(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 608 342 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication of patent specification: **13.12.95** (51) Int. Cl.[6]: **D21F 1/00**

(21) Application number: **92922306.3**

(22) Date of filing: **09.10.92**

(86) International application number:
PCT/US92/08665

(87) International publication number:
WO 93/07338 (15.04.93 93/10)

(54) **WOVEN PAPERMAKERS FABRIC HAVING A UNIBODY SEAM AND A METHOD FOR MAKING THE SAME**

(30) Priority: **11.10.91 US 775047**
24.09.92 US 951311

(43) Date of publication of application:
03.08.94 Bulletin 94/31

(45) Publication of the grant of the patent:
13.12.95 Bulletin 95/50

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI NL SE

(56) References cited:
WO-A-91/19044
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US-A- 3 309 790
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EP 0 608 342 B1

Description

Field of the Invention

The present invention relates generally to the joining of woven fabrics to render them endless. More particularly, the invention relates to joining papermakers to render them as an endless belt on the papermaking equipment. Most particularly, the present invention relates to joining woven papermakers dryer fabrics by interleaving complementary projections and recesses on each end of the fabric and inserting a retaining means into a channel formed in the cross machine direction.

Description of the Prior Art

It is known to join woven fabrics in order to render them endless. Likewise, it has been known to join woven fabrics through the use of complementary projections and recesses which are interleaved to define a channel into which a retaining means is inserted. As will be appreciated by those skilled in the art; the prior art has developed a number of techniques for producing the complementary projections and recesses which are interleaved and a number of techniques for producing the cross machine direction channel(s) into which the retaining means is/are inserted. It has been recognized by the art that the join area should, to the extent possible, duplicate the weave pattern, caliper, permeability and interstice configuration of the fabric. Efforts to accomplish such a seam configuration have produced techniques in which yarns are woven back into the fabric in an effort to create complementary ends having a substantially uniform construction with than of the remainder of fabric. In addition, techniques have been developed for folding the end of the fabric back and forming interleaving projections.

Another technique for forming a join is disclosed in GB-A-1259287. This reference teaches joining a woven fabric by cutting back alternate warp filaments on one end of a fabric, and cutting back warp filaments on the opposite end of the fabric in a complementary pattern. The weft filaments in the join area at each fabric end are then removed, leaving only the alternating warp ends which were not cut back. The fabric ends are then moved to place the warps ends into interfitting relationship, such that the corresponding and complementary warp filaments in each end portion of the fabric abut one another. Replacement weft yarns are then manually interwoven with the warp ends to form the join. The abutting warp ends are bonded together and, if desired, the warp and weft yarns in the join area are bonded together with an adhesive.

In all of the known prior art techniques, the process may be labor intensive and/or produce a seam which does not have the same caliper as the remainder of the fabric or does not share other fabric characteristics with the remainder of the fabric.

As a result of the above, efforts were undertaken to produce a join area which, except for the retaining means, was formed entirely from the fabric as woven. In addition, the efforts were directed toward preserving the fabric construction, caliper and operating characteristics throughout the seam area. Still further, it was concluded that the desired seam would not require a doubling or folding back of the fabric end.

SUMMARY OF THE INVENTION

The present invention provides an endless papermakers felt which is formed from a length of woven fabric. The fabric consists of interwoven machine direction and cross machine direction yarns having interleaving joining means at each end which are joined together to form the endless belt. The improvement is characterized by projections formed entirely from the original woven fabric with both the machine and cross machine direction yarns of the projections retained in their original woven orientation and position. Each of the projections has a cross machine direction void at least one yarn position back from the end of the projection, with each void being formed in a complementary position to the void in the opposing projections. The joined area maintains all of the woven characteristics of the fabric and is substantially identical to the remainder of the fabric.

In addition to the above, the present invention provides a method for preparing the fabric ends. In the method of the invention, each end of the woven fabric is trimmed to establish a maximum fabric length and to provide a true cross machine direction edge on each end of the fabric. Each cross machine direction edge is parallel to the last cross machine direction yarn on the respective edge. After formation of the edge of the fabric with a true cut, at least one cross machine direction yarn is removed from each end of the fabric. The removed yarns are positioned at least one cross machine direction yarn from the respective fabric edge and create a cross machine direction void on the respective fabric edge. A plurality of alternating projections and recesses are formed on each end of the fabric. The alternating projections and recesses are formed on the respective ends so that they will complement each other and the cross machine direction void at each respective end is at substantially the same distance from the respective edge.

A further method of seaming a fabric having its ends prepared in accordance with the above method is also provided. The projections and recesses of the fabric ends are interleaved to form an uninterrupted linear continuation of the original woven fabric and to align the cross machine direction voids. After the voids have been aligned, retaining means are inserted in the cross machine direction to render the fabric endless.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a section of woven fabric prior to its preparation in accordance with the invention.

Figure 2 is a top plan view of a section of fabric as illustrated in **Figure 1**.

Figure 3 is a top plan view similar to that of **Figure 2** and shows the removal of a cross machine direction yarn.

Figure 4 is a top plan view of a fabric according to the present invention prior to being joined and retained as an endless fabric.

Figure 5 is a perspective illustration of the fabric as shown in **Figure 4**.

Figure 6 is a top plan view illustrating the fabric in its joined configuration.

Figure 7 is a top plan view illustrating the fabric in position for the formation of a true cut.

Figure 8 illustrates one device for forming the fabric ends in accordance with the present invention.

Figure 9 illustrates a rotary device for further preparing the fabric edge in accordance with the present invention.

Figure 10 illustrates a non-rotary device for preparing the ends of the fabric in accordance with the present invention.

Figure 11 illustrates one potential pattern for preparing the fabric ends in accordance with the present invention.

Figure 12 illustrates one suitable retainer means for joining the fabric.

DESCRIPTION OF THE PREFERRED EMBODIMENT

This description of the preferred embodiment will be made with reference to the attached drawings and like elements are identified by the same numeral throughout. In describing the preferred embodiment, the illustrative fabric is a flat woven fabric which is more fully described in International Application Number PCT/US 91/01776 which was filed on March 15, 1991 with a designation for Canada and is assigned to the common assignee. It will be understood by those skilled in the art that the fabric weave is illustrative and does not form a limitation of the present invention. Likewise, it will be understood by those skilled in the art, after a full review of the description set forth hereinafter, that the fabric must be comprised of bondable or thermoplastic yarns.

Turning to **Figure 1**, the fabric is constructed of synthetic, thermoplastic monofilament yarns. In the illustrated configuration, the upper machine direction yarns **16** and the lower machine direction yarns **18** have a non-circular or flattened profile. The machine direction yarns are woven so that paired upper and lower yarns are stacked in the same relative vertical alignment throughout the body of the fabric. The cross machine direction yarns system is comprised of alternating yarns **12** and **14**. As illustrated in **Figure 1**, the cross machine direction yarn **14** is of a smaller diameter than cross machine direction yarn **12**. As a result, the caliper of the fabric is substantially consistent throughout its length despite the fact that the machine direction yarns **16** and **18** both interweave at the same position with yarn **14**. By way of example, the cross machine direction yarn **12** may be about 0.8 mm and the cross machine direction **14** may be about 0.6 mm.

With reference to **Figures 1** and **2**, the preparation of the ends of the fabric will be discussed in more detail. As will be appreciated by those skilled in the art, the drawing figures represent a portion of the weave for the sake of clarity. The actual fabric will have a length that is at least as long as the maximum length of the desired finished fabric. Each end of the fabric length will be prepared in a similar fashion. Accordingly, the discussion of one fabric end will apply equally to that of the other fabric end, unless otherwise described. As shown in **Figures 1** and **2**, the fabric has been trimmed so as to establish the maximum length of the fabric and to provide a cross machine direction edge which is parallel to the last cross machine direction yarn **12**. In the present construction, it is preferred to trim the fabric in this manner since the cross machine direction yarn **12** is in direct contact with the machine direction yarns from both the upper and lower systems. However, if desired, the fabric could be trimmed parallel to the cross machine direction yarn **14**. As shown in **Figures 1** and **2**, the thermoplastic nature of the machine direction yarns will result in the formation of a bond areas as shown at **20** and **22**. With reference to **Figure 2**, the bond areas will continue along the cross machine direction edge of the fabric and will bond each of the machine direction yarns **16** and **18** to the same cross machine direction yarn **12**. The trim location can also be adjusted to cause the ends of the machine direction yarns **16** and **18** to bond to each other, capturing the last MD yarn **12**. The apparatus and method for preparing the end of

the fabric as shown in **Figures 1** and **2** will be described hereinafter.

With reference to **Figure 3**, the description of seam formation will be continued. After the fabric has been true cut, at least one cross machine direction yarn is removed from each end of the fabric. The removal of the cross machine direction yarn results in the creation of a cross machine direction void. - In the present fabric construction, it is preferred that one of the larger cross machine direction yarns **12** be the removed yarn. In addition, it is preferred that the removed yarn be spaced from the cross machine direction edge of the fabric by at least one cross machine direction yarn.

It will be appreciated by those skilled in the art that the cross machine direction yarn may be removed prior to forming the cross machine direction edge. However, it is presently believed that the additional stabilization which results from formation of the cross machined direction edge will facilitate the removal of the yarn and will help to stabilize the fabric during yarn removal.

Referring to **Figure 4**, there is illustrated the ends **30** of the fabric prior to interleaving in order to form the endless fabric. Although each end of the fabric is identified as **30**, the projections and recesses on the opposed ends of the fabrics have been identified by different numerals in the interest of clarity. As can be seen from **Figure 4**, the recesses **32** will be positioned opposite the projections **36**. Likewise, the recesses **38** which alternate with the projections **36** will be positioned opposite the projections **34** which alternate with the recesses **32**. This manner of interleaving is well known in the art. When the two fabric have been interleaved, the cross machine direction voids **28** will be aligned. Likewise, the cross machine direction yarn segments **12** and **14** from each of the respective ends will be aligned.

With reference to **Figure 5**, there is shown a partial orthographic view of the fabric prior to interleaving. Also shown in **Figure 5**, in a schematic manner, is the remaining portion of the fabric which will extend from each of the portions. Since those skilled in the art will understand that the weave continues throughout the body of the fabric, there is no need to illustrate the full weave pattern as it extends throughout the fabric. As can be seen from **Figure 5**, the cross machine direction voids **28** will be spaced from the cross machine direction edge of the fabric by one cross machine direction yarn **14** and one cross machine direction yarn **12**. Likewise, the cross machine direction voids **28** will be spaced in the center of the recesses **32** and **34**. Accordingly, each of the projections will include a cross machine direction yarn **12** and **14** on either side of the cross machine direction voids **28**.

As can be seen from **Figure 5**, the thermoplastic nature of the yarns will result in material bond between the machine direction yarns **16** and **18** and the cross machine direction yarns **12** and **14**. This is generally illustrated by the numeral **40** in **Figure 5**. It will be appreciated by those skilled in the art that this bonding is localized and that it will not produce deformation in the fabric construction or interference with the projections and recess. As explained in more detail hereinafter, current techniques for producing the fabric will permit the formation of the projections and recesses within very close tolerances. In addition to the machine direction edge bonding which is illustrated at **40**, there is additional cross machine direction bonding which takes place between the cross machine direction yarn and the machine direction yarns as illustrated at **42**. As can be seen in the illustration of **Figure 5**, the machine direction yarns **16** and **18** are weaving on the same side of the cross machine direction yarn **14** in the illustration of **Figure 5**. Due to the illustrated weave construction, both of the machine direction yarns will be bonded on the same side of the cross machine yarn **14**.

Referring now to **Figure 6**, a top plan partial view of the assembled fabric, assembly of the seam will be discussed. As noted previously, the projections **34** and **36** are interleaved to align the cross machine direction voids **28**. After alignment, retaining means **50** is inserted into the cross machine direction void and the fabric is rendered endless. The use of such a pintle **50** will be well known to those skilled in the art. It will also be recognized by those skilled in the art that pintle **50** should be selected to compliment the fabric weave. It is also known to use a metal lead wire to insert and guide the pintle **50** into the void. In the present application, the use of such a lead wire has been found to be of particular advantage. Although the cross machine direction voids **28** are generally undisturbed by the processing of the fabric, it is possible to experience small variations in the void due to material flow or realignment. Accordingly, the use of a thin lead wire will permit an easy insertion. In addition, the use of a conical or funnel like ferrule to connect the lead wire and the pintle will further assist insertion of the pintle. The geometry of one acceptable pintle is shown in **Figure 12**.

Still with reference to **Figure 6**, it can be seen that the machine direction yarns **16** are aligned in the seam area. Although not visible in this view, the machine direction yarns **18** are also aligned. Likewise, the cross machine direction yarns **12** and **14** are aligned in the seam area. As noted previously, pintle **50** is approximately the same size as cross machine direction yarn **12**. As can be seen from an examination of the seam area, it will have the same

repeat characteristics as the remainder of the fabric. However, the seam area will have machine direction gaps between the projections **34** and **36**. It will be obvious to those skilled in the art that the machine direction gaps **52** result from the removal of the cross machine direction yarn segments during preparation of the fabric ends. Likewise, the cross machine direction gaps **54** result from the removal of machine direction yarn segments during formation of the recesses. It will be appreciated by those skilled in the art that the gaps between the projections **34** and **36** will vary with the fabric weave and **Figure 6** is only illustrative of the resulting configuration. Likewise, it will be appreciated that the gaps **52** and **54** maybe beneficial since they permit free movement of the yarn without interference between and among the bonding points **20**, **22**, **40** and **42**.

With reference to **Figures 5** and **6**, it can be seen that the endless fabric will have the same continuous weave pattern throughout its length, that the caliper of the fabric will not be altered, that the loops at each end of the fabric are formed entirely from and are a linear continuation of the original woven fabric and that there are no elements added to the fabric as part of the formation of the seaming loops. The insertion of a pintle as a joining expedient is a substitution for the removed cross machine direction yarn. If so desired, one of the removed cross machine direction yarns may be reinserted as the pintle. At present, the use of a pintle **50** is preferred.

With references to **Figures 6** through **11**, the formation of the projections and recesses will be more fully described. It will be appreciated by those skilled in the art that I prefer to establish a regular cross machine direction edge on each end of the fabric **10**. At present, the formation of these preliminary edges is achieved by selecting a cross machine direction yarn, marking that yarn and then cutting the fabric parallel to that yarn. The cut may be either purely mechanical or a mechanical cut aided by heat or a thermal cut such as by ultrasonics or lasers. After the initial cut on each end has established the reference cross machine direction yarn, the fabric is prepared for the establishment of a true cross machine direction cut on each end.

In order to establish the spacing and desired yarn orientation, the fabric **10** is presented to a cutting table. As shown in **Figure 7**, the previously trimmed fabric is presented against the side of a bar **60** which establishes a cross machine direction reference point. At that point, a cross machine direction yarn is selected as the location of the true cut. The fabric **10** is marked, **64**, along that cross machine direction yarn. The cross machine direction marking **64** will become the true cut. The true cut may be made by means of a laser which is optically guided along the marking 64 or by other means such as a sharp hot knife or the like. In any event, it is preferred that the true cut be accomplished by a means which includes the generation of heat which is sufficient to cause a softening or flow of the material without a deformation thereof. As will be appreciated by those skilled in the art, the desired temperature will vary according to the selected yarn materials. In any event, the cut must be a clean cut which will establish a cross machine direction edge which is parallel to the last cross machine direction yarn. If the yarns are not maintained parallel to each other, it is very possible that the final formation of the projections **32** and **34** will result in irregular alignment of the yarns when they are interleaved and pintled.

At present, the preferred technique for establishing the fabric end **64** is a laser cut under computer control. With reference to **Figure 11**, there is illustrated a pattern which may be followed by the computer in accomplishing the desired cuts. By using a single control pattern and two independently operating cutting means the laser will control the cutting means so as to make the recesses and projections at the same time. For straight line cutting a single straight line pattern will still control both cuts. This should aid in creating uniformity of cut and match.

Turning now to **Figure 8**, there is shown a computer controlled laser cutting apparatus **100** which will accomplish both the true cut edges and the formation of the opposed projections and recesses. The apparatus **100** has a fabric support table **102** and fabric positioning rolls **104** which assist in addressing the fabric around the table. Each end of the fabric is addressed to a side of the bar **60**. Bar **60** extends across the table, which is preferably of a width greater than the width of the fabric, and provides a true edge. The fabric is positioned against the bar and the true cut marking **64** is established along the cross machine direction yarn. The fabric is held in position by clamps **106**. The clamps **106** are spaced from the bar **60** by a sufficient distance to permit easy operation in the seaming area while relieving the seam area from tension which is associated with the weight of the fabric hanging over the rollers **104**. The true cut edge **64** may be accomplished in a number of ways. One way to accomplish the edge cut is to position the laser guns **116** and **118** with the respective cutting points **120** and **122** on the true cut marks **64**. The lasers may be guided by a pattern or may be optically guided along the marks 64 as they traverse the cross machine direction.

As can be seen from **Figure 8**, the laser cutting tools depend from the arm **114** and are adjustable with respect to the positioning of the cutting

point **120** or **122** as shown by the arrows on arm **114**. The arm **114** is adjustable in the vertical plane as indicated by the arrows adjacent housing **112**. Housing **112** supports the arm **114** and encases the control means for generating the laser beams and positioning the lasers. The movement of housing **112** is controlled by a computer in accordance with the fabric design parameters. The control output from the computer is applied via the input **113** to the control housing **112**. In light of the various fabric constructions, it is believed that computer control will provide more variability with respect to meeting the various fabric configurations. The cutting apparatus **110** is mounted on a pair of rails **110** which are of equal length with the table. This will permit the cutting apparatus to continue its movement in the cross machine direction and thereby avoid the possibility of introducing errors by stopping the cutting operation or moving the fabric. It will be appreciated by those skilled in the art that the table **102** and the cutting apparatus will be suitably mounted for stability. However, the embodiment shown in **Figure 8** includes a moveable arm **108** which is intended to swing away from the table **102** and to permit free access to the fabric as a means of improving the alignment operation.

As noted previously, it is highly desirable to establish the bonds **20** and **22** as shown in **Figure 1**. While it is expected that the majority of such bonds will be formed as a result of the cutting operation, it has been concluded that the bond should not be left to chance. Accordingly, the true cut edge 64 is subjected to a further bonding step. There are two approaches to this bonding step. The first approach is depicted in **Figure 9**. In **Figure 9**, two oppositely turning rollers, **70** and **72**, are applied against the true cut **64** of the fabric. Each of the rollers is heated and is particularly configured to the geometry of the fabric. The rollers **70** and **72** have base portions which meet and form a planar surface against which the true edge **64** is abutted. Each roller has an interior portion **74** which is on center line with the base but has a radius which is reduced by the distance **78**. The distance **78** is substantially equal to one half of the fabric gauge. Extending between the interior portion **74** and the base of the rollers is the curvilinear portion **76**. As can be seen from **Figure 9**, the rollers **70** and **72** present a continuous interface which maintains the gauge of the fabric and urges the edges of the machine direction yarns **16** and **18** against the side of the cross machine direction yarn **12**. This establishes good bonding and a regular true cut edge. With reference to **Figure 10**, a second device for accomplishing the preferred bonding is illustrated. With the device shown in **Figure 10**, the plates **80** and **82** are heated plates which will permit local application to accomplish the desired bonding. The faces **84** and **86** of the plates are configured to establish the desired geometry for the true edge of the fabric as previously described in connection with **Figure 9**. In the embodiment of **Figure 10**, the plates **80** and **82** may be separated by vertical movement as a means of allowing the device to be placed in smaller areas or areas where a continuous movement in the cross machine direction is not possible. Accordingly, a device such as that shown in **Figure 10** may be used for insertion into the recesses **32** so as to assure the efficiency of the bond **42**, see **Figure 5**. It will be understood by those skilled in the art that the size and geometric configuration of the plated **80** and **82** may be altered in light of the fabric construction. In general, the use of a device such as that shown in **Figure 9** is preferred for the true cut. However, if so desired a device of the type shown in **Figure 10** may be progressively moved in the cross machine direction to accomplish a similar result.

With reference to **Figure 12**, there is shown a preferred pintle assembly **130**. The pintle assembly 130 includes a lead wire **132** which is smaller than the desired pintle **50**. The lead wire **132** and the pintle **150** are joined by the conical ferrule **132**. As noted previously, insertion of the pintle **50** with the assistance of such a lead wire and ferrule are known in the art. However, it is believed that the configuration as shown in **Figure 12** is particularly desirable in the event that the cross machine direction void **28** has been somehow compressed.

Although a computer guided, laser cutting apparatus has been described, it will be appreciated by those skilled in the art that other cutting devices may be used to prepare the ends of the fabric. The critical consideration in preparing the ends of the fabric is to establish the existence of a true cut along with the bonding areas so as to provide a fabric structure of sufficient strength to permit joining of the ends of the fabric without the need for additional elements while preserving the continuous linear weave construction throughout the loops.

Claims

1. An improved endless papermakers belt formed from a length of woven fabric (10) consisting of interwoven machine direction (16, 18) and cross machine direction (12, 14) yarns having interleaving joining means at each end (30) which are joined together to form the endless belt, wherein the improvement is characterized by projections (34, 36) formed entirely from the original woven fabric (10) with both the machine and cross machine direction yarns (16, 18 and 12, 14) of the projections (34, 36) retained in their original woven orientation and

position, each of the projections (34, 36) has a cross machine direction void (28) positioned at least one yarn back from the end of the projection (34, 36), each void (28) is formed in a complementary position to the void (28) in the opposing projections (34, 36).

2. The belt of claim 1 further characterized in that complementarily spaced projections (34, 36) and recesses (32, 38) are formed by cuts in the original woven fabric (10).

3. The belt of claim 2 further characterized in that the machine direction (16, 18) and cross machine direction yarns (12, 14) of each end (30) of the fabric (10) are aligned when the ends (30) are joined together.

4. The belt of claim 1 further characterized in that the respective fabric ends (30) are parallel to a last respective cross machine direction yarn (12).

5. The belt of claim 1 further characterized in that the machine direction yarns (16, 18) at each end (30) of the fabric (10) are attached to the last respective cross machine direction yarn (12).

6. The improvement of claim 1 further characterized in that the machine direction (16, 18) and cross machine direction yarns (12, 14) are thermoplastic, and the machine direction yarns (16, 18) were secured to the last respective cross machine direction yarn (12) by fusion as the projections (34, 36) and recesses (32, 38) are being cut into the fabric ends (30).

7. The improved belt of claim 1 wherein the machine direction yarns (16, 18) are woven so that paired upper and lower yarns maintain the same relative vertical alignment throughout the body of the fabric (10), wherein the improvement is characterized by respective upper and lower yarns in the aligned pairs of machine direction yarns (16, 18) at each end (30) of the fabric (10) are attached to the last respective cross machine direction yarn (12).

8. The improved belt of claim 7 further characterized in that the machine and cross machine direction yarns (16, 18 and 12, 14) are thermoplastic, and the respective upper and lower yarns in the vertically aligned pairs of machine direction yarns (16, 18) are attached to the last respective cross machine direction yarn (12) by fusion.

9. The belt of claim 1 wherein the machine direction yarns (16, 18) are woven so that paired upper and lower yarns maintain the same relative vertical alignment throughout the body of the fabric (10), wherein the improvement is further characterized in that respective upper and lower yarns in the vertically aligned pairs of machine direction yarns (16, 18) at each end (30) of the fabric (10) are secured to each other capturing the last respective cross machine direction yarn (12).

10. The belt of claim 9 further characterized in that the machine direction yarns (16, 18) are thermoplastic, and the respective upper and lower yarns in the vertically aligned pairs of machine direction yarns (16, 18) are attached to each other by fusion.

11. A method of preparing the ends (30) of a papermakers fabric of the type having a plurality of machine direction yarns (16, 18) interwoven with a plurality of cross machine direction yarns (12, 14) for seaming by inserting retaining means (50) in the cross machine direction, said method characterized by the steps of:

trimming each end (30) of the fabric (10) to establish the maximum fabric length and to provide a cross machine direction edge on each end (30) of the fabric (10) which is parallel to the last cross machine direction yarn (12) on a respective edge;

removing at least one cross machine direction yarn (14) from each end (30) of the fabric (10), the removed yarns being at least one cross machine direction yarn from the respective fabric edge and creating a cross machine direction void (28); and

forming a plurality of alternating projections (34, 36) and recesses (32, 38) on each end (30) of the fabric (10) so that the opposed projections (34. 36) and recesses (32, 38) are interleaving and the cross machine direction voids (28) are aligning to form a continuous cross machine direction void.

12. A method of seaming a papermakers fabric of the type having a plurality of machine direction yarns (16, 18) interwoven with a plurality of cross machine direction yarns (12, 14) in which the ends have been prepared in accordance with the method of claim 11, said method characterized by the further steps of:

interleaving the opposed projections (34, 36) and aligning the cross machine direction voids (28); and

inserting retaining means (50) in the

aligned voids (28).

Patentansprüche

1. Ein verbesserter, endloser Papierherstellungsriemen, der aus einer Länge Gewebe (10) geformt ist, und aus verflochtenen MD- (16, 18) und (12, 14) CMD-Garnen besteht, die an jedem Ende verflechtende Verbindungsmittel (30) aufweisen, die zusammengefügt werden, um den endlosen Riemen zu formen, worin die Verbesserung durch Vorsprünge (34, 36) gekennzeichnet sind, die gänzlich aus dem originalen Gewebe (10) geformt sind, wobei sowohl die MD- und CMD-Garne (16, 18 und 12, 14) der Vorsprünge (34, 36) in ihrer ursprünglichen Weborientierung und Position beibehalten sind, jeder der Vorsprünge (34, 36) weist eine CMD-Lücke (28) auf, die mindestens ein Garn vom Ende des Vorsprungs (34, 36) zurück positioniert ist, jede Lücke (28) wird in einer ergänzenden Position zur Lücke (28) in den entgegengesetzten Vorsprüngen (34, 36) geformt.

2. Der Riemen des Anspruchs 1 ist dadurch weiter gekennzeichnet, daß ergänzend angeordnete Vorsprünge (34, 36) und Aussparungen (32, 38) durch Schnitte in das ursprüngliche Gewebe (10) geformt werden.

3. Der Riemen des Anspruchs 2 ist dadurch weiter gekennzeichnet, daß die MD- (16, 18) und CMD-Garne (12, 14) jedes Endes (30) des Gewebes (10) ausgerichtet sind, wenn die Enden (30) zusammengefügt werden.

4. Der Riemen des Anspruchs 1 ist dadurch weiter gekennzeichnet, daß die jeweiligen Gewebeenden (30) zu einem letzten jeweiligen CMD- Garn (12) parallel sind.

5. Der Riemen des Anspruchs 1 ist dadurch weiter gekennzeichnet, daß die MD-Garne (16, 18) an jedem Ende (30) des Gewebes (10) an das letzte jeweilige CMD-Garn (12) befestigt sind.

6. Die Verbesserung des Anspruchs 1 ist dadurch weiter gekennzeichnet, daß die MD- (16, 18) und CMD-Garne (12, 14) thermosplastisch sind, und die MD-Garne (16, 18) an das die Vorsprünge (34, 36) und Aussparungen (32, 38) in die Gewebeenden (30) geschnitten werden.

7. Der verbesserte Riemen des Anspruchs 1, worin the MD-Garne (16, 18) so gewebt sind, daß gepaarte obere und untere Garne die gleiche relative vertikale Ausrichtung im ganzen Körper des Gewebes (10) beibehalten, worin die Verbesserung dadurch gekennzeichnet ist, daß jeweilige obere und untere Garne in den ausgerichteten Paaren der MD-Garne (16, 18) an jedem Ende (30) des Gewebes (10) an das letzte jeweilige CMD-Garn (12) befestigt sind.

8. Der verbesserte Riemen des Anspruchs 7, ist dadurch weiter gekennzeichnet, daß die MD- und CMD-Garne (16, 18 und 12, 14) thermoplastisch sind, und die jeweiligen oberen und unteren in den vertikal ausgerichteten Paaren von MD-Garnen (16, 18) an das letzte jeweilige CMD-Garn (12) durch Fusion befestigt sind.

9. Der Riemen von Anspruch 1, worin die MD-Garne (16, 18) so gewebt sind, daß gepaarte obere und untere Garne die gleiche relative vertikale Ausrichtung im ganzen Körper des Gewebes (10) beibehalten, worin die Verbesserung weiter dadurch gekennzeichnet ist, daß die jeweiligen oberen und unteren Garne in den vertikal ausgerichteten Paaren der MD-Garne (16, 18) an jedem Ende (30) des Gewebes (10) aneinander befestigt sind und das letzte jeweilige CMD-Garn (12) erfassen.

10. Der Riemen des Anspruchs 9 ist dadurch weiter gekennzeichnet, daß die MD-Garne (16, 18) thermoplastisch sind, und die jeweiligen oberen und unteren Garne in den vertikal ausgerichteten Paaren der MD-Garne (16, 18) durch Fusion bzw. Verschmelzung miteinander verbunden sind.

11. Eine Methode zur Vorbereitung der Enden (30) eines Papierherstellungsgewebes des Typs, der eine Vielheit von MD-Garnen (16, 18) aufweist, die mit einer Vielheit von CMD-Garnen (12, 14) verflochten sind, für Säumen durch Eintragen von Haltemitteln (50) in der Maschinenquerrichtung, besagte Methode ist durch folgende Schritte gekennzeichnet:

    Trimmen jedes Endes (30) des Gewebes (10), um die maximale Gewebelänge festzulegen, und um für eine Maschinenquerrichtungskante an jedem Ende (30) des Gewebes (10) zu sorgen, die parallel zum letzten CMD-Garn (12) auf einer jeweiligen Kante ist;

    Entfernen von mindestens einem CMD-Garn (14) aus jedem Ende (30) des Gewebes (10), wobei die entfernten Garne mindestens ein CMD-Garn von der jeweiligen Gewebekante weg sind, und Schaffung einer Lücke (28) in Maschinenquerrichtung; und

    Formen einer Vielheit von abwechselnden Vorsprüngen (34, 36) und Aussparungen (32, 38) an jedem Ende (30) des Gewebes (10), so

daß die entgegengesetzten Vorsprünge (34, 36) und Aussparungen (32, 38) verflechtend sind und die Lücken (28) in Maschinenquerrichtung fluchtend, um eine kontinuierliche Lücke in Maschinenquerrichtung zu formen.

12. Eine Methode für das Säumen eines Papierherstellungsgewebes des Typs bei dem eine Vielheit von MD-Garnen (16, 18) mit einer Vielheit von CMD-Garnen (12, 14) verflochten sind, bei dem die Enden in Übereinstimmung mit der Methode des Anspruchs 11 vorbereitet worden sind, wobei die besagte Methode durch folgende Schritte weiter gekennzeichnet ist:

Verflechten der entgegengesetzten Vorsprünge (34, 36) und Ausrichten der Maschinenquerrichtungslücken (28); und

Eintragen von Haltemitteln (50) in die ausgerichteten Lücken (28).

[MD-Garne = Garne in Maschinenrichtung
CMD-Garne = Garne in Maschinenquerrichtung
MD = Machine Direction
CMD = Cross Machine Direction]

Revendications

1. Une ceinture améliorée et continue pour machine à papier, constituée d'une certaine longueur de tissu tissé (10) formé de fils sens machine (16,18) et de fils sens travers (12,14) entretissés et ayant des moyens de jonction entrecroisés à chaque extrémité (30), moyens qui sont unis afin de constituer la ceinture continue, dans laquelle l'amélioration est caractérisée par des prolongements (34,36) formés entièrement à partir du tissu tissé original (10), les fils sens machine et les fils sens travers (16,18 et 12,14) de ces prolongements (34,36) étant maintenus dans leur orientation et leur position de tissage d'origine, chacun des prolongements (34,36) comportant un espace vide en sens travers (28) situé au moins un fil avant la fin du prolongement (34,36), chaque espace vide (28) étant situé en position complémentaire par rapport à l'espace vide (28) des prolongements opposés (34,36).

2. La ceinture ainsi revendiquée à la revendication 1 caractérisée en outre par le fait que les prolongements espacés de manière complémentaire (34,36) et les renfoncements (32,38) sont obtenus en effectuant des coupes dans le tissu tissé original (10).

3. La ceinture ainsi revendiquée à la revendication 2 caractérisée en outre par le fait que les fils sens machine (16,18) et les fils sens travers (12,14) de chaque extrémité (30) du tissu (10) sont alignés lorsque l'on joint les extrémités (30) l'une à l'autre.

4. La ceinture ainsi revendiquée à la revendication 1 caractérisée en outre par le fait que les extrémités (30) respectives du tissu sont parallèles au dernier fil sens travers (12) respectif.

5. La ceinture ainsi revendiquée à la revendication 1 caractérisée en outre par le fait que les fils sens machine (16,18) de chaque extrémité (30) du tissu (10) sont fixés au dernier fil sens travers (12) respectif.

6. L'amélioration ainsi revendiquée à la revendication 1 caractérisée en outre par le fait que les fils sens machine (16,18) et les fils sens travers (12,14) sont thermoplastiques, et que les fils sens machine (16,18) sont soudés au dernier fil sens travers respectif (12) par fusion au moment où les prolongements (34,36) et renfoncements (32,38) sont découpés aux extrémités (30) du tissu.

7. La ceinture améliorée ainsi revendiquée à la revendication 1 dans laquelle les fils sens machine (16,18) sont tissés en sorte que les fils inférieurs et supérieurs couplés conservent le même alignement vertical relatif sur toute la longueur du tissu (10), dans laquelle l'amélioration est caractérisée par le fait que les fils inférieurs et supérieurs respectifs des couples de fils sens machine (16,18) alignés sont fixés, à chaque extrémité (30) du tissu (10), au dernier fil sens travers (12) respectif.

8. La ceinture améliorée ainsi revendiquée à la revendication 7 caractérisée en outre par le fait que les fils sens machine et les fils sens travers (16,18 et 12,14) sont thermoplastiques, et que les fils inférieurs et supérieurs des couples de fils sens machine (16,18) alignés verticalement sont fixés au dernier fil sens travers (12) respectif par fusion.

9. La ceinture améliorée ainsi revendiquée à la revendication 1 dans laquelle les fils sens machine (16,18) sont tissés en sorte que les fils inférieurs et supérieurs couplés conservent le même alignement vertical relatif sur toute la longueur du tissu (10), dans laquelle l'amélioration est caractérisée par le fait que les fils inférieurs et supérieurs respectifs des couples de fils sens machine (16,18) alignés sont fixés l'un à l'autre, à chaque extrémité (30) du tissu (10), tout en capturant le dernier fil sens tra-

vers (12) respectif.

10. La ceinture améliorée ainsi revendiquée à la revendication 9 caractérisée en outre par le fait que les fils sens machine (16,18) sont thermoplastiques, et que les fils inférieurs et supérieurs des couples de fils sens machine (16,18) alignés verticalement sont fixés l'un à l'autre par fusion.

11. Une méthode pour la préparation des extrémités (30) d'un tissu pour machine à papier comportant un grand nombre de fils sens machine (16,18) entretissés avec un grand nombre de fils sens travers (12,14) en vue d'une jonction obtenue grâce à l'insertion de moyens de retenue (50) dans le sens travers, ladite méthode étant caractérisée par les étapes suivantes :

la coupe de chaque extrémité (30) du tissu (10) afin d'établir la longueur maximale du tissu et de créer un rebord sens travers à chaque extrémité (30) du tissu (10) qui soit parallèle au dernier fil sens travers (12) du rebord respectif.

le retrait d'au moins un fil sens travers (14) de chaque extrémité (30) du tissu (10), les fils retirés comportant au moins un fil sens travers du rebord du tissu et créant ainsi un espace vide (28) en sens travers; et

la création d'un certain nombre de prolongements (34,36) et de renfoncements (32,38) alternés à chaque extrémité (30) du tissu (10) en sorte que les prolongements (34,36) et renfoncements (32,38) opposés puissent s'entrecroiser et que les espaces vides (28) en sens travers soient alignés afin de former un espace vide en sens travers continu.

12. Une méthode pour la jonction d'un tissu pour machine à papier comportant un grand nombre de fils sens machine (16,18) entretissés avec un grand nombre de fils sens travers (12,14), tissu dont les extrémités ont été préparées selon la méthode revendiquée à la revendication 11, ladite méthode étant en outre caractérisée par les étapes supplémentaires suivantes :

aménagement de l'entrecroisement des prolongements opposés (34,36) et alignement des espaces vides en sens travers (28); et

insertion de moyens de retenue (50) dans les espaces vides alignés (28).

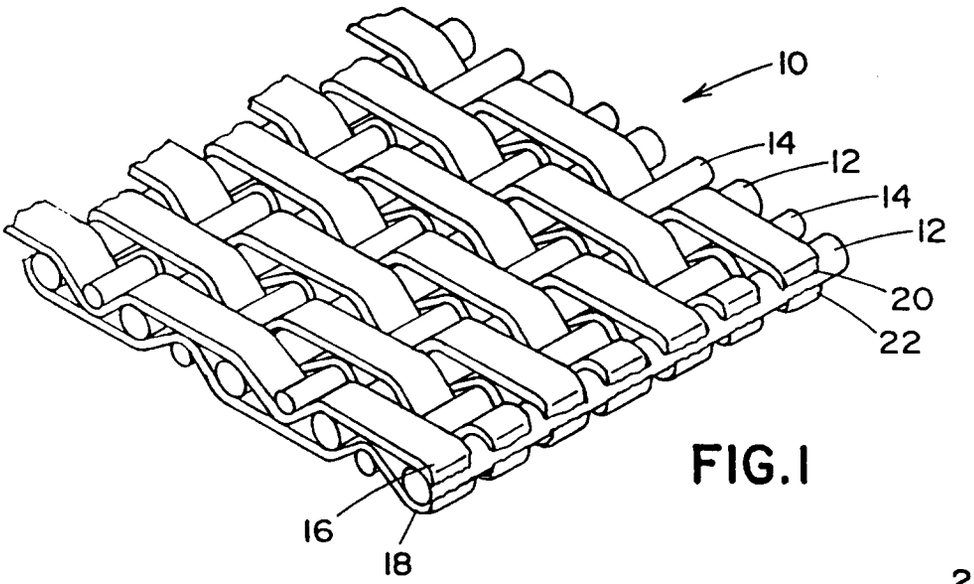

FIG.1

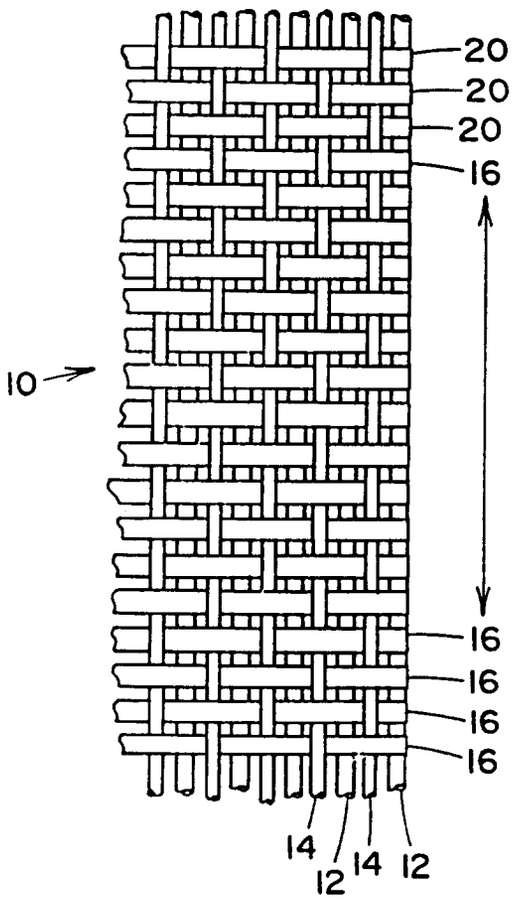

FIG.2

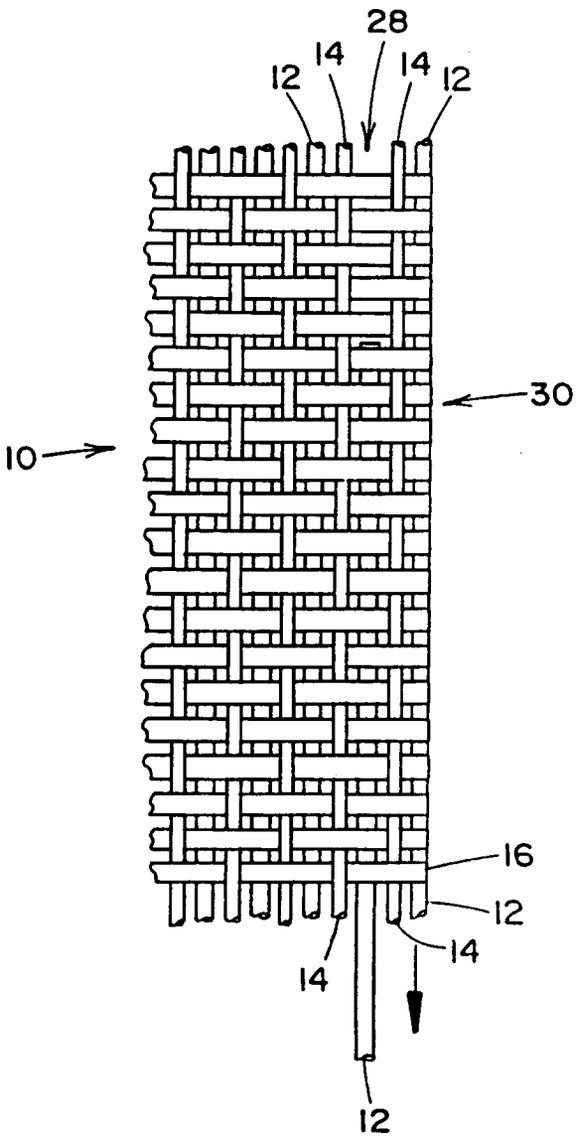

FIG.3

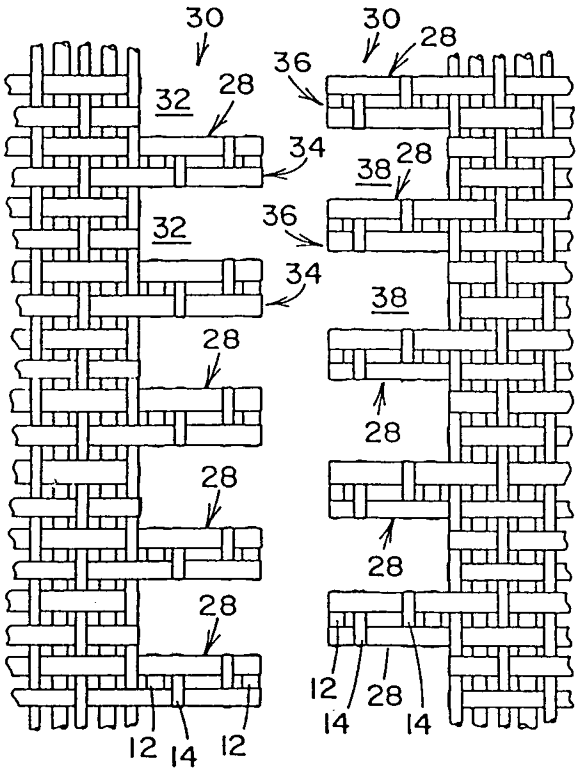
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FIG. 4

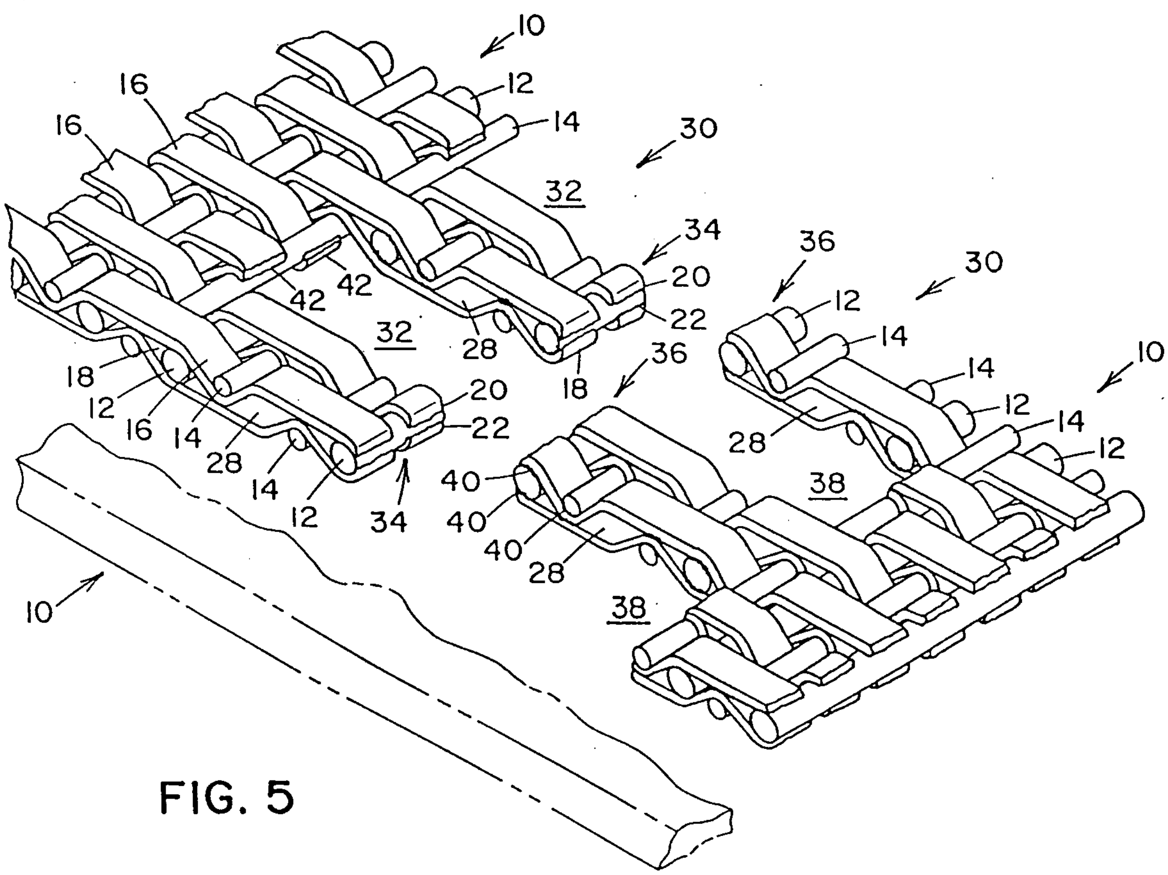
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FIG. 5

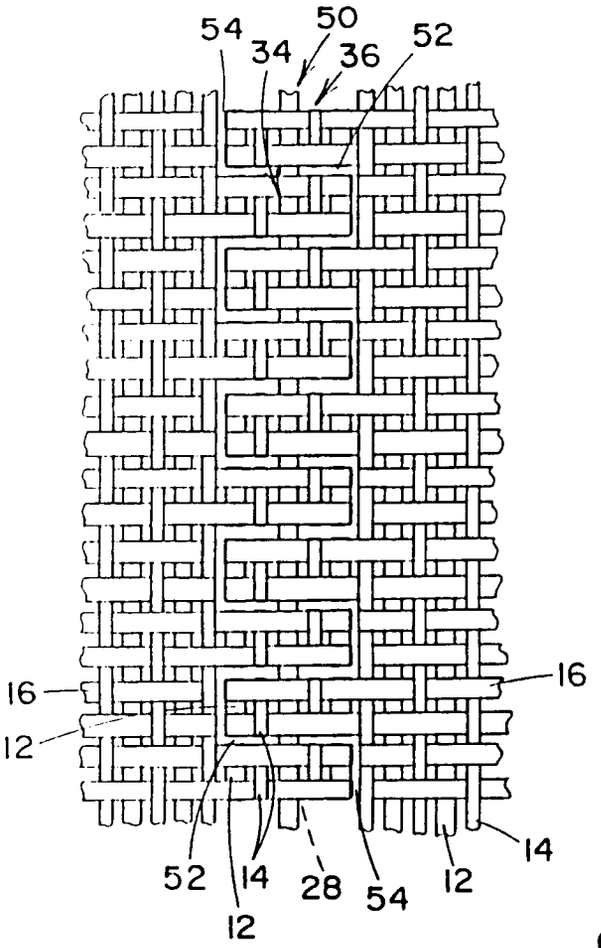
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FIG. 6

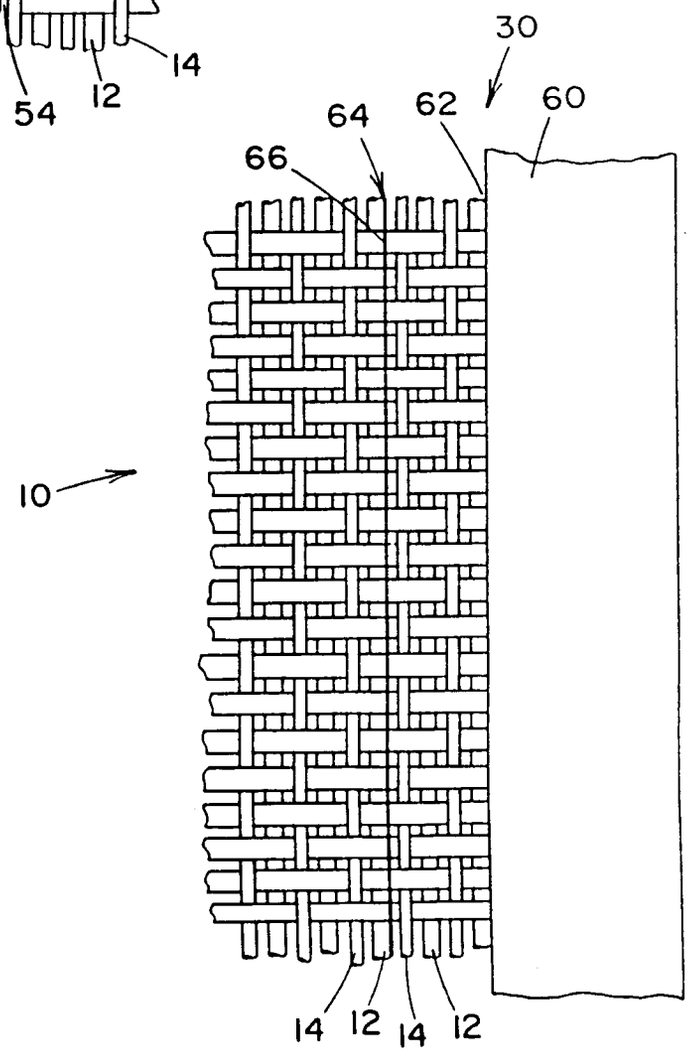
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FIG. 7

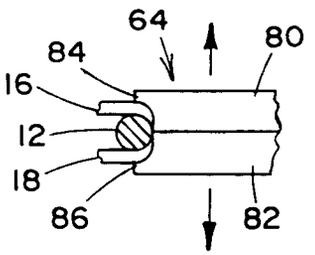

FIG. 10

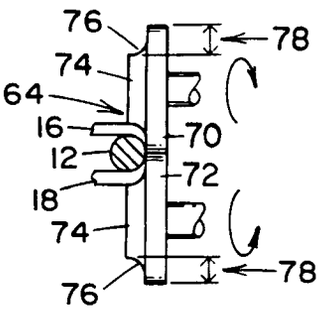

FIG. 9

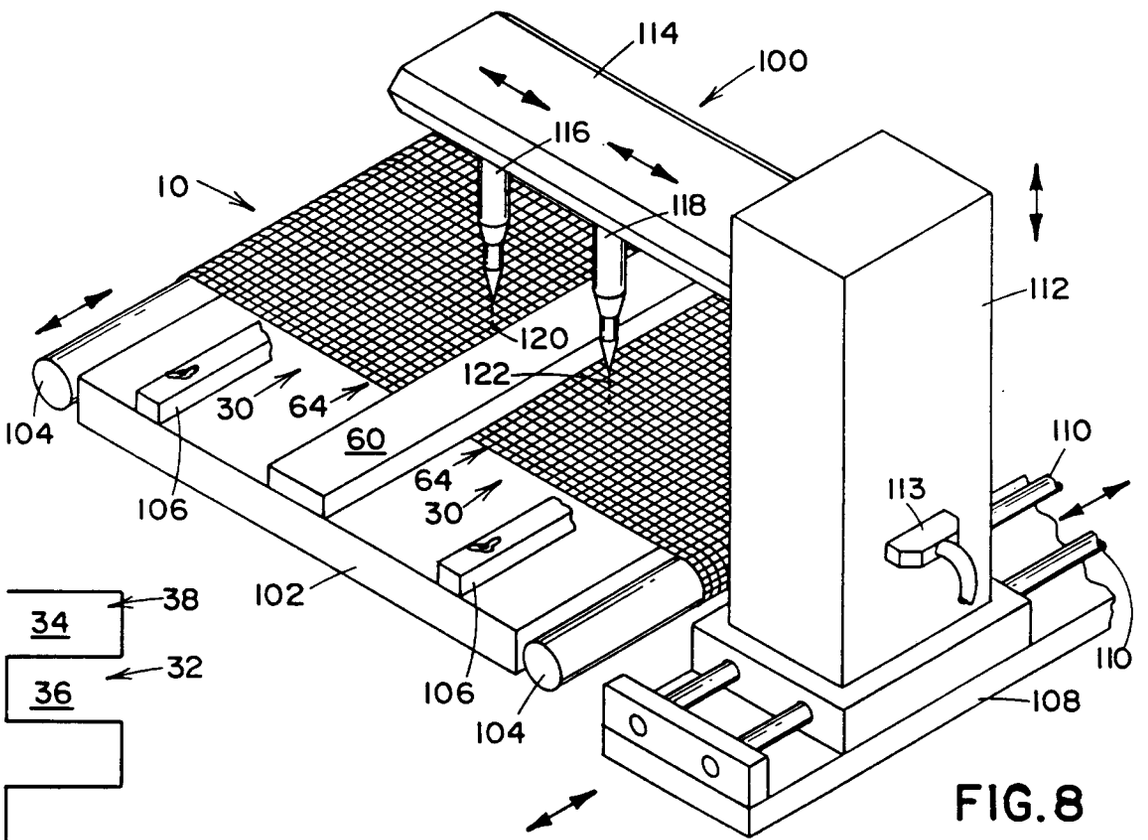

FIG. 8

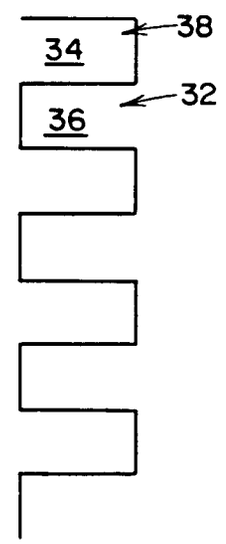

FIG. 11

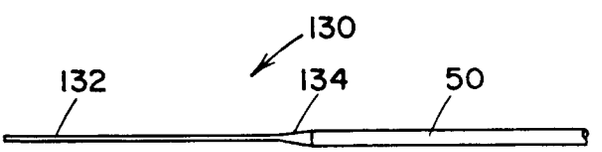

FIG. 12