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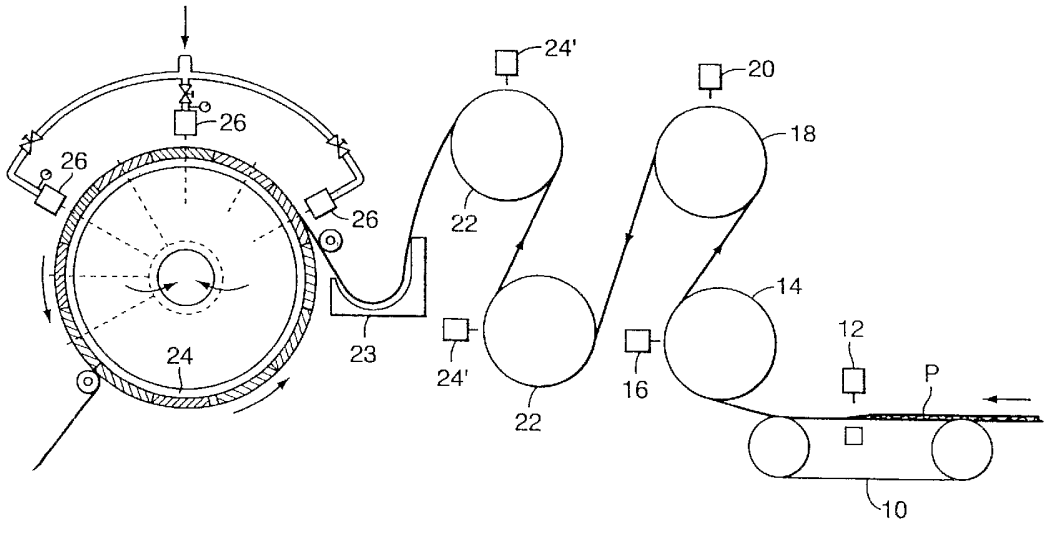
(54) Title: CLEANING SHEETS WITH IMPROVED CLEANING PERFORMANCE



(57) Abstract: The present invention is directed to a nonwoven cleaning sheet having a distance (d), defined as the expanse from the front, or leading edge of the cleaning sheet, to the back, or trailing edge of the sheet, that is imparted with two or more three-dimensional protrusions so as to create a tortuous particulate paths) within the cleaning sheet that extends more than about 1.6 times the aforementioned distance (d), resulting in a cleaning sheet with an improved particulate entrapment and entrainment performance.

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CLEANING SHEETS WITH IMPROVED CLEANING PERFORMANCE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of priority Provisional Application No. 60/591,059, filed July 26, 2004, the disclosures of which is incorporated herein by reference.

TECHNICAL FIELD

[0002] The present invention relates generally to a nonwoven cleaning sheet, and specifically to a nonwoven cleaning sheet having a distance (d) defined as the expanse from the front, or leading edge of the cleaning sheet, to the trailing edge of the cleaning sheet, which is imparted with two or more three-dimensional protrusions so as to create a tortuous particulate path within the cleaning sheet that extends more than about 1.6 times the aforementioned distance (d), resulting in a cleaning sheet with an improved particulate entrapment and entrainment performance.

BACKGROUND OF THE INVENTION

[0003] The general use of nonwoven fabrics as a component in cleaning and/or cleansing articles is well known in the art. Various cleaning products, specifically baby wipes, hard surface wipes, and facial cleansing wipes, are commercially available that utilize one or more layers of nonwoven fabrics in the construction of said wipe. Primarily, these conventional wipes have been two-dimensional or planar in construction. As the surface topography of such two-dimensional wipes is inherently restricted by the composition of the wipe, frictional cleaning induced by the composition is limited, thus necessitating increased consumption of said wipe to effect satisfactory levels of cleanliness.

[0004] Attempts have been made to induce three-dimensionality into the conventional wipe in order to improve cleaning performance. Prior art materials, such as certain high-end consumer baby wipes, have incorporated an elastic film to induce crenulation of the resultant wipe surface. While this practice induces three-dimensionality to the wipe, the effect is transitory and can be easily removed when the wipe is distended during use. Similarly, cleaning wipes have also been fabricated by various embossing processes. Again, these processes impart a three-dimensionality that can be reduced, if not removed, from the surface topography of the wipe when subjected to distention and pressure forces encountered during use.

[0005] The cleaning performance of the cleaning sheet is not only found to depend on the three-dimensionality imparted into the cleaning product, but also the ability for the cleaning sheet to entrap and entrain particulate matter, such as dust, hair, and crumbs. Imparting three-dimensional protrusions into a cleaning sheet creates more than one plane within the sheet. The apex of the protrusions that first come in contact with a surface create a first plane, while the background of the cleaning sheet from which the protrusions extend creates a second plane. It is the second plane that can act as a path for collecting and capturing particulates, subsequently affecting the cleaning performance of the sheet by allowing for a greater number of particulates to become entrapped within the sheet.

[0006] Three-dimensional cleaning sheets are known, but are limited by the amount of particulate capture due to the length of the particulate paths. A cleaning sheet comprising a short particulate capturing path will not entrap and entrain as much dirt, dust, hair, food morsels, etc., as a cleaning sheet with extended tortuous particulate capturing paths.

[0007] A need exists for a cleaning and/or cleansing sheet that has an improved cleaning and/or cleansing performance by exhibiting durable three-dimensionality and a tortuous particulate path, which can increase the amount of particulates captured within the cleaning product.

SUMMARY OF THE INVENTION

[0008] The present invention is directed to a nonwoven cleaning sheet having a distance (d), defined as the expanse from the front, or leading edge of the cleaning sheet, to the back, or trailing edge of the sheet, that is imparted with two or more three-dimensional protrusions so as to create a tortuous particulate path(s) within the cleaning sheet that extends more than about 1.6 times the aforementioned distance (d), resulting in a cleaning sheet with an improved particulate entrapment and entrainment performance.

[0009] In accordance with the present invention, an improved cleaning sheet is formed comprising a torturous path(s), wherein the shortest tortuous path that extends from the leading edge of the sheet to the trailing edge of the sheet is at least about 1.6 times the distance of the cleaning sheet from front to back thereby increasing the amount of particulate entrapment and entrainment, such as dust, hair,

and food morsels. Such a cleaning sheet promotes the use of increased surface area within the sheet by directing particulates into the paths rather than collecting at the leading edge of the sheet. Further, the tortuous particulate path facilitates an improved, more efficient cleaning performance by better entrapping and entraining particulates within the tortuous paths.

[0010] The cleaning sheets of the present invention may be used in a wet or dry state and are suitable for a variety of cleaning/cleansing applications. The sheets are suitable for home cleaning uses including, but not limited to dusting furniture, cleaning hard surfaces, such as counters and sinks, as well as floors. In addition, the improved sheets are suitable for hygienic cleansing applications, such as hand wipes, facial wipes, body wipes, and baby wipes. Also, industrial uses may include automotive or outdoor furniture cleaning sheets.

[0011] It is also within the purview of the present invention to impregnate, saturate, or topically apply a cleaning or cleansing agent or additional additives to the sheets. Such additives may include abrasives, emollients, fragrances, pigments, UV protectants, surfactants, or a combination thereof. Further, the cleaning sheet may be used in either continuous perforated roll form or discontinuous form, wherein the cleaning sheets are folded by one or more methods known to those skilled in the art and subsequently packaged.

[0012] A method of making the improved cleaning sheet includes the steps of providing a precursor web comprising a fibrous matrix, said fibrous matrix including finite staple length fibers, continuous filaments, and the blends thereof. In a particularly preferred form, the fibrous matrix is composed of a blend of staple fibers, which are carded and cross-lapped to form a precursor web that is advanced onto a foraminous surface to be imparted with two or more three-dimensional protrusions via entanglement. It is also preferred that the precursor web be subjected to pre-entangling prior to imparting two or more three-dimensional protrusions.

[0013] In the preferred form, the precursor web is hydroentangled on a foraminous surface prior to hydroentangling on a device imparting three-dimensionality, including, but not limited to a perforated or raised surface belts, metal drums, or a three-dimensional image transfer device. Pre-entangling of the precursor web acts to integrate the fibrous components of the web, but does not

impart three-dimensionality as can be achieved through the use of a three-dimensional image transfer device.

[0014] Other features and advantages of the present invention will become readily apparent from the following detailed description, the accompanying drawings, and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIGURE 1 is a diagrammatic view of an apparatus for manufacturing a cleaning sheet, embodying the principles of the present invention; and

[0016] FIGURE 2 is a plan view of a cleaning sheet made in accordance with the present invention;

[0017] FIGURE 3 is a plan view of a cleaning sheet made in accordance with the present invention; and

[0018] FIGURE 4 is a plan view of a cleaning sheet of the prior art.

DETAILED DESCRIPTION

[0019] While the present invention is susceptible of embodiment in various forms, there is shown in the drawings and will hereinafter be described a presently preferred embodiment of the invention, with the understanding that the present disclosure is to be considered as an exemplification of the invention, and is not intended to limit the invention to the specific embodiment illustrated.

[0020] The present invention is directed an improved nonwoven cleaning sheet which is imparted with two or more durable three-dimensional protrusions during the fabrication stage. The three-dimensional protrusions imparted into the structure of the cleaning sheet results in two pronounced effects. First, a cleaning sheet is formed with durable three-dimensional protrusions that maintain structural integrity during use. Second, the multiple planes imparted by the three-dimensional protrusions create a torturous path(s), for an increased number of particulates to become entrapped and entrained within the nonwoven sheet during the cleaning process.

[0021] U.S. Patent No. 3,485,706, to Evans, hereby incorporated by reference, discloses processes for effecting hydroentanglement of nonwoven fabrics. More recently, hydroentanglement techniques have been developed which impart three-dimensional protrusions to the entangled fabric by effecting

hydroentanglement on such fiber manipulating devices like perforated belts or metal drums, or three-dimensional image transfer devices. Three-dimensional image transfer devices are disclosed in U.S. Patent No. 5,098,764, hereby incorporated by reference, with the use of such image transfer devices being desirable for providing a fabric with enhanced physical properties as well as having a pleasing appearance.

[0022] With reference to FIGURE 1, therein is illustrated an apparatus for practicing the present method for forming a nonwoven fabric cleaning sheet. The fabric is formed from a fibrous matrix preferably comprising staple length fibers, but it is within the purview of the present invention that different types of fibers, or fiber blends, and with inclusive of an optional scrim layer, can be employed. The fibrous matrix can be comprised of fibers or filaments selected from natural or synthetic composition, of homogeneous or mixed fiber length. Suitable natural fibers include, but are not limited to, cotton, wood pulp and viscose rayon. Synthetic fibers, which may be blended in whole or part, include thermoplastic and thermoset polymers. Thermoplastic polymers suitable for blending include polyolefins, polyamides and polyesters. The thermoplastic polymers may be further selected from homopolymers; copolymers, conjugates and other derivatives including those thermoplastic polymers having incorporated melt additives or surface-active agents, and splittable constructions. The profile of the fiber or filament is not a limitation to the applicability of the present invention. When a finite staple length fiber is used, staple lengths are selected in the range of 0.25 inch to 8 inches, the range of 1 to 2 inches being preferred and the fiber denier selected in the range of 1 to 15, the range of 2 to 6 denier being preferred for general applications. The profile of the fiber is not a limitation to the applicability of the present invention.

[0023] The fibrous matrix is preferably carded and air-laid or cross-lapped to form a precursor web, designated P. Prior to imparting the three-dimensional protrusions into the precursor web, the web was pre-entangled by a series of entangling manifolds such as diagrammatically illustrated in FIGURE 1. FIGURE 1 illustrates disposition of precursor web P on a foraminous forming surface in the form of belt 10, with the web acted upon by an entangling manifold 12. The web then passes sequentially over a drum 14 having a foraminous forming surface, for entangling by entangling manifold 16, with the web thereafter directed about the

foraminous forming surface of a drum 18 for entangling by entanglement manifold 20. The web is thereafter passed over successive foraminous drums 22, with successive entangling treatment by entangling manifolds 24', 24'. In the present examples, each of the entangling manifolds included 120 micron orifices spaced at 42.3 per inch, with the manifolds operated successively at 30, 10, 30, 10, and 10 bar, with a line speed of about 40 yards per minute. A web having a width of 84 inches was employed.

[0024] The entangling apparatus of FIGURE 1 further includes an imaging and patterning drum 24 comprising a three-dimensional image transfer device for effecting imaging and patterning of the now-entangled precursor web. The entangling apparatus includes a plurality of entangling manifolds 26, which act in cooperation with the three-dimensional image transfer device of drum 24 to effect three-dimensional fibrous protrusions of the fabric. In the present example, the entangling manifolds 26 were successively operated at 90, 95, and 100 bar, at a line speed which was the same as that used during pre-entanglement.

[0025] The aforementioned fibrous protrusions create a multi-planed cleaning sheet, wherein a first plane is formed by the high points of the protrusions that act as initial surface contacts. The background from which the protrusions extend form a second plane that act as the tortuous particulate capturing path(s), thus improving the cleaning performance of the cleaning sheet.

[0026] The composition of the three-dimensional cleaning sheet can be specifically chosen in light of the cleaning agent to be impregnated therein or applied thereon. For example, if a water based surfactant compound is to be applied, a hydrophilic naturally derived fiber such as rayon or a hydrophilic melt additive in a polyester staple fiber would facilitate in the imaged nonwoven fabric absorbing a controlled amount of a surfactant compound. Should it be known that an abrasive cleaning surface facing material is desirable, a polypropylene staple fiber selected from the upper denier range of staple fibers would be advised.

[0027] It is within the purview of the present invention that a scrim can be interposed in the formation of the precursor nonwoven web. The purpose of the scrim is to reduce the extensibility of the resultant three-dimensional protrusions of the cleaning sheet, thus reducing the possibility of distortion and further enhancing

fabric durability. Suitable scrims may include, but are not limited to unidirectional monofilament, bi-directional monofilament, expanded films, and thermoplastic spunbond.

[0028] A laminate cleaning sheet may be formed as well by adhering chemically or mechanically, one or more layers to the nonwoven cleaning sheet. Suitable layers include, but are not limited to staple fiber layers, continuous filament layers, film layers, woven layers, or a combination thereof. Such layers may utilize nano-denier or sub-denier fibers or filaments, bi-components, copolymers, fiber or filaments of various cross-sections, and a combination thereof.

[0029] It is also within the purview of the present invention that a binder material can be either incorporated as a fusible fiber in the formation of the precursor nonwoven web or as a liquid fiber adhesive applied after fabric formation. The binder material will further improve the durability or otherwise provide enhanced cleaning performance of the resultant cleaning sheet during use.

[0030] In accordance with the present invention, an improved cleaning sheet is formed comprising a torturous path(s), wherein the shortest tortuous path that extends from the leading edge of the cleaning sheet to the trailing edge of the cleaning sheet is at least about 1.6 times the length of the cleaning sheet from front to back and acts to collect an increased amount of particulates, such as dust, hair, and food morsels. Figure 2 and 3 are exemplarily of the cleaning sheets of the present invention, wherein the background of the cleaning sheet makes up tortuous paths that act to entrain and entrap particulates. Figure 3 shows a cleaning sheet with a leading edge 12, an expansive surface comprising a plurality of three-dimensional protrusions 14, a trailing edge 16, and a distance 18 that defines the length of the cleaning sheet from front to back. Further, Figure 3 shows a torturous particulate path 20 that extends from the leading edge of the sheet to the trailing edge of the sheet. It is in accordance with the present invention that the shortest tortuous particulate path 20 that extends from the leading edge of the cleaning sheet to the trailing edge of the cleaning sheet is at least 1.6 times the length of the sheet 18 as previously defined.

[0031] Incorporating extended particulate paths within a cleaning sheet promotes the use of the entire cleaning surface area that comes in contact with a

soiled surface by directing particulates into the paths rather than collecting particulates at the leading edge of the sheet or about the three-dimensional protrusions. Further, the tortuous particulate path facilitates an improved cleaning performance by better entrapping and entraining particulates within the paths.

[0032] From the foregoing, it will be observed that numerous modifications and variations can be affected without departing from the true spirit and scope of the novel concept of the present invention. It is to be understood that no limitation with respect to the specific embodiments illustrated herein is intended or should be inferred. The disclosure is intended to cover, by the appended claims, all such modifications as fall within the scope of the claims.

WHAT IS CLAIMED IS:

1. A cleaning sheet comprising a leading edge, expansive cleaning or cleansing surface comprising three-dimensional protrusions and tortuous particulate paths, and a trailing edge, which defines the length of said cleaning sheet, wherein the shortest distance of said tortuous paths as it travels from said leading edge to said trailing edge while being further defined by said protrusions is about 1.6 times the length of said cleaning sheet.

2. A cleaning sheet as in claim 1, wherein said sheet comprises more than one layer.

3. A cleaning sheet as in claim 1, wherein said sheet comprises a cleaning or cleansing agent.

4. A cleaning sheet as in claim 1, wherein said sheet is a hard surface cleaning sheet.

5. A cleaning sheet as in claim 1, wherein said sheet is a hygienic cleaning sheet.

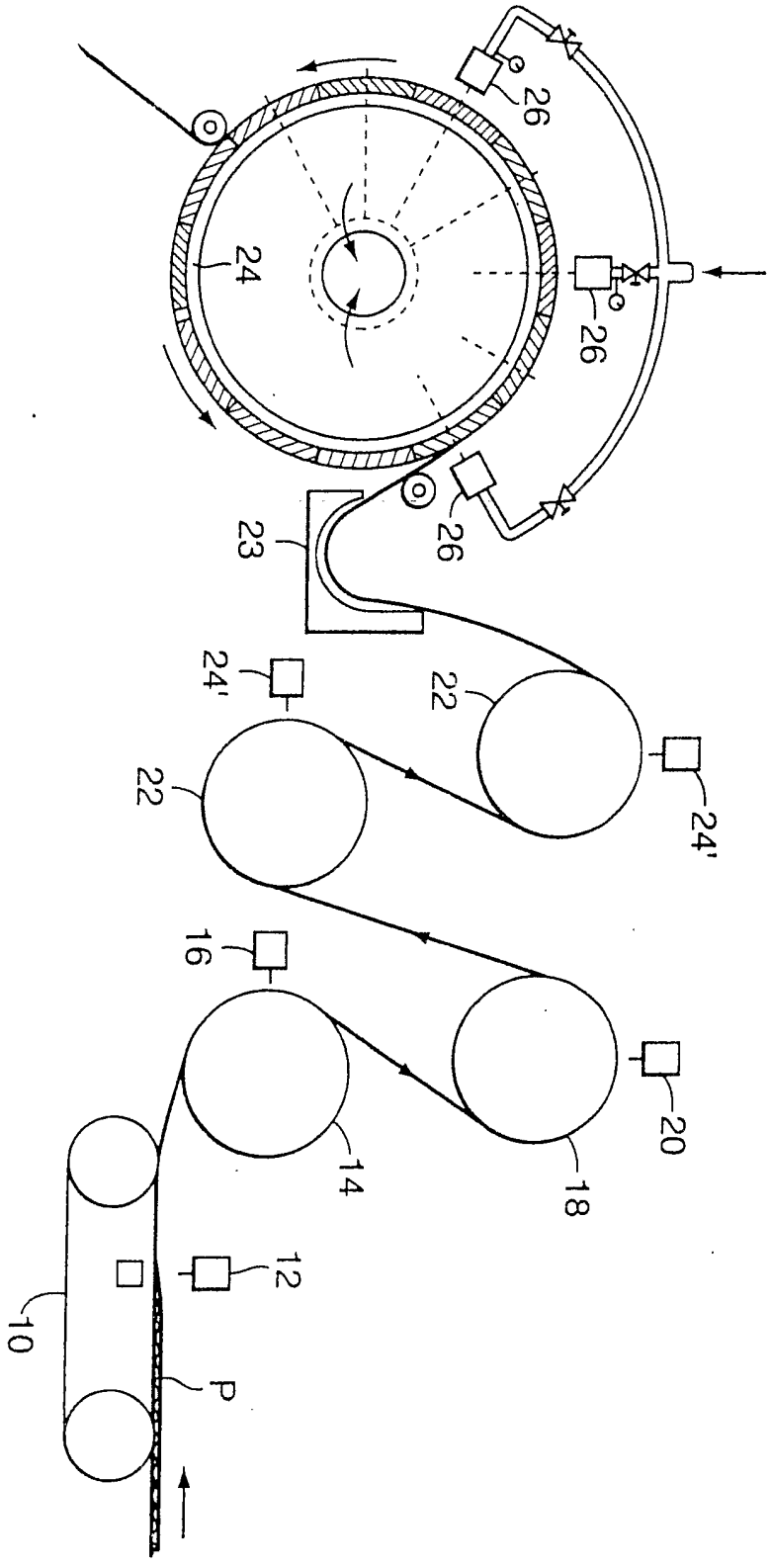

FIG. 1

FIGURE 2

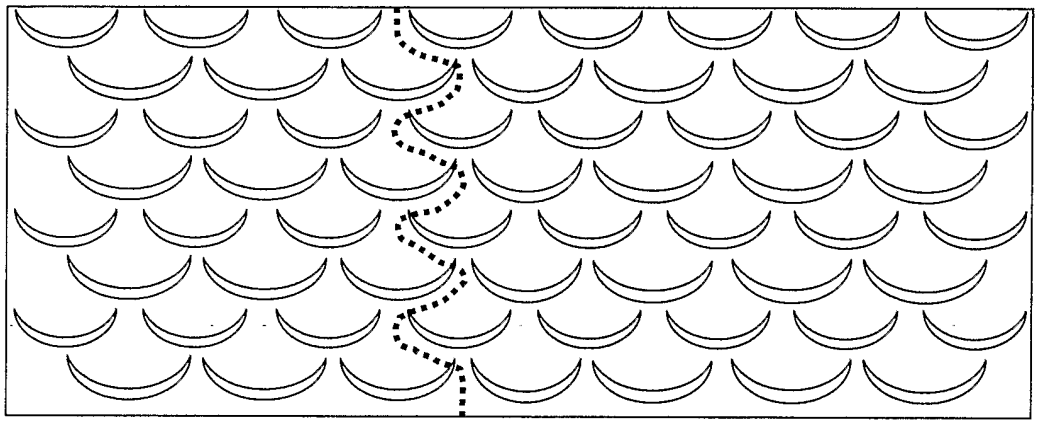

FIGURE 3

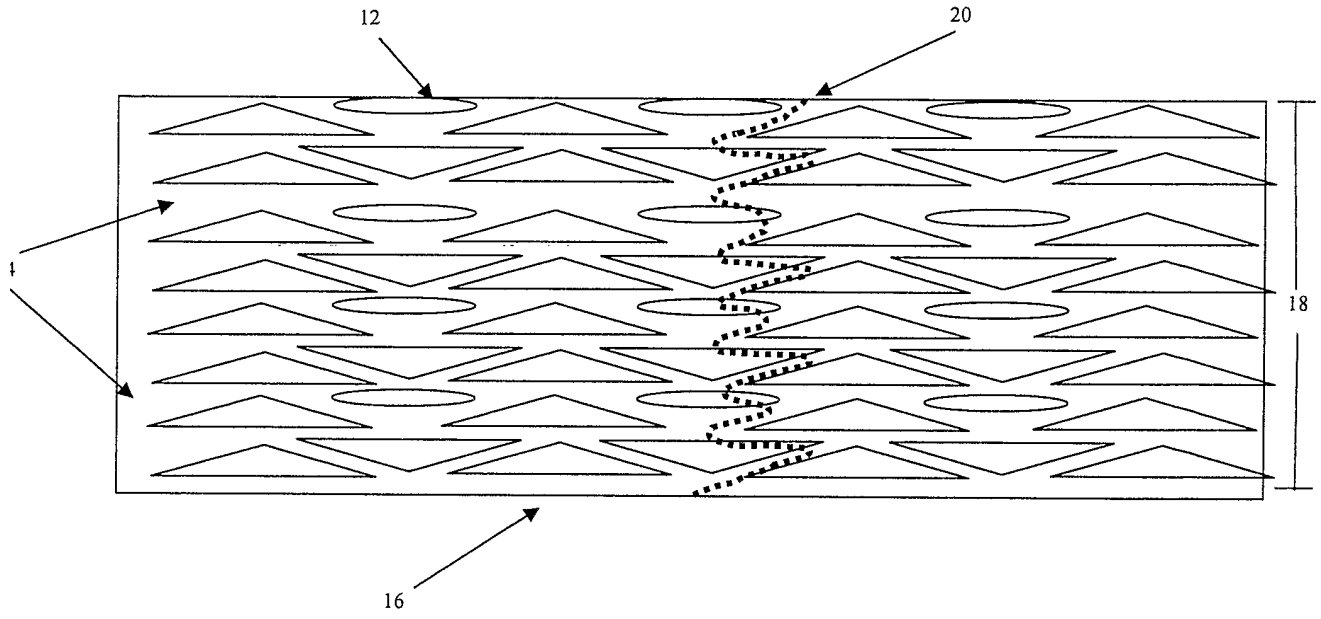

Figure 4