United States Patent

[11] 3,525,338

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[54] **ABSORBENT PAD**
5 Claims, 2 Drawing Figs.

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[51] **Int. Cl.** **A61f 13/16,** A61f 15/00
[50] **Field of Search** 128/155, 156, 284, 287, 290, 296

[56] **References Cited**

UNITED STATES PATENTS

3,029,817	4/1962	Harwood et al.	128/296
3,339,550	9/1967	Van Haaften	128/296
3,344,789	10/1967	Arnold et al.	128/287

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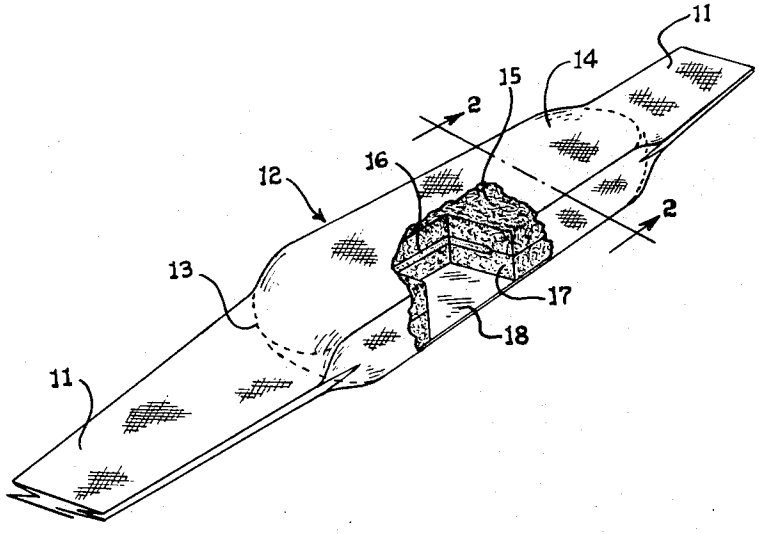
ABSTRACT: An absorbent pad having a central element with exceptional ability to receive and hold absorbed liquid. The central element comprises a batt of glass microfibers in which the individual fibers have a diameter of less than about 0.75 microns. The remainder of the pad consists of conventional absorbent materials.



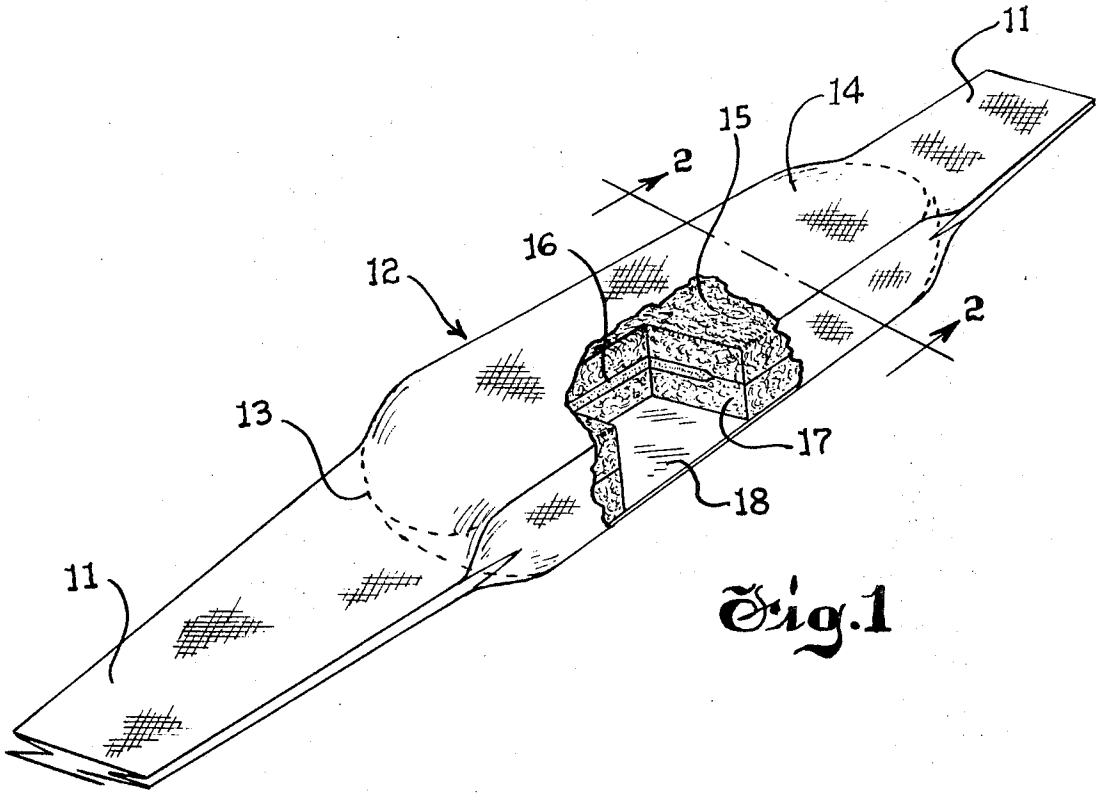


Fig. 1

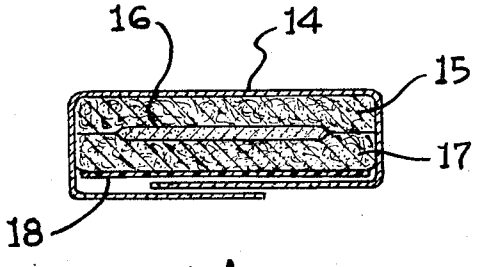


Fig. 2

ABSORBENT PAD

BACKGROUND OF THE INVENTION

Absorbent products such as sanitary napkins, surgical dressings, bandages, tampons and the like usually comprise an absorbent core made up of one or more layers of fibrous or sponge material, and a fluid permeable wrapper to hold the absorbent core material together and also to serve as attachment means. The absorbent core most commonly used consists primarily of comminuted wood pulp fibers known as fluff, of cotton fiber batts, of multiple layers of cellulose wadding, or of various combinations thereof.

In designing absorbent products, the primary object is to obtain a pad which draws fluid body exudates rapidly away from the discharge area, accepts the maximum amount of fluid possible per unit weight of absorbent material, and retains that fluid within the pad under the normal pressure forces to which the pad is subjected during use.

Wood pulp fluff, cotton fibers, and cellulose wadding sheets all are highly absorbent materials and have been found to be quite acceptable for absorbent pad use, especially with respect to their ability to absorb fluids at the point of discharge. However, each of these materials has only a marginal ability to retain the absorbed fluids when ordinary squeezing pressures are exerted on the pad during use. In spite of the latter disadvantage, the aforementioned absorbent materials are still foremost among the preferred core materials because of their ready availability and low cost.

The present invention is directed toward the use of a supplementary element which provides absorbent pads with improved ability to hold absorbed fluids under pressure.

Accordingly it is the principal object of this invention to provide an absorbent product with improved functional capacity.

SUMMARY OF THE INVENTION

This invention is based on the discovery that a fiber mat composed of glass microfibers in which the individual fibers have an average diameter of less than about 0.75 microns is capable of exerting a substantially higher capillary suction pressure with respect to aqueous fluids than the capillary suction pressure of fiber mats made up of any of the presently used conventional fibers. In addition, the glass microfiber mat has a larger absorbent capacity per unit weight than conventional fibers.

It is known that ordinary size glass fibers have excellent wicking ability for aqueous fluids even though the fibers are normally non-hygroscopic. This function has been utilized in the past to assist fluid transfer in absorbent dressings and surgical bandages (see U.S. Pat. 3,344,789 and 2,447,403). However, because ordinary size glass fibers are normally non-hygroscopic, when they are utilized in an absorbent pad construction, a supplementary absorptive element must also be provided in association therewith to perform the necessary function of receiving, and retaining immobile, absorbed liquids which are transferred to the absorptive element from the fluid source by the wicking action of the glass fibers.

It is also noted that while ordinary size glass fibers do have useful fluid transfer capabilities, they unfortunately are notorious for their adverse dermatological effect. Thus, when such fibers are included for use in elements which contact the skin, extreme care must be taken to avoid potential irritation.

It has now been found that when fiber mats composed of glass microfibers as defined herein are incorporated in an absorbent pad; these mats develop a capillary suction force so strong that even under squeezing pressures normally exerted during use, there is little or no transfer of absorbed fluid to adjacent absorbent bodies until the microfiber element itself is substantially saturated. It has also been found that the glass microfibers surprisingly cause no irritation even after prolonged and direct contact with the skin. In fact, mats of microfibers of the type defined herein, have a soft, suede-like feel and a clean, white, talc-like appearance, all desirable qualities for absorbent pad use.

Utilizing the the above discoveries, it is possible to construct pads with superior absorptive characteristics by incorporating in pads made primarily of conventional absorbent fibrous material a supplementary element comprised of glass microfibers. When added to pads of regular construction, a small central batt comprised of microfibers having a diameter of less than about 0.75 microns will increase markedly the pad's absorbent capacity, but, more important, will increase to an unusually high degree the pad's ability to retain fluid once it is absorbed. The latter characteristic is attributed to the capability of microfibers to exert greater capillary suction pressure, as hereinafter defined, than conventional materials. In addition to providing the pad with a greater capillary suction pressure and fluid capacity per unit weight, the microfiber batt also appears to do a more effective job of spreading the received fluid within the interior of the pad. When used in sanitary napkins, these characteristics also permit a reduction in bulk of the other absorbent materials without loss of total capacity, which is highly desirable in the catamenial protection field.

Other features, objects and advantages of the invention will become apparent by reference to the following specification and accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing, in which like numbers represent like parts:

FIG. **1** is a perspective view of an absorbent pad, such as a sanitary napkin, with a central portion partially cut away to show an interior construction incorporating the invention.

FIG. **2** is a section taken along line 2—2 of FIG. **1**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIGS. **1** and **2** of the drawings, there is shown a sanitary napkin **12** comprising an absorbent core or pad **13** and a fluid pervious wrapper **14** enclosing the pad and extending beyond both ends thereof to form fastening tabs **11**. In the embodiment shown, the absorbent core comprises an upper layer **15** of absorbent fibers, a central element **16** of glass microfibers, and a lower layer **17** of absorbent fibers. Underlying the core there is an optional baffle sheet **18** of polyethylene film or the like.

The absorbent fiber layers may be selected from wood pulp fluff, cotton, absorbent rayon, regenerated cellulose, multiple plies of creped cellulose wadding and the like or combinations thereof.

The microfiber element may comprise a loosely assembled batt or web of glass microfibers with the average diameter of individual fibers being in the range of .75 to .08microns.

In one specific example of the construction shown, elements **15** and **17** are comprised of comminuted wood pulp fibers assembled in 6" x 2¾" batts weighing 5 grams each, and the microfiber element **16** centered between the two wood pulp batts, is comprised of a 2.5 gram, 6" x 1½" batt of glass microfibers in which the individual fibers have a diameter range of between about 0.5 and 0.749 microns and widely varying lengths. A pad of this construction is able to absorb up to 24 grams of aqueous fluid at capacity, compared to only about 14 grams of fluid absorbed by a control pad of similar weight but made entirely of fluff.

Under a compacting pressure of 0.7ψ, the wet void volume, or ultimate fluid holding capacity, of a microfiber mat is 17grams of water per gram of fiber, compared to 7 grams of water per gram of fiber for wood pulp fluff.

Fluid body exudate which strikes the top of a napkin of the illustrated construction is first picked up by the top element **15**, then travels downward under the force of gravity and of capillary wicking action, until the fluid strikes microfiber element **16**. Element **16** then rapidly draws much of the fluid from element **15** because of the extremely high capillary suction pressure the microfiber mat exerts.

Normally, of course, the flow of exudate is intermittent and in varying degrees of intensity. Element **16** will continue to draw fluid from layer **15** until element **16** is nearly completely

saturated whereupon greater amounts of fluid will finally begin to accumulate in layer **15** and, in extreme cases, will transfer from, and/or bypass, element **16** to reach layer **17** located under element **16**. The primary function of layer **17** is to remain in reserve as a safety factor, serving to absorb excess fluid rather than to act as a primary absorbent element in itself.

As indicated previously, glass microfibers exhibit totally different characteristics in their absorptive function than are normally associated with ordinary glass fibers.

Ordinary size glass fibers are non-hygroscopic and while they do exhibit superior wicking ability for fluids, i.e. the ability to move fluid from a source of supply to an absorptive receiving body, they have no absorptive holding capacity in themselves and when subjected to capillary suction pressure, as by placing an absorbent fiber mat next to them, will release almost all fluids which are present due to that same wicking characteristic. Such fibers therefore are not useful for the element defined herein.

Other non-swelling fibers, such as some types of crosslinked cellulose, and synthetics such as Acrilan, etc. have characteristics similar to ordinary glass fibers, with respect to wicking action and fluid transfer capabilities.

On the other hand, a mat of microfibers, as defined herein has an extremely high absorptive capability and will tenaciously retain any fluid it absorbs even under extreme pressure conditions. This is attributed to the high capillary fluid suction pressure such mats exhibit.

A saturated microfiber mat which can absorb up to 24 grams of water per gram of fiber without compression will hold over 80 percent of its water content when placed in capillary contact with an equal weight of wood pulp fluff.

The following table will illustrate the capillary fluid suction pressure which various commercially available fibrous materials exert with respect to the absorption of aqueous fluids.

Fibrous material	Average fiber diameter in microns	Capillary suction at pressure at 10 g. H_2O/g. fiber in g./cm.[2]
Sulfate wood pulp fluff	(1)	7.5
Multiple plies of creped wadding	(1)	1.2
Comber cotton	15	3.4
Acrylic fibers 2d	15	2.3
Chopped glass fiber strands	9	1.7
Glass microfibers	2.6–3.8	2.7
Do	1.6–2.59	5.0
Do	.75–2.59	11.5
Do	0.5–.749	21.0
Do	0.2–.499	29.5
Do	0.1–0.199	34.5
Do	.05–.099	42.5

[1] Approx. 25.

Capillary suction pressure may be defined as the suction head which the inter-fiber capillaries of a fibrous mat exert on aqueous fluid in an adjacent fluid-containing mass with which said mat is in capillary contact, when said mat of fibers has a moisture content of 10 grams of water per gram of fiber added to the dry fiber. Wherever the term is used herein it is intended to have such meaning.

From the above table it will be noted that for mats made from microfibers of less than .75 micron diameter capillary suction pressure values are approximately 3 or more times the values for wood pulp fluff, which is presently the most common absorbent material used in pads. Thus if an element made of such microfibers is placed in physical contact with a batt containing aqueous fluid and made from any of the fibers now commonly used in absorbent pads, the difference in suction pressure will cause the fluid to be drawn rapidly from such batts into the microfiber mat. In addition the small inter-fiber pore size of the microfiber mat will cause most of the absorbed fluid to be retained in the microfiber mat even under normal squeezing pressures.

Besides having this unusual attraction for fluids, such glass microfiber webs have the added advantage of being non-irritating to the skin. This is a surprising discovery in that previously, one of the principal reasons for not using glass fibers for sanitary or surgical purposes has been the tendency of such fibers to penetrate the skin and cause irritation unless extreme caution is used.

While in the preferred embodiment of the sanitary napkin described herein the microfiber element is shown as being centrally disposed between two absorbent fluff batts of substantially equal weight, it is understood that it may be used in other location and with other absorbent materials.

It is understood, of course, that the invention is not limited to the preferred embodiment set forth above. Suitable changes, modifications, and variations may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. In a fluid absorbing pad comprising a plurality of layers of absorbent material and a fluid-pervious cover enclosing said material, the improvement in which one of said layers comprises an element made up of glass microfibers, with said microfibers being of such diameter as to cause said microfiber element to exert a capillary suction pressure in the presence of fluids greatly in excess of the capillary suction pressure exerted by the other adjacent absorbent layers.

2. The absorbent pad of claim **1** in which the capillary suction pressure of said microfiber element, when said element has a moisture content of 10 grams of water per gram of fiber, is in the range of about 21.0 to about 43.0 and the capillary suction pressure of said adjacent absorbent layers under the same moisture content is in the range of about 1.0 to about 8.

3. The absorbent pad of claim **1** in which the individual glass microfibers have an average diameter of less than about 0.75 microns.

4. The absorbent pad of claim **1** in which said microfiber mat is disposed in the central portion of said pad.

5. The absorbent pad of claim **1** in which said microfibers have average diameters ranging from 0.749 to 0.05 microns.