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[54] **SANITARY NAPKIN**

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[63] Continuation of Ser. No. 15,164, Feb. 27, 1970,
abandoned.

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[51] Int. Cl. **A61f 13/16**

[58] Field of Search **128/284, 287, 290, 296,**
128/156

[56]

References Cited

UNITED STATES PATENTS

3,067,747 12/1962 Wolterding et al. 128/296

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[57]

ABSTRACT

Sanitary napkins are disclosed comprised of an inner core of absorbent material and a cover which consists essentially of unfinished thermoplastic fibers. Preferably the cover is a web of continuous filaments of unfinished polypropylene fibers.

6 Claims, 3 Drawing Figures

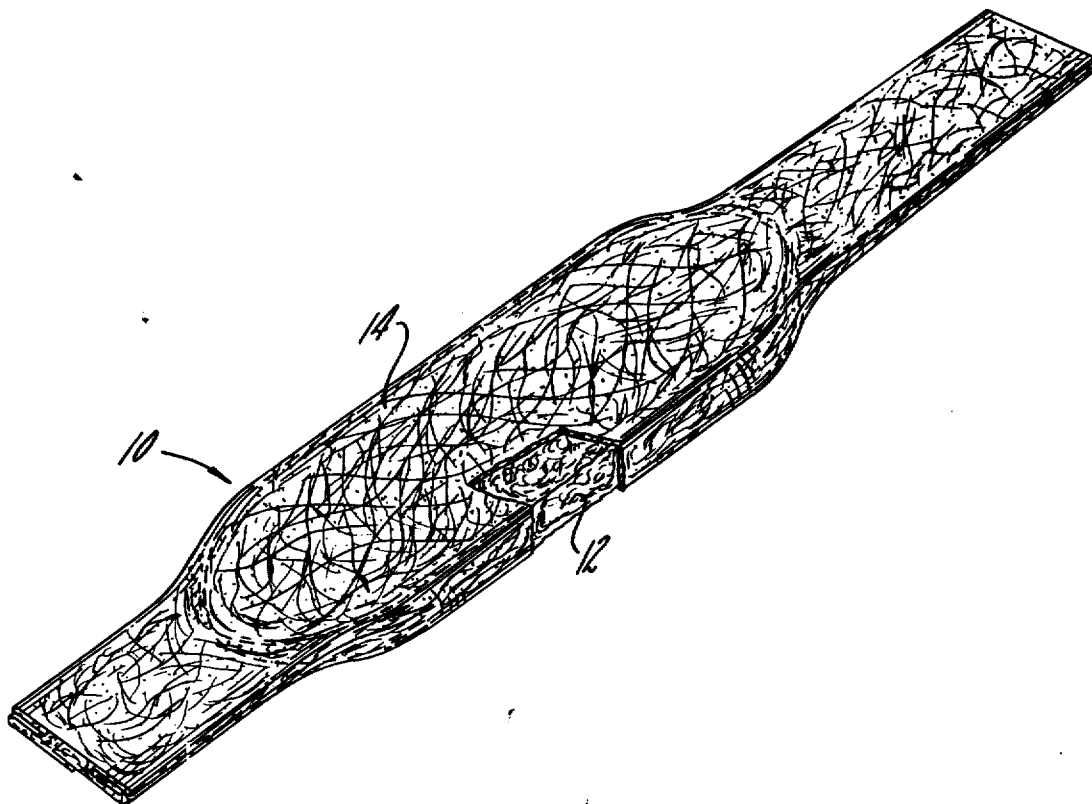


FIG. 1

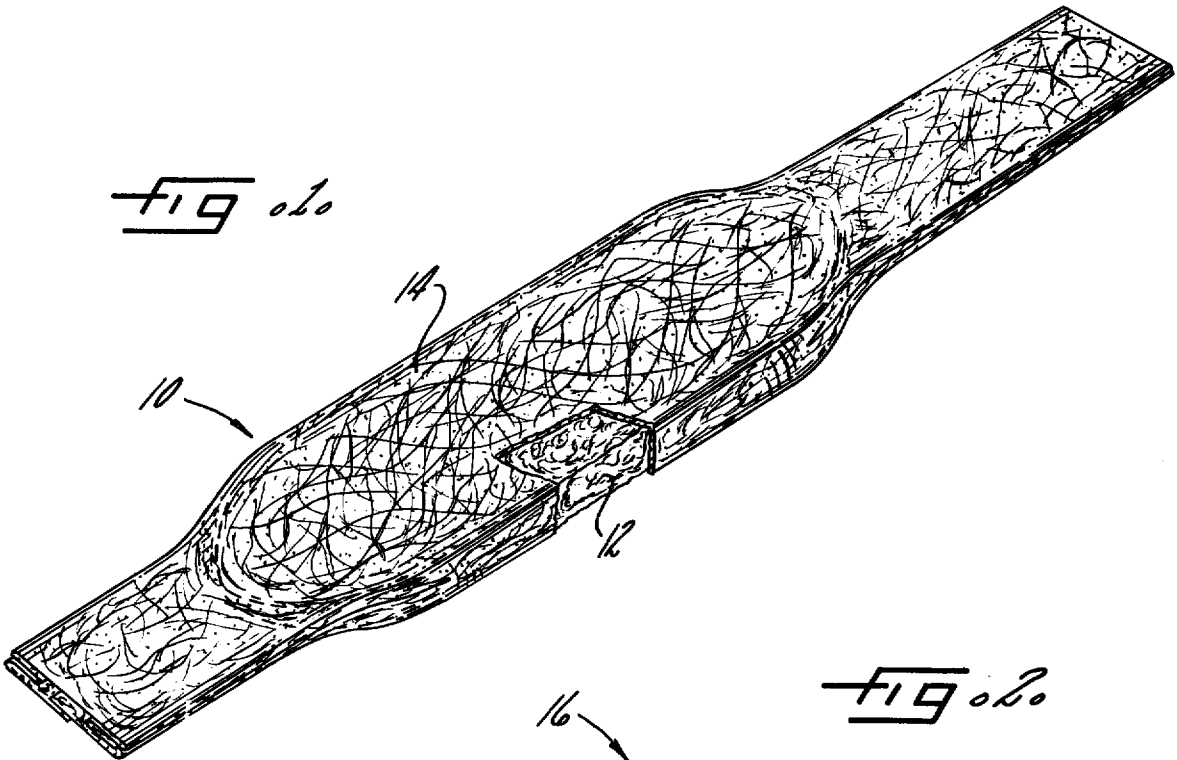


FIG. 2

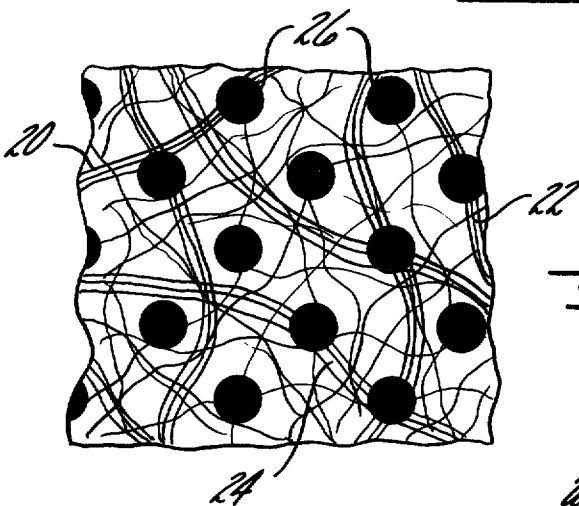
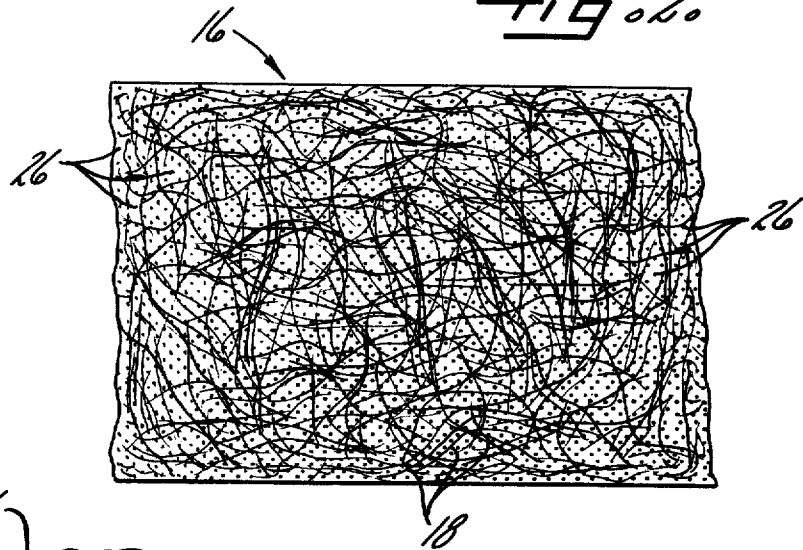


FIG. 3

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SANITARY NAPKIN

This is a continuation of application Ser. No. 15,164, filed Feb. 27, 1970, now abandoned.

DESCRIPTION OF THE INVENTION

Sanitary napkins generally comprise an inner core of absorbent material and a fluid permeable outer cover. The cover should serve merely as an enclosing means for the absorbent material and have substantially no capacity for fluid absorption or retention itself.

Canadian Pat. No. 826,352 discloses a sanitary napkin which is said to possess optimum properties. The napkin therein disclosed consists of an inner core of absorbent material covered with a web of autogenously bonded synthetic fibers such as polyethylene, polypropylene, or polyesters. The web is disclosed as being prepared by carding, garnetting, or air laying.

While the Canadian patent states that fluids will readily pass through the outer cover and be retained in the inner core with no resultant clammy or wet feeling to the wearer of the sanitary napkin, and this is true during periods of light flow; it has been found that as the amount of fluid retained by the inner core increases there is an increasing retention of fluid by the cover and this contributes to some discomfort. Thus, in actual use, the napkin surface does not remain as dry as would be expected; and, accordingly, there is still a need for improvement over the napkins disclosed in the Canadian patent.

Accordingly, it is a principal object of the present invention to provide an improved sanitary napkin which readily absorbs and retains fluid, and which maintains a substantially dry surface during use.

Another object is to provide a sanitary napkin with an improved cover. It is a further object to provide a napkin as above-described with particularly desirable strength characteristics and which can be prepared economically.

Other objects and advantages will become apparent as the description proceeds and with reference to the drawings in which:

FIG. 1 is a perspective view illustrating a sanitary napkin of the present invention with a portion thereof cut away;

FIG. 2 is a plan view of a section of a web useful as a sanitary napkin cover.

FIG. 3 is an enlarged view of a section of a preferred web useful as a sanitary napkin cover.

While the invention is susceptible of various modifications and alternative constructions, there is shown in the drawings and will herein be described in detail the preferred embodiments. It is to be understood, however, that it is not intended to limit the invention to the specific forms disclosed. On the contrary, it is intended to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

Briefly, the sanitary napkins of the present invention comprise an inner core of absorbent material and a cover consisting essentially of a porous web of unfinished thermoplastic fibers. As used herein, the term "unfinished" refers to fibers whose surfaces do not contain lubricants, anti-static, or wetting agents. In this respect, it should be noted that the fibers customarily employed in preparing webs by techniques such as weaving, carding, air-laying or garnetting are finished, i.e., — have their surfaces dressed with a combination

of a lubricating, anti-static and wetting agent. In the absence of a surface finish, it is extremely difficult to handle the fibers during web preparation, and, accordingly, finished fibers are universally employed when webs are to be fabricated by such techniques. Typically, finished thermoplastic fibers have receding contact angles with water of less than 90°. Unfinished fibers, on the other hand, have somewhat higher contact angles with, unfinished polypropylene having a receding contact angle with water of greater than about 90°, and generally in the range of about 100°–120°.

Also, as used herein, the term "consisting essentially of" means that the porous web of unfinished thermoplastic fibers is an indispensably necessary component of the cover, but that other cover components which do not detract from the desirable characteristics of the napkin can also be present. For example, those portions of the napkin cover which are not in contact with the body of the wearer need not be prepared from unfinished fibers.

Turning to the drawings, FIG. 1 depicts a sanitary napkin 10 comprised of an inner core of absorbent material 12 and a cover 14. The absorbent material 12 can be of conventional shape and size and can be any of those materials ordinarily used in sanitary napkin applications such as wood pulp fluff, cellulose wadding, cotton or rayon fibers, etc. Similarly, the manufacture of the sanitary napkin can be accomplished by generally known techniques which involve wrapping the core with the cover, and, thereafter, sealing the cover in order to enclose the absorbent material within, and provide means for securing the napkin to a belt or the like such as tabs.

With respect to the cover 14, it has been indicated that it consists essentially of a porous web of unfinished thermoplastic fibers. While webs of unfinished polypropylene fibers exhibit optimum characteristics, webs of other unfinished polyolefin fibers (e.g., polyethylene, polybutene, etc.) as well as polyester fibers can be advantageously used. FIG. 2 illustrates a preferred cover web 16 which, as shown, is made up of a plurality of substantially continuous, molecularly oriented, unfinished fiber filaments 18 arranged in a substantially random array.

Concerning the web 16, it is not essential that the fiber filaments therein be continuous, so long as they are unfinished. However, the fact that a continuous filament web can be directly obtained from unfinished fiber filaments renders such webs economically attractive. Moreover, as hereinafter discussed with respect to further aspects of the present invention, napkins prepared with covers as illustrated in FIG. 2 possess especially desirable strength characteristics. However, while continuous filament webs are preferred, other webs, such as those prepared by carding, wherein after preparation the surface fiber finish is removed, can also be used.

A variety of methods exist for preparing continuous filament webs of thermoplastic fibers. U.S. Pat. Nos. 3,341,394 and 3,338,992 to Kinney disclose several presently known techniques. In general, web formation involves continuously extruding polymer through a spinneret, drawing the spun filaments, and thereafter depositing the drawn filaments on a continuously moving surface in a substantially random fashion. Drawing serves to give the polymer filaments tenacity, while

substantially random deposition gives the web desirable isotropic strength characteristics.

In addition to presently known methods of initial web formation, a particularly useful technique is described in copending application Ser. No. 865,128, titled Continuous Filament Nonwoven Web and Process For Producing the Same, filed on Oct. 9, 1969 and now U.S. Pat. No. 3,692,618. Use of the method therein disclosed permits especially high rates of web formation and, as hereinafter discussed, results in desirable product attributes. The disclosed method involves conventional spinning of continuous filaments of a synthetic polymer by, for example, extruding the polymer through a multiple number of downwardly directed spinning nozzles, preferably extending in a row or multiple number of rows. The filaments, as they are spun, are gathered into a straight row of side-by-side, evenly spaced apart, untwisted bundles each containing at least 15 and preferably from 50 to 150 filaments. These filament bundles are simultaneously drawn downwardly at a velocity of at least 3,000 meters per minute, and preferably from 3,500 to 8,000 meters per minute, in individually surrounding gas columns flowing at a supersonic velocity and directed to impinge on a substantially horizontal carrier. The gathering of the filaments into the bundles and their drawing and directing to impinge on the carrier is preferably effected by passing the bundles through air guns which surround the filaments with a column or jet of air which is directed downward at supersonic velocity. The air guns are arranged so as to extend in a straight row in a direction extending across the carrier at right angles to its direction of movement, so that the bundles confined in the gas columns as the same strike the moving carrier extend in a line or row at right angles across the carrier. In order to enhance intermingling of the bundles, the air guns can be made to oscillate, the plane of oscillation being transverse to the direction of carrier movement. The carrier can be a conventional carrier used in a nonwoven art, such as an endless carrier or belt screen or the upper portion of a drum, as for example a screen drum.

When prepared as described above, the filament bundles, containing a number of parallel filaments, are laid down on the carrier in a loop-like arrangement with primary loops extending back and forth across the width of a section defined by the impingement of the air column from one air gun on the carrier. Before and as the parallel filaments bundles impinge the carrier, they are broken up into sub-bundles containing a lesser number of parallel filaments and forming secondary smaller loops and swirls. The secondary loops and swirls overlap each other, and those of adjacent sections, to result in substantially complete intermingling with the overlapping portions of adjacent sections. Thus, the laid-down filament bundles form a continuous uniform nonwoven web.

A portion of a web prepared as described above is shown in FIG. 3. Several filament sub-bundles, such as those numbered 20, 22, and 24, are depicted. Due to the presence of filament bundles, rather than all single filaments as with other continuous filament webs, large "inter" bundle pores exist. It is felt that the existence of these pores helps promote fluid penetration into the inner core of a napkin when such a web is employed as the cover.

The web illustrated in FIG. 2 when used as a sanitary napkin cover can have a basis weight of about 0.25-1 oz./yd.², and preferably about 0.3-0.7 oz./yd.². The filaments thereof can have a denier of about 1-5 and, preferably, about 1.2-2.

In order to be useful as a sanitary napkin cover, the web of unfinished thermoplastic fibers must be bonded in a manner which imparts sufficient web strength, and yet does not adversely affect web softness or porosity of fluid transfer. In this respect, it has been found that those techniques which involve overall web bonding are generally unsatisfactory both with respect to porosity and softness. Referring again to FIGS. 2 and 3, a preferred manner of web bonding is illustrated. As therein shown, the filaments of the webs are bonded together at a discrete number of spot bond areas 26 distributed intermittently throughout the web. A desirable combination of cover porosity and strength is present in a web wherein the total bonded area is about 5-50% of the web area and wherein the density of individual bond areas is about 50-3200 per inch², the higher bond densities being employed with higher total bonded areas. Particularly preferred webs are those having a total bonded area of about 8-20% and a bond density of 100-500 per inch.

An especially suitable manner of preparing a bonded web such as illustrated in the figures is disclosed in copending Hansens et al. application Ser. No. 15,034 titled Pattern Bonded Continuous Filament Web, which application was abandoned in favor of application maturing into U.S. Pat. No. 3,855,046. The bonding process illustrated therein comprises passing the unbonded continuous filament web through the pressure nip formed between a smooth hard roll and a heated embossing roll. By appropriately controlling the temperature of the rolls and the nip pressure, a web with a highly desirable type of bond, termed a "release" bond, can be obtained. At web speeds of about 275-350 ft./min., such bonding can be achieved by maintaining the smooth roll at a temperature of less than about 270°F., keeping the heated embossing roll at 300°-320°C., and applying a nip pressure, on each raised embossing point, of 5,000-50,000 p.s.i.

The release bonds achieved by the process illustrated in Hansen et al. are characterized by the absence of a uniform degree of fiber bonding throughout an individual spot bond area which contain autogenously bonded filaments. When viewed under a microscope, the fibers bonded in the surface next to the embossing roll are seen to have substantially lost their filamentary character, while the fibers bonded in the other surface are cohesively secured together but retain their filament identity.

A significant advantage of the sanitary napkins described herein is their ability to absorb menstrual and other body fluids under the applied pressures of normal usage, and still provide a dry surface feel to the wearer. Such is believed to be due to the fact that the unfinished thermoplastic filaments in the cover are not only resistant to fluid absorption themselves, but additionally prevent fluid, when once absorbed within the inner core of the napkin, from coming back out to stain clothing or rewet the body. The superiority of a web of unfinished fibers for sanitary napkin covers is particularly unexpected in view of the fact that the webs illustrated herein do not exhibit such superior utility in related uses, such as diaper liners.

The above-mentioned desirable fluid behavior characteristics of the cover described herein are illustrated by comparatively evaluating the capillary transfer characteristics of a variety of covers. Such is accomplished as follows:

A standard capillary transfer cell (Textile Research J. 37, No. 5: 356-366)(May, 1967) is filled with water and 3 grams of filler from a conventional regular Kotex feminine napkin is placed on one side of the cell. A single layer of the web to be tested is placed on the other side. Weights exerting about 0.1 psi are used on both sides of the cell to assure contact between the cell and the materials. After positioning, 7.5 ml. of water (or 10 ml.) is added to the web sample side of the cell after which the cell valve is opened and water transfer to the filler permitted for 100 minutes. Thereafter, the web sample is weighed and the retained moisture therein determined and reported as per cent moisture retention based on the weight of dry fiber. For sanitary napkin covers, a low value of moisture retention is desirable. Moisture retention values obtained on several conventionally available webs used as sanitary napkin covers and on a web prepared as described herein are presented in Table 1.

TABLE 1

Web	Basis Wt. g/yd. ²	% Moisture Retention	
		Initial 7.5 ml.	Initial 10 ml.
A. Adhesively Bonded Carded Rayon Web	14	220	370
B. Nylon Scrim with Cotton Applique	7.8	100	260
C. Autogenously Bonded Carded Web of Finished Polypropylene Fibers	20.3	75	108
D. Autogenously Bonded Carded Web of Unfinished Polypropylene Fibers*	20.3	2	11
E. Spot Bonded Web of Continuous Filaments of Unfinished Polypropylene Fibers**	15	2	3

*Finish removed from immediately preceding finished fiber web by 3 step Soxhlet extraction with hexane, methanol, and water (4 hours each).

**Prepared as described in Serial No. 865,128, with filament denier of 1.6 and fiber tenacity of 4.4 g/denier. Bonding accomplished as described in the above-mentioned Hansen et al. application by passing web at 330 ft./min. through a smooth roll-embossing roll nip under following conditions: Smooth roll temp. = 240°F.; Embossed roll temp. = 300°F.; Individual bond areas = 0.0285" on a side and spaced 10 per inch in both machine and cross-direction; 17% of total area bonded; Nip pressure on a raised point = 28,000 psi.

TABLE 2

Web	Tensile Strength gram/inch		Elongation %		Drape* Handle-o-Meter	
	MD	CD	MD	CD	MD	CD
A. Adhesively bonded Rayon Web	1930	125	9	20	11	2.8
B. Nylon Scrim with Cotton Applique	1700	440	26	32	2.3	0.8
C. Autogenously Bonded Carded Web of Finished Polypropylene Fibers	2660	148	7.6	9.5	12.4	3.4
E. Spot Bonded Web of Continuous Filaments of Unfinished Polypropylene Fibers	1600	1200	28	36	4.8	2.8

*Determined using a Thwing-Albert Instrument Company Handle-o-Meter.

As can be appreciated from the results presented in Table 1, sanitary napkin covers consisting essentially of unfinished fibers, particularly polypropylene, possess superior fluid behavior characteristics than do conventional webs of either rayon, nylon, or finished polypropylene fibers.

In addition to the above-discussed fluid behavior, the mechanical and aesthetic characteristics of the contin-

uous filament webs illustrated herein make them especially desirable for sanitary napkin covers. Due to the randomness of filament orientation present in such webs, the tensile strength and stretch characteristics are more isotropic than in existing webs. Such isotropic characteristics are particularly important in sanitary napkin applications since, in use, stresses are present in all directions. Moreover, by appropriate web bonding, as previously discussed, such isotropic strength can be obtained in combination with a desirable softness and overall feel. Optimum mechanical characteristics, particularly with respect to the combination tensile strength and elongation, can be achieved with a web containing release bonds as described in the previously referred to Hansen et al. application. When such a web is used as a napkin cover, the web surface which was in contact with the smooth roll during bonding should be placed adjacent to the inner core. By doing such, high abrasion resistance of the cover material can be obtained.

Table 2 illustrates the mechanical and overall feel characteristics of web covers prepared as described herein compared with conventional webs used as sanitary napkin covers.

Thus, it is apparent that there has been provided, according to the invention, an improved sanitary napkin which fully satisfies the aims, objectives, and advantages as set forth above.

I claim as my invention:

1. A sanitary napkin comprising an inner core of absorbent material having a shape and size adaptable to absorb body menstrual fluids and a cover enclosing said

inner core, said cover, in the body contacting area thereof, consisting of a nonwoven, porous and dry formed web having a basis weight of about 0.25 - 1 oz./yd.², said web consisting of unfinished polyolefin or polyester fibers, said unfinished fibers being characterized by fiber surfaces which are devoid of lubricants, antistatic, or wetting agents, said web being intermittently autogenously bonded at discrete bond areas occupying about 5-50% of the web area and disposed in a density of about 50-3200/inch² to permit the passage of menstrual fluid therethrough and into the absorbent core under the body pressures of normal usage to provide a substantially dry surface feel to the wearer.

2. The sanitary napkin of claim 1 wherein the web is an intermittently autogenously bonded porous nonwoven web of unfinished polypropylene fibers.

3. The sanitary napkin of claim 1 wherein the web is

an intermittently autogenously bonded, porous web of substantially continuous and randomly deposited unfinished, molecularly oriented filaments of a polyolefin or a polyester.

5 4. The sanitary napkin of claim 3 wherein the continuous unfinished filaments are of polypropylene.

5. The sanitary napkin of claim 4 wherein the unfinished polypropylene filaments have a denier of about 1-5.

10 6. The sanitary napkin of claim 5 wherein the web has a basis weight of about 0.3-0.7 oz./yd.², the unfinished polypropylene filaments have a denier of about 1.2-2 and wherein the autogenous bond areas occur about 8-20% of the web area and are disposed in a density of about 100-500/in.².

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