. | Base Sheet ID | Material | Softwood Fiber Content | | Basis Wt/Sht (gsm) | Density (g/cc) | Peak Geom. Mean Tensile Strnth. (g force/cm width) | Stiffness (BGU) | Thickness (mm) | Stiffness-Thickness (BGU/mm) | 45° Liquid Intake (g/g) | Blotter Test — Liquid Expressed (g/g) |
| | | | Untrtd | Cross linked | | | | | | | | |
| 19 | C-2 | Wet-pressed pulpboard microstrained sheet | 60% | 40% | 258 | 0.25 | 493 | 261 | 1 | 259 | 4.9 | 5.0 |
| 20 | F-2 | Through-air dried pulpboard microstrained sheet | 60% | 40% | 328 | 0.18 | 539 | 539 | 2 | 301 | 6.8 | 6.7 |
| 21 | G-2 | Through-air dried pulpboard microstrained sheet | 100% | 0% | 282 | 0.23 | 941 | 554 | 1 | 443 | 4.8 | 4.7 |
| 22 | E-2 | Through-air dried pulpboard microstrained sheet | 60% | 40% | 176 | 0.22 | 310 | 200 | 1 | 243 | 7.4 | 7.7 |
| 23 | H-2 | Through-air dried pulpboard microstrained sheet | 60% | 40% | 441 | 0.18 | 1,023 | 1,853 | 2 | 589 | 8.1 | 8.2 |

FIG. 10B

TENSILE STRENGTH

| Sample ID No. | Number Of Values | | PEAK GEOMETRIC MEAN TENSILE STRENGTH (g force/cm width) GMTB | | | log (GMTB) | | |
|---|---|---|---|---|---|---|---|---|
| | m.d. | c.d. | MI | VG | MAX. | IN | VG | MAX. |
| | | | 8 | 23 | 28 | .25 | .36 | .4 |
| 2 | 3 | 3 | 102 | 09 | 113 | 2.01 | 2.04 | 2.05 |
| 3 | 3 | 3 | 308 | 326 | 355 | 2.49 | 2.51 | 2.55 |
| | 3 | 3 | 205 | 226 | 242 | 2.31 | 2.35 | 2.38 |
| 5 | 3 | 3 | 184 | 191 | 202 | 2.26 | .28 | 2.3 |
| 6 | 3 | 3 | 640 | 721 | 830 | 2.81 | 2.86 | 2 92 |
| 7 | 3 | 3 | 184 | 201 | 220 | 2.26 | 2.30 | 2.34 |
| 8 | 3 | 3 | | 1 | 20 | 0.84 | 1.06 | 1.29 |
| 9 | 3 | | 6 | 24 | 3 | .25 | .37 | .49 |
| 10 | 3 | 3 | 3,8 | 4,109 | 4,347 | 3.58 | 3.61 | 3.64 |
| 11 | 4 | 4 | 2,325 | 2,449 | 2 672 | 3.37 | 3.39 | 3.43 |
| 2 | | | 465 | 500 | 54 | 67 | 2.70 | 2 73 |
| 13 | | 3 | 2, 69 | 2,266 | ,40 | 3.34 | 3.35 | 3.36 |
| 14 | 3 | 3 | 2, 03 | 2,329 | 2 658 | 3.32 | 3.37 | 3.42 |
| 15 | 3 | 3 | 1 160 | 1,247 | 1 308 | 3.06 | 3.10 | 3.12 |
| 16 | 3 | 3 | 326 | 341 | 355 | 2.51 | 2 53 | 2.55 |
| 17 | 3 | 3 | 029 | 069 | 1 116 | 3.01 | 3.03 | 3.05 |
| 18 | 3 | 3 | 1 973 | 2,036 | 2,099 | 3.30 | 3.31 | 3.32 |
| 19 | 3 | 3 | 445 | 493 | 552 | 2 65 | 2.69 | 2.74 |
| 20 | 3 | 3 | 510 | 539 | 571 | 2.71 | 2.73 | 2.76 |
| 21 | 3 | 3 | 895 | 941 | 995 | 2.95 | 2.97 | 3.00 |
| 22 | | 3 | 300 | 310 | 3 9 | 2.48 | 2.49 | 2.50 |
| 23 | 3 | 3 | 932 | 023 | 1,080 | 2.97 | 3.0 | 3.03 |

FIG 11



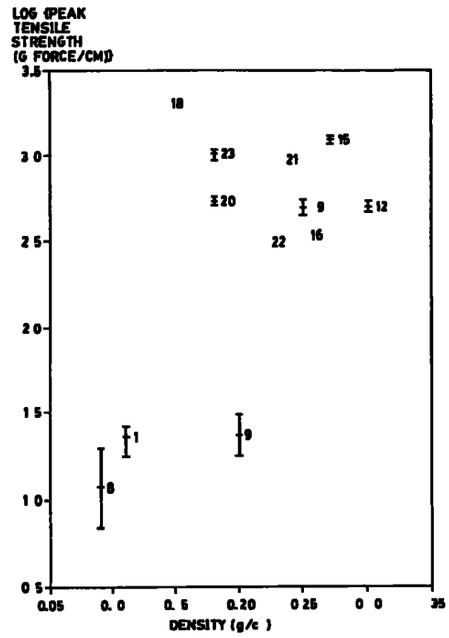


FIG 12

## ARTICLE WITH SOFT ABSORBENT PULP SHEET

### FIELD OF THE INVENTION

The present invention relates articles, particularly structures which are useful absorbent products. More particularly, the invention relates absorbent articles which include absorbent structures comprised one more layers distinctive fibrous web.

### BACKGROUND OF THE INVENTION

Absorbent articles, such disposable diapers, have included absorbent structures comprised conventional materials, such creped wadding, cellulosic wood pulp fluff, fibrous cellulose materials, superabsorbent particles, tissues and combinations thereof For example, conventional absorbent structures have been comprised mixtures superabsorbent polymer material and wood pulp fluff, and mixtures superabsorbent particles cellulose fibrous webs. Conventional absorbent structures, such those described above, however, have not provided desired combinations total absorbent capacity, dimensional stability, high strengths, ease manufacturing, and low cost. For example, creped wadding and tissues have low basis weight, and require large number plies produce desired level absorbent capacity and/or total basis weight. Non-fluffed wood pulp board has excessive density and stiffness, while fluffed, airlaid wood pulp fluff has low strength and low dimensional stability. Typically, airlaid fluff web reinforced with supplemental carrier layer, such tissue, enable movement through the manufacturing process for the assembled absorbent article. Highly densified web airlaid wood pulp fluff can have excessive stiffness and can include undesirable hard spots. addition, the fluff web has been dimensionally unstable and has marked poor thickness wherever the fluff web unconsolidated. Airlaid cellulose webs can constructed with combination natural and synthetic fibers increase the web strength. The inclusion synthetic fibers can, however, conversely raise the cost the cellulose webs. Similarly, hydroentangled pulp webs typically require sufficient proportions relatively long fibers, such fibers one-half inch (1.27 cm) more length, preserve the entangled web structures. The inclusion the long fibers and the complexity the hydroentangling process can excessively raise the cost of the formed fibrous webs.

As result, there has been continuing need for low density, high strength fibrous web which can produced low cost and can suitable for use selected articles, such articles which may absorbent and may disposable. There has also been continuing need for fibrous webs having desired permeability high basis weight and low stiffness for use the selected articles.

### BRIEF DESCRIPTION OF THE INVENTION

The present invention provides article having least one absorbent fibrous web layer which substantially non-hydroentangled. particular aspects, the fibrous web layer has high basis weight, low density, and high peak tensile strength. other aspects, the fibrous web layer can also have fiber content which large proportion the fiber content are short fibers. still further aspects, the fibrous web layer the invention can incorporated into absorbent article comprising backsheet layer, and liquid permeable topsheet layer which disposed facing relation with the backsheet layer. An absorbent retention portion interposed between the backsheet layer and the topsheet layer, and the retention portion has overall absorbent capacity least about 300 gm saline.

The present invention, various aspects, can advantageously provide lower cost fibrous web which has relatively high tensile strength and high flexibility, and can provide desired levels absorbency. The high web strength can allow the web more easily processed through manufacturing line form final article. The high basis weight and flexibility the web can help improve the function and utility the web selected articles, such absorbent articles.

### BRIEF DESCRIPTION OF THE DRAWINGS

The invention will more fully understood and further advantages will become apparent when reference made the following detailed description and accompanying drawings wherein:

FIG. shows top view representative article the invention;

FIG. representatively shows perspective, expanded view article the invention having retention portion component one more plies the fibrous web layer the invention;

FIG. representatively shows longitudinal cross-sectional view taken through article the type shown FIG.

FIG. representatively shows perspective, expanded view article the invention having retention portion which includes absorbent body comprised mixture woodpulp fluff fibers and superabsorbent particles;

FIG. representatively shows expanded, perspective view an article the invention having retention portion which includes superabsorbent material held discrete pocket regions;

FIG. representatively shows longitudinal cross-sectional view taken through article the type shown FIG.

FIG. representatively embossing pattern configured on the surface embossing roll employed prepare sample pulp sheet materials;

FIG. representatively shows another embossing pattern configured on the surface embossing roll employed prepare other sample pulp sheet materials;

FIG. 8A table which representatively shows particular physical characteristics selected sample materials;

FIG. 8B continuation the table FIG. 8A,

FIG. 18A table which representatively shows additional physical and functional characteristics the selected sample materials;

FIG. 18B continuation the table FIG. 18A,

FIG. table which summarizes data pertaining the geometric mean tensile strength values for particular sample materials;

FIG. graph which shows representative plot the logarithm particular peak geometric mean tensile force values function density for particular sample materials.

### DETAILED DESCRIPTION OF THE INVENTION

The structures the present invention will described herein relationship their use disposable absorbent articles. For the purpose the present invention, disposable absorbent article article which absorbs and contains liquids, such body exudates, and intended discarded after limited period time. The articles are not intended laundered otherwise restored for reuse. While the present description will particularly made the context disposable absorbent article, particularly disposable diaper, should understood that the various structures the present invention are also applicable other articles, such adult incontinence garments, sanitary napkins, children's training pants, bed pads, absorbent wipes and the like.

With reference FIG. article the invention includes least one fibrous web layer 48, which may include one more types fibers, such hydrophilic fibers. The fibrous web layer can absorbent, and the hydrophilic fibers can, for example, comprised cellulosic fibers. The fibrous web layer 48 can have high basis weight, such basis weight least about gsm (grams per square meter), and can have low density, such density not more than about 0.25 grams/cc. The web layer can further have high tensile strength, such peak geometric mean (GM) tensile strength least about 250 grams-force per centimeter width and fibrous web layer, and can have fiber content which large proportion, such least about %, the fiber content are short fibers. The short fibers can have fiber length not more than about 0.4 inch (about cm).

The fibrous web layer substantially non-hydroentangled. For example, the web layer can comprised fibers which have been deposited out aqueous suspension substantially random fashion, and subsequently dried. The web layer thereby formed substantially without orienting the fibers.

Particular aspects the present invention can provide absorbent article, such the representatively shown diaper 18, which has cross-wise, lateral dimension 24 and length-wise, longitudinal dimension 26. The diaper has front waistband section 13, rear back waistband section 14, and intermediate section which interconnects the front and rear waistband sections. The article also includes backsheet layer 30 which has laterally extending width and longitudinally extending length. porous, liquid permeable topsheet layer also has laterally extending width and longitudinally extending length, and superposed facing relation with the backsheet layer 30. An absorbent body, such absorbent structure 33, interposed between the backsheet layer and the topsheet layer 30, and the absorbent structure includes retention portion 48. particular aspects, the absorbent structure can have overall basis weight fibers which least about 300 grams per square meter (gsm), and other aspects can have overall absorbent capacity least about 400 grams saline. further aspects, the retention portion 48, itself, can have overall basis weight fibers which least about 300 grams per square meter (gsm), and can have overall absorbent capacity least about 400 grams saline.

particular arrangements, the fibrous web layer 48, can employed constituent otherwise provide one more selected sections components the retention portion 48. Further arrangements of the fibrous web layer 48 can have selected Gurley stiffness thickness quotient. Where the stiffness expressed Standard Gurley Units, the Gurley stiffness thickness quotient can not more than about 2000 SGU/mm (Standard Gurley Units per millimeter). other aspects, the fibrous web layer 48 can have fiber content which least about wt the fiber content are fibers having fiber length not more than about 1.2 inch (about cm). Additional aspects the invention can provide fibrous layer comprised plurality integrally formed, cooperating zones with different zones having different characteristics.

The various aspects the fibrous web layer 48 the invention can advantageously provide low cost material having high bulk along with high strength and flexibility. The web layer can also have improved resistance bunching, wadding and twisting, and can produced with lower cost manufacturing steps.

FIG. representatively shows plan view of the diaper in flat-out, unconstricted state (i.e., with elastic induced gathering and contraction removed). Portions the structures are partially cut away more clearly show the interior construction of diaper 18, and the outer facing surface of the diaper which contacts the wearer facing the viewer. the shown embodiment, diaper has front waistband region 13, back waistband region 14, intermediate crotch region which interconnects the front and rear waistband regions. The outer edges the diaper define periphery which the longitudinally extending side edge margins are designated 23. The side edges define leg openings for the diaper, and optionally, are curvilinear and contoured. The end edges are shown straight, but optionally, may curvilinear. The diaper additionally has transversely extending, lateral waist dimension 24 and longitudinal length dimension 26.

Diaper typically includes porous, liquid permeable topsheet 28; substantially liquid impermeable backsheet 30; absorbent structure 33, positioned between the topsheet and backsheet; surge management portion 46; and elastic members, such leg elastics 34 and waist elastics 42. The surge management portion positioned liquid communication with the absorbent structure, and the absorbent structure includes retention portion 48. Topsheet 28, backsheet 30, absorbent structure 33, surge management portion and the elastic members 34 and 42 may assembled various well-known diaper configurations.

addition, the diaper can include system containment flaps 62, system side panel members and 68, and suitable fastening means, such provided by fastener tabs 36. An elasticized side panel can connected the article each laterally opposed end region 73 and 74 least one the front and rear waistband sections. The side panels and are constructed elastically stretchable least along laterally extending cross-direction the article, and the fastening means, such provided the tape tab fasteners 36, configured for securing the article on wearer. tab fastener elements usually fixed end region least one, and desirably both, the side panels. The illustrated embodiment, for example, first tape tab fastener connected the distal end region 76 side panel 36, and second tape tab fastener connected the distal end region elasticized side panel 68.

As representatively shown, topsheet and backsheet 30 may generally coextensive, and may have length and width dimensions which are generally larger than the corresponding dimensions the absorbent structure 33. Topsheet associated with and superimposed backsheet 30, thereby defining the periphery diaper 18. The periphery defines the outer perimeter the diaper 18, and in the illustrated embodiment, comprises laterally marginal end edges 23, and contoured longitudinally extending marginal side edges 20. The diaper has front and back

waistband regions and 14, respectively, extending from the laterally extending end edges 32 diaper periphery 18 toward the transverse center line the diaper along distance from about percent about percent of the overall length diaper 18. The waistband regions comprise those upper portions diaper 18, which when worn, wholly partially cover encircle the waist mid-lower torso the wearer. The intermediate region lies between and interconnects waistband regions and 14, and comprises that portion diaper which, when worn, positioned the crotch region between the legs the wearer and covers the lower torso the wearer. Thus, the intermediate region area where repeated fluid surges typically occur the diaper other disposable absorbent articles.

Topsheet preferably body-facing surface which compliant, soft-feeling, and non-irritating the wearer's skin. Further, topsheet 28 can less hydrophilic than retention portion 48, and sufficiently porous liquid permeable, permitting liquid passage through thickness.

suitable topsheet may manufactured from wide selection web materials, such porous foams, reticulated foams, apertured plastic films, natural fibers (for example, wood cotton fibers), synthetic fibers (for example, polyester polypropylene fibers), combination natural and synthetic fibers. Topsheet 28 typically employed help isolate the wearer's skin from liquids held absorbent structure 33. Various woven and nonwoven fabrics can used for topsheet 28. For example, the topsheet may composed meltblown spunbonded web polyolefin fibers. The topsheet may also bonded-carded-web composed natural and/or synthetic fibers.

For the purposes the present description, the term "nonwoven web" means web material which formed without the aid textile weaving knitting process. The term "fabrics" used refer of the woven, knitted and nonwoven fibrous webs.

The topsheet fabrics may composed substantially hydrophobic and substantially nonwettable material, and the hydrophobic material may optionally treated with surfactant otherwise processed impart desired level wettability and hydrophilicity. particular embodiment the invention, for example, topsheet can nonwoven, spunbond polypropylene fabric composed about 2.8–3.2 denier fibers formed into web having basis weight about gsm and density about 0.06 gm/cc. The fabric can surface treated with selected amount surfactant wetting agent, such about 0.28% Triton X-102 surfactant. The surfactant can applied any conventional means, such spraying, printing, brush coating the like.

The surfactant material can applied medial section the topsheet layer provide greater wettability the medial section, compared remainder the topsheet layer 28. particular configurations, the cross-directional width the surfactant-treated medial section can substantially equal less than the cross-directional width the surge management portion 46. The surfactant-treated medial section can approximately centered with respect the longitudinal centerline the diaper, and can extend along substantially the entire length the topsheet layer. Alternatively, the surfactant treated medial section can constricted extend along only predetermined portion the topsheet length.

The various configurations the invention can include elasticized containment flaps 62. The represented very shown configuration includes two containment flaps 62 which may, for example, connected the bodyside surface of topsheet layer 28. Suitable constructions and arrangements for containment flaps are described, for example, U.S. Pat. No. 704, issued Nov. 1987 Enloe, the entire disclosure which hereby incorporated by reference manner that consistent (not contradictory) herewith. Other configurations the containment flaps are described U.S. patent application Ser. No. 208,83 Everett et., filed Mar. 1994 and entitled ABSORBENT ARTICLE HAVING AN IMPROVED SURGE MANAGEMENT (Attorney docket No. 372), the entire disclosure which hereby incorporated reference manner that consistent herewith.

The containment flaps can attached topsheet layer along length-wise extending fixed regions, such fixed edge 64, the flaps, movable edge such constrained flap backsite flap elastic member comprising one more individual strands elastomeric material. For example, plurality elastic strands may configured spatially separated, generally parallel arrangement, and suitable elastic strand can, for example, composed 470 decitex Lycra elastomer. Elastic member 68 connected the movable edge the containment flap elastically contractible condition such that the contraction the elastic components thereof gathers and shortens the edge the containment flap. As result, the movable edge such containment flap bends position itself spaced relation away from the bodyside surface topsheet and/or surge management portion toward generally upright and approximately perpendicular configuration, especially the crotch section of the diaper. particular embodiments, for example, the movable edge the barrier flap connected the flap elastics partially doubling the flap material back upon itself by flexible element which sufficient enclose the flap elastics 68.

least pair containment barrier flaps can connected opposed, laterally opposed, longitudinally extending regions the topsheet layer 28, and the connected topsheet regions can located generally adjacent the laterally opposed side edge regions the medial section of the topsheet layer. The connected topsheet regions can located substantially laterally inboard the elasticized side margins the diaper article 18. Optionally, the containment flaps can connected the diaper regions which are located outboard the leg elastics.

The containment flaps may, for example, constructed fibrous material which similar the material comprising topsheet 28, similar the material comprising surge management portion 46. Other conventional materials, such polyester fibers, may also employed. other aspects the invention, barrier flaps are constructed material which permeable gas, such ambient air. Alternative configurations the invention can include barrier flaps which are constructed material which substantially passage aqueous liquid, such urine, therethrough. For example, barrier flaps may constructed spunbond-meltblown-spunbond (SMS) laminate material. For example, the barrier flaps can constructed SMS material having basis weight about 0.85 oz/yd (about gsm). The spunbond layers can composed polypropylene fibers, and the meltblown layer composed meltblown polypropylene fibers.

the various configurations the invention, such where the barrier flaps 62 are configured permeable gas while having resistance and limited permeability aqueous liquid, the liquid resistant material can have construction which capable supporting hydrostatic



least about cm water substantially without leakage therethrough. suitable techniques for determining the resistance material liquid penetration Federal Test Method Standard FTMS 19 Method 3514, dated Dec. 1968.

Backsheet 30 may composed liquid permeable material, but preferably comprises material which configured substantially impermeable liquids. For example, typical backsheet can manufactured from thin plastic film, other flexible liquid-impermeable material. In the present specification, the term "flexible" refers materials which not compliant and which will readily conform the general shape and contours the wearer's body. Backsheet 30 typically helps prevent the exudates contained absorbent structure from wetting articles such bedsheets and overgarments which contact diaper 18.

particular embodiments, the backsheet 30 polyethylene film having thickness from about 0.01 millimeter (0.5 mil) about 0.051 millimeters (2.0 mils). particular embodiments, the backsheet can film having thickness about .25 mil. Alternative constructions the backsheet may comprise woven nonwoven fibrous web layer which has been totally partially constructed treated impart the desired levels of liquid impermeability selected regions that are adjacent proximate the absorbent body. Backsheet 30 typically provides the outer cover the article. Optionally, however, the article may include separate outer cover member which addition the backsheet.

Backsheet 30 may optionally composed microporous, "breathable" material which permits vapors escape from absorbent structure 33 while still preventing liquid exudates from passing through the backsheet. For example, the breathable backsheet may composed microporous polymer film nonwoven fabric which has been coated otherwise treated impart desired level liquid impermeability. For example, suitable microporous film PMP-1 material, which available from Mitsui Toatsu Chemicals, Inc., company having offices Tokyo, Japan; XKO-8044 polyolefin film available from 3M Company Minneapolis, Minn. The backsheet can also embossed otherwise provided with matte finish exhibit more aesthetically pleasing appearance.

The skin backsheet 30 typically dimensioned the size absorbent structure and the exact diaper design selected. Backsheet 30, for example, may have generally T-shape, generally I-shape modified hourglass shape, and may extend beyond the terminal edges of absorbent structure 33 selected distance provide side margins. The topsheet and backsheet 30 are connected otherwise associated together operable manner. As used herein, the term "associated" encompasses configurations which topsheet directly joined backsheet affixing topsheet directly backsheet 30, and configurations wherein topsheet 28 joined backsheet affixing topsheet intermediate members which turn affixed backsheet 30. Topsheet and backsheet can affixed directly each other the diaper periphery by attachment means (not shown) such adhesive, sonic bonds, thermal bonds any other attachment means known the art. For example, uniform continuous layer adhesive, patterned layer adhesive, sprayed pattern adhesive array of separate lines, swirls spots construction adhesive other bonds may used affix topsheet backsheet 30, should readily appreciated that the shown-described types attachment means may also employed interconnect and assemble together the various other component parts the final, constructed article.

the representatively shown embodiment the invention, the topsheet layer 28 dispensed and secured feeding relation with the backsheet layer 30 inside and held the retention portion 48 and the surge management portion between the backsheet layer and the topsheet layer. The marginal side regions topsheet layer can, for example, operably connected corresponding marginal side regions the backsheet layer 30. Each the attached marginal side regions the topsheet and backsheet layers located laterally outboard its corresponding, associated side edge region the surge management portion 46. Similarly, the topsheet and/or backsheet can include marginal end regions which are located longitudinally outboard the end edge regions the retention portion 48 and/or surge management portion 46.

the representatively shown arrangement, the elastic members are dispensed adjacent the periphery diaper along each the longitudinal side edges 20 provide elasticized leg cuffs/bags. The leg elastic members can connected either both the topsheet and backsheet layers provide elasticized side margins the diaper article, and can arranged draw and hold diaper against the legs the wearer. Water elastic members 43 may also dispensed adjacent either both the end edges diaper provide elasticized waistbands.

The elastic members and 43 are secured diaper elastically contractible condition that normal under-elastic configuration, the elastic members effectively contract against diaper 18. The elastic members can secured elastically contractible condition least two ways. For example, the elastic members may stretched and secured while diaper unconstricted condition. Alternatively, diaper may contracted, for example, pleating, and the elastic members secured and connected diaper while the elastic members are their unstretched contracted condition. Still other means, such heat-shrink elastic material, may used gather the garment.

example the illustrated configuration, leg elastic members extend essentially along the complete length the crotch region the diaper 18. Alternatively, elastic members may extend the entire length diaper 18, any other length suitable providing the arrangement elastical contractible lines desired for the particular diaper design.

The elastic members and 43 may have any suitable configurations. For example, the which the individual elastic members may varied from 0.25 millimeters (0.01 inches) millimeters inches) more. The elastic members may comprise single strand elastic material, may comprise several parallel non-parallel strands elastic material, may applied meandering meandering arrangement. Where the strands are non-parallel, two more of the strands may intersect otherwise interconnect within the elastic member. The elastic members may affixed the diaper any several ways which are known the art. For example, the elastic members may ultrasonically bonded, heat and pressure sealed using any variety bonding patterns, may adhesively bonded diaper with sprayed swirled patterns hotmelt other type adhesive.

The leg elastic members may, for example, comprise carrier sheet which are attached prestretched elastics incorporated plurality individual elastic strands. The elastic strands may intermittently interconnected.

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[illegible] synthetic urea, and optionally can have absorbent capacity least about 300 gm synthetic urea provide improved performance.

Various types [illegible] hydrophilic fibrous material can used form the acquisition parts the absorbent structure 32. Examples suitable fibers include naturally occurring organic fibers composed hydrophilic cellulose material, such orthotomic fibers, synthetic fibers composed cellulose cellulose derivatives, such rayon fibers, inorganic fibers composed hydrophilic cellulose material, such glass fibers, synthetic fibers made from inherently wettable thermoplastic polymers, such particular polyester polyamide fibers; and synthetic fibers composed inherently hydrophobic thermoplastic polymers, such polypropylene fibers, which have been hydrophilized appropriate means. The fibers may hydrophilized, for example, treatment with silica, treatment with material which has suitable hydrophilic tendency and not readily removable from the fiber, absorbing the non-wettable, hydrophobic fiber with hydrophilic polymer during after the formation the fiber. also contemplated that selected blends the various types fibers mentioned above may also employed.

the present description, the term "hydrophilic" describes fibers the surfaces fibers which are wetted the aqueous liquids contact with the fibers. The degree wetting for materials can, turn, described terms the contact angles and the surface tensions the liquids and materials involved. Equipment and techniques suitable for measuring the wettability particular fiber materials blends fiber materials used for the acquisition parts can provided Cahn SFA-222 Surface Force Analyzer System, substantially equivalent system. When measured with this system, fibers having contact angles less than 90° are designated "wettable" hydrophilic, while fibers having contact angles greater than 90° are designated "non-wettable" hydrophobic.

The retention portion 48 can include selected quantities high-absorbency material, and the high-absorbency material may comprise absorbent gelling materials, such superabsorbents. The absorbent gelling materials can natural, synthetic and modified natural polymers and materials. addition, the absorbent gelling materials can hydrogels materials, such silica gels, organic compounds such cross-linked polymers. The term "cross-linked" refers may means for effectively rendering normally water-soluble materials substantially water insoluble but swellable. Such means can include, for example, physical entanglement, crystalline domains, covalent bonds, ionic complexes and associations, hydrophilic associations, such hydrogen bonding, and hydrophobic associations Van der Waals forces.

Examples synthetic absorbent gelling material polymers include the alkali metal and ammonium salts poly(acrylic acid) and poly (methacrylic acid), poly(acrylamides), poly(vinyl ethers), maleic anhydride copolymers with vinyl ethers and alpha-olefins, poly(vinyl pyrrolidones), poly(vinylmorpholinones), poly(vinyl alcohol), and mixtures and copolymers thereof. Further polymers suitable for use the absorbent structures include natural and modified natural polymers, such hydrolyzed acrylonitrile-grafted starch, acrylic acid grafted starch, methyl cellulose, carboxymethyl cellulose, hydroxypropyl cellulose, and the natural gums, such alginates, xanthan gum, locust bean gum and the like. Mixtures natural and wholly partially synthetic absorbent polymers can also would the present invention. Other suitable absorbent gelling materials are disclosed







by Assessman U.S. Pat. No. 3,901,236 issued Aug. 26, 1975. Processes for preparing synthetic absorbent gelling polymers are disclosed U.S. Pat. No. 4,076,663 issued Feb. 28, 1978 Masuda and U.S. Pat. No. 4,286,082 issued Aug. 25, 1981 Tsubakimoto.

Synthetic absorbent gelling materials typically are enough which form hydrogels when wetted. The term "hydrogel" however, has commonly been used also refer both the wetted and unwetted forms the material.

The high-absorbency material used the retention portion 48 can the form discrete particles. The particles can any desired shape, for example, spiral or spherical, cubic, rod-like, polyhedral, etc. Shapes having large greatest dimension/smallest dimension ratio, like needles, flakes, and fibers, are also contemplated for use herein. Conglomerate particles absorbent gelling material may also used the retention portion 48.

Preferred for use are particles having average particle size from about [illegible] micrometers about [illegible] micrometers. "Particle size" used herein means the weighted average the smallest dimension the individual particles.

Suitable high-absorbency materials can have particular characteristics Absorbent Capacity (sometimes referred AC"), Deformation Under Load (sometimes referred "DUL"), and the Wicking Index (sometimes referred "WI"). These parameters are described detail U.S. patent application Ser. No. 757,707 Byerly et al., entitled "ABSORBENT COMPOSITES AND ABSORBENT ARTICLES CONTAINING SAME" and filed Sep. 9, 1991 (Attorney Docket No. 12,196), the entire disclosure which hereby incorporated reference contract that consistent with the present specification.

particular aspect the invention, the particular superabsorbent material can selected provide absorbency under load (AUL) value which within the range about 25–40, and provide Absorbent Capacity (AC) value which within the range about 33–48. The rate liquid uptake by the superabsorbent material within the range about 3–15 g/g (grams liquid per gram superabsorbent) seconds absorbency under load, 4.5–31 g/g minutes absorbency under load and 25–40 g/g 60 minutes absorbency under load.

suitable method for determining AUL described detail U.S. patent application Ser. No. 84,301 Kellenberger and entitled ABSORBENT PRODUCTS CONTAINING HYDROGELS WITH ABILITY TO SWELL AGAINST PRESSURE" (Attorney Docket No. 17981; European Patent Application EP 139 461A published Nov. 2, 1983; the entire disclosure which hereby incorporated reference manner that consistent with the present specification. An example superabsorbent polymer suitable for use the present invention SANWET IM 3900 polymer available from Hoechst Celanese, business having offices Portsmouth, Va. Other suitable superabsorbents may include WS9526 polymer obtained from Stockhausen, business having offices in Greensboro, N.C.

Due the desired thickness the retention portion 48, and/or the high superabsorbent concentrations within the retention portion, the liquid uptake rates the retention portion, itself, may too low, may not adequately maintained over time handle liquid into the absorbent structure. The addition process, liquid-permeable porous surge management material, however, can advantageously improve the overall uptake rate the composite absorbent structure. The surge management portion 46 may less hydrophilic than the retention portion 48, and has operable level density and basis weight suitably surface and temporarily hold liquid surges, transport the liquid from initial entrance point and substantially completely release the liquid other parts the absorbent structure 32, particularly the retention portion 48. This configuration can help prevent the liquid from pooling and collecting on the portion the absorbent garment positioned against the wearer's skin, thereby reducing the feeling wetness by the wearer.

Various woven and nonwoven fabrics can used construct the surge management portion 46. For example, the surge management portion may layer composed meltblown web spunbonded web polyolefin fibers. The surge management layer may also bonded-carded-web stabled web uncrimped natural synthetic fibers. The bonded-carded-web may, for example, powder-bonded-carded web, infrared bonded carded web, through-air-bonded-carded web. The infrared and through-air bonded carded webs can optionally include uniform different fibers, and the fiber lengths within selected fabric web may within the range about 0–3.0 inch (about 2.54–7 cm). The surge management portion may composed substantially hydrophobic material, and the hydrophobic material may optionally treated with surfactant otherwise processed impart desired level wettability and hydrophilicity.

The surge management portion typically arranged direct, contacting liquid communication with adjacent absorbent retention portion 48. As representatively shown, the surge management portion 46 may configured for placement adjacent major, outwardly facing, substantially surface the topsheet 38. Optionally, the surge management portion can placed adjacent inwardly facing, bodyside surface topsheet layer 38. The shown configuration the surge management portion separately constructed the topsheet layer with conventional attaching mechanisms, such swirl adhesive pattern. Similarly, the surge management portion can optionally connected the bodyside layer waistpiece 78. The scrim adhesive add-on should sufficient provide the desired bonds bonding, but should low enough avoid excessively restricting the movement liquid from the topsheet layer, through the surge management portion and into the retention portion.

the various configurations the invention, the retention portion positioned liquid communication with surge management portion 46 receive liquids released from the surge management portion, and hold and store the liquid. the shown embodiments, surge management portion 46 comprises separate layer which positioned over another, separate layer comprising the retention portion. The surge management portion serves quickly collect and temporarily hold discharged liquids, transport such liquids from the point initial contact and spread the liquid other parts the surge management portion, and then substantially completely release such liquids into the layer layers comprising retention portion 48.

The representatively shown configuration the surge management portion substantially free absorbent gelling material. The surge management portion 46 may, however, contain very small amount particulate gelling material help acquire initial liquid surge, but the amount should not be excessive. Excessive amounts particulate absorbent gelling material can cause the structure retain and hold unacceptably high amounts the liquid and can impede the transport liquids into the retention portion 48.

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The surge management portion can any desired shape consistent with the absorbency requirements described herein. Suitable shapes include for example, circular, rectangular, triangular, trapezoidal, oblong, dog-bowed, hourglass-shaped, oval. Preferred shapes the surge management portion are those that increase the exciting, fluid communicating surface area between surge management portion 46 and retention portion that the relative capillarity differences between the portions can fully utilized. certain embodiments, for example, the surge management portion can generally rectangular-shaped.

the various configurations the invention, surge management portion may extend over the complete length occupied retention portion 48, may extend over only part the overall retention portion length. Where the surge management portion extends only partially along the overall length the retention portion, the surge management portion may selectively positioned anywhere along absorbent structure 33. For example, surge management portion 46 may function more efficiently when offset toward the front waistband the garment and transversely centered within front section absorbent structure 33. Thus, surge management portion can approximately centered about the longitudinal center line of absorbent structure 33, and positioned potentially central region front section the absorbent structure 33.

other aspects the invention, the end edge the surge management portion can spaced longitudinally inboard from the terminal end edges the overall retention portion. particular configurations the invention, the corresponding, relatively adjacent front end edge surge management portion 46 can spaced posteriorward discrete distance from front waistband end edge the overall retention portion.

has been found that effective fluids for engaging the surge management portion can distinctively characterized by particular parameters; such basis weight, permeability, specific volume, porosity, surface area per unit volume (SA/VV), compression resiliency and saturation capacity. Further parameters can include bending stiffness which will help stabilize the pore size structure, and hydrophilicity. The basis-stiffness and the blend fiber denier can advantageously provide for and substantially maintain desired pore size structure.

Additional details regarding the surge materials and suitable techniques for determining the above-described parameters are set forth: U.S. patent application Ser. No. 206,986 Ellis and Bishop, entitled, FIBROUS NON-WOVEN WEB SURGE LAYER FOR PERSONAL CARE ABSORBENT ARTICLES AND THE LIKE, and filed Mar. 1994 (Attorney docket No. 1,256); and U.S. patent application Ser. No. 206,069 Ellis and Bishop, entitled, IMPROVED SURGE MANAGEMENT FIBROUS NONWOVEN WEB FOR PERSONAL CARE ABSORBENT ARTICLES AND THE LIKE, and filed Mar. 1994 (Attorney docket No. 1,387); the entire disclosures which are hereby incorporated references insofar that consistent herewith.

To ensure rapid intake liquid, the overall structure the surge portion has hydrophilic tendencies. least portion the fibers have contact angle less than 90 degrees provide fibrous nonwoven web which has sufficient hydrophilic tendencies when the web has saturation capacity greater than grams 0.9% saline solution per gram web.

Another feature the surge material resiliency back the wet and dry states. The surge material configured rapidly acquire large amount of liquid without excessive collapsing. Excessive collapse would detrimental since the collapsing the surge material would result reduced capacity for receiving liquid. Accordingly the surge material employed with the present invention have wet resilience which allows them substantially retain their bulk both the wet and dry states.

the shown configuration of the diaper 18, the side panel members and 58 are separate members operably connected and stretched laterally opposed and portions the back waistband portion backsheet 38. The side panels can manufactured substantially non-elastomeric material, such polymer films, woven fabrics, nonwoven fabrics the like, well combinations thereof. particular aspects the invention, the side panels can comprised substantially elastomeric material, such stretch-bonded-laminate (SBL) material, neck-bonded-laminate (NBL) material, elastomeric film, elastomeric foam material, the like. For example, suitable embodiments elastomeric fibrous webs are described U.S. Pat. No. 4,663,220 issued May 5, 1987 Wisneski et al., the entire disclosures which hereby incorporated by reference. Examples composite fabrics comprising least one layer nonwoven textile fabric secured fibrous elastic layer are described European patent application EP No. 0310 published Apr. 5, 1989 with the inventors Bond Taylor et al., the entire disclosures which hereby incorporated references. Examples NBL materials are described U.S. Pat. No. 5,226,992 issued Jul. 13, 1993 Morman, the entire disclosures which hereby incorporated references.

The fastening system, such provided by the tab fasteners 34, typically applied the back waistband region diaper provide mechanics for holding the diaper the wearer. The tab fasteners 34 can any fasten well known the art, and are typically applied the exterior diaper 18. For example, adhesive fasteners, mechanical fasteners, hook and loop fasteners, snaps, pins buckles, may used alone, combination. the shown configurations, the fasteners are adhesive fasteners, which are contemplated releasably adhere bonding zone patch attached the front waistband section the diaper provide substantable adhesive fastening system. More particularly, the fastener tabs connected manufactured, laterally outboard edge regions the side panels 56 and along appointed factory-bond regions the tab fasteners.

particular aspects the invention, the fastener tabs can have relatively wide near-bond section contribution with relatively narrower fastenable section. The near-attachment section positioned between the near-bond and factory-bond sections the fastener tab.

Articles which include elastomeric side panels and distinctively configured fasteners are described U.S. patent application Ser. No. 08,6 Roessler et., entitled DYNAMIC FITTING DIAPER and filed Dec. 16, 993 (Attorney docket No. 0,961), and patent application Ser. No. 366,080 of G. Zehner et., filed Dec. 28, 994, and entitled NON-PERF. TAB FASTENER (attorney docket No. 1,571 the entire disclosures which are hereby incorporated herein references insofar that consistent herewith. The fastening systems can include stress beam member for distributing applied stresses the area of the side panel material, and can include fastening tabs which incorporate molded down intermediate region assembly with relatively wider, near-bond section fastened



Techniques for forming the desired fastening systems are described U.S. patent application Ser. No. 202,987 of T. Roessler et., entitled METHOD FOR MAKING FASTENING SYSTEM FOR DYNAMIC FITTING DIAPER and filed Feb. 23, 994 (Attorney docket No. 869, the entire disclosures which hereby incorporated herein references insofar that consistent herewith.

The fibrous web layer 49 employed the present invention can comprised fibrous material which substantially non-hydrocollapsed. The web layer can have desired levels of bulk, flexibility and strength without undergoing the complicated procedures of hydroentanglement and associated post-treatments, such further drying. particular aspects the invention, the fibrous web layer can have basis weight least about 60 gsm. The fibrous web layer 49 can alternatively have basis weight least about 100 gsm, and can optionally have basis weight least about gsm provide desired levels of performance.

other aspects the invention, the fibrous web layer can have relatively low density and/or improve the flexibility and/or absorption characteristics the web. For example, the web layer can have density and/or more than about 0.25 grams/cc. Alternatively, the web layer density can not more than about 0.23 grams/cc, and optionally can not more than about 0.2 grams/cc provide improved performance. addition, the web layer density can be low 0.1 grams/cc, and optionally, can low 0.05 grams/cc.

The fibrous web layer 49 can also have high strength which can, for example, allow the web layer processed through conventional manufacturing lines substantially without the need for supplemental reinforcement another layers. particular configurations the invention, the web layer 49 can have peak geometric mean tensile strength least about 250 grams-force per centimeter width and/or alternatively have peak geometric mean tensile strength least about 300 grams-force per centimeter width, and can optionally have peak geometric mean tensile strength least about 350 grams-force per centimeter width. further embodiments, the web layer 49 can have peak geometric mean tensile strength which high about 2500 grams-force per centimeter width, and optionally, can have peak geometric mean tensile strength which high about 3000 grams-force per centimeter width. suitable techniques for determining the geometric mean tensile strength described below the "EXAMPLES"

The large proportion short fibers the fibrous web layer 49 can provide for various advantages, such keeping the cost the web low and permitting higher processing speed. particular aspects the invention, the web layer 49 has fiber content which least about 98wt the fiber content are fibers having fiber length not more than about 0.4 inch (about cm). Alternatively, least about 98, and optionally, least about the fiber content are fibers having fiber length not more than about 0.4 inch (about cm). other desired arrangements, the web layer can have fiber content which substantially about 100 wt the fiber content are fibers having fiber length not more than about 0.4 inch (about cm).

To further help the efficiency and cost effectiveness the fibrous web layer 49, the web layer can have fiber content which not more than about weight percent the fiber content are fibers having fiber length least about inch (about cm). Alternatively, not more than about weight percent the fiber content, and optionally, substantially zero weight percent the fiber content are fibers having fiber length least inch (about cm).

To provide article which readily conformable the body the wearer, the fibrous web layer can non-woven have Gurley stiffness not more than about 0,000 BGU. Alternatively, the Gurley stiffness can not more than about 5,000 BGU, and optionally can not more than about 2,000 BGU provide desired levels performance. other aspects of the invention, the fibrous web layer 49 can constructed have Gurley stiffness not less than about 100 BGU. Alternatively, the Gurley stiffness can not less than about 150 BGU, and optionally can not less than about 300 BGU provide other aspects improved performance.

other aspects the invention, the fibrous web layer 49 can configured have Gurley stiffness thickness quotient not more than about 4,000 BGU/mm. The web layer 49 can further constructed have Gurley stiffness thickness quotient which alternatively not more than about 2,000 BGU/mm, and optionally not more than about ,000 BGU/mm provide improved levels flexibility and conformability.

suitable techniques for determining the Gurley stiffness set forth TAPPI 543. For the purposes the present invention, the stiffness values are measured and expressed units Standard Gurley Units (SGU) (traditionally reported milligrams force).

the various configurations the invention, the fibrous web layer 49 can advantageously provide relatively high levels tensile strength without employing large amounts supplemental binder material, such binder fiber. particular aspects the invention, the fibrous web layer 49 substantially free binder material. Alternatively, the fibrous web layer can include not more than about 1.5 weight percent binder material, and optionally can include not more than about weight percent binder material.

The fibrous web layer 49 can substantially free superabsorbent polymer material, and can comprised cellulose fibers which are primarily hydrogen bonded one another. Desired configurations of the fibrous web layer 49 can comprised least about weight percent cellulosic fibers. Alternatively, the fiber web can composed substantially 100 weight percent cellulosic fibers. The bonding between the fibers within the web layer large proportion provided hydrogen bonding. particularly desired arrangements, least about percent cellulose fibers provided hydrogen bonding. In other desired arrangement, least about percent, and desirably substantially 100 percent the bonding provided by hydrogen bonding.

other aspects the invention, the fibrous web layer 49 non-hydrocollapsed, and substantially free fused bonds, such thermal bonding. Desirably, not more than about 1.5% the interfiber bonding within the fibrous web 49 provided fused bonds. Alternatively, not more than about 3%, and optionally not more than about the interfiber bonding provided by fused bonds.

desired arrangements the invention, the fibrous web layer 49 includes substantially added supplemental chemical bonding agents. other aspects the invention, the fibrous web layer can include selected quantity added chemical bonding agent, such bonding agents comprised vinyl acrylic copolymers, polyvinyl acetate, cross-linkable polyacrylics, polyvinyl alcohol, and the like. particular configurations, the fibrous layer can contain

not more than about %, and optionally, can contain not more than about the chemical bonding agent provided desired benefits. the amount the chemical bonding agent too large, the fibrous web can undesirably exhibit excessive cost, increased processing complexity, decreased absorption rates, decreased softness and decreased flexibility.

The fibrous web layer 48 integral, unitary fibrous web which, particular aspects, has web thickness of least about 0.5 mm. Alternatively, web thickness least about 0.6 mm, and optionally least about mm provide desired benefits. addition, the fibrous web layer can have web thickness not more than about mm. Alternatively, the layer thickness can not more than about 3.6 mm, and optionally can not more than about 2.8 mm provide desired performance. For the purpose the present invention, the thickness the fibrous web layer determined under restraining pressure 0.2 psi kPa).

The fibrous layer the invention can unsupported planarity biaxially formed, incorporating areas with different zones configured have different characteristics. The zones extend substantially along the general plane of the fibrous layer, and the differing zones can provide differing, selected physical attributes through the thickness the fibrous layer 48. For example, the fibrous layer 48 of the invention can include relatively high-density zone zone integrated into multi-tuft arrangement between two, relatively lower-density zones, wherein the lower-density zones have higher loft and zone thickness than the high-density zone. The high-density zone can impart desired tensile strength, such higher geometric zone tensile strength, and other properties, such desired levels capillary wicking. The lower-density zones can impart desired bulk loft and void volumes. The resultant, integral composite structure can formed from single, unitary base layer lower cost and higher efficiencies.

particular configurations the invention, the fibrous web layer can composed fibrous web matrix(s) which has been mechanically worked otherwise treated impart distinctive combination strength, flexibility and high bulk weight, well other selected characteristics. The fibrous material can subjected treatment which imparts multiplicity localized, relatively zones mechanical strain, and particular configurations the invention, the fibrous web layer 48 can subjected mechanical treatment which imparts predetermined pattern locally strained zones distributed over the zone the fibrous web layer. Localized tensile stresses applied the fibrous layer can thereby produce catchers strikes, such substance bond fractures substance compressed zones, within the treated fibrous web. The strains can impart desired levels softness and flexibility the web, and can produced while substantially avoiding fibrillation fragmentation the web.

The web layer 48 can, for example, provided fibrous, mechanically worked, cellulosic material, and the material may selected mechanical pulp. suitable techniques for producing the mechanical pulp described U.S. patent application Ser. No. 298,924 filed Jun. 1994 Kamps and entitled METHOD FOR MAKING SOFT TISSUE (Attorney docket No. 6939), the entire disclosure which hereby incorporated reference. assume that consistent herewith.

With reference FIGS. and particular aspects the absorbent article the present invention can have retention portion which includes one more individual layers plies the fibrous web layer 48. The fibrous web layer layers can arranged provide composite basis weight within the range about 120–1200 gsm. particular aspects the invention, where the retention portion includes multiple plies the fibrous web layer 48, the individual plies can configured with different characteristics, such selected combination strength and/or absorbency characteristics. For example, different plies the web layer 48 can have different ply basis weight, ply density and/or ply tensile strength. The different plies can be sufficiently bonded, separated apart intervening components (e.g. FIG. 6). As result, one moves through the thickness of the composite retention portion, the individual plies can contribute different absorbency characteristics and different tensile strength characteristics their various locations within the absorbent structure.

With reference FIG. the retention portion can alternatively comprise intimate hydrophilic fibers and high-absorbency particles, and fibrous web layer 48 can positioned adjacent either both the wafer facing surfaces the retention portion 48. the illustrated example, the fibrous web 48 located the outside surface the retention portion and the retention portion comprised intimate cellulose wood pulp fibers and superabsorbent particles. other arrangements, the retention portion may comprise intimate superabsorbent hydrogel-forming particles and synthetic polymer melt-blown fibers, intimate superabsorbent particles with fibrous cellulose material comprising blend natural fibers and/or synthetic polymer fibers.

The superabsorbent particles may substantially homogeneously mixed with the hydrophilic fibers. may unconditionally mixed. For example, the concentration superabsorbent particles may arranged non-step-wise gradient through substantial portion the thickness (x-direction) the absorbent structure, with lower concentrations toward the backsheet the absorbent structure and relatively higher concentrations toward the outside the absorbent structure. Suitable x-gradient configurations are described U.S. Pat. No. 4,699,823 issued Oct. 987 Kellenberger et al., the entire disclosure which incorporated herein by reference manner that consistent with the present description. The superabsorbent particles may also be arranged generally discrete layer within the matrix hydrophilic fibers may configured discrete, separate pocket regions superabsorbent material. addition, two more different types superabsorbent may be selectively positioned different locations within along the fiber matrix.

For example, the SAP basis weight may vary across the which discussion retention portion 48. Alternatively, relatively larger amounts SAP may positioned toward the front waistband and the retention portion. For example, see U.S. Pat. No. 4,585,448 issued Apr. 29, 986, Brown. the illustrated embodiment, the majority the superabsorbent material may distributed down medial region the retention portion 48 which extends along the length dimension the retention portion and can measure about 3.5–4.5 inches (about 8.9–1 cm) width. addition, the superabsorbent material may have selected zonal placement. reduce the amount superabsorbent material located proximate the side and end edges the retention portion 48. The reduced amount superabsorbent material the edges the retention portion can improve the containment the superabsorbent particles within the fibrous SAP matrix the retention portion. The pointed, zonal placement the superabsorbent material can,



for example, achieved by the method and apparatus described U.S. Pat. No. 5,028,224 Flegar et al., entitled "METHOD AND APPARATUS FOR INTERMITTENTL DEPOSITING PARTICULATE MATERIAL IN SUBSTRATE" and issued Jul. 991 (Attorney Docket No. 8781 the entire disclosure which hereby incorporated reference manner that consistent herewith.

The hydrophilic fibers and high-absorbency particles can provided fiber-to-particle ratio which not more than about 75:25, alternatively, not more than about 70:30, and optionally, not more than about 55:45, weight. Further aspects the invention, the fiber-to-particle ratio not less than about 25:75, alternatively not less than about 30:70, and optionally not less than about 45:55, by weight. Such fiber-to-particle ratios are particularly desirable the target zone the absorbent structure.

The hydrophilic fibers and high-absorbency particles can form average composite basis weight which is within the range about 200–800 gsm. Again, such basis weight particularly desirable the target zone the absorbent structure. certain aspects the invention, the average composite basis weight can within the range about 300–800 gsm, and optionally can within the range about 400–700 gsm provide desired performance.

Due the high concentration superabsorbent particles, either high-absorbency material, the retention portion 48, there can increased difficulty with regard containing the high-absorbency particles within the retention portion and restricting the movement migration the superabsorbent onto the backsheet the diaper. To improve the containment the high-absorbency material, absorbent structure can include overwrap, such wrap sheet 78, placed immediately adjacent and around the retention portion 48, approximatively shown FIG. The overwrap can include hydrophilic high wet-strength envelope web, such high wet strength fibrous synthetic fibrous web. Such overwrapping can also increase the in-use integrity the absorbent structure. The wrap sheet can suitably bonded, such with adhesive, the absorbent structure 10 and other components the product construction, diapers.

The wrap sheet positioably layer liquid permeable material which covers the wafer bodyside and outside surfaces the retention portion, and preferably surrounds substantially the peripheral edges the retention portion from substantially complete envelope therefrom. Alternatively, the wrap sheet can provide shortest wrap which covers the wafer bodyside and outside surfaces the retention portion 48, and sections substantially only the lateral side edges the retention portion. Accordingly, both the front and the lowerally curved portions the lateral side edges the wrap sheet would closed about the retention portion. such arrangement, however, the end edges the wrap sheet may not completely closed around the end edges the retention portion 48 the unfolded napkin the article.

The wrap sheet may optionally include multi-element wrapsheet which includes separate bodyside wrap layer and separate outside wrap layer, each which extends past more the peripheral edges the retention portion 48. Such configuration the wrap sheet can, for example, facilitate the formation substantially complete sealing and closure around the peripheral edges retention portion 48, and can help add opacity and strength the final article. the illustrated embodiment, the bodyside and outside layers shortest wrap 78 extend beyond the peripheral edges the retention portion provide substantially peripheral, flange-type bonding area over which the periphery the bodyside portion the absorbent wrap may completely partially concealed the periphery the outside portion the absorbent wrap.

The bodyside and outside layers wrap sheet 78 may composed substantially the same material, may composed different materials. To provide the bonding between the bodyside and outside portions shortest wrap 78, adhesive, such National Starch 33-5136 adhesive, can printed over the appropriated bonding areas the shortest wrap with, for example, rotogravure-type system. The adhesive available from National Starch and Chemical Co., business having offices Bridgewater, J., and rotogravure-type adhesive applicators are available from Egan Machinery Division, business having offices Oconomowoc Falls, Wis. The retention portion 48 can then placed between the bodyside and outside portions shortest wrap 78, and the mating edges the shortest wrap portions can bonded together provide generally complete peripheral and strong substantially the entire perimeter the retention portion 48. the illustrated embodiment, the adhesive applied add-on rate about grams solids per square meter of bonding attach together the lapping edges the bodyside and outside portions shortest wrap 78.

Alternative arrangements can have shortest wrap composed nonwoven multifibrous fibrous web. The peripheral sealing the bodyside and outside wrap layers accomplished employing hot embossing provide sealed strip region around the periphery the retention portion 48.

With reference FIG. the retention portion diaper can include superabsorbent absorbent laminate 88, and fibrous web layer can located on either the outside bodyside the absorbent laminate, located back the outside and bodyside the absorbent laminate. The absorbent laminate 88 includes particles high-absorbency material, such superabsorbent polymer, which are held physically individual, discrete pocket regions 82. The pocket regions are spaced apart on wafer facing surface least one liquid permeable web, and preferably arrangements, the pocket regions are formed and sandwiched between first and second liquid permeable webs and 84, respectively (FIG. 4). desired arrangements, either both the liquid permeable webs can provided fibrous web layer 48. Examples suitable superabsorbent laminate structures having discrete pocket regions are described U.S. patent application Ser. No. 145,926 Theisen et al., which was filed Oct. 29, 993 and entitled ABSORBENT ARTICLE WHICH INCLUDES SUPERABSORBENT MATERIAL LOCATED IN DISCRETE, ELONGATE POCKETS ARRANGED IN SELECTED PATTERNS (attorney docket No. 10,802).

To provide the desired thickness the various configurations the final absorbent article, the retention portion can configured with overall bulk thickness which not more than about 0.6 cm. Preferably, the bulk thickness not more than about 0.55 cm, and more preferably not more than about 0.5 cm provide improved benefits. The bulk thickness determined under restraining pressure 0.2 psi kPa).

should readily appreciated that the density retention portion 48 other component the absorbent article can calculated from basis weight and thickness. With respect diapers, for example, the weight and thickness are

measured newly acquired, unfolded and dry diapers containing pressure 0.1 psi kPa). Conventional thickness measuring devices may employed determine the thickness masked calculate the density.

particular aspects of the invention, the absorbent structures can generally T-shaped with the lateral extending cross-bar the "T" generally corresponding the front waistband portion the absorbent article for improved performance, especially for male bodies. the illustrated embodiments, for example, the attention portion across the rear section the front waistband region the article can have cross-directional width about 9.0 inches (about 22.5 cm), the narrowest portion the crotch section can have width about 3.5 inches (about 8.9 cm) and the back waistband region can have width about 4.5 inches (about cm).

The following examples are presented provide more detailed understanding the invention. The EXAMPLES are intended representative, and are not intended specifically limit the scope the invention.

## EXAMPLES

### Examples 1–9

Example was 100% fluff, slitted web composed fluffated, bleached kraft wood pulp. The wood pulp was Kimberly-Clark Ocean River CR-2054 fluff pulp, which was blend 30% southern softwood and 70% southern softwood. The base pulp was obtained from Kimberly-Clark Corporation' pulp mill Crown Plaza, Ala. 35044-0333. The wood pulp was dry fluffated and defaulted from the feed slitted web.

Example was creped wadding composed high-porosity, low basis weight, creped softwood tissue which available from Kimberly-Clark Corporation under the Kimberly-Clark raw material specification Kim-3088, and has typically been adhered "Turning Beans" The creped tissue had Frazier Porosity of about 300 standard cubic feet per minute per square foot tested surface area (ft³/min/ft²), and had basis weight about gsm. The creped wadding also has surfactant mole content about 0.9% (w/w dry polyamidine dry fiber).

Example was wet-shaped, through-air dried, premium consumer paper towel manufactured the Procter and Gamble Company (Cincinnati, Ohio) and sold under the trademark BOUNTY.

Example was conventionally wet pressed, economy paper towel made Kimberly-Clark Corporation and sold under the trademark HI-DESIR.

Example was double re-creped, high performance consumer paper towel made Scott Paper Corp. (Philadelphia, Pa.) and sold under the trademark JOB SQUAD.

Example was hydroentangled, nonwoven-substrated, disposable, manufactured rag produced Kimberly-Clark Corporation and sold under the trademark WORK-HORSES.

Example was co-formed web composed nonwoven polypropylene meltblown microfiber (15% weight) and wood fluff pulp (85% weight).

Example was airformed web composed blend superabsorbent particles (60% by weight) and softwood fluff pulp (40% weight). The web has been used construct the absorbent core the disposable baby diaper produced Kimberly-Clark Corporation and sold under the trademarks HUGGIES® UltraTrim.

Examples 1–9 lists the parameters and properties listed FIG.

### Examples 0–1 15, and

Examples 10–13, 15, and were composed pulp boards which were produced conventional wet-forming, wet pressing method. particular, the wet-pressed pulp board handsheets were produced 24-inch (about cm) pilot fourdrinier paper machine Western Michigan University, McCracken Hall, Kalamazoo, Mich. 49008-3080. After pressing, the handsheets were conventionally dried steam-heated dryer cans. Examples 12, and were further processed micro-creping accordance with the parameters that are set forth more detail Tables below.

TABLE

| Fiber Engagement (inches) | | | |
|---|---|---|---|
| Sample No. | Pass | LBW | SPEED (fpm) |
| | | 0.023 | 0.015 | 100 |
| | | 0.023 | 0.015 | 100 |
| | | 0.023 | 0.015 | 100 |
| | | 0.018 | 0.020 | 100 |
| | | 0.018 | 0.020 | 100 |
| | | 0.018 | 0.020 | 100 |
| | | 0.018 | 0.020 | 100 |
| | | 0.018 | 0.020 | 100 |
| | | 0.018 | 0.020 | 100 |
| | | 0.018 | 0.020 | 100 |
| | | 0.018 | 0.020 | 100 |
| | | 0.018 | 0.020 | 100 |
| | | 0.018 | 0.020 | 100 |
| | | 0.018 | 0.020 | 100 |
| | | 0.018 | 0.020 | 100 |
| | | 0.018 | 0.020 | 100 |

fpm feet/min 2.54

### Examples 14, and 20–23

Examples 14, 18, and 20–23 were produced conventional through-air drying technique. particular, the through-air dried polybrasil handsheets were produced on inch (about cm) Rotoformer machine the Harty Foundation's Research and Development Center, P.O. Box 7788, Savannah, Ga. 1413 Drying was conducted without pressing, passing the sheet over Honeycomb through-air dryer. Examples 20–23 were further processed micro-creping accordance with the parameters that are set forth more detail Tables below.

TABLE

| Fiber Engagement (inches) | | | |
|---|---|---|---|
| Sample No. | Pass | LBW | SPEED (fpm) |
| | | 0.01 | 0.025 | 100 |
| | | 0.01 | 0.025 | 100 |
| | | 0.01 | 0.01 | 100 |
| | | 0.014 | 0.01 | |
| | | 0.01 | 0.025 | |



TABLE 3-continued

| Fiber Engagement (inches) | | | |
|---|---|---|---|
| Sample No. | Pass | LBW | SPEED (fpm) |
| | | 0.014 | 0.010 | 100 |
| | | 0.014 | 0.010 | 100 |
| | | 0.014 | 0.010 | 100 |
| | | 0.014 | 0.010 | 100 |
| | | 0.014 | 0.010 | |
| | | 0.014 | 0.010 | |

fpm feet/min 2.54

### Microcreping Process and Conditions under which Pulp Sheets were Slitted

Pulp webs were microcreped wrinkling the pulp sheet through the nip between pairs coarse-coating engraved metal rolls which had been engaged mechanically surface the sheet without tearing tearing. Multiple passes were often required produce desired amount sheet softening. typical pass consisted wrinkling the sheet between the elements of the 1804 and 8/2 patterns. The engagements and speeds for the microcreped pulps used this investigation are shown Tables and above.

Both the 1804 and 8/2 patterns are provided matched pair steel rolls and female rolls are fixed gap pressure. With reference FIG. the patterns 1804 male roll has male elements with height 2.34 millimeters, side wall angle 30° length millimeters, and width 1.0 millimeter, hence having length-to-width ratio The elements are oriented with the major axis the elements parallel the axial direction of the roll. There are average 0.1 male elements per millimeter the axial direction the roll and average 0.5 male elements per millimeter the circumferential direction the roll, resulting element density 6.3 elements per square centimeter. The male elements are arranged diamond pattern matching pattern repeat 94 millimeters. The female roll has corresponding voids with corresponding dimensions and orientations.

With reference FIG. the 8/2 wooven pattern male element has height 8.6 millimeters, side wall angle 33° element surface area 0.015 square centimeters, element density 6.5 elements per square centimeter, embossing area about 30%, and pattern repeat length millimeters. The male elements are made up of two distinct design elements. The female roll has corresponding voids with corresponding dimensions and orientations.

### Test Procedures The following test procedures were employed assess the Samples.

### 45-Degree Liquid Intake

2"x10" (about cmx25 cm) samples absorbent material were cut and placed plexiglass board having inclines degrees. Fifty (50) milliliters 0.9% saline solution (e.g. Baxter Sodesalte, Catalog Number B3 58-3) were weighed and placed funnel positioned above the sample location located (about cm) from the uppermost end the absorbent. The stopcock was opened allow the saline sol dose contact the sample. The initial (dry) and final (wet) weights the samples were obtained and the quantity fluid retained the sample was determined differences.

### Tensile Testing

Tensile testing was conducted on tensile test apparatus, such Instron Model No. 4201. The test samples were cut (2.54 cm) width, the jawspan was cm), and the crosshead speed was 0.5 inch/min (1.27 cm/min).

### Horner Test

The stiffly samples absorb liquid and hold water load was determined soaking the samples excess saline, and then blotting liquid from the samples with absorbent paper wetter impressed load exceeding the following procedure.

dry 3"x7" (about cmx1 cm) sample was weighed, placed on screen screen for physical support, and soaked excess 0.9% saline for minutes. After soaking, the sample was removed from the saline solution and allowed drain against 5-degrees board until liquid no longer drained from the sample (60- seconds). The drained sample was then weighed. Each sample was then placed between pair "#8" (about 10.1 mm×20.1 cm) sheets Janos River Verigard (No. -01 13) absorbent blotter paper under weight impress pressure of 0.33 psi (about 2.4 kPa). These pairs blotter sheets were used successive time intervals 60–80 seconds. Following the blotting, the sample was again weighed.

The amount liquid saline expressed from the sample the difference between the wet sample (W) weight and the blotted sample (B) weight. This difference divided the initial dry sample weight (D) report the amount expressed liquid on "grams liquid per gram sample" basis.

$$\text{grams liquid per gram sample} = (W-B)/D$$

### Caliper Testing

The calipers (thicknesses) the Samples were obtained using the following device:

Digimatic Thickness Tester

Model Number 543-445-1

Type ID- 0508MH

Mitutoyo Mfg. Co. Ltd.

This tester has range 0.001"–3" (0.00254 cm–5. cm) and resolution 0.01 mm.

After zeroing the instrument, the weighted foot was gently placed the sample and the thickness recorded from the digital readout. Three measurements were recorded per sample, The circular foot on the Digimatic tester had mass 633 grams and diameter 76 mm, providing pressure approximately 0.2 psi kPa).

### Characteristics and Parameters the Samples

The compositional and physical characteristics the Samples were determined and are summarized the tables FIGS. and 16. With reference FIGS. and 18, can seen that the softened sheets of the invention can exhibit high levels absorbency combination with low stiffness and relatively high tensile strengths.

The tensile strengths were measured with the above-described tensile testing procedure using 100 pound load cell, and the geometric mean, peak tensile strength values were determined for the various samples the following manner:

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Let $C_1$, $C_2$, $C_3$ represent the experimental cross-machine direction (c.d.) peak tensile strength values for given sample, where the c.d. extends along the general plane the sample.

Let $M_1$, $M_2$, $M_3$ represent the experimental machine direction (m.d.) peak tensile strength values for given sample, where the machine direction extends along the general plane the sample and perpendicular the cross-machine direction.

Calculate the average geometric mean tensile strength, from permutations the cross-machine direction and machine direction tensile strengths:

$$\text{average } \sqrt{C_1 C_2} \sqrt{C_1 C_3} \sqrt{C_2 C_3}$$
$$\text{average } \sqrt{M_1 M_2} \sqrt{M_1 M_3} \sqrt{M_2 M_3}$$

The quantities "x" and "y" are least and typically are equal and within the range 3-5.

The calculation the average geometric mean tensile strength case represented the following formula:

$$\sigma = \left[ \frac{x}{x+y} \quad \frac{y}{x+y} \right]$$

The geometric mean, peak tensile strength data for the indicated Sample numbers are summarized the table shown FIG. 11. For each of the Samples, the table lists the minimum (min) and maximum (max) values, along with the arithmetic mean (average) the measured values. The values are expressed terms grams-force per centimeter sample width, and the Identification Sample numbers correspond the Samples presented FIG.

FIG. shows representative plots the logarithm (base 10) the geometric mean, peak tensile strength values function density for particular sample materials, and the Identification Sample numbers correspond the Samples presented FIG. 11. The middle cross bar for each identified Sample represents the logarithm ($\log_{10}$) the arithmetic average the geometric mean peak tensile strength values that were determined for the identified Sample. The high and low cross bars represent the logarithms the maximum and minimum values, respectively, the geometric mean peak tensile strengths that were determined for the Sample.

With reference FIGS. and 12, can seen that samples materials having various configurations the present invention, such samples 18, 20, 21, and 23, exhibited advantageous combination strength and density. For example, samples 19-23 had much greater tensile strengths than some ordinary absorbent materials, such samples and without the high density samples and 18. More particularly, representative samples the materials the present invention provided high strength even though the densities the materials were less than about 0.25 grams. The combination relatively high strength and low density predominately cellulosic web sets marks the materials the present invention particularly desirable for absorbent products.

Having described the invention rather full detail, will readily appreciate that various changes and modifications can made without departing from the spirit the invention. All such changes and modifications are contemplated being within the scope the invention, defined for the subjoined claims.

We claim:

An article, comprising:



least one absorbent fibrous web layer which substantially non-hydroentangled, said fibrous web layer having basis weight least about 60 gms, density not more than about 0.25 grams, peak geometric mean tensile strength least about 250 grams-force per centimeter of width said fibrous web layer, Cheney stiffness thickness quotient not more than about 4000 BCU/mm, and having fiber content which least about 90 said fiber content are fibers having fiber length not more than about 0.4 inch (about 1 cm).

An article, comprising:

backsheet layer;

liquid permeable topsheet layer which disposed facing relation with said backsheet layer; and

absorbent structure which interposed between said backsheet layer and topsheet layer and has overall absorbent capacity least about 300 gm saline, said absorbent structure including least one absorbent fibrous web layer which is substantially non-hydroentangled, said fibrous web layer having basis weight least about 60 gms, density not more than about 0.25 gm/cc, peak geometric mean tensile strength least about 250 grams-force per centimeter of which said fibrous web layer, and having fiber content which least about 90 wt said fiber content are fibers having fiber length not more than about 0.4 inch.

An article method claim wherein said article includes plurality said fibrous web layers.

An article method claim wherein said article includes absorption particles having particles superabsorbent material held plurality discrete pocket regions said absorption particles.

An article method claim wherein said article includes absorption particles having particles superabsorbent material held in plurality individual, discrete pocket regions which are provided for said least one fibrous web layer.

An article which comprises particles superabsorbent material held plurality individual pocket regions, said pocket regions interbonded between first and second liquid permeable, non-hydroentangled fibrous web layers, each said first and second web layers having basis weight least about 60 gms, density not more than about 0.25 grams, peak geometric mean tensile strength least about 250 grams-force per centimeter which said fibrous web layer, and each having fiber content which least about 90 said fiber content are fibers having fiber length not more than about 0.4 inch (about cm).

An article method claim wherein said first and second web layers are interconnected define said pocket regions.

8. An article method claim wherein least about wt said fiber content are fibers having fiber length not more than about 0.4 inch (about cm).

9. An article method claim wherein least about wt said fiber content are fibers having fiber length not more than about 0.4 inch (about cm).

10. An article method claim wherein not more than about said fiber content each fibrous web layer are fibers having fiber length least about inch (about cm).

11. An article method claim wherein said fibrous web layer further includes Cheney stiffness thickness quotient not more than about 4000 BCU/mm.

12. An article method claim wherein each said fibrous web layer further includes Cheney stiffness thickness quotient not more than about 2000 BCU/mm.





13. An article method claim wherein each said fibrous web layer further includes Cheney stiffness thickness quotient not more than about 1000 BCU/mm.

14. An article method claim wherein each said fibrous web layer substantially free binder material.

15. An article method claim wherein each said fibrous web layer includes not more than about binder material.

16. An article method claim wherein each said fibrous web layer includes not more than about binder material.

An article method claim wherein each said fibrous web layer has basis weight least about 100 gms.

18. An article method claim wherein each said fibrous web layer has basis weight least about gms.



19. An article method claim wherein said article includes absorbent particles having selected wood pulp fluff and particles superabsorbent material.

20. An article method claim wherein said fibrous comprises each said web layer least about 95 cellulosic fibers.

21. An article method claim wherein said fibrous comprises each said web layer substantially 00 cellulosic fibers.

22. An article method claim wherein said fibrous web layer has thickness not more than about mm.

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**United States Patent** 3,837,343
Mesek 45] Sept. 24, 97

54 DISPOSABLE DIAPER, FABRIC USEFUL THEREIN, AND METHOD OF MANUFACTURE

75 Inventor: Frederick K. Mesek, Downers Grove, Ill.

73 Assignee: Johnson Johnson, New Brunswick,

Notice: The portion the term this patent subsequent May 990, has been disclaimed.

[22] Filed: Mar. 27 973

Appl. No.: 345,398

Related U.S. Application Data

63 Continuation-in-part Ser No. ,349, Oct Pat. Nb. 3,730, 84.

52 U.S. Cl. 28/287 23/284
Int. Cl. A61f 13/16
Field Search 28/284, 285, 287 290 28/290 296

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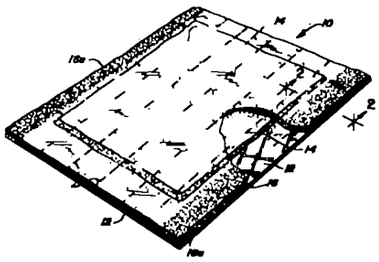
*Primary Examiner*—Aldrich Medbery

ABSTRACT

non-woven fabric disclosed which comprises highly water-absorbent web mixed long and short fibers that through-bonded throughout dimensions with binder (adhesive retain the fibers their assembled relationship. the final set stage the binder hydrophobic character and hence the resulting fabric rendered more less water repellent. the invention the mid-portion the bonded fabric treated with wetting agent (surfactant) substitute the water-repellent effect the binder and make the mid-portion the fabric readily wettable. Marginal portions the bonded fabric are not treated with wetting agent, that these portions the fabric throughout their dimensions are more less water repellent. By this means that the marginal portions the bonded fabric are substantially wettable compared the mid-portion the fabric. As indicated, the binder material the side edges the fabric present throughout the thickness of the fabric, and hence effective prevent liquid that wetted into the central portion the fabric from wicking readily outwardly The fabric of the invention has particular utility facing layer disposable diaper that includes an absorbent pad and water repellent backing member since it substantially liquid leakage from the side edges the diaper

another embodiment, the portions the fabric not treated with wetting agent include particular bands across the continuous length the fabric spaced apart that when the continuous fabric cut into facing fabric lengths, the end margins the facing fabric will also be more less water-repellent.

Claims, Drawing Figures



PATENTED SEP 24 1974 3 837 343

SHEET 1 OF 3

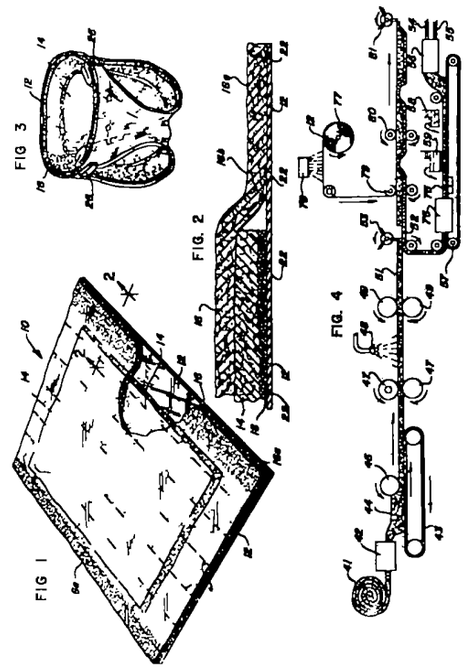



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FIG. 5

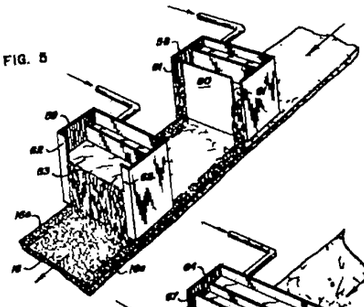


FIG. 6

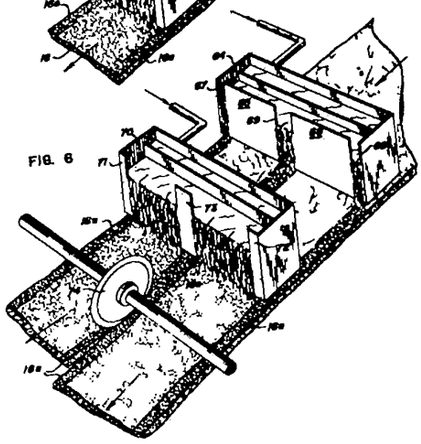




FIG 7

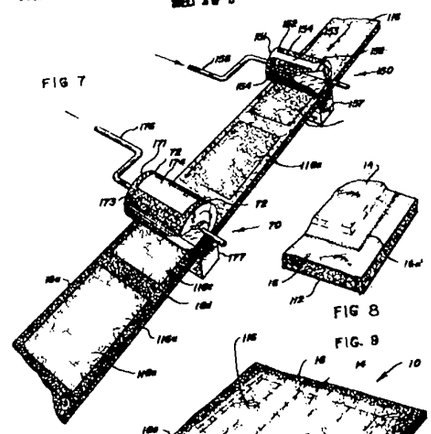
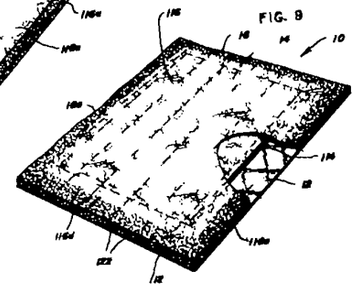


FIG 8



FIG. 9



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# DISPOSABLE DIAPER, ARTICLE USEFUL THEREIN, AND METHOD OF MANUFACTURE

## CROSS-REFERENCE TO RELATED APPLICATION

This application continuation-in-part application application Ser No. 87,249, filed Oct. 197 now U.S. Pat. No. 730, 84.

## BACKGROUND OF THE INVENTION

Disposable diapers have met with increased commercial acceptance in recent years primarily because their convenience, opposed cloth diapers, which must be laundered once soiled. Many different constructions have been proposed and used, and some have met with widespread commercial success spite certain inadequacies functional properties.

One of the most serious prior art problems has been the inability provide suitable construction that would keep moisture away from the surface the diaper which comes into contact with the infant's skin and thereby avoid skin irritation and infection. Mesek, et., U.S. Pat. No. 3,6 3,055, issued Oct. 97 discloses several diaper constructions that function extremely well keeping moisture away from infant's skin, while the same time handling full volume urine.

These functions are accomplished by multilayer diaper comprising, order fibrous facing layer which be brought into contact with the infant skin, layer highly porous, loosely compacted cellulosic batt, paper-like densified, highly compacted cellulosic fibrous layer integral with the loosely compacted batt and an impervious backing sheet adhered the densified layer throughout the interface therebetween. The facing layer of porous construction and fibers have less wettability for water than the fibers the loosely compacted batt, resulting tendency for liquid flow from the facing web into the batt. The densified fibrous layer has smaller average pore size than the loosely compacted batt, resulting in tendency for liquid flow preferentially from the batt into the underlying densified layer rather than other areas the batt, thus heading restrict wetting the batt to area moderate size. Liquid flowing into the densified layer tends spread laterally because wicking action and liquid which might pass through the densified layer during discharge (when flow is rapid) is held back by the impervious backing sheet for sufficient time permit absorption take place. Liquid excess of the absorptive capacity of the densified layer forced back by the impervious layer into the dry portion of the loosely compacted batt, thus utilizing the additional absorptive capacity therein.

The facing layer the above-described diaper comprised of mixture long and short fibers that are held together by binder having wetting agent therein which reduces the water repellency the facing layer that urine may readily pass therethrough and into the loosely compacted batt. The binder and wetting agent are uniformly applied across the width and thickness the facing layer that the facing layer has uniform functioning properties. While the above type facing layer has functioned satisfactorily min, certain circumstances, particularly when the diaper becomes saturated, there has been tendency for urine wick along the facing layer and cause leakage the



edges the diaper has been proposed obviate this problem by spraying, otherwise applying, water-repellent agent on the edges of the facing layer an effort prevent urine from wicking outwardly, but this proposal has proven be unsatisfactory, since the water-repellent agent does not penetrate throughout the thickness the fabric and hence does not prevent the wicking action.

## SUMMAR OF THE INVENTION

The present invention provides an improved nonwoven fabric having particular utility this facing layer disposable diaper the type disclosed the above mentioned application. The facing layer the present invention absorbent and readily wettable the central portion and water-repellent (difficulty wettable least two opposite marginal portions. The facing layer may be conveniently produced by treating the mid-portion web of mixed short and long fibers with binder and wetting agent, and treating marginal portions of the web with binder material only. The binder material used amount sufficient impart marginal portions the facing layer after the binder has cured, the desired degree of water repellency.

In application the binder material the web mixed short and long fibers, the binder material flowed onto the web amount excess of the minimum amount required retain the fibers their assembled relationship. The binder material drawn through the facing layer by suction, that the web thoroughly impregnated. As already indicated, the binder material applied the central portion the web has incorporated therein wetting agent, whereas that applied the marginal portions does not, that amount provided in the resulting facing layer the invention effectively prevent urine from wicking readily outwardly.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. perspective view with certain portions broken away for clarity Illustration, of an open unfolded diaper one embodiment this invention;

FIG. an enlarged cross-sectional view taken generally along line 2—3 FIG.

FIG. perspective view on reduced scale of the diaper FIGS. 1 and configuration after being put on infant;

FIG. simplified schematic view the production line on which the diaper made;

FIG. an enlarged perspective view illustrating the binder applying means utilized the production line FIG.

FIG. enlarged perspective view modified binder applying means;

FIG. 7 is an enlarged perspective view illustrating an alternate binder applying means utilized the production line FIG. 4, and suitable for the production of the diaper FIG.

FIG. 8 enlarged fragmentary perspective view illustrating corner another variation of the diaper of this invention; and

FIG. perspective view, with certain portions broken away for clarity Illustration, an open unfolded diaper illustrating the water-repellent marginal portions of another embodiment of this invention.





## DETAILED DESCRIPTION OF THE INVENTION

Referring the drawings, and particularly FIGS. and the diaper assembly 18, when fully opened and laid out flat, comprises lowermost water-impervious sheet which rectangular shape, highly water-absorbent fibrous pad, batt 14, which also rectangular shape, but smaller than the impervious sheet and centrally disposed thereon, and overlying facing layer fibrous material, which also rectangular shape, equal dimensions, and coterminous with the impervious sheet and contact therewith the portions the diaper extending peripherally beyond the absorbent pad, i.e., the portions 14a and 2a facing layer 16 and impervious sheet 13, respectively The batt 14 has paper-like densified highly compacted lowermost fibrous layer which adhered the impervious sheet by bead lines of adhesive 23 substantially throughout the interface therebetween. Portions 4a and 2b are also adhered each other by bead lines 22.

the preferred embodiment the invention, moisture-impervious sheet 13 formed polyethylene having thickness approximately 0.00 inch. The sheet may smooth, may embossed improve drape and feel. Other suitable flexible moisture-impervious sheets may be used accordance with the invention, such as, for example, polyethylene terephthalate sheets having thickness of about 0.0005 inch.

the embodiment of FIG. the general structure the diaper similar the structure described above with reference FIG. and the elements described above find their counterparts FIG. and are designated the latter Figure by numerals higher than those FIG. by 100. For convenience, these elements will referred herein by the reference numerals they bear FIG.

addition the foregoing elements, there are the facing layer the diaper of FIG. side edge portions which are lesser wettability than the remainder the facing layer The diaper of FIG. has similar side edge portions 14a and also lesser wettability than the remainder the facing layer Together portions 14a and 4a comprise rectangular border "picture frame" reduced wettability surrounding the central portion the facing layer

The relative sizes of the central portion and the edge portions the embodiments FIGS. and are matters design dependent on number of factors including the overall size the diaper and whether intended for newborn infant for larger and more active baby Generally the central portion will comprise from about 50 percent about 90 percent the total area of the diaper and the marginal portions will range from about inch about inches width.

Batt formed of loosely compacted short cellulose fibers, such wood pulp fibers, cotton linters, mixtures thereof which are primarily held together by interfiber bonds requiring no added adhesive, known the art. Briefly, this batt low bulk density coherent web loosely compacted cellulose fibers preferably comprises wood pulp fibers the form so-called "fluff.

The term "short fibers, used herein, refers fibers less than about inch length, contrast "long



fibers, "textile length fibers which are longer than about inch length, and generally are between about and 2¼ inches length. The former are substantially less costly than the latter The classification of fibers by length may carried out by the Clark Classification procedure described the test manual of The Technical Association Pulp And Paper Industry (TAPPI-T233 SU64

The paper-like densified layer batt 14 formed by slight moistening one surface the batt followed by the application pressure thereto. The mixture the batt and densified layer and the method producing the same are described U.S. Pat. No. 3,0 304, dated Jan. 963.

The composite density batt 14, including densified layer 18, should above about 0.07 gm./cc., and preferably between about and gm./cc. The foregoing density values are applicable the diaper produced. storage and handling, the loft thickness the batt decreased some extent, resulting lowered densities.

Facing layer 16, described the above-mentioned Mesek et. patent, made up mixture fibers consisting predominantly short cellulosic fibers such wood pulp fibers cotton linters, amounts about 75 percent about 96 percent, the balance being textile length fibers such rayon. Short cellulosic fibers such wood pulp fibers cotton linters are substantially less expensive than textile length cellulosic fibers such cotton and rayon, and this low cost factor reducing the cost the facing layer component the diaper this invention.

the facing layer the short fibers are uniform mixture with percent about percent by weight textile length fibers, such denier rayon fibers uniformly cut inch length. The short and long fibers are randomly and substantially uniformly dispersed and bonded with bonding agent such self-cross-linking acrylic emulsion, and hereinafter described detail, the web impregnated with binder fluid by flowing solution dispersion the binder over the web. As result, the binder substantially uniformly distributed throughout the thickness of the web.

accordance with another preferred embodiment this invention, the facing layer comprises mixture long and short fibers which varies compositions with respect proportions long and short fibers different thickness portions the web. Such webs and the methods of forming them are disclosed the commonly owned copending U.S. Pat. application Ser No. 08,346 Ruffin, et., filed Jan. 97 the disclosure of which hereby incorporated by reference. The preferred web the Ruffin, et., application for the facing layer this invention has given overall concentration of long and short fibers, greater concentration long fibers one major face (the exterior face the facing layer the diaper assembled greater concentration short fibers the opposite major face and uniform transition fiber concentrations different thickness portions increasing distances from one major face the other

the diaper the aforementioned Mesek, et., patent the binder fluid impregnated into the facing web contains surfactant wetting agent partially counteract the water repellency of the bonding agent and

bring the facing layer the desired degree of wettability

accordance with the present invention, only the central portion the web, comprising the major portion area, and including portions likely initially wetted when the diaper use, accordance with the present invention, the marginal and side and/or edges the facing layer are treated with lesser amount wetting agent, no wetting agent all. By not treating the marginal edges the facing layer with wetting agent, these portions of the web are less wettable and less absorbent than the coil portion the web, which minimizes any tendency for urine spread outwardly the facing layer

Facing layers suitable for use this invention have fabric weights the range oz./yd² and preferably 2 oz./yd² and densities less than gm./cc. generally the range between 0.05 and gm./cc. The dry strength the facing layer for fabric having weight about oz./yd² is least lbs./in., preferably lbs./in. width the machine direction and least 0.08 lbs./in., preferably lbs./in. width the cross direction. The fabrics have reasonably good elongation, loft, softness and drape characteristics comparison prior products incorporating any substantial amount of short fibers.

As important aspect this invention the provision for selective wettability among the above-described three components the diaper and within the components themselves, such that the moisture selectively drawn from the facing layer into the body of the batt and then from the body the batt into the densified layer thereof.

The least wettable the fibrous elements the diaper this invention facing layer 16. However even in the facing layer the ability wetted by water desired. Water repellency the central portion of the facing layer not desired since, the desired fiber densities in the facing layer water repellency can prevent the liquid from penetrating into the facing layer and the absorbent layers behind just least fabric holds back penetration rate water. For this reason, the central portion the facing layer treated with wetting agent, such as anionic non-ionic surfactant, moderate and reduce the water repellency which may imparted the short and long fibers of the web by the bonding agent which bonds them into an integral layer After treatment with wetting agent, the central portion the facing layer receptive penetration by urine but remains less wettable than the batt.

Water repellency least reduced wettability, desirable the marginal edges of facing layer 16 minimize any tendency for urine wick along the facing layer toward the marginal edges thereof. In accordance with the present invention differential wettability the facing layer can accomplished by not treating the marginal edges the facing web with wetting agent, that only fibers and binder impregnated are present the marginal edges, by applying some binder the marginal edges of the facing web then the subportion thereof

useful parameter wettability the liquid-fiber contact angle for the individual fibers the layer the contact angle approaching 90° for fibers which are difficultly wettable, exceeding 90° for fibers which are highly water repellent and approaching zero for fibers which are highly wettable water The liquid-fiber contact angle may determined from interface high speed photographs individual dry fibers, held clamp, and advanced into the wetting liquid (water) rate 0.5 cm./sec. by techniques known the art.

any particular facing layer the liquid-fiber contact angle for individual fibers may vary considerably because nonuniform distribution the water-repellent bonding agent and/or nonuniform distribution of wetting agent and/or surfactant. Nevertheless, liquid-fiber contact angle between about 30° and about 60° for most over 50 percent) the individual fibers random selection provides suitable wettability the central portion the facing layer and liquid-fiber contact angle between about 40° and about 60° preferable. liquid-fiber contact approaching 90° and preferably above 90° gives the marginal side edges of the facing layer adequate degree water repellancy.

The body batt substantially more wettable than the facing layer and teach draw liquid away from the facing layer The individual fibers the batt are extremely wettable, generally having liquid-fiber contact angles below about and approaching zero the optimum embodiment. The wickability, preferential absorptivity the body the batt for water finished, however by its low density which results in large effective capillary radius for the capillaries between adjacent fibers.

The pressure causing liquid enter cylindrical capillary expressed by the equation:

$$2\gamma\cos\theta/r$$

where

the capillary pressure,

$\gamma$ the surface tension the liquid,

$\theta$ the liquid-fiber contact angle, and

the capillary radius.

With given liquid, the pressure capillary forces increases with the cosine of the liquid-fiber contact angle reaching maximum where the angle zero and decreases with narrower capillary radii that narrower capillaries will draw liquid from wider ones.

The relative wickability between facing layer 16 and the body of batt affected by both the relative densities of the layers and the relative wettability the individual fibers each layer The facing layer nonetheless more dense than the body the batt, tending provide greater wickability the facing layer but even than the individual fibers of the batt have substantially smaller liquid-fiber contact angles than those the facing layer overcoming the density difference and providing substantial overall increase capillary pressure absorb liquid into the body of the batt.

Densified fiber layer of the batt provides the maximum capillary pressure because combines the very low contact angle the fibers the batt with the high density (small capillary radius) the densified fibers.

When urine voided into an area facing layer 16, partially wets the facing layer and absorbed therein, spreading out lateral extent focus roughly circular vertical zone therein. When the urine passes through the facing layer and comes into contact with the body batt 14, preferentially absorbed into the body the batt because the enhanced wettability thereof. spreads within the body the batt wet roughly circular zone therein that is larger than the wetted zone the facing layer When the urine passes through the body the batt into contact with densified layer strongly drawn therein because high density and spread laterally through much larger substantially circular zone, the edges the batt, depending on the amount urine passed.

On occasions when substantial amount urine has been voided, the densified layer becomes saturated and excess urine, aided by the presence impervious sheet and adherence the densified layer discontinuous pattern substantially throughout the interface therebetween, flows into the previously dry portions the body the batt, and finally into the previously dry portions the facing layer be noted, however that such flow from saturated densified layer from the outermost portions the diaper inward that most the facing layer remains dry until other fibrous portions the diaper are saturated. Furthermore, the marginal side and end portions the facing layer are not readily wettable, and hence urine that does flow back into the facing layer flows laterally into the central portion minimizing the possibility of fluid leakage the sides the diaper

The densified layer the batt, for the reasons explained above, creates high capillary pressure which tends move liquid away rapidly from the area the original wetting. However the speed liquid migration limited in the densified layer because the resistance provided by small capillaries. The compressed batt used this invention, with its densified layer intimate contact with absorbent material of lesser density provides improved speed liquid migration over either the densified layer alone, the uncompressed layer alone.

While not desired bound by any particular theory operation, believed that the improvement speed of liquid migration obtained by the compaction the dense and uncompressed layers the batts used this invention results from the practicality the two layers and the fact that just sufficient the high capillary pressure generated by the dense layer are the large capillaries of the uncompressed layer which can move larger quantities the liquid with relatively little flow resistance.

There also cooperation between the densified layer the batt and impervious sheet which internal wicking of urine usually takes place within short time, and the rate absorption the diaper might overwhelmed during this short period spite the diaper's ultimate capacity absorb the amount liquid voided and spite of the relatively high rate absorption obtainable for the reasons specified above. The impervious sheet serves hold the urine and keep from wetting the bed clothes outer clothing that the absorptive portions the diaper can have the time function. In addition, the impervious sheet serves anchor stabilize the fluff portion the batt against migration the loosely compacted fibers, since the impervious sheet adhered the densified layer (integral with the fluff portion of the batt, over widely distributed area.

noted that the facing layer assembled into the diaper noncontiguous with the impervious sheet and there no folding over the impervious sheet envelope any edge fibrous material. Thus, there no portion of the upper surface the diaper which covered with any plastic material, and no plastic material comes into direct contact with the infant's skin when the diaper affixed position by pins tabs. Prolonged direct contact plastic material with an infant skin can cause irritation and infection but, nonetheless, employed prior art disposable diapers provide an impervious seal the infant's skin. The superior absorptive capacity of the diaper this invention and superior functioning units such plastic-skin contact unnecessary.

The diaper this invention normally packaged and sold folded condition. Briefly the side margins 12b and 14b the impervious sheet 12 and the facing web 16, together with portion batt 14, are folded inwardly first fold provide the uppermost layer of the fold, portion the moisture-impervious sheet. This sub-assembly then folded outwardly along each edge second fold cover the first folded portion and expose the water-repellent edge portion the facing web the upper layer the double fold. the preferred embodiment, each double fold the edge the diaper comprises approximately one-third of the resulting transverse dimension the folded diaper having approximately one-third the width the folded diaper central unfolded and uncovered portion.

The diaper held folded condition by two small central spots adhesive applied between the main body the diaper and the overlying sides 46 the facing web, one spot on each folded side the diaper When the diaper is put on the infant, the folds are opened on one side each the adhesive spots, and the open portion the diaper put under the infant's buttocks while the folded portion raised into the crotch region. The final form the diaper shown perspective on reduced scale FIG. 2.

one form the invention, illustrated FIG. the diaper provided with adhesive tabs 24, each having fixed and secured the impervious sheet and free end wherein the adhesive surface covered with facing sheet. The facing sheets are removed expose the adhesive surfaces when the diaper applied the infant, the configuration shown FIG. and the free ends the adhesive tabs are secured opposite corners the diaper

the embodiment discussed above, densified layer 18 continuous layer covering one entire face batt 14. However the densified layer may, desired, be widely distributed discontinuous layer such the form parallel, narrow densified strips running lengthwise the diaper and separated by narrow undensified trips. Alternatively, the densified layer may the form rectangular gridwork densified material encompassing plurality small areas undensified material. Densified layers this latter type are made the same manner the continuous densified layers described above, except that the compressing applied embossed rollers, described the aforementioned U.S. Pat. No. 3 ,304.

Suitable fibrous structures for making the pads batts 14 used this invention are made from short cellulosic fibers obtained by the grinding comminution of compacted wood pulp fibers cotton linters. The compacted cellulosic material moisture content 5-10 weight percent before being subjected the

grinding operation so that the fibers produced by grinding have sufficient surfaces have the capability of developing weak interfiber hydrogen bonds which give some cohesiveness the body the batt.

The batts are initially formed by air blowing the slightly moist cellulosic fibers onto support total weight about oz./yd² and then subjecting the air blown fibers heavy compression.

The dense compacted paper-like layer skin prepared by moistening surface the cellulosic batt with fine spray water and then subjecting the moistened batt pressure. The formation of the densified skin on the cellulosic batt believed due the formation strong hydrogen bonds between contacting moistened fibers, similar the bonds between the fibers paper By the proper selection the amount moisture applied the surface the batt and by the proper selection degree compression imparted, the properties the densified skin may varied desired. The thickness, density, strength and other characteristics the densified skin will depend upon the sufficiency by which the moisture applied, the depth which penetration, and the degree which the fibers are compressed. For example, by finely spraying about 0.001 $H_2O$/cm. of web surface and then exposing the web pressure about 40 lbs./in. suitable densified, coherent paper-like skin obtained on the surface the web which has been moistened.

The short fibers used making batts this invention are generally ordinary fibers wood pulp cotton linters. However other cellulosic fibers may used well blends of cellulosic fibers with other fibers such silk, wool, nylon and cellulose acetate. Highly purified kraft paper pulp fibers have proven most satisfactory for most applications.

The diaper this invention may manufactured equipment such that schematically shown FIGS. and FIGS. and being particularly relevant the diaper FIG. and FIG. 7 being particularly relevant the diaper FIG. As shown in FIG. 4, roll of compacted wood pulp 41 provided feed source short cellulosic fibers grinding mill 42 from which stream fibers blown onto belt 43 layer 44 weighing between about and about oz./yd.²

Mill 42 grinds the pulpboard into individual short fibers. However in one preferred embodiment, some the pulpboard fibers are not completely comminuted and remain joined other fibers small clumps, generally smaller than about inch across. has been found that the presence of such small clumps of fibers the body batt 14 provides inherent increased capacity for holding liquid. When an infant's weight on one portion the batt densifies that portion and tends concentrate the liquid the densified portion, the presence clumps of fibers elsewhere the batt tends hold the liquid place. Preferably from about about weight percent of the fibers should the form such clumps.

The air blown layer passed under compacting roll 46 from which emerges with enough integrity sustain itself web without the support of belt 43. The web then passes through pair of calender rolls 47 for further compression and then under nozzle 48 which deposits fine spray moisture on the upper surface the web. The moistened web then passes between another set calender rolls 49 which exert heavy pressure on form skin on upper surface.

The amount moisture applied the web may vary suitably from about 0.0005 about 0.03 cc. of $H_2O$/cm.² web surface, depending on the thickness the web and the thickness the paper-like densified skin desired, with lesser amounts of moisture being used for thinner webs and very thin, papery skins and greater amounts for thicker webs and skins greater thickness.

The amount pressure applied by rolls 49 may vary from about about 00 more lbs./in. with the commercially preferable range being from about about 30 lbs./in. typical embodiment, the web sprayed with about 0.001 cc. $H_2O$/cm. web surface and subjected pressure about 40 lbs./in. obtain densified, coherent papery skin on the surface the web which has been moistened.

the absorbent web and the batts cut therefrom, there are weak hydrogen bonds the body the batt providing sufficient strength maintain the integrity the batt in ordinary handling, and there are strong hydrogen bonds the densified layer skin increase the cohesive strength the composite. After the skin formed, the absorbent web comes into contact with web facing material 52 and supported thereby while being cut by cutter 53 into individual batts 54.

The facing material prepared by initially feeding source 54 of short fibers and source 55 of long fibers fiber individualizing and mixing means 56, which removes the fibers from their respective sources, mixes them, and deposits them on foraminous belt 57 The web forming means may similar Rando-Webber made by the Curlator Co. To produce the diaper FIG. the web then moved by belt 57 beneath web bonds 58 and 59 which apply binder material the web, can best seen in FIG.

The facing layer described above, contains between percent and 96 percent by weight short fibers, not exceeding about length. The average short fibers are from about about inch in length. The web continuously laid dry fibers the desired rate short and long lengths has density from about 0.09 gm./cc. about 0.025 gm./cc. measured by ASTM Method D— 777 lbs./in.

Facing layers having weights between about and about 3 oz./yd. preferably oz./yd. are generally suitable for use this invention. One particular facing layer which has been used with satisfaction composed of approximately percent textile length fibers such uniformly cut inch denier rayon fibers and 85 percent fibers individualized second cut cotton linters. This facing layer has weight about oz./yd. bonding agent, such self-cross-linking acrylic emulsion, applied the web results the fibers in their associated relationship. One bonding agent which has been employed with considerable success latex polyethyl-acrylate copolymer containing small amounts acrylamide and cross-linking monomer sold under the trademark HYCAR 2600 20. The bonding agent should preferably the low viscosity type with viscosity less than 5 centipoises.

The downstream web box 58 designed apply binder material only the marginal side edges of the web, and hence barrier 60 provided centrally the web box, that binder material can flow outwardly only through the openings 61 the sides the web box. The binder material may be of the acrylic latex



type described above and sufficient quantity flowed onto the web completely impregnate the mass throughout the thickness the marginal edges.

The web then passes the downstream web box 59, which includes inwardly extending barriers 62 opposite sides thereof which are substantially aligned with openings 61, that binder material within web box 59 flows outwardly through the central opening 63 between barriers 62 and impregnates the central side-portions the web.

The binder material which fed web box 59 includes wetting agent, such suitable non-ionic surfactant, and sufficient quantities binder and wetting agent are applied the central portions the web thoroughly and completely impregnate the mass. Typical surfactants which have been found be suitable are the suitable sulfonated alkyl ester sold under the trademark Triton GR—5 and the non-ionic polyoxyethylene sorbitan monolaurate sold under the trademark TWEEN 20. The binder material that fed the web box 58 does not contain wetting agent, that the edge portions 14a the facing layer are given the desired water repellent characteristics. By way example, the edge portions 14a may each extend inwardly inch penetrated inches wide.

The composition the binder suspension controlled typical application give the fabric dry add-on of percent based on the fabric weight, which about percent the amount of surfactant, suitable range for the amount binder from about percent about percent, based on fabric weight.

As alternative form binder applying means illustrated FIG. and with the arrangement illustrated therein, pair side-by-side facing layers can be simultaneously bonded. web substantially double width initially fed past downstream web box 64 which includes spaced barriers 65 and 66 that define slots 67 and 68 alignment with the side edges the web, and that also define opening 69 that disposed centrally of the web. Opening 69 approximately twice wide openings 67 and 68, which are equal width. The binder that is fed web box 64 the same the binder material that fed web box 58, i.e., the binder does not contain wetting agent.

After the web passes from beneath web box 64, moves beneath further web box 70 that includes relatively narrow projections and 72 opposite sides thereof and relatively wide projection 73 the mid-portion thereof. Projections 71, 72 and 73 correspond in width openings 67 68 and 69, respectively. The binder material that fed web box 70 the same that fed web box 59, i.e., the binder material has wetting agent therein. As with the embodiment FIG. when the web emerges from beneath web box 70, relatively narrow water repellent strips 14a are provided opposite sides the web, relatively wide strip 14c provided centrally the web, with strip 14c being substantially twice the width strips 14a. The web then passes beneath centrally disposed cutter 74 that severs the web into two separate facing layers 14.

With either the above arrangements, the binder fluid flowed onto and through the web quantities substantially excess of the minimum amount be deposited on the fibers completely impregnating the web.

The web, immediately after impregnation with the binder fluid, passes over suction box 75 where excess binder fluid is removed. The wet web then conveyed into drying oven 76 having temperature 0F-325F where dried and the resin binder cured. The resultant material has density 0.05 0.07 gm./cc. and dry strength about lbs./in. of width the cross direction. The wet strength are about lbs./in. width the machine direction and about 0.5 lbs./in. width the cross direction. The fabric may then be collected on storage roll, rolls, now shown, pass directly the heat material, shown FIG.

Polyethylene film fed the assembly from roll 77 from adhesive being applied from applicator 78. As described above, the adhesive applied parallel lines beads between the impervious sheet and the densified layer the batt the facing layer the marginal portion the diaper). Adhesive may desired, be applied continuous layer between the polyethylene and the batt, but such application tends provide excessive stiffness. The adhesive may also be applied other patterns, such spaced dots other forms so-called "island" bonds, but fairly close overall adhesion between the sheet and the batt required and so portion the polyethylene should be more than about 2 inches from point of adhesion, the absence of such close overall adhesion, the polyethylene film may separated from the densified layer create substantial spaces which uncontrollably large amounts free liquid urine can accumulate.

After the facing material and polyethylene are brought into contact with opposite faces the absorbent batts, the assembly subjected compression by rolls 79 and 80 shape the diaper assembly, and the individual diapers are cut off cutter 81.

desired, adhesive applicator 78 may omitted and adhesion between the polyethylene layer and the brown layers may achieved by heat sealing, employing suitable sealing element the production line.

If desired, the facing layer may made with venser long fibers on one both surfaces thereof, place addition the long fibers intermixed with the short fibers. another embodiment, the facing layer may made substantially entirely textile length fibers bonded together with resinous bonding agent. This embodiment can provide facing layer of greater strength, but not preferred because more expensive and because the strength the short fiber containing facing material adequate most instances.

The adherence the impervious layer the densified layer continuously discontinuously, over substantially the entire interface between these important between provents substantial separation between the two and the creation substantial spaces which substantial accounts of free liquid urine can accumulate. The adherence the impervious layer the paper-like densified cellulosic layer effects dimensional stabilization the densified layer against transverse movement and thereby brings about stabilization the loosely compacted fiber fluff portion the batt layer since the paper-like densified layer integral with the fluff portion the batt, and bending forces are transmitted from the dimensionally stable impervious layer through the widely distributed adhesive, the densified layer and thence the fluff.

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The binder application system FIG. can also be used when desired make diaper with facing layer having areas of lesser wettability the end margins rather than the side margins. this instance, the facing web width of sufficient dimension comprise the length the facing layer on the diaper FIG. and the web, after drying, is cut into diaper widths for assembly with the remaining diaper elements.

When desired have areas lesser wettability both the side edges and the end edges, the system of FIG. may substituted for the system of FIG. the binder application system within the overall assembly system of FIG.

The FIG. system includes two spaced apart through printing assemblies 150 and 78. Assembly 150 designed through print substrate binder and surfactant onto the central area portion web provide rectangular area 16c which has the desired wettability for the particular the facing layer through which urine must pass. To this end, roller 151 provided which rotates the direction the web feed (downward and the left shown FIG. 7). Roller 151 hollow and contains small quantity the desired binder-surfactant mixture, maintained low level therein by continuous supply through line 156. The cylindrical surface roller 151 comprises solid areas 152 and 153 corresponding respectively the side and margins lesser wettability desired the facing layer and perforated areas 154 corresponding the rectangular area 16c on the web. Baffles box 157 below the web where contact with roller 151 and helps pull the binder-surfactant mixture through the perforations area 154 and through the web when the perforations are under the shallow pool liquid and over the web. As the web emerges from under roller 151 wet with the binder-surfactant mixture the areas 16c and dry the areas 16 and 164.

Roller assembly 78 serves apply binder without surfactant the areas left dry by roller Roller also hollow and contains shallow pool of binder composition provided by line 76. The cylindrical surface roller 71 the complement the cylindrical surface roller 151 that the latter solid area 74 corresponding area 16c on the web and perforated areas 72 and 73 corresponding the side and end margins the facing layer

The rotating roller 71 cooperates with sucker box 77 wet the previously unwetted portions of the web with the water repellent binder solution produces, after drying and curing, the desired marginal areas 16a and 16d FIG. 8 having lesser wettability than the remainder the facing layer

the modification described above, the desired water repellency applied the marginal portions of the facing web in strips extending from the more wettable central area the edges the web. an alternate embodiment, the water-repellent marginal portion of the facing layer may be narrower strips forming barrier to outward flow of liquid from the more wettable central'area but not extending far the edge the facing layer

Facing layer 16 FIG. extends beyond the edges batt 114, FIGS. and end strips 16a' and 16d' the side and marginal areas, respectively, of the facing layer between the edges the batt and the edges the facing layer but spaced from both, serve discus prevent the flow of liquid outwardly from the more wettable central area the edges the diaper desired, the facing layer need not have both strips 16a' and 16d' and may instead have either side strips end strips depending on the particular design of the diaper and the relative likelihood of leakage through the sides through the ends the diaper

Strips 16a' and 16d' should sufficient width serve an effective barrier the easy transmission aqueous fluids, the necessary width being inversely related the degree wettability the strip. Generally, strips 16a' and 16d' range in width from about about inches.

will understood by those skilled the art that variations and modifications the specific embodiments described above may employed. For example, while facing layer has been described detail having utility disposable diaper may also used shaller products intended absorb body fluids, such bed pad.

should also understood that the invention applicable other forms of facing layers and other forms absorbent pads having greater wettability than the facing layers.

Among the alternative facing layers which may be utilized in accordance with this invention and provided with marginal areas lesser wettability are porous, paper-like facing materials made of long fibers bonded together with thermoplastic binder applied sandstrip form, such the facing layers disclosed Duncan U.S. Pat. No. 80,333, issued Apr 27 1965 and upon-called polymeric foam facings, such those disclosed Meisel, et., U.S. Pat. No. .43 1

Among the alternative absorbent pads which may be used accordance with this invention are pads made plurality piles of cellulose wadding, as disclosed the aforementioned Duncan, et. patent.

Other modifications and variations will be apparent those skilled the art.

claim:

multi-layer diaper comprising: backing layer highly absorbent pad disposed face-to-face juxtaposition said backing layer and facing layer on the side said pad opposite said backing layer said facing layer comprising through bonded non-woven fabric of mixed short and long fibers, said fabric having short fiber content of least about 75 percent by weight the fabric, said short fibers having length less than inch and said long fibers having length greater than inch, said fibers being bonded by cross-linked binder applied through-out the thickness said fabric an amount between about percent and about 30 percent the weight the fibers on dry solids basis, said fabric having weight less than oz./yd. and density 0.05 3 gm./cc., said fabric being treated with rewetting agent give desired degree wettability for water the ratio said binder said rewetting agent the mid-portion said web and the marginal side and end portions thereof being varied that said marginal portions have less absorbency and less wettability for water than the mid-portion of said fabric.

The diaper of claim wherein said facing layer and said backing layer are rectangular and substantially coextensive, said pad substantially rectangular narrower than said facing layer and said backing layer and centrally disposed with respect thereto provide marginal portions said diaper which said facing layer



and said backing layer are direct contact with each other

The diaper claim wherein said marginal portions less wettability for water than said mid-portion extend width from said mid-portion the side edges said fabric.

The diaper claim wherein said mid-portion of said facing layer wider than said pad, and said marginal portions are narrower extending width from the sides said mid-portion lines spaced inwardly from the side edges of said fabric.

The diaper claim wherein said marginal portions said facing layer and said backing layer are adhered one another

The diaper claim which the short and long fibers said facing layer are randomly dispersed and uniformly distributed.

The diaper claim which the short and long fibers said facing layer are different proportions different thickness portions said diaper with the outermost face said facing layer having greater proportion long fibers than the overall proportion of long fibers the entire facing layer

8. The diaper claim wherein said marginal side edges contain lesser amount of rewetting agent than said mid-portion.

The diaper claim wherein said marginal side edges contain greater amount binder than said mid-portion.

10. multi-layer diaper comprising: porous facing layer the form water-wettable web mixed long and short fibers, said web being through bonded with cross-linked binder and treated with rewetting agent give desired degree of wettability for water the ratio said binder said rewetting agent the mid-portion said web and the marginal side and end portions thereof being varied that said marginal portions have less absorbency and less wettability for water than the mid-portion of said web; highly porous, loosely compacted, cellulosic fibrous batt in face-to-face juxtaposition said facing layer and having greater wettability water than said facing layer particles, densified compacted cellulosic fibrous layer relatively high wettability and relatively high field resistivity integral with said loosely compacted batt on the face thereof opposite the face juxtaposition said facing layer and water-impervious backing sheet adhered said densified layer

The diaper claim 10 wherein said backing sheet and said facing layer are substantially rectangular and substantially coextensive, said batt substantially rectangular narrower than said backing sheet and facing layer and centrally disposed with respect thereto provide marginal portions said diaper which said backing sheet and said facing web are direct contact with each other

12. The diaper claim 10 wherein the fiber content said facing layer comprises from about 75 about 98 weight percent short fibers having fiber length less than ¼ inch and from about about weight percent long fibers having fiber length between about and ¼.

13. The diaper of claim wherein said side and end marginal portions extend width from said mid-portion the side and end edges said facing layer

14. The diaper claim 10 wherein said mid-portion said facing layer wider and longer than said batt, and said marginal portions are narrower extending width from the sides and ends said mid-portion lines spaced inwardly from the side and end edges said fabric.

15. The diaper claim wherein said central portion comprises from about 50 percent about 90 percent the area of said facing layer

The diaper claim 10 wherein said marginal portions include side marginal portions and end marginal portions and are from about inch about inches wide.

The diaper claim wherein said marginal portions include side marginal portions and end marginal portions and are spaced inwardly from the side and end edges.

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US0059 37

# U ited States Patent

Clark al.

Patent number 5,910,137

[45] Date of Patent. Jun. 8, 999

[54] AYERED ABSORBENT PRODUCTS

[75] Inventors: Tracey A. Clark, North Brunswick; Mary Gail Chaisdald, East Brunswick; Kathleen O'Donnell, Somerville,

[73] Assignee: McNeil-PPC, Inc., Skillman, NJ

Notice: This patent issued on continued prosecution application filed under CFR .53(d), and subject the twenty year patent term provisions U.S.C. 154(a)(2).

[21] Appl. No. 08/723,741

[22] Filed: Sep. 30, 996

Related U.S. Application Data

Continuation application No. 08/294,703, Aug. 29, 994, abandoned.

Int. Cl. ..... A61F 13/15

[52] U.S. Cl. ..... 604/387; 604/385. 604/386; 604/389

[58] Field Search ..... 604/365, 378, 604/385.1–387 389–394

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*Primary Examiner*—Robert Clarke
*Assistant Examiner*—K. Reichle

[57] ABSTRACT

multilayered absorbent feminine hygiene product which configured for releasable attachment user's garment has plurality absorbent pads. Each the absorbent pads has absorbent layer contain absorbed fluid and barrier layer prevent absorbed fluid from leaking completely through the individual pad. The first, lowermost pad the product configured for releasable attachment user's garment. Additional pads the product can releasably attached above the first pad form stacked layered product. The pads adhesive therein compressively, mechanically bonded. Preferably, the multilayered product includes three absorbent pads.

Claims, Drawing Sheets

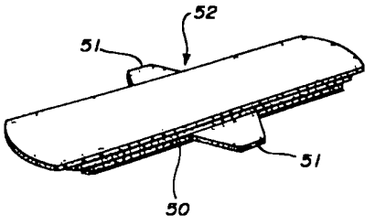




FIG 1

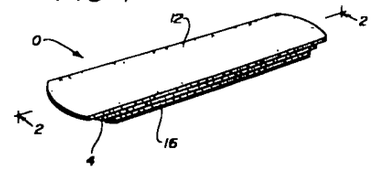


FIG 2

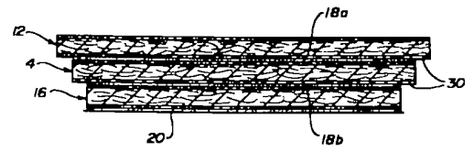


FIG 3

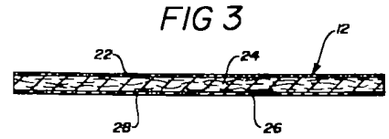


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FIG 4a

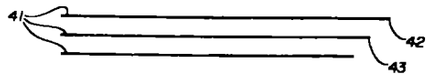


FIG 4b

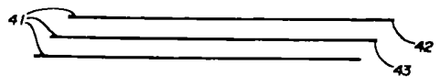


FIG 5

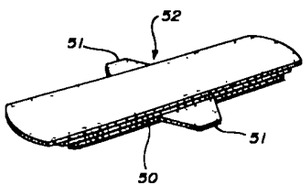




FIG 6a

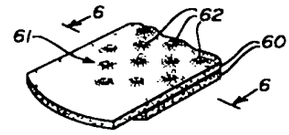


FIG 6b

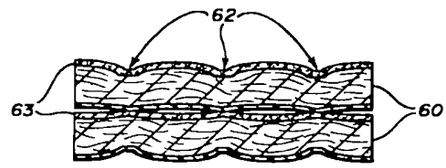


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FIG 7a

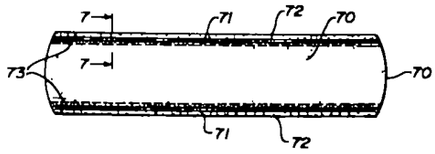


FIG 7b

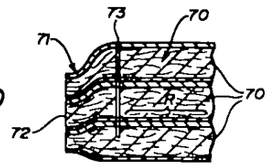


FIG 7c

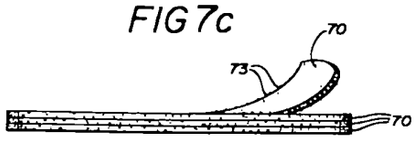




FIG 8

FIG 9

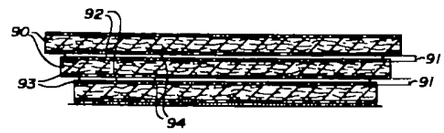

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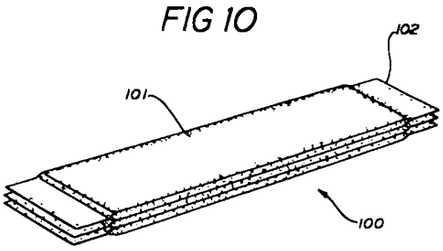
FIG 10




LAYERED ABSORBENT PRODUCTS

This continuation application Ser. No. 08/236,763, filed Apr. 29, 994, now abandoned.

FIELD OF THE INVENTION

The present invention relates multilayered absorbent feminine hygiene product. particular, relates stacked layered product containing individual absorbent pads which are releasably attached one another.

BACKGROUND OF THE INVENTION

Absorbent products have long been used feminine hygiene products. Discretion the use these products has been goal manufacturers and users alike. Absorbent pads and napkins used for feminine hygiene provide some specific capacity for absorbing body fluids. Once soiled, product must replaced by unsoiled product Unfortunately, woman not always locate otherwise conveniently user supply these absorbent products, and many necessary for her keep individual supply products with her. Thus, feminine hygiene products have been manufactured carried conveniently woman's purse pocketbook. These products have also been manufactured convenient, individual packages keep the product clean until use however, more discrete ways keep easily supply feminine hygiene products handy are constantly sought.

Pontiac, U.S. Pat. No. 2,929,379, suggested that woman might carry supply these sanitary napkins sanitary napkin product having multiple layers. Aside from the multiple layers absorbent pads which made up the sanitary napkin product, incorporated cloth tabs which extended from the front and rear the absorbent pad which were secured belt. This belt was separately worn about the user's waist. The use the belt in conjunction with sanitary napkins allowed the napkins held closely the user's body. The plurality absorbent layers of the Pontiac product are stacked and attached one general location proximate the front the sanitary napkin product. The back the upper individual layers was not anchored the adjacent layer was constricted only the nature the belted product.

more recent times, belted feminine hygiene products have generally been replaced by products which are releasably secured user's undergarments by means layer strip pressure sensitive adhesive disposed upon garment-facing surface the product. addition, new and thinner products, including thin sanitary napkins and panty liners, have been developed. Panty liners may used for applications other than those for which traditional sanitary napkins were designed. These feminine hygiene products are substantially thinner than conventional sanitary napkins and have substantially concentrated absorbent volume. Thin feminine hygiene products therefore, have lost the absorbent fluff layer which helps provide flexibility the product.

Most feminine hygiene products have body-facing absorbent side and garment facing barrier side, pressure sensitive adhesive generally disposed the garment facing side one more lines provide attachment means removably fix the product the garment. This pressure sensitive adhesive protected from contamination until use with piece release liner. When the product used, the user must first remove the release liner and dispose The disposal piece release liner with each panty liner increases the waste generated the use these products. Thus, desirable reduce the amount release liner used conjunction with panty liners are harmful environmental awareness.

Absorbent products have finite absorbent capacity, and they must periodically replaced. Unsatisfactorily continue search for products which are easily carried by users, are convenient and discrete. One solution discussed Takao et al., Japanese Utility Model 5-1 (Y2), which discloses panty liner product having three single layers stacked and secured together. The bottom panty liner has conventional adhesive disposed for positioning the product the crotch area user's undergarment. Each remaining layer releasably attached the layer below the stack adhesive embossing (heat sealing) means. The Takao adhesive illustrates that the adhesive applied two relatively small areas proximate the front and rear ends the layer, adjacent layers may embossed four discrete positions the layers.

Additionally, Fuji Kikaku, Ltd, Japanese Utility Model Application No 60-175330 (U), discloses multilayered sanitary napkin product having smaller pads stacked top larger pads and secured with two discrete strips two adhesive tape. Again, these strips are the ends the pad layers.

After substantial amount research into the problems associated developing panty liners having several removable absorbent layers, has been discovered that panty liners having only one local attachment point between individual layers are susceptible substantial movement the unsecured portions the panty liner layers. The forces acting on such pads tend displace least the topmost pad the wear moves. The displacement allows the pad intrude into the area between the buttocks where can wedged, causing discomfort and painful chafing. This movement presents major problem for users thinner panty liners. Merely adding second minor spot adhesive cannot guarantee firm attachment the topmost panty liner through intermediate panty liner layers the user's undergarment.

Using two small areas adhesive spaced apart the ends panty liner pad presents additional problems. The adhesive may effectively attach adjacent pads the adhesive application sites, but the adhesive cannot always prevent separation the pads away from the application sites. Thus, when the application sites are located the panty liner pad ends, the center section adjacent pads can separate, causing problems similar those identified above. Finally, while important that the absorbent layers the panty liner product secured together, the final product should flexible enough generally conform the user reduce chafing and other irritation.

Therefore, new and useful panty liner product needed having plurality absorbent pads which are releasably attached together means ensure desirable that the product flexible and comfortable wear.

SUMMARY OF THE INVENTION

The present invention relates absorbent feminine hygiene product configured for releasable attachment undergarment. The product has several individual absorbent pad layers releasably joined together. Each the absorbent pads has absorbent layer and liquid-impermeable barrier layer. An upper surface each absorbent pad defined the top surface the absorbent layer. bottom, garment-facing surface first absorbent pad configured for

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removable attachment wearer's garment. bottom surface second absorbent pad releasably attached the top absorbent surface the first absorbent pad wearer prevent separation significant portions the absorbent pads during use. Preferably, the absorbent pads are releasably attached using attachment means which have plurality attachment points areas distributed about the contact area adjacent pads. Thus, preferred embodiment, the attachment means covers substantial portion the contact area. The first absorbent pad can releasably attached wearer's garment with first separation force, and the second absorbent pad releasably attached the first absorbent pad with second separation force less than the first separation force.

preferred embodiment, each absorbent pad has peripheral edge, and least portion the peripheral edge the second absorbent pad extends beyond least corresponding portion the peripheral edge the first absorbent pad.

another preferred embodiment, the absorbent pads are stacked together and releasably attached with layering adhesive. The layering adhesive applied low coating weights per unit area pattern over substantial portion the contact area between adjacent pads. The application pattern the layering adhesive keeps the individual pad layers the product secured one another and prevents gapping, curling and other separation during use.

While individual pad layers are secured adjacent layers, the individual pad layers can, nonetheless, slip along one another when subjected shear forces. This allows the absorbent product the present invention remain flexible some single pad absorbent products the same class which are commercially available.

Unless otherwise stated, when used conjunction with adhesive coating under terms relating surface area, the term "coverage" and related forms the word including the verb "to cover" used the specifications and claims includes both continuous layer adhesive and regular random pattern adhesive coating having void areas. particular, "coverage" includes the application pattern discrete dots, fibrils, continuous discontinuous lines, etc., over area substantially enclosing area, even the adhesive particles, fibers, etc., cost only fraction that area. Thus, the area "covered" adhesive that area defined the boundaries the applied adhesive pattern.

As used the specification and the claims, the phrase "contact area" means the area first absorbent pad contacted by second absorbent pad stacked the first.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. shows perspective view multilayered pasty floor according the present invention.

FIG. shows cross section the multilayered pasty floor along line 2—2 FIG.

FIG. shows cross section individual pad along the line 3—3 FIG.

FIGS. 4and 4A show line depictions two alternative embodiments the arrangement absorbent pads having overlapping portions.

FIG shows perspective view alternative embodiment the present invention incorporating laterally extending tabs peripheral center section bottom absorbent pad.

FIG shows alternative embodiment the present invention which the absorbent pad layers are releasably attached with discrete bonding pattern.

FIG. illustrates cross-section FIG along line 6—6.

FIG shows top view alternative embodiment the present invention which the absorbent pad layers are releasably attached embossing/heat sealing along the side edges and which the absorbent pads are removed tearing along perforations inside the heat sealed lines.

FIG. shows cross-section FIG along line 7—7

FIG. shows side view the embodiment FIG. during the removal the top absorbent pad.

FIG. shows cross section along line 2—2 FIG. alternative embodiment employing fiber entanglement.

FIG. shows cross section along line 2—2 FIG. alternative embodiment employing hook-and-loop type fasteners.

FIG. shows perspective view multilayered disposable napkin according the present invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The absorbent product the present invention has plurality releasably attached absorbent pads which are stacked together. The pads may attached any means which provide sufficient attachment strength maintain product integrity during use. Preferably, the stacked pads are held together manner prevent separation significant portions the absorbent pads during use. Thus, the attachment means should able continue hold adjacent pads together under both shear and peel forces likely encountered during product use.

The attachment means may adhesive, thermal compressive such heat sealing and embossing, and mechanical such fiber entanglement hook-and-loop type fasteners. Preferably, the attachment means provides varied attachment strength between adjacent pads and between the bottom pad and the wearer's garment which attached. The first, garment-facing pad may releasably attached the wearer's garment with first attachment strength, and second absorbent pad releasably attached the first pad with second attachment strength which preferably less than the first attachment strength. Additional pads may releasably attached stacked manner the top the second absorbent pad with attachment strengths, preferably not greater than the second attachment strength.

The absorbent pads which are stacked the absorbent product may any geometry normally used the feminine hygiene field, including strip-like (like FIG. dog-bone hourglass shaped, and the like. Referring FIG. the pads may also have laterally extending tabs preferably center portion the pad for least partially wrapping around wearer's undergarment. the stacked multilayered absorbent product, each pad may have least substantially similar geometry, i.e., strip-like hourglass shaped. As used herein, the term "at least substantially similar geometry" includes identical geometry. Where the pads are substantially similar geometry, they may have slightly different proportions. Thus, successive absorbent pads may proportionately longer shorter length. Alternatively, the pads may have different geometry. For example, only the first, garment-facing absorbent pad may have tabs another embodiment, the ratio length width may substantially shared, e.g. one layer long and narrow, and second layer short and wide.

Referring FIGS. and 4b, the geometry the individual absorbent pads may therefore allow for partial overlapping one absorbent pad relative adjacent pad. Preferably, least portion the peripheral edge 42 upper absorbent pad overlaps least portion adjacent lower absorbent pad the stacked product. This overlap can prevent the lower pad from sliding underlying body fluids during use and facilitates the removal of soiled pad from the pad immediately below. Where the absorbent product constructed from identically-shaped individual pads, the overlap least one edge the appearance pad achieved staggering the pads FIG. 4b. Where the pads are different sizes, the pads may stacked manner cover each pad with the absorbent pad immediately above. Thus, the first, garment-facing pad may completely covered second absorbent pad, and third absorbent pad may completely cover the second absorbent pad. Additionally, each upper pad may extend beyond the peripheral edge the pad immediately below the stack.

The individual absorbent pads the multilayered product are preferably relatively thin. This allows several absorbent pads from absorbent product which will not too thick for the average product user. The individual pads may pasty floors, thin sanitary napkins even ultrathin sanitary napkins, and possibly thin incontinence pads. Preferably, the individual absorbent pads the invention have thickness less than about mm, more preferably, less than about mm, and most preferably, less than about 2.5 mm

The absorbent product the present invention remains flexible. Indeed, preferred multilayered absorbent products have a flexural resistance according the test method Example below. The range equivalent absorbent products. Thus, multilayered sanitary napkins have flexural resistance the range cross-sectional sanitary napkins, and multilayered pasty floors have flexural resistance the range conventional pasty floors. Preferred multilayered pasty floors have flexural resistance less than about 0.25 lbs, and more preferred multilayered pasty floors have flexural resistance less than about 0.2 lbs.

Referring FIG. three depicted, multilayered pasty floor having top pad center pad and bottom pad 16. FIG. shows cross section the multilayered pasty floor 18, including the attachment means (for example adhesive 18a, 18b, which releasably attach the top pad the center pad and the center pad the bottom pad 16, respectively addition, the bottom pad has positioning means 20, illustrated FIG. adhesive layer.

### Individual Absorbent Pads

A detail individual absorbent pad depicted FIG. The individual absorbent pad comprises top, liquid permeable layer 22, absorbent structure and bottom, barrier film 26. The absorbent pad can any conventional pasty floor pad. To keep lower pads clean until use, the absorbent pads 12,14,1 preferably disposable also from top bottom, particularly preferred embodiment, the top pad about inches 20 cm) long and 294 inches 6.4 6.4 cm) wide, the center pad about 574 794 inches (14.8 cm) long and inches 6.4 cm) wide and the bottom pad about 794 inches (12. cm) long and 294 inches (3.8 cm) wide. Examples single layered pasty floor products currently the market include pasty floors sold under the trademarks CAREFREE, KOTEX LIGHTDAYS, NEW FREEDOM, and ALWAYS and the like. These products generally have absorbent structure 34, and plastic barrier film 36. The absorbent structure may include woven layers, may single layer having upper liquid pervious surface. Preferably, the absorbent structure has several layers, the top layer forming the liquid pervious layer 22. The liquid permeable layer may nonwoven fabric such spunbonded fabric, thermal bonded fabric, resin bonded fabric, the like; apertured film such those known by the trademarks DRI-WEAVE, RETICULOFE, Apex, and the like; described top layer formed with hydrogen bonding; any other suitable covering surface. The cost the absorbent structure may cellulosic fibers, including wood pulp and cotton pulp; synthetic fibers, including polyacrylics polyamides; and the like. Preferably, the absorbent structure includes wood fluff pulp and about 80% fusible, thermoplastic fibers. Useful absorbent structures and top surfaces are disclosed Cancellieri et al., U.S. Pat. No. 4,592,943; Mayer, Pat. No. 13,134; Mayer U.S. Pat. No. 787,947 and Shimada et al., Pat. No. 774,124. The disclosures which are herein incorporated references.

particular preferred class individual absorbent pads flexible fiber pulp structure (FFP). constructed with liquid permeable layer 22. one embodiment, the layer comprises nonwoven fibrous web formed staple hydrophobic textile fibers. Such fibers may treated being coated with water-insoluble rubbery fiber-binding resin that the individual fibers are substantially covered with resin coat, thus bonding them together their crossing points while leaving the interstices of the web unfilled.

The liquid permeable layer can also porous, substantially planar flexible polymeric coating on the surface bonded staple hydrophobic fiber web on the enforced surface body web blended fibers pad construction wherein such component essentially completely secured adjacent components. Such surface, due the thickness the polymeric coating, has unusually soft, smooth feeling and pleasing the touch.

Preferably, the fibers the liquid permeable layer are thermoplastic or, more preferable, mixture two more types of thermoplastic fibers having different melting points. Upon application heat and pressure sufficient melt least one the fiber types, the resulting nonwoven fibers will thermofocused fused together into porous web. This processing step described more fully in Lauchenauer, Pat. No. 4,622,188, hereby incorporated by reference.

The fibrous materials found satisfactory the melting the liquid permeable layer have been found blends two thermoplastic fibers having distinguishable melting temperatures. Nonconponent fibers, fibers with lower cost thermoplastic fiber, e.g., polyester, surrounded by outer sheath thermoplastic e.g. polyethylene, having melting point much lower than the core, have been found the best fibers work with from processing and performance standpoints this class absorbent pads. also conceivable that the material for liquid permeable layer may conformed blends pulp fluff and thermoplastic fibers, e.g., polypropylene.

has been found acceptable use fibrous materials for the liquid permeable layer 22 having denier the range from about about 4.0. Fiber length for the liquid permeable layer has been found satisfactory the range from about 0.5 inches about 2.5 inches.

The resulting web thin, pliable, resilient, porous, cloth-like fabric whose top surface has soft, smooth,

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pleasing, tactile quality. This web may find directly and continuously into the manufacturing process for the individual absorbent pad this invention. may also collected and stored for later use.

best bonded relationship with liquid permeable layer 22 absorbent structure comprising blend thermoplastic fibers this class absorbent pads, preferable that the thermoplastic fibers absorbent structure 24 mixture two more types thermoplastic fibers having different melting points. Bicomponent fibers having melting point much lower than the core, have been found the best fibers work with from processing and performance standpoints. Like layer 22 above upon application heat and pressure sufficient melt least one the fiber types, the remaining unmelted fibers will thermobonded fused together into porous web.

also preferable include cellulosic pulp fibers with the thermoplastic fibers absorbent structure 24. Since thermoplastic fibers, without further treatment, are essentially hydrophobic, absorbent structure will not effectively draw fluid away from liquid permeable layer absent some hydrophilic material. important have sufficient pulp absorb fluid. An acceptable amount pulp for effective absorbency from about 20% about 95% weight. Conversely, acceptable amount thermoplastic fibers from about 5% about 80% weight. preferred amount pulp would the range from about 20% about 60% weight (with thermoplastic fibers being the range from about 40% about 80%).

second flexible fiber layer, made from the same similar material liquid permeable layer 22, may used "sandwich" the absorbent structure 24. Pulp fluff may damp, by sandwiching the absorbent layer containing pulp between two thermoplastic layers, the dust the operating environment greatly reduced this construction, the layer that laid down manufacture generally smoother.

The ratio thermoplastic fiber pulp fluff may characterized by comparing the total amount pulp and thermoplastic fibers in both the total absorbent structure including the liquid permeable layer 22 and the bottom outside "sandwiching" layer (not shown) and absorbent structure 24. Since they are best bonded relationship, preferable that, when looking the finished fiber layers 22 together with absorbent structure 24, there least 35% by weight thermoplastic fibers. more preferable that there least 60% by weight thermoplastic fibers both "sandwiching layers.

The fibrous materials found satisfactory the making the absorbent structure 24 are the same similar fibrous materials used for the liquid permeable layer 22. Bicomponent polyester/polyethylene fibers have been found the best fibers work with from processing and performance standpoints this class absorbent layers. Although has been found that using fibers having denier about liquid permeable cover layer results improved comfort, not necessary use fibers of this denier for absorbent structure 24. Although any denier the range from about about 4.0 will suffice, from cost standpoint denier from about 2.5 about 3.5 will yield good performance with acceptable manufacturing costs. Fiber length for absorbent structure has been found satisfactory the range from about 0.5 about 2.5 inches.

clear that the major distinctions between the liquid permeable layer and absorbent structure 24 the pressence pulp absorbent structure 24 and the possibility fiber denier fibers liquid permeable layer 22. however, above the ranges for each layer overlap, possible and acceptable use the same denier fibers for both the liquid permeable layer and absorbent structure 24. such case, there real need for two separate and distinct layers. Instead, possible construct the pad using one layer that has body connecting surface and surface which faces barrier film (which is described more detail below). such case, however, important remember that the body connecting surface should substantially devoid pulp.

The plastic barrier film may any barrier film useful the panty liner and sanitary napkin art. Useful films include, without limitation, polyolefin films such polyethylene and polypropylene, polyvinyl films such polyvinyl acetate, polyvinyl chloride, and polyvinylidene chloride, copolymeric films such ethylene-vinyl acetate, and blends mixtures one more the above polymers. Preferred barrier films include ethylene-vinyl acetate/polyethylene mixture films and polypropylene films.

## Attachment Means

The absorbent pads 12, 14, generally and particularly described above are stacked and releasably attached from the absorbent product the present invention. The pads 12, 14, may attached any attachment means which provide sufficient attachment strength maintain product integrity during use. The attachment means may adhesive 18a, 18b (as illustrated FIG. 2), thermal compressive seals heat sealing and embossing, mechanical such fiber entanglement hook-and-loop type, and the like.

The attachment means may single attachment zone such solid area, series lines, pattern attachment points which cover area, and the like. Preferably, plurality attachment zones are used, each attachment zone within inches adjacent attachment zone. This helps that the separates adjacent absorbent pads the product according the present invention.

preferred embodiment, the attachment zones may also include weld zones. These weld zones preferably have major zone less than about inch and more preferably less than about inch.

## Adhesive

one preferred embodiment, the adhesive may applied the bottom surface individual absorbent pad 12, 14, 16. Preferably, the adhesive disposed upon substantial portion the contact area the bottom surface 28. The adhesive also preferably applied relatively low coating levels, i.e., low coating weights per unit area. The low coating weight over relatively large surface area provides secure attachment between the adjacent absorbent pads the multilayered product.

The adhesive adhesion between the adjacent absorbent pads the panty liner product encapsulation with the strength the attachment means 20 between the panty liner product and the garment which attached characteristic one embodiment the present invention. Preferably, the attachment strength between adjacent absorbent pads 12, 14, should less than the strength the attachment means 20 between the panty liner product and the garment. the case adhesive attachment the garment (positioning adhesive), this can achieved adhesive use adhesives for both the bonding adhesive and the positioning adhesive 28. For example, adhesive which adhesive more strongly cotton than synthetic polymers would adhere more strongly cotton undergarments. particularly preferred embodiment, the attachment strength between layers decreases with increasing vertical distance from the bottom pad. Thus, three layered panty liner product, the positioning adhesive 28 other attachment means between the product and garment would have the highest attachment strength, the attachment strength the bonding adhesive 18b between the bottom absorbent pad and the center absorbent pad 14 would less than the attachment strength between the bottom pad and the undergarment, and the attachment strength the bonding adhesive 18a between the top pad and the center pad would less than that between the center pad and the bottom pad. addition, the attachment strength between adjacent pads the construction preferably substantially less than the force necessary delaminate the individual absorbent pads.

general, the bonding adhesive has average peel strength least about 0.02 lb/in according the test method. Examples below, show materials the structural integrity the panty liner product during use. More preferably, the bonding adhesive has average peel strength least about 0.04 lbs/in and peak peel strength less than about lbs/in according the test method. Example 10 over the bonding adhesive maintains the integrity the panty liner product without manifesting delamination the individual absorbent pads when the user removes the top pad. most preferably, the bonding adhesive has average peel strength greater than about 0.04 lbs/in and peak peel strength less than about lbs/in.

Generally, these adhesive peel strength ranges relate average attachment strength least about 0.04 for absorbent pad layer the present invention. This can determined for the product according the test method Example The peak attachment strength the absorbent pad layer preferably less than about lbs for the product, more preferably, less than about lbs when measured according the test method Example

Preferably, the bonding adhesive covers least about 40% the contact area the bottom surface 28. More preferably, covers about 60% 95% the contact area, and most preferably, about 75% 95%. preferred that the bonding adhesive not applied the entirety longitudinal ends the barrier film. The lack adhesive the longitudinal ends the barrier film provides finger tabs 38 enable user more easily separate adjacent absorbent pads.

The bonding adhesive can classified method setting: solvent-evaporating, e.g., aqueous organic solvent based; curing, e.g., radiation cure, electron beam, catalyst cure; hot melt. Preferred adhesives are pressure sensitive adhesives (PSA). PSAs can allow adjacent pads mechanical they are prematurely separated. However, PSAs have the potential of transferring the cover material absorbent layer and forming somewhat tacky surface on the cover material. Therefore, PSA used the bonding adhesive, preferred that selected such that subsequent removal, say, the PSA transfers the cover material from the barrier film. non-PSA used, preferred that the adhesive remain flexible after setting that the cover material remains supple and relatively soft the touch. representative, non-limiting list useful PSAs includes those based natural rubber, styrene/butadiene rubber, A-B-A block copolymer (yl rubber and polyisobutylene, acrylics including vinyl acetate-acrylate copolymers, vinyl ether polymers, polyallene polymers, polyurethane, alkylene-vinyl acetate copolymers and polypropylene isotactic or polypropylene representative, non-limiting list useful non-PSAs includes lotions based on the above-listed resins and hot melts based these resins. Preferably, the adhesive PSA, and more particularly, the PSA A-B-A block copolymer, acrylic resin, ethylene-vinyl acetate copolymer. Most preferably, the PSA based A-B-A block copolymer. The adhesive can applied the absorbent pad any manner known the ordinary practitioner. Such application methods include, without limitation, spraying, roll coating, slot coating, gravure rolling, etc.

The selection the adhesive for use bonding adhesive 18a, 18b also dependent upon the composition the bottom surface and the covering layer the individual absorbent pads 12, 14, which make the multilayered product. particular, PSA used, adhesive transfer can noticeable. Also, the cover sheet and barrier film adjacent absorbent pads are formed from similar material, there any greater tendency for PSA transfer the cover sheet.

Generally, the adhesives described above adhere bottom surfaces formed barrier films 26. Preferably, the adhesives adhere strongly the selected barrier film 26. The adhesives described above also adhere the cover sheet 22, although preferred that the adhesion the cover sheet 22 less than that the barrier film 26.

The choice adhesive used practice the invention depends part the barrier film, and perhaps more particularly, the cover sheet used. The selection adhesive use with given cover sheet and barrier film will readily determined one ordinary skill the Preferably, the adhesive adheres strongly the barrier film, less strongly the cover sheet adjacent absorbent pad, and does not transfer from the barrier film the cover sheet. As guideline, has been determined that A-B-A block copolymers work well with polyolefin barrier films and nonwoven cover sheets. These block copolymers also work with spunbond film cover materials. Acrylics, EVA and other similar adhesives also work with these materials.

According preferred embodiment the present invention, block copolymer PSA, such that available from National Starch and Chemical Company product 69-5130, atactic polypropylene adhesive, such LUMATACK 3457C Fuller Co., used low coating weight over large surface area. Preferably, the adhesive applied about 0.5 mg/in$^2$ mg/in$^2$ More preferably, the adhesive applied about 0.1 about mg/in$^2$ Most preferably, the adhesive applied about mg/in$^2$ substantially cover the bottom surface the top absorbent pad and about mg/in$^2$ substantially cover the bottom surface the middle absorbent pad three-layered product. The bottom pad may enclosed wear's garment with about mg/in$^2$ block copolymer adhesive such that sold under the product number HM-1972 positioning adhesive from Fuller Co. The coating weight determined weighing the absorbent pad before and after application the adhesive and dividing the weight (in grams) the area covered the adhesive.

## Thermal and/or Compressive Means

another embodiment, thermal and/or compressive attachment means can used releasably attach the absorbent pads the multilayered product. Thermal attachment means include, without limitation, heat sealing,

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embossing elevated temperatures, ultrasonic sealing, and the like. Compressive attachment means include, without limitation, cold flow embossing, crimping, and the like. Generally, the thermal attachment means include element compressive force, well. Thus, embossing with applied heat included this category attachment means.

Referring FIGS. 6a–7c, the absorbent pads 60, any heat sealed embossed with applied heat pattern (See FIGS. and 6d) described for the adhesive attachment means, the absorbent pads 68, any heat sealed/embossed along their side edges (See FIGS. 7a–7c). the thermal attachment means are applied pattern over substantial surface the absorbent pads 68, the individual heat sealed embossed attachment points 63 should leave soft surface the upper, absorbent surface avoid irritating the user. The thermal attachment means can also used substantially permanently seal the side edges the pads the absorbent product while allowing perforated portion 78a the pad defined by perforations removed illustrated FIG. 7c. In addition, combination thermal and adhesive attachment can used. As example such combination would apply adhesive the angles designated FIG. 7b more securely attach the center portions the absorbent pads during use.

### Mechanical Attachment Means

Another embodiment illustrated FIGS. and mechanical attachment means any used advantageously attach the absorbent pads 88, 98 the multilayered product. Mechanical attachment means include, without limitation, fiber entanglement, hook-and-loop type fasteners and the like. Fiber entanglement involves the use fibrous top surface conjunction with fibrous bottom surface adjacent absorbent pads the stacked product. this embodiment, fibers from these adjacent surfaces come into close contact and become entangled releasably attach the two layers 82, together. Any fibrous surfaces can used this embodiment provided that the fibers forming the surface have sufficient crimp enable the fibers from adjacent layers become entangled and catch. Examples fibers such this invention include natural fibers having crimp such cotton, wool, and the like, and synthetic fibers which have curled crimped nature such rayon, polyester, nylon, and the like. Preferred synthetic fibers are relatively thick and resilient, having denier about 15, preferably about 10. This allows the entanglement the adjacent layers have sufficient attachment strength hold the product together during use. preferred embodiment this invention, the adjacent fibrous layers 82, adjacent absorbent pads are different, e.g., top surface and bottom surface allow the fibers one layer intrude greater extent into the fibers the adjacent layer, however, may also desirable use fibrous layers having similar fibers allow the entanglement more uniform.

Alternative mechanical attachment means includes hook-and-loop type fasteners. These fastener systems are well known those ordinary skill the art, are widely available and include fasteners sold under the trademark VELCRO and the like. These fasteners generally have first attachment surface having array relatively rigid hooks (not shown detail) and second attachment surface looped fibers. using this type attachment means, the array hooks can secured the bottom barrier side the individual absorbent pads 88, and the second attachment surface can located the top, absorbent surface the individual absorbent pads 88. The second attachment surface can comprise looped fibers, the fibers can made from relatively loose, woven nonwoven fabric. merely applied first the array hooks can contact and hold securely onto the second fibrous attachment surface.

### Alternative Embodiments

While the above discussion refers primarily pasty liner products, the practitioner will recognize with reference FIG. that the multilayered product the present invention can this sanitary napkin 188. Commercially available this napkins include SURE NATURAL THIN, ULTRA IN, and PRIMA napkins, STAYFREE IN and ULTRA THIN napkins, ALWAYS ULTRA napkins, and KOTEX ULTRA THIN napkins, etc. These products generally have liquid permeable overwrap 181 which encloses absorbent structure and liquid impervious barrier sheet (not shown). The overwrap sealed together about the periphery the ends 182 the product. The materials the exterior surfaces this sanitary napkins may similar those used pasty liners. The dimensions the sanitary napkin are generally larger than corresponding pasty liner. For example, the napkin pads may about inches cm) long and about cm) inches wide.

The teaching this invention relating pasty liners can furnishes need create multilayered sanitary napkin well.

### Method Use

use, consumer would remove the release liner which protects the positioning adhesive from the multilayered pasty liner product and secure the product the crotch area of her undergarment. After some period time when the top absorbent pad has become soiled, the user can simply remove the soiled pad expose the next absorbent pad. This procedure can continued until absorbent pads have been soiled and new multilayered product needed.

The present invention will further understood reference the following specific Examples which are illustrative the composition, form and method product. ing the multilayered pasty liner product the present invention. understood that many variations composition, form and method producing the pasty liner product would apparent those skilled the art. The following Examples, wherein parts and percentages are weight unless otherwise indicated, are only illustrative.

### EXAMPLE

such delamination tests were run several commercial pasty liners determine maximum commercially useful peel strength the bonding adhesive.

Samples were prepared follows:

a2" strip Personal Professional Grade Gaffer's Tape was cut, one end was folded onto itself create 1/4" tab. 2½"x3½" piece release paper was placed on the tape, with the 2½" side parallel the edge the tape, having length adhesive exposed. The adhesive coated side the tape was then placed on the surface test product such that the sides the tape strip lined with the edges the product, the folded tab the tape did not overlap with the test product but extended past and provide constant thickness over the surface the product, and the edge the exposed adhesive did not overlap any crimp curve either end the test product

The test product was then placed Jenkins press between two platens heated 70° and pressed psi for minutes. Onto cakers after removal from the heated platens, the sample secured TMI tester sled and the top cover clamped for peel testing. The TMI tester engaged removes the top cover rate 1200 in/min The force removal, well adhesive tear-out and/or transfer, recorded. The TMI tester Release and Adhesive Tester, Model 680- available from Testing Machines, Inc. Amityville, order get more detailed output than the test method described, the dial strain gauge the TMI Release and Adhesive Tester was replaced with Sensor Devices, Inc. model ELF-TC500-10 load cell. The load cell was fed into Tektronix TRK 2430A digital oscilloscope and the force profile over the entire peel was captured and plotted.

Each prepared sample was placed on the sled with the barrier side the product down. The end the test product closest the rib on the Gaffer's Tape was anchored the sled using 3M Duct Tape. The release paper patch was removed from the Gaffer's Tape and the ribbed end the tape was held jaws attached the load cell. As each sample was run, the force profile over the peel the test sample, the maximum force over the peel and the mean force were captured the oscilloscope and plotted.

Between each sample tested the oscilloscope was zeroed within 0.04 using the mean force read-out zero load.

Product was prepared by forming 2.5 oz/yd² absorbent structure having first veneer layer 0.3 oz/yd² BASF 1040 bicomponent fiber, denier, nonwoven fabric, oz/yd² air-laid core .14 oz/yd² BASF 1039 bicomponent fiber, 3.0 denier, and oz/yd² ITT KI DM Type Cellulosic Fluff Pulp 60-40 ratio weight bicomponent fiber fluff pulp), and second veneer 0.3 oz/yd² BASF 1039 bicomponent fiber, 3.0 denier, nonwoven sheet. The absorbent structure thermobonded by passing hot air (about 300° through the structure from the BASF 1039 veneer side the BASF 1040 side for about sec. The absorbent structure has "smooth side" comprising the BASF 1040 veneer which formed against screen the preparation the structure. The surface opposite the "smooth side" the absorbent structure adhered 1.25 mil PEBNA, hydrophobic barrier film using about mg/in² National Starch 834-3539 adhesive coated on the EVA (top) side the hydrophobic barrier film. The resultant absorbent pad thermally bonded about perimeter and the absorbent structure the barrier film, resulting integrity.

Each type sample had characteristic force profile. For example, the KOTEX LIGHTDAYS products have very sharp force increase the very beginning the peel peak force value and then sharp drop relatively steady peel. However, the Product samples have jump force the beginning when the veneer initially tears, which holds for short time creating broader peak than the KOTEX products and another more narrow peak the end when the seal breaks. Depending on the Product sample's seal strength, the veneer tear force peak may may not correspond the maximum force displayed. The results shown Table were calculated using the peak force the veneer tearing the inherent strength the material and assume normal distribution.

TABLE

INHERENT STRENGTH OF PRODUCT BEARING MATERIALS*

| | Mean Max. Force (lbf/" Width) | Std. Dev. | 95% Conf. Int. (lbf/" Width) | Normalized Mean Max. Force (lb/in) | Normalized 95% Conf. Int. (lb/in) |
|---|---|---|---|---|---|
| ALWAYS with DRYWEAVE Positioner | 3.61 | 0.64 | 3.78–4.32 | 1.81 | 1.35–2.26 |
| ALWAYS INNER CONFIDENCE Positioner | 3.11 | | 3.07–3.15 | 1.56 | 1.54–1.59 |
| KOTEX LIGHTDAYS Positioner | 3.35 | 0.42 | 3.48–4.22 | 1.68 | 1.25–2.11 |
| Product "A" | 3.34 | 0.38 | 3.39–4.68 | | 1.30–2.35 |

*Test run with samples each product

The oscilloscope was calibrated using the dial strain gauge verify two three force read-outs the start each test session. All tests were run volt, pound.

The samples tested were ALWAYS LONG with DRI-WEAVE (longs were used avoid tape over the crimped ends and still allow peel), ALWAYS INNER CONFIDENCE (cut width avoid edge effects), KOTEX LIGHTDAYS WRAPAROUND (cut width), and Product samples the present invention.

Under these test conditions the lower limit each product type confidence interval would the upper limit for layer adhesive's peel force. however would wise make the upper limit for the layer adhesive some safety factor below the lower confidence limit assure that does tearing the surface the lower layer For example, calculating 25% 50% reduction the lower confidence limit the inherent strength product surface material determine the new upper limit for layer adhesive peel force would yield the values shown Table below.

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TABLE

| | Lower Limit Metabel Strength | Stabon | 25% Reduction Layer Adhesive Power Upper Limit | |
|---|---|---|---|---|
| | lb/2" Width | Normalized lb/in | lb/2" Width | Normalized lb/in |
| ALWAYS with DRYWEAVE Pantiliner | | | 3.03 | |
| ALWAYS SHEER COMFORCE Pantiliner | 3.67 | 3.04 | 4.33 | 3.13 |
| BOTH LIGHTDAYS Pantiliner | 2.49 | | 1.27 | 0.83 |
| Pantiliner | 1.39 | | | 0.90 |

EXAMPLE

series tests were run determine the amount adhesive which transfers from barrier film adjacent cover sheet after aging with weight for hours. The products were Encoded follows:

TOP LAYER. 8.5" long, rectangular with curved ends.

The absorbent pad used the top layer was prepared the same manner Product Example with

The sample placed the test apparatus horizontally, and the leading edge the sample lifted attached the test arm 90° orientation. Under the test conditions, the leading edge the sample pulled upwards in/min, and the moveable sled moved in/min toward the point separation the sample maintain the 90° orientation. four back pad was recorded. The results are shown Table below.

TABLE

90 DEGREE PEEL TEST RESULTS

| COATING LEVEL (mg/in²) | AVG. LOAD PEEL (lb/2" | STD. DEV. | AVG. PEAK LOAD (lb/2" | STD. DEV. | NORMALIZED AVG. LOAD (lb/in) | NORMALIZED AVG. PEAK LOAD (lb/in) |
|---|---|---|---|---|---|---|
| | .088 | .032 | .192 | .068 | 0.044 | 0.096 |
| | .032 | .139 | .374 | 0.036 | | 0.113 |
| .149 | .038 | | .388 | 0.088 | | .140 |
| .277 | .038 | .048 | .388 | 0.119 | | 0.189 |
| .370 | .053 | .097 | .383 | 0.148 | | 0.206 |
| .340 | .024 | .020 | .348 | | | 0.184 |
| .317 | .026 | .091 | .370 | 0.129 | | 0.166 |
| .348 | .033 | .052 | .372 | | | 0.206 |
| .143 | .024 | .081 | .368 | | | 0.250 |
| .217 | .025 | .088 | .378 | | | 0.204 |
| .323 | .054 | .438 | .337 | 0.71 | | 0.188 |

the following changes: The absorbent structure had basis weight 3.3 oz/yd² and the air-laid core had basis weight oz/yd²

BOTTOM LAYER. 6.0" long, rectangular with curved ends.

The absorbent pad used the bottom layer was prepared from the same material the top layer. addition, mg/l HM-1972 positioning adhesive from Fuller Co. was also coated onto the bottom (PE) side the barrier film pattern 3.25" longx1.75" wide.

Varying coating levels layering adhesive, National Starch #34-3339 adhesive, were spray coated the bottom (PE) side the barrier film the top layer pattern covering the entire exposed surface.

TEST CONDITIONS

After preparation, samples were run INSTRON Model No. 1123 apparatus equipped with removable sled.

The amount adhesive transfer increased with increasing coating level. All coating levels exhibited some trace of adhesive transfer. Transfer was extremely sparse coating levels 0.5 and mg and was not present most the samples. Samples were prepared using 0.3 mg coating level but would not stay assembled long enough pull test. Samples were tested from coating levels 0.5 mg mg. 5% the 0.5 mg samples were positive for transfer and 10% were positive for the mg samples. Between coating levels and mg, substantial fiber pull and bagging the veneer occurred. Coating levels mg had significant decrease fiber pull and bagging.

EXAMPLE

order identify maximum desired peel strength between individual absorbent pads, the adhesion between bottom pad layer and cotton underpaper was tested. The test pad layer was identical the bottom layer Example

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90° peel strength testing was performed samples title product using the procedures outlined Example The results are shown in Table below.

TABLE

| Avg. Load Peel (lb/2. Width) | Std. Dev. | Normalized Avg. Load Peel (lb/in.) | Avg. Peak Load (lb/2 Width) | Std. Dev. | Normalized Avg. Peak Load Peel (lb/in) |
|---|---|---|---|---|---|
| 0.34 | 0.08 | 0.14 | 0.39 | 0.03 | 0.19 |

The testing continued evaluate the 90° peel strength between individual peel layers. The test products had individual absorbent pads. The test data relates the separation top pad from middle pad while the middle and lower most pad remained adhered cotton underpaper pad.

Product was prepared follows

TOP LAYER: 6.5" long, rectangular with curved ends.

the following changes: The layering adhesive was mg/in² Fuller Co. H4-1335X hot melt adhesive.

MIDDLE LAYER. 6.0" long, rectangular with curved ends.

The middle layer was the same the top layer.

BOTTOM LAYER. 6.0" long, rectangular with curved ends.

The absorbent pad used the bottom layer was prepared the same manner the top layer while the following changes: The positioning adhesive was mg/in² H4- 1335X adhesive from Fuller Co.

90° peel strength testing was performed 20 samples each product using the procedures outlined Example The data relate removing the top pad layer from the middle pad layer and the middle layer from the bottom layer. The results are shown Table below.

TABLE

| | Avg. Load Peel (lb/6.75" wide) | Std. Dev. | Normalized Avg. Load Peel (lb/in.) | Avg. Peak Load Peel (lb/1.75" wide) | Std. Dev. | Normalized Avg. Peak Peel (lb/in) |
|---|---|---|---|---|---|---|
| Product "B" | | | | | | |
| Top Layer | 0.087 | 0.033 | 0.038 | 0.126 | 0.013 | 0.058 |
| Middle Layer | 0.088 | 0.013 | 0.034 | 0.089 | 0.013 | 0.050 |
| Product "C" | | | | | | |
| Top Layer | 0.036 | 0.088 | 0.021 | 0.033 | 0.028 | 0.018 |
| Middle Layer | 0.033 | 0.01 | 0.018 | 0.038 | 0.011 | 0.020 |

The absorbent pad used the top layer was prepared the same manner Product of Example I with the following changes: The barrier film was replaced with 0.6 mil polypropylene XP-544 PS/F, from Mobil Plastics, Edison, N.J., the absorbent structure was adhered the barrier film with 2.5 mg/in² the National Starch #34-3339 adhesive, and mg/in² layering adhesive, Fuller Co. H4-1972 hot melt adhesive was coated onto the bottom side the barrier film pattern 5.25" longx 75" wide.

MIDDLE LAYER. 6.25" long, rectangular with curved ends.

The absorbent layer used the middle layer was prepared the same manner the top layer with the following changes: mg/in² the Fuller Co. H4-1972 hot melt adhesive was coated onto the bottom side the barrier film pattern .5" longx1.75" wide.

BOTTOM LAYER. 6.0" long, rectangular with curved ends.

The absorbent pad used the bottom layer was prepared the same manner the top layer with the following changes: mg/in² H4- 972 adhesive from Fuller Co. was coated onto the bottom side the barrier film pattern 5.25" longx .75" wide.

The products were assembled staggered both ends.

Product was prepared follows

TOP LAYER. 6.0" long, rectangular with curved ends.

The absorbent pad used the top layer was prepared the same manner the top layer Product with

EXAMPLE IV

Individual absorbent pads were prepared the same manner Product Example with the following changes: The surface opposite the "smooth side" the absorbent structure adhered 0.6 mil polypropylene barrier film using about 2.5 mg/in² National Starch #34-3339 adhesive coated the top side the barrier film. The pads were rectangular with curved ends, long wide, and had surface area in² Finished pads having adhesive on the exposed barrier film surface were taped roll paper and run through spray coating line exposed adhesive for the trial. The entire exposed surface the barrier film was coated with adhesive (the taped area was considered negligible). The adhesive coating weights the resulting samples Products D–K are shown Table

TABLE

| Product | Adhesive | Coating Weight* | Peel Behavior |
|---|---|---|---|
| | Amoco polypropylene[1] | 0.06 | PPS[2] |
| | Amoco PP[1] | 0.04 | PPS[2] |
| | Amoco PP[1] | 0.06 | PPS[2] |
| | Ethylene-vinyl acetate[3] | 0.03 | PPS[2] |
| | Acrylic[4] | NGA | PPS[2] |
| | Acrylic[4] | 0.03 | PPS[2] |

TABLE 6-continued

| Product | Adhesive | Coating Weight* | Peel Schmoo |
|---|---|---|---|
| | [illegible]* | 0.82 | [illegible]* |
| | [illegible]* | 0.84 | [illegible]* |

*[illegible]
*H. Fuller Co. LUMATACK 345TC
*H. Fuller Co. LUMATACK 364AC
*Schmoo[illegible] [illegible] 37257
*Schmoo[illegible] [illegible] 4326
Fuller Co. 7382
*The [illegible] Product [illegible] 285° [illegible]
*The [illegible] Product

The samples were prepared and tested (90° Peel) according the test method described Example The results are shown Table

Product was prepared the same manner Product Example with the following changes: The seal pattern around the perimeter the individual pad layers was separating flower pattern having space about [illegible] between adjacent flowers, the absorbent structure was thermoformed 300° for sec., and the layering adhesive coated mg/in² pattern 75°

Product was prepared the same manner Product with the following changes: The seal pattern around the perimeter the individual pad layers was continuous embossed lines, the absorbent structure formed film that Product Example and the layering adhesive coated mg/in² pattern 75° 75°

TABLE

90 DEGREE PEEL TEST RESULTS

| PRODUCT | SAMPLE SIZE | AVG. LOAD PEEL (lbs)* | STD. DEV. (lbs)* | PEAK LOAD (lbs)* | STD. DEV. | NORMALIZED AVG. LOAD (lbs/in) | NORMALIZED AVG. PEAK LOAD (lbs/in) |
|---|---|---|---|---|---|---|---|
| | | 0.834 | 0.051 | 0.944 | 0.083 | 0.013 | 0.026 |
| | | 0.840 | 0.013 | 0.888 | 0.019 | 0.010 | 0.049 |
| | | 0.772 | 0.011 | 1.08 | 0.021 | 0.012 | 0.020 |
| | | 0.301 | 0.019 | 0.146 | 0.038 | 0.007 | 0.008 |
| | | 0.86 | 0.22 | 1.19 | 0.38 | 0.48 | 0.39 |
| | | 0.041 | 0.024 | 0.072 | 0.011 | 0.020 | 0.036 |
| | | 0.34 | 0.14 | | 0.18 | 0.27 | 0.38 |

*Samples did hold together testing.
*All samples exhibited adhesive tipping and adhesive transfer.
*The cover less samples date tested remaining samples.

The results suggest that several classes adhesives are useful the practice the present invention. While the results using acrylic adhesives were not optimal, they suggest that acrylics can formulated work.

EXAMPLE

The flexural resistances three types commercial pantyliners and two embodiments the present invention (Product and Product M) was tested using the following test protocol:

Ten 10) samples each product were obtained and conditioned for hours 72° 65% relative humidity. Each product sample was placed modified INSTRON Flexure Fixture, Model #2810-020. The fixture was modified provide adjustable roller gap, the gap was set -M" and the Fixture was placed the INSTRON Model 1.22 test device described Example above, with 2,000 gram compression cell. sample product was placed across the two rollers, and the transverse beam the test device was adjusted 16" above the rollers. The transverse beam descended toward the sample 5"/min and continued until had traveled 1-16" and the maximum deflection values had passed the maximum value and began decrease. The maximum force the deflection was measured grams and converted lbs.

The results this testing are shown Table below.

TABLE

| Product | Average Flexural Force (lbs.) | Range (lbs.) |
|---|---|---|
| ALWAYS DRY WEAVE | 0.839 | 0.829-0.800 |
| ALWAYS LIGHT DAYS | | |
| Comfort Design | 0.088 | 0.080-0.073 |
| FOXY FIT Panty Liner | 0.114 | 0.114-0.106 |
| Product | 0.347 | 0.43-0.325 |
| Product | 0.313 | 0.294-0.331 |

Both embodiments the present invention fall within the flexural resistance range currently available commercial panty liners.

The specification and examples above are presented aid the complete and non-limiting understanding the invention disclosed herein. Since many variations and embodiments the invention can made without departing from spirit and scope, the invention resides the claims hereinafter appended.

What claimed

An absorbent feminine hygiene product which configured for releasable attachment user's garment, the product comprising three stacked individual absorbent pads, each said pads comprising top liquid-permeable surface opposite bottom surface and having disposed therebetween absorbent layer and barrier layer, wherein first said



absorbent pads having peripheral edge, configured for releasable attachment the bottom surface said first absorbent pad the user's garment with first attachment strength; second said absorbent pads having peripheral edge and attachment means for releasably attaching the second pad the top surface the first absorbent pad, thereby forming contact area between the first and second absorbent pads, with second attachment strength, less than the first, manner prevent separation significant portions the first absorbent pad from the second pad during use, least portion the peripheral edge the second absorbent pad extends beyond least corresponding portion the peripheral edge the first absorbent pad; and third said absorbent pads having peripheral edge and attachment means for releasably attaching the third pad the top surface the second absorbent pad, thereby forming contact area between the second and third absorbent pads, with third attachment strength, not greater than the second, manner prevent separation significant portions the second absorbent pad from the third absorbent pad during use, least portion the peripheral edge the third absorbent pad extends beyond least corresponding portion the peripheral edge the second absorbent pad, wherein the attachment means layering adhesive which applied from plurality attachment areas having void areas, each void area having major dimension less than about 1mm; said attachment means covers least about 40% the contact area between the first and second absorbent pads and the second and third absorbent pads.

The absorbent product claim which has flexural resistance less than about 0.25 lbs.

The absorbent product claim wherein the adhesive elastic polypropylene adhesive block copolymer adhesive.

The absorbent product claim wherein the first absorbent pad has basically extending tube proximate center portion the pad for wrapping about the user's garment.

The absorbent product claim wherein the liquid-permeable surface each pad spunbond film.

The absorbent product claim wherein the layering adhesive disposed within the contact area manner prevent rolling curling the first absorbent pad relative the second absorbent pad.

The absorbent product claim wherein the layering adhesive selected from the group consisting block copolymer adhesives, styrene/vinyl acetate adhesives, polyolefinic adhesives, and acrylic adhesives.

8. The method claim wherein the layering adhesive pressure sensitive adhesive.

The absorbent product claim wherein each absorbent pad has thickness less than about mm.

The absorbent product claim wherein the layering adhesive covers from about 60% about 95% the contact area.

method forming absorbent feminine hygiene product which configured for releasable attachment user's garment comprising the steps of:

forming plurality individual absorbent pads, each said pads having peripheral edge and comprising top liquid-permeable surface opposite bottom surface and having disposed therebetween absorbent layer and barrier layer

configuring the bottom first said absorbent pads for releasable attachment having first attachment strength the user's garment; and

releasably attaching, second attachment strength, less than the first attachment strength, the bottom surface second said absorbent pads the top surface the first said absorbent pads, thereby forming contact area between the first and second absorbent pads, wherein the attachment means layering adhesive which applied from plurality of attachment areas having void areas, each void area having major dimension less than about 1mm; and attachment means covers least about 40% the contact area between the first and second absorbent pads,

the second absorbent pad extends beyond least corresponding portion of the peripheral edge the first absorbent pad.

12. The method claim wherein peak attachment strength the first absorbent pad the user's garment greater than about lbs.

13. The method claim wherein average attachment strength between the first and second absorbent pads greater than about 0.04 lbs. and peak attachment strength between the first and second absorbent pads less than about lbs.

14. The method claim which further comprises the step releasably attaching third attachment strength, not greater than the second attachment strength, the bottom surface third absorbent pad the top surface the second said absorbent pads.

15. The method claim wherein average attachment strength between the second and third absorbent pads least about 0.04 lbs. and peak attachment strength between the second and third absorbent pads less than about lbs.

16. The method claim wherein the absorbent product has flexural resistance less than about 0.25 lbs.

The method claim wherein each absorbent pad has thickness less than about mm.

18. The method claim wherein the layering adhesive applied from about 0.5 mg/in² about mg/in²

19. The method claim wherein the layering adhesive covers from about 60% about 95% the contact area.

US006569274B1

U ited States Patent
M kowl al.

Patent US 6,569,274 B1
(45) Date of Patent: May 27 2003

(54) REALARLE NONWOVEN WEB

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Notice: Subject any disclaimer the term this patent extended adjusted under U.S.C. 154(b) 877 days.

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(22) Filed: Feb. 998

Related U.S. Application Data

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(58) Field Search ..... 56/276, 308 156/309.6, 308.6, 204, 226, 209, 308.3

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(57) ABSTRACT

Disclosed process for producing laminate material for use producing disposable absorbent products comprising nonwoven web formed from randomly dispersed fibers bonded web crosslinked vinyl acetate/ethylene adhesive and particulate polymeric absorbent entrapped within the laminate fixed location by means adhesively bonding the nonwoven web itself another substrate, the improvement which comprises utilizing nonwoven web incorporating acrylic vinyl acetate/ethylene adhesive having the following characteristics, and further, said nonwoven web adhesively bonded itself another substrate through the crosslinked acrylic crosslinked vinyl acetate/ethylene adhesive.

Claims, No Drawings



# REALARLE NONWOVEN WEB

## CROSS-REFERENCE TO RELATED APPLICATIONS

This application continuation-in-part U.S. Ser. No. 08/852,626 filed May 997 now U.S. Pat. No. 5,96 763 the subject matter being incorporated reference.

## STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable.

## BACKGROUND OF THE INVENTION

Over the past two decades or, variety disposable absorbent products have been widely marketed for use disposable baby and adult diapers, underpads, hospital bed pads, feminine napkins, and forth. These products largely consist laminates one more layers tissue-like material incorporating layer liquid absorbing agent. Typically, these laminates are constructed nonwoven cover sheet, absorbent center section and water impermeable backing sheet materials moisture within the disposable absorbent product.

recent years, variety hydrocolloidal polymers, often referred superabsorbents, have been incorporated into these laminates for disposable absorbent products. Prior the incorporation superabsorbents, was common incorporate tissue-like cellulose and other bulky, water absorbing materials absorb body fluids. Superabsorbents have been used replace least portion the cellulosic materials primarily because these polymeric components have ability absorb larger quantities liquids, thereby enhancing the effectiveness the disposable product. Another factor leading their use their ability retain moisture under pressure might experienced when child sits the absorbent medium. Cellulose, wadding and fluff pulp tend fall under those types pressure conditions.

The introduction superabsorbents into the disposable absorbent product started has not been without problems. The superabsorbents are dusty thus making handling and storage difficult and they tend shift within the finished product. Shifting the superabsorbent presents two problems, first the superabsorbent may shift from the point where most needed the product and second, shifting allows the superabsorbents agglomerate within the product. When the superabsorbents agglomerate, they display tendency generate gelatinous barrier film when wet which detracts from their ability absorb fluids. To overcome shifting the superabsorbents within these laminates for disposable absorbent soft goods, variety methods have been developed retain the superabsorbents fixed location within the laminates. Typically, these methods retaining the superabsorbents within fixed position within the laminates (typically the fixed locations have been the shape squares, rectangles, and triangles) have involved the application variety adhesives, the use hot melts, specialty fibers, superabsorbents which are moisture activated, anchor the superabsorbent between fibrous facing sheets.

The following patents are representative various techniques for preparing variety disposable absorbent soft goods and fixing superabsorbents and hydro-colloidal polymers within the disposable product.

Pat. No. 102,340 discloses absorbent article, such diaper sanitary napkin, comprised facing sheet, absorbent pad means and moisture-impervious backing sheet. The absorbent pad comprises fibrous structure having interstitial, densified layer and layer highly porous, loose compacted bats each side the densified layer, the bat incorporating particulate water insoluble and water swellable polymeric absorbents. The facing sheet comprised cellulosic material incorporating self-crosslinking acrylic emulsion bonding agent supply strength the cellulosic substrate such that when the disposable product wet retains dimensional stability, practice, the absorbent pad disposed between the moisture impervious backing, and the facing sheet and then bonded the moisture-impervious backing sheet means adhesive bonds.

European 202 472 discloses non-woven, dry formed absorbent products formed by air-laying technique. More particularly, the absorbent products are formed by forming dry conditions, sheet web from matrix fibers consisting cellulose mixture cellulosic and synthetic fibers. Distributed among the matrix fibers superabsorbent material and heat-activated binder such polyvinyl acetate, vinyl acetate ethylene and vinyl chloride, etc., which, upon the application heat, thermally sets bind the matrix fibers and liquid absorbing material into coherent web.

Pat. No. 4,360,443 discloses process for producing disposable absorbent goods which comprises forming laminated sheet composed two outer layers tissue bevtag water-absorbing polymer, e.g., superabsorbent, fixed in place between the layers. When the tissue sheets are passed through embossing roll, small amount water applied all, percentage the embossed area, which causes the superabsorbent become tacky and act adhesive fixes laminate thereby securing the tissue sheets together. After the resulting laminate has passed through the embossing roll, the laminating sheet dried.

U.S. Pat. No. 3,575,749 discloses method for making fibrous sheets web incorporating binder such starch starch derivatives, acrylic butadiene/styrene emulsions, etc. into the fibrous material. The fiber layer which the binder has been applied made plastic by applying moisture. During embossing operation where the fibers are brought into intimate contact with each other followed by drying the product, the partly plasticized binder cured, thereby effecting strong bond.

U.S. Pat. No. 5,273,598 discloses method for producing disposable absorbent pads employing multi-layer nonwoven fabric for use top sheet. The multi-layer fabric comprised continuous first layer about 75% hydrophobic thermoplastic fibers and second layer comprised blend hydrophobic and hydrophilic fibers. The layers are secured bonds which are formed melt-fusing portions the hydrophobic thermoplastic fiber.

Pat. No. 5,415, discloses apparatus for depositing particles moving web materials, the process, web conveyed station bait and particulate material, e.g., superabsorbent, deposited upon the web. As the web conveyed along the bait, brought into contact with second web and the second web caused overlap the particulate particles. The first and second webs then are compressed between rollers and the particles caused bonded into fixed position through the use binder coatings spray adhesives.

U.S. Pat. No. 5,370,764 discloses process for producing film-laminated material employing nonwoven web formed variety processes such spun bonding, air laying,

wet laying, dry laying, etc. The laminates incorporate moisture-absorbing medium and, when brought into contact with another web, are embossed from spaced apart bonding regions. Bonding effected via thermal means, e.g., heated rollers and the like.

## BRIEF SUMMARY OF THE INVENTION

This invention relates improvement process for producing laminate for use preparing disposable absorbent products. Such laminates are comprised nonwoven fibrous web bonded by means polymeric resin, particularly crosslinkable polymeric resin, particulate, polymeric absorbent (superabsorbent) fixed position within the laminate. The improvement resides utilizing nonwoven web bonded with slightly pressure sensitive vinyl acetate/ethylene polymer having $T_g$ −22.0 and using the adhesiveness afforded within the nonwoven web itself for anchoring the superabsorbents within fixed position room temperatures, e.g., from 20 30°. Anchoring effected by applying localized pressure the nonwoven web. Another embodiment the can from −22 +18° and anchoring can effected applying pressure the nonwoven web and minimal heat effect adhesive temperatures below about 100° C., preferably from 100° C., and then the absence the substantial heat required for melting thermal fusible thermoplastic fibers, and the absence applied moisture. Additionally, the adhesion effected the absence applied moisture. Substrates essentially devoid thermofusible fibers which require temperatures higher than 05° melt and effect adhesion, can used form the laminates.

The nonwoven web when utilized the manufacture laminates for disposable absorbent products incorporating superabsorbents within fixed locations within the laminate product allows for the following advantages:

ability effect excellent adhesion with the application heat and pressure temperatures below the fusion temperature conventional thermofusible plastics and polymeric binders employed personal care products, e.g. below temperatures about 105° C.,

ability effect sufficient adhesion between the nonwoven web and another substrate, including itself, without additional adhesive additive water and yet retain sufficient strength;

ability simplify the process for producing laminate used producing disposable absorbent products by eliminating process steps associated with the application moisture activated adhesive and/or the elimination the step applying water

ability wind the laminates into large rolls and then rewind such laminates without tearing delivering the adhesion itself

ability reduce energy costs associated with the manufacture laminates for disposable products by virtue the elimination costs associated with the use heated (high temperature) rollers and/or dryers melt fibers and evaporate water

ability eliminate the use specialty fusible bicomponent fibers and "hot melt" adhesives the nonwoven web necessary for effecting adhesion substrates define regions fusible and fix the location superabsorbents, and,

ability form embossed products which retain embossed markings without employing adhesives;

## BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF DRAWINGS

Not applicable.

## DETAILED DESCRIPTION OF THE INVENTION

The nonwoven web incorporating the polymeric resin performs multiple functions the process for making laminates for disposable goods and these primarily include supplying wet strength the nonwoven web and supplying sufficient pressure sensitive adhesion permit the nonwoven web adhere itself polymeric fibers and substrates employed the manufacture of laminates for use preparing disposable absorbent products. The use these unique nonwoven webs permits one also the way such laminates are made that one may eliminate some process steps and/or reduce energy requirements associated with the manufacture the laminate products.

The nonwoven web key producing the laminates for disposable absorbent products contemplated herein. To form the laminate containing the superabsorbent within fixed location the nonwoven web should have sufficient pressure sensitive adhesive characteristics provided by the binder provide peel strength ranging from low about 50 g/5 cm about 400 g/5 cm which and yet have wet strength provide wet strength least g/5 cm width. Preferably, the peel strength within range 60 130 g/5 cm width and, wet strength desired feature the application, from the wet strength least 300 g/5 cm and typically least 000 g/5 cm width. When the nonwoven web has peel strength within this range, the nonwoven web can forced adhere itself under application localized pressure (slightly better with the application minimal heat) but the same time "delaminated from itself when wound into large roll. The wet strength requirement necessary prevent disintegration under wet conditions. some personal care applications that wet strength not required. This wet strength imparted through the crosslinkable functionality the binder impregnated in the nonwoven webs. The latch crosslinking functions bonds destroy the pressure sensitive characteristics the nonwoven web thus rendering unsuited for the process for preparing the laminate.

The nonwoven webs comprise structure fibers (fibrous interlayer) random fashion bonded together with preferably, crosslinkable vinyl acetate/ethylene adhesive. variety processes have been used prepare nonwoven webs and can used the preparation the nonwoven webs described herein. These methods include air laying, wet laying, where the fibers are deposited upon belt and self-crosslinking vinyl acetate/ethylene adhesive sprayed over the surface the fibers passed along the belt. The fibers typically comprise wood pulp cellulose synthetic melt-fusible fibers, including rayon other polymeric fibers. The nonwoven web passed over suction box which traps pull the adhesive emulsion through the fibers facilitate penetration and coating fibered fibers, the latter treated and adhesive applied the opposite surface the fibers but while suction applied. The fibrous but then compressed between rollers and conveyed heated oven where the moisture driven off and the adhesive cured. The polymer typically incorporated amount provide from 30%, preferably 0–25% weight the nonwoven web dry weight basis.

Crosslinkable acrylic and vinyl acetate/ethylene emulsions have been used herein in the preparation nonwoven fabrics and have served fugacy wet strength disposable absorbent products conventional manner. contrast conventional prior nonwoven webs, the acrylic vinyl acetate/ethylene emulsion, for example, used for producing the nonwoven web acrylic emulsion polymer vinyl acetate/ethylene copolymer binder emulsion should have viscosity in the range 1000 cps 52% solids 25° that may appropriately sprayed onto the fibers and caused penetrate and coat the fibers for enhanced adhesion. The vinyl acetate/ethylene copolymer further characterized the has vinyl acetate content from 40 wt %. ethylene concentration from wt. %, and crosslinking monomer functionality, e.g., N-methylolacrylamide low formaldehyde deriv ive, the -ester by hydroxyacrylamide/acrylamide derivative 50/50 molar ratio. The from −26 18° adhesion effected more temperature (20–30° C), minimal heat and lower roll pressures are employed, the can from higher polymer may employed. Another key the preferred vinyl acetate/ethylene/crosslinkable polymer emulsion that prepared by emulsion polymerization the possesses low molecular weight polyvinyl alcohol having degree hydrolysis from about 80 89% and degree polymerization from 200 300. This viscosity range permits ease application by spraying. Although stabilizing surfactants can employed the emulsion polymerization processes amounts 0% weight the emulsion stabilizer, preferred, surfactant employed surfactants may affect the wet strength the web.

Acrylic emulsions stabilized with polyvinyl alcohol (PVOH) can used for forming the laminates such the C-fold applications. This polymer should contain 2–10 polyvinyl alcohol based upon the weight the monomers and with the alcohol having hydrolysis value from 98.8% and the degree polymerization the same that used forming the vinyl acetate/ethylene emulsions. The monomers can such acrylates methacrylates butyl acrylate, 2-ethylhexyl acrylate, ethyl acrylate, methyl methacrylate, butyl methacrylate, etc. known the art and balanced give heavily between −36 and +18° C., minimal heat employed and −23 adhesion effected room temperature.

The monomers for providing crosslinking functionality utilize the acrylic the vinyl acetate/ethylene polymers include N-methylolacrylamide, acrylamide, acrylamidobutyraldehyde dimethyl acetal, acrylamidobutyraldehyde diethyl ace al, rylamidoglycolic cid ano acrylamidoglycolate, methyl acrylamidoglycolate methyl ether acrylamidoglycolic acid methyl ester, isobutyl methyl acrylamide any other crosslinking monomer known the art. The monomer/vinyl functional monomer the polymer typically ranges from 0.5–6% by weight the polymer, preferably 1–4%. The level any used adjusted within that range accommodate variations under optimum pressure sensitive adhesive properties.

The fiber component which forms the nonwoven substrate base generally comprised cellulosic fibers, i.e., wood pulp having basis weight from about 30 g/m² 300 g/m² preferably 40 120 g/m². The wood pulp can combined bonded with other materials fibers bonders, such nonwovens-films, nonwovens-plastic (polyethylene polypropylene) nonwovens-cellulosic, etc.

One key that through the use these nonwoven fibrous webs bonded with the unique vinyl acetate/ethylene polymers, pressure alone sufficient cause the nonwoven web fabric adhere another substrate, typically itself, provide adhesive bonds substrates bonds which then have sufficient strength substrate dry particulate, superabsorbent powders and cellulosic pulp within defined regions within the laminate. Another key that under mild application heat, i.e., temperatures for low than required for effecting adhesion via thermofusible bicomponent fibers, may employed for higher $T_g$ polymers. Temperatures required for effecting adhesion in non wovens webs incorporating essentially thermofusible fibers component range from 60 00° Conventional temperatures required for effecting bonding thermofusible bicomponent fibers range from about 105° and above. Elevation temperature the web enhances adhesion best achieved by use heat sealing bar heated temperature not greater than about 250° C for time ranging few seconds through ultrasonic bonding techniques.

The liquid-absorbing agents which can utilized forming the disposable absorbent products include the nonwoven particulate water-absorbing polymeric absorbents. Best superabsorbent materials are widely known the art and can employed here; representative examples are given U.S. Pat. No. 4,960,4 and are incorporated reference. Typically these are crosslinked polyacrylic acids and salt, polysaccharides, starch, regenerated cellulose and derivatives thereof. Crosslinked polyacrylamides, crosslinked sulfonated polystyrenes, crosslinked poly (alkylene oxides) and alkyl-substituted phenyl ether, and others described U.S. Pat. No. 4,103,340 can also employed and are incorporated by reference.

accordance with one embodiment the process, high-capacity liquid absorbing laminate suitable for the fabrication disposable absorbent soft goods prepared applying neutral cement dry, hydrophilic, polymeric absorbing agent substrate fibers other material commonly used the preparation such liquid-absorbing laminates, enclosing the polymeric absorbing agent within the substrate and introducing the combined web into embossing nip, calender roll corrugated roll, (pressure roller) for providing indentations and defined regions the laminate. One common method forming the laminate deposit the particulate polymeric absorbents onto moving nonwoven web and then once the particulate polymeric absorbent deposited the web, another substrate, e.g., another nonwoven web placed over the particulate polymeric absorbent and then the two substrates bonded together. When least one the nonwoven webs has the vinyl acetate/ethylene self crosslinking adhesive described herein, bonding points these can afforded through the localized pressure supplied the pressure roller.

Another embodiment for producing absorbent particles referred the C-fold process. the s-fold process, nonwoven web carried upon belt and the liquid-absorbing polymeric materials, e.g., the superabsorbents, powder fiber cellulose pulp, added generally toward the middle portion the web proceeds along the belt. The side portions the nonwoven web then are folded inwardly toward the center longitudinal axis the web overlapping manner and then passed under the pressure roller. Again, because the unique acrylic and vinyl acetate/ethylene blendes employed the bonding the nonwoven web, pressure the pressure roller alone which used provide indentations within the now-folded web causes the nonwoven web adhesively adhere surface and provide bonding points these. Accordingly, the liquid-absorbing polymeric material cellulosic pulp fixed within the folds the nonwoven web. The resulting laminate then can incorporated into final product by,

converters (down stream manufacturers) wherein the laminate comprising the nonwoven web containing the polymeric superabsorbent combined with other components generic disposable product, such disposable diaper, etc.

Adhesion the nonwoven web itself another substrate affected means pressure applied the nonwoven web via nonbreaking rips ultrasonic bonding techniques. These pressure rollers e.g., nip rolls, they are sometimes called, are rollers having smooth-like surface which form indentations the nonwoven web the web passes under the pressure rollers. When using the nonwoven webs described herein, rolling nip pressures from about 50,000 lbs/in$^2$ 100,000 lbs/in$^2$ preferably within 50,000 lbs/in$^2$ the web incorporating the acrylic, vinyl acetate/ethylene crosslinkable acrylic vinyl acetate/ethylene adhesive bonds between the surfaces of the web, thereby defining regions within the web and thus fixing the location the hydrophilic polymeric absorbing materials within the laminate formed from the web. Lower pressures may used some heat employed. Also, the nonwoven web allows for the retention of embossed and decorative surfaces due the selected hydrophobic the self crosslinking vinyl acetate/ethylene adhesive. Recall that earlier processes required the application additional adhesives, the addition water tackify the polymeric absorbents adhesives causes heat affect adhesive the nonwoven web through the melt fusion thermoplastic polymeric fibers and hot melt adhesives.

The following examples are provided illustrate various embodiments of the invention and are not intended restrict the scope thereof.

## EXAMPLE

### Preparation Nonwoven Laminates

### General Procedure

one-gallon pressure reactor charged 400.0 distilled water, 760.0 10% aqueous solution Airvol 203 polyvinyl alcohol, 15.0 acetic acid, 4.0 5% aqueous solution ferrous ammonium sulfate and .09 phosphoric acid. To this added 346.6 vinyl acetate. The agitator turned 1000 rpm and the temperature raised 40°. Once the temperature has stabilized, 650 ethylene added over minutes and 15.0% aqueous solution sodium formaldehyde sulfoxylate added. To this heated mixture added 0.8% solution hydrogen peroxide rate ml/min.

Once the reaction initiated, the 15.0% aqueous solution sodium formaldehyde sulfoxylate added 0.3 ml/min. The minutes later, 229 32% aqueous solution N-methylolacrylamide (NMA) added rate 1.09 g/min. the 30 minute mark from initiation, 735.0 vinyl acetate added rate 4.6 g/min. The temperature and pressure maintained throughout the reaction until the hour and minute mark, whereupon the pressure allowed decay. When the N-methylolacrylamide delay complete, the hydrogen peroxide delay shut off and delay 5% aqueous t-butyl hydroperoxide added 2.0 g/min. When the free vinyl acetate level below 2.0%, the reactor cooled 35° and the emulsion transferred the degasser.

The composition the copolymer was estimated from monomer input the reactor and comprised 63% vinyl acetate, 32.3% ethylene and 7% N-methylolacrylamide (NMA). The emulsion had solids content 9%, 732 cps viscosity with Brookfield LV viscometer 60 rpm. The Tg was −25°.

## EXAMPLE

series laminates were prepared using C-fold procedure from variety nonwoven webs which incorporated different acrylate, vinyl acetate and crosslinkable polymers with the crosslinkable, vinyl acetate/ethylene prepared accordance with the general procedure of Example

Super absorbents were laid onto the nonwoven web and the web folded over upon itself. The nonwoven webs were fabricated into laminates with the super absorbent embedded into rectangular squares patterns consisting small squares formed under roll pressure 50,000 lbs/in$^2$. The resulting laminates were evaluated for peel strength the laminate potato and wet strength.

Table provides the following conditions and results.

TABLE

| Run | deg | g/m$^2$ | Thickness mm | Abs. | Run g/g/min | Dry CD | Wet CD | Peel |
|---|---|---|---|---|---|---|---|---|
| | −15 | 90.3 | | 11.8 | | 2984 | 1,339 | |
| | −25 | | | 11.2 | | 1,888 | 1,188 | |
| | −30 | 93.8 | | 10.1 | 8.64 | 2877 | | |
| | −30 | 95.9 | | 11.3 | 8.66 | 1769 | | |
| | −44 | | | | | 1477 | 778 | |
| | (−13) | 91.1 | | | 8.24 | NO | NO | |
| | (−32) | | | | | | | |
| | | 93.1 | | | | 1,594 | 576 | 344 |
| | −45 | 95.0 | | | | 788 | 333 | 493 |
| | −53 | | | 10.4 | | 814 | 1,313 | 375 |

| Run | Polymer Type | | | |
|---|---|---|---|---|
| | VAE −15° | | | |
| | VAE −30° | | | |
| | VAE | | | |
| | VAE | | | |
| | PVOH modified | VAE | | Modifier acrylic |
| | Blend −15° | VAE and | 30° | |
| | Commercial VAE | | | |



TABLE -continued

emulsion acrylic/vinyl acrylic emulsion solid water trademark
Fascryl 625.
Acrylic PVOH modified methyl methacrylate/vinyl acrylate emulsion modified with polyvinyl alcohol.

rolling "The Rock Weight" sample was measured TAPPI Standard Method "T410 om-87"
Abs* rolling speed fluid uptake grams water per gram laminate per minute.

Dry CD (Dry Tensile test) based on TAPPI Standard Method "T494 om-88" called "Tensile Breaking Properties Of Paper And Paperboard (Using Constant Rate Of Elongation Apparatus" is measure (a fine cross-direction (CD). The only modifications this test that inch wide (3 cm)x10 inch long (25 cm) sample rather than inch wide (2.5 cm)x inch long (25 cm) sample employed.

Wet CD (Wet strength Wet Tensile Test) based on TAPPI Standard Method "T456 om-87" called "Wet Tensile Breaking Strength Of Paper And Paperboard" inch wide sample (3 cm) rather than inch wide sample employed the procedures described herein.

Peel refers "peel test" that modification the peel test method known industry PSTC- called "Peel

## EXAMPLE

The procedure for preparing laminates accordance with the procedure Example was followed except that the rollers were maintained temperature 30° and the roll pressure was reduced psig for runs A–D. Rinse was conducted ambient temperature 60°. The contact time was approximately seconds which resulted raising the laminated temperature the point contact about 95°.

The results are set forth Table

TABLE

Peel Strength as a Function of Chemical Modification

| Sample ID | "T"-Peel Strength | Absorption Capacity g/g | Absorbency Rate g/g/min. | Strength (Dry CD) g/3 | Strength (Wet CD) | Roll Temp. |
|---|---|---|---|---|---|---|
| | | | | 2985 | 1139 | 30° |
| | | | | 832 | 948 | 30° |
| 183 | | | | 1,883 | 381 | 30° |
| 180 | | | 0.82 | 1088 | 141 | 30° |
| 181 | | | | 1182 | 193 | 300° |

Tg of

Adhesion For Single Coated Pressure-Sensitive Tapes 180 Degree Angle" The description the test published book called Test Methods for Pressure Sensitive Tapes the Pressure Sensitive Tape Council (9th edition). This test also known the industry the "T Test specify that the test carried out measure the adhesion the substrate itself rather than release paper; the other modification employed the test results described herein that the test based upon degree peel rather than 180 degree peel

The results show that nonwoven webs impregnated with crosslinkable vinyl acetate/ethylene emulsion polymers having peel strengths least g/3 cm permitted the formation laminates with acceptable bonding points. The results show that good peel strength not enough and can too high (above 350) for example run These laminates would not unwind from roll and delaminate upon unwinding thereby rendering the laminates unusable. Runs also was unacceptable because the poor absorbency value. Note that was below the desired level. some applications, the wet strength must least 100. The peel strength must sufficient for forming the laminate the procedure described herein using localized pressure especially with minimal heat forces the adhesive bonds thus defining regions for retaining the superabsorbents.

The results show that the application minimal heat the process for forming C-fold products results good dry and wet cross-directional tensile strengths. Runs D and E show little wet strength would expected. However, many cases wet strength not paramount importance. T-peel values did increase with increased levels NMA crosslinker and with mild application heat shown Run.

What claimed

process forming laminate added for use preparing disposable absorbent products by

overlaying substrate over the particulate polymeric absorbent and thereby forming laminate trapping the polymeric absorbent between said first nonwoven fibrous web and said substrate;

passing the laminate having the polymeric absorbent trapped between the first nonwoven web and second substrate through pressure roll causes for imparting indentations the laminate, and then,

adhesively bonding the first nonwoven web and overlaid substrate plurality points thereby forming discrete regions within the laminate and thus fixing portion the polymeric absorbent within said regions, the improvement which comprises:

adhesively bonding the first nonwoven fibrous web said overlaid substrate solely causing the pressure supplied by said roller means and effecting adhesion through the polymeric resin utilized bonding the fibers the web and said substrate effected without the addition water heat sufficient raise the adhesive temperature above about 100°

The process claim wherein the polymeric resin capable effecting pressure sensitive adhesiveness sufficient impart from 400 g/5 cm peel strength nonwoven web consisting essentially wood pulp the fiber component after having pressure applied by said pressure roll means from 000 00,000 lbs/in²

The process claim wherein the polymeric resin vinyl acetate/ethylene polymer resin crosslinkable and capable imparting wet strength least g/5 cm the resulting laminate.

The process claim wherein the binder crosslinkable vinyl acetate/ethylene polymer having Tg from −26 +18°

The process claim wherein the crosslinkable component N-methylolacrylamide and present range from 1–4% weight the copolymer.

C-fold c-fold process for forming laminate suited for use preparing disposable absorbent products which comprises:

depositing polymeric absorbent onto first nonwoven fibrous web bonded with crosslinked polymeric resin;

folding the side portions the nonwoven web inwardly toward the center along the longitudinal axis the web overlapping manner thereby forming laminate trapping the polymeric absorbent within the fold said nonwoven fibrous web;

passing the laminate having the polymeric absorbent trapped within the fold the nonwoven web through pressure roller for defining longitudinal indentations the laminate; and then,

adhesively bonding the thus formed laminate formed from the first nonwoven web plurality points thereby forming discrete, sealed regions within the laminate and thus fixing portion of the polymeric absorbent within said regions,

the improvement which comprises:

adhesively bonding the laminate solely by causing the pressure supplied by said pressure roller and effecting said adhesive bonding through the polymeric resin the nonwoven web without the addition water said pressure roller substantial temperature below about 250° and the contact time between the roller and nonwoven web such that the temperature the adhesive the nonwoven web does not exceed about 00°

The process claim wherein the polymeric resin capable effecting pressure sensitive adhesiveness sufficient impart from 400 g/5 cm peel strength nonwoven web consisting essentially wood pulp the fiber component.

The process claim wherein the crosslinked polymeric resin vinyl acetate/ethylene polymer that has crosslinkable functionality capable imparting wet strength least 300 g/5 cm the resulting laminate.

process forming laminate suited for use preparing disposable absorbent products

depositing particulate polymeric absorbent onto first nonwoven fibrous web, the fibers bonded with polymeric resin;

placing second substrate over the particulate polymeric absorbent and thereby forming laminate trapping the polymeric absorbent between said first nonwoven fibrous web and said substrate;

passing the laminate having the polymeric absorbent trapped between the first nonwoven web and second substrate through pressure roll means for imparting indentations the laminate; and then,

adhesively bonding the first nonwoven web and second substrate plurality points thereby forming discrete regions within the laminate and thus fixing portion the polymeric absorbent within said regions,

the improvement which comprises:

stitching vinyl acetate/ethylene polymer having from −22 18° C., and,

applying pressure by said roller means temperature from 20 30° and thereby effecting adhesion through the polymeric resin used bond the fibers within the web.

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# United States Patent

Cook et al.

Patent Number: 4,481,250

[45] Date of Patent: Nov 6, 1984


[54] VINYL ACETATE-ETHYLENE BINDER COMPOSITION HAVING GOOD WET TENSILE STRENGTH AND LOW HEAT SEAL TEMPERATURE FOR NONWOVEN PRODUCTS


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[52] U.S. Cl. ——— 428/288; 428/288; 428/913; 524/502

[58] Field Search ——— 428/288, 290, 913; 524/502



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[57] ABSTRACT

An emulsion composition disclosed which provides binder having good wet tensile strength and low heat seal temperature for nonwoven products which comprises aqueous dispersion of solutions consisting essentially of wt vinyl acetate-ethylene copolymer and wt vinyl acetate-ethylene-crosslinking monomer copolymer.


20 Claims, No Drawings



## VINYL ACETATE-ETHYLENE BINDER COMPOSITION HAVING GOOD WET TENSILE STRENGTH AND LOW HEAT SEAL TEMPERATURE FOR NONWOVEN PRODUCTS

### TECHNICAL FIELD

The invention relates vinyl polymer emulsions and, more particularly, the invention relates vinyl acetate-ethylene copolymer compositions for bonding nonwoven products.

### BACKGROUND OF THE INVENTION

many commercial applications, necessary attach bonded nonwoven material some other substrate. For example, baby diapers the inner liner the diaper typically nonwoven fabric comprising rayon, polyester polypropylene fibers bonded together with some polymeric composition. The outer layer the diaper is generally polyethylene film and between the two layers the absorbent padding.

quite apparent from economic viewpoint that fast, efficient way attach the nonwoven inner liner the polyethylene film desired by the industry. Additionally, since the inner liner repeated urine, must exhibit good wet strength order maintain integrity and hold the absorbent padding place. Currently, these an fast, efficient way of doing this.

The state the art binder compositions which can produce the necessary wet strength normally have heat seal temperatures that are too high make such single step process possible due prohibitive time and energy costs and the physical melting constraint of the polyethylene film.

This problem makes the manufacture of diapers, sanitary napkins, and the like and inclusive of similar problems in air-laid type paper embossing.

One approach which used solve this problem the diaper area two-step procedure. First the nonwoven inner liner bonded with self-crosslinking binder achieve the necessary wet strength. Then this inner liner attached the polyethylene outer layer with an adhesive composition. This procedure very slow, costly and inefficient.

air-laid type paper embossing two separate binders may be used. The first binder weak wet strength, good heat sealing binder which used treat the paper prior embossing. After embossing, the paper then treated with self-crosslinking binder achieve wet strength. This process also slow, inefficient operation which costly, produces stiff feel the paper and has tendencies delaminate binder layers giving weak intermediate wet strength.

### SUMMARY OF THE INVENTION

The invention provides binder composition which prepared by blending two vinyl acetate-ethylene copolymer emulsions. The first copolymer emulsion about 60 wt% vinyl acetate and 40 wt% ethylene, the second copolymer emulsion wt% vinyl acetate, 40 wt% ethylene and up about wt% crosslinking mono-olefinically unsaturated monomer. The blend contains about wt% the first copolymer and about wt% the crosslinking copolymer.

As an advantage the invention there provided emulsion composition that exhibits the strength self-crosslinking polymer emulsion with the heat sealing properties non-crosslinking polymer. When used the diaper-type nonwovens protect the emulsion composition applied the inner nonwoven liner and produces good wet strength. This inner layer can then be heat sealed relatively low temperatures the polyethylene outer layer fast, neat single step.

the air-laid type paper embossing area, the wood pulp can be pre-treated with the emulsion composition that during the thermal embossing step, the polymer composition will flow producing single step the neat clean embossing. Subsequently, curing will develop the full wet strength.

### DETAILED DESCRIPTION OF THE INVENTION

There provided emulsion binder composition having good tensile strength and good heat sealability binder for nonwoven products comprising mixture consisting essentially of

(a) wt% copolymer consisting wt% vinyl acetate and wt% ethylene and

(b) wt% of copolymer consisting 60 to 95 wt% vinyl acetate, 40 wt% ethylene and up about wt% crosslinking mono-olefinic monomer copolymerizable with vinyl acetate and ethylene.

There also provided emulsion composition for use binder for nonwoven products comprising an aqueous dispersion the mixture copolymers.

another embodiment there also provided nonwoven product bonded with the binder composition the invention deposited from the emulsion composition.

preferred embodiment the mixture copolymers contains about 50 wt% the vinyl acetate-ethylene-crosslinking copolymer and 35 wt% the vinyl acetate-ethylene-crosslinking monomer copolymer also preferred that the first copolymer contain about 85 wt% vinyl acetate and wt% ethylene and that the crosslinking copolymer contain about 70 wt% vinyl acetate, 25 wt% ethylene and about wt% crosslinking monomer with N-methylol acrylamide being the preferred crosslinking monomer

Other well known crosslinking mono-olefinically unsaturated monomers that can be used the practice of the invention include N-methylol methacrylamide, the lower alkyl ethers the N-methylol acrylamide, acrylamide, methacrylamide, and acrylic acid. When such copolymerizable crosslinking monomers are incorporated into the crosslinking copolymer preferably done about wt% level.

preferred that both the non-crosslinking and the crosslinking vinyl acetate-ethylene copolymer emulsions prepared the presence non-polyvinyl alcohol protective colloid surfactants. Desirably, the non-crosslinking copolymer emulsion prepared using hydroxyethyl cellulose and nonionic alkoxylated surfactants.

Suitable vinyl acetate-ethylene copolymer and vinyl acetate-ethylene-crosslinking monomer copolymer emulsions for blending the composition the invention can prepared by the following process.

Vinyl acetate and ethylene are copolymerized the presence a protective colloid surfactants pressure medium under pressure not exceeding about 100 atm and the presence catalyst which added incrementally, the aqueous system being maintained by suitable buffering agent pH of about The

process involves first homogenization which the vinyl acetate suspended water thoroughly agitated the presence of ethylene under the working pressure effect solution of the ethylene the vinyl acetate while the reaction medium gradually heated polymerization temperature. The homogenization period is followed by polymerization period during which the catalyst, which consists redox catalyst, inhibitor and any buffers as activator, added intermittently.

the case of the preparation of the emulsifying copolymer, the emulsifying alkalinically neutralized copolymerizable monomer may added all once with the vinyl acetate and ethylene intermittently over the course of the polymerization reaction.

Various free-radical forming catalysts can used carrying out the polymerization the monomers, such peroxide compounds. Combination-type catalysts employing both reducing agents and oxidizing agents can also be used, i.e. redox system. The reducing agent often referred activator and the oxidizing agent initiator. Suitable reducing agents activators include bisulfites, sulfoxylates, other compounds having reducing properties such ferrous salts and tertiary aromatic amines, e.g. N,N-dimethyl aniline. The oxidizing agents include hydrogen peroxide, organic peroxides such benzoyl peroxide, t-butyl hydroperoxide and the like, persulfates, such ammonium potassium persulfate, perborates and the like. Specific combination-type catalysts redox systems which use sodium bisulfite hydrogen peroxide and also formaldehyde sulfoxylate, hydrogen peroxide, ammonium persulfate potassium persulfate with sodium metabisulfite, sodium bisulfite, ferrous sulfate, dimethyl aniline, also formaldehyde sulfoxylate sodium formaldehyde sulfoxylate. preferred use t-butyl hydroperoxide and sodium formaldehyde sulfoxylate. Other types catalysts that are well known the art can also be used polyamides the monomers. Catalyst typically employed an amount of 0. 3%, preferably 0.25 75%, based on the weight the vinyl acetate introduced into the polymerization system. The activator additionally added aqueous solution an amount that generally 0.25 times the amount of the catalyst.

also possible use redox systems containing reducing agent which formaldehyde-free disclosed U.S. Pat. No. 4,320,032 which incorporated by reference.

The emulsifying agents which can be used the polymerization recipe include ionic and nonionic surfactants, preferably the nonionic types which are well known those skilled the polymerization art. Suitable nonionic emulsifying agents include polyoxyethylene nonylphenols.

The monomeric range the total amount emulsifying agents useful from 0.3 3% based on the aqueous phase of the emulsion regardless solids content.

Latex stabilizers are also advantageously used. When the vinyl acetate-ethylene copolymer between are have small average particle size, for example, below 0.35 microns, an ethylenically unsaturated acid having up carbon atoms used the stabilizer, such acrylic acid, maleic acid, and the like. These unsaturated acids impart increased stability the latexes. They tend copolymerize with the monomers the system, the amount such unsaturated acid used suitable with based on the interpolymer preferably 0.1 with.

On the other hand, when the latex has average particle size above 0.25 microns, protective colloid can used the polymerization enhance the stabilizing agent. advantageous maintain the colloid content the latexes between about 0.02 and with based on the total latex. Polyvinyl alcohol and hydroxyethyl cellulose are examples of particularly advantageous colloids.

desired maintain the pH of the system desired value, there may suitably added an alkaline buffering agent any convenient type which compatible with the stabilizing agent. The amount buffer is generally about 0.1 with based on the monomers.

Vinyl acetate-ethylene copolymer latexes relatively high solids contents can directly produced having solids contents 50%. They can, course, be easily diluted by the addition water lower solids contents any desired value.

The reaction temperature can be controlled by the rate catalyst addition and by the rate heat dissipation. Generally, advantageous maintain room temperature of about 30° during the polymerization the monomers and avoid temperature much above 50° While temperatures low can be used, economically the lower temperatures limit about 30°

The reaction time will also depend upon other variables such the temperature, the catalyst and the desired extent polymerization. generally desirable continue the reaction until less than 0.5% the vinyl acetate remains unreacted.

carrying out the polymerization, amount of the vinyl acetate initially charged the polymerization vessel and saturated with ethylene. Most advantageously, least about 10% the total vinyl acetate be polymerized initially charged, preferably least about 20%, and the remainder of the vinyl acetate added incrementally during the course the polymerization. The charging all the vinyl acetate initially also contemplated with no additional incremental supply.

When reflux vinyl acetate incremental addition, whether vinyl acetate, emulsifying copolymerizable monomer catalyst activator, substantially continuous additions, both with respective specificity and time, are contemplated. Such additions are also referred "delay" additions.

The quantity ethylene entering the copolymer influenced by the pressure, the agitation and the viscosity of the polymerization medium. Thus, increase the ethylene content the copolymer high pressures, greater agitation and low viscosity are employed. The process of forming the vinyl acetate-ethylene copolymer and vinyl acetate-ethylene emulsifying monomer copolymer emulsions generally comprises the preparation of aqueous solution emulsifying least some the emulsifying agent and stabilizer, and the pH buffering system. This aqueous solution and the initial charge of the vinyl acetate are added the polymerization vessel and ethylene pressure applied the desired value. As previously mentioned, the mixture thoroughly agitated dissolve ethylene the vinyl acetate and the water phase. Conveniently, the charge brought polymerization temperature during this agitation period. The polymerization then initiated by



introducing initial amounts the catalyst and the activator when used. After polymerization has started, the catalyst and the activator are incrementally added supplied continue polymerization. The emulsifying copolymerizable monomer and the remaining vinyl acetate, any, may be added separate delays.

As mentioned, the reaction generally continued until the residual vinyl acetate content below 0.5%. The completed reaction product then allowed cool about room temperature while sealed from the atmosphere. The pH then suitably adjusted value the range 4.5 preferably 4.5 insure maximum stability.

Another method for producing vinyl acetate-ethylene-containing copolymer emulsions this invention comprises first forming aqueous emulsion vinyl acetate and stabilizer and charging this emulsion reactor. The reactor pressurized with ethylene ethylene-equilibrium pressure about 300 500 psig. The resulting reaction mixture adjusted temperature from about 10° 30° Polymerization initiated by the addition catalyst rate such that the reaction mixture brought temperature from 45° 85° C., preferably 50° 60° C., within period one hour less, preferably minutes. The polymerization continued until the vinyl acetate content reduced below about 0.5% the copolymers.

The emulsifying monomer can added the reaction vessel with the initial charge during combination the two.

This latter polymerization process the subject of U.S. Pat. No. 4,333,850 which incorporated by reference.

The binder composition of the invention is prepared simply by blending mixing the vinyl acetate-ethylene copolymer emulsion with the vinyl acetate-ethylene emulsifying monomer copolymer emulsion. This binder composition used prepare nonwoven products, fabrics, by various methods know the art which, generally, involves the impregnation loosely assembled mass fibers with the binder latex, followed by subsequent heating dry the mass, the case the present invention, this moderate heating also serves cure the binder by forming cross-linked interpolymer within the binder applied. cures induced with suitable catalyst for the emulsifying monomer. For example, for the N-methylol acrylamide, acid catalyst such mineral acids, e.g. hydrogen chloride, organic acids, e.g. maleic acid, acid salts such ammonium chloride, are suitable used known the art. The amount catalyst generally about 0.1 2% of the total resin.

The starting fiber layer mass can be formed by any one the conventional techniques for depositing arranging fibers web layer. These techniques including carding, garnetting, air-laying and the like, individual webs thin layers formed by one more of these techniques can also be laminated provide thicker layer for convenience into fabric. Typically, the fibers natural plurality diverse directions general alignment with the major plane of the fabric, overlapping, interwoven and supporting one another form open, porous structure.

When reference made "cellulose" fibers, those fibers containing predominantly $C_6H_{10}O_5$ groupings are meant. Thus, examples the fibers be used in the starting layer are the natural cellulose fibers such wood pulp, cotton and hemp and the synthetic cellulose fibers such rayon, and regenerated cellulose. Often the fiber starting layer contains least 50% cellulose fibers, whether they be natural synthetic, constitution thereof. Often the fibers the starting layer may comprise natural fibers such wood, jute, artificial fibers such cellulose acetate, synthetic fibers such polyamides, nylon, polyester, acrylics, polyolefins, i.e. polypropylene, polyvinyl chloride, polyurethanes, and the like, alone in combination with one another.

The fibrous starting layer subjected least one the several types of bonding operations another the individual fibers together form self-sustaining web. fibers the better known methods of bonding are overall impregnation, printing the web with intermittent configurations straight wavy lines areas binder extending generally transversely diagonally across the web and additionally, desired, along the web.

The amount binder calculated on dry basis applied the fibrous starting web that amount which least sufficient bind the fibers together form self-sustaining web and suitably ranges from about about 100% more by weight the starting web, preferably from about about 50 with the starting web. The impregnated web then dried and cured. Then the fabrics are suitably dried by passing them through air oven the film and then through curing oven. Typical conditions relative applied cross-linking are sufficient time and temperature such drying 150° 200° (66° 93° C.) for minutes, followed by curing 300° 350° (149° 154° C.) for minutes more. However other time-temperature relationships can be employed well known the art, shorter times higher temperatures longer times lower temperatures being used.

The bonded nonwoven product may then be attached joined another substrate material by heat sealing process. Heat heat sealing processes include the steps of passing the nonwoven product and substrate between two cylindrical rollers heated suitable temperature and having applied pressure where the sealing mean, passing the nonwoven product and substrate between parallel heated plates for specific time.

Nonwoven products prepared embodiments with this invention have wet and dry tensile strength values approximating comparable those nonwoven products prepared using vinyl acetate-ethylene-emulsifying monomer binders alone. More importantly, these nonwoven products have the outstanding advantage relatively low heat sealability temperatures.

Theoretically, both heat and temperature and wet tensile strength are functions the degree of cross-linking of the polymer. At cross-linking increases, heat and temperature and wet tensile strength both increases.

contrast, the binder composition the invention does not follow this expected pattern. Instead, wet tensile strength maintained relatively high level while heat and temperature decreased significantly. This makes possible heat and two materials together low temperatures and still have good wet tensile strength. Specifically, about 30/70 ratio of emulsifying monoemulsifying copolymers, up about 95% the wet tensile strength the fully self-cross-linked vinyl acetate-ethylene copolymer with essentially the same heat seal temperature the non-self-emulsifying vinyl acetate-ethylene copolymer achieved.

Illustrative the types nonwoven products which can made from wood pulp and, optionally, other fibers utilizing the invention are nonwoven wash disposable diapers, sanitary napkins, underpads and surgical masks.

In the examples the following commercially available vinyl acetate-ethylene copolymer emulsions were used:

Airflex ® 105—79% vinyl acetate; 16% ethylene; 5% N-methylol acrylamide 52.5 wt% solids. (A-105).

Airflex-150—89% vinyl acetate, 22% ethylene, 4% N-methylol acrylamide; 52.5 wt% solids. (A-150).

Airflex-410—94% vinyl acetate, 16% ethylene; wt% solids. (A-410).

Airflex registered trademark Air Products and Chemicals, Inc. for polymer emulsions.

The nonwoven substrates used the following examples were carded rayon and air-laid unbonded unbonded paper substrates.

The cross machine direction tensile (CMD) strength, wet and dry, were measured according ASTM D1682.

The heat seal temperature test combined of measuring the relative heat seal temperature polymer film specified thickness weight per unit area range and was follows

About 150-250 grams 39% heat solids binder formulation was prepared.

Lessta cards 7 inches were conditioned overnight (minimum hours) 72° F./50% relative humidity. After the cards were laid, paddle the binder formulation the leading edge of #30 rod was slowly drawn down by applying moderate pressure the rod catch. The coated cards were quickly placed oven dry for minutes 300° 10° The coated cards were then reconditioned 72° F./50% relative humidity overnight. Each template was cut and weighed 0.01

The applied coat weight was the difference weight per unit area between the uncoated card and the coated card expressed lb/3000 ft². Then,

Weight (g) card 33.452 lb/3000 coated
— Table 24.3.1 x 10.8 card X 21.81 x lb/3000 ft² coated
coating weight lb/3000 ft²

The coating weight should 7±3 lb/3000 ft² order achieve operable heat seal temperatures. the coating weight outside the range, weight be for different equations using the same wire wound rod, the rod will have changed accordingly. lower number rod will reduce coating weight.

Two bath strips were cut from the 4× bath coated dimension perpendicular the bath side. All cuts were made with the coated side up.

Uncoated Lessta cards were then similarly cut. The bath side these blank cards, containing an natural clay paper coating, was used surface which the coated side of the Lessta card was heat sealed.

Sintilind heat sealer Model No. 1A8 was adjusted opposite 40 psi, 100° and five second dwell time. The uncoated side the blank Lessta cards was placed on top of the coated side the sample. The samples were placed the heat sealer with one square inch area under pressure. After the pressure was released. After the sample had cooled room temperature, the top piece was peeled off the coated sample and the exposed fiber tear on the coated sample, based on visual estimate, was recorded. fiber tearing based over least 70% of the one square inch seal area was not achieved, the seal temperature was increased 10° F., 10° increment. The test was then repeated. The temperature was increased 10° increments achieve 100% fiber tear bond. The temperature which seal demonstrating least 70% fiber tear was achieved was the heat seal temperature.

To determine hand, which the assessment of fabric feel via the sense touch, the following test measured consideration the resistance due flexural rigidity and surface friction fabric.

The hand was measured by method utilizing Thwing-Albert Handle-O-Meter which the lower the number, the softer the hand.

The resistance due surface friction and flexural rigidity specimen are measured the force required by blade forcing the specimen set distance into the parallel edges. The hand was considered the average four readings taken on both sides and both directions the specimen and was recorded grams per standard with specimen.

Samples to tested were conditioned 72° and 50% relative humidity for least hours prior test. Specimens inches were cut that one side was parallel the machine direction and one side was parallel. After calibrating the Handle-O-Meter, the test specimen were evaluated and the value hand was considered the average of readings taken on both sides and both directions.

EXAMPLE

this example samples carded rayon were impregnated with the emulsion samples shown Table which also sets forth the tensile strengths and hand the impregnated carded rayon and the heat seal temperature the emulsion polymer.

TABLE

| RUN | EMULSION COMPOSITION | ADD-ON | CATALYTE (%) TOTAL BASED ON SOLIDS | CROSS MACHINE DIRECTION TENSILE (GMS) STRENGTH DRY | WET | HEAT SEAL TEMP (°F.) | HAND |
|---|---|---|---|---|---|---|---|
| | A-105 | | | 1.34 | | 300 | |
| | A-150 | | | 1.39 | | 300 | |
| | 50/50 | | | 1.28 | | 300 | |
| | A-105/A-410 | | | | | | |
| | 50/50 | | | 1.49 | | 300 | |
| | A-105/A-150 | | | | | | |
| | A-105 | | 0.5 | 1.28 | | 320 | 3.7 |

As can seen from Table both wet and dry tensiles for the blends Runs and were high for the self-crosslinking polymers Runs and The heat seal temperatures for the copolymer blendes the blends of Runs and were temperatures lower than what would have been predicted for 50—50 mixture while the heat was either



EXAMPLE

Another series binder emulsions alone and combinations were tested on carded rayon. The relevant experimental and resulting data are presented Table

TABLE

| RUN | EMULSION COMPOSITION | ADD-ON | CATALYTE (%) TOTAL BASED ON SOLIDS | CROSS MACHINE DIRECTION TENSILE (GMS) STRENGTH DRY | WET | HEAT SEAL TEMP (°F.) | HAND |
|---|---|---|---|---|---|---|---|
| | A-105 | | | 1.30 | 1.05 | 300 | |
| | 50/50 | | | 1.27 | | 340 | |
| | A-105/A-410 | | | | | | |
| | 50/50 | | | 1.15 | 0.84 | 340 | |
| | A-105/A-410 | | | | | | |
| | 50/50 | | | 1.38 | 0.85 | 300 | |
| | A-105/A-410 | | | | | | |
| | A-410 | | 0.5 | 1.35 | 0.39 | 320 | |

Assuming the wet strength values for A-105 and A-410 emulsion copolymers are additive when blended, the expected values for Runs and would be 0.32, 0.44 and 0.62, respectively. Surprisingly, the measured wet tensile strengths were 73, 0.84 and 0.86, respectively.

Another analysis of the heat seal temperatures shows unexpected results.

EXAMPLE

this example various emulsion compositions were applied unbonded carded substrate. The relevant data summarized Table

TABLE

| RUN | EMULSION COMPOSITION | ADD-ON | CATALYTE (%) TOTAL BASED ON SOLIDS | CROSS MACHINE DIRECTION TENSILE (GMS) STRENGTH DRY | WET | HAND | HEA SEAL TEMP (°F.) |
|---|---|---|---|---|---|---|---|
| | A-150 | | 0.5 | 1.20 | | 32.4 | 320 |
| | 50/50 | | | 1.27 | 1.20 | 29.4 | 300 |
| | A-105/A-410 | | | | | | |
| | A-105 | | | 4.04 | | 35.8 | 300 |

The expected wet tensile strength for Run 12, based on the data of Runs and 11, would be about not the measured value 78.

From the above examples can be seen that binder compositions which comprises blend about wt% self-crosslinking vinyl acetate-ethylene copolymer and about wt% non-crosslinking vinyl acetate-ethylene binder, preferably 10-33 wt% and 90 wt% respectively, provides for relatively high wet tensile strengths while effecting relatively low heat seal temperatures. For heat sealing applications requiring heat seal temperature less than about 230° F., for example about 190° 200° F., 50/50 blends of the two copolymers are suitable. Blends which contained self-crosslinking copolymer amounts greater than about wt% are not preferred because the wet tensile strength improvement marginal while heat seal temperature increases rapidly. Where heat sealing temperatures less than the 190° 200° are required, blends containing about 20 wt% self-crosslinking copolymer should prove suitable. When the amount of self-crosslinking copolymer the blend falls below about wt%, particularly below wt%, there will insufficient crosslinking within the copolymer provide requisite wet tensile strength.

The binder compositions the invention does not follow the expected pattern. Instead, wet tensile strength enhanced high level while heat seal temperature decreased significantly. This possible heat seal low temperature and still have good wet tensile strength. The binder combines the heat sealing properties and thermoplasticity uncrosslinked polymer with the excellent wet strength fully crosslinked polymer addition, imparts excellent bond nonwoven fabrics, resists disintegration upon soaking and leaves no residual odor the finished product.

STATEMENT OF INDUSTRIAL APPLICATION

The invention provides binder compositions having good wet strength and good low temperature heat sealability nonwoven allowing end use manufacturers use single binder and still use inexpensive thermal bonding step achieve the nonwoven another substrate. Additionally, thermal embossing possible paper bonded with the composition with the resulting embossed paper having good wet strength.

We claim:

An emulsion composition providing binder having good wet tensile strength and heat sealability for nonwoven products comprising aqueous dispersion of polymers consisting essentially

(a) wt% copolymer A consisting wt% vinyl acetate and 40 wt% ethylene, and

(b) wt% copolymer consisting wt% vinyl acetate, 40 wt% ethylene and up about wt% crosslinking mono-ethylenically unsaturated monomer

The composition claim which the polymers consists essentially 90 wt% copolymer and wt% copolymer

The composition claim which the vinyl acetate contained wt% and the ethylene contained wt% copolymer and the vinyl acetate 70 wt%, the ethylene wt%

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and the crosslinking mono-olefinically unsaturated monomer wt copolymer

The composition claim which the vinyl acetate content wt% and the ethylene content wt% copolymer A, and the vinyl acetate wt%, the ethylene wt% and the crosslinking mono-olefinically unsaturated monomer wt% copolymer

The composition claim which the crosslinking olefinically unsaturated monomer N-methylol acrylamide, N-methylol methacrylamide, the lower alkyl ethers of N-methylol acrylamide N-methylol methacrylamide, acrylamide, methacrylamide, acrylic acid.

The composition claim which the crosslinking mono-olefinically unsaturated monomer 4-6 wt%.

nonwoven product comprising web of fibers bonded together with binder deposited from emulsion composition comprising an aqueous dispersion mixture consisting essentially

(a) wt% copolymer containing 60 wt% vinyl acetate and 40 wt% ethylene, and

(b) wt% copolymer containing about wt% crosslinking mono-olefinically unsaturated monomer

The nonwoven product claim which the mixture consists essentially 90 wt% copolymer and wt% copolymer

The nonwoven product claim which the vinyl acetate content wt% and the ethylene content wt% copolymer and the vinyl acetate wt%, the ethylene wt%, and the crosslinking mono-olefinically unsaturated monomer wt% copolymer

10. The nonwoven product claim which the vinyl acetate content wt% and the ethylene content wt% copolymer and the vinyl acetate 70 wt%, the ethylene wt%, and the crosslinking mono-olefinically unsaturated monomer wt% of copolymer

The nonwoven product claim which the crosslinking mono-olefinically unsaturated monomer N-methylol acrylamide, N-methylol methacrylamide, the lower alkyl ethers N-methylol acrylamide N-methylol methacrylamide, acrylamide, methacrylamide, acrylic acid.

12. The nonwoven product claim which the crosslinking olefinically unsaturated monomer 4-6 wt%.

13. An emulsion composition providing binder having good wet tensile strength and heat resistivity for nonwoven products comprising an aqueous dispersion mixture consisting essentially

(a) wt% copolymer containing 60 wt% vinyl acetate and 40 wt% ethylene, and

(b) wt% copolymer containing 60 wt% vinyl acetate, wt% ethylene and up about wt% N-methylol acrylamide.

14. The composition claim in which the mixture consists essentially 90 wt% copolymer and wt% copolymer

15. The composition claim which the vinyl acetate 65 wt% and the ethylene wt% copolymer and the vinyl acetate wt%, ethylene wt% and the N-methylol acrylamide is wt% copolymer

16. The composition claim which the vinyl acetate wt% and the ethylene wt% copolymer and the vinyl acetate wt%, ethylene wt% and the N-methylol acrylamide is wt% copolymer

17. nonwoven product comprising web of fibers bonded together with binder deposited from the emulsion of claim 13.

18. nonwoven product comprising web fibers bonded together with binder deposited from the emulsion claim 14.

19. nonwoven product comprising web fibers bonded together with binder deposited from the emulsion claim 15.

20. nonwoven product comprising web fibers bonded together with binder deposited from the emulsion claim 16.

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US005536555A

# United States Patent

Patent Number 5,536,555

Zelenski et al.

[45] Date of Patent: Jul. 16, 1996

[54] LIQUID PERMEABLE, QUILTED FILM LAMINATES

[75] Inventors: Gregory Zelenski, Woodstock; William George Cutler, Cheryl Parkins, Roswell, Ga.

[73] Assignee: Kimberly-Clark Corporation, Neenah, Wis.

[21] Appl. No. 382,951

[22] Filed: Feb. 995

Related U.S. Application Data

[63] Continuation Ser. No. 188,479, Jan. 1995, abandoned.

Int. Cl. ..... B32B 3/18

[32] U.S. Cl. ..... 428/138; 28/840; 56/73. 156/84; 56/93; 156/163; 156/164; 56/229; 56/257; 156/308.4; 428/1 428/138; 428/137; 428/152; 428/198; 428/283; 428/284; 428/296; 428/297; 428/298; 428/373; 604/358; 604/378

[58] Field Search ..... 428/1 34, 428/137, 138, 198, 33, 283, 284, 296, 297 298, 373; 28/840; 38/73. 84, 85, 63, 64, 229, 257 308.4; 604/358, 378

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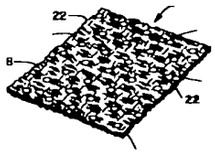
Primary Examiner—Jerom Bell

[57] ABSTRACT

Disclosed herein spoiled film laminate wherein film having plurality generally parallel slits laminated substrate layer such Bonus nonwoven web. Due processing conditions, once the slit film layer and substrate layer have been laminated one another, the composite allowed retract thereby giving the composite puckered spoiled appearance with undulating surface. The undulating surface also across the slits. Since plurality openings which are generally perpendicular the central plane the film, addition, due the undulating nature the surface the film, the apertures created inside above and below the central plane the film layer. The composite produced here wide variety uses not the least which include cover extended body side liner for personal care absorbent products. The process for producing the composite also disclosed.

Claims, Drawing Sheets



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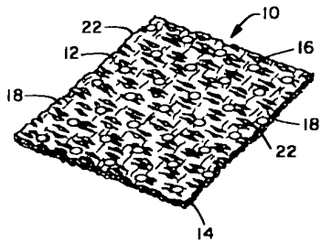


FIG 1

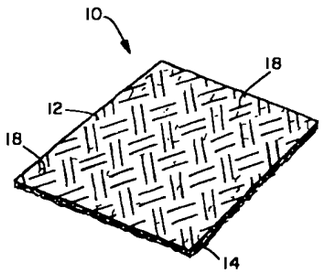


FIG 2

U S Patent Jul. 6, 996 Sheet of 5,536,555

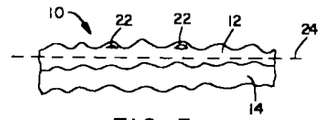


FIG 3

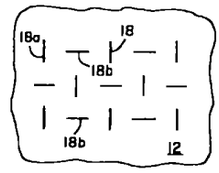


FIG 5

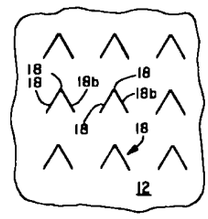


FIG 6

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FIG 4



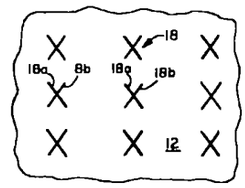


FIG 7

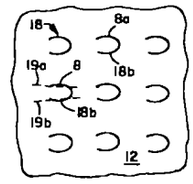


FIG 8

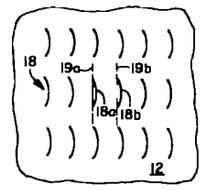


FIG 9

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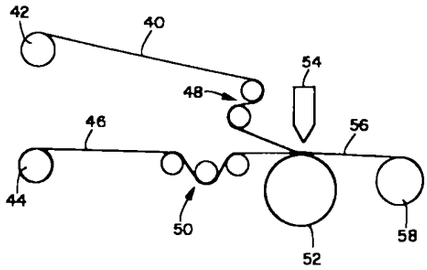


FIG 10

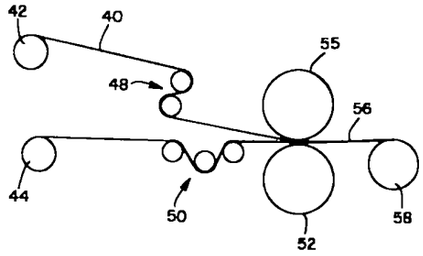


FIG 11



## LIQUID PERMEABLE, QUILTED FILM LAMINATES

This application continuation application Ser. No. 08/169,479 entitled "Liquid Permeable, Quilted Film Laminates" and filed the U.S. Patent and Trademark Office Dec. 1993 now abandoned.

### FIELD OF THE INVENTION

The present invention directed quilted film laminates. More particularly, the quilted film laminate the present invention includes embossments wherein the film laminated fibrous nonwoven substrate thereby yielding particularly suitable body side liner material for personal care products including diapers, sanitary napkins, training pants, incontinence garments, bandages and the like.

### BACKGROUND OF THE INVENTION

Almost personal care absorbent articles include body side liner material cover, absorbent core and some type leaching material which generally liquid impervious help prevent leakage. The types cover materials have basically fallen into two main groups with the division being based, least part, upon two schools thought aesthetic preferences. the non fastener core and sanitary napkins, the market polarized two segments, women who prefer clean and dry film covers and women who prefer soft, cloth-like nonwoven covers. The Procter and Gamble Company Cincinnati, Ohio markets sanitary napkins under the trademark ALWAYS® with apertured film the cover material. This product allegedly made accordance with the teachings of U.S. Pat. No. 3,929,1 Thompson. Molnlycke AB, Gothenburg, Sweden markets sanitary napkin with film layer laminated nonwoven. The film layer has openings with tabs designed for transporting fluids. This product allegedly made accordance with the teachings of Wellland, U.S. Pat. No. 4,626,254. The advantage such film covers for sanitary napkins that they provide relatively clean and dry surface menses tends pass through the film layer and into the interior the absorbent product. drawback, however, that such film layers not provide the degree softness and comfort that nonwoven cover material can provide. Another drawback the smooth, slick, non-cloth-like feel that many films possess. This due, least part, the two-dimensional nature film covers. Conversely, nonwoven-based cover materials such KOTHOS® Pure Care pads from the assignee sound are very soft and cloth-like feel but, given the viscosity menses, tend remain near the tissues just below the surface the cover material which, turn, makes the product suffer from the standpoint properties such cleanliness and dryness. view the foregoing deficiencies both nonwoven film covers, would desirable form material that combined the attributes both types covers more three-dimensional structure, fluid material would tend reduce the polarity acceptance cover materials and products. As result, there need for improved material which, among other applications, can used body side cover for personal care absorbent products.

### SUMMARY OF THE INVENTION

The present invention directed quilted film laminate composite which provides good blend the positive properties from both film and fibrous nonwoven cover materials. Due the nature the perforation the film layer, the selection the substrate material which the film laminated and the method by which the composite assembled, there provided cover material which very soft and cloth-like the touch while still providing good fluid intake rates and protection against sweat when used cover material for personal care products. addition, due the nature the materials used form the composite, the composite use used with either the film side the nonwoven side positioned adjacent the wearer personal care absorbent article applications. Beyond the area personal care products, the material the present invention has many other uses, not the least which material which can used the construction absorbency pads surgical drapes, etc. Given the excellent absorption rates for menses which blood-based fluid, the material the present invention would well-suited for use about the inches some surgical drapes contain and sterile fields.

The quilted film laminate the present invention includes film layer and substrate layer joined one another plurality spaced-apart bond points which can created by using heat and pressure adhesives. The film contains plurality small generally parallel slits. Once the two layers have been bonded together, the composite caused recover one several different processes thereby creating plurality perforations the film layer which relate to, above and below the general plane the film layer. Depending upon the degree retraction and then the degree stretching positioning the composite, the slits defined the film layer will tend open thereby creating plurality openings apertures which extend vertically rather than horizontally with respect the plane the film, and which also will relate to, above and below the general plane the film layer.

Personal care absorbent articles will typically comprise body side liner and back side liner with absorbent core disposed therebetween. The quilted film laminate the present invention can used the body side liner for such personal care absorbent articles provides great bonds liquids and resistance sweat. Examples such personal care products include, but are not limited to, feminine napkins, diapers, training pants, incontinence garments, bandages and the like. such applications, oftentimes desirable mask the absorbed fluid provide more aesthetically appealing product once has been soiled. For this purpose, the film layer can contain opacifying agent such titanium dioxide weight percent from about about percent based upon the total weight the film.

The process for forming the quilted film laminate involves placing film layer defining plurality generally parallel slits generally face-to-face relationship with substrate layer and then bonding the film layer the substrate layer form composite. To form the perforations the film layer, least one the film and/or substrate layers caused retract thereby forming the perforations and also creating plurality openings formed by the slits which relate to, above and below general plane defined the film layer. The perforations the film layer can imparted several different ways. One method by stretching the substrate layer prior the bonding the substrate layer the film layer. After the two layers are bonded one another, the stretching forces are released and the substrate layer retracts thereby forming the perforations and the openings the slits. second way forming perforations force one the two layers from heat shrinkable material. Once the two layers have been bonded one another, heat one applied the composite thereby activating the heat shrinkable layer and

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creating retract which runs across the pockets and openings form. addition, either one both the two layers can stretched and the stretching can the same different directions cross the pockets the composite. Lastly, heat shrinkable material can used with stretched material thereby combining the processes for forming the pockets and openings.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. perspective view liquid permeable, quilted film laminate according the present invention.

FIG. perspective view liquid permeable, quilted film laminate according the present invention.

FIG. cross-sectional side view liquid permeable, quilted film laminate according the present invention.

FIG. photomicrograph liquid permeable, quilted film laminate according the present invention.

FIGS. through are examples slit patterns which can used for the film layer the liquid permeable, quilted film laminate according the present invention.

FIGS. and are schematic views two processes for forming the liquid permeable, quilted film laminate the present invention.

## DETAILED DESCRIPTION OF THE INVENTION

The present invention discloses quilted film laminates. The laminate designed liquid permeable thereby making suitable for wide variety uses including, but not limited to, floor material for personal care products including feminine pads sanitary napkins, diapers, training pants, incontinence garments, bandages and the like. addition, the laminate could used the construction mops and pockets pads, wipers and absorbents general. Other applications would include fluid management materials for health care applications such sheetcloth for use around the lesion prone surgical drapes, made oleophilic, the laminate the present invention could also be used the construction oil absorption materials. The foregoing list uses should considered illustrative only other uses also contemplated within the scope the present invention.

Referring FIGS. through the quilted film laminate the present invention includes film layer and substrate layer joined one another plurality spaced-apart bond points 16. As can seen FIGS. and the film layer contains plurality slits 18, the nature which will described further detail below. After bonding has been completed, the laminate composite assumed retract thereby forming plurality pockets. "Pockets" "pathway" are indicated material composite which extend above and below the general plane the film layer. Depending upon the degree retraction and thus the degree gathering performing the composite 10, the slits defined film layer will tend open thereby creating plurality openings 23 which can also been seen the photomicrograph FIG. An imaginary center plane can defined generally equidistant between the upper and lower surfaces the performed film layer 13. With this plane acting reference point, the openings inside above and below this central plane thus creating openings multitude vertical heights within the thickness the overall composite 10. As will shown the examples and data below, the resultant material when used body side liner material cover for personal care products provides good intake liquids and resistance wet.

The film layer can made from number polymers including homopolymers, copolymers and blends polyolefins, nylons polyesters, polyesters and the like. The particular polymer selection can influenced the desire for particular attributes including strength, softness and opacity. For personal care product applications, film thicknesses will typically range between about 0.4 and about 2.0 mils with mils being most desirable. should noted, however, that larger smaller film thicknesses are also contemplated within the scope the present invention depending upon the end use.

Certain end use applications such sanitary napkins require that the body side liner cover material skin contact body exudates impart cleaner and dryer appearance. To increase matching opacity, additives such pigments, fillers and other materials, collectively referred opacifying agents, may added the film. Examples opacifying agents would include titanium dioxide (White-rutile grade), titanium dioxide complexes (yellow, buff, green, and blue) iron oxides (red, yellow, tan and black) ultramarines blue and green, cobalt complexes (blue and turquoise), iron blue and chromic green, lead chromates and molybdates (yellow and orange) cadmiums (yellow, orange and red), calcium carbonate, carbon black, phthalocyanines (blue and green) and quinacridones (red and magenta). For sanitary napkin applications has been found that adding between about and about percent by weight opacifying agent such titanium dioxide the film, based upon the total weight the film, will enhance the matching ability the film. should noted, however, that larger smaller quantities opacifying agents can added depending upon the particular end use.

Many polymers used make the film layer are naturally hydrophobic which may make them suitable for certain end use applications. other applications, such personal care products, the quilted film laminate the present invention employed cover material, more desirable that the film layer be hydrophilic. As result, internal surface treated wetting agents can added the film layer make the film layer hydrophilic. Such wetting agents and their use with films are well known those ordinary skill the art.

Many desirable impart other properties characteristics the film layer 12. As result, other additives can incorporated into the film layer impart such properties characteristics. For example, possible create films which are breathable, thereby permitting the film layer pass water vapor from one surface through the other, even between the openings.

To permit fluid transport through the composite 10, the film layer provided with plurality slits 18. The slits are distinguishable from apertures in that when making the slits the film 12, little material removed when cutting through the film layer. As result, slit film, within expanded state, provides limited visibility through the slits when the film flat. As shown FIG. 1, the slits are provided pairs which are generally parallel one another. By "generally parallel" meant that the intersection the axes the slits forms interior angle which less than equal 45° Referring FIG. the pairs slits are provided staggered rows with the axes these slits and pairs slits being generally parallel one another due their stagger. the axes general direction.



FIG. the pairs slits are provided herringbone design.

Other slit patterns are also contemplated within the scope the present invention. Several such patterns are shown FIGS. through FIG. these shows plurality slits which have alternating perpendicular pattern. such configuration there are plurality pairs slits 18a, 18b and 18a' 18b' which are generally parallel one another yet separated transversing slits.

FIG. depicts plurality V-shaped slits 18a, 18b and 18a' 18b' which each respectively intersect pairs 18c and 18c' this configuration, can seen that slits 18a and 18c are generally parallel one another as 18b and 18b'

FIG. the slits form series X's cross hatches. See for example, slits 18a, 18b and 18a' 18b'. Again with this configuration can been seen that there are pairs generally parallel slits including pairs 18a, 18c and 18b, 18b.

FIGS. and these are shown, respectively, horseshoe-shaped slits and crescent-shaped slits. The horseshoe-shaped slits FIG. can viewed having two curved sides 18c and 18b which are joined one another. Normalized axes 19a and 19b can drawn through the respective legs 18a and 18b the horseshoe-shaped slits and examination these two axes would indicate that the two sides 18a and 18b are generally parallel one another given the present definition. The same type normalized axes 19a and 19b can drawn through the crescent-shaped slits 18a and 18b FIG. and examination these axes again indicates that the pairs slits 18a and 18b are generally parallel one another.

The advantage slits various apertures sheet and one applications resides the ability vary the degree opening the film layer through stretching and retraction. The degree appearance of the film layer and thus the composite will depend upon the number slits and the length the slits well the degree stretching the film and the amount performing gathering the overall composite 10. The slit density can defined the average total slit length per unit area and can measured each units total inches per square inch. While the slit density can varied for particular end-use application, has been found that for personal care absorbent articles and sanitary napkins particular, the slit density should be least five total inches per square inch (cm/cm²). Below this number, there are insufficient openings created when the composite gathered allow for effective transport body exudates such sources and urine through the composite 10. Care should taken however balance the number slits with the strength the film excessive slitting can result composite which tears under very little stress.

Bonded the slit film layer substrate layer which can provide extra strength, bulk and caliper the overall composite 10. Focus for standpoint economics, can the less costly materials for the substrate fibrous nonwoven web, believed possible, however, use other materials for the substrate layer including films, foams, knitted materials, woven materials, scrim and netting. Bonding the film layer the substrate layer 14 may accomplished any number ways including, but not limited to, pressure, heat and pressure, ultrasonic bonding, adhesives, stitching, matching and the bonding elastic threads with without adhesives between the two layers well combinations the foregoing. Those the most efficient ways bonding the layers together are ultrasonic bonding, adhesives (hot-melt, water-based and solvent-based) and thermomechanical bonding such through the use heated and patterned bonding rolls. Whatever bonding process chosen, the resultant nonwoven should have sufficient longevity such that one expanded from first original length second and retracted length and then, after handling, retract third length which less than the second stretched length.

present case product applications, when contemplating cover materials, nonwoven substrates more web particularly well. With slit fibrous nonwoven laminates, it possible use the composite body side liner with either surfaces facing the wearer. Due the differences fluid properties various body exudates, been found that film side up configurations work well for nonwoven webs nonwoven side up configurations work well for diapers though either configuration can used for other type body exudates and end use product. There appears be no apparent restriction the type fibrous nonwoven webs which can used make the substrate layer 14. The nonwoven webs may bonded carded webs, spunbonded webs, meltblown webs, air laid webs, wet laid webs and solution spun webs which may include composites blends of several types fibers including natural and synthetic. addition, other additives may incorporated into the nonwoven webs such as, for example, hydroxyl-functionalized polyolefins superabsorbent particulates and/or fiber forms.

Meltblown and spunbond fibrous nonwoven webs work particularly well materials from which fibers the substrate layer 14. Meltblown webs are made from fibers formed extruding molten thermoplastic material through plurality fine, usually circular die capillaries molten threads filaments into high-velocity heated air streams which attenuate the filaments molten thermoplastic material reduce their diameters. Thereafter, the meltblown fibers are carried the high-velocity gas streams and are deposited collecting surface form web randomly dispersed meltblown fibers. The meltblown process well known and described various patents and publications, including NRL Report 4364, "Manufacture Super-Fine Organic Fibers" V. Wendt, Boone and Finkelnburg: NRL Report 5265, "An Improved Device For the Formation Super-Fine Thermoplastic Fibers" Lawrence, Lohse and Young; and Pat. No. 3,849,241, issued Nov. 19, 1974 Buntin.

Spunbond nonwoven webs are made from fibers which are formed extruding molten thermoplastic material filaments from plurality fine, usually circular, capillaries spinneret with the diameter the extruded filaments then being rapidly reduced, for example, by non-eductive eductive fluid-drawing other well known spunbonding mechanisms. The production spunbonded nonwoven webs illustrated patents such Appel, et al., U.S. Pat. No. 4,340,563, Dorschner et al., U.S. Pat. No. 3,692,618; Kinney, U.S. Pat. Nos. 3,338,992 and 3,341,394; Levy, U.S. Pat. No. 3,276,944; Peterson, U.S. Pat. No. 3,502,538; Hartman, U.S. Pat. No. 3,502,763; Dobo et al., Pat. No. 3,542,615; and Harmon, Canadian Patent Number 803, 14.

particularly well-suited spunbonded nonwoven web for the substrate layer made from side-by-side polyethylene/polypropylene spunbond bicomponent fibers. The process for forming such fibers and resultant webs including such webs extruders for separately supplying both the polyethylene and the polypropylene bicomponent spinneret. Spinnerets for producing bicomponent fibers are well known in the art and fibers are not described detail herein.

general, the spinneret includes housing containing spin

pack which includes plurality plates having pattern openings arranged remote flow paths for directing the high melting and low melting polymers each flow forming opening the spinneret. The spinneret has openings arranged one more rows and the openings from downwardly extending curtain fibers when the polymers are extruded through the spinneret. As the curtain of fibers exit the spinneret, they are contacted quenching gas which heat partially quenches the fibers and develops latent helical crimp the extending fibers. Oftentimes the quenching air will be directed substantially perpendicular the length the fibers velocity from about 100 about 400 feet per minute temperature between about and about 80°F.

fiber draw unit aspirator positioned below the quenching gas receive the quenched fibers. Fiber draw units aspirators for use melispinning polymers are well known the art. Exemplary fiber draw units suitable for use the process include Rieter fiber aspirators the type shown U.S. Pat. No. 3,802,8 Maxwell and educative gun the type shown the U.S. Pat. No. 3,692,6 Dorschner and U.S. Pat. No. 3,423,266 Davies The fiber draw unit general has elongated passage through which the fibers are drawn aspirating gas. The aspirating gas may air gas, such air, that does not adversely interact with the polymers the fibers. The aspirating gas can heated the aspirating gas draws the quenched fibers and heats the fibers temperatures that surpassed activate the latent crimps thereto. The temperature supplied activates the latent crimping within the fibers will range from about 10° maximum less than the melting point the low melting component polymer which, this case, the polyethylene. Generally, higher air temperatures produces higher number crimps.

The drawn and crimped fibers are deposited onto continuous forming surface surface moisture, generally assisted vacuum device placed underneath the forming surface. The purpose the vacuum withdraw the undesirable scattering the fibers and guide the fibers onto the forming surface form uniform unbonded web bicomponent fibers. desired, the resultant web can lightly compressed compression roller before the web subjected bonding process.

To bond the bicomponent spunbonded web through-air bonder used. Such through-air bonders are well known the art and therefore need not described detail. the through-air bonder, flow heated air applied through the web heat the web temperature above the melting point the lower melting point component the bicomponent fibers but below the melting point the higher melting point component. Upon heating, the lower melting polymer portion of the web fibers are melted and the melted portions the fibers adhere adjacent fibers the crossover points while the high melting polymer portions the fibers tend maintain the physical and dimensional integrity the web.

The types fibers which can used make the fibrous nonwoven webs can include staple length fibers well multifibers and spunbond fibers which are longer length relative staple fibers. The fibers themselves may single polymer fibers multicomponent component fibers such bicomponent fibers including side-by-side, sheath/core and islands-in-the-sea type cross-sections. The fibers may hollow fibers well straight or bent. Addition, the fibers may have circular irregular cross-sections such lobular, trilobal, etc. The fibers may made from natural synthetic materials. Examples natural-based fiber materials include cellulose, cotton, rayon and wood pulp. Examples synthetic fiber materials include polyolefins, polyamides, polyesters and polyvinyl alcohol and include homopolymers, copolymers and blends.

Fiber sizes for the fibers making the fibrous nonwoven webs can relatively uniform can mixture various sizes fibers. For personal care product applications, fiber diameters the range about about thirteen can used. possible, however, within fiber sizes ranging from submicron several hundred microns depending upon the particular end use application.

The ratios the staple ratio will also bear upon the basis weight the nonwovens, however, born upon the basis weight most sufficiently great allow expansion and extension the nonwoven substrate layer gathering puckering not being caused solely the non heat-shrinkable material. Generally, basis weights between about 0.3 and 2.2 ounces per square yard (osy) (about and about grams per square meter (gsm)) will work for personal care product applications.

An important feature the present invention the gathers puckers caused by expanding one of the layers, bonding the layers together and then accounting the overall composite. Prior the bonding the two layers together, one the layers stretched expanded that once the two layers are joined, the laminate and especially the film layer puckers. The gathers puckers increases the overall surface area per unit area thereby making the composite thicker and more bulky and causing plurality the slits open the vertical direction thereby creating more effective passages for the transport fluids through the thickness the composite from one surface the other. These gathers puckers can created several different ways.

The first method involves stretching one the two layers one direction prior the bonding of the stretched layer the non-stretched layer. Once the two layers have been bonded one another the stretching tensional forces can released thereby causing the composite retract and gather puckers. Thus, for example, the substrate layer can stretched the machine direction and then bonded the film layer. Conversely, the film layer could stretched and then bonded the unstretched substrate layer. Addition, the substrate layer could stretched one direction as, for example, the machine direction (MD) while the film layer stretched another second direction such as, for example, the cross direction (CD). With both the layers their stretched forms, the two layers can then bonded one another and then allowed retract thereby causing gathering puckering least two directions.

second method inducing gathers puckers the spunbond composite involves making one the two layers from heat extensible heat shrinkable material. Examples such materials include oriented films that are not heat set and elastomeric materials made from resins including polyethylene, polyester, polyolefins and polyurethanes. this process, the heat shrinkable layer, whether film nonwoven, bonded the other layer and, once bonded, the composite subjected sufficient amount heat cause the heat shrinkable layer retract thereby causing the composite gather puckers. Here again, either the film layer the substrate layer can made heat shrinkable. One should when that the amount heat needed effect shrinking does not destroy the bonding between the layers.

Also another of inducing gathers puckers the composite involves stretching one the layers and bonding the other layer with the other layer being made from heat shrinkable material. Once the two layers are bonded, the tension the stretched layer can released and heat can applied the composite thereby providing two ways within the same composite for creating gathers puckers. desired, the direction retraction the heat shrinkable material can parallel with diagonal from the direction stretching the other layer provide gathering puckering one more directions.

fourth way inducing gathers puckers the composite contacted 18 the present invention would which the two layers together using elastic heat shrinkable threads. Once the stitching was complete, the elastic threads would retract thereby gathering and puckering the composite material 18.

fifth way inducing gathers puckers the material the present invention would one elastic threads sandwiched between and bonded the film layer and substrate layer 14. The elastic threads would stretched elongated prior their adhesive bonding between and the two layers. Once the bonding had been completed, the elastic threads would retract thereby gathering and puckering the composite material the present invention.

much the same way with the elastic threads, also possible inducing gathers puckers the composite material of the present invention through the use elastic heat shrinkable scrim sealing materials sandwiched between and bonded the film layer and substrate layer the present invention.

The degree gathering puckering of the composite 18, the least part, the degree retraction the composite, any one the foregoing processes, the composite will have first original length which greater than the second extended length and third retracted length which will less than the second length. Factors affecting the retraction will include the degree percent which stretched one heat shrink and/or the extent which particular layer can extended and whether not portion the extensible layers can regained upon release the tension the stretched layer. the present non-absorbent product was has been found that when making body side liner material, advantageous stretch fibrous nonwoven substrate layer approximately 20 percent beyond original unstretched length prior bonding the film layer 13. Once the two layers have been bonded together, the tension the fibrous nonwoven substrate layer released and the nonwoven layer retracts from second extended length portion original length. The degree recovery retraction dependent upon the recovery properties the substrate material well the degree bonding the composite, both which can impede complete recovery.

The degree bonding will effect the aesthetic properties the composite such feel and nonstickiness. The degree bonding will also effect the bulk the composite 18 well the delamination characteristics the composite 18. Generally, less bonds formed that small distance bond points provide better bonding strength while maintaining the bulk and three-dimensional surface topography. However, also possible use other bonding patterns such lines, and other geometric abstract designs well combinations the foregoing. When using adhesives, care should taken not bond the film too heavily the substrate layer this the case, then will difficult for the slits open up and form plurality openings.

Two of the previously described processes for forming the spunbond composite are shown FIG8. and 11. FIG. 10 depicts process for forming spunbond film/fibrous nonwoven laminate using ultrasonic bonding techniques while FIG. utilizes heat and pressure. Referring FIG. 10, there shown supply nonwoven material being unwound from supply roll 43. Unwound from similar supply roll 44 supply silt film which has previously been slit. The nonwoven substrate layer 48 passes through pair contoured S-wrapped rollers 48 driven heated spread that the substrate layer stretched the machine direction. the same time, the film layer sent through series spreader rolls 50 which function contoured surfaces which with rotational velocities. The spreader rolls are travelling speed which greater than The nonwoven layer 48 and the film layer 46 are brought into contact with one another between pattern roll 53 and ultrasonic horn where the two layers are bonded one another. the point bonding, the spread the nonwoven layer and the spread the film layer are the same. As result, the nonwoven layer bonded the film layer while the nonwoven substrate stretched condition with the degree stretch being function the spread differential between and After bonding takes place, the composite allowed retract thereby gathering and puckering the composite prior accumulation take roll 58.

FIG. 11, the same process and stretching techniques as used described above with respect the process shown FIG. 10, the only difference being the method bonding the two layers and together. FIG. 11, the ultrasonic horn replaced with heated anvil roll which together with the pattern bond roll 53 serve bond the two layers 48 and together.

Having described the materials and process for forming the quilted film laminate the present invention, series examples were prepared demonstrate the present invention. addition, series tests were performed determine the functional properties the resultant materials. These examples, test procedures and results are presented below.

## TEST METHODS

series tests were performed on the materials the present invention including Frazier porosity, trapezoid tear, tensile rate, sweat, run-off, thickness and surface smoothness.

Air permeability was measured using the Frazier porosity test. Air permeability the rate air flow through material under pressure differential between two fabric surfaces. Samples were tested Frazier Air Permeability Tester available from Frazier Precision Instrument Company Gaithersburg, Md. The procedures used conformed the specifications Method 5450, Federal Test Methods Standard except that the specimen size was inchesall inches (20.3x20.3 cm) rather than inches(7 inches 3x cm). The larger size made possible access that sides the specimen extended well beyond the retaining ring and facilitated clamping the specimen securely and evenly across the orifice. the procedure, air was drawn through the specimen and calibrated orifice using inclined tube. By controlling the speed the fan, the rate air flow through the fabric was adjusted obtain pressure differential 0.5 inches (1.3 cm) water between the two surfaces. The amount air flowing through the specimen was determined from the drop pressure across calibrated orifice indicated by vertical oil manometer. This reading

was converted air flow rate using conversion table provided by the manufacturer the instrument. The results were expressed cubic feet air per square foot specimen per minute cubic centimeters per square centimeter per second. The higher the number, the more permeable porous the material.

To test the tear strength the materials, trapezoid tear test was conducted. This test was measure the tearing strength material materials when necessarily increasing load was applied parallel the length the specimen. The test uses mechanical constant rate extension tester such Instron, model TM available from Instron Corporation Canton, Mass. Thwing-Albert, Model INTELLECT tester available from Thwing-Albert Instrument Company Philadelphia, Pa.

The procedure was performed accordance with the specification ASTM Standard Test Method with the exception that the tearing load was calculated the average the first and highest peaks recorded rather than was the lowest and highest peaks. An outline of a trapezoid was drawn inches inch cm(15.2 cm) specimen (the longer dimension the direction being tested) and small, preliminary cut was made the shorter the parallel sides. The specimen was clamped along the non-parallel sides the trapezoid with the cut halfway between the clamps. continuous load was applied the specimen such that the tear propagated across the specimen width. The force required completely tore the specimen was recorded on chart. The results were expressed pounds kilograms and higher numbers indicated greater resistance tearing load, therefore, stronger material.

The surface smoothness material another important feature material the material used body contacting layer the cover with the present material when used liner for sanitary napkin. The surface smoothness the materials described herein was tested measuring the coefficient friction the surface when contacted with another plate drawn across the surface the material. Values between materials were then compared establish relative scale for purposes evaluation. Higher coefficients friction accompanied rougher surfaces.

Fluid run-off test was performed measure the ability material absorb liquid. Individually each sample the material was placed 30" inches and 3cm synthetic menstrual fluid was then applied the surface were second packet. The amount fluid which was not absorbed and therefore ran off the end the sample was measured grams. The lower the gram reading and then the run-off, the higher was the degree absorption the material.

The absorption time test indicated the intake rate for material using synthetic menstrual fluid, inch by inch sample the test material was insulted with 10cc synthetic menstrual fluid delivered from fluid reservoir having inch 0.5 inch delivery slot. The three absorb fluid was then measured materials. lower absorption time measured materials was indicative faster intake rate for the particular material.

Once material has been insulted, was also important measure the amount rewet that took place. The wicks combination the synthetic menstrual fluid were delivered the test specimen from reservoir having inch 0.5 inch delivery slot. Next blotter was placed top the specimen and one pound per square inch pressure was applied for period minutes. After the minutes interval, the blotter paper was removed and weighed and the amount



rewetted fluid absorbed the blotter paper was measured grams. Higher values were indication greater degree rewet for the particular material tested.

The adhesion level between the film layer and the substrate layer also important. To measure the adhesion level kilograms per square inch between the two layers, adhesion test was performed. For each sample, the cohesive force inch square sample was measured using Chatillon Digital Force Gauge Model DFI 50 from John Chatillon and Sons, Inc., Greensboro, N.C. The device has pneumatically operated base plate mounting holes by inches and one inch square top plate which was connected digital force gauge. Double-faced adhesive tape was applied both the base plate and the top plate and inch inch sample material was positioned on top the inch inch base plate. The tape used cover the surfaces both the base plate and top plate was Scotch® Brand double-coated pressure-sensitive tape number 465, which available inch and 3-inch widths. The 3-inch width tape was used for the base plate and the inch wide strip tape was used for the top plate. Once the sample had been placed top the base plate, the base plate and sample were compressed for period seconds under pounds per square inch. After seconds, the pressure was released. The digital force gauge was then activated and the sample was compressed between the base plate and top plate 60 psi for period seconds. Next, the base plate was drawn away from the top plate and the separation force was measured kilograms per square centimeter. The amount force required separate the laminate was then recorded.

To measure the Rewet Back back the material which reduce the thickness the material, five inch five inch rectangular sample material were compressed under load of 0.05 pounds per square inch and the thickness the material was measured while the sample was under compression. Higher numbers indicated thicker, more bulky materials.

## EXAMPLE

Samples series samples were prepared demonstrate the present invention and properties. The film and nonwoven substrate layers were the same for each sample with the basis weight and fiber size the nonwoven web being the variable. With samples the film layer was mil polyethylene film made Edison Plastics Company Plainfield, N.J. containing approximately 4% weight titanium dioxide opacifying agent based upon the total weight the film. The film was slit using pair matched razor/blade steel pattern/anvil cutting rolls. Pair slits were cut into the film the pattern shown FIG. Each slit was 165 inches (4.3 cm) length. The spacing between slits pair was 0.035 inches (0.9 cm) and the spacing between each pair slits lying along the same horizontal line row was 0.145 inches mm). Vertically, between adjacent pairs slits columns, the pairs slits were spaced 0.015 inches (0.4 cm) apart. As will readily appreciated, the film can slit then stretched and then annealed into the composite process. The film had slit density inches slits per square inch 48 cm/cm²) film.

The substrate layer Examples was fibrous thermoplastic spunbonded web made the manner described above. Fiber sizes ranged between and denier (21 and 28.3 microns) and the fibers due the use the spunbond





process were essentially continuous length. By "continuous" meant that the units fiber length which approached infinity. The thermoplastic fibers were side-by-side construction using polyethylene and polypropylene. The polyethylene was Grade from Dow Chemical, U.S.A. Midland, Mich. and the polypropylene was Grade 3445 from Hercules Chemical Company Darlen, Conn. Basis weights ranged between and ounces per square yard (oxy) (34-3 gms) and the webs were through air bonded.

The nonwoven substrate layer was treated with 1.3488 surfactant from Union Carbide Danbury, This non-ionic surfactant wetting packaging which references U.S. Pat. No. 3,037,36 The surfactant was added spray form and the treated nonwoven web had add on of 0.4 percent surfactant based upon the total dry weight the nonwoven web.

Prior bonding the two layers together, the nonwoven layer was stretched between and percent due the speed differential the rolls. Into the process description above. As example, material that was originally 00 inches (254 cm) length and which was then stretched inches (305 cm) treated stretched percent.

$$\frac{\text{stretched length} - \text{original length}}{\text{original length}} \times 100 = \text{percent}$$

$$\frac{305 - 254}{254} \times 100 = 20\%$$

The film and substrate layers were point bonded one another using conventional ultrasonic equipment from Branson Sonic Power Corp Danbury, Conn. using model 2001 series bonder. The relative energy was and the line speed the point bonding was feet per minute (1. meters per minute). Total bond area per unit area material was eight percent with approximately bond points per square inch (4.34 points/cm²). The gap existing between the horn and anvil was 0.010 inches (0.3 mm).

Once the film and nonwoven layers were bonded one another, the nonwoven substrate layer was allowed relax thereby causing the composite gather pucker which turn caused plurality the slits vertically open up and form pocks for greater transmission liquids through the composite. After the composite was formed was then hand sprayed the exposed film surface with the same surfactant used the nonwoven layer add level 0.4 percent on dry weight basis, based upon the total weight the film. The compositions the samples are listed Table below.

TABLE

| SAMPLE | FILM THICKNESS (mils) | NONWOVEN FIBER SIZE (microns) | BASIS WT. (oz/yd) | STRETCH (%) |
|---|---|---|---|---|
| | | 20.7 | | |
| | | 20.7 | | |
| | | 21.5 | | |
| | | 21.5 | | |
| | | 21.5

intake time for g was quantity fluid. The samples were tested for fluid intake time (cc), rewet (cc) and fluid run off (cc) using "Z-Date" synthetic menstrual fluid containing, weight percent basis, approximately 81.5% water, 1.8% polyvinyl pyrrolidone and 1 7% salts, coloring agents and surfactants. It has viscosity centipoise and surface tension 51.3 dynes per centimeter. The results are given Table below. As shown the data Table below, intake rates for "Z-DATE" synthetic menstrual fluid were the average less than seconds. Once the synthetic menses had been absorbed, the rewet was less than 0.5 grams.

TABLE

| SAMPLE | INTAKE (sec) | REWET (grams) | RUN-OFF (grams) |
|---|---|---|---|
| | 18.14 | 0.36 | |
| | 7.42 | 0.32 | |
| | 8.88 | | |
| | 3.68 | | |
| | | | |
| | 6.52 | 0.13 | |
| | 3.57 | 0.02 | |
| | 8.33 | 0.08 | |
| | | 0.37 | |
| | 10.33 | 0.44 | |
| | 7.83 | 0.38 | |
| | 3.67 | 0.14 | |
| | 3.57 | | |
| | 7.52 | | |
| | 8.48 | | |
| | 5.38 | 0.28 | |
| | 10.03 | 0.39 | |
| | 7.33 | 0.38 | |
| | 7.84 | 0.38 | |
| | 6.38 | | |
| | 8.34 | 0.36 | |
| | 7.33 | 0.33 | |
| | 6.88 | 0.39 | |
| | 8.77 | | |

Overall the material the present invention performed very well cover material for the body side liner/absorbent pad with the film positioned adjacent the wearer. The film layer was soft the touch and the composite provided excellent intake the synthetic menses and simulant rewet. Generally for grams Z-date added, less than percent the initial liquid covered the surface. addition because the intake rate was good, very little liquid ran off the pad.

believed that this excellent performance was due the openness the film the "Z" direction and the embossing, three-dimensional surface with the film resulting multiplicity places provide good fluid flow into the nonwoven layer below. addition, because the openings the film layer were primarily the "Z" direction opposed the X- plane the film, stain masking was also good. The lofty, low density nonwoven layer below the film surface provided temporary storage the fluid while was being absorbed into the absorbent core. Furthermore, the nonwoven layer acted means for separating the user from the absorbent core.

Caliper bulk measure the thickness material. While again depending upon the particular end use application, for personal care applications subject least about 0.025 inches (0. mm) are desirable percent rewet the film layer already absorbed material contained within the absorbent core the personal care structure.

For personal care product applications, the composite should have sufficient strength and integrity against delamination not delaminate; otherwise bunch down during use. As result, delamination values should exceed kg/cm² Typically such applications the composite will have longitudinal tear strength least about 0.5 lbs. (0.23 kg) both the machine and cross-directions relative the machine and cross-direction the nonwoven substrate layer.

EXAMPLE

Example four samples materials according the present invention were prepared and compared against two controls. The first control was KOTEXⓇ Maxi Pad sanitary napkin manufactured the assignee record. The napkin had polypropylene spunbond nonwoven cover. The second control was ALWAYSⓇ sanitary napkin manufactured the Procter and Gamble Company Cincinnati, Ohio. The ALWA SⓇ sanitary napkin had spunbond film cover.

The film layer for four samples the present invention was the same that used Example The substrate layer was the same type that used in Example fibrous spunbond bicomponent nonwoven web using darker polyethylene/polypropylene side-by-side bicomponent fibers. The basis weight the fibrous nonwoven web was 0.8 ounces per square yard (27 gms) and the web was thermally bonded.

Prior the bonding the film and fibrous nonwoven layers, the nonwoven layer was stretched the machine direction elongate The degree neck stretch shown Table IV below was calculated using the formula below:

$$\frac{\text{Original width} - \text{Final width}}{\text{Original width}} \times 100 = \text{neck stretch}$$

As can seen from Table IV below, samples had stretching the nonwoven layer. Samples and were made using increased degrees stretch represented the values and 40%.

The film and substrate layers were bonded one another using heat and pressure via pair patterned and smooth bond rolls. The patterned roll was heated 140° (60° C.) and the smooth roll was heated 60° (71 C.). The bond pressure the nip was pounds per square inch (5.8 kg/cm²) and the two layers were bonded one another rate feet per minute (feet/min) using pattern bond pattern with overall bond area 8%. Once the composites were made, the exposed sides the nonwovens and film layers were hand sprayed with surfactant solution Cloralen RM-33 surfactant from Pilsonna, Inc. Harwood Park, N.J. add-on 0.6% based on the weight the composite.

Once the samples were prepared, they were placed the KOTEXⓇ Maxi Pad chassis and compared the two controls. The KotexⓇ Maxi Pad had plastic film the outer cover baffle material and 0.4 oz/yd polypropylene spunbond fibrous nonwoven liner which was removed and replaced with samples the present invention. The positioning the absorbent core element the liner comprised six plies cellulosic tissue body wadding each which weighed grams. Below this layer there was single layer gram fibrous which accounted 5.84 grams fluff batt having density 0.07 grams/cc. For samples through the overstock from the KOTEXⓇ Maxi Pad fluid/skin pad was removed and pieces of the sample materials were laid on top the pad with gluing. The fibrous nonwoven layer was positioned adjacent the absorbent core. The samples the



present invention and the controls were then tested for bulk, intake rate, rewet and run-off. The results are shown Table below.

TABLE

| SAMPLE | LINER | Sheath | BULK (mm) | INTAKE RATE (sec) | REWET | RUN-OFF |
|---|---|---|---|---|---|---|
| | Fiber/PP | | 13.0 | 0.87 | 0.6 | |
| | Fiber/PP | | | | 0.0 | |
| | Fiber/PP | | | 0.86 | 0.0 | |
| | Fiber/PP | | 3.2 | 0.86 | 0.0 | |
| CONTROL | KOTEX | 0.35 | 14.8 | 1.38 | 3.9 | |
| | pad | | | | | |
| CONTROL | ALWAYS | 0.35 | 9.0 | 0.38 | 0.4 | |
| | pad | | | | | |

As can seen from Table IV, the bulk increased with the increase the percentage stretching the fibrous nonwoven web substrate layer. As the percent stretching the nonwoven layer was increased color bonding the two layers, the resultant pattern the surface the composite and particular the film layer was also increased. As result, there was dramatic decrease the amount time needed pass the synthetic menstrual fluid through the coversheet. The KOTEXⓇ Maxi Pad sanitary napkin control took seconds absorb the fluid. The ALWAYSⓇ pad control took seconds absorb fluid. The nonstretched film nonwoven laminate took seconds but once stretch was imparted the material was the case samples and the intake time dramatically decreased low value 3.2 seconds which was third the three needed absorb the same amount liquid with respect the KOTEXⓇ Maxi Pad control.

The amount rewet was also dramatically decreased with the material the present invention. The KOTEXⓇ Maxi Pad control exhibited .30 gram rewet and the ALWAYSⓇ pad exhibited 0.3 gram rewet whereas the samples the present invention had values less than one tenth gram. Thus, one here sees that the quilted film laminate of the present invention can used coversheet which dramatically increases intake time and reduces the amount fluid that ultimately wetted the surface.

run-off test was also performed accordance with the test procedures described above. Relative the KOTEXⓇ Maxi Pad control, one sees that there was dramatic decrease the amount fluid which ran off the surface the pad due the three-dimensional surface which translates into coversheet which should result lower leakage for the user.

EXAMPLE

Example three samples according the present invention were prepared of which used the same substrate layer. The substrate layer was made the same fibrous Examples and using darker polyethylene/polypropylene side-by-side bicomponent fibers. The substrate layer had basis weight ounces per square yard gms) and was treated with 0.4% the same surfactant used Example

The variable Example was the film layer. For sample the film layer was mil thick polyethylene film containing 4% weight titanium dioxide made Edison Plastics Plainfield, Example was mil thick low density polyethylene film made from total weight percent basis, 70% NA306 low density polyethylene from Quantum, Inc. Wallingford, Conn. and 24% pigment which contains 12% by weight titanium dioxide from Ampacet Company Mount Vernon, Example was mil elastomeric copolymer film made from 76% weight Hiscoat KS072 resin and 24% weight the pigment. The Hiscoat KS072 resin available from Hiscoat, Inc. U.S.A. Whitehouse, Del. Each these films was stretched the same manner the film used Example Prior bonding, the substrate layer for each the samples was stretched and then bonded the film layer with the percent stretch equaling 30% for three samples. The composites once formed were hand sprayed with 0.4% weight the Union Carbide 2428 surfactant the exposed film side each the samples. The controls for Example were the same described Example For samples through the coversheets KOTEXⓇ Maxi Pad was removed and replaced with pieces the three samples the same fashion with the previous examples. All three samples plus the two controls were then measured for bulk, porosity, adhesion between layers, CD tensile test, intake rate, rewet, run-off values and surface smoothness. The results these tests are shown Table below.

TABLE

| SAMPLE | BULK (mm) | POROSITY (sec/cc) | ADHESION (g/inch²) | CD TEAR (kg) | Intake (sec) | Rewet | Run-off |
|---|---|---|---|---|---|---|---|
| | | 1.76 | 0.35 | | 4.3 | 0.10 | |
| | | 1.39 | 0.28 | | | 0.14 | |
| | | 1.55 | 0.26 | | | 0.12 | |
| KOTEX CONTROL | 0.35 | | | | 14.8 | | |
| ALWAYS CONTROL | 0.35 | 793 | | | 9.0 | 0.38 | |

Adhesion values were not obtained for the controls they were single layer cover materials. As can be seen from the data Table the three samples according the present invention were bulkier than either the controls. Their CD tensile tears, intake rates, rewet and run-off values surpassed both of the controls. Adhesion levels for samples and were good but sample this particular case was too sticky. The surface smoothness for the film surfaces the composites were acceptable. Each the composites was soft the touch and had cloth-like feel. Based upon Example should noted that the smoothness and cloth-like feel the laminate was altered based upon the film polymer selection. Sample (elastomeric copolymer film) was smoother than Sample (LDPE film) which turn was smoother than Sample (PE film).

EXAMPLE IV

Example the film and substrate layers used were the same Example The difference between Example and Example was the slit pattern used slit for film layer. Example hexagonal design similar that shown FIG. was used. The hexagonal design yielded average slit length per square inch 16.5 inches² (6.4 cm/cm²). addition, opposed using heat and pressure bond the film and substrate layers together, Example process per square meter 34.5341 hot-melt adhesive from the National Starch Company Cincinnati, Ohio was applied continuous spray pattern across the width the nonwoven layer. Prior bonding the two layers together, the film layer was stretched the machine direction and the percent stretch was calculated 5%. After forming the sample, was hand-sprayed with 0.6%, based upon the dry weight the composite, with Gantrez ES4-33 surfactant the exposed sides the film and substrate layers. Fluid handling properties including bulk, intake and rewet rates were measured and are given below Table VI below. Relative the two controls, the sample Example had much better intake rate and far less rewet. addition, there was cut-off synthetic sources with the hexagonal slit design. Lastly, should noted that the same good fluid handling properties were achieved using adhesively bonded-coated composite instead thermally bonded composite.

TABLE VI

| SAMPLE | BULK (mm) | INTAKE (ml) | REWET | RUN-OFF |
|---|---|---|---|---|
| | | | 0.23 | |
| SUTER CONTROL | 0.38 | 16.0 | 1.20 | |
| ALBAYE CONTROL | 0.32 | | 0.20 | |

Having thus described the invention shall should appreciated that various modifications and changes can made the present invention without departing from the spirit and scope the following claims.

We claim:

process for forming quilted film laminate comprising:

placing film layer defining plurality generally parallel slits generally face-to-face relationship with substrate layer

bonding said film layer said substrate layer form composite,

causing least one said film layer and said substrate layer retract from plurality pockets said film layer with plurality said slits defining openings which match shown and below central place defined said film layer.

The process claim 1 wherein said substrate layer heat-shrinkable and said composite heated retract said heat-shrinkable substrate layer and form said plurality pockets.

The process claim wherein said film layer stretched prior the bonding said film layer said heat-shrinkable substrate layer.

process for forming quilted film laminate comprising:

stretching substrate layer,



bonding film layer defining plurality generally parallel slits therein said substrate layer form composite,

retracting said substrate layer from plurality pockets said film layer and plurality said slits define openings said film layer with said slits matching in, shown and below central place defined by said film layer.

The process claim wherein said substrate layer stretched least two directions before being bonded said film layer.

The process claim wherein said film layer stretched in first direction and said substrate layer stretched second direction before said bonding step.

The process claim wherein said film layer stretched prior bonding said film layer said substrate layer.

quilted film laminate comprising:

film layer defining plurality generally parallel slits, said film layer further defining central plane,

substrate layer bonded said film layer form composite, said composite having plurality pockets,

said slits defining plurality openings said film layer which match shown and below said central plane.

The quilted film laminate claim said substrate layer bonded said film layer plurality spaced apart bond sites.

10. The quilted film laminate claim wherein said substrate layer fibrous nonwoven web.

11. The quilted film laminate claim wherein said film layer scratch opacifying agent.

12. The quilted film laminate claim wherein said opacifying agent titanium dioxide and present said film layer weight percent from about about percent based upon the total weight said film layer.

13. The quilted film laminate claim wherein each said slits said film layer define slit length and wherein said film layer defines total slit length per square inch said film layer least inches per square inch.

14. The quilted film laminate of claim wherein said fibrous nonwoven web includes plurality bicomponent fibers.

15. personal care absorbent article comprising body side liner and back side liner with absorbent core disposed therebetween, said body side liner comprising the quilted film laminate claim

16. The personal care absorbent article claim wherein said personal care absorbent article handsheet napkin.

The personal care absorbent article claim wherein said personal care absorbent article diaper.

18. The personal care absorbent article claim wherein said personal care absorbent article training pant.

19. The personal care absorbent article claim wherein said personal care absorbent article incontinence garment.

20. The personal care absorbent article claim wherein said personal care absorbent article bandage.

21. angled design wherein least portion said angled design comprises the quilted film laminate claim