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Eisdorfer et al.

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[54] **PLIED ABSORBENT STRUCTURES**

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[52] **U.S. Cl.** **128/156**

[51] **Int. Cl.** **A61f 13/00**

[58] **Field of Search**.... 128/156, 155, 132 R, 290 R, 128/296

[56] **References Cited**

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[57] **ABSTRACT**

A surgical dressing is provided comprising a plurality of plies of a textile-like nonwoven fabric of unbonded, mechanically entangled fibers. The dressing exhibits an absorption capacity per gram of total fabric at least equal to the absorption capacity per gram of a single ply of said fabric and additionally, exhibits an unusually low propensity to lint.

8 Claims, 5 Drawing Figures

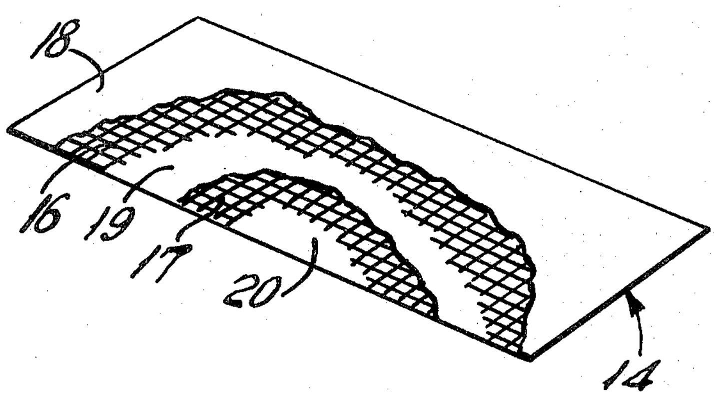


Fig. 1.

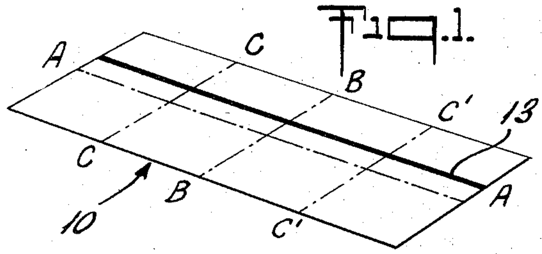


Fig. 2.

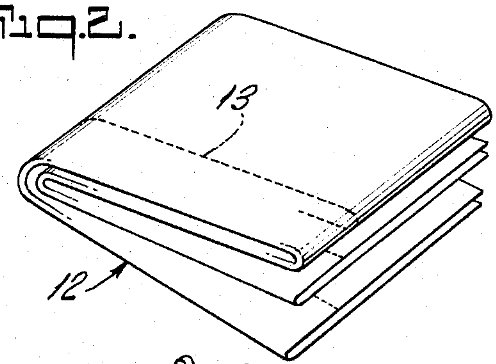


Fig. 3.

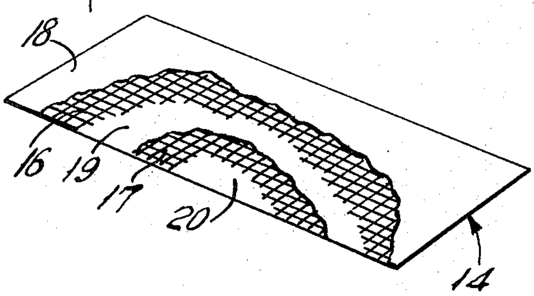


Fig. 4.

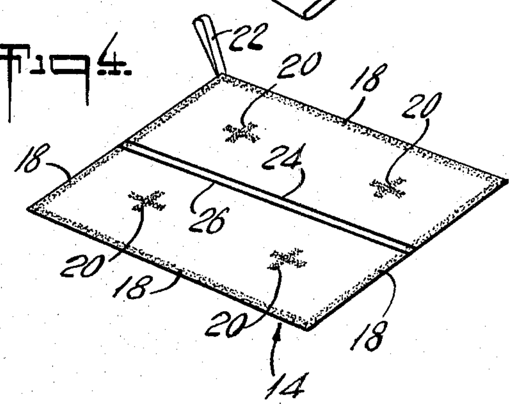
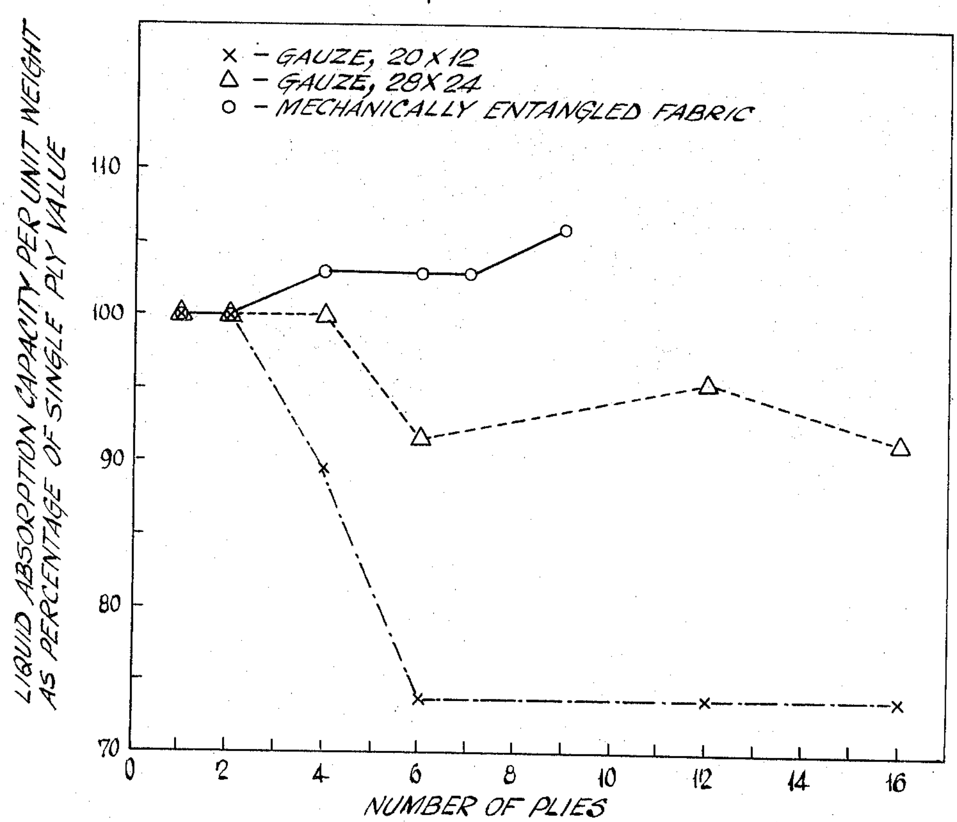


Fig. 5.



PLIED ABSORBENT STRUCTURES

BACKGROUND OF THE INVENTION

This invention concerns absorbent structures such as dressings, bandages, catamenial sanitary napkins, tampons, incontinence pads, and underpads and, in particular, is directed toward absorbent dressings such as those used in surgical procedures.

Absorbent dressings are used in an operating theatre to serve a variety of functions such as, for example, to staunch the flow of blood, to apply medication, to wall off organs and to separate and dry tissue. It is basic that the dressing used for all such purposes be capable of absorbing fluids and maintaining its structural integrity. Unfortunately, these criteria are, to some extent, in conflict as those materials which are highly absorbent tend to have little structural stability. For example, cotton wadding, wood pulp and the like, while highly absorbent do not, in themselves, maintain their structural integrity and consequently, the art has found it necessary to compromise by using a loosely woven material, cotton gauze commonly being the material of choice.

Several drawbacks reside in the use of cotton gauze. Firstly, a single or double layer of gauze exhibits relatively little absorbency and so surgical gauze dressings have required many layers of gauze, e.g., 16, in order to obtain the requisite absorbent capacity. This has proven to be an uneconomical method of providing extra absorbent capacity as it has been discovered that, while the total absorbent capacity increases with each increasing layer of gauze, the absorbent capacity per unit weight of dressing decreases. Said in other words, the additional layers add less and less to the increase in absorption capacity. Further, gauze dressings have been found to be unsatisfactory for many applications because of their tendency to deposit undesirable quantities of lint. Lint, as used herein, is particulate matter which tends to separate from the dressing during use. When left in a wound, lint may cause inflammation, adhesions and the formation of granulomata. The dangers of lint are more acute in the so called "full thickness incisions" as are encountered in such surgical procedures as tracheotomies and cardiovascular procedures wherein lint can form the focal point for the growth of thrombi which in turn may result in the formation of emboli, and laparotomies and thoracotomies resulting in turn in the formation of adhesions and possibly granulomata.

Because of the drawbacks of gauze, the art has long been devoted toward finding suitable substitutes. For example, in U.S. Pat. No. 3,081,515 issued to H. W. Griswold et al on Mar. 19, 1963, a foraminous nonwoven fabric is described as a substitute for gauze in surgical dressings. Such as fabric, in the unbonded state (i.e., with no additional adhesive binder material added) has been found to be highly absorbent. However, when incorporated into a dressing, it has been discovered that the fabric has essentially no ability to maintain its structural integrity and hence, is extremely unsatisfactory for this purpose. To compensate for this inherent weakness, Griswold suggests that the material be strengthened with an adhesive binder. While a useable surgical dressing can be produced this way, it has been discovered that the binder material greatly interferes with the absorptive capacity of the sponge and

hence, this method of producing dressings does not cure the drawbacks associated with cotton gauze.

Accordingly, there has heretofore been no dressing available which can overcome the drawbacks of inefficient absorbency and undesirable linting associated with th prior gauze dressings while maintaining its structural integrity under stress.

SUMMARY OF THE INVENTION

It has now been discovered that an absorbent dressing can be provided which overcomes the drawbacks heretofore associated with cotton gauze dressings. This dressing is made up of a plurality of plies of a textile-like nonwoven fabric of unbonded, mechanically entangled fibers randomly entangled with each other in a pattern of localized entangled regions interconnected by fibers extending between adjacent entangled regions. This fabric and a method for making the same is described in U.S. Pat. No. 3,485,706 which issued on Dec. 23, 1969 to Franklin Jones Evans. It has been discovered that an absorbent dressing comprised of a plurality of plies of such nonwoven fabric, when said fabric is selectively chosen to have a Tensile Energy Absorption value of at least 1.0 foot - pounds per square foot in both the machine and cross direction, cures the drawbacks heretofore experienced in prior absorbent dressings. Specifically, it has been discovered that, for some reason as yet unknown, the dressings of this invention exhibit an absorbent capacity per gram of total fabric in the dressing at least equal to the absorbent capacity per gram of a single ply of the fabric. In fact, when more than two plies of the fabric are used, the dressing actually exhibits an increase in the absorbent capacity per gram as contrasted with a single ply value. This property is entirely unexpected in view of the fact that the commonly used gauze dressings exhibit essentially the opposite characteristic. Further, when a fabric such as that described in the aforementioned patent to Evans is chosen so as to have a Tensile Energy Absorption value of at least 1.0 foot - pounds per square foot, the absorbent dressing maintains its structural integrity to an extent at least comparable to that of gauze dressings and exhibits a marked reduction in the degree of linting. Linting of no more than 0.008 mg. of particulate matter per in.^{2} of exposed area is obtained in contrast with that of cotton gauze which typically is about twice as high. This marked reduction in linting is of particular importance in absorbent dressings such as laparotomy pads used in critical surgical procedures. In a specific embodiment, a single use laparotomy pad is provided comprising a plurality of layers of the textile-like nonwoven fabric of this invention having interlayers of a meltable polymeric scrim placed therebetween to provide the wet resiliency requisite in large laparotomy pads and to provide means for bonding the plurality of layers together by fusing the polymeric scrim.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a sheet of the prescribed fabric of this invention prior to folding into an embodiment of a dressing of this invention;

FIG. 2 is a perspective view of a dressing of this invention;

FIG. 3 is a perspective, partially fragmented view of a second embodiment of a dressing of this invention;

FIG. 4 is a perspective view of a laparotomy pad utilizing the construction shown in FIG. 3; and

FIG. 5 is a graphical representation illustrating the advantageous absorptive properties of the dressings of this invention.

DETAILED DESCRIPTION OF THE INVENTION

The unique surgical dressings of the invention incorporate nonwoven textile fabrics made in accordance with the teachings of U.S. Pat. No. 3,485,706, issued to F. J. Evans on Dec. 23, 1969. As described therein, these fabrics (hereinafter referred to as, "mechanically entangled" fabric) comprise fibers locked into place by fiber interaction to provide a strong cohesive structure which maintains its structural integrity without the need for adhesive binders or filament fusing. The fabrics have a pattern of entangled fiber regions of higher area density (weight per unit area) than the average area density of the fabrics as a whole and there are interconnecting fibers which extend between the dense entangled regions and are randomly entangled with each other in the dense entangled regions. As is described in the aforementioned patent to Evans, the entanglement is accomplished by first preparing a loose layer of fibers and then treating the layer with liquid, jetted at a pressure of at least 200 p.s.i.g., from a row of small orifices, to convert the layer directly into the nonwoven fabrics useful in the surgical dressings of this invention.

In accordance with this present invention, it has been discovered that by incorporating certain of the mechanically entangled fabric of Evans into a multiplied sponge dressing, many of the drawbacks heretofore associated with prior gauze dressings are obviated. This type of fibers used in the dressings of this invention must generally be wettable fibers or fibers which have been treated so as to be wettable. In some cases, blends of wettable fibers in combination with small quantities of non-wettable fibers may be used. Fibers of cotton, rayon, polyethylene terephthalate, polyamides, cellulose acetates, polyacrylonitriles, acrylonitrile-vinyl chloride copolymers, reconstituted protein, polyolefins and blends of these are all useable fibrous systems. Included in this group are hydrophobic fibers which have been treated to give them hydrophilic characteristics. Examples of such treatment are the grafting of polymeric substances onto the fiber surfaces by means of forms of radiation, free radical initiators and other polymerization techniques known in the art. Still other examples of such treatment are the use of wetting agents, rewetting agents and modification in the surface by chemical reaction such as the mercerization of cotton and the caustic treatment of polyethylene terephthalate. In this connection, it is, of course, important to avoid the use of such modification techniques as will be incompatible with the final use of the fibers in a surgical procedure, such as the use of methods leaving residual chemicals which may leach out of the dressing and into body wounds.

The fibers should have a staple length and denier compatible with attaining the strength and decreased particulate matter deposition described herein. Generally, the denier may vary from about 0.5 to about 3.0 with a range of about 1.0 to about 2.0 being preferable. Fiber staple lengths may vary from about 0.25 to about 1.5 inches with lengths of about 0.5 to about 1.25 inches being preferable. The fabric weight per unit area may vary from about 0.5 to about 3.0 ounces per square yard depending upon the degree of bulk desired in the ultimate product. Preferably, the weight per unit area should be about 0.75 to about 2.0 ounces per square yard.

It is desirable, in many dressing applications, that the fabric be apertured. Apertures can provide the dressing with desirable added bulk without the necessity for providing additional fibers. An apertured fabric is less slick, wads less when wet and is more useful in a surgical procedure such as the separation of tissue where a somewhat abrasive character is required for the dressing. From an aesthetic point of view, apertured fabrics more closely resemble the familiar gauze dressings. The apertures may be formed in the fabric by methods now well-known in the art such as, for example, by needle punching or by a jet of fluid impinging on the fabric which is supported on a patterned substrate. The degree of open area of the aperture will vary in accordance with the desired final use of the product, a degree of openness of about 50 to 500 holes per square inch being generally suitable, with an open area of about 100 to 400 holes per square inch being preferred.

In order to be useful as a surgical dressing, the fabrics must have a degree of mechanical entanglement sufficient to have the resulting product maintain its structural integrity under the conditions of use. Specifically, it has been found that the fabric should have a Tensile Energy Absorption value, in both the machine and cross direction, of at least about 1.0 ft.-lbs./ft.^{2} and preferably at least about 2.0 ft.-lbs./ft.^{2}. The Tensile Energy Absorption value is defined as the area under a stress strain curve which is developed by placing the fabric under tensile stress in accordance with the method described in test T494 SU-64 suggested by the Technical Association of the Pulp and Paper Instute (TAPPI) in 1964.

It is important in this instant invention that the above defined minimum tensile strength be accomplished essentially by a sufficient degree of mechanical entanglement rather than by the use of adhesive binders. Thes binders, generally either a latex applied in the form of an emulsion to a weak web of fibers or a crosslinked resin system, are undesirable from the point of view that they tend to interfere with the absorptive properties of the resulting dressing. While the reason for this is not entirely understood, it is possible that the presence of the binder interferes with the communication between the capillary-like spaces of the fibrous fabric, this communication believed to be essential for a good absorbent material. Still another possibility is that the binders commonly used are less hydrophilic than the fibers, result in an overall loss of absorptive characteristics. Perhaps a still more important reason for using the essentially binderless dressings of this invention is that, since these dressings are to be used in connection with body wounds, the essential absence of binder obviates the possibility of introducing substances into the body, either by leeching out or by primary contact, which may induce or cause adverse tissue reactions as, for example, toxic or allergenic responses.

The mechanically entangled fabric has, in accordance with this invention, been incorporated into a surgical sponge, using a plurality of plies. Referring to FIG. 1, illustrated therein, is a single rectangular sheet 10 of the prescribed mechanically entangled fabric which may be folded to produce a multiplied surgical sponge such as the eight-ply sponge 12 shown in FIG. 2. The sheet 10 is first folded along line A—A and then along line B—B so that lines C—C and C′—C′ coincide. The final product, sponge **12**, is achieved by folding once more about coinciding lines C—C and C′—C′. Attached to sheet **10** is an X-ray detectable element **13** such as, for example, a filament of a polyolefin which has, embedded therein, barium sulfate or other suitable X-ray opaque material. As shown in FIG. **1**, the element **13** is preferably located near line A—A so as to be centrally positioned in the final product.

FIGS. **3** and **4** illustrate still another embodiment of this invention wherein the prescribed mechanically entangled fabric is incorporated into a laparotomy pad **14**. These pads generally are used within body cavities during major surgical procedures and, in addition to providing absorbency, must also perform the function of walling off organs and covering the outer edges of an incision. Accordingly, the laparotomy pads require a degree of wet resiliency in order to maintain their bulk characteristics when performing these non-absorption functions. The embodiments of this invention shown in FIG. **3** incorporates thin thermoplastic grids **16** and **17** interlayered between plies **18, 19** and **20** of the prescribed mechanically entangled fabric. A preferred grid material may be, for example, made of polyolefin such as, for example, polypropylene which may weigh between about 20 to about 70 grains per square yard. The degree of openness of the grid must be sufficient to preclude interference with the absorbing characteristics and flexibility of the pad. Hole patterns such as 3 × 5, 5 × 5, 9 × 9 or 12 × 12 holes/inch are preferred. The entire laminate of fabric plies interlayered with thermoplastic grids may be bound together, as shown best in FIG. **4.** by heat sealing, at least at the marginal portions **18** of the pad **14** so as to fuse the grids **16** and **17** and form an integral bond with the fabric plies. To assure still greater integrity of the structure of the laminate, additional heat sealing points **20** are provided inward of the margins **18,** these shown to be in a cross-like pattern in FIG. **4.** It will be understood by one skilled in the art that other patterns and arrangements of heat sealing points may also be used. It will also be understood by one skilled in the art that the plies of the pad may be bound together by means other than heat sealing, such as ultrasonic sealing or by sewing. The laparotomy pad **14** is provided with a handle **22** which may likewise be heat-sealed to the pad or alternatively, may be sewn on. As in the prior embodiment, the laparotomy sponge may be provided with X-ray detectable elements **24** and **26.**

The dressings of this invention exhibit properties which are totally unexpected when contrasted with prior multiplied dressings. Specifically, it has been discovered that both the absorbency characteristics and the degree of linting of the multiplied structure is surprisingly improved.

With respect to the absorbency characteristics, it has been found that, as the number of plies are increased beyond a single ply, there is no loss in the average total absorbent capacity for liquid per unit weight of dressing. In fact, by increasing the number of plies beyond two, there is actually an increase in the absorbent capacity per gram. This result is particularly surprising when contrasted to the commonly used cotton gauze dressings which exhibit just the opposite result, i.e., the average total absorbent capacity for liquid per unit weight of gauze dressing decreases with increasing number of plies. The extent of such decreases in the absorbent capacity of prior art gauze dressings is considerable and, for example, may be as high a decrease as ten percent of the single-ply value and in extreme cases, as high as 25 percent of the single-ply value. In contrast to this, no such decrease in absorbent capacity is noted with the dressings of this invention. In fact, an increase is noted of approximately at least about 3 percent for a five-ply sponge and still greater increases for a ten-ply dressing. This is advantageous in that less material may be used to obtain the requisite absorption capacity. Concomitant with this advantage, is the fact that the use of less material or, stated in other words, fewer plies of fabric, means that less surface of the fabric is incorporated into each sponge. Since the degree of linting, i.e., deposition of particulate matter is to a major extent a function of the area of the material used, the fact that less area need be used, coupled with the other herein prescribed requisites of the dressing, results in a substantial reduction in the degree of linting. Thus, for example, a sponge made in accordance with the teachings of this invention will exhibit a degree linting of less than about 0.008 mg of particulate matter per $in.^2$ of exposed area when used in a multiplied structure. In contrast therewith, a cotton gauze sponge will exhibit a degree of linting of about 0.012 mg of particulate matter per $in.^2$ of exposed area. This comparison has been made after the usual precautions have been taken with respect to limiting the linting of gauze dressings. Specifically, because of the nature of cut gauze, a great deal of particulate matter is released from the cut edges and so these are generally inwardly folded and buried within the folded dressing. Further, the actual cutting of the gauze before folding must be accomplished by the specialized technique of crush cutting wherein the cut ends of the gauze yarns are sealed by crushing into an elliptical crimped configuration to prevent loose fibers from working themselves free. While all of these precautions are taken with respect to gauze dressings tested, none are necessary for the mechanically entangled fabric dressings of this invention. Had such precaution not been taken with the gauze dressings, the contrast in degree of linting would be markedly greater.

To further illustrate the advantages of this invention, the following examples are given:

EXAMPLE I

Samples of dressings having varying number of plies are prepared from three types of fabrics. The first type consists of surgical grade, bleached and scoured cotton gauze (U.S. Pharmacopoeia Type VII) having a thread count of 20 warp threads by 12 fill threads and weighing 0.6 ounces per square yard. The second type consists of surgical grade, bleached and scoured cotton gauze (U.S. Pharmacopoeia Type III) having a thread count of 28 warp threads by 24 fill threads and weighing 1.0 ounces per square yard. The third type, in accordance with the teachings of this instant invention, consists of mechanically entangled fabric made from 100 percent surgical grade rayon fibers, the fibers being of 1.5 denier and having a staple length of ¾-inch. The mechanically entangled fabric weighs 1.0 ounces per square yard and is apertured to an open area of about 300 holes per square inch.

The samples are prepared in disk form having a diameter of 68.5 millimeters. The samples are tested to determine their total absorbent capacity with distilled water using an apparatus which consists of a smooth Teflon coated plate having an aperture of 3 mils in diameter there-through. The aperture is in flow communication with a reservoir of distilled water and means are provided to insure that the hydraulic head of the liquid in the aperture at a level essentially equal to the top surface of the smooth plate is essentially zero throughout the test period. The means for insuring this hydraulics head relationship are illustrated in the description of a constant flow burette as given in the Journal of Chemical Education, Volume 47 at pages 841–842, December 1970. Each of the samples was placed on the top surface of the plate above the aperture and allowed to absorb liquid and reduce the level in the liquid reservoir until no further level change was noted in the reservoir. The volume of liquid absorbed by each sample was noted.

Table I below, summarizes the results of these tests indicating the number of plies used for each sample, the type of absorbent used in each sample, and the absorbent capacity of each sample, which is expressed in terms of the total capacity of each plied sample as a percentage of the single ply capacity in cubic centimeters of liquid absorbed per gram of dressing.

TABLE I

No. of Plies	Total Capacity Per Gram as a Percentage of Single Ply Capacity Per Gram		
	20 × 12 Gauze	28 × 24 Gauze	Mechanically Entangled Fabric
1	100	100	100
2	100	100	100
4	89.5	100	103
6	73.6	91.5	103
7			103
9			106
12	73.6	95.7	
16	73.6	91.5	

FIG. 5 is a graphical representation of these data wherein the abscissa is the number of plies and the ordinate is the total absorption capacity per gram as a percentage of the single ply capacity per gram. The data points for the 20 × 12 gauze samples, the 28 × 24 gauze samples and mechanically entangled samples are plotted as X's, triangles, and circles, respectively. As is evident from FIG. 5 and Table I, both gauze samples characteristically exhibit a decreasing total absorbency per gram as the number of plies are increased, this trend being most noticeable beyond four plies. In marked contrast therewith, the novel mechanically entangled samples of this invention exhibits exactly the reverse relationship whereby the absorbency per gram increases with the number of plies, the increase being noticeable beyond two plies and still more evident at four plies.

EXAMPLE II

Eight samples of various types of surgical sponges are prepared. The first and second types are conventional cotton gauze sponges consisting of, respectively, the 20 × 12 count and the 28 × 24 count gauze described in the prior example. The remaining types are made in accordance with this invention and comprise mechanically entangled fibers of the various kinds reported in Table II below and having various weights per unit area as likewise reported in Table II. Eight samples of each type are tested for particulate matter released by dipping the sample into 1,000 ml of distilled water contained in a beaker. The sample, held at its edge by crucible tongs is dipped, to submersion, into the water and withdrawn five times. Each time the sample is dipped, it is agitated back and forth five times. The solution is then filtered into a vacuum flask through a crucible having a porous fritted glass bottom and first having been rinsed with distilled water, dried in an oven at 105°C. for 3 hours and then cooled in a desiccator for 1 hour. The weight of the cooled and dried crucible has been recorded. The filtered solution is returned to the beaker and the above-described dipping, agitating, withdrawing and filtering procedure is repeated for each of the remaining samples of the same dressing type. The crucible is then dried to constant weight in an oven at 105°C. and weighed once again, the difference in weighing being recorded. This difference in weight is divided by the total exposed surface of all sponge samples and is reported in Table II as the weight of particulate matter released per unit exposed area of sponge.

As Table II indicates, all of the mechanically entangled sponges of this invention exhibit a markedly decreased deposition of particulate matter as compared to conventional gauze sponges. Typically, the particulate matter deposition is reduced by a factor greater than two. It should be further noted that the nature of the particulate matter deposited from the gauze sponge differs from that of the mechanically entangled sponges of this invention. It is observed that lint from the gauze sponges consists essentially of pieces of yarn about 0.13–0.32 mm in diameter, most of which are about 1 mm in length although pieces as long as about 6 and 7 mm are not uncommon. Intermingled with these pieces of yarn are loose, short fibers which are components of said yarns and such impurities as bits of cotton husk, leaf and stem. In contrast with this, the mechanically entangled sponges deposit lint particles which are substantially smaller, being of dust-like quality.

TABLE II

Sponge Type	Fibers	Weight (oz./yd.^{2})	Particulate Matter (mg/in.^{2})
Gauze	Cotton yarn, 20 × 12	0.6	0.0134
Gauze	Cotton yarn, 28 × 24	1.0	0.0112
Mechanically Entangled	100% Rayon	1.0	0.0049
Mechanically Entangled	100% Rayon	2.0	0.0055
Mechanically Entangled	75% Rayon, 25% PET(1)	1.1	0.0057
Mechanically Entangled	75% Rayon, 25% PET(2)	1.1	0.0060
Mechanically Entangled	10% Rayon, 90% PET(1)	1.0	0.0040
Mechanically Entangled	10% Rayon, 90% PET(2)	1.0	0.0044

(1) Polyethylene terephthalate
(2) Polyethylene terephthalate grafted with polyacrylic acid

EXAMPLE III

This example illustrates the advantages of the instant invention over prior art attempts to produce non-woven surgical sponges. Two samples of single-ply fabrics are made in accordance with the method described in U.S. Pat. No. 3,081,515, issued to H.W. Griswold et al on Mar. 19, 1963, using 100 percent rayon fibers having a denier of 1.5 and a staple length of ¾in. The first sample is made from a carded web and is provided in the unbonded state. The second sample is likewise made from a single-ply carded web and is then impregnated with a crosslinkable acrylic emulsion polymer, the quantity of polymer used being equal to about 30 percent of the weight of the unbonded web. Both samples are tested for absorbent capacity as described in Example I. Both samples are also tested for their Tensile Energy Absorption values using the method described by the Technical Association of the Pulp and Paper Industries (TAPPI), Suggested Method T494 SU-64, 1964. Samples of single ply mechanically entangled fabric prescribed by this invention and identical to that of Example I are similarly tested and the results are reported in Table III below.

TABLE III

Sample	Weight (oz./yd.^{2})	Absorption Capacity (cc/gm)	T E A[1] ft.-lb./ft.^{2}	
			Machine Direction	Cross Direction
Carded, Unbonded	1.0	8.5	0.21	0.01
Carded, Bonded	1.1[2]	5.6	5.36	4.35
Mechanically Entangled	1.0	8.3	4.54	2.88

[1] Tensile Energy Absorption value
[2] Exclusive of binder

As is shown in the above table, the bonded samples exhibit good absorbency but are insufficiently tensile-stress resistant to suffice as a material of construction for a surgical sponge. In fact, this material is so weak that when attempts were made to determine the particulate matter deposited by a sponge made from such a fabric, in accordance with the method described in the foregoing example, the sponge lost its structural integrity. As is suggested by Griswold, the unbonded materials were strengthened by impregnating them with a binder. In this form, the samples tested showed adequate tensile stress resistance. However, as is clearly shown in the above table, the absorptive capacity is greatly diminished. In comparison with both of the aforementioned samples, the material prescribed by the teachings of this invention exhibited both satisfactory strength and satisfactory absorption capacity.

It will be apparent to one skilled in the art that many modifications to the invention are possible without departing from the scope and spirit thereof.

What is claimed is:

1. A surgical dressing comprising a plurality of plies of a textile-like nonwoven fabric of essentially unbonded, mechanically entangled fibers randomly entangled with each other in a pattern of localized entangled regions interconnected by fibers extending between adjacent entangled regions, said fabric having a Tensile Energy Absorption value of at least 1.0 foot - pounds per foot square, in both the machine and cross directions and said dressing having an absorption capacity per gram of total fabric at least equal to the absorption capacity per gram of a single ply of said fabric.

2. The surgical dressing of claim 1 having a degree of linting of less than 0.008 mg. of particulate matter per inch square of exposed area.

3. The surgical dressing of claim 1 wherein each ply has a weight ranging from about 0.75 ounces per yard square to about 3.0 ounces per yard square.

4. The surgical dressing of claim 1 wherein the Tensile Energy Absorption value is at least about 2.0 ft.-lbs./ft.^{2} in both the machine and cross directions.

5. The surgical dressing of claim 1 provided with a plurality of thermoplastic grids interlayered between said plurality of plies of fabric thereby providing said dressing with wet resilience.

6. The surgical dressing of claim 5 wherein said grids comprise a polyolefin.

7. The surgical dressing of claim 5 wherein said interlayers are heat-sealed together at their marginal portions.

8. The surgical dressing of claim 7 wherein said interlayers are further heat-sealed together at points inward of said marginal portion.

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