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⑰ **Low bulk seam for papermakers equipment fabrics and method of producing said seam.**

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**DE-A-2 064 085
DE-A-3 151 941
DE-A-3 227 433
FR-A-1 425 987
US-A-4 401 137**

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Description

The present invention relates to a papermakers fabric comprising a woven fabric having at least one system of filament yarns extending in the machine direction interwoven with at least one system of filament yarns extending in the cross machine direction, each end of said fabric having an overlap portion folded back upon the fabric body defining a fold line, with an area free of cross machine direction yarns adjacent the fold line and with selected machine direction yarns having segments extending from the fold line and defining a series of loops, each overlap portion being secured to the fabric body by stitchings.

The series of loops of one end is introduced between the series of loops of the other end to form a channel for receiving a pintle wire or joining wire. Such a papermakers fabric is described in the document DE—A—2 064 085.

In the known papermakers fabric, machine direction yarns which are not forming loops are cut near the fold line.

Additional cross machine direction yarns are interwoven with machine direction yarns near the loops. Said additional yarns are stronger and more flexible than the original cross machine direction yarns in order to prevent them from sliding into the loops.

But there is no real binding of the cross machine direction yarns which can therefore slide into the loops. Further the ends of the cut machine direction yarns can slip out the fabric and mark the paper.

The papermakers fabric according to the invention not having these drawbacks is characterized in that remaining non-loop forming yarns are pulled from the area away from the loops against the fold line and through the overlap portion.

The present invention relates also to a method of producing a low bulk pin-type seam in a length of flat woven fabric for use with paper making equipment, said length of flat woven fabric comprising a plurality of continuous filament warp yarns interwoven with a plurality of pick yarns, by removing selected pick yarns from a portion of the fabric to create a pick free area adjacent the end to define a fold line which corresponds to the fabric end of one of the sides of the seam to be formed, the fold line defining adjacent fabric body and fabric overlap portion on the fabric, by folding the overlap portion at the fold line to overlap the fabric body to form a series of loops, and by securing the overlap portion to the fabric body by stitchings, characterized by

a) prior to folding, raising alternating selected non-loop forming warp yarns in the pick free area from the plane of the fabric, while leaving alternating remaining loop forming warp yarns within the plane of the fabric,

b) inserting a forming wire between the raised selected warp yarns and the remaining warp yarns such that the forming wire overlies the remaining warp yarns,

c) folding the overlap portion and the loop

forming yarns about the forming wire to form said loops, and

d) prior to securing the overlap portion to the fabric body, pulling the selected non-loop forming warp yarns from the pick free area away from the loops against the fold line and through the overlap portion.

Fig. 1 is an orthographic projection of a fragment of a fabric end to be seamed in accordance with the invention.

Fig. 2 is an orthographic projection of the fabric of Fig. 1 with a pick free area.

Fig. 3 illustrates the separation of warp yarns according to the invention.

Fig. 4 illustrates the insertion of a loop forming means according to the invention.

Fig. 5 illustrates the formation of a fold over or hem according to the invention.

Fig. 6 illustrates the pull through of selected warp yarns against the hem line according to the invention.

Fig. 7 illustrates the fabric seam end after pull through of the selected yarns and trimming of the hem.

Fig. 8 illustrates the fabric of Fig. 7 with beveled edges and stitches according to the invention.

Fig. 9 illustrates an alternative embodiment according to the invention.

The present invention is directed to a fabric having a low bulk pin-type seam. The seam is constructed by forming loops in each end of a flat woven papermakers fabric. The loops are formed from machine direction yarns which are selected from a portion of the fabric which had previously been freed of all cross machine direction yarns. The fabric is folded back on itself in the manner of a hem and selected machine direction yarns are pulled through the fabric to bind the fabric body and fold over together. Both ends of the fabric are made similar and when mated together, the loops forming yarns define a channel which receives the pin or pintle wire.

Although specific forms of the invention have been selected for illustration and the following description will refer in specific terms to those drawings, this description is not intended to limit the scope of the invention which is defined in the claims appended hereto.

The invention will be set forth with references to the attached drawings, wherein like numerals indicate like elements in all views. The following description is intended to aid in an understanding of the invention and it is understood that the invention may be utilized with weaves or fabrics not specifically described in detail.

Referring now to Fig. 1, there is shown a fragmentary view of one end of the fabric 2 which is to be seamed. The fabric 2 is woven in the usual manner with a plurality of warp yarns or machine direction yarns interlacing with a plurality of pick or cross machine direction yarns 6 and 8. The warp yarns are preferably monofilament or continuous filament yarns, however, they may be spun yarns which are twisted or treated so as to behave as a continuous or monofilament yarns.

Additionally, it will be understood that the warp yarns may be of any cross sectional shape, i.e. round, square, oval, rectangular, etc., according to fabric design. Likewise, the pick yarns may be any of the available yarns selected according to fabric design. As will be known to those skilled in the art, the fragmentary view of the fabric 2 shown in Fig. 1 is a duplex fabric having two pick systems, comprised of yarns 6 in one pick system and yarns 8 in the other pick system, interwoven with a single warp or machine direction system 4. As will also be known to those skilled in the art, the overall length of the fabric prior to seaming is somewhat longer than the length of the final seamed fabric in order to provide the material necessary for fabric seaming and subsequent treatment. While the fabric 2 may be cut to the predetermined width of the desired fabric, it has been found that it is advantageous to have approximately 50 mm of additional width in the unseamed fabric in order to facilitate the ease of seaming.

Generally, the fabric end is prepared for seaming by removing a plurality of picks 6 and 8 from a predetermined area of the fabric. The warp yarns which have been exposed by the removal of the picks are then segregated into loop forming yarns and binder yarns according to a predetermined pattern. A loop forming wire is inserted between the warp yarns which will essentially separate the fabric into 2 levels. The forming wire is located as close to the body of the fabric as is possible. The fabric is then placed on a work table with the fabric faced down. The free end of the fabric is then folded back toward the body of the fabric in the manner of a hem. The folding back of the free end of the fabric thus produces a plurality of loops extending from the fabric fold or hem line. The binder warp ends noted previously are then drawn back into the folded over section of the fabric. After the binder yarns have been pulled back into the fold over of the fabric, the fold over section of the fabric is cut to width. Stitches are then placed in the seam area to additionally secure the fold over and fabric together. The fold over is then trimmed or cut to length and beveled or rounded as is known in the art.

With reference to Fig. 1, the preparation of one end of the fabric seam will be described in detail. It will be remembered that the other end of the fabric is prepared in a like manner. Selected picks are removed at an area in from the free end of the fabric in order to provide sufficient material for the fold over section. In the preferred embodiment, the pick removal area is approximately 125 mm from the free end of the fabric. The picks to be removed, generally illustrated as 10 are removed in both the face and back pick layers. Picks 10 are removed from the fabric for approximately (10 mm) starting from the end of the fold area previously described. Thus, picks are removed in the area between approximately 125 to 135 mm from the free end of the fabric, this pick free condition is illustrated in Fig. 2 and generally identified as 12.

Referring now to Fig. 3, a tool 14 such as a long stem awl or scribe, is used to separate pairs of the warp yarns 4. Alternating pairs of warp yarns 4(a) are raised from the plane of the fabric using the tool 14, likewise, alternating pairs of warp yarns 4(b) are left within the plane of the fabric, as illustrated in Fig. 3. The operation of raising the warp yarns 4(a) out of the plane of the fabric is difficult to illustrate, however, this will be known to those skilled in the art. As shown in Fig. 3, after a number of the warp yarns 4(a) have been raised from the plane of the fabric, a suitable needle or insertion tool 16 with a forming wire 18 attached is inserted between the raised warp yarns 4(a) and the remaining warp yarns 4(b). Note that since the warp yarns 4(b) have not been disturbed with respect to the plane of the fabric, the forming wire when inserted will overlie the warp yarns 4(b). This condition is illustrated graphically in Fig. 4. The forming wire 18 is positioned as close to the body of the fabric as is reasonably possible. In this position the forming wire 18 will be adjacent the fold line or hem line 19 as will be described hereinafter. Warp yarns 4(a) will be binder yarns and warp yarns 4(b) will be loop forming yarns.

After the fabric has been so prepared, the fabric is positioned on a work table with the fabric face down. Due to the bulk and weight of the flat woven fabric, it has been found advantageous to secure the fabric to the work table such as by tacking or other securing means. With the fabric so positioned, the free end of the fabric is then folded back over the body of the fabric. Once again, it has been found that securing the free end by tacking or other means is advantageous.

With reference now to Fig. 5, there is shown the fabric (without the work table) in the folded or hemmed condition just described. For purposes of clarity of illustration, the fabric has been shown with only the loop forming warp yarns 4(b) extending from the hem line 19 adjacent the forming wire 18. It will be understood that the warp yarns 4(a) are still part of the fabric but they are not part of the loop forming warps shown in Fig. 5. Also it should be remembered that warp yarns 4(a) are to become the binding yarns which are tight against the fold or hem line and therefore would not appear in the area of the loops in the final configuration.

After the fabric has been secured to a work surface and has been folded as indicated in Fig. 5, the binder warp yarns 4(a), which are not part of the loop, are pulled through the fabric. With reference to Fig. 6, it can be seen that the warp yarns 4(a) can be pulled through the folded over portion or hem of the fabric. For purpose of clarity, the yarns 4(a) are shown as the first yarns in the fabric, however, it will be understood that the yarns 4(a) are spaced across fabric at selected locations. The pulling of the warp yarns 4(a) through the fold of the fabric will serve to remove the excess warp length of yarns 4(a) in the area of the loop formed by the yarns 4(b). In pulling the warp yarns 4(a) through the fold over or hem it

has been found beneficial to locate the outermost warp yarn and to begin pulling the slack out of the yarn created by the fold over. The pull through then proceeds across the width of the fabric until all of the binding yarns have had the slacks removed therefrom. While it is not necessary, it has on occasion been found beneficial to spray the warp yarns to be pulled through with a silicone lubricant. However, in using a silicone lubricant, care should be exercised because an excess application of silicone lubricant has also been found to create a sticky or tacky surface on the yarns which may actually hinder the pull through. The binder yarns 4(a) are pulled through the fold over with sufficient force to draw the fold over and body of the fabric into intimate contact. It has been found in constructing the seam that the appearance of a ripple may be noted in the fabric fold over or hem on the back of the seam. This ripple phenomenon has not been found to be detrimental to the seam and in fact, it has been found to be a useful indicator that the warp yarns have been pulled with sufficient force against the fold or hem line. Thus, the ripple may be used as an indicator that the pull through has been done correctly. The ripple is not always visible but can be felt with slight hand pressure or the finger tips. The pull through of the binder yarns 4(a) which has just been described should be completed so that the loops 24 of slack warp yarns are spaced approximately 50 mm from the position where the loop yarns 4(b) enter the fold over. By so spacing the loops 24, it is then possible to trim the fold over so that it may be trimmed or cut at 28 approximately 25 mm from the point where the loop yarns enter the fold over, see Fig. 7. As it will be recognized by those skilled in the art, the cut edge 28 of the fold over is preferably beveled, see Fig. 8, to aid in the running of the fabric on the papermaking machine.

The fold over and fabric body are stitched together in the area adjacent the loops. With reference to Fig. 8, in the preferred embodiment two rows of stitching 30 and 32 are utilized. The first row of stitching 30 is located approximately 5 mm from the point where the loops 4(b) enter the fabric and a second row of stitching 32 is placed approximately 15 mm from the first stitch. In applications where a smooth seam surface is essential, it has been found to be beneficial to remove a face pick in the position where the stitching 30 and 32 is to be located. If desired, the pick may be removed both from the body of the fabric and the fold over of the fabric. In this way, the stitching 30 and 32 will sink into the fabric and do not alter the surface characteristics thereof. In addition, to preserving the surface characteristics of the fabric, it is believed that the recessed stitching will not be subjected to excessive wear.

It will be understood by those skilled in the art that the selection of stitch point location will be a matter of design choice and will vary accordingly. For example, in a weave pattern such as shown in Figure 1, one stitch arrangement which has been employed is to place the stitches at the fourth and

thirteenth pick of one and at the fourteenth and ninth pick of the other end. Once again the fabric design is free to selected stitch points according to weave design.

With respect to Figure 9, there is illustrated an alternative embodiment which in all respects not set forth hereinafter will be the same as the fabric illustrated in Figure 4. In Figure 4, the forming wire 18 is positioned such that the warps are paired into alternating loop and binder yarns. At Figure 9, the forming wire 18 is positioned such that the warp yarns are arranged according to the selected repeat pattern. In this repeat pattern, the warp yarns are arranged as two binder, two loop, three binder and one loop yarn per repeat. This repeat pattern provides approximately 25% more binder yarns per seam with and approximately 25% less loop forming yarns per seam with. This alternative arrangement has been found to produce a seam which is fully acceptable with respect to strength and performance and which provides additional spacing between the loop forming yarns. The additional spacing between the loop forming yarns has found to be of some benefit in manipulating and aligning the loops in the actual seam formation process.

It will be recognized that many various repeat patterns will be possible with the instant invention. The essential feature is that the repeat pattern selected provide sufficient loop forming yarns to achieve the necessary tensile strength and maintain the seam stability. Likewise, it is required that sufficient binder yarns be provided to maintain the hem tightly and to assure the required tensile strength.

Seams according to the invention have been made in both single ply and multiply fabrics.

As noted previously, the fabric weave construction may be according to design selection.

It will be understood that the other or remaining end of the flat woven belt will be prepared in the manner described above and that after such preparation, the two ends may be mated so that the loops are interleafed and thereby define a channel through which a hinge wire or pintle may be inserted to complete the pin seam.

It will be understood that no back weaving is required to form the loop and that no additional clipper hooks or coils are in the insert seam.

Claims

1. A papermakers fabric comprising a woven fabric (2) having at least one system of filament yarns (4a, 4b) extending in the machine direction interwoven with at least one system of filament yarns (6, 8) extending in the cross machine direction, each end of said fabric (2) having an overlap portion folded back upon the fabric body defining a fold line (19), with an area (12) free of cross machine direction yarns adjacent the fold line (19) and with selected machine direction yarns (4b) having segments extending from the fold line (19) and defining a series of loops, each overlap portion being secured to the fabric body by stitch-

ings (30, 32), characterized in that remaining non-loop forming yarns (4a) are pulled from the area (12) away from the loops against the fold line (19) and through the overlap portion.

2. A papermakers fabric according to claim 1, characterized in that the number of segments constituting the loops is approximately equal to one half of the total number of machine direction yarns (4a, 4b).

3. A method of producing a low bulk pin-type seam in a length of flat woven fabric (2) for use with paper making equipment, said length of flat woven fabric (2) comprising a plurality of continuous filament warp yarns (4a, 4b) interwoven with a plurality of pick yarns (6, 8, 10), by removing selected pick yarns (10) from a portion of the fabric to create a pick free area (12) adjacent the end to define a fold line (19) which corresponds to the fabric end of one of the sides of the seam to be formed, the fold line (19) defining adjacent fabric body and fabric overlap portion on the fabric, by folding the overlap portion at the fold line (19) to overlap the fabric body to form a series of loops, and by securing the overlap portion to the fabric body by stitchings (30, 32), characterized by

a) prior to folding, raising alternating selected non-loop forming warp yarns (4a) in the pick free area (12) from the plane of the fabric, while leaving alternating remaining loop forming warp yarns (4b) within the plane of the fabric,

b) inserting a forming wire (18) between the raised selected warp yarns (4a) and the remaining warp yarns (4b) such that the forming wire (18) overlies the remaining warp yarns (4b),

c) folding the overlap portion and the loop forming yarns (4b) about the forming wire (18) to form said loops, and

d) prior to securing the overlap portion to the fabric body, pulling the selected non-loop forming warp yarns (4a) from the pick free area away from the loops against the fold line (19) and through the overlap portion.

Patentansprüche

1. Gewebe (2) für die Papierindustrie mit mindestens einem Fadensystem (4a, 4b) in Maschinenrichtung, das mit mindestens einem senkrecht zur Maschinenrichtung verlaufenden Fadensystem (6, 8) verwoben ist, wobei jedes Ende des Gewebes (2) einen Überlappungsbereich aufweist, der auf den Gewebekörper zurückgeschlagen ist und eine Falzlinie (19) definiert, mit einer Zone (12) in der Nähe der Falzlinie (19), die frei von Fäden quer zur Maschinenrichtung ist, und mit ausgewählten Fäden (4b) in Maschinenrichtung, die von der Falzlinie (19) ausgehende Segmente besitzen und eine Reihe von Schlaufen definieren, wobei jeder Überlappungsbereich durch Nähte (30, 32) auf dem Gewebekörper befestigt ist, dadurch gekennzeichnet, daß verbleibende keine Schlaufen bildende Fäden (4a) von der Zone (12) aus den Schlaufen heraus gegen die Falzlinie (19) und durch den Überlappungsbereich gezogen werden.

2. Gewebe für die Papierindustrie nach Anspruch 1, dadurch gekennzeichnet, daß die Anzahl von Segmenten, die die Schlaufen bilden, etwa gleich der Hälfte der Gesamtzahl der Garnfäden (4a, 4b) in Maschinenrichtung ist.

3. Verfahren zur Herstellung eines Saums geringen Volumens vom Stifftyp in einer Länge eines flachen Gewebes (2) zur Verwendung in einer Papierherstellungsanlage, wobei diese Länge des flachen Gewebes (2) eine Vielzahl durchlaufender Kettfäden (4a, 4b) aufweist, die mit einer Vielzahl von Schußfäden (6, 8, 10) verwoben sind, durch Entfernung von ausgewählten Schußfäden (10) aus einem Bereich des Gewebes, um eine von Schußfäden freie Zone (12) in der Nähe des eine zukünftige Falzlinie (19) definierenden Endes entsprechend dem Gewebeende an einer der Seiten des zu bildenden Saums zu definieren, wobei die Falzlinie (19) zwischen dem Gewebekörper und dem Überlappungsbereich liegt, durch Falten des Überlappungsbereichs entlang der Falzlinie (19), um auf den Gewebekörper umgeschlagen zu werden und eine Reihe von Schlaufen zu bilden, und durch Befestigung des Überlappungsbereichs auf dem Gewebekörper mithilfe von Nähten (30, 32), gekennzeichnet durch

a) das Anheben alternierender ausgewählter, keine Schlaufen bildender Kettfäden (4a) in der schußfadenfreien Zone (12) von der Gewebeebene vor dem Falten, während die verbleibenden alternierenden, die Schlaufe bildenden Kettfäden (4b) in der Gewebeebene bleiben,

b) das Einfügen eines Formungsdrahts (18) zwischen die ausgewählten angehobenen Kettfäden (4a) und die verbleibenden Kettfäden (4b) derart, daß der Formungsdraht (18) oberhalb der verbleibenden Kettfäden (4b) liegt,

c) das Umschlagen des Überlappungsbereichs und der die Schlaufe bildenden Fäden (4b) um den Formungsdraht (18), um die Schlaufen zu bilden, und

d) das Herausziehen der ausgewählten, nicht die Schlaufen bildenden Kettfäden (4a) aus der schußfadenfreien Zone weg von den Schlaufen gegen die Falzlinie (19) und durch den Überlappungsbereich vor der Befestigung der Überlappungsbereichs auf dem Gewebekörper.

Revendications

1. Feutre pour machines à papier comprenant un feutre tissé (2) ayant au moins un système de fils (4a, 4b) s'étendant dans la direction de la machine entretissé avec au moins un système de fils (6, 8) s'étendant dans une direction perpendiculaire à celle de la machine, chaque extrémité dudit feutre (2) ayant un ourlet replié sur le corps du feutre et définissant une ligne de pliure (19) avec une zone (12) sans fils s'étendant dans la direction perpendiculaire à celle de la machine et adjacente à la ligne de pliure (19) et avec certains fils dans la direction de la machine ayant des segments s'étendant à partir de la ligne de pliure et définissant une suite de boucles, chaque ourlet étant fixé au corps du feutre par des points (30, 32), caracté-

térisé en ce que les fils (4a) restant qui ne forment pas de boucles sont tirés de la zone (12) à travers l'ourlet en les éloignant des boucles et en les mettant contre la ligne de pliure (19).

2. Feutre pour machines à papier selon la revendication 1, caractérisé en ce que le nombre de segments constituant les boucles est approximativement égal à la moitié de la totalité des fils s'étendant dans la direction de la machine. (4a, 4b).

3. Procédé de fabrication d'une jonction à jonc de faible encombrement dans une longueur de feutre plat tissé (2) utilisé dans un équipement de fabrication de papier ladite longueur de feutre tissé plat (2) comportant plusieurs fils de chaîne continus (4a, 4b) entretissés avec plusieurs fils de trame (6, 8, 10), dans lequel on retire certains fils de trame (10) d'une partie du feutre pour créer une zone (12) sans fils de trame adjacente à l'extrémité pour définir une ligne de pliure (19) qui correspond à l'extrémité du feutre d'un des côtés de la jonction à former, la ligne de pliure (19) définissant sur le feutre un corps de feutre

adjacent et un ourlet à replier sur le feutre et on plie l'ourlet selon la ligne de pliure (19) pour recouvrir le corps du feutre pour former une suite de boucles puis on fixe l'ourlet au corps du feutre par des points (30, 32), caractérisé en ce que

a) avant de plier on soulève du plan du feutre les fils de chaîne alternés choisis pour ne pas former de boucles (4a) dans la zone (12) sans fils de trame tandis qu'on laisse les fils de chaîne alternés restants qui forment des boucles dans le plan du feutre,

b) on insère un fil de formage (18) entre les fils de chaînes soulevés (4a) et les fils de chaîne restants (4b) de façon que le fil de formage recouvre les fils de chaîne restants (5b),

c) on plie l'ourlet et les fils formant les boucles (4b) autour du fil de formage (18) pour former lesdites boucles et avant de fixer l'ourlet sur le corps du feutre,

d) on tire les fils de chaîne ne formant pas les boucles (4a) à travers l'ourlet à partir de la zone sans fils de trame en les éloignant des boucles et en les mettant contre la ligne de pliure (19).

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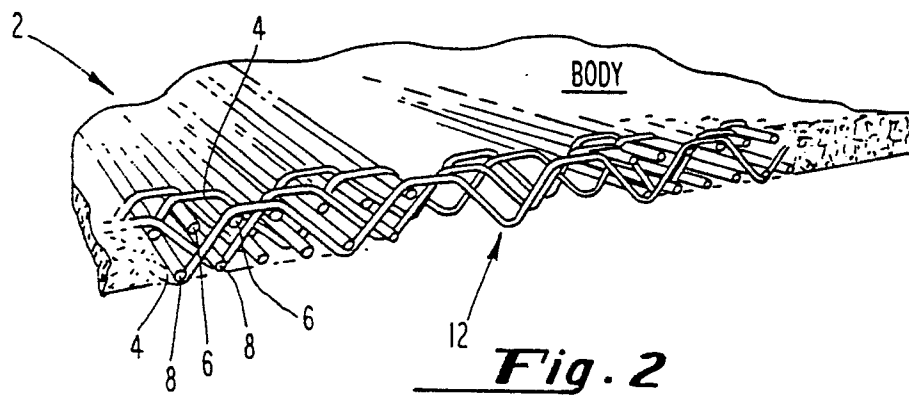
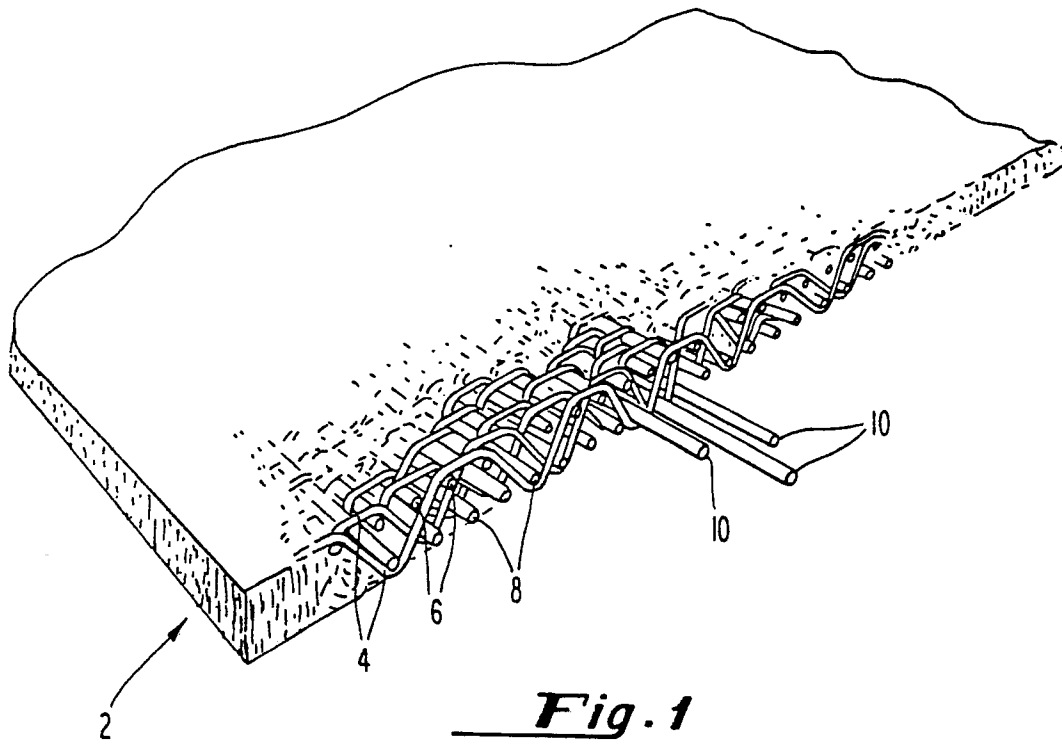
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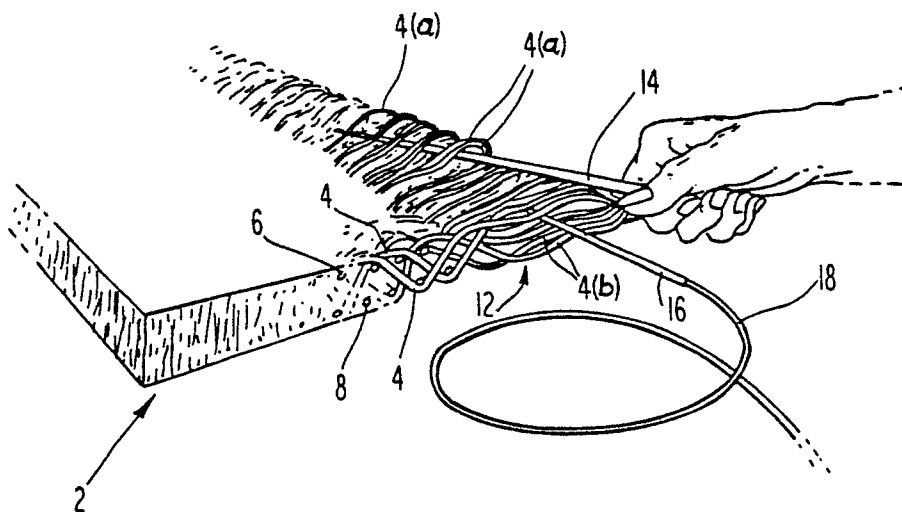


Fig. 3

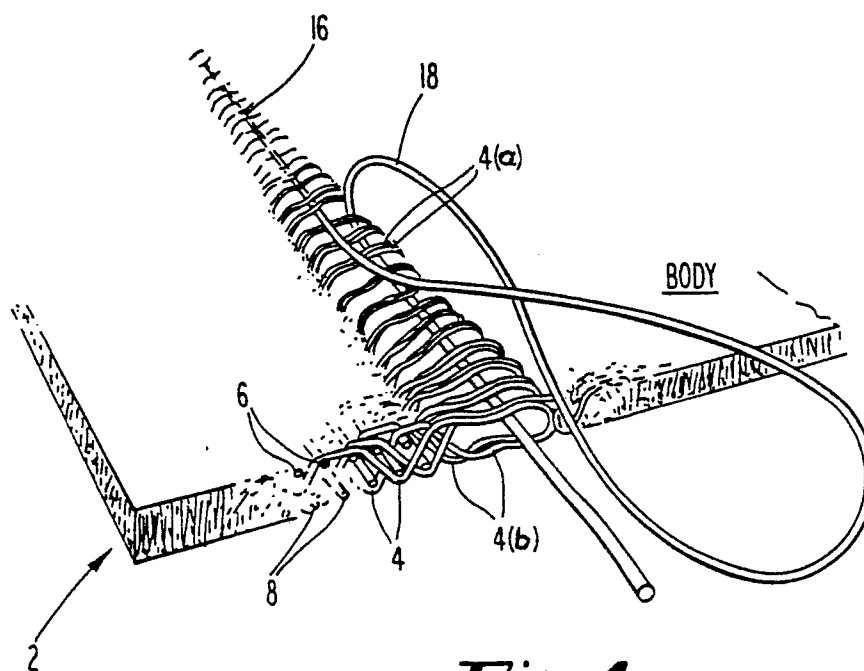


Fig. 4

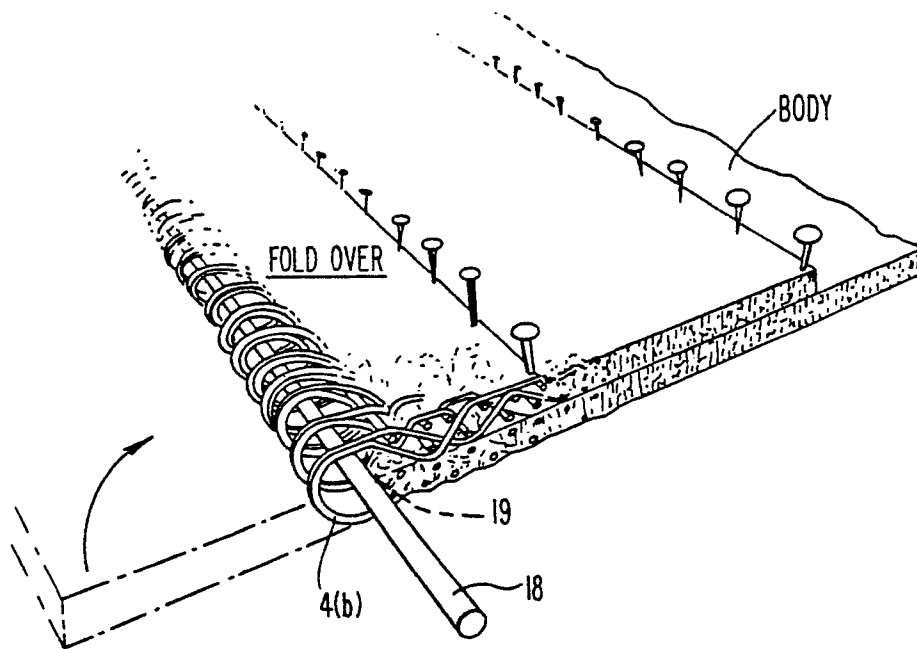


Fig. 5

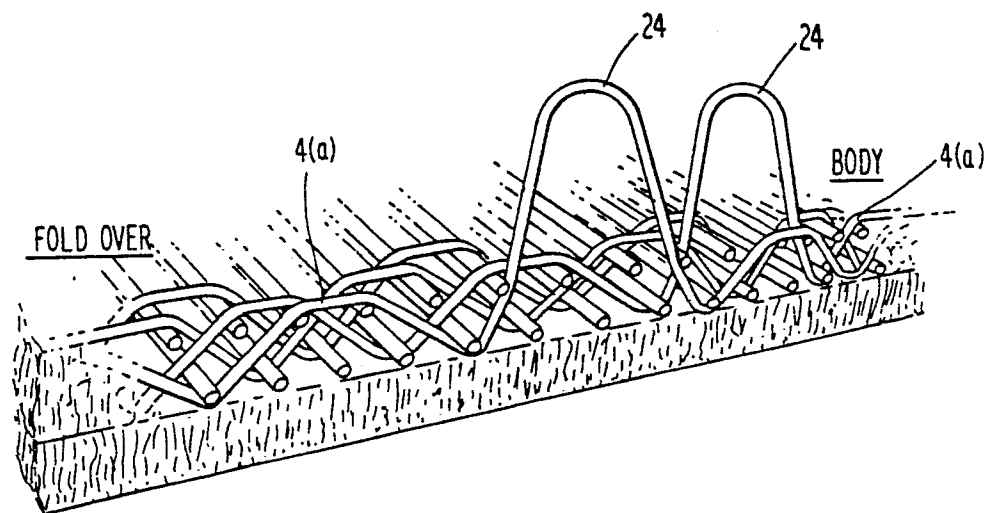


Fig. 6

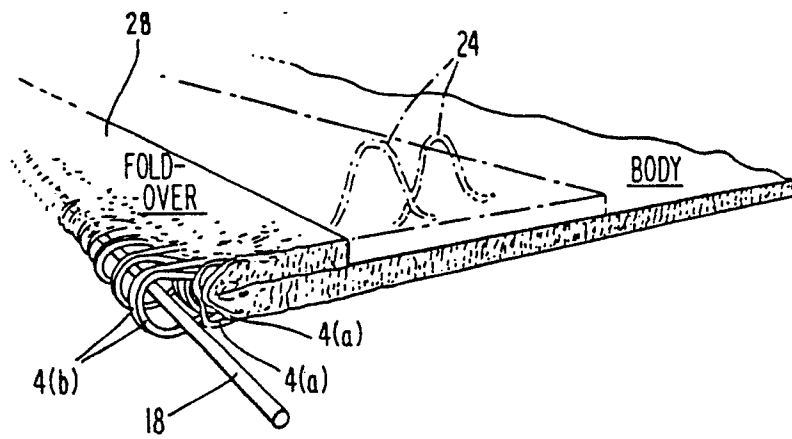


Fig. 7

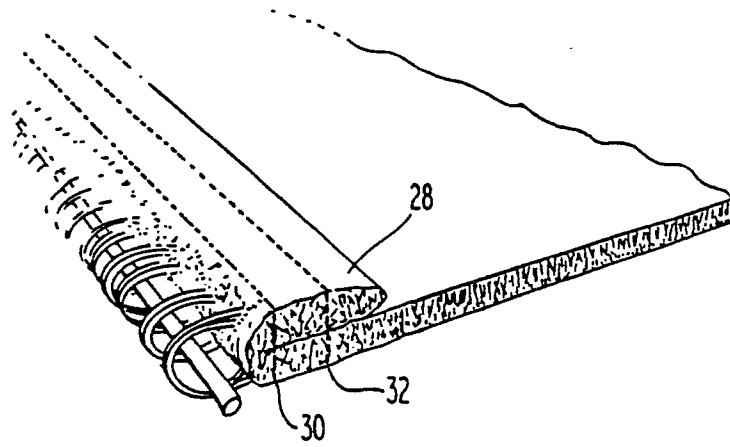


Fig. 8

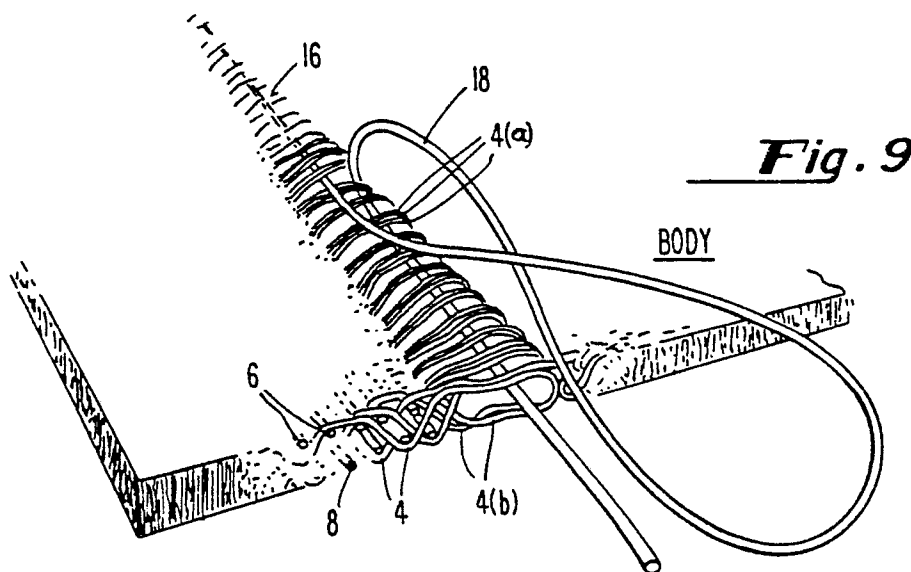


Fig. 9