

Aug. 4, 1964

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3,143,150

FABRIC FOR FOURDRINIER MACHINES

Filed Oct. 18, 1961

3 Sheets-Sheet 1

Fig. 1

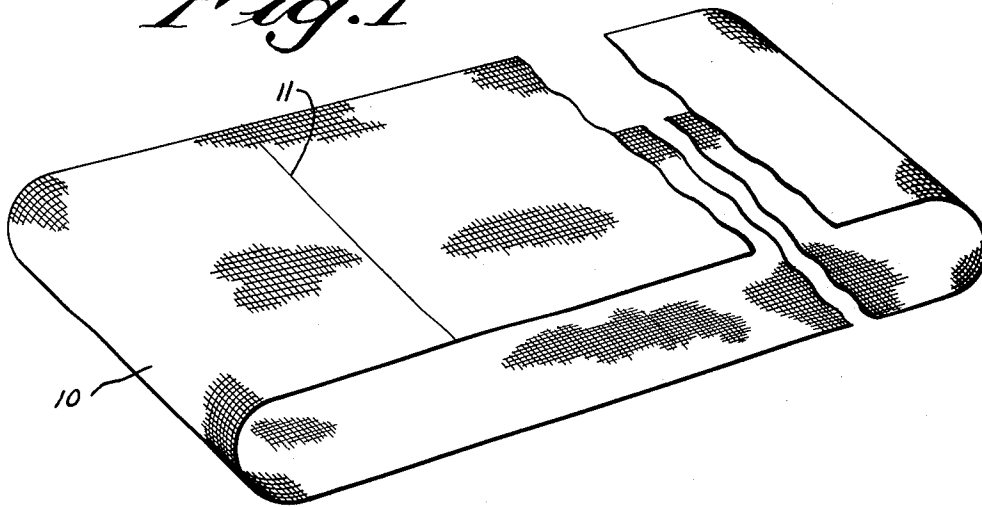
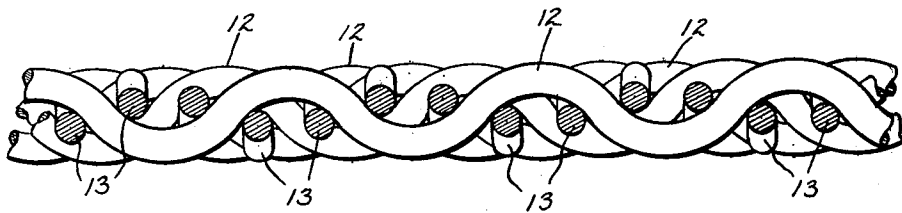


Fig. 3



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Fig. 2

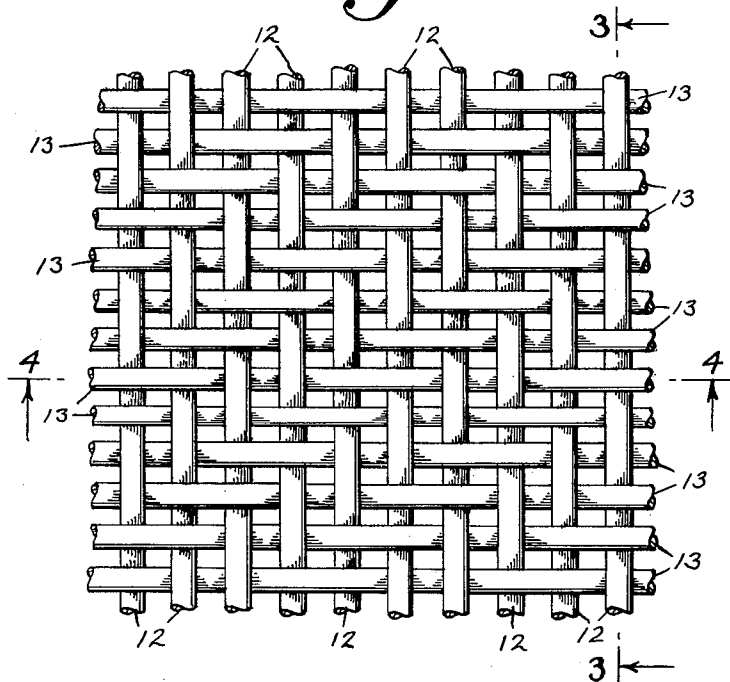
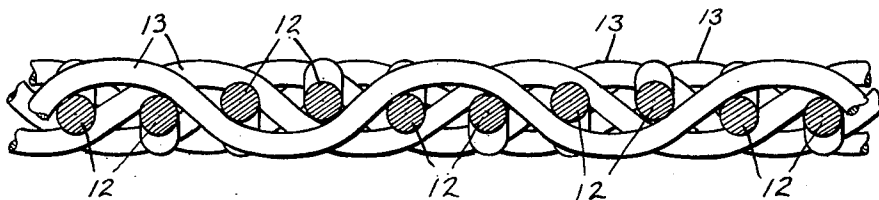


Fig. 4



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Fig. 5

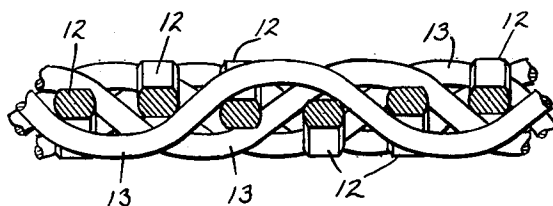


Fig. 6

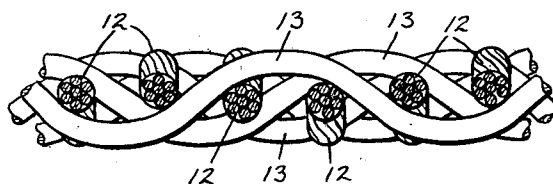
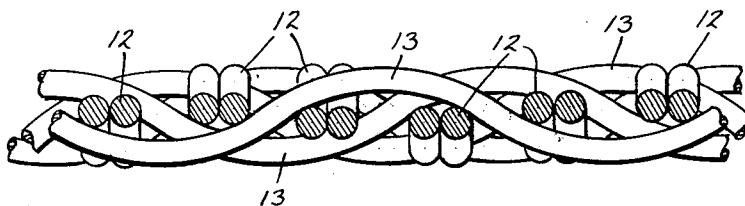


Fig. 7



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FABRIC FOR FOURDRINIER MACHINES

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10 Claims. (Cl. 139—425)

This invention relates to Fourdrinier fabrics for paper making machines and it more specifically resides in a weave for Fourdrinier fabric comprising a plurality of spaced longitudinal warp threads interwoven with a plurality of spaced transverse weft threads wherein each weft thread passes under a pair of warp threads and over a pair of warp threads in a repeated pattern and wherein there are more weft threads than warp threads per square inch of fabric and the open area of the fabric is within a specified range.

In a Fourdrinier paper making machine, paper stock is fed onto a traveling endless belt that is supported and driven by rolls associated with the machine and which serves as the paper making surface of the machine. Fourdrinier belts are commonly formed from a length of woven Fourdrinier fabric with its ends joined together in a seam to provide an endless belt. Fourdrinier fabrics of this type generally comprise a plurality of spaced longitudinal warp threads and a plurality of spaced transverse weft threads which have been woven together on a suitable loom.

While a number of different weaves have been proposed for Fourdrinier fabrics, the only two which find extensive use today are the so-called "plain" weave and the "twill" (sometimes also called semi-twill or twilled) weave. In the plain weave, each weft thread passes successively under one warp thread and then over the next warp thread, whereas in the twill weave each weft thread passes over two warp threads, under the next warp thread and then over the next two warp threads in a repeated pattern. Of these two weaves, the twill weave is the most widely used and it has been estimated that 90% of the Fourdrinier belts made are formed with this weave, see vol. III, Pulp and Paper Manufacture, page 120 (McGraw-Hill, 1953).

The Fourdrinier fabrics to which this invention relates, however, have a weave wherein each weft thread passes alternately over two warp threads and then under two warp threads, which weave will be herein referred to as a "full-twill weave" to distinguish it from the plain and twill weaves as defined above. The full-twill weave of this invention thus has a different arrangement of warp and weft threads than either the plain weave or twill weave now in general use. The full-twill weave, however, is not a new development in itself; instead, it was proposed long ago but has never been widely adopted for Fourdrinier fabrics because it possesses at least two major defects which have inhibited its use in Fourdrinier paper making machines, at least in the forms heretofore proposed.

One of these defects was that a fabric with a full-twill weave was dimensionally unstable to such an extent that it was unsuitable for Fourdrinier fabric; thus it would be termed by the trade as a "sleazy" fabric. The sleaziness of a full-twill weave Fourdrinier fabric manifests itself in the manner in which a Fourdrinier belt fashioned from such a fabric behaves while operating on a Fourdrinier paper making machine. During operation, the sleaziness of the full-twill weave Fourdrinier fabrics leads to the development of wrinkles and ridges, most of which lie generally in the machine direction although some may also lie diagonally of the belt. These ridges and wrinkles are extremely undesirable since if they are formed so as to project from the plane of the paper making side, or outer surface, of the Fourdrinier belt they lead to undesirable imperfections in the paper,

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and if they project from the wear side, or inner surface, of the Fourdrinier belt they lead to greatly reduced wire life since any such projections will wear extremely rapidly as they pass over the rolls and suction box of a Fourdrinier paper making machine. This sleaziness also leads to diagonal deformation of a full-twill weave Fourdrinier belt as it is used on a Fourdrinier paper making machine, which is evidenced by the gradual change of position of the seam in the belt during operation. Thus, although a new belt will have a seam which is perpendicular to the edges of the belt, the seam will gradually assume a diagonal or slanted position relative to the edges as the belt deforms during use. In this respect, it has been found that the full-twill weave Fourdrinier belts will often gradually deform to such an extent that one end of the seam will advance as much as 20 inches ahead of the other end of the seam, measured in the machine direction. For these reasons, the dimensional instability of the full-twill weave has prevented its widespread use as a Fourdrinier fabric and the problem has persisted to this day.

The second major defect of the full-twill weave in Fourdrinier fabric is that full-twill weave Fourdrinier fabrics which have been woven according to the customary techniques now used for plain or twill weave result in Fourdrinier fabrics that have an undesirably high drainage rate. That is, when a full-twill Fourdrinier fabric is woven to have the same percentage of open area as is now used for the plain and twill weaves, the full-twill fabric will exhibit a much higher drainage rate than fabric in the latter two weaves. Because this drainage rate has been so high as to lead to undue loss of fibers and fillers from the paper stock, the drainage characteristics of the full-twill weave fabrics in the forms heretofore proposed are not acceptable in the paper making art.

It has now been discovered that the full-twill weave can be adapted for Fourdrinier fabrics by incorporating a greater number of weft threads than warp threads per unit area of the woven fabric and by controlling the open area of the fabric to within a specified range; this discovery forms the subject matter of the present invention. Both of these features run counter to customary weaving techniques for both the plain and twill weave Fourdrinier fabrics wherein there are usually a greater number of warp threads than weft threads per unit area of fabric and wherein the fabric has a greater percentage of open area than is contemplated for the full-twill weave in accordance with this invention.

Accordingly, one of the objects of this invention is to provide Fourdrinier fabrics having a full-twill weave, i.e. a weave wherein each weft thread passes over two warp threads and then under two warp threads in a repeated pattern, which will overcome defects heretofore exhibited by the full-twill weave in the Fourdrinier paper making art.

Another object of this invention is to provide a Fourdrinier fabric having a full-twill weave of greatly improved dimensional stability and drainage characteristics to thereby enable such fabric to be useful in a Fourdrinier machine.

It is not the singular purpose, however, of the present invention to merely provide a fabric suitable for Fourdrinier machines that complements fabrics already available, but instead to also provide a fabric having characteristics that surpass those of past weaves, namely the plain and semi-twill. One of the inherent problems in continuously running a fabric over the rolls of a Fourdrinier machine is abrasive wear that erodes away fabric metal and leads to fabric failure. Down time of the paper making machine materially increases paper costs, and the provision of a fabric of longer life that will decrease

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the frequency of Fourdrinier fabric replacement has been a long sought achievement. To fulfill this need, the full-twill weave of this invention may be woven so that the crests of the warp and weft knuckles are in substantially the same plane on both surfaces of the fabric, so that a Fourdrinier belt fashioned from such fabric will provide good paper support along its outer surface and improved wear characteristics along its inner surface. Although present weaves are now woven so that the weft and warp knuckles lie in approximately the same plane on the paper making side, the warp knuckles are higher than weft knuckles on the wear, or inner, surface of the wire so that the warp knuckles must withstand most of the abrasive wear. By weaving the full-twill weave of this invention, however, so that the warp and the weft knuckles will be in the same plane on both the paper making surface and the wear surface of the belt, the increased paper support provided by having weft and warp knuckles in the same plane on the paper making surface is retained and, at the same time, some of the abrasive wear may be transferred to the weft knuckles along the inner surface. In a preferred form, the weft threads may be of a hard abrasion-resistant material and the warp threads of a relatively softer flexible material which provides a Fourdrinier fabric of excellent lift characteristics since the hard weft material will resist abrasive wear and will also serve to decrease the rate of wear of the softer warp thread material since it will generally be difficult for the warp knuckles to wear to a point below the surface of the weft knuckles. At the same time, the warp threads may be of a material flexible enough to withstand the flexing encountered in travel over and about the Fourdrinier rolls and suction box as well as being easily seamable by known soldering techniques.

Together with the foregoing achievements it has been found that the full-twill weave fashioned in accordance with the present teachings will demonstrate remarkably trouble free operation with respect to seam failures and edge cracking, so that the advantages are more than may be expected from the use of the materials and weave characteristics discussed herein.

Another object of the invention is to provide a full-twill weave Fourdrinier fabric having weft knuckles in substantially the same plane as the warp knuckles along both surfaces of the fabric so as to obtain a desirable paper making surface and to have the weft in a position to sustain wear.

It is a further object to provide a full-twill weave Fourdrinier fabric of improved lift characteristics through incorporation of a large plurality of weft threads of abrasive resistant metal that sustain a major amount of the wear.

The foregoing and other objects will appear from the description to follow. In the description, reference is made to the accompanying drawings which form a part hereof and in which there are shown by way of illustration several specific embodiments in which this invention may be practiced. These embodiments will be described in sufficient detail to enable those skilled in the art to practice this invention, but it is to be understood that other embodiments of the invention may be used and that structural changes may be made in the embodiments described without departing from the scope of the invention. Consequently, the following detailed description is not to be taken in a limiting sense; instead, the scope of the present invention is best defined by the appended claims.

In the drawings:

FIG. 1 is a view in perspective of a length of Fourdrinier fabric embodying the present invention fashioned into an endless belt;

FIG. 2 is a fragmentary view on an enlarged scale of a portion of the fabric shown in FIG. 1;

FIG. 3 is a longitudinal sectional view taken along the

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plane of line 3—3 of FIG. 2, looking in the direction of the arrows;

FIG. 4 is a transverse sectional view taken along the plane of line 4—4 of FIG. 2, looking in the direction of the arrows;

FIG. 5 is a view similar to FIG. 4 and showing an alternate embodiment of this invention;

FIG. 6 is a view similar to FIG. 4 and showing an alternate embodiment of this invention; and

FIG. 7 is a view similar to FIG. 4 and showing an alternate embodiment of this invention.

In FIG. 1 there is shown a Fourdrinier belt 10 formed by joining together the ends of a woven length of fabric by a seam 11, which may be a soldered or sewed seam or other suitable type seam. A Fourdrinier belt of this type may be as much as thirty feet wide and have a circumference of 180 feet, its actual size being dependent upon the particular paper making machine it is to be installed on.

As indicated in FIG. 2, the fabric of which the Fourdrinier belt 10 is formed comprises a plurality of spaced warp threads 12 and spaced weft threads 13 which have been so woven together that each weft thread 13 passes alternately over a pair of warp threads 12 and then under a pair of warp threads 12 in a repeated pattern. The terms warp and weft are employed in their usual sense as used in the weaving art. Thus, when a Fourdrinier fabric of the type shown in the drawings is woven on a loom, a supply of warp threads is wound on a warp roll with each individual warp thread strung longitudinally of the loom through a set of heddles, the number of such warp threads varying according to the desired mesh and width of the fabric. The warp threads are raised and lowered by movement of the heddles in accordance with the desired weave to form the usual triangular sheds. The supply of weft threads is carried in a shuttle which is caused to move transversely of the loom to pass through the sheds formed by raising and lowering the warp threads, after which a lay is actuated to beat the wefts into the apex of the sheds or beat line. The woven fabric forward of the beat line is transported over a breast roll onto a fabric roll. When woven in this fashion, both the warp and weft threads develop a crimped or wavy condition and are locked together; this configuration is best shown in the sectional views of FIGS. 3 and 4, FIG. 3 illustrating the contour of a typical warp thread and FIG. 4 illustrating the contour of a typical weft thread in the woven fabric.

For the fabric of FIGS. 1-4 the mesh of the warp threads per inch of fabric is less than that of the weft threads. In the actual fabric from which these figures were prepared the warp count per inch was 48 and the weft count per inch was 68. It has been found that by weaving the full-twill weave in this fashion, i.e. with a greater number of weft threads than warp threads per square inch, it may be adapted for use as Fourdrinier fabric without the dimensional instability heretofore exhibited by the weave. The use of a greater number of weft than warp threads per square inch of fabric represents a departure from the general practice used in connection with weaving Fourdrinier fabric in either the plain or twill weaves. It is now customary to weave Fourdrinier fabric in these latter two weaves wherein there are fewer weft than warp threads per square inch. Thus a typical Fourdrinier fabric with a plain weave may have 70 warp threads and 48 weft threads per square inch, a typical Fourdrinier fabric with a twill weave may have 48 warp threads and 33 weft threads per square inch, whereas a typical Fourdrinier fabric with a full-twill weave in accordance with this invention may have 48 warp threads and 60 weft threads per square inch. The contrast between the Fourdrinier fabric weaves of this invention and those now most common in the art will be apparent from Table I in which the weft counts of typical twill weaves are compared to the weft counts

of typical full-twill weaves produced according to this invention for fabrics which have the same warp count.

Table I

Number of Warp Threads Per Square Inch	Number of Weft Threads Per Square Inch	
	Twill Weave	Full-Twill Weave
48-----	33 to 34	60 to 72
54-----	32 to 44	60 to 68
59-----	38 to 48	68 to 84

It is apparent from Table I that the weaves of this invention include a substantially greater number of weft threads per square inch than is now the custom in the Fourdrinier art and that this feature runs counter to the usual practice in this field. It has been found that best results appear to be obtained when the ratio of the number of weft threads to warp threads per square inch is about 1.1 or greater, and when weft threads of the stiffer materials are used particularly effective results have been obtained when such ratio is about 1.2 or greater. Successful results have been obtained with the ratio as high as 1.6. The warp count may range from about 20 to 100 warp threads per inch and, within this range, a warp count from about 35 to 80 warp threads per inch has proven most effective.

It has been found, further, that not only should the weft count exceed the warp count to adapt the full-twill weave for successful use as Fourdrinier fabric but that the open area of the fabric must also fall within certain limits in order to provide full-twill weave Fourdrinier fabric with drainage characteristics suitable to good paper making. For the purposes of this description and the appended claims, the term "open area" is defined as the mathematical open area computed according to the following formula, which is in general use in this art:

Open area in percent=[1-(warp count×warp diameter)]×[1-(weft count×weft diameter)]×100

In this formula, warp and weft count mean the number of warp and weft threads per inch and the warp and weft diameter is the diameter of the threads prior to weaving. If warp or weft threads with other than a round cross-sectional shape are used the warp thread dimension in the transverse direction is used as the warp diameter and the weft thread dimension in the longitudinal direction is used as the weft diameter.

A conventional Fourdrinier fabric in either the plain or twill weave generally has an open area ranging from about 20 to 25%, and in some cases even higher, with most conventional fabrics falling within the 23 to 25% range. On the other hand, it has been found that Fourdrinier fabric in the full-twill weave should have an open area ranging from about 12 to 20%, with about 14 to 17% being preferred, in order to provide a full-twill weave Fourdrinier fabric with good drainage characteristics. Stated otherwise, if a full-twill weave Fourdrinier fabric is woven to have the same percentage of open area now exhibited by conventional Fourdrinier fabrics in plain or twill weave it does not have drainage characteristics suitable for good paper making. Apparently, full-twill weave Fourdrinier fabric will drain faster than a plain or twill weave of the same open area, so that an undue amount of fibers and fillers may be lost from the paper stock if full-twill weave is woven with the same open area now used for the latter weaves.

The open area of the woven fabric can be controlled by the weaver by controlling the size of the warp and weft threads and by the number of weft threads in the fabric. Thus, assuming a given number of warp threads per inch of a given diameter, the weaver can control the

open area of the finished fabric by choosing the proper diameter weft thread and by choosing the proper number of weft threads per inch and, in this manner, he can weave the full-twill fabric to have an open area within the above range. In general, it has been found that the best results are obtained when the full-twill weave of this invention is formed from warp threads which have a greater cross-sectional area than the weft threads.

A particularly preferred form of the full-twill weave Fourdrinier fabric of this invention is that wherein the crests of the warp and weft knuckles along both surfaces of the woven fabric are in substantially the same plane. Referring to FIG. 1, the outer surface of the Fourdrinier belt 10 is generally referred to as the paper making side since it is the belt portion on which the paper sheet is formed. The inner surface of the belt 10, however, must withstand most of the wear since it is in contact with the various rolls and suction box of the Fourdrinier paper making machine. It has been known to weave conventional Fourdrinier fabrics with the crests of the weft and warp knuckles in substantially the same plane on the outer surface to provide good paper support. However, in such conventional weaves, the crests of the warp and weft knuckles along the inner surface of the belt are not normally in the same plane, but, instead, the warp knuckles generally project beyond the weft knuckles, and the warp threads thus must absorb most of the abrasive wear. With the Fourdrinier fabrics of this invention, on the other hand, the crests of the warp and weft knuckles may be in substantially the same plane along both surfaces of the belt thereby combining the advantages of increased paper support along the outer surface and improved wear characteristics along the inner surface, since the weft knuckles will be positioned so as to present additional wear surface. In general, it has been found that there should be no more than about 0.0005", and preferably about 0.0003" or less, difference between the crests of the warp and weft knuckles in order to provide this feature.

In this respect, the use of a material for the weft threads that is harder and more abrasion-resistant than the material for the warp threads has proved particularly effective. The use of a hard abrasion-resistant material in the weft, with the crests of the weft knuckles in substantially the same plane as the crests of the warp knuckles will provide a relatively slow-wearing surface. Not only will the weft knuckles wear slowly due to the nature of the materials employed for the weft threads but they will also serve to protect the softer less wear-resistant materials employed in the warp since the warp knuckles will not generally wear lower than the weft knuckles along the inner surface. In this fashion the weft knuckles tend to limit the wear of the warp threads and since the weft threads can be woven from highly abrasion-resistant materials, the life of the warp threads and the fabric in general can be increased over what is now obtainable. At the same time, it is possible to retain softer materials as warp threads which will be flexible enough to withstand the flexing encountered as the belt is driven by the paper machine and which will also be relatively easy to seam according to known Fourdrinier seaming techniques. The following combinations of materials have proven particularly effective for the Fourdrinier fabrics of this invention: stainless steel weft threads and bronze or brass warp threads, Phosphor bronze weft threads and warp threads of a softer bronze or brass, and weft threads of an alloy of nickel and copper with a major portion of nickel (e.g. "Monel") or an alloy of nickel, chromium and iron with a major portion of nickel (e.g. "Inconel") and warp threads of brass or bronze. In general, it appears that when a very hard material such as stainless steel, "Monel" or "Inconel" is used for the weft threads, the ratio of the weft threads to the warp threads may be about 1.2 or greater; on the other hand, when Phosphor bronze is used as the weft thread material, the

ratio may be about 1.1 or greater. The use of the stiffer, or harder, abrasive resistant weft thread materials also apparently contribute to attaining proper weft knuckle height together with the desired drainage areas hereinbefore discussed. Thus, the use of weft threads as stiff as, or stiffer, than the warp threads may be a particular feature in the practice of the invention. In the particular embodiment of the fabric of FIGS. 1-4, for example, the weft threads were of a .0085 inch diameter stainless steel that was harder and stiffer than the warp threads, which were of a .0095 inch diameter Phosphor bronze. It can be seen in FIGS. 3 and 4 that for this embodiment the crests of the weft and warp knuckles are substantially in the same plane on both sides of the fabric.

The term "thread" as used in connection with the warp and weft members of the Fourdrinier fabric of this invention is not used herein in its narrow dictionary sense as meaning a cord having two or more twisted yarns or filaments but instead is intended to be used in the broad sense in which it is normally employed in this art. Thus the term weft or warp thread is intended to cover the configuration shown in FIGS. 1 through 4 comprising a solid wire with a circular cross-section. A variety of other warp or weft configurations may be employed in the practice of this invention and, in connection with the warp threads: FIG. 5 illustrates the use of a so-called "flat" warp thread comprising a round wire member which has been flattened on at least two sides prior to weaving; FIG. 6 illustrates the use of a twisted cable warp thread comprising a plurality of filaments twisted together in cable-form; and FIG. 7 illustrates the use of warp threads wherein each thread comprises two non-twisted elements arranged in lengthwise side-by-side abutting relationship. The flat warp shown in FIG. 5 has proven particularly effective for the practice of this invention. It is therefore intended that the term warp thread and/or weft thread as employed in the appended claims be construed in a broad sense.

It should also be pointed out that in the embodiment of this invention illustrated in FIGS. 1 through 4, adjacent weft threads do not pass over and under the same pairs of warp threads. Instead, as best illustrated in FIG. 2, the fabric was woven so that each weft thread passes alternately over a pair of warp threads and under a pair of warp threads in a repeated pattern and this repeated over and under pattern of any particular weft thread is offset from that of its adjacent weft threads by one warp thread. In this fashion, the knuckles formed in adjacent weft threads during the weaving process are offset from each other by one warp thread and, similarly, the knuckles developed in each warp thread will be offset from one another by one weft thread; this is the preferred relative arrangement of warp and weft threads in the full-twill weave of this invention.

It has been found that Fourdrinier fabrics woven in the full-twill weave according to this invention exhibit neither the dimensional instability nor the undesirable drainage characteristics heretofore shown by the full-twill weave in this art. This invention has thus served to solve the long-standing problem of the adaptation of the full-twill weave for Fourdrinier fabrics. The provision of full-twill weave Fourdrinier fabric wherein the crests of the warp and weft knuckles are in substantially the same plane on both sides of the fabric further enhances the wear characteristics of the Fourdrinier fabrics of this invention and this can be particularly advantageous by employing relatively hard abrasion-resistant material for the weft threads. The excellent wear characteristics exhibited by Fourdrinier belts produced according to this invention have proven capable of lessening the "down-time" of many Fourdrinier paper making machines on which they have been installed. Due to the expense of changing Fourdrinier belts on a paper making machine and the resulting loss of time during which the machine can be put to productive use, an improvement in the life of a Four-

drinier belt is extremely important in the paper industry. Thus, in addition to providing a solution for the long-standing problem of adapting the full-twill weave for utility as a Fourdrinier fabric, the Fourdrinier fabrics of this invention also exhibit advantages not now attainable from conventional Fourdrinier fabrics.

I claim:

1. A woven Fourdrinier fabric comprising a plurality of spaced warp threads interwoven with a plurality of spaced weft threads wherein each weft thread passes alternately over a pair of warp threads and under a pair of warp threads in a repeated pattern that includes knuckles in both the weft and warp threads and defines an open area between the spaced threads, said weft threads being of a material at least substantially as abrasive resistant as said warp threads and with the knuckles of the weft threads being at least substantially as high as the knuckles of the warp threads, the fabric having more weft threads than warp threads per square inch of fabric, and the open area of the fabric being from about 13% to about 20%.

2. Woven Fourdrinier fabric according to claim 1 further characterized in that the open area of the fabric is from about 14% to about 17%.

3. A woven Fourdrinier fabric comprising a plurality of spaced warp threads interwoven with a plurality of spaced weft threads wherein each weft thread passes alternately over a pair of warp threads and under a pair of warp threads in a repeated pattern that defines an open area between the spaced threads, and wherein there are more weft threads than warps threads per square inch of fabric by a ratio of 1.1 to 1 or greater and the open area of the fabric is from about 13% to about 20%, both the weft and warp threads having knuckle portions with the crests of the warp and weft knuckles being in substantially the same plane on both sides of the fabric, and the weft threads being of a material at least substantially as hard as the warp threads.

4. Woven Fourdrinier fabric according to claim 3 further characterized in that there is less than about 0.0005" difference between the crests of the warp and weft knuckles on both sides of the fabric.

5. A woven Fourdrinier fabric comprising a plurality of spaced warp threads interwoven with a plurality of spaced weft threads wherein each weft thread passes alternately over a pair of warp threads and under a pair of warp threads in a repeated pattern that includes knuckles in both the weft and warp threads and defines an open area between the spaced threads, said repeated over and under pattern of a particular weft thread being offset by one warp thread from that of its adjacent weft threads, said weft threads being of a material stiffer than and of greater abrasive resistance than said warp threads and with the knuckles of the weft threads being at least substantially as high as the knuckles of the warp threads, the fabric having more weft threads than warp threads per square inch of fabric by a ratio of 1.1 or greater, and the open area of the fabric being from about 13% to about 20%.

6. In a Fourdrinier fabric the combination comprising: a plurality of warp threads and a plurality of weft threads with the weft threads each passing over a pair of warp threads and then under a pair of warp threads in a repeated pattern having the warp threads spaced and the weft threads spaced to define an open area, the number of weft threads per inch being 1.1 or more times the number of warp threads per inch with the open area of the fabric being less than 20%, and the weft threads being of a stiffer material of greater abrasive resistance than the warp threads with the abrasive resistance material of the weft threads being exposed as a wear surface for the fabric.

7. The fabric of claim 6 in which the weft threads are selected from the materials Phosphor bronze, stainless steel, Inconel metal and Monel metal.

8. The fabric of claim 6 in which the weft and warp

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threads are formed with knuckles having crests and these weft knuckle crests and warp knuckle crests on both sides of the fabric are within .0005 inch of one another.

9. A woven Fourdrinier fabric comprising a plurality of spaced warp threads interwoven with a plurality of spaced weft threads wherein each weft thread passes alternately over a pair of warp threads and under a pair of warp threads in a repeated pattern, wherein there are more weft threads than warp threads per square inch of fabric, and said spaced threads defining an open area in the fabric that is from about 13% to about 20% of the total area of the fabric, both the weft and warp threads having knuckle portions with the crests of the warp and weft knuckles being in substantially the same plane on both sides of the fabric, and the weft threads are of a metal selected from the group consisting of stainless steel, a nickel-copper alloy with a major portion of nickel, a nickel-chromium-iron alloy with a major portion of nickel, and Phosphor bronze, and the warp threads are of softer metal selected from the group consisting of Phosphor bronze, brass and bronze.

10. In a Fourdrinier fabric the combination of warp and weft threads woven in a full-twill weave with spacing between threads that defines an open area in the fabric

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and with knuckles in both the weft and warp threads, the ratio of the number of weft threads to the number of warp threads per inch of fabric being 1.1 or greater and the open area of the fabric being less than 20%, the weft threads being of a material at least substantially as hard as the warp threads with the surface of such material being exposed to comprise a wear surface for the fabric by having the weft knuckles at least substantially as high as the warp knuckles.

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