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93 24
SUPERINDUSTRIA Y COMERCIO
Radiación: 03107459
Fecha (PMD): 2006-02-06 17:11:37
Trámite: 011 PCT-PATENT 379 FASE NACI 5-0 PETICION
Dependencia: SIN DIVISION DE NUEVAS CREACIONES
Folios: 2

Trámite : 011
Evento : 379
Actuación : 538

Referencia : Expediente No. 03.107.459
Asunto : Solicitud de patente para **LAMINADO HECHO DE CAPAS FIBROSAS.**
Solicitante : **SCA HYGIENE PRODUCTS AB**
Fecha de Solicitud : 5 de diciembre de 2003

1. Yo, Emilio FERRERO, identificado como aparece al pie de mi firma, actuando como apoderado en el asunto de la referencia, atentamente, solicito se efectúe el examen de patentabilidad de la solicitud en referencia presentada de acuerdo con el Capítulo II del PCT y según lo establecido en el artículo 44 de la Decisión 486 de la Comisión de la Comunidad Andina. Para tal efecto presento junto con este escrito el recibo No. 06-7,453 por valor de \$ 194.000.00, que corresponde a la tasa fijada según lo dispuesto en la resolución No. 35582 de 28 de diciembre de 2005.

2. Ruego atentamente a la Señora Jefe se sirva ordenar que se anexe este recibo para que se efectúe dicho examen y se continúe con el trámite de la solicitud.

Bogotá, 06 FEB. 2006
Señora Jefe,


EMILIO FERRERO
T.P.A. No. 31.929

COLO 11256-841-031-3
ZCA/ASG/ID-001438/WPC11256

N I T. 860.041.367-3

Colo 11256-841-031-3

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

RIT 800174009-2

RECIBO OFICIAL DE CAJA 06 - 7 433
FECHA ENERO 30 DE 2006

Superintendencia de Industria y Comercio
Subsección Gastos 8000000
Fecha 2006-02-06 17:11:37
Item 001 PLE-PRIMO 3/5 FINE NULI 500 PEIACOM
Observación 2do DEVENIR DE MARCA ORACIONES

CONSIGNACION

DEPOSITANTE	TIPO PAGO	BANCO	CUENTA	Nº PAGO	FECHA PGO	Vr PAGO
CAVELIER ASSOCIADOS	CONSIGNACION	BANCO POPULAR	050-00110-6	36494410	30/01/2006	43 526 000 00

CONCEPTO

CANT	DESCRIPTIVO	CONCEPTO	TOTAL CONCEPTO
1	50005 01-01 SOLICITUDES	114 PTC CAP 11 EXAMEN DE PATENTIBILIDAD	194 000 00
		TOTAL	194 000 00

SON CIENTO NOVENTA Y CUATRO MIL PESOS

RESPONSABLE

RECIBO DE CAJA APLICADO AL EXPEDIENTE Nº

En 11756-841-031-3

DIVISION DE NUEVAS CREACIONES

RADICACIÓN EXPEDIENTE No. 03-107450

**EL EXTRACTO DE LA PRESENTE SOLICITUD DE PATENTE DE INVENCION -
PCT FUE PUBLICADO EN LA GACETA DE PROPIEDAD INDUSTRIAL No 555,
DE FECHA 31 DE AGOSTO DE 2005, EL TERMINO HABIL SEÑALADO POR
LA LEY EXPIRA EL 28 DE NOVIEMBRE DE 2005.**

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** ☒

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

2020

Bogotá, D. C., 21 de Diciembre de 2006

Doctor

EMILIO FERRERO

Representante **SCA HYGIENE PRODUCTS AB**

ASUNTO

Radicación No. 03-107459
Trámite 002
Evento 001
Actuación 430
Oficio 14895
Folios 058

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 23 a 47 de la solicitud en estudio.
- b) Para el presente estudio se tendrá en cuenta el capítulo reivindicatorio que comprende 13 reivindicaciones en los folios 48 a 51 de la solicitud en estudio.
- c) 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 5 de diciembre de 2003, y en el momento de la radicación se presentó como solicitud PCT FASE NACIONAL y donde SI se reclamó prioridad de la primera solicitud presentada en Suecia SE0102035-3

2) Objeto de la Invención

- a) Las reivindicaciones 1 a 13 de la solicitud en estudio se refieren a
 - i) (1.-) Laminado hecho de capas fibrosas para uso de artículos absorbentes, tal como toallas sanitarias, pañales o similares, el laminado incluye una capa exterior (5) hecha de tela no tejida, que está en contacto con el portador durante el uso del artículo, y una capa de interior (6), cuyas dos capas están interconectadas en un primer patrón de unión que consiste de puntos de unión separados (7), caracterizado por que los huecos son hechos al menos a través de la capa exterior (5) en un patrón de hueco separado, cuyo patrón de hueco es más denso con más huecos por unidad de área que el número de puntos de unión (7,21) por unidad de área en dicho primer patrón de unión.

- ii) (2.-) Laminada de acuerdo con la reivindicación 1, caracterizado por que cada uno de dichos huecos se forma al disponer al menos una rajadura (16) a través de al menos una capa exterior (5) y al presionar hacia abajo un área que forma la apertura del hueco respectivo desde el exterior de la capa.
- b) El anterior producto 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:

- i) El título no corresponde a lo que se quiere proteger. De acuerdo a lo que se observa en la solicitud, el solicitante pretende que se le proteja un laminado de varias capas con más huecos por unidad de área que puntos de unión por unidad de área en la capa exterior.
- ii) La descripción se basa en unos dibujos que no se anexan. Es imposible realizar un correcto estudio cuando la solicitud no se encuentra completa.
- 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 no es posible diferenciar la reivindicación 4 de lo presentado en la reivindicación 1. Podría eliminarse dicha reivindicación.

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) 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, B 32 B 7/04 y las más cercanas a ellas, se encontró que antes del 8 de junio de 2001 (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 desechable con patrones de agujeros..

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

Nº	Documento	Título	Fecha de Publicación
D1	US 4397644	Sanitary napkin with improved comfort	1983.08.09
D2	US 4 888632	Method for perforating nonwoven web and use of the web as a cover for a feminine pad	1989.12.12
D3	WO 99 00082	Method for producing an apertured covering sheet for an absorbent article and a material produced in accordance with the method.	1999.01.07

5) 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

A pesar de que no es posible realizar un estudio completo sobre la patentabilidad de la solicitud, toda vez que a esta solicitud le hacen falta los dibujos, se hará una primera evaluación previa.

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."

"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 prioridad de la solicitud de patente que se estuviese examinando, siempre que dicho contenido esté incluido en la solicitud de fechas de prioridad cuando ella se publique o hubiese transcurrido el plazo previsto en el artículo 40."

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".

Documentos como D1 relacionan artículos absorbentes que incorporan en la capa exterior patrones de huecos que son mayores que los puntos de unión.

Además, la forma de hacer los huecos resulta demasiado evidente para una persona que conozca del arte. Así también lo permite establecer los documentos D2 y D3.

b) Resumen

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

Nº	Documento	Relvindicaciones afectadas	Requisito que afecta
D1	US 4397644	1 - 13	Novedad
			Nivel inventivo
D2	US 4 886632	2 - 13	Novedad
			Nivel inventivo
D3	WO 99 00082	2 - 13	Novedad
			Nivel inventivo

6) 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
29 DIC. 2006

Concepto Técnico Nº	EXAMINADOR TÉCNICO Código No.	EXAMINADOR JURÍDICO Código No.
1992	202003	

[34] **SANITARY NAPKIN WITH IMPROVED COMFORT**

[75] **Inventors:** Billie J. Matthews, Menasha; John P. Allison, Appleton; Paul S. Woon, Appleton; Robert A. Stevens, Appleton; Stephen R. Berninger, Appleton, all of Wis.

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

[21] **Appl. No.:** 346,888

[22] **Filed:** Feb. 4, 1983

[51] **Int. Cl.** _____ A61F 13/16

[52] **U.S. Cl.** _____ 604/376; 604/370

[58] **Field of Search** _____ 604/370, 374, 376-380

[56] **References Cited**

U.S. PATENT DOCUMENTS

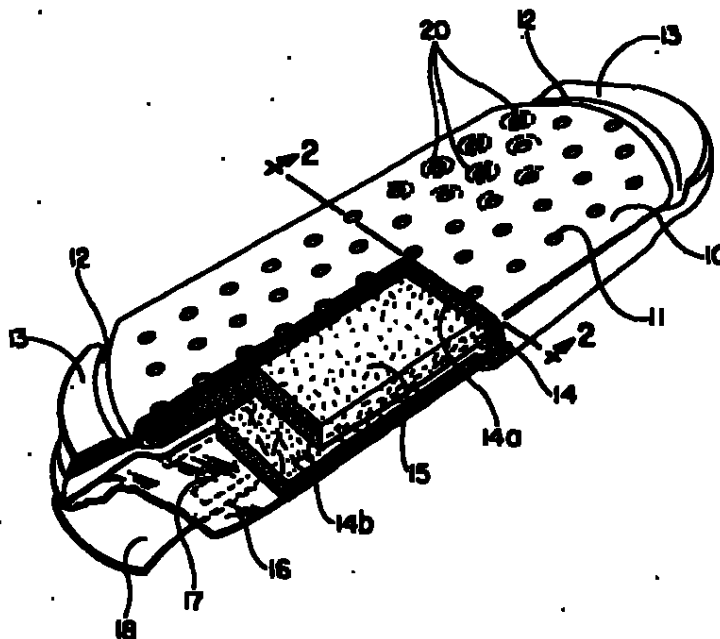
3,881,480 5/1975 Whitehead et al. _____ 604/380
3,886,941 6/1975 Deane et al. _____ 604/376
3,934,588 1/1976 Monk et al. _____ 604/376
4,033,180 10/1977 Karrol _____ 604/376
4,173,046 11/1979 Gallagher _____ 604/376

Primary Examiner—C. Fred Rosenbaum
Attorney, Agent, or Firm—Howard Olevisky, R. Jonathan Peters, Gregory E. Croft

[37] **ABSTRACT**

A sanitary napkin is provided which is capable of transmitting viscous menstrual fluid into the absorbent portion of the napkin without cover runoff. The napkin has a fluid permeable cover which is integrated with a portion of the absorbent matrix. This portion of the absorbent matrix is also designed to provide increased comfort, initially during use, and after the napkin has become wet.

19 Claims, 4 Drawing Figures



104
102

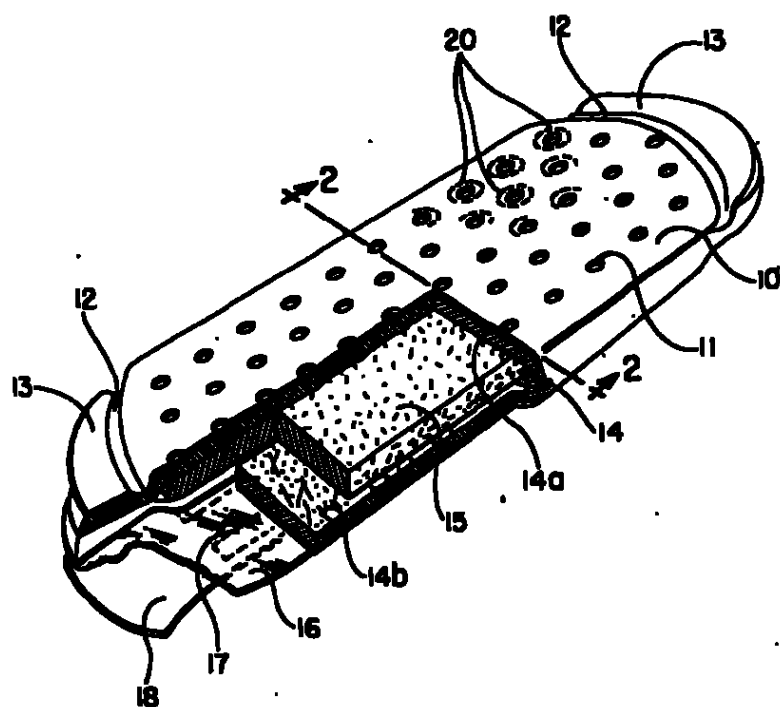
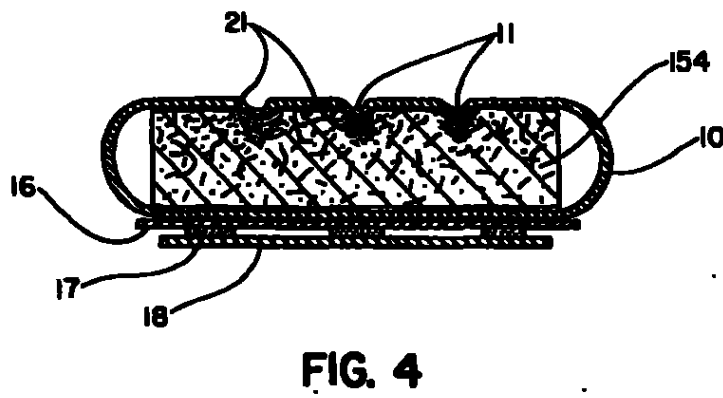
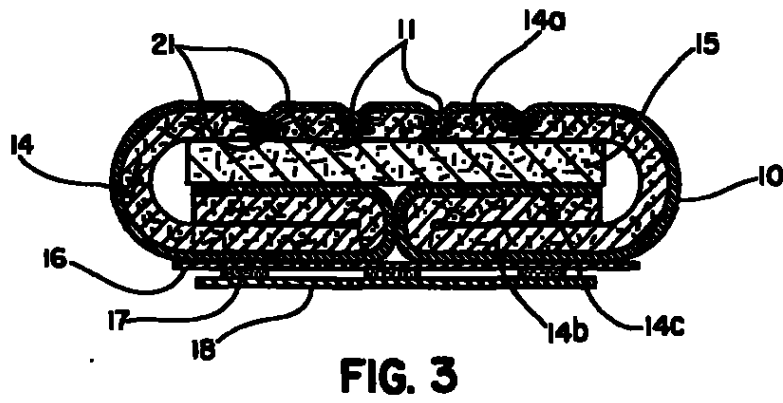
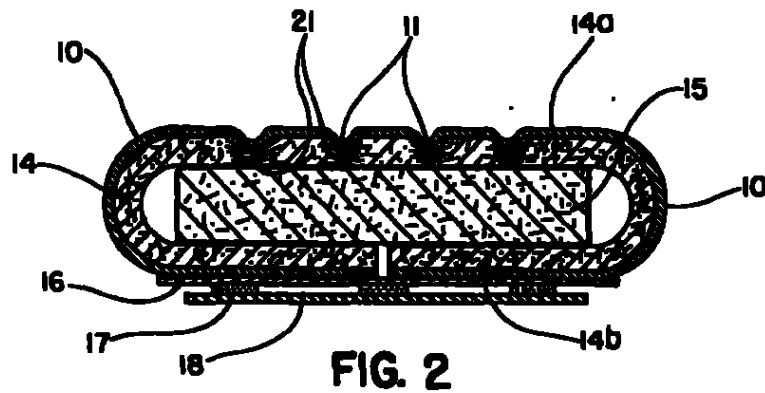


FIG. 1



SANITARY NAPKIN WITH IMPROVED COMFORT

FIELD OF THE INVENTION

This invention relates generally to sanitary napkins and particularly to a sanitary napkin featuring improved comfort and absorbency.

BACKGROUND OF THE INVENTION

Sanitary napkins are conventionally made of layers of cellulosic material such as wood pulp fluff, creped wadding or the like. These materials provide relatively good absorbency and some shape recovery when dry. Unfortunately, when these napkins are wet, the cellulosic material collapses, loses its shape and is much less comfortable to the wearer, with the result that even the low levels of shape recovery and flexibility present in the cellulosic material in the dry state tend to disappear.

Recognition of the discomfort problems associated with these napkins, both in the wet and dry form, has produced a variety of solutions. One of these solutions involves the addition of so-called super-absorbent materials to a sanitary napkin with the concomitant decrease in conventional cellulosic absorbents. This has resulted in a thin napkin which distorts easily and which suffers from loss of shape recovery.

Another solution which has been discussed in the patent literature involves the concept of adding thermoplastic material to the absorbent matrix. The thermoplastic is typically added as fibers or powder. It has been intermingled with the absorbent to keep the capillaries within the absorbent open, and at varying levels with decreased amounts present in the center or most absorbent area of the absorbent matrix. In the latter case, thermoplastic is added to establish a capillary gradient in which absorbent layers with larger capillaries are present nearest the body of the wearer.

Examples of the addition of thermoplastic can be found in: U.S. Pat. Nos. 4,082,886 and 4,129,132 issued to George A. M. Butterworth et al.; 3,976,074 issued to Harry G. Fitzgerald et al.; 4,034,141 issued to Julius Schweiger et al.; 4,047,531 issued to Hameesh Karant; 3,543,441 issued to Gunner Gravidahl and 4,219,024 issued to Donald Patience et al.

The prior art listed above recognizes the desirability of having a capillary gradient with larger capillaries nearest the body of the wearer and smaller capillaries in the area where maximum absorbency is desired. If the absorbent matrix in the napkin was designed so that the smallest capillaries were closest to the body of the wearer, fluid would remain in the area of the smallest capillaries and would not disperse through the rest of the absorbent matrix due to capillary attraction. If a number of large capillaries are near the point of fluid contact and a greater number of small capillaries are farther from that point, then fluid will be drawn away from the initial contact site.

In general, the greater the level of unfused thermoplastic material, the higher the amount of shape recovery introduced into the absorbent matrix of the sanitary napkin.

A napkin with a relatively thick layer of large capillaries readily transfers relatively low viscosity fluids such as urine, water, or even blood. It has been recognized, however, that menses is a complex fluid with uterine blood being only one component of its composition. Additionally, menses contains cellular debris and a

slucous-like fraction. It has also been recognized that the character of menses can differ in composition, viscosity, volume and flow rate from individual to individual and also at different times in the menstrual cycle with a given individual. It has also been determined that certain women have constantly high viscosity menses and comparatively low flow volumes.

Since highly viscous menses has been identified, it has now been discovered that the composition of menses also has a significant effect on the transport of fluid from the cover into the absorbent matrix of a sanitary napkin. When the viscosity and cellular debris content of menses are relatively low, usually during periods of high flow, it passes relatively rapidly through the cover material and into the absorbent matrix; even in cases where the portion of the absorbent matrix adjacent the cover material has relatively large capillaries. However, it has been observed that more viscous, high debris-content menses, especially prevalent during periods of low flow, tends to stay on the upper surface of the cover. In addition, particularly when there is little capillary attractive force exerted on the bottom of the cover by the absorbent matrix, the fluid component tends to stay on the surface and then run off the edges of the napkin. It is believed that earlier attempts at designing sanitary napkins containing thermoplastic materials have been unsuccessful because of the failure of the absorbent matrix to draw viscous menses through the cover material.

U.S. Pat. No. 4,214,582 issued to Harish A. Patel and 3,283,245 issued to Charles L. Eldredge et al describe wound dressings in which a thermoplastic fluid pervious cover is fused to an absorbent layer also containing thermoplastic. The Patel patent discloses a wound dressing having a hydrophobic cover, a microcreped absorbent layer underneath the cover and a second hydrophobic cover positioned on the bottom of the absorptive layer. This combination is subjected to embossing by a compressor to provide large locally fused discrete portions along the cover surface in contact with the wound. This relatively severe compression in fusing is designed to provide an irregular top surface for ease of release from the wound area as it heals. The fusing of the major proportion of the top surface area also provides a reliable release surface.

The Eldredge patent discloses a surface in which the fusible fibers are drawn through the cover material to provide a soft matt finish and aid in the wicking of fluid wound exudate along the top surface of the cover and into the main absorbent area through the cover.

Neither of these configurations would be particularly useful for a sanitary napkin. In the wound dressing described by Patel, the rapid discharge of fluid would settle on the relatively large fused surface since there is no penetration of fluid in the fused area. The relatively great amount of compression applied over relatively substantial areas in Patel also tends to destroy such deformability and compressibility as may otherwise have been present. To design a napkin having the Eldredge configuration would tend to provide a competing capillary structure above the cover which would tend to trap debris and prevent fluid transfer into the napkin resulting in a perpetually wet surface after initial discharge.

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SUMMARY OF THE INVENTION

According to this invention the sanitary napkin is provided with improved comfort and the ability to relatively rapidly transfer viscous masses from the cover into the absorbent matrix. The absorbent matrix contains principal absorbent component characterized by relatively high fluid retention and a second component including comfort enhancement capabilities positioned at least in part between the principal absorbent and the fluid permeable cover or wrap. The second component is integrated with the cover to provide intimate contact and denatification of localized regions. As a consequence, fluid transfer routes are established and fluid is conveyed to the principal absorbent component.

When used in this specification, a comfort enhancement layer may include the entire layer which in certain configurations extends around the sides and at least a part of the bottom of the principal absorbent component layer while the fluid transfer layer terminology refers only to the position of the comfort enhancement layer between the top of the cover and the absorbent on the body facing side.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention may be more readily understood by reference to the drawings in which:

FIG. 1 is a perspective view partially in cross section of one embodiment of the sanitary napkin of this invention;

FIG. 2 is a cross sectional view taken along lines 2-3 of FIG. 1.

FIG. 3 is a cross section of a second embodiment of the construction of the sanitary napkin according to this invention; and

FIG. 4 is a cross section of a third embodiment of the sanitary napkin according to this invention. In all figures like numbers relate to like portions.

DETAILED DESCRIPTION OF THE INVENTION

According to the embodiment shown in FIGS. 1 and 2 a sanitary napkin is provided having a fluid pervious cover 10 and a thermoplastic-containing comfort enhancing layer 14 which surrounds an absorbent layer 13. The comfort enhancement layer 14 has a bottom portion 14b to further improve comfort and a top portion 14a. Attached to the bottom portion 14b is a fluid impermeable baffle 16. Garment suspension adhesive lines 17 are centrally longitudinally positioned on baffle 16 and a release liner 18 is removably attached to the bottom surface of the adhesive lines 17. The comfort enhancing layer 14 is preferably coextensive with the cover 10 at the ends of the napkin 13 which are sealed, e.g., by ultrasonic bonding as shown by fused lines 12 which are inset from the ends 13.

The outer wrap or cover is integrated to the comfort enhancement layer 14 at least at selected parts of the transfer layer 14a corresponding to integration sites 11 of the wrap 10. Integration refers to the bonding of the wrap 10 to at least the transfer layer 14a at sites 11 at distances not greater than 2 centimeters apart at least in the perineal area of the napkin.

The perineal area of the napkin is that portion of the napkin abutting the perineal area of the wearer. This portion, depending on the design of the napkin and the positioning of the napkin by the wearer, is generally centered longitudinally and transversely and is 1 centimeter wide in the transverse direction and 5 centimeters long. As will become apparent, it is desirable that at least one and preferably at least 2 to 3 integration sites be present at the napkin surface directly beneath the perineal area of the wearer.

Integration may occur throughout the top of the cover and may be used to bond the layer 14 to the cover 10 which may then be treated as a single unit for manufacturing purposes and this is desirable for ease of processing.

Bonding to accomplish integration can be by the application of heat, such as by hot calender embossing, or by ultrasonic means or it can be by mechanical manipulation of fibers with or without heat as, in needling. It is preferred that bonding be by heating means and ultrasonic bonding is particularly preferred. The bonding, if by heat may be something less than fusing such as described in U.S. Pat. No. 3,855,046.

The bonding step may, in fact, produce holes in the cover material itself which may extend into the comfort enhancement layer depending upon the severity of the bonding treatment. It is also possible that stray fibers may penetrate the cover 10 on occasion and penetration may occur at or near the area of integration. Large amounts of this penetration is undesirable however, because the body-facing surface of the cover must be as dry as possible. If large amounts of fiber are present, particularly if this fiber is contiguous over an area, lateral surface wicking occurs and the surface produces a highly objectionable wet tactile sensation which is likely to result in the premature discarding of the napkin. Integration of the cover 10 to the transfer layer 14a of the comfort enhancement 14 alters the character of the transfer portion 14a by providing transfer zones 21 of increased density and compression which diminish as they extend radially outwardly from the integration sites 11 through the depth of the transfer portion 14a. It should be noted that the part of layer 14a directly under the integration sites may be entirely fused and not form part of zone 21.

These zones 21 which are observable and quantifiable by microscopic examination as to their extent and degree of compaction provide conduits for transfer of viscous masses described previously. Transfer occurs in these zones 21 where the capillaries are predominantly not greater in size than that of the absorbent layer 13.

Transfer areas 20, illustrated by dotted lines in FIG. 1, are areas which are directly above the transfer zones 21 and indicate the portion of the cover where fluid transfer will first occur from the top of the cover through the layer 14a. These transfer areas 20 vary from being irregular to circular in shape, and may overlap. There may be portions of the surface of the napkin which are neither integration sites 11 nor transfer areas 20. These areas lack capillary attractive force to pull fluid through and for that reason, transfer of viscous, cellular debris and mucus-containing masses through this portion of the surface of the napkin is extremely slow if it occurs at all. Relatively nonviscous fluid will transfer downward more readily through these portions but will preferentially transfer in the transfer areas 20. These portions which are neither transfer zones or bond sites in the transfer layer 14a help provide the comfort enhancement features of the napkin of this invention.

The reason for having integration sites with the resultant transfer areas 20 and transfer zones 21 beneath the areas of fluid discharge becomes readily apparent with these facts in mind. It has been found that viscous masses

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one of the type previously described transfers when as little as 0.12% of perineal area of the napkin beneath the body of the wearer is transfer area.

This minimal amount of transfer area can be obtained by positioning a single integration site in the 1 by 5 cm perineal area.

The effect of integration, with regard to the number and size of the integration sites in this 1 by 5 cm area is also important. Fluid transfer seldom, if ever occurs through the integration site. Large integration sites, contiguous integration sites and several closely spaced integration sites are therefore to be avoided particularly when integration is by fusing. It is generally preferred to maintain individual integration sites more than 0.15 centimeters apart, in any event, because the higher the level of integration the stiffer and therefore the less comfortable the napkin becomes. It has been found that when the fused bond sites are more than 20% of the 1 by 5 cm area on the surface of the integrated cover where fluid transfer occurs, there is significant padding of menses rendering the napkin unsuitable for use. It is preferred that if fusing is utilized as the process for integration, the fused area is less than 10% and particularly between 0.5 and 5% of the napkin cover surface.

Since it is preferred that the transfer layer 14a be integrated with the cover 18 prior to napkin assembly it is easiest to maintain the napkin integration pattern with regard to spacing over the entire surface 14a as well as layer 14b. From the standpoint of fluid transfer, into layers 14a and 18, however, it is apparent that the critical portion for control of transfer area and integration is that part of the napkin surface directly under and nearest initial fluid discharge, i.e., the perineal area of the female defined earlier.

It has been observed that fusing of the comfort enhancing layer 14 particularly at fluid transfer layer 14a prior to integration with the cover 18 increases the efficiency of viscous menses transfer possibly by increasing the number of small capillaries around the integration sites 11. However, fusing tends to stiffen the layer and, therefore a tradeoff of benefits results. It should be noted that the minimum transfer area described above is based upon the use of a fused transfer layer 14a. Fusing as defined herein is the partial softening and/or melting of a thermoplastic material to provide bonds with the thermoplastic.

The transfer layer may contain nonthermoplastic fibers, absorbent fibers such as rayon, superabsorbent rayon, cellulose fibers or blends of the above.

Suitable thermoplastic fibers are polyester, polypropylene, acrylic or nylon fibers or blends. Crimped fibers add comfort and their use at least at some level is preferred.

If fusing is desired the addition of a low-melting point readily fusible fiber is highly desirable. Suitable fusible fibers for this invention are: Vinyon, a vinyl chloride/vinyl acetate copolymer sold by Avtex Fibers Inc. of New York, N.Y.; Eastman 410 amorphous or crystalline polyester fibers sold by Eastman Chemical Products, Inc., a subsidiary of Eastman Kodak Co., Kingsport, Tenn.; or Chisso ES a bicomponent polypropylene/polyethylene fiber sold by Chisso Ltd., Osaka, Japan, which due to its differential melting point for each component of the fiber, could be used as the only thermoplastic fiber as well as in blends with other fibers.

The comfort enhancing layer can be formed by carding or it may be airlaid, however, randomized carding is

preferred because it increases bulk and therefore perceived dry softness to the comfort enhancing layer.

The transfer layer 14a has a basis weight range from 30 to 400 gms/square meter and a thickness generally between about 0.1 to about 1 cm. Of course, if the embodiment depicted, for example at FIGS. 1 and 2 is used, there will be two layers 14a and 14b each having thickness and basis weight characteristics within the parameters set forth above. These values may not be identical for layers 14a and 14b however if only the transfer layer 14a is integrated.

The cover or outer wrap 18 of the napkin of this invention is primarily of a nonwoven thermoplastic web and should be of a sufficiently open structure to enhance the transfer of the viscous fluid menses described above into the transfer layer 14a.

For a cover to readily transfer this viscous fluid according to the teachings of this invention it must be sufficiently open to enhance transfer. While the surface of the cover may be altered by treatment with suitable surface active agents, to aid in the transfer certain cover structures have been found to perform better than others and their performance has been correlated to the number of small holes present.

Several cover materials were submitted for examination by a Quantimet 900 Image Analyser made by Cambridge-Isotaco Ltd, Cambridge, England. A Bausch and Lomb Model L transmitted light photomicrographic unit was employed to take photomicrographs of cover materials which had been previously tested. The photomicrographs were compared with the Image Analyser pixel size set at 13.28 microns.

For a cover to be acceptable no more than 40% of the holes or pores may have a breadth of less than 27.3 microns; with preferred covers having less than 25% of the holes which are less than 27.3 microns. Breadth is defined as the maximum dimension of the hole measured at 90° to the major axis of the hole.

A second set of measurements which were taken directly on the cover material with a pixel size of 3.04 microns revealed that preferred cover materials should have no more than 90 holes/mm² with a breadth of less than 13 microns. Generally, this latter breadth measurement has been correlated to fluid retention within the cover. In other words, a potential cover material may transfer fluid but retain a significant amount within the cover holes, thus producing a wet feeling surface.

One of the thermoplastic nonwoven cover materials which meets the first criterion and is acceptable is Sharnet (x1008-30A). Sharnet is a trademark of Inmont Corp., Somerville, Mass.

A most preferred cover material which meets both criteria is a uniform spaced nonwoven web having 3 denser or larger filaments. Such a material is described in copending patent application bearing Ser. No. 146,430 filed May 5, 1980 by Appel and Morpman which has been informally allowed and is hereby incorporated by reference.

EXAMPLE I

Comfort enhancement as used herein relates to the force needed to compress the cover and the absorbent matrix, i.e., the transfer layer integrated with the cover layer and the principal absorbent layer. For purposes of this invention a standard wood pulp fluff layer was used as indicated below as the principal absorbent layer. This fluff was fiberized in a hammermill and has a basis weight of 580 gm/m² which is a value between that of

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the standard commercial fluff used for nappies and that used for nappies sold under the NEW FREEDOM trademark by Kimberly-Clark Corporation of Nantua, Wis. Several 3x6 in. fluff blanks were prepared. Several 3x3 in. samples of both fused and unfused transfer layers having differing degrees of integration were also prepared and centered on the fluff.

The test described below was run on an Instron Model TM with an integrator unit Model DI-33 with a compression load cell model CC having a 2 1/2 in. diameter compression ram.

The transfer layer basis weight used for all samples was 0.0129 g/cm². The preferred cover described earlier of a uniform spunbonded polypropylene web having 3 denser filaments was integrated to several samples of the transfer layer by ultrasonic bonding with a 0.078 in. diameter pin with the spacing between integration for each sample indicated in the table below. (This pin value is ±0.01 in. due to wear encountered on the pin head.) A glycerol water mixture having a viscosity of 700 centipoises at 21° C. and a surface tension of 52±2 dynes/cm was prepared. Phronic P68 a surfactant made by Wyandotte Chemical Corporation, Wyandotte, Mich., a division of BASF was used to obtain the desired surface tension and a red dye was added. This fluid has proven to be a satisfactory simulation for the fluid transfer characteristics of the viscous menses described throughout this disclosure. Ten cc's of this fluid are added through a 3/8 inch diameter orifice in a plexiglass block weighing 113.3 gm. The block rested on each sample with a 2 in. diameter circular base with the orifice centered. After all of the fluid enters the cover the block is removed without exerting downward pressure. The sample is allowed to sit for 5 minutes. Each of the samples was wrapped in 5 by 8 in. sheets of 2 mil-polyethylene film.

The sample is centered under a 2 1/2 in. diameter circular Instron ram head. The Instron and Integrator was calibrated as per standard procedure and the cross head speed set to 2 in./min. Each sample was individually compressed to 40% of the original dry thickness as measured on Canson Scientific Instruments Thickness Tester Model CS-55-210.

As compression occurred the force applied to compress and the distance the ram head travels was recorded. After compression was accomplished the force was removed by reversing ram head direction at the same cross speed thereby providing a recovery period. The cycle of compression and recovery was repeated an additional 9 times to obtain an equilibrium state for each sample tested.

The maximum force (F_{max}) exerted during the equilibrium cycle is representative of the condition of the napkin which has been compressed during use. According to this test, comparatively lower values are better because they reflect comfort as a function of residual wet compressibility.

TABLE 1

Bond Spacing (mm)	F_{max} 50% Compression (gms)	
	With Fused Transfer Layer	With Unfused Transfer Layer
0.251	6810	7470
0.359	7730	5980
0.539	6010	6320
0.718	6869	4719
0.898	4831	4110
1.796	2451	2840

For comparison a napkin blank with fluff only was tested and yielded a value of 8610 gms. The addition of conventional cover materials does not significantly alter this value. Values greater than 7000 gms are not desirable.

EXAMPLE II

During the test performed to produce the data set forth in Example I the Instron data were evaluated at the 50% compression points on the first and the last, i.e., equilibrium cycles. The ratio between the forces at 50% compression is a measure of the resistance of the pad to permanent distortion, F_1 being the value of the force at the initial 50% compression cycle, and F_{eq} the value of the force applied at the equilibrium, i.e., tenth compression cycle.

TABLE 2

Bond Spacing (mm)	Ratio of F_{eq}/F_1	
	Fused	Unfused
0.251	0.171	0.178
0.359	0.186	0.159
0.539	0.237	0.218
0.718	0.265	0.207
0.898	0.344	0.255
1.796	0.520	0.343

For comparison purposes fluff only had a value of 0.068 and when conventional cover materials were placed over the fluff no significant change was observed when compared to the fluff alone.

It should be noted that values greater than 1/10 are desirable and especially preferred are values greater than 1/5. The greater this ratio the less the change in a wet pad during use.

Since in all instances in the above examples the bond points were arranged in square patterns, the amount of fused area can be determined by calculating the area of the embossing pins contacting the surface. In the case of the closest spacing set forth, assuming the maximum possible number of fused sites within the perimetal area of the napkin, the amount of fused area is about 9.6% with the variance again due to variability in pin head diameter. This particular configuration has lost a substantial amount of comfort and softness when compared to the wider spacing set forth in the Table above and from the standpoint of increased tactile satisfaction by the wearer, this number provides a realistic maximum.

The principal absorbent layer 15 may be any conventional absorbent used in feminine protection products such as cellulosic fibers or the like and may contain absorbency additives, e.g., superabsorbents. One useful material for the principal absorbent 15 is described in U.S. Pat. No. 4,100,324. This material is a turbulently conformed mixture of air-laid meltblown microfibers and a cellulosic material such as wood pulp fluff. The absorbent activity may be heightened by the addition of absorptive materials having higher absorptive capacity per unit weight and these materials such as superabsorbent materials may be used as the primary absorbent to the exclusion of, or in conjunction with conventional cellulosic absorbents within the scope of this invention.

The embodiment depicted in FIG. 3 is identical to that in FIGS. 1 and 2 except that the absorbent portion containing the thermoplastic 14 along with the cover 19 is folded onto itself on the bottom of the absorbent area at 14c to provide additional comfort enhancement. The garment attachment adhesive 17 is shown attached to

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the baffle 16 outside of the cover wrap 18. A release liner 18 is conventionally provided to protect the attachment adhesive. Extra comfort enhancement layers can be added under the fluff and, in fact, a series of coterminous comfort enhancement layers may be used. These layers can also be coterminous with the principal absorbent layer within the scope of this invention.

FIG. 4 illustrates an embodiment which is different than the other two embodiments because, in this instance, the thermoplastic is present in the same layer as the conventional absorbent portion 154 but is present in a higher percentage near the body facing surface of the napkin. Although the currently preferred embodiments are those depicted in FIGS. 1, 2 and 3 because of the simplicity of manufacture this embodiment is also contemplated by this invention.

What is claimed is:

1. A sanitary napkin with a perineal area generally corresponding to and positioned beneath the perineal area of the wearer in use comprising:

- (a) a fluid permeable cover with a body contacting surface;
 - (b) an absorbent matrix system including a principal absorbent portion and a transfer portion including thermoplastic material;
 - (c) said transfer portion positioned between said cover and said principal absorbent portion and in fluid conductive contact between said cover and said principal absorbent portion and integrated at spaced apart sites with said cover, at least in the perineal area, to produce zones of greater density and enhanced fluid conduction relative to the remainder of said transfer portion; said zones corresponding to a transfer area on said cover, said transfer area being not less than 0.12% of said napkin perineal area; and
 - (d) a fluid impermeable baffle adjacent said absorbent matrix system having a garment facing surface and an absorbent-matrix-system-facing-surface.
2. A sanitary napkin characterized by relatively improved comfort as measured by reduced wet compressibility with a perineal area generally corresponding to the perineal area of the wearer in use comprising:
- (a) a fluid permeable cover with a body contacting surface;
 - (b) an absorbent matrix system including a principal absorbent portion and a transfer portion including thermoplastic material;
 - (c) said transfer portion positioned between said cover and said principal absorbent portion and in fluid conductive contact between said cover and said principal absorbent portion and integrated at spaced apart sites with said cover, at least in the perineal area, to produce zones of greater density and enhanced fluid conduction relative to the remainder of said transfer portion; said zones corresponding to a transfer area on said cover;
 - (d) a fluid impermeable baffle adjacent said absorbent matrix system having a garment facing surface and an absorbent-matrix-system-facing-surface; and
 - (e) said wet compressibility being defined as an F_{max} at 60% compression of not greater than 7000 gms when said wet compressibility is measured for said matrix system based upon a principal absorbent layer of wood pulp fluff having a basis weight of 580 gm/m².

3. A sanitary napkin having relatively increased resistance to permanent distortion with a perineal area generally

corresponding to and positioned beneath the perineal area of the wearer in use comprising:

- (a) a fluid permeable cover with a body contacting surface;
- (b) an absorbent matrix system including a principal absorbent portion and a transfer portion including thermoplastic material;
- (c) said transfer portion positioned between said cover and said principal absorbent portion and in fluid conductive contact between said cover and said principal absorbent portion and integrated at spaced apart sites with said cover, at least in the perineal area, to produce zones of greater density and enhanced fluid conduction relative to the remainder of said transfer portion; said zones corresponding to a transfer area on said cover;
- (d) a fluid impermeable baffle adjacent said absorbent matrix system having a garment facing surface and an absorbent-matrix-system-facing-surface; and
- (e) said increased resistance to permanent distortion being measured when the principal absorbent layer is wood pulp fluff having a basis weight of 580 gm/m² and when the ratio F_{ap}/P_1 is at least 1/10 at 50% compression.

4. A sanitary napkin according to claim 1, 2, or 3 wherein said transfer portion is coterminous with said cover and integrated throughout the coterminous surface.

5. A sanitary napkin according to claim 1 wherein integration occurs at sites between at least 0.75 and 2 centimeters apart.

6. The napkin according to claim 3 wherein the F_{ap}/P_1 is at least 1/5 at 50% compression.

7. The napkin according to claim 1 wherein the principal absorbent layer is a coformed airlaid mixture of meltblown thermoplastic and cellulosic fibers.

8. The napkin according to claim 1, 2 or 3 wherein the transfer portion is a separate part of a comfort enhancement layer, said comfort enhancement layer extending around the side edges and at least a part of the surface of the principal absorbent portion opposite the surface in fluid conductive contact with the transfer portion.

9. The napkin according to claim 1, 2, or 3 wherein the transfer portion is a separate part of a comfort enhancement layer and extends around the side edges of the napkin and is folded in a double thickness at the surface of the principal absorbent portion opposite the surface in fluid conductive contact with the transfer portion.

10. The napkin according to claim 1, 2, or 3 wherein the transfer portion contains between about 40 and about 100% by weight of thermoplastic material.

11. The napkin according to claim 1, 2, or 3 wherein the principal absorbent layer is primarily cellulosic material.

12. The napkin according to claim 1, 2, or 3 wherein the absorbent matrix is formed as a unitary layer having thermoplastic material with higher levels of thermoplastic present in at least that part of the absorbent matrix adjacent the cover.

13. The napkin according to claim 1, 2, or 3 wherein integration is not greater than 20% of the perineal area of the napkin.

14. The napkin according to claim 1, 2, or 3 wherein integration is not greater than 10% in the perineal area of the napkin.

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15. The napkin according to claim 1, 2, or 3 wherein integration is between 0.5 and 5% in the perineal area of the napkin.

16. The napkin according to claim 1, 2, or 3 wherein the cover material has no greater than 40% of its pores with a breadth of less than 27.3 microns.

17. The napkin according to claim 1, 2, or 3 wherein the cover material has no greater than 40% of its pores with a breadth of less than 27.3 microns and no greater

than 90 pores/mm² with a breadth of less than 13 microns.

18. The napkin according to claim 1, 2, or 3 having a plurality of mutually coterminous layers at least one of which is a principal absorbent layer.

19. The napkin according to claim 1, 2, or 3 having a plurality of coterminous comfort enhancement layers.

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**UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION**

PATENT NO. : 4,397,644

DATED : August 9, 1983

**INVENTOR(S) : Billie J. Matthews, John P. Allison, Paul S. Woon,
Robert A. Stevens, Stephan R. Bornslaeger**

**It is certified that error appears in the above-identified patent and that said Letters Patent
are hereby corrected as shown below:**

**Column 7, line 65, "6869" should be changed to
--5869--.**

Signed and Sealed this

Thirty-first **Day of January 1984**

[SEAL.]

Attest:

GERALD J. MOSSINGHOFF

Attesting Officer

Commissioner of Patents and Trademarks

United States Patent [19]

Van Iten et al.

[11] Patent Number: 4,886,632

[45] Date of Patent: Dec. 12, 1989

[54] METHOD OF PERFORATING A NONWOVEN WEB AND USE OF THE WEB AS A COVER FOR A FEMINE PAD

[73] Inventors: Thomas P. Van Iten, Neenah; Howard A. Whitehead, Appleton; Julie A. Schindler, Oshkosh, all of Wis.

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

[21] Appl. No.: 231,732

[22] Filed: Aug. 11, 1988

Related U.S. Application Data

[60] Continuation-in-part of Ser. No. 31,154, Mar. 27, 1987, abandoned, which is a division of Ser. No. 774,252, Sep. 9, 1983, abandoned.

[51] Int. Cl.⁴ B28B 3/16; B28B 1/48; B28B 31/16

[52] U.S. Cl. 264/156; 156/252; 156/313; 264/154; 264/163; 425/290; 425/369

[58] Field of Search 264/154, 156, 163; 425/290, 369, DIG. 37; 156/250, 251, 513

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Primary Examiner—Jan H. Silbaugh

Assistant Examiner—Mathieu Vargot

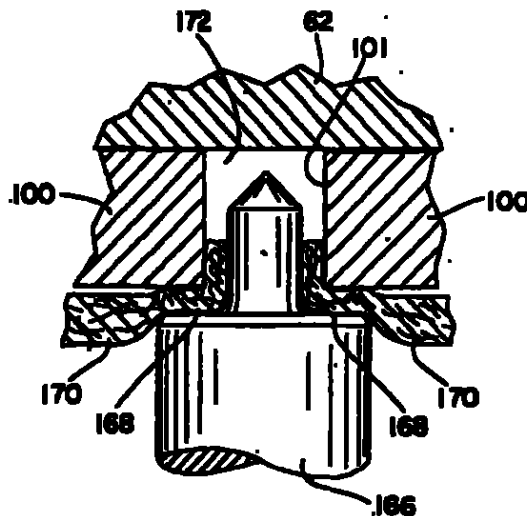
Attorney, Agent, or Firm—Thomas J. Connolly

[57]

ABSTRACT

A method of perforating a nonwoven web of fibrous fabric by directing the web through a nip defined by first and second movable members. As the web moves through the nip it is penetrated by a plurality of heated pins projecting from the first member which enter heated apertures formed in the second member. The penetration of the pins causes the fibers of the fabric to separate and enter into the apertures and form openings through the web. The openings are surrounded by dense consolidated rings exhibiting greater hydrophilic properties than the nonperforated surface of the web.

16 Claims, 7 Drawing Sheets



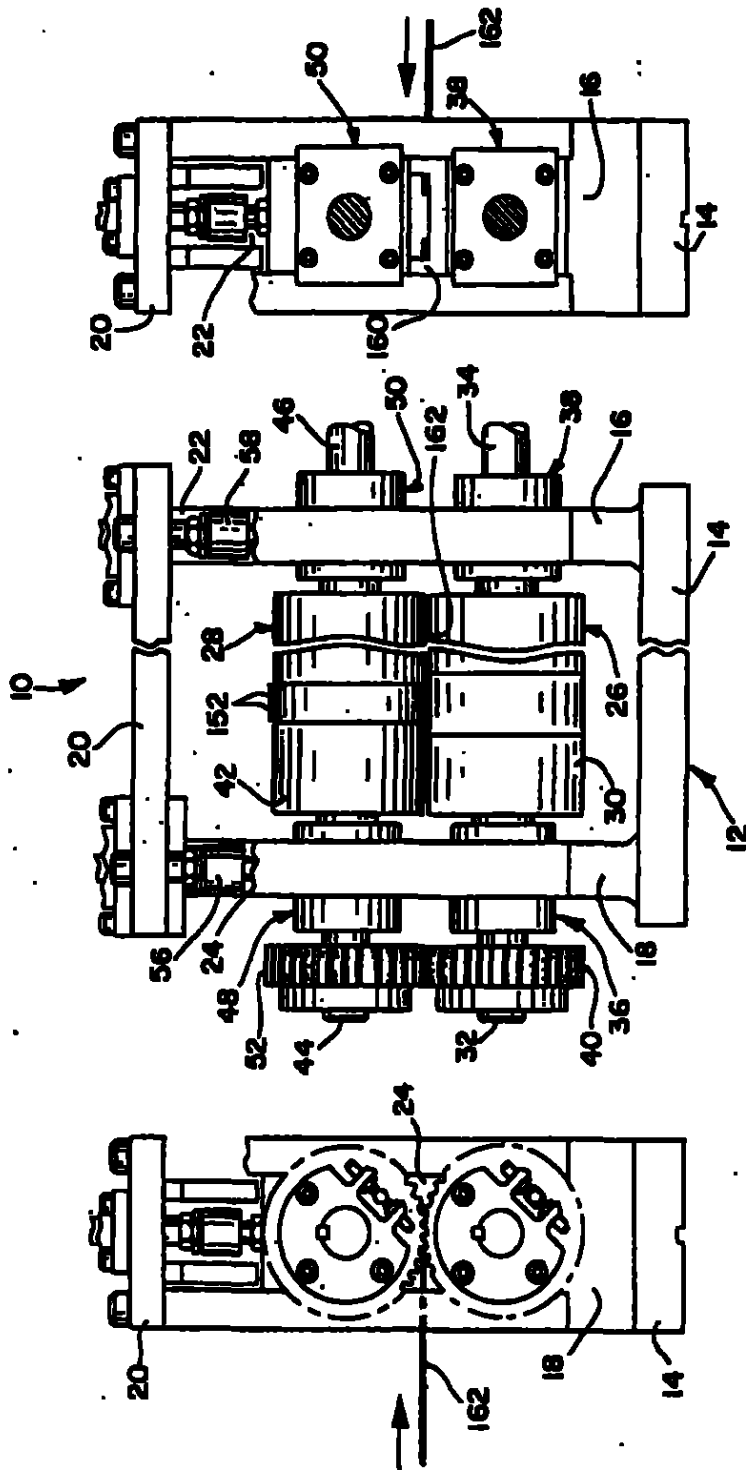


FIG. 2

FIG. 1

FIG. 3

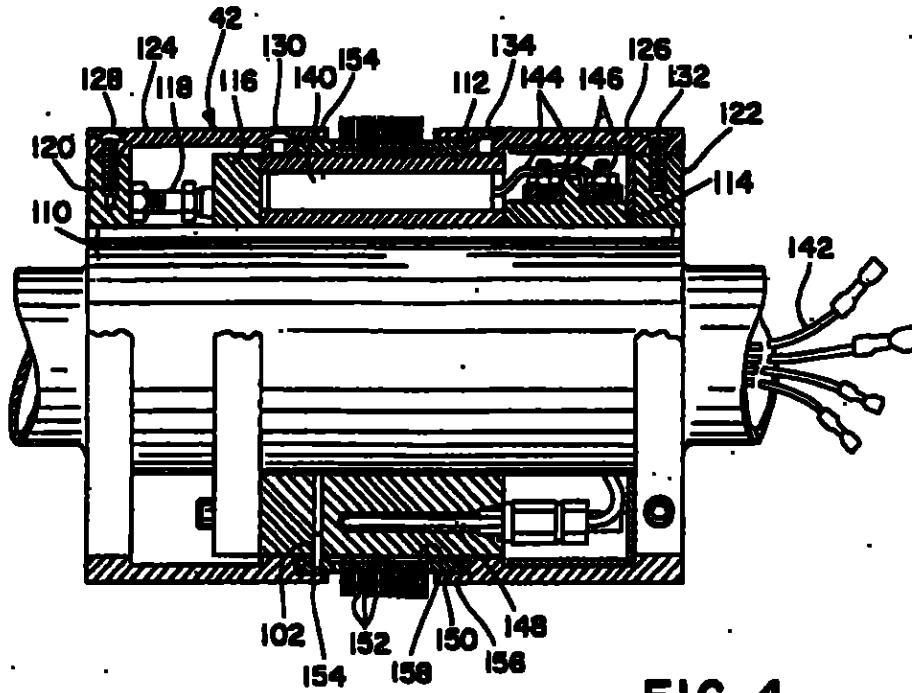


FIG. 4

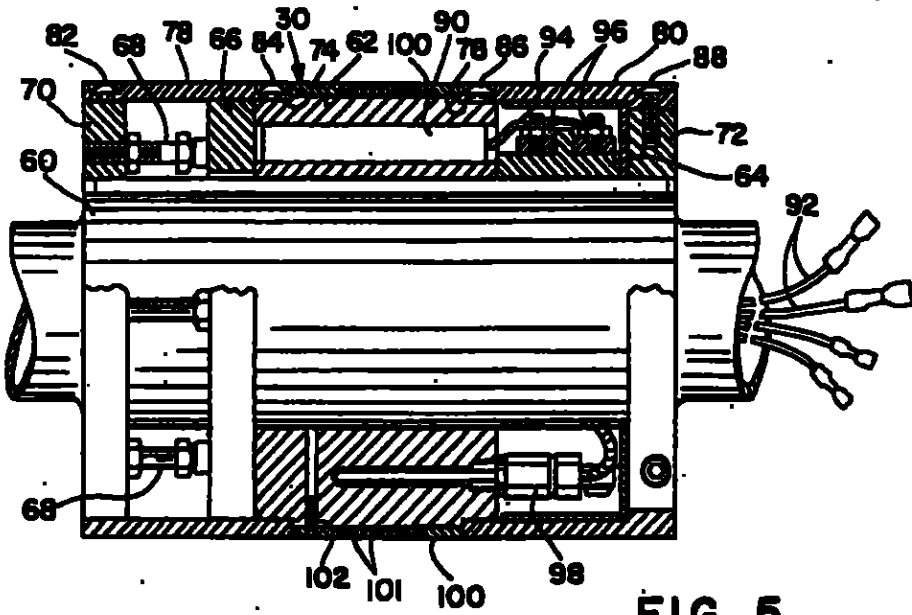


FIG. 5

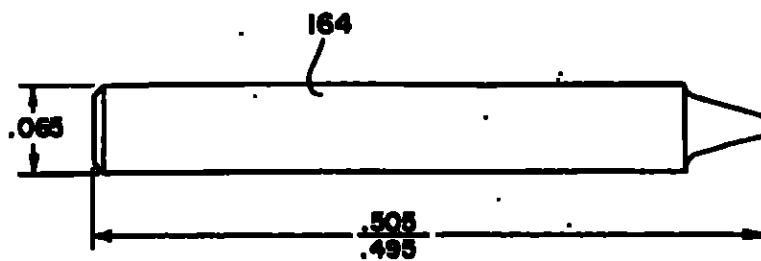


FIG. 6

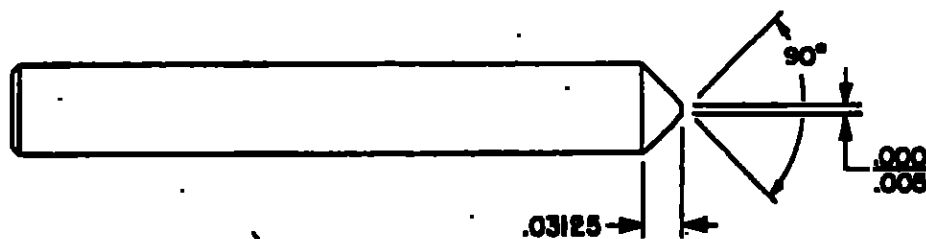


FIG. 7

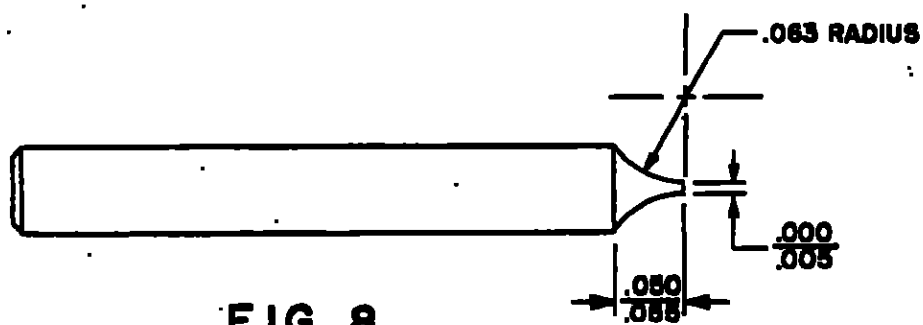
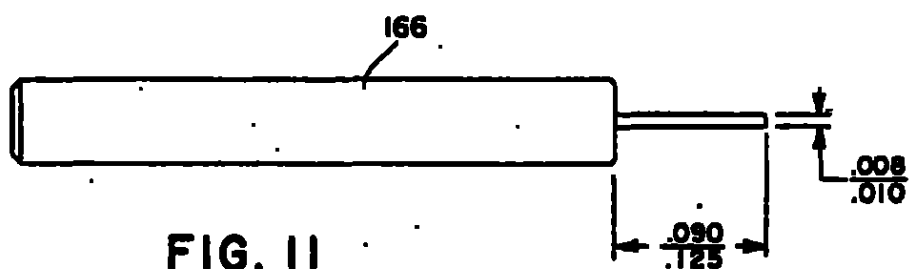
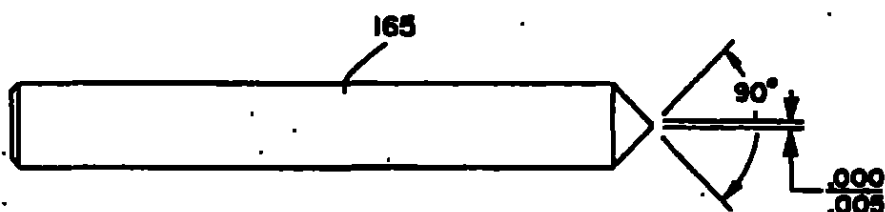
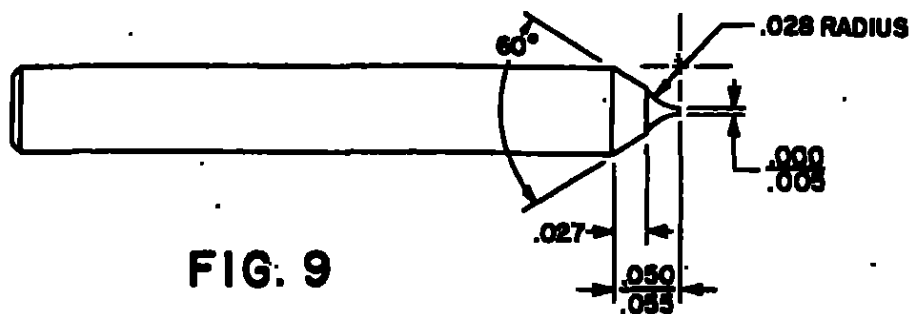


FIG. 8

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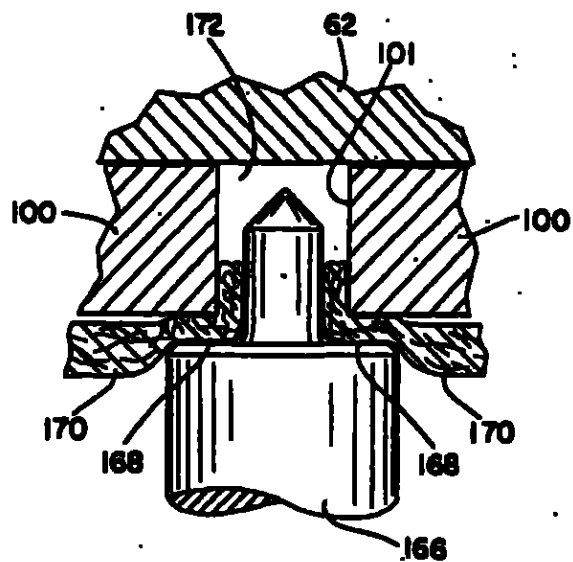


FIG. 12

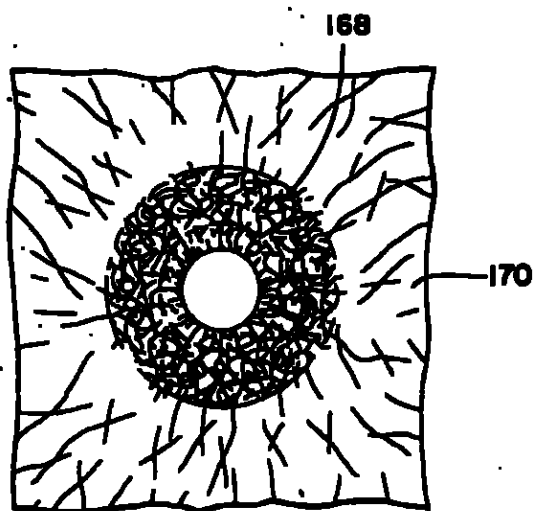


FIG. 13

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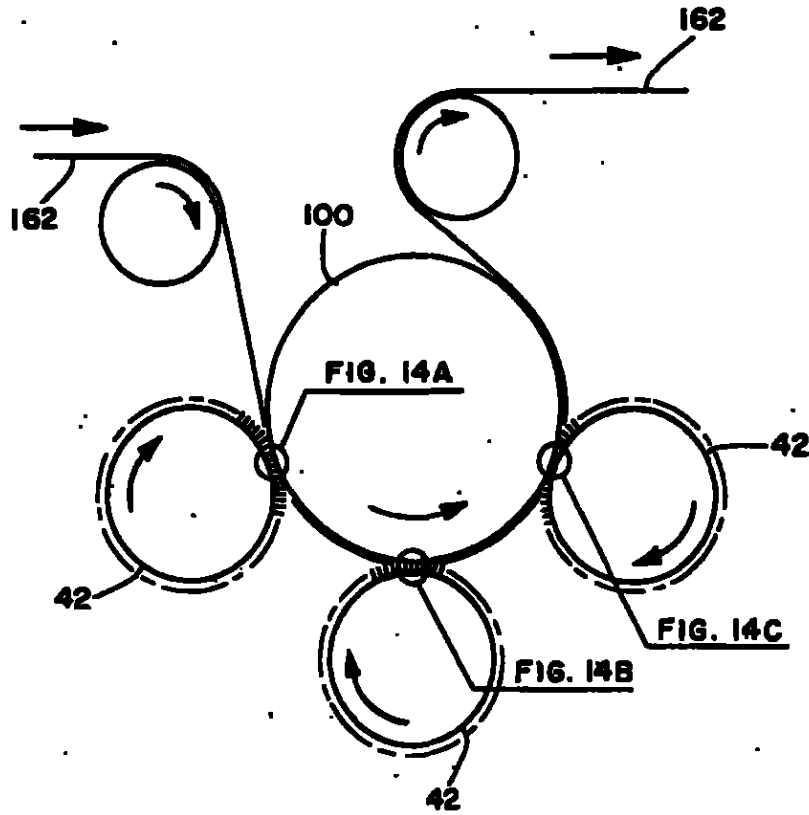


FIG. 14

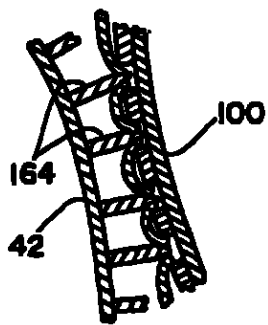


FIG. 14A

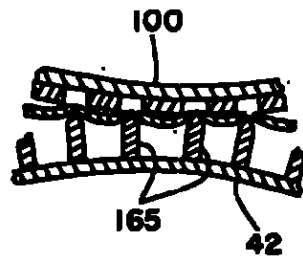


FIG. 14B

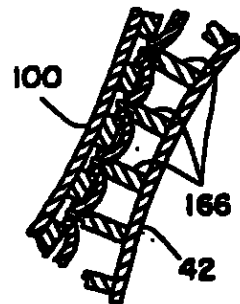


FIG. 14C

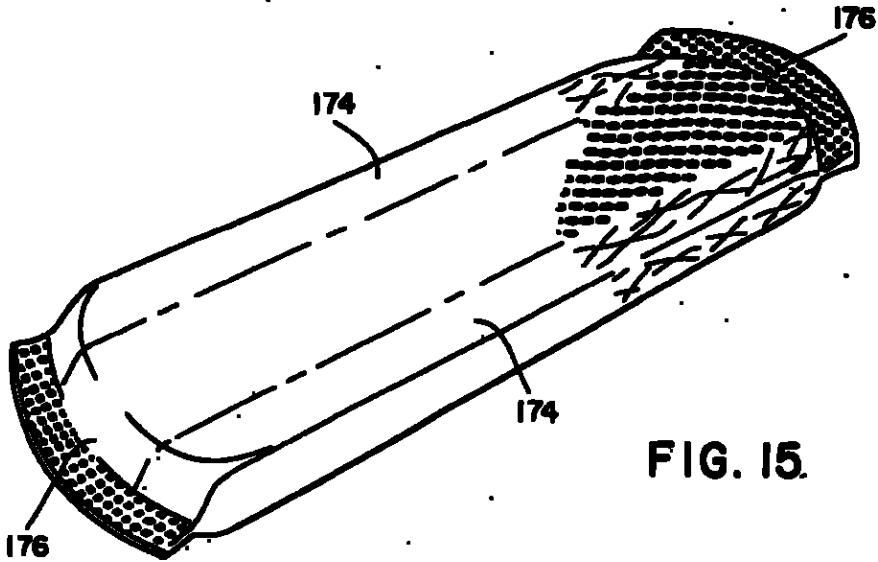


FIG. 15.

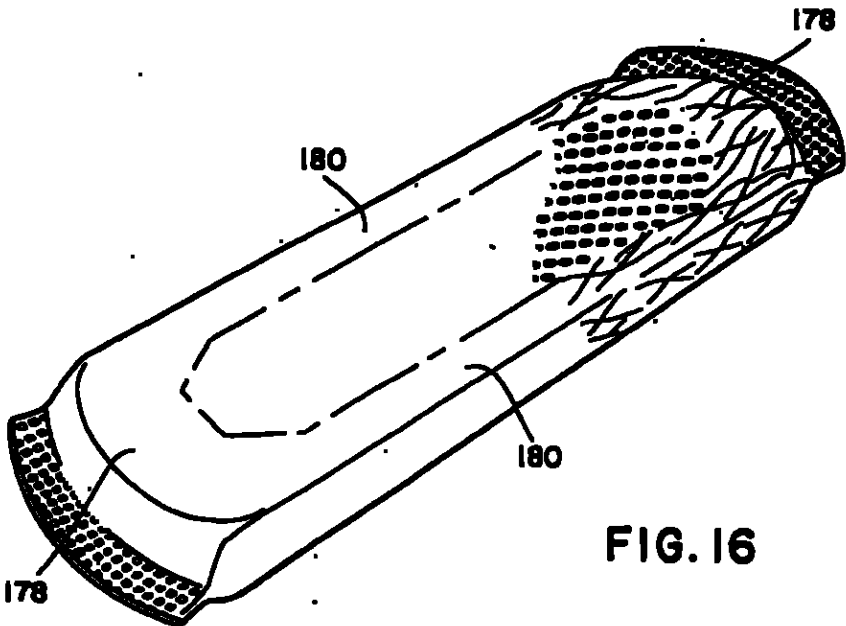


FIG. 16

METHOD OF PERFORATING A NONWOVEN WEB AND USE OF THE WEB AS A COVER FOR A FEMININE PAD

This application is a continuation-in-part of Ser. No. 032,154 filed on Mar. 27, 1967, now abandoned, which was a division of Ser. No. 774,252, filed on Sept. 9, 1983, also now abandoned.

FIELD OF THE INVENTION

This invention relates to a method of perforating a nonwoven web and using the web as a cover for a feminine pad. More specifically, this invention relates to a method of perforating a nonwoven web, with a patterned multitude of fine heated pins to form dense consolidated rings and raised ridges about the openings formed in the web.

BACKGROUND OF THE INVENTION

Feminine pads, also referred to as sanitary napkins, such as those described in U.S. Pat Nos. 4,397,644 and 4,079,739, are well known. Sanitary napkins of the prior art are normally of multilayered construction including: a fluid absorbent core interposed within a fluid impermeable baffle and a fluid permeable cover. The cover being designed to transmit menstrual fluid or the like across its boundary to the absorbent core. As those skilled in the art will readily appreciate, the interrelationship of components is substantially more intricate; however, for purposes of basic understanding, the foregoing suffices. Within those very general parameters one may also profitably compare the contoured sanitary napkin disclosed in U.S. Pat. No. 4,184,498.

Conventional sanitary napkins typically comprise an absorbing layer serving as the uppermost layer to be held in contact with the human body and made of a hydrophilic absorbent material such as absorbent paper, absorbent cotton, pulverized pulp or the like, so that when having absorbed therein a large quantity of body fluid, the napkin becomes sticky on its surface. In addition, when the absorbing layer is subjected to pressure, the body fluid once absorbed therein is likely to ooze or flow out reversely toward the body making the surface sticky. Thus, the uppermost layer of the sanitary napkin becomes very uncomfortable to use and unsanitary. This problem is particularly apparent when body fluid is discharged in large quantities within a relatively short period of time in the initial stage of menstruation. The absorbing layer is unable to fully absorb the discharge in some cases, permitting the body fluid to remain on the surface of the absorbing layer and allowing sideways leakage when the layer is subjected to varying body pressures.

Even at times of light flow, however, body fluids do not necessarily readily pass through the fluid permeable cover into the fluid absorbent core of the sanitary napkin. It has been recognized that menses is a complex fluid with uterine blood being only one component of its composition. Menses also contains cellular debris and a mucous-like fraction. The composition of menses has a significant effect on the transport of fluid from the cover into the absorbent matrix of a sanitary napkin, especially for certain women who consistently have high viscosity menses and comparatively low flow volumes. High viscosity menses tends to stay on the upper surface of the cover of the sanitary napkin.

The cover, or top layer of a sanitary napkin is an important structural component respecting overall product efficacy, both objectively and subjectively from the user's point of view. A number of dichotomies become apparent when describing the ideal or preferred top layer of sanitary napkins. For consumer acceptance, a cloth-like texture and feel are preferred. In addition, the top layer should appear clean, dry and stain-free even during use. Thus, the cover layer should remain aesthetically pleasing even during use. Nonwoven webs which most economically and effectively achieve the objective of an acceptable cloth-like texture are, however, generally undesirable when evaluated on their ability to remain clean, dry and stain-free during use. With nonwoven webs, menses tends to get hung up or remain on the top layer while never reaching the lower absorbent layer since the fibers oftentimes act to block the path to the absorbent layer. Thus, the sanitary napkin becomes uncomfortable, wet, sticky and generally unsatisfactorily pleasing.

SUMMARY OF THE INVENTION

Briefly, this invention relates to a method of perforating a nonwoven web and use of the web as a top layer or cover for a sanitary napkin. The cover has a cloth-like texture or feel but remains clean, dry and relatively stain-free during use, in contrast-distinction to conventional fibrous covers. An attribute of the present invention is that the material has the ability to relatively rapidly transfer menses across its boundaries into the absorbent material lying beneath it while preventing the return of that fluid to the cover; i.e., the cover has excellent wick characteristics. Covers of the foregoing variety are conveniently and beneficially provided in a fairly simple manner using straight-forward apparatus. Thus, capital expense and elaborate methodologies are minimized while nonetheless delivering product of enhanced characteristics as aforesaid. Still further, the cover optionally provides means for improved stain masking, either integrally or in association with the absorbent core or matrix of a sanitary napkin, increasing significantly the aesthetic characteristics of this class of catamenial product.

The foregoing advantages and benefits are achieved by forming a perforated nonwoven web comprising essentially broken thermoplastic fibers wherein the nonwoven web contains distinct, stable perforations with a consolidated zone or area of densified, thermally set material immediately surrounding each such perforation. The fibrous web substrate is most preferably autogenously bonded and thus does not require an ancillary adhesive. When the perforated, selectively or discretely consolidated nonwoven web is adopted as a cover material for a sanitary napkin, the perforations tend to attract body fluid (i.e., menses), and thus allow for relatively easy passage of the fluid through the web into the absorbent area of the napkin.

A novel rotary, perforating apparatus provides the desired apertured nonwoven web system of the present invention. In a particularly preferred aspect thereof, matting pin/hole rolls suitably heated relative to the physical characteristics of the web to be apertured provide an expedient apparatus and convenient method for achieving the ends of the present invention.

Other advantages of the present invention, and a fuller appreciation thereof, will become apparent as the following detailed description ensues.

BRIEF DESCRIPTION OF THE DRAWINGS

This invention can better be understood by references to the drawings in which:

FIG. 1 is a cross-sectional view through the length of the rotary, perforating apparatus of the present invention.

FIG. 2 is a partial cross-sectional view through the drive side of the apparatus shown in FIG. 1.

FIG. 3 is a partial cross-sectional view through the operator side of the apparatus shown in FIG. 1.

FIG. 4 is a cross-sectional view through the pin roll of the apparatus shown in FIG. 1.

FIG. 5 is a cross-sectional view through the hole roll of the apparatus shown in FIG. 1.

FIG. 6 through FIG. 11 are views of various types of pins which are useful in the practice of the present invention.

FIG. 12 is a cross-sectional view of a shouldered pin shown to be performing an area of nonwoven web comprising thermoplastic fibers.

FIG. 13 is a view from the bottom of the nonwoven web of FIG. 12 after the pin has been removed.

FIG. 14 is a cross-sectional view through the hole roll and each of the pin rolls is a multi-roll system showing the path of the nonwoven web.

FIG. 14A is an enlarged view of a portion of FIG. 14 showing pins having a profile as depicted in FIG. 6 piercing the nonwoven web and entering into the apertures formed in the roll 100.

FIG. 14B is an enlarged view of a portion of FIG. 14 showing pins having a profile as depicted in FIG. 10 piercing the nonwoven web and entering into the apertures formed in the roll 100.

FIG. 14C is an enlarged view of a portion of FIG. 14 showing pins having a profile as depicted in FIG. 11 piercing the nonwoven web and entering into the apertures formed in the roll 100.

FIG. 15 is a plan view of the top or cover layer of a feminine sanitary napkin depicting the pattern of the perforations.

FIG. 16 is a plan view of the top or cover layer of another feminine sanitary napkin depicting the pattern of the perforations.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Any type of nonwoven web comprising fusible polymeric filaments is useful in the practice of the present invention. For instance, a suitable nonwoven web cover material is a uniform spunbonded nonwoven web having one and one-half denier or larger filaments. Such a material is described in U.S. Pat. No. 4,340,561, to which reference is made for a fuller description of such material. This material is also referred to as a linear drawn spunbonded (LDS).

Alternatively, a bonded carded web is useful in the practice of the present invention. The bonded carded web is generally composed of 100% polypropylene, however, blends containing rayon, polyester and the like are equally suitable. Hollowfill fiber types may also be present in the bonded carded web. The bonded carded web is generally in the range of about 10 to about 50 gsm (grams per square meter) and is preferably within the range of about 18 to about 24 gsm. The bonded carded web fibers range from about one and one-half to about three denier. The staple length is within the range of about one and one-half to about two

inches. Alternatively, the bonded carded web may be laminated to a film of ethyl methacrylate.

Another suitable nonwoven web is a "coform" material as described in U.S. Pat. No. 4,100,324. Coform is a blend of meltblown microfibers and an absorbent fiber such as pulp fluff. Representative meltblown fibers include polypropylene, polyethylene, polyethylene terephthalate, polyamides, acrylic and rayon fibers or blends. Alternatively, the coform may be laminated to a spunbonded nonwoven web.

A sanitary napkin cover such as that described in U.S. Pat. No. 4,397,644, is also useful in the practice of the present invention. The material described therein is primarily a nonwoven thermoplastic web which is of sufficiently open structure to enhance the transfer of menses into an absorbent layer. Bonding is used to accomplish integration. This may be achieved by the application of heat, such as hot calendar embossing, or by ultrasonic means. Alternatively, the bonding may be accomplished by mechanical manipulation of the fibers without heat as, in needling. Ultrasonic bonding is particularly preferred. This nonwoven web is typically comprised of a polyester and polypropylene combination, typically 30% and 70% respectively. Alternatively, it may be comprised of 100% polypropylene. Hollowfill fiber types may also be present. This nonwoven web is a carded web which is generally in the range of about 30 to about 150 gsm. Preferably, this nonwoven web ranges from about 40 to about 120 gsm. This material ranges from about one and one-half to about eight denier and may be of high crisp nature thus giving it greater loft. Preferably, it is within the range of about 5 to 8 denier. The staple length is also within the range of about one and one-half to about three inches. This material may alternatively be laminated to spunbonded web.

In particular, suitable fusible fibers for this invention are: Vinyon, a vinyl chloride/vinyl acetate copolymer sold by Celanese Fiber Division and formerly by Avtex Fibers, Inc., of New York, N.Y.; Eastman 410 amorphous or crystalline polyester fibers sold by Eastman Chemical Products, Inc., a Subsidiary of Eastman Kodak Co., Kingsport, Tenn.; or Chisso ES a bi-component polypropylene/polyethylene fiber sold by Chisso Ltd., Osaka, Japan, which due to its differential melting point for each component of the fiber, could be used as the only thermoplastic fiber as well as in blends with other fibers.

A cylinder which would simply punch holes through and displace fiber is easily achieved. However, the nonwoven web material typically has a memory and thus a strong tendency to return to its original position and thereby close the hole which was just formed.

It has been found that heating the tips of the pin to heat the nonwoven web during penetration acts to heat the fusible polymeric filaments near the area of the pin hole. The polymeric filaments are heated up to a temperature just below the point of melting and cooled to room temperature after the pin is removed. This produced the consolidated area 168 seen in FIG. 12 and FIG. 13. The consolidated rings 168 preferable have a diameter at least twice the diameter of the apertures formed in the web 162. The fusible thermoplastic fibers used in the nonwoven web are meltable and if sufficient heat and pressure are applied to this nonwoven material select areas will consolidate or tend to melt and lose the fibrous network characteristics of nonwoven materials. Under magnification of 20X, the material appears glass-

has, almost glass-like in appearance. This consolidated or densified area of the material is now hydrophobic, particularly more hydrophobic than the non-perforated surface of the web, and attracts fluid into the perforation or hole. Of course, it is possible that some areas will actually melt and fuse during the course of the subject operation, but this is deemed to be less desirable in the practice of the present invention.

It is also relevant to note that it is not desirable to simply make a hole that removes or evaporates the material previously in the hole or aperture area and thus leaving a solid clean hole in the fabric. The goal of the present invention is to allow all of the material or nonwoven fabric to remain in the web because it is desirable to create some type of depth to the point of penetration. This depth or three dimensional profile is desirable since it allows a perception of thickness or texture to the nonwoven fabric.

Ideally, by making the apertures in the nonwoven web in the manner taught by the present invention, the raised ridges 170 are formed around the periphery of the dense consolidated portions 160 (see FIGS. 13 and 15). The nonwoven material which has not become consolidated or densified is fluffier and thicker and therefore appears like a ridge 170 adjacent the consolidated area 160. This ridged area 170 is ideally considerably less acceptable to fluid or menses since the menses one readily get hung up or stuck on the upper surface of the ridged portion 170 and be unable to enter the absorbent below. Generally, the heavier the fabric, the higher the ridge 170 will be. Advantageously, since the dense consolidated areas 160 are more hydrophobic, the menses will be attracted to these areas and then readily pass through the apertures directly into the absorbent area below.

Preferably, the heated pin makes a distinct, true hole through the nonwoven fabric. That is, no fibers remain in the hole itself. The hole should be free from any extraneous fibers or impurities. If a glob of fluid enters an aperture blocked by a few fibers, the glob of fluid will get hung up on the top of the nonwoven web and remain in that position blocking the entrance of to hole. This is obviously undesirable since it leaves an undesirable stain and wetness on the surface of the nonwoven cover.

The sides of the aperture or perforation formed in the web are preferably at approximately a 90 degree angle with respect to the length of the nonwoven fabric.

Briefly, the apparatus of the present invention may be envisioned as any type of perforating or aperturing device having a first member or containing a series of pins and a second member containing a series of indentations or apertures for receiving entry of the pins. Preferably, the apparatus is a rotary perforating system with the capability of generating a combination of holes having a variety of shapes and in a wide range of patterns with a single pass of the nonwoven web through the system. The rotary perforating/aperturing system can be described as a system comprising two or more cylinders mounted in a configuration such that one or more cylinders are associated with the peripheral surface of a single apertured cylinder.

The apertured cylinder can be described as a hole roll which has been machined or engraved for finished female pattern design. The hole roll is heated internally and the surface is hardened to withstand embossing pressure.

A pin roll is also machined to a finished male pattern design for perforating the web. This matches the hole roll and is equipped with tools, for example, perforating pins, embossing pins or a combination of both. The pin roll is also heated internally.

Referring to FIGS. 1-3, a perforating apparatus 10 is shown having a frame 12 which includes a horizontal base 14, a pair of vertical side walls 16 and 18, and a top member 20 extending across the upper end of the side walls. The side walls 16 and 18 include vertical slots 22 and 24, respectively. Mounted within the slots are a pair of roll assemblies 26 and 28. The lower assembly 26 includes a hollow roll 30 and a pair of support shafts 32 and 34 extending coaxially from opposite ends of the lower roll 30. The shaft 32 is journaled in a bearing mechanism 36 mounted in the slot 24 of the side wall 18. The shaft 32 projects completely through the slot 24 and is operably connected to a toothed gear 40. The other shaft 34 extends completely through the slot 22 and is journaled in bearing housing 38. The shaft 34 is of a hollow construction for the purpose of receiving electrical conduits as will be hereinafter explained.

The upper roll assembly 28 includes a pin roll 42 and a pair of support shafts 44 and 46 extending longitudinally coaxially from opposite ends thereof. The shaft 44 is journaled in a bearing mechanism 48 which is mounted in the slot 24, and the shaft 446 is journaled in a bearing mechanism 50 which is mounted in the slot 22.

The shaft 44 projects completely through the slot 24 and is operably connected to a toothed gear 52 which meshingly engages the gear 40. There is a zero backlash arrangement. The shaft 44 may be driven by a power source (not shown) through a controllable speed variator. The other shaft 46 extends completely through the slot 22 and is hollow in order to receive electrical conduits as will be hereinafter explained.

Referring to FIG. 3, a spacer 160 is shown which is used to adjust the clearance between the rolls 30 and 42. The spacer 160 determines the amount of penetration obtained by the pins into the hole roll 30.

Referring again to FIG. 1, the bearing mechanisms 48 and 50 are each vertically adjustable within the respective slots 24 and 22 by turnbuckle type connectors 56 and 58. The connectors 56 and 58 enable the upper or pin roll 42 to be raised or lowered relative to the hole roll 30 in order to change the vertical depth of the nip defined between the rolls 30 and 42, and also for maintenance and replacement of parts.

Referring to FIG. 5, the lower or hole roll 30 contains an arbor 60 upon which a sleeve 62 is mounted by a keyway (not shown). The sleeve 62 is formed of a heat conducting material, typically brass, steel or aluminum. Aluminum being preferred. The sleeve 62 is axially sandwiched between a terminal ring 64 and a retaining ring 66. The retaining ring 66 is pushed against the sleeve 62 by turnbuckle type connectors 68 which extend between the retaining ring 66 and an end ring 70. The end ring 70, in turn, is mounted on the arbor 60. The terminal ring 64 is positioned axially between the sleeve 62 and a second end ring 72 which is also mounted on the arbor 60.

The outer periphery of the sleeve 62 is stepped at its ends to define a pair of annular shoulders 74 and 76 which receive the inner ends of a pair of cover rings 78 and 80. A cover ring 78 engages the shoulder 74 and the outer peripheries of both the end ring 70 and the retaining ring 66. The cover ring 78 is suitably fastened to the end ring 70 and to the sleeve 62 by fasteners 82 and 84.

A second cover ring 80 engages the shoulder 76 and the outer periphery of the end ring 72 and is suitably fastened thereto by fasteners 86 and 88.

The sleeve 62 contains a cartridge heater 90 which is electrically connected to an external power source (not shown) via electrical conduits 92 and 94 which are interconnected to terminals 96 carried by the terminal ring 64. The cartridge heater 90 provides heat to the sleeve 62. The sleeve 62 also carries a conventional temperature probe 98 for monitoring the temperature of the sleeve 62.

Mounted on the outside periphery of the sleeve 62 is a cylindrical strip 100. The strip 100 is formed of a heat conducting material such as brass, steel or aluminum. Aluminum being preferred. The strip 100 is mounted on the sleeve 62 by press fit, and a roll pin 102 is inserted through both the strip 100 and the sleeve 62 to prevent relative circumferential movement therebetween. Axial movement of the strip 100 is prevented by the cover sleeves 78 and 80 which bear against the axial ends of the strip 100. The strip 100 contains a series of tiny apertures or nozzles 101 arranged in a pre-set pattern for reasons to be explained hereinafter. Preferably, each aperture 101 is round or circular in configuration and is sized to receive a corresponding pin 152 mounted on the upper roll 42.

Referring to FIG. 4, the upper roll 42 contains an arbor 110 upon which a sleeve 112 is mounted in the same manner as the sleeve 62 is mounted on the lower roll 30. The sleeve 112 is formed of a heat conducting material, such as brass, steel or aluminum, and is axially sandwiched between a terminal ring 114 and a retaining ring 116. The retaining ring 116 is pushed against the sleeve 112 by turnbuckle type connectors 118 which extend between the retaining ring 116 and an end ring 120 which is mounted on the arbor 110. The terminal ring 114 is positioned axially between the sleeve 112 and another end ring 122 mounted on the arbor 110.

Extending around opposite ends of the arbor 110 are a pair of cover sleeves 124 and 126. The cover sleeve 124 is secured to the outer peripheries of both the end ring 120 and the sleeve 112 by fasteners 128 and 130. The cover sleeve 126 is secured to the outer peripheries of both the end ring 122 and the sleeve 112 by fasteners 132 and 134.

The sleeve 112 contains a cartridge heater 140 which is electrically connected to an external power source (not shown) via electrical conduits 142 and 144. The conduits 142 and 144 are interconnected to terminals 146 carried by the terminal ring 114. The cartridge heater 140 provides heat to the sleeve 112. The sleeve 112 also carries a conventional temperature probe 148 for monitoring the temperature of the sleeve 112.

Mounted on the outside periphery of the sleeve 112 is a cylindrical strip 150 formed of a heat conducting material such as brass, steel or aluminum. Aluminum being preferred. The strip 150 is mounted on the sleeve 112 by press fit, and a roll pin 182 is inserted through both the strip 150 and the sleeve 112 to prevent relative circumferential movement therebetween. Lip portions 154 and 156 of the cover sleeves 124 and 126 overlap the edges of the strip 150 to aid in the retention thereof.

The strip 150 carries a plurality of needles or pins 152 which project outwardly beyond the outer peripheries of the cover sleeves 124 and 126 by a distance greater than the depth of the nip between the rolls 30 and 42 so that the ends of the pins 152 enter the apertures 101 formed in the lower roll 30. To that end, the apertures

101 are arranged in register with the pins 152 and have a wider diameter than the pins 152 to prevent the pins 152 from contacting the walls of the apertures 101. It will be appreciated from the foregoing that the upper roll 42 may be designated as a pin roll, and the lower roll 30 as a hole roll. Preferably, the pins 152 are formed of a heat conductive material such as brass or steel. The pins 152 are mounted within the strip 150 by placement either from the inside of or from the outside of the cylinder. Placement of the pins 152 on the outside of the cylinder generally requires a space for setting of the pins 152 and the use of a type of compound that upon filling the space provides an element of permanence to the setting, thereby not allowing the pins 152 to be removed. The strip 150 includes a recess 158 facing the sleeve 112 to receive the inner ends of the pins 152. The pins 152 project in radial outward directions with respect to the axis of rotation of the pin roll 42. The apertures 101 formed in the strip 100 project in corresponding directions so as to be able to receive the ends of the pins 152.

It will be appreciated that the pins 152 are heated by conduction due to contact between the heated sleeve 112 and the strip 150 and between the strip 150 and the inner ends of the pins 152. The corresponding hole roll 30 is heated in a similar manner. In operation, the rolls 30 and 42 are synchronously rotated while a web 162 of fabric is fed through the nip defined by the rolls. As this occurs, the pins 152 contact and completely penetrate the fabric, separating the individual fibers to form a generally cylindrical hole through the fabric. Since the pins 152 are heated, the fibers which are displaced by each heated pin will be consolidated, compressed or otherwise densified and set in that glassine-line configuration so that the hole cannot reclose. Thus, the fibrous web is autogenously bonded, that is, does not require the use of an adhesive to form structurally stable apertures. Some portion of the fibers being pushed will enter the associated opening in the hole roll 30, whereby dense consolidated rings 168 and annular rings 170 will be formed around each of the holes. Such dense consolidated rings 168 and raised ridges 170 serve to add depth to the web and thereby improve the cloth-like texture and feel.

Since the pins 152 pass completely through the fabric and tend to set thermally any fiber with which they come into contact, it is assured that all of the holes will be unblocked, i.e., no fiber strands will remain which might extend across, and partially obstruct, the holes.

Nonwoven web fabric 162 may enter the apparatus 10 from either side of the two cylinders.

The foregoing describes a two cylinder configuration with a female patterned main cylinder and a male patterned worker cylinder. However, other embodiments are anticipated such as a three cylinder configuration where the three cylinders may or may not relate in a linear fashion. By using a multiple cylinder configuration a wider variety of patterns can be attained since different male or pin rolls 42 may be used. That is, the pin rolls 42 need not be of the same shape or diameter. This is best depicted in FIGS. 14, 14A, 14B and 14C wherein there are three different pin rolls 42.

At the outset, it is relevant to note that the temperature of the heated pin roll 42 may be higher than that of the hole roll 30 without departing from the spirit of the present invention. This is because approximately 10% of the heat from the pin roll 42 may be lost at the tips of the pins 152, but without a loss in overall operating or

functional efficiency. Of course, the two rolls 38 and 42 may be maintained at about the same temperature. There is no easy means of actually heating the tips of the pins 152 than it is necessary to heat the pin roll 42 itself and via conduction drive heat to the pin head to perform the aperturing operation of the present invention. The temperature of the pin roll 42 may generally be maintained in the range of about 110 degrees Fahrenheit to about 300 degrees Fahrenheit. The hole roll 38, on the other hand, may generally fall within the temperature range of about 90 degrees Fahrenheit to about 350 degrees Fahrenheit.

The speed of the rotary apparatus is generally within the range of about 12 feet on nonwoven fiber per minute to about 220 feet per minute. Since we are dealing with a rotary process, if parameters such as heat, angle of approach of the pin, and the like are controlled, speeds up to approximately 300 feet per minute could conceivably be achieved.

It may be considered suitable to thermally treat the nonwoven web 162 prior to processing. The web 162 may be pre-cooled or post-cooled, that is, cooled after undergoing the perforation operation.

Generally, if the speed of a nonwoven web 162 through the rotary apparatus is increased, the temperature must also be increased. These two parameters are directly related since the web 162 may actually burn if the temperature is too high and the pins 152 and the web 162 maintain contact for too long. Preferably, an electrical mechanism is used which is able to maintain both parameters of temperature and speed in the ideal or best relationship.

It is also particularly relevant to note that during the rotary operation, the pins 152 never touch the interior of the corresponding hole on the hole roll 38. The individual hole diameters in the hole roll 38 are most preferably always approximately 0.010 inch larger than the diameter of the pin shaft. This is area 172 in FIG. 12. As a minimum, the hole diameter is selected to be nonbinding respecting the size of the mating pin, typically at least 0.005 inch greater than the diameter of the pin shaft on the pin roll. This spacing is important in the practice of the present invention in order to achieve the proper depth of the entry of the pin through the nonwoven web fabric. Otherwise, if the pin head was too long, it might touch the sides of the hole.

FIG. 6 through FIG. 11 each depict a pin of varying sizes and shapes. Each of these pins are suitable for forming the apertures in the nonwoven web 162. Each pin may be located on a flat plate type device placed on some type of rotary cylinder as was previously described. The hole in the hole roll 38 need not be of the same shape as the pin or pin head. As long as the proper relative dimensions are maintained to preclude binding or interference, the hole may be less defined or more rounded than the pin shape.

FIGS. 11, 12 and 14C depict a shouldered pin 166 which is a suitable pin in the practice of the present invention.

The exact shape and dimensions of the pin head are not critical for present purposes. However, the diameter of the shaft 164 of the pin is important. The shaft 164 of the pin is most relevant since it determines the diameter of the aperture which is formed. Generally, the diameter of the shaft of the pin ranges from about 0.015 to about 0.125 of an inch. Preferably the pin shaft ranges from about 0.032 to about 0.097 of an inch. The pins essentially act to burst the nonwoven fabric while not

actually damaging or breaking any of the fibers themselves.

The pin itself is comprised of a metal. Preferred metals include steel or brass with steel being more preferred. Any type of steel is suitable in the practice of the present invention including hard or soft steel such as stainless steel. The preferred metal is one which would allow the greatest heat transfer from the heated roll to the pin head.

A plastic pin or pin head may be desired in the practice of the present invention at the option of the designer. However, some plastics are generally not able to withstand the high operating temperatures as described herein and materials selection needs to be made accordingly.

Alternatively, the pin may comprise a metal core such as steel with a plastic surface. The plastic covering may be applied by coating or it may be mechanically fit by pushing the coat or layer onto the pin. The plastic coated metal pin concept is particularly advantageous since the plastic surface provides a smooth, slippery surface to the pin thus allowing it to penetrate the nonwoven fabric more readily. A preferred coating material would be a fluoropolymer coating, in particular, polytetrafluoroethylene (Teflon® by Dupont).

A metal pin may also be impregnated with plastic material. In this case, the metal surface must be porous enough to allow the actual impregnation of the plastic onto the metal. Suitable plastic materials for this impregnation include, but are not limited to, polypropylene, polyethylene and the like.

Every one of the pins must enter the matching hole on the hole roll 38 with perfect clearance. There is never any metal-to-metal, or in the case of plastic coated pins, plastic-to-plastic contact.

The diameter of the shaft of the pin is generally in the range of 0.015 inch to about 0.125 inch. This is the true diameter of the tool therefore this value does not necessarily represent the diameter of the finished hole. The finished hole may be slightly oblong and slightly larger than the diameter of the pin shaft when completed. The exact diameter of the hole is dependent on a variety of factors that must be each independently determined.

In determining the number of holes per area on the nonwoven web 162, it is pertinent to discuss the percent of openness, as that is a more meaningful value than the pin population per square inch since pin diameter varies so widely. The goal is to open and texture the surface of the nonwoven to allow fluid masses to penetrate more readily while at the same time to minimize rewet, that is, a return of the fluid to the nonwoven cover. Maintaining a product which is aesthetically pleasing is thus a key to the present invention.

The degree of openness or perforation on the nonwoven web can range from about 20% to about 55% of the available surface area. The upper practical limit seems to be approximately 55% due to mechanical/physical limitations of the system. Preferably, the degree of openness is in the range of about 40% to about 50%.

The pattern of the pins themselves may vary considerably. If a smaller shaft size is selected, a greater number of holes are necessary to achieve the same degree of openness.

It is also suggested to add a binder to the intact area of the nonwoven web, that is, the area between the holes or apertures. This has been described as the ridge area. The addition of a binder has two-fold advantage. First, the binder will not destroy the cloth-like texture

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and appearance of the nonwoven web. Second, by filling in the tiny voids within the ridges, fluid will not have a tendency to get hung up there and therefore alter the visual appearance of the surface of the sanitary napkin. The binder maybe applied at any stage of the process such as during the formation of the nonwoven web, sprayed on after the web is formed or added during the aperturing or consolidating process. The optimal qualities of a binder is that it withstand body temperature heat, but neither melt nor rub off. Suitable binders include polyethylene glycol and the like.

Another feature of the subject invention involves color toning or pigmenting either the area of the aperturing or the entire top surface of the sanitary napkin which may or may not contain the apertures of the present invention. This color toning or pigmenting of the cover layer has several advantages. Most significantly, it tends to affect perceptual or visual masking of fluid during use of the sanitary napkin. The coloring may thus attenuate the typical red menstrual stain observable during use. It also improves visual perception by emphasizing in the case of a perforated nonwoven cover material that the product is effective in achieving a degree of physical separation between the body of the wearer and the core containing or laden with menstrual fluid. The perforations also become more distinct and noticeable. The coloring or pigmentation is selective and may involve all or a portion of the nonwoven cover material. The preferred colors include those in the blue, blue-green, and green areas of the visible light spectrum. Alternatively, the toning or coloring agent may be already present in the binder. In addition, instead of toning or pigmenting the cover layer itself, a similar effect could be achieved by toning or pigmenting the absorbent material directly under the cover layer. If a more conventional white coloration is desired a whitening or opacifying agent maybe used such as titanium dioxide (TiO₂) up to a level of approximately 8% of the total weight of the cover material.

As previously indicated, the apertured nonwoven web 162 is suitable as the uppermost layer or cover of a feminine pad. The raised ridges 170, as shown in FIG. 12, face the perineal area of the wearer when the nonwoven web is used as a cover on a feminine sanitary napkin. Any sanitary napkin bearing a fibrous cover currently known in the art may contain the apertured nonwoven web cover material of the present invention. In the simplest terms, a feminine sanitary napkin is comprised of a highly absorbent core of fibrous material or the like, a fluid pervious cover member such as that described by the present invention and a fluid impervious backing member which is oftentimes referred to as a baffle, with pressure sensitive attachment means disposed thereon. The highly absorbent core of fibrous material may comprise any of the well-known materials currently known in the art, including wood pulp fluff, multiple layers of cellulose wadding, cotton or rayon fibers, cellulose sponge, hydrophilic synthetic sponge, and the like.

The fluid impervious backing member or baffle is preferably a thin plastic film such as polyethylene or polypropylene of about one-half to three mils (i.e., thousandths of inches) in thickness. Other thin flexible films such as polyvinylchloride, polyvinylidene chloride, natural rubber, etc., may be employed. Another useful material is a thin polyurethane film which maybe of open or close-celled construction on the interior, and may be absorbent or nonabsorbent, but which should

have a closed fluid-impervious skin on at least the bottom surface.

Exemplary of such a baffle is a conventional 0.4 oz. per square yard spunbonded web with a 0.75 mil (0.00075 inch) film of an ethylene methyl acrylate (EMA), preferably with the EMA side toward the body of the absorbent material.

According to this invention, the sanitary napkin is provided with improved comfort and the ability to relatively rapidly transfer viscous menses from the apertured nonwoven web cover material into the absorbent layer below. The absorbent matrix described in U.S. Pat. No. 4,397,644 contains a principal absorbent component characterized by relatively high fluid retention and a second component including comfort enhancement capabilities positioned at least in part between the principal absorbent and the fluid permeable cover or wrap. The second component, that is the comfort enhancing component, may be integrated with the apertured nonwoven web cover material of the present invention to provide intimate contact and densification of localized regions. As a consequence, fluid transfer routes are established and fluid is conveyed to the principal absorbent component. This fluid transfer system may be used in association with the nonwoven web cover of the present invention.

FIGS. 15 and FIG. 16 indicate two possible designs or patterns for the apertured holes on the surface of the cover material of the sanitary napkin. Looking at the length of the sanitary napkin, the range of the width of the apertured material is generally from about one to about two inches wide, that is, the apertures do not extend the full width of the sanitary napkin. This can be observed at areas 174 and 180 of FIG. 16. The area without aperturing is generally about 0.75 inch to about 2.0 inch wide on each side of the sanitary napkin.

Alternatively, a distinct registered pattern may be obtained on the sanitary napkin cover. That is, the apertured pattern of approximately one to two inches wide need not extend the full longitudinal length 178 of the sanitary napkin as described in FIG. 16. Typically, the aperturing may be terminated from $\frac{1}{8}$ inch to approximately 2 inches from the longitudinal edge of the pad. In the case of the registered pattern the apertured portions of the cover material does not touch the edges of the sanitary napkin and is primarily located in and near the center of the sanitary napkin. This is obviously most advantageous since it corresponds with the perineal area of the wearer. In FIG. 15, the aperturing 176 extends the full longitudinal length of the sanitary napkin.

While the invention has been described in connection with a specific embodiment, it will be understood that is not intended to limit the invention to those embodiments. On the contrary, it is intended to cover all alternatives, modifications, and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

We claim:

1. A method of perforating a nonwoven web of fibrous fabric comprising the steps of:

- (a) directing said web through a nip defined by first and second movable members; and
- (b) penetrating said web with a plurality of heated pins each having a shoulder which surrounds a penetrating point, said pins projecting outward from said first member and entering heated apertures formed in said second member causing fibers of said fabric to separate and enter into said aper-

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tures to form openings through said web, each of said shoulders having a diameter larger than the diameter of a corresponding aperture into which said point enters, each of said openings being surrounded by a consolidated ring formed by pressing said web between one of said heated pins and a corresponding aperture and between one of said shoulders and said second member, a combination of said openings and said consolidated rings exhibiting greater hydrophilic properties than the non-perforated surface of said web.

2. The method of claim 1 wherein said first moveable member is heated to a temperature of between about 100 degrees Fahrenheit to 300 degrees Fahrenheit.

3. The method of claim 1 wherein said second moveable member is heated to a temperature of between about 90 degrees Fahrenheit to 350 degrees Fahrenheit.

4. A method of forming a perforated liquid permeable nonwoven cover material for a feminine pad, said pad including a fluid absorbent partly covered by said cover material and partly surrounded by a baffle which in turn is bonded to said cover material, said method comprising the steps of:

- (a) directing said cover material through a nip defined by first and second moveable members; and
- (b) penetrating said cover material with a plurality of heated pins each having a shoulder which surrounds a penetrating point, said pins projecting outward from said first member and entering heated apertures formed in said second member causing fibers of said cover material to separate and enter into said apertures to form openings through said cover material, each of said shoulders having a diameter larger than the diameter of a corresponding aperture into which said point enters, each of said openings being surrounded by a consolidated ring formed by pressing said cover material between one of said heated pins and a corresponding aperture and between one of said shoulders and said second member, a combination of said openings and said consolidated rings exhibiting greater hydrophilic properties than the non-perforated surface of said cover material.

5. A method of perforating a nonwoven web of fabric including fusible polymeric filaments, said method comprising the steps of:

- (a) positioning a first roll relative to a second roll to obtain a preselected nip opening therebetween, said first roll containing a plurality of radially extending pins each having a shoulder which surrounds a penetrating point, and said second roll containing a plurality of circular apertures arranged and sized to receive said pins each of said shoulders having a diameter larger than the diameter of a corresponding aperture into which said point enters
- (b) heating both said first and second rolls to a predetermined temperature;
- (c) directing said web between said nip; and
- (d) rotating said first and second rolls to cause said pins to penetrate said web and enter into said apertures, said penetration causing fibers of said fabric to separate and be drawn into said apertures to form openings in said web which are surrounded by consolidated rings formed by pressing said web between one of said heated pins and a corresponding aperture and between one of said shoulders and said second roll, a combination of said openings and said consolidated rings, said rings imparting a

three dimensional profile to said web which facilitates passage of fluid through said openings.

6. The method of claim 5 wherein said first roll is heated to a temperature of between about 110 degrees Fahrenheit to 300 degrees Fahrenheit.

7. The method of claim 5 wherein said second roll is heated to a temperature of between about 90 degrees Fahrenheit to 350 degrees Fahrenheit.

8. The method of claim 5 wherein said web is cooled after being perforated.

9. The method of claim 5 wherein said web is pre-cooled prior to being perforated.

10. A method of perforating a nonwoven web of fibrous fabric comprising the steps of:

- (a) positioning a first roll relative to a second roll to obtain a preselected nip opening therebetween, said first roll containing a plurality of radially extending pins each having a shoulder which surrounds a penetrating point, and said second roll containing a plurality of circular apertures arranged and sized to receive said pins each of said shoulders having a diameter larger than the diameter of a corresponding aperture into which said point enters;
- (b) heating both said first and second rolls to a predetermined temperature;
- (c) directing said web between said nip; and
- (d) rotating said first and second rolls to cause said pins to penetrate said web and enter into said apertures, said penetration causing fibers of said fabric to separate and be drawn into said apertures to form openings in said web which are surrounded by consolidated rings formed by pressing said web between one of said heated pins and a corresponding aperture and between one of said shoulders and said second roll, a combination of said openings and said consolidated rings exhibiting greater hydrophilic properties than the non-perforated surface of said web.

11. The method of claim 10 wherein said first roll is heated to a temperature of between about 110 degrees Fahrenheit to 300 degrees Fahrenheit.

12. The method of claim 10 wherein said second roll is heated to a temperature of between about 90 degrees Fahrenheit to 350 degrees Fahrenheit.

13. The method of claim 10 wherein said web is cooled after being perforated.

14. The method of claim 10 wherein said web is pre-cooled prior to being perforated.

15. A method of forming a perforated nonwoven cover material for a feminine pad, said pad including a fluid absorbent having a first surface facing the body of a user which is covered by said cover material and a liquid impermeable baffle surrounding the remaining portion of said absorbent and which is bonded to said cover material, said method comprising the steps of:

- (a) positioning a first roll relative to a second roll to obtain a preselected nip opening therebetween, said first roll containing a plurality of radially extending pins each having a shoulder which surrounds a penetrating point, and said second roll containing a plurality of circular apertures, arranged and sized to receive said pins, each of said shoulders having a diameter larger than the diameter of a corresponding aperture into which said point enters;
- (b) heating both said first and second rolls to a predetermined temperature;
- (c) directing said cover material between said nip; and

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(d) rotating said first and second rolls to cause said pins to penetrate said cover material and enter into said apertures, said penetration causing fibers of said cover material to separate and be drawn into said apertures to form openings therein which are surrounded by consolidated rings formed by pressing said cover material between one of said heated pins and a corresponding aperture and between one of said shoulders and said second roll, a combination of said openings and said consolidated rings, exhibiting a greater hydrophilic property than the non-perforated surface of said cover material.

16. A method of perforating a nonwoven web of fabric comprising the steps of:

- (a) directing said web through a nip defined by first and second movable members; and
- (b) penetrating said web with a plurality of heated pins each having a shoulder which surrounds a

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penetrating point, said pins projecting outward from said first member and entering heated apertures formed in said second member causing fibers of said fabric to separate and enter into said apertures and form openings through said web which occupy approximately 20 to 35% of the available surface area of said web each of said shoulders having a diameter larger than the diameter of a corresponding aperture into which said point enters, each of said openings being surrounded by a consolidated ring formed by pressing said web between one of said heated pins and a corresponding aperture and between one of said shoulders and said second member, a combination of said openings and said consolidated rings exhibiting greater hydrophilic properties than the non-perforated surface of said web.

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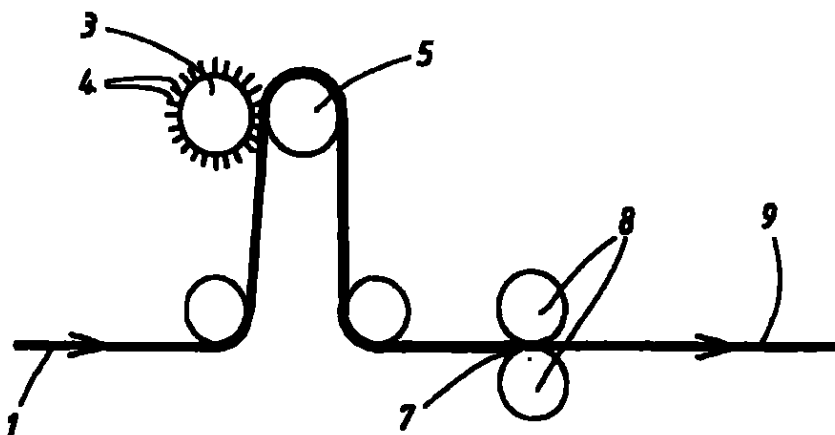
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(54) Title: METHOD OF PRODUCING AN APERTURED COVERING SHEET FOR AN ABSORBENT ARTICLE AND A MATERIAL PRODUCED IN ACCORDANCE WITH THE METHOD



(57) Abstract

A method of manufacturing a fluid permeable covering sheet (9) for an absorbent article such as a diaper, a sanitary napkin, an incontinence protector or the like, wherein heated needles (4) are brought to penetrate a sheet of textile material (1) comprising at least one thermoplastic component, whereby the thermoplastic component closest to the needles (4) melts, whereafter the needles (4) are removed and the heated material (1) is passed through at least one nip of rollers (7) so that the thermoplastic component closest around the apertures is smoothed out into a substantially smooth material surface around the apertures, whereafter the thermoplastic component is brought to solidify. The invention further pertains to an apertured covering sheet (201, 301) for an absorbent article manufactured in accordance with the method, and an absorbent article (300) provided with a covering sheet manufactured in accordance with the method.

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5 **TITLE:**

**METHOD OF PRODUCING AN APERTURED COVERING SHEET FOR AN
ABSORBENT ARTICLE AND A MATERIAL PRODUCED IN ACCORDANCE
WITH THE METHOD.**

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TECHNICAL FIELD:

The present invention relates to a method of producing an
apertured covering sheet for an absorbent article such as
15 a diaper, a sanitary napkin, an incontinence protector, or
the like, wherein heated needles are caused to penetrate a
sheet of material comprising at least one thermoplastic
component, and wherein the temperature of the needles
during penetration of the sheet of material exceeds the
20 melting temperature of the thermoplastic component.

The invention also concerns an apertured covering sheet for
an absorbent article manufactured in accordance with the
method, and an absorbent article provided with a covering
25 sheet manufactured in accordance with the method.

BACKGROUND OF THE INVENTION:

High demands on softness as well as dryness are put on
30 fluid permeable covering sheets for absorbent articles of
the kind which during use are intended to be in contact
with the body of a user.

However, it has proven difficult to accomplish a fluid
35 permeable covering sheet having a soft, textile-like
surface which remains dry even after repeated wetting when
the covering sheet is being used on an absorbent article.

In order to achieve a soft, textile-like covering sheet, it
40 is common to use nonwoven materials. In order to more

quickly lead fluid through the surface material down into a lower, absorbent material layer, it is common to perforate the material.

5 One such perforated nonwoven material is previously known through, for instance, EP 0,235,309. The perforated nonwoven material consists of a spunlace material having a high percentage of hydrophobic fibres. In a spunlace process, holes are formed in a fibrous material by ejecting
10 very high pressure water jets against the material. The spunlace material is one of two layers in a topsheet-laminate and is intended to be the layer which during use is arranged closest to the user. The spunlace material consists of a higher percentage of hydrophobic fibres than
15 the lower material layer in the topsheet. Thereby, the lower layer can drain liquid from the upper layer.

However, one problem with the described material is that holes which are formed by water jets become irregular both
20 in shape and in size and exhibit fibres protruding from the edges of the holes, into the holes. Such protruding fibres diminish the area of the holes and will in addition act as wicks which transport liquid into the material between the holes by capillary action. The protruding fibre ends and
25 the irregular shape and size of the holes considerably increase the risk of liquid remaining in the covering layer after wetting. Since a very small amount of liquid is sufficient for a surface material to be perceived as wet, this is evidently a considerable disadvantage with the
30 known surface material.

A further problem with the described nonwoven material is that it is difficult to create a predetermined, well-defined hole-size. It is well known, for instance through
35 EP 0,409,535, that the hole dimensions of a perforated material are of determining significance to obtaining an

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optimal inflow of liquid. For nonwoven material exhibiting some areas having a dense fibre structure and other areas having an open fibre structure, this implies that it is difficult to obtain a uniform hole size. This is due to the fact that the holes in the dense fibre areas are smaller, since they are surrounded by more fibres. Moreover, such an apertured nonwoven material exhibits a relatively low tensile strength, since the aperturing involves a decrease in the strength of the material. Since it is important that the material has sufficient strength so that no risk of breaking exists either in connection with the aperturing process, during production of the absorbent article, or during use of the finished absorbent article, naturally the decrease in the strength of the material which accompanies the aperturing is a problem.

In EP 0,214,608 a nonwoven material is apertured using hot needles which heat the nonwoven material to a temperature which is somewhat below the melting point of the material. The holes which are thus created in the material are surrounded by an edge exhibiting a densified fibre structure. The previously mentioned problems with varying hole sizes and reduced material strength are partially solved with a material which is apertured in this manner. However, the problem with liquid spreading in the nonwoven and staying in its fibre structure still remains. The denser fibre structure around the holes is intended to absorb liquid in order to transport liquid through the holes into a material layer below. However, there is a risk that a portion of the liquid is left in the denser hydrophilic fibre structure surrounding the holes. Further, liquid may spread horizontally in the plane of the nonwoven material in the fibre capillaries in the nonwoven material. Since, during use, the nonwoven material is in direct contact with the skin of the user such spreading of liquid is, of course, extremely inconvenient.

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In SE 9601681-1, nonwoven material is apertured with hot needles which heat the nonwoven material to a temperature exceeding the melting temperature of at least one component in the material. Accordingly, the holes which are thus created in the material are surrounded by an edge which is at least partially melted. The melted hole edge reduces horizontal spreading of liquid via the fibre capillaries, in the plane of the nonwoven material. However, it is possible to further improve the fluid pervious covering layer as disclosed in SE 9601681-1 in order to obtain a cover exhibiting both high softness and high surface dryness.

DESCRIPTION OF THE INVENTION:

The problem with accomplishing a fluid pervious topsheet for absorbent articles, which topsheet is soft and comfortable against skin and still exhibits high surface dryness has been substantially removed by the present invention.

Accordingly, the invention provides an apertured covering sheet exhibiting high softness as well as dryness against the skin of a user.

This is accomplished in accordance with the invention by means of heated needles which are caused to penetrate a sheet of textile material comprising at least one thermoplastic component, wherein the temperature of the needles during penetration of the sheet of material exceeds the melting temperature of the thermoplastic component. The heated needles melt the thermoplastic component closest to the needles whereafter the needles are removed and the heated material is passed between at least one pair of compression rollers whereby the thermoplastic component immediately surrounding the apertures is smoothed out in

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the plane of the sheet of material so that a substantially smooth material surface is formed around each aperture. The thermoplastic component is then solidified.

5 One advantage with an apertured sheet of material produced in accordance with the invention is that it exhibits high smoothness in the plane of the material. This means that the risk of the edges of the apertures in the covering sheet rubbing against the skin of the user is practically
10 eliminated. A further advantage with the apertured sheet of material is that the surrounding, substantially melted edge of the apertures to a higher degree can be relied upon to constitute a continuous, liquid impermeable surface. Due to the fact that the thermoplastic material surrounding the
15 apertures in the textile material is in a molten or at least softened state when the material is passed between the compression rollers, the molten or softened thermoplastic material is pressed into and fills out cavities between optionally occurring non-thermoplastic
20 fibres in the textile material.

A further advantage of thermally aperturing the material so that the structure surrounding the apertures melts, and thereafter passing the material through the nip of a pair
25 of rollers is that a specific aperture size is obtained with a high degree of repeatability.

The optimal aperture size varies with the intended use for the covering sheet. Menses and urine, for instance, have
30 completely different surface energies and different rheological properties, which means that the design of the covering layer must be adapted accordingly. However, in a covering material in accordance with the invention, the shape and size of the apertures deviate only to a minimal
35 degree from the intended optimal shape and size which has been decided with regard to the intended use for the

covering material. Consequently, in accordance with the invention, well performing covering materials can be created for a wide range of different absorption purposes with great accuracy and repeatability.

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Another advantage with passing the material through the nip of a pair of rollers directly after the aperturing step so that a substantially two-dimensional, flat material structure is created, is that the material demands less space when transported or stored. Moreover, it is possible to manufacture very thin absorbent articles when using such a covering material.

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In accordance with one embodiment of the invention, the needles are of different size in the thickness dimension which means that a covering sheet which is apertured with such needles exhibits apertures having different aperture sizes. In accordance with an advantageous embodiment, when the apertured covering sheet is used as a fluid permeable covering sheet for a sanitary napkin, the apertures are of two different sizes. The larger apertures exhibit a diameter which is between 2-4.5 mm and the small apertures exhibit a diameter which is between 0.1-2 mm. For the larger apertures which preferably have a diameter greater than 2 mm this implies that a comparatively large amount of fibrous material must be eliminated from the aperture itself during the aperturing procedure. A small amount of material is evaporated due to the heat to which the material is exposed by the hot needles. The remaining amount of material will mainly attach itself to the edge of the created aperture where it forms a fluid impermeable edge. The total length of the edge of the aperture, which is the same as the circumference of the aperture, increases exponentially with a factor of two with regard to the radius of the aperture. This means that the larger the apertures in the material are, the more material per length

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unit is gathered along the edge of the aperture than for the smaller apertures.

5 When using the apertured covering layer as a fluid permeable covering layer positioned closest to a user, the edges of the apertures may irritate the skin. The edges of the apertures may irritate the skin both if the apertures are arranged over all of the surface of the covering layer and if the apertures are arranged only within limited areas
10 such as, for instance, within the area of the article which is expected to be initially wetted by body fluid. In order to eliminate the problem with thick material edges, the flat-rolling of the covering layer after the aperturing is essential. Furthermore, for reasons which are explained in
15 the above discussion, the flat-rolling is particularly important for covering layers exhibiting relatively large apertures.

20 In accordance with another embodiment, the distance between the needles is different within different areas of the covering layer whereby the sheet of material after the aperturing step exhibits areas with different spacing between the apertures. The advantage with such an embodiment is that it is possible to have the apertures
25 more closely spaced within the area which is expected to receive the greatest amount of fluid and further apart along the longitudinal and transverse outer edges of the article.

30 In accordance with yet another embodiment, the sheet of material is passed through the nip between the rollers together with at least one additional fluid pervious sheet of material whereby the melted component surrounding the apertures in the apertured sheet of material adheres to the
35 additional sheet of material. After passage through the nip between the rollers, the melted component is caused to

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solidify whereby the additional sheet of material is laminated to the apertured sheet of material. This embodiment is advantageous since a particular laminating step is eliminated. Usually, sheets of material are laminated using adhesive or by welding, such as, for instance, ultrasonic welding. However, a problem in connection with adhesive lamination is that the adhesive often penetrates the covering sheet so that a portion of the adhesive will be in direct contact with skin during use. This problem is also more pronounced when using covering layers having a large open area. In accordance with this embodiment the problem that an adhesive coating often causes reduced fluid wicking and acquisition is also avoided. A further advantage is that the production cost is reduced since no adhesive or additional process-step such as a welding step is needed.

In accordance with one embodiment, the additional sheet of material consists of a hydrophilic sheet of nonwoven. The advantage with such an embodiment is that the hydrophilic sheet of nonwoven absorbs fluid from the apertured sheet of material. Consequently, the apertured covering is efficiently drained of fluid.

The invention further concerns a fluid pervious covering layer which is produced according to the method for use in an absorbent article such as a diaper, an incontinence protector, a sanitary napkin, or the like. Accordingly, the fluid pervious covering layer comprises at least one apertured textile sheet of material comprising at least one thermoplastic component. The apertured sheet of material exhibits a substantially two-dimensional structure having a plurality of apertures each surrounded by a substantially fluid impervious edge consisting of a substantially smooth plastic surface in the plane of the material.

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The apertured sheet of material preferably consists of a nonwoven material but may, of course, alternatively consist of other textile materials. As has been previously mentioned, the smooth aperture edge is particularly advantageous for covering sheets which exhibit relatively large apertures, something that is common in sanitary napkins. However, such covering sheet are also suitable as apertured covering sheets for children's diapers and incontinence protectors. It is extremely important that fluid permeable covering sheets for children's diapers exhibit high softness and smoothness, since the skin of a child is sensitive and, moreover, is not protected by hair. Moreover, for incontinence protectors, particularly of the kind which is used by older people who are mostly bed-ridden, it is very important that the covering layer which is closest to the user does not irritate the skin since wounds which may arise take a very long time to heal.

In accordance with one embodiment, the fluid permeable covering sheet comprises at least two layers of material. One advantage with a further layer of material which is positioned between the absorbent core in an absorbent article and the upper material layer positioned closest to the user is that such a layer may prevent superabsorbent particles or granules which come loose from the absorbent structure from spreading further out of the article. In addition to the fact that a reduced amount of superabsorbent material will lower the absorption capacity of the absorbent structure, the granules may also cause skin irritation when they come into direct contact with skin. A further layer of material will also serve to mask fluid which has been absorbed into the article, whereby the visual impression of, for instance, menstrual blood in a sanitary napkin does not appear as prominent as when using a single layer of material.

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Still another embodiment of a fluid permeable covering sheet produced in accordance with the invention comprises a first layer of material and a second layer of material wherein the second layer of material is more hydrophilic than the first layer of material. The advantage with such an embodiment is that the second layer of material, which is more hydrophilic, will absorb fluid from the first layer of material and thereby improve the surface dryness of the cover. The second layer of material, which is more hydrophilic, also acts as a wicking layer, resulting in a more even distribution of fluid in an absorbent core arranged inside the cover. A fluid distribution layer also makes it possible to achieve a higher level of exploitation of the total absorption capacity of the absorbent core, which reduces the risk of fluid leakage.

In accordance with one embodiment, the second layer of material is non-perforated. The advantage with a non-perforated second layer of material is that a non-perforated layer increases the tensile strength of the covering sheet. A high tensile strength in the covering sheet is of importance during production of the covering sheet itself, during production of the absorbent article and, finally, during use of the produced article. However, it is possible to use a second layer of material exhibiting perforations.

The invention also includes an absorbent article such as a sanitary napkin, a diaper, an incontinence protector, or the like, comprising an absorbent core enclosed within a cover, wherein at least a portion of the cover consists of a fluid permeable covering sheet. The covering sheet is characterised in that it exhibits a substantially two-dimensional, flat structure. In addition, the covering sheet comprises at least one layer of material exhibiting a plurality of apertures. Each of the apertures is

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surrounded by a substantially fluid impermeable edge exhibiting a substantially smooth plastic surface in the plane of the material. Accordingly, the material exhibits the softness and textile feel of a nonwoven material at the same time as the smooth plastic surfaces around the apertures create a material exhibiting similarities with a perforated plastic film with regard to the ability of maintaining a high surface dryness.

10 SHORT DESCRIPTION OF FIGURES:

The invention will in the following be more closely described with reference to the embodiments which are shown in the appended drawings.

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Figs. 1a and 1b show a cross section of the equipment which is used when producing covering sheets in accordance with the invention.

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Fig. 2 shows a cross section of a covering sheet produced in accordance with the invention.

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Fig. 3 shows a sanitary napkin having a fluid permeable covering sheet in accordance with the invention, viewed from the side which during use is intended to be facing a user.

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Fig. 4 shows an enlarged view of a piece of a covering sheet having an aperture surrounded by a flattened material edge.

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DETAILED DESCRIPTION OF EMBODIMENTS:

5 In Figs. 1a and 1b are schematically shown two somewhat different ways of producing fluid permeable materials intended for use as fluid permeable covering sheets on absorbent articles.

10 In the method of manufacturing which is illustrated in Fig. 1a, a web of material consisting of a textile material 1 is continuously fed between a pair of rollers 3,5 comprising a needle roller 3 and a counter roll 5. The needle roller exhibits a plurality of heated needles 4, protruding radially from the needle roller 3 and being heated by one or more electrical cartridges which are arranged in the
15 cylindrical space inside the needle roller. In order to heat the needles 4, it is further possible to expose the needle roller to infrared heat. In order to obtain a desired temperature in the needles 4, a combination of the said heating methods is preferably used. Naturally, it is
20 also possible to use other available methods in order to achieve the desired temperature in the needles 4. The textile material 1 comprises fibres having a fibre surface which at least partly consists of a thermoplastic material. Suitable textile materials for the purpose are, for
25 instance, nonwoven materials wholly or partially consisting of thermoplastic fibres such as polyethylene or polypropylene or bicomponent fibres comprising a thermoplastic component. Although nonwoven materials are preferred, it is, of course, possible to use other types of
30 textile materials such as woven, knitted or crocheted materials.

35 The hot needles 4 are heated to a temperature which exceeds the melting temperature of the thermoplastic component in the textile material 1. When the textile material passes between the needle roller 3 and the counter roll 5, the

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material is penetrated by the needles 4, whereby the thermoplastic component in the material 1 melts in the vicinity of the needles 4. The apertured textile material 1 is subsequently passed into the nip 7 between two compression rollers 8. Because the thermoplastic material surrounding the apertures in the textile material is still hot and therefore is in a melted, or at least softened state, the calendering in the roller nip 7 between the compression rollers 8 creates a substantially smooth, flat, ring-shaped plastic surface surrounding each aperture in the textile material. The melted, or softened thermoplastic material is pressed into and fills out cavities between any occurring non-thermoplastic fibres or fibre-components in the textile material, whereby the fibre structure around the apertures disappears. After passage between the calender rollers 8, the formed covering material 9 is left to cool at room temperature, or is cooled at a temperature below room temperature.

By the provision of a fluid impermeable plastic edge surrounding the apertures in the covering material 9, fluid transport in a direction away from the edges of the apertures into the fibrous portions of the covering material is prohibited when the covering material 9 is used as fluid permeable covering layer on an absorbent article.

Fig. 1b shows the manufacturing process for a covering material 10, which, apart from a sheet of material 1 which is perforated by hot needles 4 arranged on a needle roller 3, comprises a second, fluid permeable sheet of material 6.

In the example which is being shown, the still warm sheet of textile material is passed into a roller nip 7, between two compression rollers 8 together with the second sheet of material 6. When the thermoplastic component in the perforated sheet of material 1 is brought to cool after the

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compression step, the thermoplastic component is solidified. Thus, the two sheets of material 1,6 are bound together into a covering laminate 10. The material in the second sheet of material 6 in the laminate 10 may be of any kind suitable for the purpose as long as it is fluid permeable. Preferred materials are nonwoven, perforated plastic film, or netting. If the second sheet of material 6 is intended to be facing the absorption core in an absorbent article, it is suitable to use a hydrophilic second sheet 6, which preferably exhibits a higher hydrophilicity than the first sheet of material 1.

It is, of course, possible to produce covering laminates 10 comprising more than two layers in the way shown in Fig. 1b. One sheet of material may, for instance, be placed on each side of the perforated sheet of material 1. Further, two or more sheets of material may be arranged on the same side of the perforated sheet of material 1. However, in the latter case it is necessary that the sheet of material which is perforated with hot needles primarily consists of thermoplastic material so that a sufficient amount of thermoplastic material is available in order to permit the sheets of material to be bonded together. The number of sheets of material which may be joined together depends, apart from the proportion of thermoplastic material in the perforated textile sheet of material, also on the thickness of the different sheets. An upper limit for the number of layers which may be bound together with the method shown in Fig. 1b is approximately 4-5 layers.

Furthermore, it is possible to let two or more sheets of material, at least one of which comprises thermoplastic material, pass between the needle roller 3 and the counter roll 5 in the production methods shown in Figs. 1a and 1b. In this manner, a finished covering laminate is obtained having at least two perforated layers of material.

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Fig. 2 shows a covering material 201 consisting of a first sheet of material 202 and a second sheet of material 210. The first sheet of material 202 has been perforated with hot needles, as is shown in Figs. 1a and 1b. The second sheet of material 210 has been laminated together with the first sheet of material in a compression step following on the perforation step, as is shown in Fig. 1b.

The different layers being part of the covering material 201 may be nonwoven materials of different types or composition. A nonwoven material gives the covering material 201 a soft, pleasant surface which does not chafe or otherwise irritate the skin. However, it is also possible to use one or several layers of plastic film, net material, or the like. The apertured sheet of material 202 comprises at least one heat meltable component which may exist in the form of complete fibres, in the form of a part component in a so-called bicomponent fibre, or in the form of a film material. Suitable heat meltable materials for the purpose are polyethylene, polypropylene, or polyester. The heat meltable component constitutes at least 55 % by weight of the textile material, at least within the perforated area. The heat meltable component preferably constitutes at least 70 % by weight of the textile material. Further, it is possible that the sheet of material 202 consist solely of thermoplastic material. The sheet of material 202 exhibits a plurality of penetrating apertures 204, 208. The apertures 204, 208 exhibit two mutually different aperture sizes. The larger apertures 204 are preferably fewer in number and the smaller apertures 208 are preferably more numerous. Apertures having two mutually different aperture sizes have been formed by bringing hot needles of two different thicknesses to penetrate the sheet of material 202. The temperature of the needles has exceeded the melting temperature of the heat meltable component in the sheet of material 202. Due to a

sufficiently high proportion of material which melts as a result of the penetration of the covering layer, the finished material has a substantially fluid impermeable edge 206 surrounding each aperture. The fluid impermeable edge 206 increases the tensile strength of the covering layer and prevents fluid from spreading from the aperture edge 206, out over the surface of the covering layer 201. The fluid barrier effect is due to the fact that no free fibre ends are present around the apertures, which might have caught fluid and led it, through capillary action, in a wrong direction away from the aperture 204.

The sanitary napkin 300, shown in Fig 3 comprises a first fluid permeable covering layer 301, in accordance with the invention, a fluid impermeable covering layer 303, and an absorption core 305 enclosed between the covering layers 301,303. The fluid impermeable covering layer 303 may consist of a fluid impermeable plastic film, a nonwoven sheet which has been coated with a fluid barrier material, or some other flexible sheet of material which resists fluid penetration. It is generally advantageous if the fluid impermeable covering layer 303 has a certain degree of breathability, that is, will permit the passage of water vapour. The two covering layers 301,303 have a somewhat larger extension in the plane than the absorption core 305 and extend a distance past the edges of the absorption core 305, around the entirety of its periphery. The covering layers 301,303 are joined to each other within the extending portions 307, for instance by gluing, or welding with heat or ultrasonically.

The absorption core 305 is usually constructed of one or more layers of cellulose fibres, for instance fluffed cellulose pulp. An example of an absorbent structure which is suitable for the purpose is found in WO 94/10956, which publication describes an absorbent material which is cut

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from a web of material without preceding defibration and mat-forming steps. The material increases the surface dryness of the resulting article, which is a particular advantage when the fluid permeable covering layer 301 has a textile sheet of material closest to the user. A high absorbent capacity means efficient draining of fluid from upper layers of material.

In addition to cellulose fibres, the absorption core 305 may also contain superabsorbent material, i.e. material in the form of fibres, particles, granules, film or the like, which has the ability to absorb fluid corresponding to several times the weight of the superabsorbent material itself. A superabsorbent material binds the absorbed fluid and forms a fluid-containing gel. The absorbent core 305 may further contain binders, shape stabilising components, or the like. Additional absorption layers which improve the absorption properties may also be used, such as different types of wicking inserts, or material layers. The absorbent core 305 may be chemically or physically treated to alter the absorption properties. It is, for instance, common to arrange compressed areas in an absorption layer in order to control the fluid flow in the absorbent core 305. Moreover, other types of absorption materials may be utilised, alone or in combination with cellulose fibres and superabsorbent material. Some examples of useful absorbent materials are absorbent nonwoven materials, foam, or similar.

On the outside of the fluid impermeable covering layer 303 is arranged a fastening means in the shape of two areas 312 of self-adhesive glue. Before use, the adhesive areas 312 are preferably covered by removable protection sheets of release-coated paper, or plastic film, which are not shown in Fig. 3. A number of adhesive patterns other than the ones which are shown are, of course, conceivable, as well as other kinds of fastening means such as hook-and-loop

surfaces, press-studs, girdles, special underpants, or the like. A sanitary napkin of the kind shown in Fig. 3 is attached inside an ordinary pair of underpants during use. The fastening means should naturally be of a kind which permits removal of the sanitary napkin from the underpants without causing damage thereto.

The sanitary napkin 300 is hourglass-shaped, having somewhat broader end portions 314, 316 and a somewhat narrower crotch portion 318 located between the end portions 314, 316. The crotch portion 318 is the portion of the sanitary napkin which is intended to be placed in the user's crotch during use and serve as a receiving surface for the body fluid which is discharged to the sanitary napkin. Furthermore, the sanitary napkin exhibits two transversely extending end edges 320, 322, and two longitudinally extending side edges 324, 326, running between the end edges 320, 322.

In the example which is shown, the sanitary napkin is further provided with fastening flaps 328, 330, which are formed of the two covering layers 301, 303 and which extend from the side edges 324, 326 of the sanitary napkin 300 at the crotch portion 318. The fastening flaps 328, 330 are intended to be folded around the leg edges of the user's underpants during use of the sanitary napkin and to be attached to the outside of the underpants. For this purpose, the fastening flaps 328, 330 are provided with special fastening means 332, which may be chosen in the same way as the fastening means 312 on the fluid impermeable covering layer 303.

The fluid permeable covering layer 301 consists of a first layer of material 302 and a second layer of material 310. The first layer of material 302 exhibits a plurality of penetrating apertures 304, 308. The apertures 304, 308 have

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two different aperture sizes. The larger apertures are preferably fewer in number than the smaller apertures 308. The small apertures 308 are evenly distributed over the entire surface of the covering layer 301. Furthermore, the area of the first layer of material 302 which covers the absorption core 305 on the inside of the covering layer, also exhibits large apertures 304 evenly distributed over this area. Accordingly, the first layer of material 301 exhibits both large and small apertures 304, 308 within all of that portion of the sanitary napkin which has an absorbent core 305 on the inside and only small apertures within the remaining portions of the surface of the covering layer 301. It is, of course, also possible to use a first layer of material exhibiting apertures of only one size, or apertures of more than two sizes.

The first layer of material 302 consists of a textile material which, during use of the sanitary napkin, is intended to be in contact with the body of the user. The layer of material 302 consists, at least partially, of a material which is heat meltable. The heat meltable material has, during forming of the apertures 304 in the layer of material 302, been melted in the area closest to each aperture 304. Before the melted material is solidified, the material is passed through at least one nip of rollers so that the heat meltable component closest to the apertures is smoothed out, causing the material surrounding the apertures to exhibit a smooth plastic surface in the plane of the material. The continuous, plastic-like surface surrounding the apertures forms a substantially completely fluid impermeable edge around the whole periphery of the aperture 304. Moreover, as has been previously mentioned, the continuous edge 306 increases the tensile strength of the covering material 301. In addition, the edge 306 prevents fluid from spreading from the apertures out into the covering layer 302. Instead, body fluid which impinges

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upon the sanitary napkin 300 passes down through the apertured layer of material 302 to the second layer of material 310 and then further down into the absorption core 305 which is located inside this layer. Moreover, the risk of the aperture edges being perceived as chafing against skin is reduced due to the layer of material 302 having been passed through a nip of rollers.

The second layer of material 310 of the fluid permeable covering layer 302 is arranged inside the first layer of material 302. Accordingly, the second layer of material 310 is located between the first layer of material 302 and the absorption core 305 of the sanitary napkin. The second layer of material 310 consists of a material which is more hydrophilic than the first layer of material 302, whereby fluid transport will take place in a direction towards the absorption core 305 of the sanitary napkin. Some examples of suitable material for the second layer of material 310 are different types of nonwoven materials, air-laid or wet-laid cellulose layers, wadding of different kinds, foam materials, or the like. Further, it is possible that the second layer of material consists of a laminate consisting of, for instance, an air-laid cellulose layer and a layer of thermo-fibres. The second layer of material may also be a laminate of a cellulose layer and a thermo-bonded or latex-bonded nonwoven. Furthermore, it is also possible to use other laminates, or so called combination materials as a second layer of material 310.

In order to facilitate fluid transfer between the fluid permeable covering layer 301 and the absorption core 305, it is suitable to arrange the second layer of material 310 in direct contact with the absorption core 305. The layer of material 310 is preferably joined to the absorption core 305 by adhesive, welding, needling, or similar. It is also conceivable that the covering layer 301 of the sanitary

napkin only consists of a single layer of material, i.e. the first layer of material 302, which in that case is in direct contact with the absorption core 305.

- 5 Fig. 4 is a greatly enlarged view showing the appearance of an aperture 404 in a piece of covering material 401. It is evident that the material surrounding the aperture 404 and forming the fluid impermeable edge 406 exists in the form of a substantially flat, smooth surface after melting and
- 10 rolling of the material. As the material is melted round the apertures, its fibrous structure is lost and the subsequent rolling causes the fluid impermeable edge to be of a character comparable to a plastic film.
- 15 The invention shall not be considered to be restricted to the embodiments described herein. Accordingly, a number of further variants and modifications are conceivable within the scope of the appended claims.
- 20 The invention is also intended to encompass all conceivable combinations of the described embodiments.

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5. CLAIMS:

1. A method of producing a fluid permeable covering sheet (9) for an absorbent article such as a diaper, a sanitary napkin, an incontinence protector or the like, wherein
10 apertures are created in a sheet of textile material (1) comprising at least one thermoplastic component, by bringing heated needles (4) having a temperature exceeding the melting temperature of the thermoplastic component to penetrate the sheet of textile material (1), whereby the
15 heated needles (4) melt the thermoplastic component closest to the needles (4), whereafter the needles (4) are removed from the sheet of textile material (1),
c h a r a c t e r i z e d i n that after aperturing, the heated material (1) is passed through at least one nip of
20 rollers (7) between two compression rollers (8), whereby the thermoplastic component closest around the apertures is smoothed out in the plane of the sheet of material so that a substantially smooth material surface is obtained around the apertures, whereafter the thermoplastic component is
25 brought to solidify.
2. A method of producing a fluid permeable covering sheet in accordance with claim 1,
c h a r a c t e r i z e d i n that the apertured sheet of
30 material (1) consists of a layer of nonwoven.
3. A method of producing a fluid permeable covering sheet in accordance with claim 1 or claim 2,
c h a r a c t e r i z e d i n that the needles (4)
35 exhibit at least two different thicknesses, whereby the apertures formed in the sheet of material (1) exhibit at least two different aperture sizes.
4. A method of producing a fluid permeable covering sheet
40 in accordance with any one of claims 1-3,

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5 characterized in that the mutual distance between the needles is different within different areas of the covering sheet (9), whereby the covering sheet (9) exhibits areas having different aperture spacing after the aperturing step.

5. A method of producing a fluid permeable covering sheet in accordance with any one of the preceding claims, characterized in that the sheet of material (1) is passed through the nip of rollers (7) together with at least one further fluid permeable sheet of material (6), whereafter the melted component is brought to solidify after passage through the nip of rollers, whereby the further sheet of material (6) is joined to the apertured sheet of material.

6. A method of producing a fluid permeable covering sheet in accordance with claim 5, characterized in that the further sheet of material (6) consists of a hydrophilic sheet of nonwoven.

7. A fluid permeable covering sheet (301) for an absorbent article such as a diaper, an incontinence protector, a sanitary napkin, or the like, comprising an apertured, textile sheet of material (9) comprising at least one thermoplastic component, characterized in that the covering sheet (301) exhibits a substantially two-dimensional structure with a plurality of apertures (204, 208) each surrounded by an essentially fluid impermeable edge (206) consisting of an essentially smooth plastic surface in the plane of the material.

8. A fluid permeable covering sheet in accordance with claim 7,