

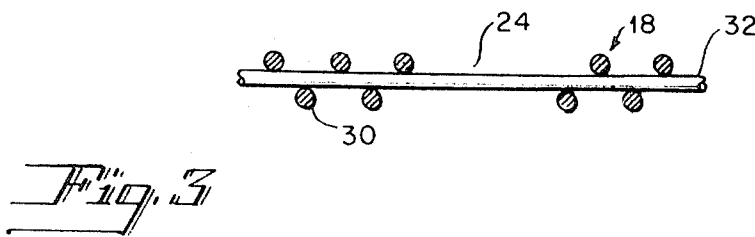
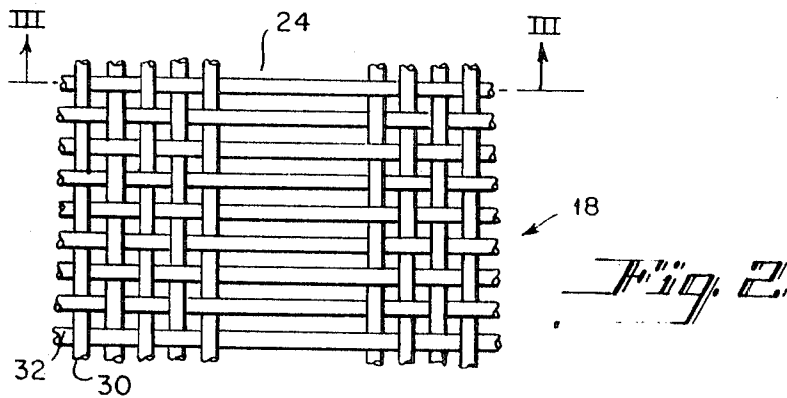
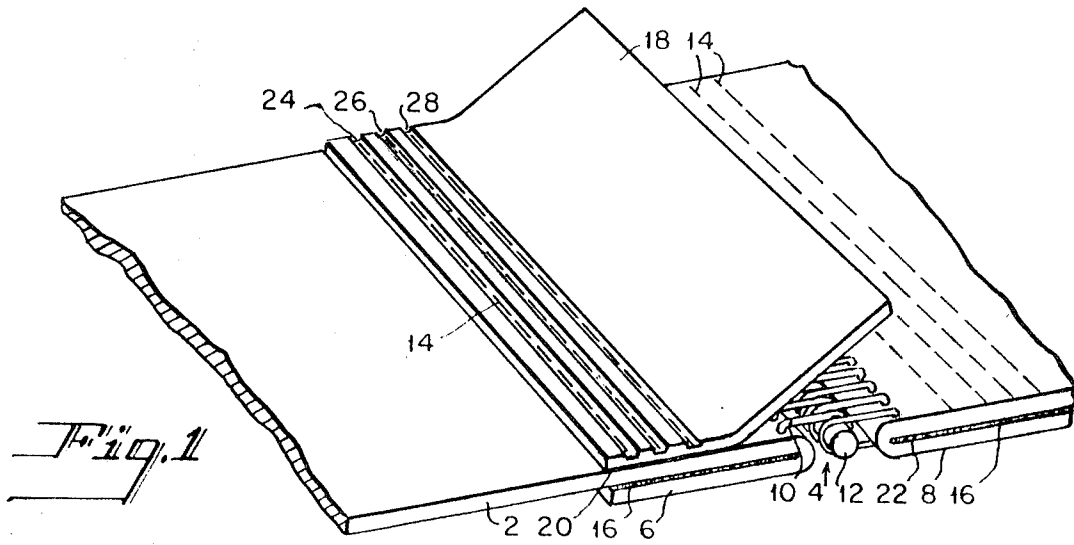
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SEAMS FOR PAPERMAKING CLOTHING

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SEAMS FOR PAPERMAKING CLOTHING
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18 Claims

ABSTRACT OF THE DISCLOSURE

This invention relates to seams for joining together the ends of conveyor belts used in paper manufacturing that include means for flexibly interconnecting the ends, and comprises a flap having at least one channel, which flap covers all of the connecting means and is affixed to the paper contacting surface of said belt by yarns which are positioned in said flap.

BACKGROUND OF THE INVENTION

In the typical papermaking machine, such as the so-called Fourdrinier machine, an aqueous suspension of fibers called the "furnish" is flowed onto a travelling forming medium, generally an endless woven belt of wire and/or synthetic material, to form paper or paper-like material, such as board, pulp, asbestos sheet, or the like. As the forming medium travels through the forming section of the machine, much of the water is removed from the "furnish" and a somewhat self-supporting, continuous paper web is formed. This water removal is facilitated by the use of such well-known devices as hydrofoils, table rolls and/or suction boxes.

The web is then transferred to the press section of the machine, where still more of its water content is removed. This is accomplished by passing the paper web through a series of nips formed by cooperating press rolls; these press rolls also serving to compact the web.

The paper web is then transferred to the dryer section of the machine where it is passed about and held in contact with a series of heated, generally cylindrical dryer rolls, or cans, to remove still further amounts of water therefrom. In most instances, the dryer rolls will be arranged in upper and lower parallel arrays with the continuous web being passed upward and downward in a serpentine manner about the rolls. The surface of the dryer rolls usually is imperforate and the web is held in contact therewith over at least a portion of the surface thereof by an endless, and preferably porous, belt or backing material (herein referred to as a "dryer fabric").

In the past, dryer fabrics have generally been made of a relatively impervious, blanket-like construction. However, the modern trend is to utilize an open weave porous material, usually of natural or synthetic fibers, as such open weave fabrics readily permit fluids to pass therethrough. Such fabrics may be woven endless, but, since such a fabric must be cut in order to install it on the papermaking machine, most dryer fabrics produced today are woven flat to begin with and are made endless by joining the ends together. However the fabric may have been woven, the join is effected by connecting means, as, for example, a clipper seam. A clipper seam is a flexible hinge-like structure comprising a series of inter-leaved clipper hooks clinched to both ends of the flat fabric, and having an elongated connector, customarily in the form of a cable or pintle wire, extending through the hooks to hold the fabric in place. In order to prevent the various components of the connecting means from marking the paper product during manufacture, a flap material is usually attached to the paper contacting surface of the dryer fabric such that the flap material extends across

the full width of the fabric covering substantially all of the connecting means.

One of the problems papermakers have is the tendency for the flap to become partially or totally torn from the dryer fabric while there is a considerable amount of useful life remaining in the fabric, causing the connecting means to mark the paper web. It is then necessary for the papermaker to shut down the paper machine and remove the fabric so that the flap may be restitched to the fabric before the fabric can be used again.

Without intending to be bound by any statement of theory, it is believed that flap failure results from portions of the threads which are used to unite the flap to the fabric being abraded; that is, as the dryer fabric serpentine through the dryer section of the paper machine, the portions of the sewing threads which are at the surface of the flap come into contact with the paper web and hold the web against the surface of the dryer cans in such a manner that the force exerted by the fabric against the paper web and dryer cans causes the sewing yarns to abrade and break.

Attempts have been made to produce a seam having a flap material which will remain attached to the fabric for the operating life thereof. For example, attempts have been made to eliminate sewing yarn abrasion and thereby cause the flap material to stay affixed to the fabric for the full life thereof. Thus, the sewing yarns which are exposed to the paper-contacting surface of the flap material have been covered with a protective resin. However, after the dryer fabrics embodying such seam constructions are in operation a short period of time, the resin coating wears away to such an extent that the sewing yarns become exposed at the surface of the flap such that they abrade and break. Efforts to increase the amount of resin used have not been successful in that excessive resin on the sewing yarn alone renders it difficult or impossible to sew, while excessive resin affixed to the yarn region after sewing has the effect of rendering the flap material too stiff for dryer fabric applications considering the tortuous path through which the fabric travels during the papermaking process.

Accordingly, it is an object of this invention to produce a flap for papermaking clothing, which will withstand the vigorous treatment said clothing is subjected to while in operation.

Another object of this invention is to produce a flap for papermaking clothing which is inexpensive and not time-consuming in producing.

Still another object of this invention is to produce a flap for a dryer fabric which will remain operative throughout a substantial portion or all of the useful life of said fabric.

Another object of this invention is to produce a flap for a dryer fabric wherein sewing thread abrasion is substantially reduced, or even eliminated.

Still another object is to produce a seam for papermaking clothing comprising a flap material embodying the present invention which will remain operative throughout a substantial portion or all of the useful life of said fabric.

SUMMARY OF THE INVENTION

These and other objects may be achieved through practice of the present invention which comprises a flap, and a method for making same, alone and in combination with means affixed to said clothing for flexibly interconnecting both ends thereof, characterized by having a channel in the paper-contacting surface wherein the yarns by which the flap is affixed to the fabric body may be positioned.

DESCRIPTION OF DRAWINGS

This invention may be clearly understood by reference to the attached drawings wherein like reference characters

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denote corresponding parts throughout the several views:

FIG. 1 is a fragmentary perspective view of a clipper seam comprising a flap material produced in accordance with the teachings of the present invention.

FIG. 2 is a fragmentary plan view of the flap material shown in FIG. 1, the separation of the various yarns of the flap material being exaggerated for clarity of illustration.

FIG. 3 is a fragmentary view taken along line III—III of FIG. 2.

DESCRIPTION OF PREFERRED EMBODIMENT

The embodiment of this invention, which is illustrated in FIGS. 1 through 3, is one which is particularly suited for achieving the objects of this invention. FIG. 1 depicts a dryer fabric 2 which has been rendered endless by means of clipper seam 4 wherein the fabric has been folded back upon itself with clipper hooks 10 being affixed to the folded back portion of fabric 2. The clipper hooks attached to one end of the fabric 2 interleave with the clipper hooks attached to the other end of the fabric 2, a pintle wire 12 being inserted therebetween. Although FIG. 1 depicts what is generally known in the art as a "continuous fold back seam," it should be understood that the present invention may be practiced with other types of seams also; for example, a segmented seam as disclosed and claimed in Wagner, U.S. Pat. No. 3,281,905, or seams which comprise separate reinforcing strips affixed to and extending substantially across the entire width of each of the ends of the fabric, with the clipper hooks being affixed to the fabric and the reinforcing strips, as well as other known seaming methods which do not utilize clipper hooks such as those where the fabric ends are joined by means of a zipper.

Fabric 2 may comprise any construction suitable for use in the dryer section of a papermaking machine such as an all-synthetic open weave DRI-FAB® fabric as manufactured and sold in the United States by the Formex Company Division of Huyck Corporation, or one produced in accordance with the teachings of Clark, U.S. Pat. No. 3,325,909. Since in most cases it is necessary to avoid marking of the paper web resulting from contact with the components of the seam, including the clipper hooks, a flap material 18 is so affixed to one end of the paper-contacting side of the fabric 2 that it covers substantially all of the clipper hooks across the full width of the fabric. As depicted in the drawings, flap material 18 may be sewn to fabric 2, by utilizing the same sewing threads 14 which maintain the folded back portions 6, 8 in place. Adhesive 20 or other bonding agents optionally may be disposed at the fabric-flap material interface to increase the strength of the composite structure.

The flap material of the present invention may comprise a woven tape such as disclosed in Wagner, U.S. Pat. No. 3,316,599, or any other flap material having the requisite physical characteristics. In FIGS. 1 through 3, flap material 18 comprises a woven tape having grooves or channels 24, 26 and 28 in which the sewing yarns which connect the flap to the fabric are positioned. Although FIG. 1 depicts three rows of grooves or channels 24, 26, and 28 which extend substantially in the lengthwise direction of the tape across the entire width of the fabric in the cross-machine direction (that is, the direction normal to the "machine direction," which is the direction in which the fabric travels during the papermaking process) the present invention is not limited to such a structure. For example, more or fewer than three grooves may be used, and the grooves may extend in the machine direction, or be angularly disposed relative to the machine and/or cross-machine direction.

In some dryer section applications, the thickness or bulk of the flap or tape preferably may be maintained at a minimum. In these situations, tapes of single-layer construction, such as the plain weave tape 18 depicted in FIGS. 2 and 3 are of particular utility. The present invention is not limited to such a weave pattern, however,

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for other weaves may be employed, including twill weaves and basket weaves. Alternatively, it may be desirable to employ a multilayer tape to improve the durability characteristics of the tape and to further reduce the possibility of transmitting an impression of the interconnection therethrough to the web of paper.

Tapes constructed in accordance with the invention may be woven with warps and filling yarns of any of a wide variety of materials, combinations of materials, and constructions, such as, for example, heat-resistant material. Representative synthetic materials that may be used for the yarns of the tape include monofilament and multifilament yarns such as nylons (a polyamide), polyesters such as Dacron, or acrylics, such as Orlon, and similar materials, fiberglass, asbestos, or blends of any of the foregoing materials alone or in combination with natural materials. In cases in which the tape is subjected to repeated wetting and drying, polyester (Dacron) is of particular utility because of good dimensional stability. Polyamide (nylon) is useful on paper machines in which the tape is subjected to high abrasion, although its resistance to heat degradation is not as good as some of the other synthetic yarns presently available. In addition, some forms of polyamides exhibit extremely high resistance to temperature and include other properties which make them highly desirable for use in the drying section of many types of machines.

Of course, the specific synthetic materials discussed above are but illustrative of a wide variety of materials that may be used for the various yarns of flaps constructed in accordance with the present invention. In addition, when the flap comprises a woven tape, the material of the yarns may be non-synthetic such as cotton, fiberglass, metallic or asbestos, or may be a combination of synthetic and nonsynthetic yarns.

Optionally, the flap material may be subjected to any thermal and/or chemical treatments in order to improve its physical characteristics for use in the environment to which it is to be exposed.

As depicted in FIG. 1, the flap material 18 is affixed to fabric 2 by means of sewing threads 14 such that the threads reside in channels 24, 26 and 28 below the surface of the flap. The sewing threads 14 may comprise any material strong enough to withstand those shearing stresses to which the flap material is subjected during the papermaking operation, such as synthetic polyester or polyamide multifilament yarns.

Referring to FIGS. 2 and 3, the groove 24 results from the elimination of at least one yarn 30 as described hereinafter in greater detail; that is, in those cases where the flap material comprises a tape, the constituent elements of which are yarn or strand-like structures, each channel or groove 24 in a surface thereof may be effected by the elimination of one or more yarns as described hereinafter. The elimination of yarns to effect channeling may be accomplished either during or subsequent to, the weaving of the tape. For example, the flap may be woven in such a manner that one or more yarns is omitted or "dropped" from the weaving pattern during the weaving process, or yarns may be used in the area of the groove or channel the diameter of which is less than the diameter of the remaining yarns of the woven tape. For example, the channel may be formed by weaving into the flap at least one yarn the diameter of which is less than the diameter of the yarns of the remaining portion of the tape. It should be noted that by the use of the word "diameter" it is not meant to limit the scope of the present invention to the use of yarns, a cross-sectional view of which is circular. Rather, "diameter" is used in its broadest sense and means the length of a straight line through the center of gravity of a cross-sectional view of a circular or non-circular yarn or strand-like materials. Alternatively channeling may be accomplished subsequent to the weaving of the tape, by removing or eliminating from the tape one or more of the constituent yarns. Thus a yarn or yarns may

be manually pulled from the woven structure subsequent to the weaving thereof. Alternatively, water or chemical soluble yarns, such as for example, alginate or acetate yarns, may be woven into the tape in the area where the grooves or channels are required, and subsequent to the weaving process, the soluble yarns may be dissolved. In a further embodiment of the present invention, woven or non-woven tapes may be channeled by burning or melting a groove in a surface thereof by means of, for example, a needlelike iron which has been heated. Although FIGS. 2 and 3 depict a channel or groove effected by the elimination of four yarns 30, the present invention is not limited as such, and more or fewer yarns may be eliminated. Alternatively, in those cases where the flap material comprises a perforate or imperforate plastic strip, grooves may merely be routed out of the surface of the flap as described hereinafter. Thus, it will be apparent that by "channel" is meant a groove or depression in the paper-contacting surface of the flap characterized in that its width is at least as wide as the means by which the flap is affixed to the papermakers clothing in question, and in depth is at least as deep as the height of the means by which the flap is affixed to the papermakers clothing. "Depth," in this context means the minimum distance between the effective plane of contact of the paper-contacting surface with the paper web and the least distant portion of the bottom of the channel. Thus, with respect to a routed-out channel in a plastic, sheet-like flap, the "depth" of the channel will be the distance between the paper-contacting surface of the flap and the base of the channel. But with respect to a woven structure in which yarns from one array are eliminated, the "depth" will be the distance between the effective plane of contact with the paper web and the uppermost peripheral point on a cross-section of yarns in the remaining array in the channel (i.e., the array at 90° to the yarns which have been eliminated). In this manner, after the flap has been sewn to the clothing, the sewing yarn will not extend above the paper-contacting surface of the flap.

It has been found that a clipper seam embodying the teachings of the present invention exhibits unexpectedly advantageous results when positioned on a papermaking machine. For example, in those cases where a channeled flap as disclosed herein is sewn to the dryer fabric, sewing thread breakage due to repetitive contact between the flap material and dryer cans is substantially reduced, and the operative life of the seam is increased accordingly, relative to seams heretofore used. Without wishing or intending to be bound by a theory of operation, it is believed that such breakage of the sewing thread is so reduced because since the sewing threads are positioned in the channel or groove and are therefore disposed beneath the surface of the flap material, these threads are not abraded as a result of the force which the threads exert against the paper web during the point in time when the seamed portion of the dryer fabric holds the paper web in contact with the dryer cans.

It should be noted that the flap material, and seam construction comprising the flap material, disclosed herein is useful in other applications; that is, the present invention is not limited to dryer fabrics. Rather, the teachings of the present invention are applicable to other types of papermakers clothing, such as, and by way of example only, press felts, conventional dryer felts, or various perforate or imperforate non-woven belts such as those of rubber or various synthetic materials.

EXAMPLE I

Two ends of a woven dryer fabric were joined together as set forth herein to produce an endless belt-like structure. The fabric comprised multifilament synthetic yarns woven into a four harness double satin weave wherein there were 30 picks per inch and 56 ends per inch. The fabric was subjected to a resin treatment and heat set for

stabilization. Both ends of the fabric were folded back upon the remaining portion of the fabric about two inches and sewn thereto by means of multifilament polyester Terylene sewing yarns. Clipper hooks were affixed to the folded back seam area at both ends of the fabric. A flap material was produced comprising multifilament polyester Dacron yarns woven into a three-ply twill weave wherein there were 44 picks per inch and 176 ends per inch. The flap material was heat set for stabilization. Finally, the tape was sewn to one end of the fabric using multifilament Terylene polyester yarns. The flap did not include channels or grooves to position the sewing yarns in. The fabric was rendered endless by inserting a pintle wire through the clipper hooks. The joined fabric was positioned on a paper machine and run at 750 feet per minute in the production of fine paper. The fabric remained in operation for about 72 days at which time it had to be removed from the paper machine due to failure of the flap material.

EXAMPLE II

Two ends of a woven dryer fabric were joined together to produce an endless belt-like structure. The fabric comprised multifilament synthetic polyester yarns woven into a four harness double satin weave wherein there were 30 picks per inch and 56 ends per inch. The fabric was subjected to a resin treatment and heat set for stabilization. Both ends of the fabric were folded back upon the remaining portion of the fabric about two inches and sewn thereto by means of multifilament Terylene polyester sewing yarns. Clipper hooks were affixed to the folded back seam area at both ends of the fabric. A flap material was produced comprising multifilament polyester Dacron yarns woven into a three-ply twill weave wherein there were 44 picks per inch and 176 ends per inch. The flap material was heat set for stabilization. In addition 6 yarns were pulled from the tape to effect two cross-machine direction channels; that is, three yarns were pulled from the tape to effect each channel. The tape was stitched to one end of the fabric by using multifilament Terylene polyester yarns sewn through the flap along the channels such that the sewing yarns were positioned in the channels beneath the surface of the flap. The fabric was rendered endless by inserting a pintle wire through the clipper hooks. The joined fabric was positioned on the same paper machine as the fabric described in Example 1, and was also run at about 750 feet per minute in the production of fine paper under similar operating conditions. This fabric has been in operation for about 6 months, the operating life already having been increased in excess of 100% compared to fabrics positioned on the same machine under similar operating conditions, as for example, the fabric described in Example I.

The embodiments which have been described herein are but some of several which utilize this invention and are set forth here by way of illustration but not of limitation. It is apparent that many other embodiments which will be readily apparent to those skilled in the art may be made without departing materially from the spirit and scope of this invention.

I claim:

1. A flap for covering a seam in papermakers clothing characterized by having at least one channel at its paper-contacting surface which is at least as wide as the means by which said flap will be stitched to said clothing and is at least as deep as the height of said means.

2. The article described in claim 1 wherein said flap comprises a woven structure.

3. The article described in claim 2 wherein said channel is formed by at least one yarn, the diameter of which is less than the diameter of the constituent yarns of the remaining portion of said flap.

4. The article described in claim 2 wherein at least one of the constituent yarns of said flap has been removed from said tape to form said channel.

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5. The article described in claim 4 wherein said channel extends substantially in the cross-machine direction.

6. The article described in claim 2 wherein said channel extends substantially in the cross-machine direction.

7. The article described in claim 1 wherein said channel extends substantially in the cross-machine direction.

8. A seam for joining the ends of papermaking clothing comprising means affixed to said clothing for flexibly interconnecting both ends of said clothing, and a flap for covering said seam characterized by having at least one channel at its paper-contacting surface which is at least as wide as the means by which said flap is stitched to said clothing and is at least as deep as the height of said means, said flap being affixed to the paper-contacting surface of said clothing by said means, said means being positioned in said channel, said flap substantially covering all of said connecting means.

9. The article described in claim 8 wherein said flap is woven.

10. The article described in claim 9 wherein at least one of the constituent yarns of said flap has been removed from said tape to form said channel.

11. The article described in claim 10 wherein said channel extends substantially in the cross-machine direction.

12. The article described in claim 9 wherein said channel extends substantially in the cross-machine direction.

13. The article described in claim 8 wherein said channel extends substantially in the cross-machine direction.

14. A method of making a flap for covering a seam in papermakers clothing comprising the steps of forming constituent material into a flap and producing at least one channel at the paper-contacting surface of said flap which is at least as wide as the means by which said flap is to be stitched to said clothing and is at least as deep as the height of said means.

15. The method of making a flap as described in claim 14 in which said forming step comprises the step of weaving.

16. The method described in claim 15 wherein said

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producing step comprises omitting during the weaving process at least one of the sequence of constituent yarns.

17. The method described in claim 15 wherein said forming step comprises the step of weaving, with selected of the constituent yarns being readily dissolvable in a chosen material and the remainder of the constituent yarns being relatively undissolvable in the chosen material in comparison to the selected yarns, and wherein said producing step comprises the step of exposing said flap material to said chosen material long enough to substantially entirely dissolve said dissolvable constituent yarns without substantially entirely dissolving said relative undissolvable constituent yarns.

18. A seam for joining the ends of a dryer fabric comprising a series of clipper hooks affixed to and extending across the entire length of each of said ends, a rod being extended through said clipper hooks to flexibly interconnect both ends of said fabric, and a flap material for covering said clipper hooks characterized by having at least one channel at its paper-contacting surface which is at least as wide as the yarn means by which said flap is stitched to said clothing and is at least as deep as the height of said means, said flap being affixed to the paper-contacting surface of said fabric by yarn means which are positioned in said channel, said flap covering substantially all of said clipper hooks and extending across substantially the full width of said fabric.

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