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(73) Proprietor: **THE TEXWIPE COMPANY**
650 East Crescent Avenue
Upper Saddle River
New Jersey 07458 (US)

(72) Inventor: **Paley, Steven J.**
86 Irongate Lane
Aberdeen
New Jersey 07747 (US)
Inventor: **Eberhardt, Clifford A.**
43 Pehle Avenue
Saddle Brook
New Jersey 07662 (US)
Inventor: **Paley, Edward**
38 Westerly Road
Saddle River
New Jersey 07458 (US)

(74) Representative: **Jones, Michael Raymond et al**
HASELTINE LAKE & CO.
Hazlitt House
28 Southampton Buildings
Chancery Lane
London WC2A 1AT (GB)

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Description

The present invention relates generally to the prevention of particulate contamination in cleanrooms and pertains, more specifically, to the construction of wipers for use in a cleanroom, or another similar controlled environment, the construction being such that the wipers will not release contaminating particles into the controlled environment.

Cleanrooms are finding wider use in the manufacture, inspection and maintenance of precision products where it is essential that various operations be conducted in an environment as free of undesired small particles as possible. Cleanrooms can function effectively only when every effort is taken to maintain the close control necessary to preclude contamination of the controlled environment within the cleanroom. Such contamination most often is generated by the worker in the cleanroom and by items brought into the cleanroom. Rigorous standards have been established, and continue to be developed, for the operation of cleanrooms in such a manner as to exclude unwanted contaminants from the controlled environment. One potential source of particulate contamination in cleanrooms has been the wipers used extensively in connection with operations carried out in the controlled environment of a cleanroom. For example, in the fabrication of semiconductor wafers, wipers are used for cleaning up spills which can occur during the procedures carried out in the controlled environment of a cleanroom. In addition, wipers are used for wiping surfaces of various equipment and items in the cleanroom, as well as for wiping down the walls and other interior surfaces of the cleanroom itself. The very nature of a wiper, which requires a high degree of absorbency and pliability, militates against a construction which resists shedding and the concomitant release of small particles into the surrounding environment.

The present invention provides a wiper construction and a method by which a potential source of particulate contamination of a cleanroom environment, or another such controlled environment, is eliminated in that particles which otherwise might be generated by a wiper used in the cleanroom, or other such controlled environment, no longer are present for release into the controlled environment. The invention attains several objects and advantages, some of which are summarized as follows: Eliminates a potential source of particulate contamination of a controlled environment, such as a cleanroom, by precluding the introduction of particles through the use of wipers in the environment; provides a wiper structure which eliminates the release of unwanted particles into a controlled environment, such as that found in a cleanroom, while

enabling effective and efficient wiping procedures; enables the use of wiper materials having the desired pliability and absorbency characteristics in wipers employed in controlled environments, such as in cleanrooms, without risk of introducing particulate contamination into the controlled environment; promotes ease of use as well as effectiveness in wipers constructed for use in a controlled environment, such as a cleanroom; utilizes commonly available materials, thereby enabling economy of manufacture and use while eliminating a source of particulate contamination, as set forth above; provides a strong and durable as well as an aesthetically pleasing wiper which finds acceptance in a wide variety of manufacturing, inspection and maintenance procedures; and is readily manufactured economically in large numbers of consistent high quality.

The above objects and advantages, as well as further objects and advantages, are attained by the present invention, which provides a wiper for use in a controlled environments such as that maintained in a cleanroom, wherein the wiper is of the type constructed from a knitted fabric material including thermoplastic filaments, wherein the filaments of the knitted fabric material are knitted into loops having a relaxed loop length L , wherein the wiper is formed by severing the wiper along peripheral edges thereof from a sheet of such knitted fabric material having indeterminate dimensions, and wherein the severing of the wiper from the sheet establishes severed segments of the knitted filament loops potentially freed for release from the wiper during use of the wiper, the potentially-freed segments having a maximum length equal to the relaxed loop length L ; characterised in that the wiper is improved so as to enable the reduction of particulate contamination by the severed segments of the knitted filament loops which results from the use of the wiper in a controlled environment, such as that maintained in a cleanroom, in that the wiper comprises a fused border in the knitted fabric material of the wiper along each of the peripheral edges of the wiper where the wiper was severed from the sheet of the knitted fabric material, the fused border extending inwardly into the wiper a distance which is a multiple of the length L and which is therefore so related to the maximum length of the potentially-freed segments of the filaments as to capture and maintain within the fused border those potentially-freed segments of the knitted fabric material of the wiper which otherwise might be released into the cleanroom from the peripheral edges of the wiper during use of the wiper and which therefore provides the border with sufficient tear-strength, while maintaining pliability and absorbency in the wiper for wiping procedures.

In one embodiment, the wiper comprises first and second sheets of said knitted fabric material including thermoplastic filaments, which sheet are juxtaposed with one another; wherein said fused border secures together said first and second sheets while leaving an envelope between them; and wherein an absorbent material is placed within the envelope and isolated from the controlled environment by the first and second sheets and the fused border such that particles from the absorbent material in the envelope will remain sealed within the envelope.

The invention will be understood more fully, while still further objects and advantages will become apparent, in the following detailed description of preferred embodiments of the invention illustrated in the accompanying drawing, in which:

FIG. 1 is a plan view of a wiper constructed in accordance with the invention;

FIG. 2 is a somewhat diagrammatic, highly enlarged view of a portion of the material from which the wiper is constructed;

FIG. 3 is a view similar to FIG. 2, but illustrating a step in the procedure for constructing a wiper;

FIG. 4 is a view similar to FIG. 3, but showing an alternate configuration;

FIG. 5 is an enlarged cross-sectional view taken along line 5-5 of FIG. 1;

FIG. 6 is a partially diagrammatic view illustrating a procedure for the manufacture of the wiper; and

FIG. 7 is a longitudinal cross-sectional view of an alternate wiper construction of the present invention.

Referring now to the drawing, and especially to FIG. 1 thereof, a wiper constructed in accordance with the invention is illustrated generally at 10. Wiper 10 is constructed of one of a variety of generally thermoplastic fabric materials which have found use in wipers. Among these materials are polyester, nylon, polypropylene and blends of these materials, as well as blends of natural materials, such as cotton, with synthetic thermoplastic materials. The materials are in the form of a knitted, woven or non-woven fabric. The preferred material, and the one described in connection with the embodiment of wiper 10, is a knitted polyester, preferably knitted from a continuous filament. As illustrated in FIG. 2, the material of wiper 10 is constructed of filaments 12 knitted together in interlocking loops 14. The loops 14 have a relaxed loop length L. Preferably, the length L is very small, in the order of about 0.75 mm and the filaments 12, which are made up of a plurality of fibrils, have a diameter of about 0.25 mm, so that the wiper 10 is provided with the requisite pliability and absorbency.

Wiper 10 is most economically manufactured by severing the wiper 10 from a larger sheet of the knitted fabric to establish a wiper of desired dimensions. However, as illustrated in FIG. 3, severing the fabric of a larger sheet 20 along a cut line 22 leaves a cut edge 24 along which there are free segments 26 of the filaments 12. These free segments 26 can be released into the ambient atmosphere and become contaminating particles when the wiper is utilized in a controlled environment, such as is found in a cleanroom. It has been suggested that cutting be accomplished with a hot knife or a hot wire so that the segments 26 will fuse and will remain in place within the remainder of the wiper; however, experience has shown that the localized melting of the segments 26 is insufficient to prevent the segments 26 from release when subjected to agitation and other manipulations common in the use of the wiper. Moreover, during the severing operation, the larger sheet 20 usually is stretched and distorted, particularly when the material is a knitted fabric, so that the interlocking loops of the material are somewhat skewed and the cut line is less uniform, as seen at 28 in FIG. 4. The less-uniform cut line 28 produces odd-shaped free segments 30, in addition to the aforesaid free segments 26, at locations which do not lend themselves readily to capture of all of the free segments 26 and 30 within the wiper, thereby increasing the propensity for contamination by the release of free segments into the surroundings.

In order to preclude the release of severed segments from the remainder of the wiper, wiper 10 is provided with a fused border 32 along the peripheral edges 34 of the wiper 10, within which fused border 32 all of the severed segments are captured and retained throughout the useful service life of the wiper 10. As best seen in FIG. 5, as well as in FIG. 1, border 32 extends inwardly into the wiper 10, away from the peripheral edges 34, a distance D. The distance D is chosen so as to be large enough to accomplish the objective of capturing all of the segments 26 and 30 which otherwise could be free to escape into the ambient atmosphere and contaminate the controlled environment within which the wiper 10 is used, while resisting any tendency for tearing of the wiper 10 at the peripheral edges 34, yet is small enough to retain the desired degree of pliability in the wiper 10 and to resist any tendency toward abrasiveness in the wiper 10, while maintaining the necessary absorbency. In the illustrated wiper 10, the distance D is about 7L, that distance having been determined empirically as providing an optimum balance between attaining the complete capture of all of the otherwise free segments 26 and 30 along the peripheral edges 34 and establishing sufficient tear-strength, while maintaining pliability and resistance

to abrasiveness. Thus, the selected distance D provides a border 32 of minimum area so as not to interfere with the requisite pliability and absorbency of wiper 10, while capturing potential contaminants in a construction having sufficient strength and durability to resist tearing and other deterioration during use. At the same time, abrasiveness is not introduced at the peripheral edges and an aesthetic appearance is maintained which provides a visual balance between the area of the border 32 and the area of the remaining absorbent portions of the wiper 10 to instill confidence in the user that the wiper 10 provides the necessary absorbency to accomplish any wiping job.

Turning now to FIG. 6, the preferred manufacturing technique for making a plurality of wipers 10 is to sever the wipers from a sheet 40 of indeterminate dimensions. The sheet 40 is advanced in the direction of the arrow 42 along a predetermined path of travel 44. A pattern 46 is fused in the sheet 40, the pattern defining a plurality of latent wipers 10 including fused and unfused areas, and the sheet 40 is severed within the fused pattern 46, along sever lines 48 and 50, to establish each individual wiper 10 with a fused border 32 along the peripheral edges 34 of wiper 10. In this manner, dimensional stability is maintained for wiper manufacture, while the appropriate fused border 32 is established in each wiper 10.

An alternate wiper construction is illustrated in FIG. 7 wherein a composite wiper 60 includes two sheets of material in the form of outer plies 62 and 64 of a thermoplastic fabric material, chosen from the materials outlined above in connection with the description of wiper 10, and a third sheet, or inner ply, in the form of pad 66 of highly absorbent material, such as cotton, a blend of polyester and cellulose, tissue stock or the like, sealed within the envelope 68 provided by the outer plies 62 and 64. A fused border 70 extends along the peripheral edges 72 of the wiper 60, all around the periphery of the wiper, in much the same manner as that described in connection with wiper 10. In this manner, the fused border 70 secures together the outer plies 62 and 64 and at the same time precludes the release of any segments of the thermoplastic fabric material which forms the plies 62 and 64, and together with the remainder of the plies 62 and 64 isolates the pad 66 so that any particles which might otherwise emanate from the material of the pad 66 are maintained within the wiper 60 and are precluded from contaminating the environment within which wiper 60 is employed. It is noted that even in those instances where pad 66 is in the form of a sheet which extends all the way to the peripheral edges 72, as a result of the particular manufacturing process in which the pad 66 and the plies 62 and 64 all have essentially the same

length and width and are placed into juxtaposition with one another prior to establishing the fused border 70, the fused border 70 will preclude the emanation of particles from the pad 66, as well as from the outer plies 62 and 64, while securing together the plies 62 and 64 and the interposed pad 66. Thus, wiper 60 makes available the use of highly absorbent materials in pad 66, while assuring that potentially contaminating particles, which are prevalent in such absorbent materials, are contained and are not released to the controlled environment within which wipers 60 are to be used.

It is to be understood that the above detailed description of preferred embodiments of the invention are provided by way of example only. Various details of design, construction and procedure may be modified without departing from the scope of the appended claims.

Claims

1. A wiper (10) for use in a controlled environment, such as that maintained in a cleanroom, wherein the wiper is of the type constructed from a knitted fabric material including thermoplastic filaments (12), wherein the filaments of the knitted fabric material are knitted into loops (14) having a relaxed loop length L, wherein the wiper is formed by severing the wiper along peripheral edges thereof from a sheet of such knitted fabric material having indeterminate dimensions, and wherein the severing of the wiper from the sheet establishes severed segments (26) of the knitted filament loops potentially freed for release from the wiper (10) during use of the wiper, the potentially-freed segments (26) having a maximum length equal to the relaxed loop length L; characterised in that the wiper is improved so as to enable the reduction of particulate contamination by the severed segments of the knitted filament loops (14) which results from the use of the wiper in a controlled environment, such as that maintained in a cleanroom, in that the wiper comprises a fused border in the knitted fabric material of the wiper along each of the peripheral edges (34) of the wiper where the wiper was severed from the sheet of the knitted fabric material the fused border (32) extending inwardly into the wiper (10) a distance which is a multiple of the relaxed loop length L and which is therefore so related to the maximum length of the potentially-freed segments of the filaments as to capture and maintain within the fused border those potentially-freed segments of the knitted fabric material of the wiper which otherwise might be released into the clean-

room from the peripheral edges of the wiper during use of the wiper and which therefore provides the border with sufficient tear-strength, while maintaining pliability and absorbcency in the wiper for wiping procedures.

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2. A wiper as claimed in claim 1, wherein the border (32) extends inwardly into the wiper a distance of at least about 7L so as to provide the border with sufficient tear-strength.

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3. A wiper as claimed in claim 1 or 2, wherein the wiper comprises first (62) and second (64) sheets of said knitted fabric material including thermoplastic filaments, which sheets are juxtaposed with one another; wherein said fused border (70) secures together said first and second sheets while leaving an envelope between them; and wherein an absorbent material (66) is placed within the envelope and isolated from the controlled environment by the first and second sheets and the fused border (70) such that particles from the absorbent material in the envelope will remain sealed within the envelope.

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4. A wiper as claimed in claim 1 or 2, wherein a plurality of said wipers (10) are severed from a sheet of knitted fabric material having a single ply.

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5. A wiper as claimed in any of claims 1 to 4, wherein the relaxed loop length L is about 0.75mm.

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Patentansprüche

1. Wischtuch (10), geeignet zum Gebrauch in einer überwachten Umgebung, wie sie beispielsweise in einem Reinraum aufrechterhalten wird, wobei das Wischtuch ein Wischtuch der Art ist, die aus einem gewirkten Gewebematerial aufgebaut ist, das thermoplastische Filamente (12) enthält, in dem die Filamente des gewirkten Gewebematerials zu Schleifen (14) gewirkt sind, die eine entspannte Schleifenlänge L aufweisen und worin das Wischtuch gebildet wird durch Abtrennen des Wischtuchs entlang seiner Randkanten von einer Bahn eines derartigen gewirkten Gewebematerials mit unbestimmten Abmessungen, und worin das Abtrennen des Wischtuchs von der Bahn abgetrennte Abschnitte (26) der gewirkten Filamentschleifen erzeugt, die das Wischtuch (10) möglicherweise freisetzt, während es gebraucht wird, und die möglicherweise freigegebenen Abschnitte (26) eine größtmögliche Länge aufweisen, die gleich der entspannten

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Schleifenlänge L ist, dadurch gekennzeichnet,

daß das Wischtuch verbessert ist, um das Vermindern der Teilchenverschmutzung durch abgetrennte Abschnitte der gewirkten Filamentschleifen (14) zu ermöglichen, die durch den Gebrauch des Wischtuchs in einer überwachten Umgebung entsteht, wie sie beispielsweise in einem Reinraum aufrechterhalten wird,

daß das Wischtuch einen geschmolzenen Rand im gewirkten Gewebematerial des Wischtuchs entlang jeder seiner Randkanten (34) enthält, an denen das Wischtuch von der Bahn des gewirkten Gewebematerials abgetrennt wurde, und sich der geschmolzene Rand (32) eine Länge in das Wischtuch (10) hinein erstreckt, die ein Vielfaches der entspannten Schleifenlänge L ist und die daher so zur größtmöglichen Länge der möglicherweise freigegebenen Abschnitte der Filamente in Beziehung steht, daß diese möglicherweise freigegebenen Abschnitte des gewirkten Gewebematerials des Wischtuchs, die sonst bei Gebrauch des Wischtuchs von seinen Randkanten möglicherweise in den Reinraum freigesetzt würden, im geschmolzenen Rand erfaßt und festgehalten werden, und der geschmolzene Rand daher den Rand mit ausreichender Reißfestigkeit versieht und zugleich die Geschmeidigkeit und Saugfähigkeit im Wischtuch für Wischvorgänge aufrecht erhält.

2. Wischtuch nach Anspruch 1, wobei sich der Rand (32) eine Strecke in das Wischtuch hinein erstreckt, die ungefähr mindestens 7L beträgt, um den Rand mit ausreichender Reißfestigkeit zu versehen.

3. Wischtuch nach Anspruch 1 oder 2, wobei das Wischtuch eine erste Lage (62) und eine zweite Lage (64) des gewirkten Gewebematerials umfaßt, das thermoplastische Filamente enthält, und die beiden Lagen nebeneinander liegen, und worin der geschmolzene Rand (70) die erste und die zweite Lage aneinander befestigt und eine Hülle aus beiden erzeugt, und ein saugfähiges Material (66) in der Hülle angeordnet und durch die erste und Zweite Lage und den geschmolzenen Rand (70) von der überwachten Umgebung isoliert wird, so daß Teilchen des saugfähigen Materials in der Hülle in dieser eingeschlossen bleiben.

4. Wischtuch nach Anspruch 1 oder 2, wobei eine Anzahl Wischtücher (10), die von einer Bahn aus gewirktem Gewebematerial abgetrennt werden, eine einzige Lage aufweisen.

5. Wischtuch nach irgendeinem der Ansprüche 1 bis 4, wobei die entspannte Schleifenlänge L etwa 0,75 mm beträgt.

Revendications

1. Torchon (10) à utiliser dans un environnement contrôlé, tel que celui maintenu dans une salle blanche, pour lequel le torchon est du type réalisé à partir d'un matériau d'étoffe tricotée comprenant des fils thermoplastiques (12), pour lequel les fils du matériau d'étoffe tricotée sont tricotés en des boucles (14) ayant une longueur de boucle relâchée L, pour lequel on forme le torchon en séparant le torchon le long de ses bords périphériques à partir d'une feuille d'un matériau d'étoffe tricotée ayant des dimensions indéterminées et pour lequel la séparation du torchon à partir de la feuille crée des segments séparés (26) des boucles de fils tricotés virtuellement exemptés d'une libération à partir du torchon (10) lors de l'utilisation du torchon, les segments virtuellement exemptés (26) ayant une longueur maximale égale à la longueur de boucle relâchée L; caractérisé en ce que le torchon est amélioré de manière à permettre la réduction d'une contamination particulaire par les segments séparés des boucles de fils tricotés (14), laquelle provient de l'utilisation du torchon dans un environnement contrôlé, tel que celui maintenu dans une salle blanche, en ce que le torchon comprend une bordure fondue dans le matériau d'étoffe tricotée du torchon le long de chacun des bords périphériques (34) du torchon où le torchon a été séparé de la feuille du matériau d'étoffe tricotée, la bordure fondue (32) s'étendant vers l'intérieur dans le torchon (10) sur une distance qui est un multiple de la longueur de boucle relâchée L et qui est donc ainsi reliée à la longueur maximale des segments virtuellement exemptés des fils de manière à capturer et à maintenir dans la bordure fondue les segments virtuellement exemptés du matériau d'étoffe tricotée du torchon qui pourraient sinon être libérés dans la salle blanche à partir des bords périphériques du torchon lors de l'utilisation du torchon et qui propose donc la bordure avec une résistance à la déchirure suffisante tout en maintenant la souplesse et la capacité d'absorption dans le torchon pour des procédures d'essuyage.
2. Torchon selon la revendication 1, pour lequel la bordure (32) s'étend vers l'intérieur dans le torchon sur une distance d'au moins environ 7L de manière à proposer la bordure avec une résistance à la déchirure suffisante.

3. Torchon selon la revendication 1 ou 2, pour lequel le torchon comprend une première (62) et une deuxième (64) feuille dudit matériau d'étoffe tricotée comprenant des fils thermoplastiques, lesquelles feuilles sont juxtaposées l'une à l'autre; pour lequel ladite bordure fondue (70) immobilise ladite première et ladite deuxième feuille ensemble tout en laissant une enveloppe entre elles; et pour lequel un matériau absorbant (66) est placé dans l'enveloppe et est isolé de l'environnement contrôlé par la première et la deuxième feuille et la bordure fondue (70) de sorte que les particules provenant du matériau absorbant dans l'enveloppe resteront scellées dans l'enveloppe.
4. Torchon selon la revendication 1 ou 2, pour lequel on sépare un grand nombre desdits torchons (10) à partir d'une feuille d'un matériau d'étoffe tricotée ayant une seule couche.
5. Torchon selon l'une quelconque des revendications 1 à 4, pour lequel la longueur de boucle relâchée L est d'environ 0,75 mm.

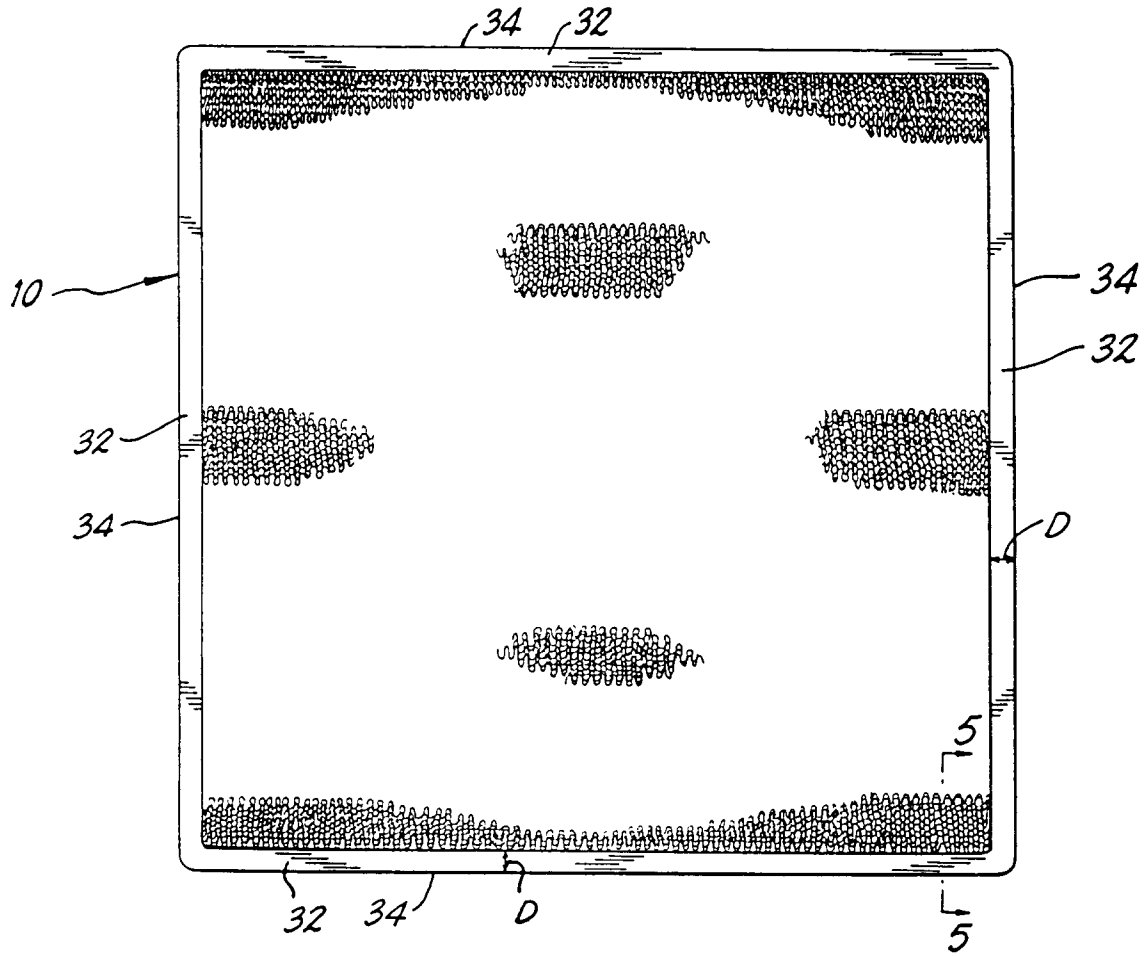


FIG. 1

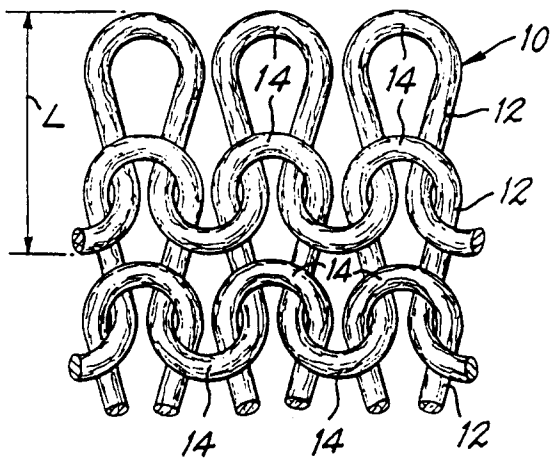


FIG. 2

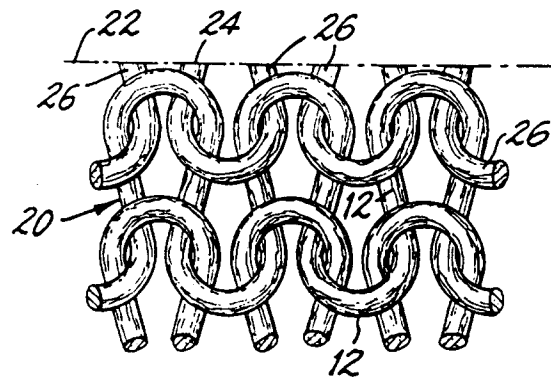


FIG. 3

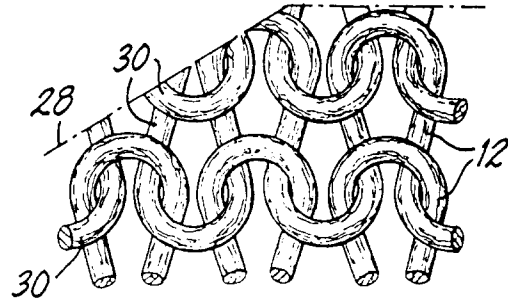


FIG. 4

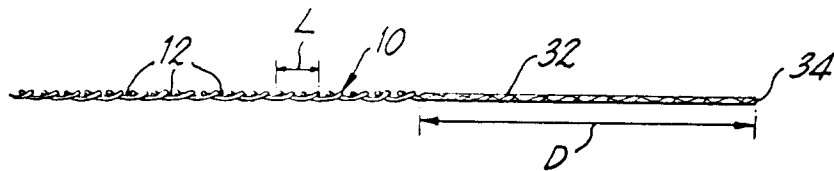


FIG. 5

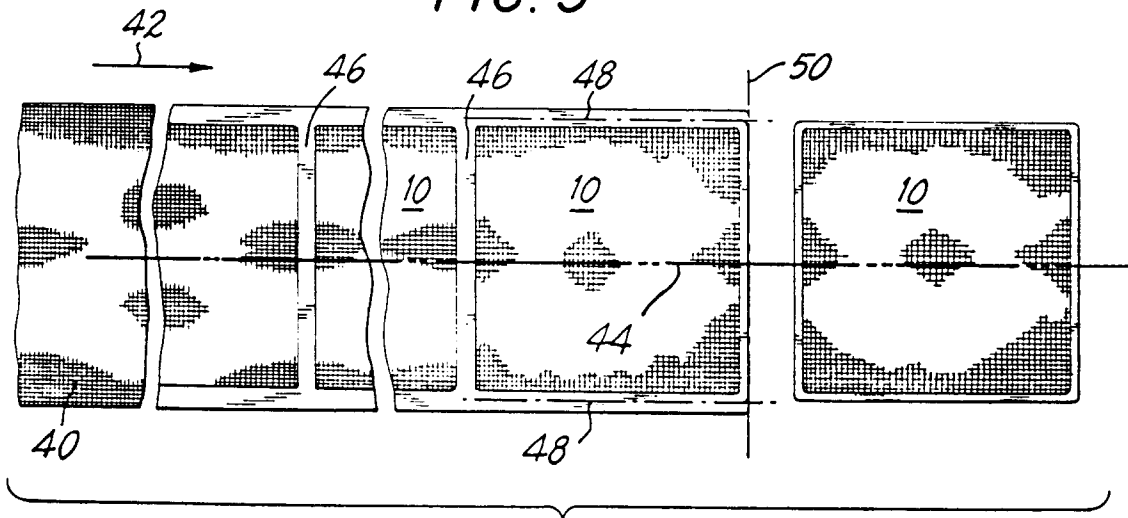


FIG. 6

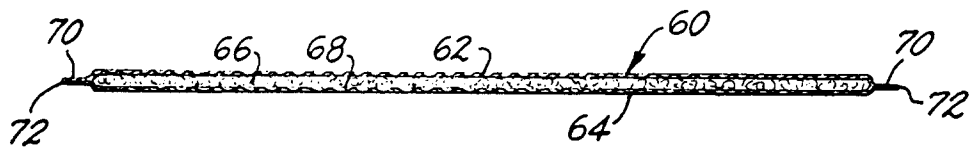


FIG. 7