United States Patent

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[54] PAPERMAKING FABRIC SEAM AND METHOD OF MAKING THE SAME

24 Claims, 7 Drawing Figs.

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28/72, 156/159, 156/258, 245/10, 162/DIG. 1
[51] Int. Cl. **D04h 3/12**
[50] Field of Search 162/DIG. 1,
348; 139/383, 425.5; 156/502, 546, 159, 158, 258;
28/72, 73; 245/10

[56] **References Cited**

UNITED STATES PATENTS

3,060,547	10/1962	MacBean	162/FFM
3,109,219	11/1963	De Bell et al.	139/425.5
3,238,594	3/1966	Schuster	245/10
3,366,355	1/1968	Haller	245/10

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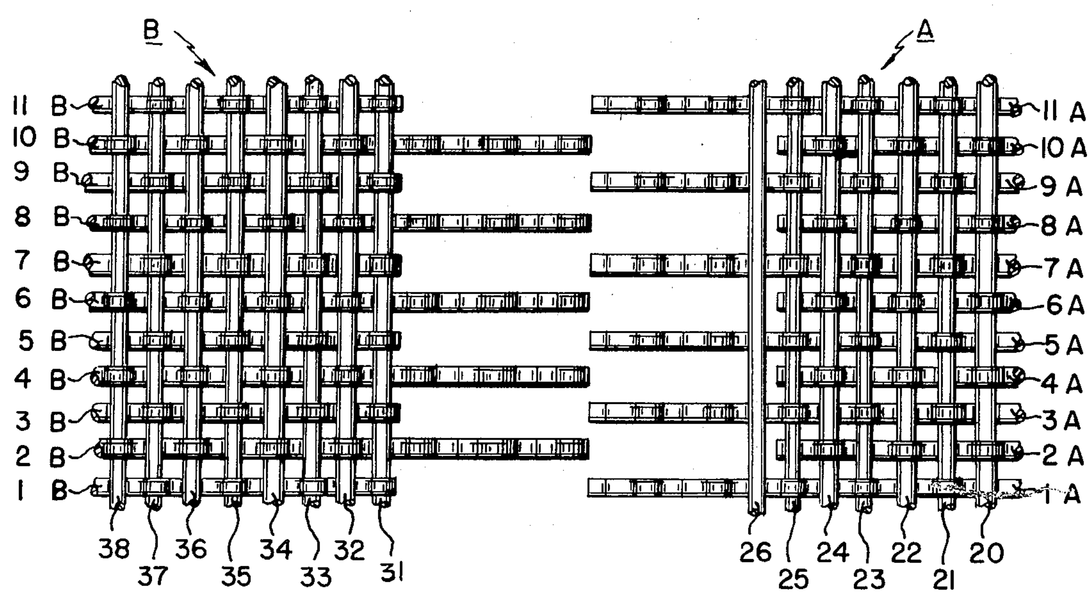
ABSTRACT: A Fourdrinier papermaking belt having porous fabric comprising warp and weft strands and having a porous seam of polymeric filaments and a method of making such seam by interconnecting the end portions of the fabric together to form an endless belt. The method including cutting the warps back into complementary patterns and removing the weft strands from the cut area. Laying a first polymeric replacement weft strand over certain of the exposed warp pickets and moving the adjacent end portions together so that other of the warp pickets ride over the first replacement strand and into abutment with the corresponding cut warps of the other end portion. A plurality of other polymeric replacement weft strands are then woven across respective of the exposed warp pickets to complete the seam area, whereafter, the warp joints are bonded together and the warp and weft strands are bonded to each other at their areas of contact to provide the porous seam.



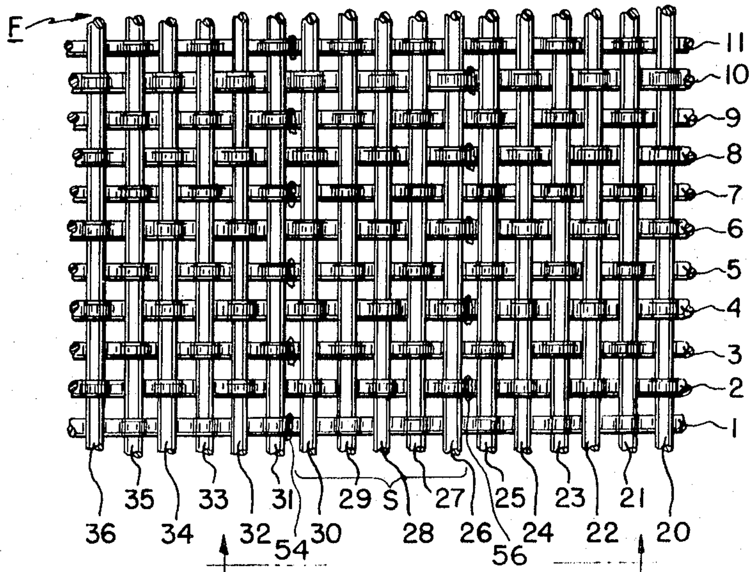


FIG. 1

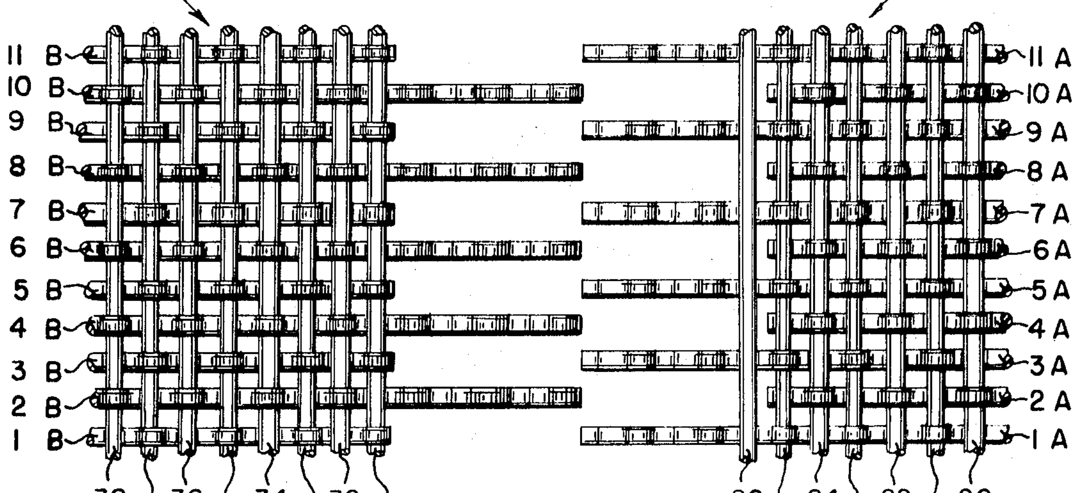


FIG. 2

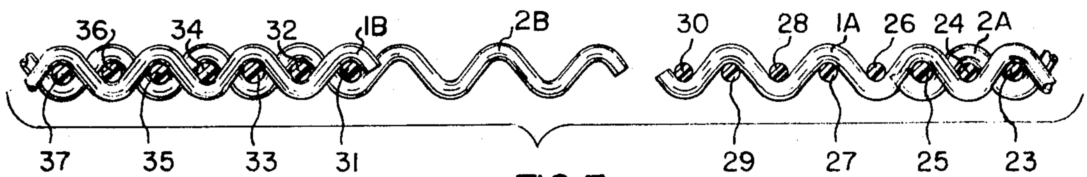


FIG. 3

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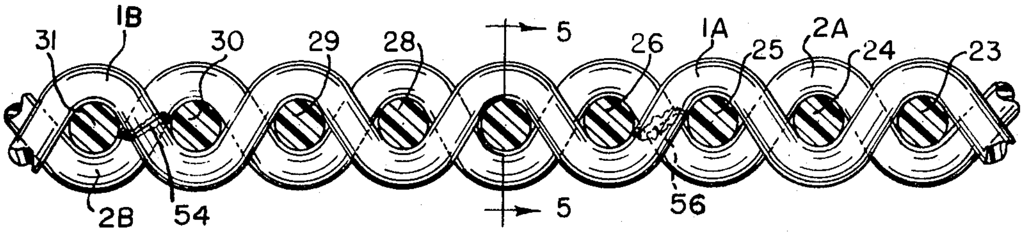

FIG.4

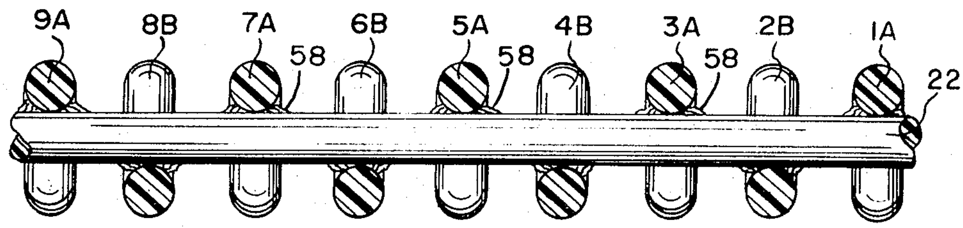

FIG.5

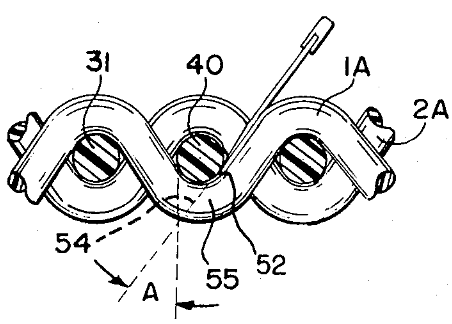

FIG.7

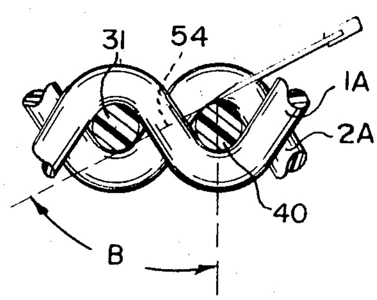

FIG.6

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PAPERMAKING FABRIC SEAM AND METHOD OF MAKING THE SAME

BACKGROUND OF THE INVENTION

This invention relates to porous fabrics, and more particularly relates to a porous seam and method for making the same by interconnecting the end portions of the fabric to form an endless forming structure, such as a Fourdrinier-type belt.

A Fourdrinier-type belt, as the term is here used, is the type of belt upon which paper is made in conjunction with paper making machines. It is generally a woven fabric composed normally of metal warp and shute wires which extend lengthwise and crosswise, respectively. In most cases, a length of the fabric has its ends joined, wire by wire, by brazing to provide the seam or joint necessary to make an endless belt.

The type of seam depends upon the mesh of the fabric and the type of paper to be made on its surface. Generally, coarse mesh fabrics are formed into belts with woven or sewed seams, although brazed seams have been employed in some instances. The finer mesh metal fabrics are formed into belts almost exclusively by brazing techniques. Brazing provides a seam which appears as a continuation of the fabric so as not to cause any difference in the appearance of the paper made thereon.

Fourdrinier belts woven of metal warp and weft or shute wires have been satisfactory in many respects, but have caused difficulties because of the inherent nature of metals. Generally, metals soft enough to weave suffer from rapid wear and sustain damaging stresses with some degree of permanency of damage. Metals also have a flexing limit at a given stress level, commonly known as fatigue life. In addition, metals are subject to corrosive attack which limits the service life of the belt.

During the past few years, a growing interest has arisen in the application of plastic filaments in place of the metal warp and shute wires in the weaving of Fourdrinier-type fabrics. While such plastic filaments offer some advantage over the metal wires in service, it has been difficult to make woven fabrics into belts by seaming or joining the ends thereof. In one such prior application, the ends of the warp filaments have been flattened or otherwise shaped by swagging and by heat and/or pressure. The shaped ends were then lapped and joined together by an adhesive. In another form the warp and shute filaments were joined together under heat and pressure, such as by press plates, to provide a solid weld joint across the filaments. In a further application, the warp filaments have been cut back and the shutes removed to provide complementary patterns on the warps which are joined together, but wherein specially shaped auxiliary shute filaments were drawn or pushed through corrugations in the warps to complete the seam area.

With woven plastic fabrics or semiplastic fabrics, such as plastic warp and metal weft strands, the seam must be strong in tension and flexing, with no objectionable discontinuities in the woven geometry of the fabric. In addition, the seam must have an efficient service life and be economical to produce. Heretofore known methods have not incorporated all such specifications necessary to form an acceptable seam.

Typical of the methods in the prior art are disclosed in the United States Pat. Nos. to MacBean 3,060,547, DeBell 3,109,219 and Schuster 3,238,594.

SUMMARY OF THE INVENTION

A porous seam for interconnecting the end portions of a porous fabric having polymeric warp filaments is made by cutting adjacent warp filaments on one of said end portions to different lengths relative to one another, cutting adjacent warp filaments on the other of said end portions to different lengths relative to one another to provide a complementary pattern with respect to the first cut end portion, removing the shute filaments between the cut ends of the warp filaments so as to expose the extensions of said warp filaments, laying a polymeric replacement shute filament transversely of the warp filament extensions and in spaced relation adjacent the nearest remaining shute element on one of said end portions, moving said end portions together so that the cut ends of the warp filaments of said other end portion ride over said replacement shute and into abutting engagement with the corresponding cut ends of the warp filaments of said one end portion, and then weaving a plurality of other polymeric replacement shute filaments transversely across the exposed warp filament extensions of both of said end portions. The joints between the cut ends of the warp filament extensions are then bonded together by an adhesive material, and a further adhesive material is applied to saturate the area adjacent the joints to bond the warp and replacement shute filaments together at their areas of contact, whereafter, excess adhesive material is removed to provide the finished seam, and then the adhesive subjected to thermal curing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary top plan view of a woven fabric strip with its end portions joined together by the improved seam construction of the invention;

FIG. 2 is a fragmentary top plan view of the two end portions of the strip ready to be connected together after the warp filaments have been cut and the shute filaments removed, and with the first replacement shute placed in position;

FIG. 3 is an enlarged fragmentary side elevation view of the end portions of the fabric strip shown in FIG. 2, but illustrating the intended position of the replacement shute filaments on the right hand end of the fabric;

FIG. 4 is an enlarged fragmentary side elevation view looking in the direction of the line 4—4 of FIG. 1;

FIG. 5 is a fragmentary vertical section view taken along the line 5—5 of FIG. 4;

FIG. 6 is an enlarged fragmentary section view illustrating one method of cutting the ends of the warp filaments in accordance with the invention; and

FIG. 7 is an enlarged fragmentary section view illustrating another method of cutting the warp filaments in accordance with the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings and in particular to FIG. 1, there is illustrated a length of Fourdrinier type fabric, designated generally at F, with the warp filaments being indicated at **1** to **11** and the shute strands or filaments being indicated at **20** to **36**, respectively. In the form shown, the fabric has a plain weave in which an evenly spaced pattern of warps and shutes form a series of openings therebetween. The warp filaments are shown (FIG. **3**) as overlying one shute filament and underlying the next adjacent shute filament etc., so as to provide a transverse line of knuckles over every other shute filament when looking either from the top or bottom side of the fabric.

In FIG. **1**, the two opposed transverse end portions of the fabric are connected together by the improved seam, designated generally at S, and made in accordance with the invention to provide a composite unitary structure, such as a filter, screen, belt or the like. FIG. **2** illustrates one end portion A, such as the right hand, and the other end portion B, such as the left hand, spaced apart from another and ready to be joined into the fabric F, as shown in FIG. **1**.

In the main body of the fabric F, the warp filaments, such as **1** to **11**, may be made from a polymeric material while the shute filaments, such as **20** to **25** and **31** to **36**, may be made from a metallic material of the type known in the art. Alternately, the warp filaments may be made of a plastic material and the shute filaments may also be made of a polymeric material. The types of polymeric materials which may be employed will be more fully described hereinafter.

As an initial step in the seaming operation, the two end portions A and B of the fabric may be heat treated to remove internal stress in the material and to stabilize the fabric to prevent shrinkage upon subsequent use at elevated temperatures as may occur in use of the paper making machine. For filaments comprised of a polyester material, the heat treatment may be carried out at a temperature of about 200° F. for about twenty minutes to heat set the fabric.

In forming the seam S, the adjacent ends A and B of the fabric are cut, so that the ends of the warp filaments are trimmed square. Moreover, if butted together with edges in perfect alignment, the warp filaments 1–A to 11–A are substantially parallel and appear to be geometrically continuous with the warp filaments 1–B to 11–B, as best seen in FIGS. 1 and 2.

After the end portions A and B of the fabric have been cut, the warp filaments of each of the respective portions are cut back and the shutes removed in accordance with a predetermined pattern, such as shown in FIG. 2. In one form, this may be accomplished by cutting alternate warp filaments on each end portion so that 3 or more shutes lie transversely between the cut and the adjacent terminal edge of the fabric. For example, the cutting may proceed in end portion A by cutting warp filaments 1–A, 3–A, 5–A, 7–A, 9–A, etc., in one plane extending transversely of the fabric, and by cutting adjacent warp filaments 2–A, 4–A, 6–A, 8–A, 10–A, etc. in another plane extending transversely of the fabric. After such pattern is cut, the shute filaments within this marginal area are removed so as to form the warp pickets shown in FIG. 2. This sequence of cutting the warp filaments and removal of the shute filaments is similarly carried out with respect to the adjacent end portion B. Preferably, the cutting on end portion A is taken from the top side of the fabric while the cutting on end portion B is taken from the bottom side of the fabric. In addition, it is preferred that the cutting of the warp filaments take place from bottom to top, as viewed in FIG. 2.

After the patterns in the end portions A and B are cut, and the shutes are removed, the end portion A (cut from the top side) may then be laid upon a support, such as an assembly table, and held against movement adjacent its cut edge by suitable means, such as a weight. A polymeric replacement shute, such as 26, may then be laid transversely (FIG. 2) across the trough which is formed by the upper surfaces of the innermost bottom warp knuckles in the pickets of warp filaments, 1–A, 3–A, 5–A, etc.

Upon placement of the shute filament 26, the end portion B of the fabric may then be moved into interfitting relationship with the end portion A until the cut ends of the corresponding and complementary warp filaments in each portion abut one another. Such abutment may be assured by perfectly aligning the fabric along one edge. Thus, the end of warp filament 1–A on the portion A abuts the end of the warp filament 1–B on the other portion B of the fabric. Similarly, the ends of warp filaments 2–B, 4–B, 6–B, 8–B and 10–B, abut the ends of warp filaments 2–A, 4–A, 6–A, 8–A, etc. After the end portions A and B have been brought together, the end portion B may also be held against movement on the assembly table as by a second weight. It has been found, for example, that magnetic metals weights laid on the surface of the fabric near the seam area are effective for holding the ends of the fabric during the seaming operation.

After intermeshing the end portions A and B in this manner, additional replacement shute filaments of polymeric material are progressively woven into place. In the form shown, this may be achieved by hand "picking" into place a second replacement shute, such as 27, by progressively lifting the pickets on the end portion A and sliding the shute into place. For example, commencing at the lower side of FIG. 2, the shute filament 27 is picked under warp 1–A, over warp 2–B, under warp 3–A, over warp 4–B, etc., until the shute is placed beneath all the warps in the row. Thus positioned, the fabric, including the end portions A and B, may then for convenience be lifted into a generally vertical position, whereupon, a third polymeric replacement shute, such as 28, may be hand woven (i.e., picked) into place, but from the bottom side of the fabric. For example, the shute 28 may be picked over warp 1–A, under warp 2–B, over warp 3–A, under warp 4–B, etc., thereby to complete the row. After the third shute 28 is positioned, a fourth polymeric replacement shute filament, such as 29, may then be picked into place while the fabric is still in the vertical position, but from the top side of the fabric. For example, the picking would proceed under warp 1–A, over warp 2–B, under warp 3–A, over warp 4–B, etc. Preferably, a fifth polymeric replacement shute, such as 30, may then be picked into place while the seam area remains in the vertical position, but from the bottom side of the fabric by picking the shute over warp 1–A, under warp 2–B, etc., in the same manner described in connection with the third shute 28. By this method, an effective seam area is provided, except for the interlocking joint between the corresponding cut warps of both end portions, and which may be achieved without the need for specially shaped shutes and/or auxiliary drawing techniques for inserting the shutes into the seam area.

It will be appreciated that the width of the seam area A is actually very narrow as compared to the actual dimensions of the fabric which may vary dependent on such factors as the size and/or number of shute filaments employed. In this connection, it will be understood that while 5 replacement shute filaments are preferred to provide the seam, a less number, such as 4 or 3, may also be employed, as desired.

In cutting the warp filaments, it is important that a tool, such as a thin razor-type blade, narrow enough to fit into the fabric geometry and cut the individual filaments without distorting and/or cutting adjacent filaments of the fabric to be employed. In addition, the angle and position of the cut are important to achieve proper abutment of the filament ends. In the invention, basically two freehand-type cuts may be employed. In one method (FIG. 6), the cut is made between shutes 31 and 40 (previously removed) by slicing through the warp filament, such as 1–A, at approximately its midpoint, as at 54, as it slopes upward from the bottom toward the top of the fabric and at an angle B, such as 60°, with respect to a line extending perpendicular to the general plane of the fabric. Accordingly, to insure that the mating ends of the warp filaments will abut flatly against each other, the angle of cut on one filament preferably supplements the angle of cut on the mating filament end. In this regard, the cut on the long warp pickets, such as 1–A, 3–A, etc., can also be made by a hand shears by making the cut supplementary to the angle of cut for the short warp pickets, such as 2–A, 4–A, etc., as aforesaid.

The aforementioned second cut which may be employed may be achieved, as shown in FIG. 7, by placing the cutting tool T (blade edge) at the point, such as 52, at which the upper surface of the bottom warp knuckle 55, of the warp 1–A meets the peripheral surface of the shute filament 40. By placing the blade at point 52 from the top side of the fabric, the cut can be made at an angle A of approximately 45° with respect to a line which extends perpendicular to the general plane of the fabric. This provides a cut through the warp filament, such as 1–A, which is hidden from view when looking from the top side of the fabric. Similarly, the warp filaments which are used for forming the short pickets on the end A, may be cut in the manner described in connection with the formation of the short pickets on end B, and as illustrated in either FIG. 6 or 7, while the ends of the long pickets on end A are cut at an angle supplementary to that of the short pickets on end A.

Prior to bonding the abutting ends of the warp filaments together, it has been found that the surfaces of the filaments which comprise the seam and a portion of the body of the fabric on each side of the seam may be treated to enhance their adhesive characteristics. In one method, the surface of the filaments may be roughened by blasting the surface with small particles of abrasive material, such as micron-sized silicon carbide. This method may be carried out following the removal of the shute filaments and after the warp pickets have been cut at their ends. Preferably, both the top and bottom surfaces of the seam are treated in this manner so that all exposed surfaces of the warps are roughened. This treatment may also be employed after assembly (meshing) of the end portions A and B so as to increase the adhesability of all the filament surfaces in the region of the seam and to remove any soil or the like deposited during the seam assembly. As an alternate method, a suitable electrical corona discharge treatment may be employed. By either method, it has been found that seam strengths improve by about 25 percent as compared to seam strengths as derived from adhering untreated seams.

In the invention, the warp filaments and the replacement shute filaments for the seam are comprised of a polymeric material. Preferably, such filaments are formed of a polyester resin, such as polyethylene terephthalate. For example, a polyester filament having a diameter of 0.032 inch is available from the Goodyear Polyester Products Department under the trade name, VITEL, type VFR 1676, or a 0.025 millimeter polyester filament available from the American Hoechst Company under the trade name TRIVERA, or a 0.020 millimeter polyester filament available from the American Hoechst Company under the trade name TRIVERA, type P, may be employed for the warps. For the shute, 0.020 millimeter polyester filaments available from the American Hoechst Company under the trade names TRIVERA, type PR and TRIVERA, type PRN, may be employed. In the case of semi-polymeric fabrics, such as when metal shutes are employed during weaving for use in paper making belts, it is preferred that the polymeric material for the filaments of the seam have a low thermal shrinkage, such as about 1 percent shrinkage by length at a temperature of about 212° F.

After the end portions A and B of the fabric have been assembled (intermeshed), the abutting ends of the warp filaments are bonded to one another. In one form, the bonding may be achieved by the application of an adhesive by means of a tool, such as a hypodermic syringe needle, which, for example, may have an 0.006 inch I.D. and a 0.013 inch O.D. The needle may be force fed by a micro-metering pump of the type available from the Pyles Equipment Company. In use, the needle may be mounted on a suitable support (not shown) and may be guided along a row of joints in the seam pickets so as to disperse a metered amount of adhesive to provide the joints, such as **54**, between the free cut ends of the opposed warp filaments, as seen in FIGS. **1** and **4**. The other row of joints, as at **56**, is similarly treated so that all the joints are filled with the adhesive and without filling the openings in the fabric adjacent the bond.

The adhesive material employed will depend on the material of which the warp and shute filaments are formed to provide a compatible and strong adhesive bond therebetween. For polyester filaments, at least three classes of adhesive material have been found to be useful including (**1**) polyester resin cured with a free radical catalyst, (**2**) phenoxy resin cured with free isocyanate prepolymeris, and (**3**) vinyl acetate maleic acid ethylene terpolymer cured with urea formaldehyde. The curing agents or catalysts are added to the resins to cause them to become tough, strong and water resistant after curing. For example, when the warps are polyester filaments, the adhesive material applied may be equal weights of a polyester resin (available under the trade name MOBAY R–12) and trimethylolpropane adduct of tolylene di-isocyanate (available under the trade name MOBAY CB–75).

To effect completion of the curing process, the applied adhesive is preferably heated to a temperature sufficient to cause a complete cure within a time period suitably short for production purposes. It is preferred that the temperature never be equal to or greater than the temperature employed to thermally stabilize (heat set) the warp pickets prior to cutting thereof. By this method, the seam area remains stable throughout the adhesive cure so as to insure proper strength characteristics at the joints. Moreover, any thermal movement and/or shrinkage of the pickets during the curing period would disrupt the bonding effect which takes place during the cure. For a polyester type adhesive material and a preseam thermal treatment at about 200° F., the cure may be carried out at a temperature of about 175° F. and at a time between about 3 to 4 hours, for example. The joints may then be allowed to cool or cooled to ambient temperature, as desired.

After the picket joints have been cured and cooled in the manner aforesaid, the entire area of the seam S is then preferably saturated with an adhesive material. After saturation of the seam, the excess adhesive material which fills the mesh may be blown off, such as by compressed air, at about 100 lbs. p.s.i. so that there is provided a thin film of material adhering to the exposed surfaces of the filaments. This remaining film of material is sufficient to provide a filleting, as at **58**, around the crossovers of the warp and shute filaments, as seen in FIG. **5**. Upon curing of the fillet material, the warp and shute filaments are further adhered to one another so as to increase the overall strength of the seam. Such curing of the saturating adhesive may be achieved by the addition of a suitable catalyst of the types aforementioned and/or by the application of heat at a temperature which is also applied below the thermal stabilizing (heat set) temperature for the seam. For example, with a polyester bond adhesive, such as available under the trade name MOBAY CB–75, the cure may be carried out at a temperature of about 175° F. for a period of about 3 hours. In curing, there is achieved a cross-linking between the adhesive material for the warp joints and the saturating adhesive material to provide a strong bond between the warp and shute filaments.

In the invention, the saturating adhesive may be diluted with a solvent which is appropriate for the resin of which the warp and shute filaments are formed. For example, when the saturating adhesive is MOBAY CB–75, it may be diluted with cellosolve acetate to a viscosity of about 0.1 poises. The use of the solvent thins the adhesive and facilitates blowing-out of the mesh openings, particularly as the mesh count per square inch increases. In the form shown, saturation of the seam following the bonding of the joints prevents movement of the warp pickets so as to eliminate geometric discontinuities, thus effecting a better quality seam.

As a specific example, the invention was carried out by making a 70 by 58 mesh fabric of polyester warp and shute filaments which were heat set at 275° F. for 5 minutes. The material for the warp was 0.20 (mm) and 0.25 (mm), available under the trade designations as types P No. 087031 and PRN No. 017032, respectively, from the American Hoechst Company. The adhesive for the seam was a mixture in a ratio of 1:1 of the trade name materials MULTRON R–12 (polyester) and MONDUR CB–75 (isocyanate), available from the Mobay Chemical Company. This adhesive mixture was cured at a temperature of 140° F. for a period of 18 hours.

By the foregoing method, there is provided a seam which will not yield or separate in any manner until after the tensile yield strength of the fabric has been surpassed so as to achieve a seam which is especially suitable as to durability in tension. Furthermore, it has been found that the fatigue life of the seam is comparable to that of the body of the fabric, and also that the seam does not mark the paper made upon it to any significant extent.

Accordingly, it will be seen that this method of seaming can be applied to other forms of weaving other than that illustrated. Similarly, the method may be applied in making other types of relatively fine mesh fabrics and for other purposes.

The terms and expressions which have been used are used as terms of description and not of limitation and there is no intention in the use of such terms and expressions of excluding any equivalents of the features shown or described or portions thereof and it is recognized that various modifications may be possible within the scope of the invention claimed.

I claim:

1. A method for joining together the end portions of a porous, woven fabric strip having warp and shute filaments to form an endless article, comprising the steps of

cutting at least some of the warp filaments adjacent one of said end portions to different lengths relative to one another to form a first set of warp pickets defining a pattern of points of warp filament severance,

cutting at least some of the warp filaments adjacent another of said end portions to different lengths relative to one another to form a second set of warp pickets defining a complementary pattern of points of warp filament severance,

removing the shute filaments from each of said end portions between the respective points of warp severance and the terminal ends of said end portions,

placing a first replacement shute transversely of and in overlying relation to at least some of said warp pickets of said first set of warp pickets and in spaced relation adjacent to the remaining original shute filament nearest the terminal end of said one end portion,

moving both of said end portions together with said second set of warp pickets positioned in overlying contact with said first replacement shute and with the ends of said second set of warp pickets positioned in abutting end-to-end engagement with the corresponding complementary ends of said first set of warp pickets,

progressively weaving at least one additional replacement shute, one at a time, into transverse relation with relation to the remaining exposed warp pickets of said first and second sets of warp pickets by,

commencing at a first lateral edge of said fabric and proceeding toward a second lateral edge of said fabric and proceeding toward a second lateral edge of said fabric,

progressively raising the ends of said warp filaments of said one end portion which extend beyond said first replacement shute filament in a direction toward the terminal end of said one end portion,

commencing at said first lateral edge and inserting a single additional replacement shute filament between said raised warp filaments and the remaining warp filaments transversely and progressively across the fabric to the second lateral edge, and

returning the raised warp filament to their initial unraised positions to recreate and preserve the weave pattern of the remainder of said fabric.

2. A method according to claim **1**, including the additional step of,

inserting another single additional replacement shute filament by progressively raising said warp filaments of said one end in a direction opposite to the direction raised for inserting said single additional replacement shute filament

3. A method according to claim **2**, including

weaving still further replacement shute filaments, one at a time until the number of replacement shute filaments equals the number of shute filaments removed from said one end portion of said fabric.

4. A method according to claim **6**, wherein

at least the end portions of the fabric are heat set prior to the joining together of the end portions of the fabric.

5. A method according to claim **1**, wherein

said shute filaments are made of a metallic material.

6. A method according to claim **1**, wherein

said warp filaments comprise a polyester material.

7. A method according to claim **6**, wherein

at least the end portions of said warp filaments are heat set at a temperature of about 200° F. for a duration of about 20 minutes prior to joining together the end portions of the fabric.

8. A method according to claim **1**, wherein

said shute filaments are made of a polymeric material.

9. A method according to claim **1**, wherein

the cutting on one of said end portions is taken from the top surface of said fabric, and

the cutting on another of said end portions is taken from the bottom surface of said fabric.

10. A method according to claim **1** wherein

said additional replacement shute filaments are woven from alternate surfaces of said fabric.

11. A method according to claim **1**, wherein

each end portion during said cutting steps is cut with the distance between the respective end portion of the fabric and the farthest point of warp severance being about five shute filament spacings,

five shute filaments are removed, and

five replacement shute filaments are woven into said fabric.

12. A method according to claim **1**, wherein

said some warp filaments of at least one of said end portions are cut across the filaments at a point on each filament between adjacent shute-warp crossings.

13. A method according to claim **12**, wherein

said some warp filaments of at least one of said end portions are cut at an angle of about 60° with respect to a line extending perpendicular to the general plane of the fabric.

14. A method according to claim **1**, wherein

said some warp filaments of at least one of said end portions are cut across the filaments adjacent a point on each of said filaments at which the warp filament contacts the peripheral surface of a shute filament.

15. A method according to claim **14**, wherein

said some warp filaments are cut at an angle of about 45° with respect to a line extending perpendicular to the general plane of the fabric.

16. A method according to claim **1**, wherein

said some of said warp filaments are angularly cut, and

the cut warp filaments adjacent one end portion are cut at an angle which is the supplement of the angle at which the cut warp filaments adjacent the other end portion are cut.

17. A method according to claim **1**, wherein,

adhesive material is applied to the warp and weft filaments in the region of the seam in sufficient quantity to fill the interstices between the warp and weft filaments which comprise the seam and a portion of the body of the fabric on each side of the seam, and wherein excess adhesive material is pneumatically removed from the filaments.

18. A method in accordance with claim **1**, including,

the step of increasing the adherability of the warp picket filament surfaces to the adhesive prior to the application of adhesive material thereto.

19. A method in accordance with claim **18**, wherein

said surfaces are blasted with abrasive particles.

20. A method in accordance with claim **18**, wherein

said surfaces are subjected to electrical corona discharge treatment.

21. A method according to claim **1**, wherein

said replacement shute filaments have a maximum thermal shrinkage of about 1° shrinkage by length when subjected to a temperature of about 212° F.

22. A method according to claim **1**, wherein

adhesive material is applied to the joints between free cut ends of opposed warp filaments without substantially filling spaces between adjacent shute filaments and between adjacent warp filaments.

23. A method according to claim **22**, wherein

additional adhesive material is applied to the warp and weft filaments in the region of the seam in sufficient quantity to fill the interstices between the warp and weft filaments which comprise the seam and a portion of the body of the fabric on each side of the seam, and wherein excess adhesive material is pneumatically removed from the filaments.

24. A method according to claim **22**, wherein

at least the end portions of the fabric are heat set prior to the joining together of the end portions of the fabric, and

said adhesive material is cured at a temperature below the temperature at which said end portions are heat set.

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