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Paper forming fabric

The present invention relates to a paper forming fabric having two, upper and lower, layers of synthetic weft strands interwoven with synthetic warp strands to form a regularly repeating weave pattern having approximately 100% warp fill.

Forming fabrics for paper making machines should provide uniform support for the fibres of the pulp stock so that marking of the formed web of paper by aberrations at the supporting surface will be minimised. The fabrics must be stable in the plane of the cloth, flexible at least in the machine direction, resist stretching, resist wear and at the same time provide sufficient drainage capacity.

For many years, forming fabrics were woven of metal strands and while these "wires", as they are called, provided most of the essential requirements they had a short life span due to failure of the metal strands to resist flexural fatigue, wear and corrosion. Furthermore, due to the nature of metal strands, the woven wires could be easily damaged and damaged areas were generally not repairable.

In recent years, forming wires have been woven of plastic polymetric strands and while these have largely overcome the disadvantages of metal strands insofar as resistance to fatigue, wear, corrosion and inadvertent damage is concerned, some of the more desirable qualities of the metal strands were lost. For example, difficulties have been experienced with plastic fabrics that have been woven in the same manner as metal wires, that is, with about 50% warp fill, with respect to dimensional stability, resistance to stretching and also with respect to drainage and fibre support. Although many improvements have been made to produce reasonably satisfactory synthetic forming fabrics, some of the desirable properties of metal fabrics have still not been regained.

Recently, synthetic forming fabrics have been woven in duplex weaves having two or more layers of interwoven weft strands and these have provided greater dimensional stability and resistance to stretching while maintaining the good wearing and damage resistant qualities of a single layer synthetic fabric. Duplex fabrics are woven with 100% warp fill or greater and, due to the nature of the weave, inevitably have an uneven surface that tends to leave a characteristic and objectionable mark on the surface of the paper, moreover, no amount of stretching during heat setting will alleviate this objectionable sheet marking condition, but, in fact, will generally make it worse.

"Warp fill" is defined as the amount of warp in a given space relative to the total space considered. For example, 50% warp fill means that 50% of the space in the weft direction is taken up by warp. For example, a 68 mesh fabric (i.e. 68 warp strands per inch of width (2677

strands per metre)) having 0.008 inch diameter (0.20 mm) warp strands would have a warp fill factor of

$$68 \times 0.008 \times 100 = 54.4\%.$$

Warp fill can be over 100% when there are more warp strands jammed into the available space than the space can dimensionally accommodate in a single plane. Fabrics having a nominal warp fill of approximately 100% will generally have an actual calculated warp fill of from 90% to 125%. Values over 100% are brought about by crowding and lateral undulation of the warp strands.

A variety of duplex forming fabrics are disclosed in FR—A—23 42 368.

In each of these forming fabrics the upper surface of the fabric has a plurality of knuckles formed by the interwoven weft and warp strands with the knuckles being essentially tangent to the plane of the fabric on which the paper is to be formed. The upper layer of the fabric comprises a regular array of mesh openings which are spaced apart in the weft direction by a distance not greater than the thickness of a single warp strand lying between them and in the warp direction by a distance not greater than the thickness of a single weft strand lying between them. Each said mesh opening is defined by the spacing between adjacent upper weft strands and by the spacing between warp strands which are held separated within the body of the fabric by at least one intervening warp strand.

The particular aim of these dryer fabrics is to reduce sheet marking by having each weft on the upper layer float over at least 80% of the warp strands it crosses. When compared with the known duplex forming fabrics it is the principal object of the present invention to provide a duplex paper forming fabric in which improved drainage is present both in the upper layer of the fabric and in the lower layer of the fabric, in which the fabric is stabilised in the machine direction, and in which a surface pattern is produced at the top surface of the forming fabric which reduces marking of paper produced on the fabric.

In order to accomplish this object there is provided, in accordance with the invention, a paper forming fabric having two, upper and lower, layers of synthetic weft strands interwoven with synthetic warp strands to form a regularly repeating weave pattern having approximately 100% warp fill, the upper surface of the fabric having a plurality of knuckles formed by said interwoven weft and warp strands, said knuckles being essentially tangent to the plane of the fabric on which the paper is to be formed, wherein the upper layer of the said fabric comprises a regular array of mesh

openings which are spaced apart in the weft direction by a distance not greater than the thickness of a single warp strand lying between them and in the warp direction by a distance not greater than the thickness of a single weft strand lying between them, and wherein said mesh openings are defined by the spacing between adjacent upper weft strands and by the spacing between warp strands which are held separated within the body of the fabric by at least one intervening warp strand, characterised in that said at least one intervening warp strand is woven with the lower layer weft strands only and extends in its entire length below said upper layer weft strands.

The fact that the mesh openings are formed by intervening warp strands which are woven with the lower layer weft strands only directly improves the drainage through the upper and lower layers of the fabric. Secondly, it ensures a shallower crimp of these intervening warp strands which directly stabilises the fabric against stretching in the machine direction and improves the strength of the fabric and its resistance to wear. Finally, it contributes to the provision of a surface pattern at the top surface of the forming fabric which reduces marking of paper produced on the fabric.

In a specially preferred embodiment of the invention the weft strands in a lower layer of the fabric are duplexed, at the most, under every second weft strand in the upper layer. This arrangement allows better drainage through the thickness of the fabric. Furthermore, the fact that the intervening warp strands are woven only with the lower layer of weft strands assists in producing an even shallower crimp of these warp strands. This even shallower crimp results in further stabilisation of a fabric against stretching in the machine direction and increases knuckle length in a lower surface of the fabric which increases wear resistance.

In another embodiment of the invention some of the top surface warp strands are woven with upper layer weft strands only. This produces a further stabilisation of the fabric against stretching in the machine direction and improves the support of the pulp stock.

It is admittedly known from FR—A—11 92 331 to provide a duplex fabric for a paper making machine in which certain warp strands are woven with the lower layer weft strands only. However, FR—A—11 92 331 relates to a dryer fabric and there are significant differences in the demands placed on a forming fabric and a dryer fabric.

While a dryer fabric preferably has some of the characteristics of a forming fabric, such as for example, sufficient tensile strength to prevent stretching, resistance to corrosive elements in the pulp stock and a reasonably smooth surface, it does not have to be particularly sensitive in respect to drainage capacity nor does it have to have a pulp supporting surface that is substantially monoplanar, i.e. in

which both the warp and weft knuckles on the pulp supporting surface are essentially tangent to the plane of the fabric. Furthermore, while a dryer fabric is subjected to much higher temperatures it does not pass over as many stationary elements, such as foils and suction boxes, and is therefore not subject to abrasive wear to the same extent as forming fabrics. These characteristic differences are reflected in the different manner in which the two types of fabric are woven and especially in the materials used. For example, it would not be practical to make a forming fabric of cotton and asbestos.

Furthermore, although FR—A—11 92 331 discloses warp strands which are woven with lower layer weft strands only, there is no indication that the upper surface of the fabric would comprise a regular array of mesh openings. In fact, with warp strands taken in the order as shown in FR—A—11 92 331, some warp strands will directly cross each other between consecutive top layer wefts which results in blockages and not in the desired array of mesh openings.

A further duplex fabric is disclosed in US—A—22 37 115. This fabric is again a dryer fabric rather than a forming fabric. Furthermore, there are no warp strands which weave only the lower layer weft strands and the fabric does not exhibit the desired regular array of mesh openings. In addition core warps are present between the upper and lower layers of weft strands and are not interwoven with either.

The present invention will now be described in more detail with reference to the accompanying drawings in which:

Fig. 1 is a schematic view of a typical forming section of a paper making machine,

Fig. 2A is an enlarged sectional side view of a portion of a 4 shaft 8 repeat pattern duplex fabric in accordance with the present invention,

Fig. 2B is a view on the upper surface of the fabric of Fig. 2A,

Figs. 2C to 2F are cross-sectional views along the section lines a—a to d—d of Fig. 2A,

Fig. 3A is an enlarged sectional view of a portion of an 8 shaft 16 repeat pattern duplex fabric also in accordance with the present invention,

Fig. 3B is a view of the upper surface of the fabric of Fig. 3A,

Figs. 3C to 3H are cross-sectional views along section lines a—a to f—f of Fig. 3A,

Fig. 4A is an enlarged sectional side view of a portion of an 8 shaft 6 repeat pattern duplex fabric, also in accordance with the present invention,

Fig. 4B is a view of the upper surface of the fabric of Fig. 4A, and

Figs. 4C to 4F are cross-sectional views along section lines a—a to d—d of Fig. 4A.

In the drawings, Figs. 2 to 4 show the weave patterns in a simplified manner in order that they may be more easily visualized. In actual practice, the upper and lower layers of weft will

lie closer together as the warp strands weaving the one layer interdigitate with the adjacent warp strands weaving the other layer. Furthermore, after being heat set under conditions of controlled tension, the upper knuckles of the warp and weft strands will lie, in all embodiments, substantially coplanar with the top surface of the fabric.

In the top surface views, Figs. 2B, 3B and 4B the strand knuckles have been indicated by ovals to represent where they might lie substantially tangent to the top plane of the fabric, thus illustrating a slightly worn condition for the sake of clarity. Representative mesh openings are indicated at R, X and Y, signifying openings equivalent to approximately one, three and five warp diameters respectively, in the weft direction. S in Fig. 2B signifies an unusual twinned opening peculiar to the 4 shaft 8 repeat pattern.

Referring to Fig. 1 which illustrates a conventional forming section of a Fourdrinier paper making machine, the upper run of fabric 1, moves in a direction from the breast roll 2 to the couch roll 3, as indicated by arrow 4. The fabric passes from the breast roll 2 over a forming board 8, over foils 9, and then over suction boxes 10 before passing around the couch roll 3. The lower or return run of the fabric 1 is supported by return rolls 5 and passes over a guide roll 6 and a tensioning roll 7. Pulp stock is supplied to the upper surface of fabric 1 by means of a headbox 11 through a slice orifice 12. As the pulp stock progresses along with the upper run of the fabric 1, water is withdrawn at the foils 9 as the web of fibres is formed and further dewatering occurs at the suction boxes 10 and the couch roll 3 before the web (not shown) is released from the upper surface of the fabric at the lower reach of the couch roll 3 or just beyond.

The fabric 1 is driven by the couch roll 3 at speeds up to 900 meters per minute or more and at tensile loads that may surpass 14 kg per linear cm, of fabric width. It will be appreciated therefore that the fabric 1 must be strong and flexible yet have good dimensional stability and at the same time provide adequate and uniform support for the fibres of the pulp stock that are forming the sheet of paper. The fabric 1 must also have good drainage capacity to permit removal of water from the pulp stock at a high rate.

Fig. 2A to 2F show a 4 shaft 8 repeat pattern duplex fabric. In Fig. 2A a set of weft strands 1 to 8, repeating as 1', 2', 3' etcetera is shown in cross-section and warp strands 30, 31 32, 33, repeating as 30', 31', 32' and 33' are shown as they are woven in each repeated pattern of four consecutive warp strands. Weft strands 1 and 5 in each set are duplexed by weft strands 2 and 6 respectively and there are no weft strands under 3, 4, 7 and 8 in each set. Warp strands 30 and 32 weave both the upper layer and the lower layer weft strands while warp strands 31 and 33 weave only the lower layer weft strands.

For example, warp strand 30 passes over weft strands 1 and 2, under 3, over 4 under 5 and 6, over 7 and under 8 and then repeats the sequence. The next warp strand 31 weaves only the bottom weft strands, passing between weft strands 1 and 2 under 3, 4, 5 and 6, 7 and 8 then repeats the sequence. Warp strand 32 weaves both upper and lower weft strands in the same pattern as warp strand 30 but weaving under weft strands 1 and 2 instead of 5 and 6. Warp strand 33 weaves only the lower weft strands in the same manner as warp strand 31 but over and under alternate lower weft strands.

It will be apparent from Fig. 2B that warp strands 30 and 32, whose knuckles appear on the upper surface, will be held separated by warp strand 31, and, similarly, warp strands 32 and 30', whose knuckles also appear on the upper surface, will be held separated by warp strand 33. The weft strands form knuckles at the upper surface where they cross over warp strands which lie within the body of the fabric. The upper layer of the fabric thus contains regularly spaced mesh openings surrounded by spaced weft knuckles and spaced warp knuckles. Each of these openings is encompassed i.e. bounded by a pair of upper weft strands and by a pair of the spaced warp strands and it will be seen that all adjacent upper level mesh openings are separated in the weft direction by a single warp strand and in the warp direction by a single weft strand. Some of the mesh openings, as shown at R, are substantially rectangular in shape while others, as shown at S, are twin openings.

The combination of the fewer number of weft strands in the lower layer and the fact that the lower layer warp strands 31 and 33 are held separated by warp strands 30 and 32 that weave both upper and lower layers of weft obviously improves drainage at the lower layer. Also, the long slope of the knuckles of warp strands 31 and 33 at the lower surface of the fabric provides ample wearing surface, while the shallow crimp of the lower warp strands provides improved dimensional stability in the machine direction.

It will be seen in the cross-section views, Figs. 2C to 2F, that adjacent warp strands always cross each other below the upper layer of weft strands thus preventing blockages in the upper layer of the fabric and thereby preserving the regular array of mesh openings.

Figs. 3A to 3H show an 8 shaft 16 repeat pattern duplex fabric, which is another embodiment of the present invention. A set of weft strands 1 to 16, repeating at 1', 2'... etcetera, is shown in Fig. 3A in cross-section and warp strands 40, 41, 42, 43, 44, 45, 46 and 47 repeating at 40', etc., are shown as they are woven consecutively in each repeated pattern of 8. Weft strands 1, 5, 9 and 13 in each set are duplexed by 2, 6, 10 and 14 respectively and there are no weft strands located under upper

weft strands 3, 4, 7, 8, 11, 12, 15 and 16. Warp strands 40, 42, 44 and 46 all weave both the upper and lower layer weft strands in the same manner. That is, as seen in the case of warp strand 40, over weft strands 1 and 2, under weft strands 3 and 4, between weft strands 5 and 6, over 7, under 8, 9, 10 and 11 over 12 then between 13 and 14 and under 15 and 16 before repeating the sequence. Warp strands 41, 43, 45 and 47 weave only over and under the lower layer weft strands 2, 6, 10 and 14 shown. As in the case of the 4 shaft 8 repeat pattern of Figs. 2A to 2F, the warp strands 40, 42, 44 and 46 whose knuckles appear on the upper surface, as shown in Fig. 3B, are held separated by warp strands 41, 43, 45 and 47 respectively. Thus the upper layer of the fabric contains regularly spaced mesh openings that are separated in the weft direction by a single warp strand and in the warp direction by a single weft strand.

Again, the fewer number of weft strands in the lower level of the 8 shaft 16 repeat fabric, as well as the long slope of the lower knuckle, result in the advantages of better drainage, better wear resistance and better dimensional stability in the machine direction.

As will be seen from the cross-section views, Figs. 3C to 3H, adjacent warp strands always cross each other below the upper layer weft strands thereby preserving the regular array of mesh openings in the upper level of the fabric.

Due to the particular order in which the warp strands appear in the weaving pattern, a broken pattern is seen on the top surface. The same pattern of warp strands could, of course, be woven in sequence without the broken pattern effect if desired. The three sizes of upper surface mesh openings, designated as R, X and Y, which this weaving pattern produces are also apparent.

Figs. 4A to 4F show an 8 shaft 6 repeat pattern duplex fabric which is yet another embodiment of the present invention. A set of weft strands 1 to 6, repeating at 1' to 6' and again as 1'', 2'' etcetera is shown in Fig. 4A in cross section. Warp strands 50 to 57 are shown as they are woven in each repeated pattern of eight consecutive warp strands. Weft strands 2 and 5 are duplexed by weft strands 3 and 6 respectively and there are no weft strands under weft strands 1 and 4 in each set. Warp strand 50 weaves only the top layer of weft strands passing over 1, between 2 and 3 under 4, between 5 and 6 and over 1' to repeat the sequence. Warp strand 51 weaves only the lower weft strands, passing under weft strands 1, 2, 3 and 4, between 5 and 6 then under 1', 2', 3' etcetera to repeat the sequence. Warp strand 52 weaves both upper and lower weft strands passing under 1, over 2 and 3, under 4, under 5 and 6 and under 1' to repeat the sequence. Warp strand 53 weaves only the lower weft strands alternately with warp strand 51. Warp strand 54 weaves only the upper weft

strands following the pattern of warp strand 50 but commencing over weft strand 4. Warp strand 55 is next in sequence and weaves only the lower weft strands in the same manner as warp strand 51. Warp strand 56 weaves both upper and lower weft strands in the same pattern as warp strand 52 but passes first over weft strands 5 and 6. Warp strand 57 weaves only the lower weft strands in the same manner as warp strand 53. It will be seen in Fig. 4B that the warp strands whose knuckles appear on the upper surface of the fabric are held separated in the weft direction by the alternate warp strands that weave only the lower weft strands thus producing an array of regularly spaced mesh openings at the upper layer of the fabric as shown at R and Y. The openings, as in the other embodiments of the invention, are separated in the weft direction by a single warp strand. Again, the advantage of the fewer number of weft strands in the lower level is apparent.

As can be seen in the cross section views, Figs. 4C to 4F, adjacent warp strands always cross each other below the upper layer weft strands thereby preserving the regular array of mesh openings at the upper surface of the fabric.

The pattern of Figs. 4A to 4F may be modified by having strands 50 and 54 each weaving alternate upper weft strands in the manner of plain weave instead of over one upper weft strand and under the next three upper weft strands as shown. This modification would provide a denser knuckle pattern on the upper surface without impairing drainage.

It will be noted that all the described weaving patterns have the characteristic wherein the weft strands of the lower layer are duplexed under, at the most, every second weft strand of the upper layer.

It will be appreciated that it is within the scope of the invention that the lower weft strands might be different in diameter than the upper weft strands. Further, the lower weft strands might be of different synthetic material than the upper weft strands and both upper and lower weft strands might be of different material from the material of the warp.

It is also within the scope of the invention to use warp and/or weft strands that have other than a circular cross-section.

The configuration of the upper surface of the fabric of this invention can be plain weave, 3 shaft twill, 4 shaft twill, 4 shaft satin weave or any other known configuration.

Claims

1. A paper forming fabric having two, upper and lower, layers of synthetic weft strands (upper layer weft strands, 1, 3, 4, 5, 7, 8; 1, 3, 4, 5, 7, 8, 9, 11, 12, 13, 15, 16; 1, 2, 4, 5; lower layer weft strands 2, 6; 2, 6, 10, 14; 3, 6) interwoven with synthetic warp strands (30—33; 40—47; 50—57) to form a regularly repeating

weave pattern having approximately 100% warp fill, the upper surface of the fabric having a plurality of knuckles formed by said interwoven weft and warp strands, said knuckles being essentially tangent to the plane of the fabric on which the paper is to be formed, wherein the upper layer of the said fabric comprises a regular array of mesh openings (R, S; R, X, Y; R, Y) which are spaced apart in the weft direction by a distance not greater than the thickness of a single warp strand (30, 32; 40, 42, 44, 46; 50, 52, 54, 56) lying between them and in the warp direction by a distance not greater than the thickness of a single weft strand lying between them 1, 3, 4, 5, 7, 8; 1, 3, 4, 5, 7, 8, 9, 11, 12, 13, 15, 16; 1, 2, 4, 5) and wherein said mesh openings (R, S; R, X, Y; R, Y) are defined by the spacing between adjacent upper weft strands (R=7, 8, S=4, 5; R=8, 9, X=4, 5, Y=5, 7; R=2', 4', Y=1', 2') and by the spacing between warp strands (R=32, 30', S=30, 30'; R=44, 46, X=42, 46, Y=42, 40'; R=52, 54, Y=52, 50') which are held separated within the body of the fabric by at least one intervening warp strand (R=33; S=31, 33; R=45, X=43, 45, Y=43, 45, 47; R=53, Y=53, 55, 57) characterised in that said at least one intervening warp strand (R=33, S=31, 33; R=45, X=43, 45, Y=43, 45, 47; R=53, Y=53, 55, 57) is woven with the lower layer weft strands (2, 6; 2, 6, 10, 14; 3, 6) only and extends in its entire length below said upper layer weft strands (1, 3, 4, 5, 7, 8; 1, 3, 4, 5, 7, 8, 9, 11, 12, 13, 15, 16; 1, 2, 4, 5).

2. A paper forming fabric in accordance with claim 1 and characterised in that the weft strands (2, 6; 2, 6, 10, 14; 3, 6) in a lower layer of the said fabric are duplexed, at the most, under every second weft strand (1, 5; 1, 5, 9, 13; 2, 5) in the upper layer.

3. A forming fabric as claimed in either of the preceding claims and characterised in that some of said top surface warp strands (50, 54) are woven with upper layer weft strands (1, 2, 4, 5) only.

Patentansprüche

1. Formgewebe für die Papierherstellung mit je einer oberen und einer unteren Schicht aus synthetischen Schußfäden (Schußfäden der oberen Schicht 1, 3, 4, 5, 7, 8; 1, 3, 4, 5, 7, 8, 9, 11, 12, 13, 15, 16; 1, 2, 4, 5; Schußfäden der unteren Schicht 2, 6; 2, 6, 10, 14; 3, 6), die zur Bildung eines sich regelmäßig wiederholenden Webmusters mit annähernd 100% Kettichte mit synthetischen Kettfäden (30—33; 40—47; 50—57) verwebt sind, mit einer Vielzahl von durch die verwebten Schuß- und Kettfäden gebildeten Kuppen an der oberen Fläche des Gewebes, die im wesentlichen tangential zu der Gewebeebene liegen, auf der das Papier geformt wird, wobei die untere Schicht des Gewebes eine regelmäßige Anordnung von Maschenöffnungen (R, S; R, X, Y; R, Y) enthält, welche in Schußrichtung keinen größeren Ab-

stand als die Stärke eines einzelnen, dazwischenliegenden Kettfadens (30, 32; 40, 42, 44, 46; 50, 52, 54, 56) aufweisen und in Ketttrichtung keinen größeren Abstand als die Stärke eines einzelnen dazwischenliegenden Schußfadens (1, 3, 4, 5, 7, 8; 1, 3, 4, 5, 7, 8, 9, 11, 12, 13, 15, 16; 1, 2, 4, 5) und wobei die Maschenöffnungen (R, S; R, X, Y; R, Y) durch den Abstand zwischen benachbarten oberen Schußfäden (R=7, 8, S=4, 5; R=8, 9, X=4, 5, Y=5, 7; R=2', 4', Y=1', 2') und durch den Abstand zwischen Kettfäden (R=32, 30', S=30, 30'; R=44, 46, X=42, 46, Y=42, 40'; R=52, 54, Y=52, 50') bestimmt sind, welche innerhalb des Gewebekörpers durch mindestens einen zwischenlaufenden Kettfaden (R=33; S=31, 33; R=45, X=43, 45, Y=43, 45, 47; R=53, Y=53, 55, 57) getrennt gehalten sind, durch gekennzeichnet, daß der mindestens eine zwischenlaufende Kettfaden (R=33, S=31, 33; R=45, X=43, 45, Y=43, 45, 47; R=53, X=43, 55, 57) nur mit den Schußfäden der unteren Schicht (2, 6; 2, 6, 10, 14; 3, 6) verwebt ist und sich in seiner ganzen Länge unterhalb der oberen Schicht von Schußfäden (1, 3, 4, 5, 7, 8; 1, 3, 4, 5, 7, 8, 9, 11, 12, 13, 15, 16; 1, 2, 4, 5) erstreckt.

2. Formgewebe für die Papierherstellung nach Anspruch 1, dadurch gekennzeichnet, daß die Schußfäden (2, 6; 2, 6, 10, 14; 3, 6) in einer unteren Schicht des Gewebes gedoppelt sind, jedoch höchstens unter jedem zweiten Schußfaden (1, 5; 1, 5, 9, 13; 2, 5) in der oberen Schicht.

3. Formgewebe für die Papierherstellung nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß einige der an der oberen Fläche verlaufenden Kettfäden (50, 54) nur mit Schußfäden (1, 2, 4, 5) der oberen Schicht verwebt sind.

Revendications

1. Tissus pour la fabrication de papier ayant deux couches, une supérieure et une inférieure, de brins de chaîne synthétique (couche supérieure de brins de chaînes 1, 3, 4, 5, 7, 8; 1, 3, 4, 5, 7, 8, 9, 11, 12, 13, 15, 16; 1, 2, 4, 5; couche inférieure de brins de chaîne 2, 6; 2, 6, 10, 14; 3, 6) entrelacées avec des brins de trame synthétique (30—33; 40—47; 50—57) pour constituer une armure à motif régulièrement répétitif dont le contenu est environ 100% de trame, la surface supérieure du tissu ayant plusieurs arêtes formées par l'entrelacement desdits brins de chaîne et de trame, lesdites arêtes étant essentiellement tangentes au plan du tissu sur lequel le papier est appelé à être formé, la couche supérieure dudit tissu comprenant un arrangement régulier d'ouvertures de mailles (R, S; R, X, Y; R, Y) qui sont espacées entre elles en direction de chaîne sur une distance ne dépassant pas l'épaisseur d'un simple brin de trame (30, 32; 40, 42, 44, 46; 50, 52, 54, 56) que l'on retrouve entre elles et

en direction de trame sur une distance ne dépassant pas l'épaisseur d'un simple brin de chaîne que l'on retrouve entre elles (1, 3, 4, 5, 7, 8; 1, 3, 4, 5, 7, 8, 9, 11, 12, 13, 15, 16; 1, 2, 4, 5) et où lesdites ouvertures de mailles (R, S; R, X, Y; R, Y) sont définies par l'espace entre les brins de chaîne supérieure adjacents (R=7, 8, S=4, 5; R=8, 9, X=4, 5, Y=5, 7; R=2', 4', X=1, 2') et par l'espace entre les brins de trame (R=32, 30', S=30, 30'; R=44, 46, X=42, 46, Y=52, 54, Y=52, 50') qui sont maintenus séparés à l'intérieur de corps du tissu par au moins un brin de trame interposé (R=33; S=31, 33; R=45, X=43, 45, Y=43, 45, 47; R=53, Y=53, 55, 57) caractérisé en ce que au moins ledit brin de trame interposé (R=33, S=31, 33; R=45, X=43, 45, Y=43, 45, 47; R=53, Y=53, 55, 57) est entrelacé uniquement avec les brins

de chaîne de la couche inférieure (2, 6; 2, 6, 10, 14; 3, 6) et se prolonge sur toute sa longueur sous les brins de chaîne de la couche supérieure (1, 3, 4, 5, 7, 8; 1, 3, 4, 5, 7, 8, 9, 11, 12, 13, 15, 16; 1, 2, 4, 5).

2. Tissu pour la fabrication de papier selon la revendication 1 caractérisé en ce que les brins de chaîne (2, 6; 2, 6, 10, 14; 3, 6) d'une couche inférieure dudit tissu sont doublés, au plus, sous chaque second brin de chaîne (1, 5; 1, 5, 9, 13; 2, 5) de la couche supérieure.

3. Tissu pour la fabrication de papier selon l'une quelconque des revendications précédentes caractérisé en ce que certains des brins de trame de la surface supérieure (50, 54) sont entrelacés uniquement avec des brins de chaîne de la couche supérieure (1, 2, 4, 5).

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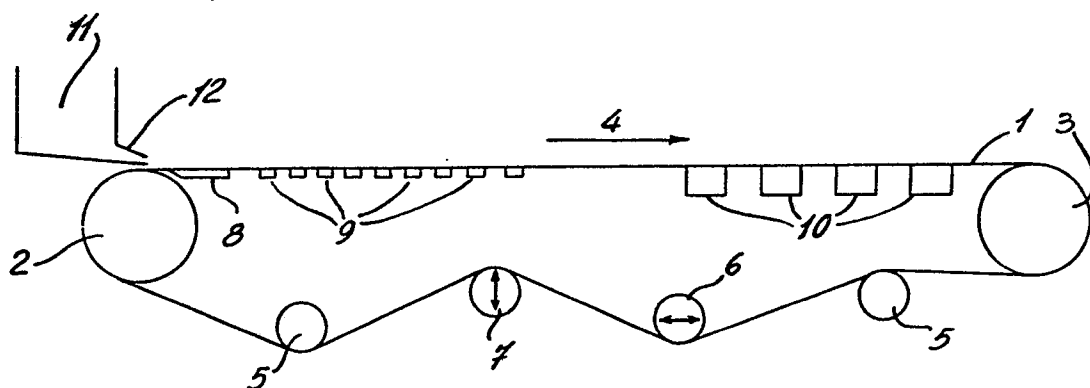


Fig. 1 (PRIOR ART)

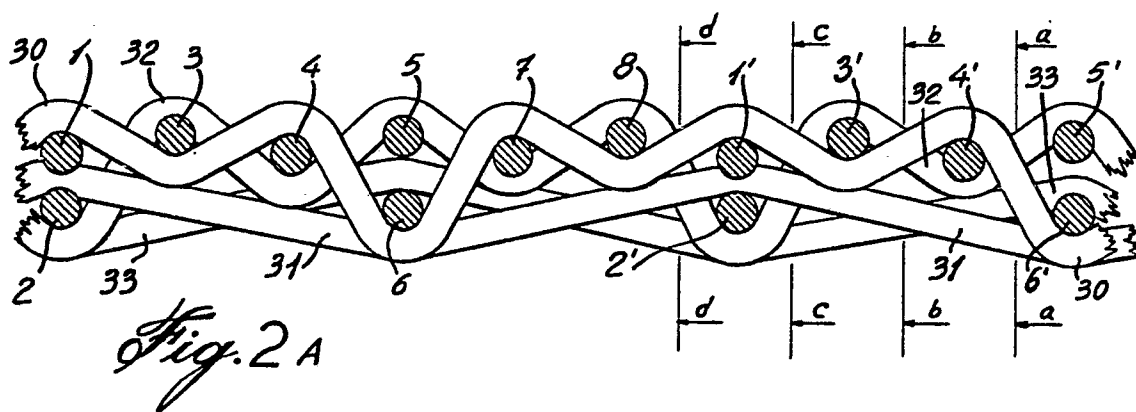
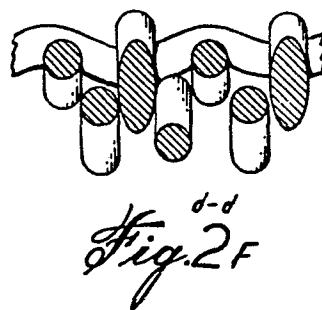
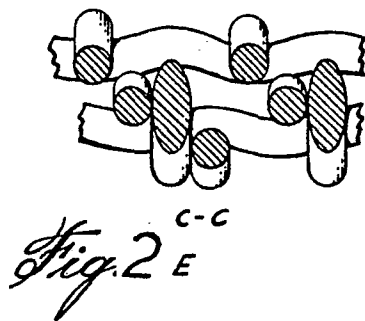
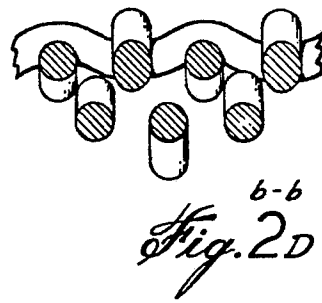
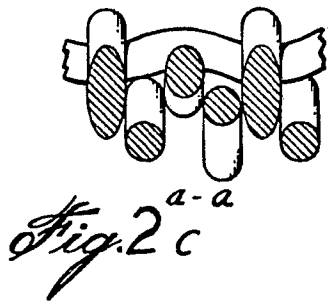
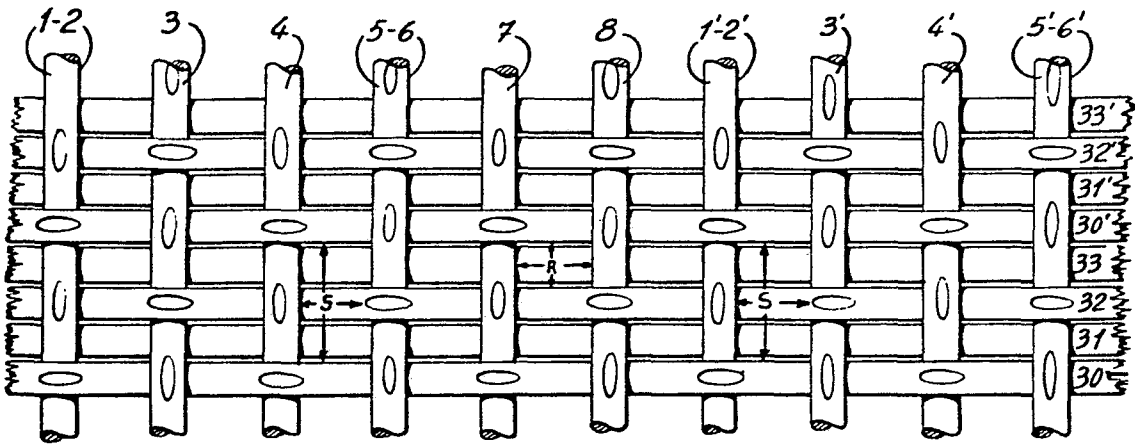


Fig. 2 A



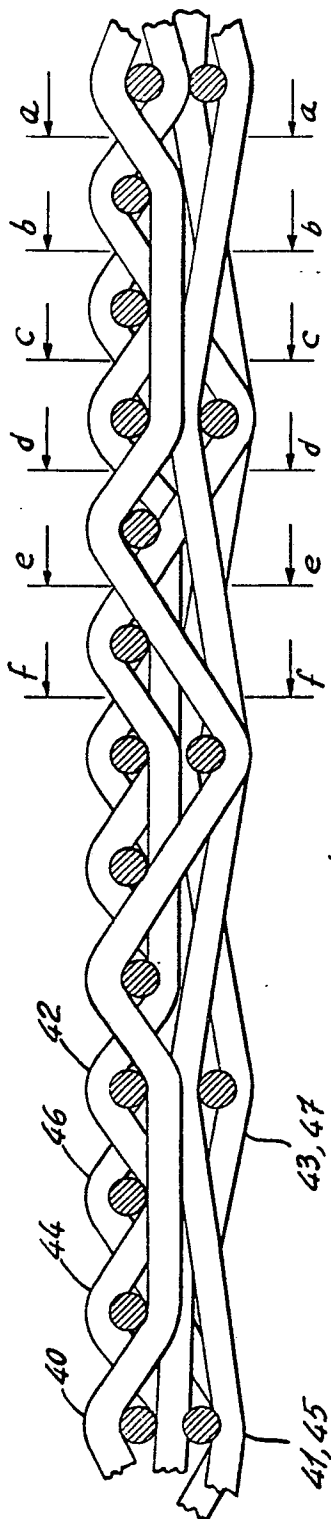


Fig. 3A

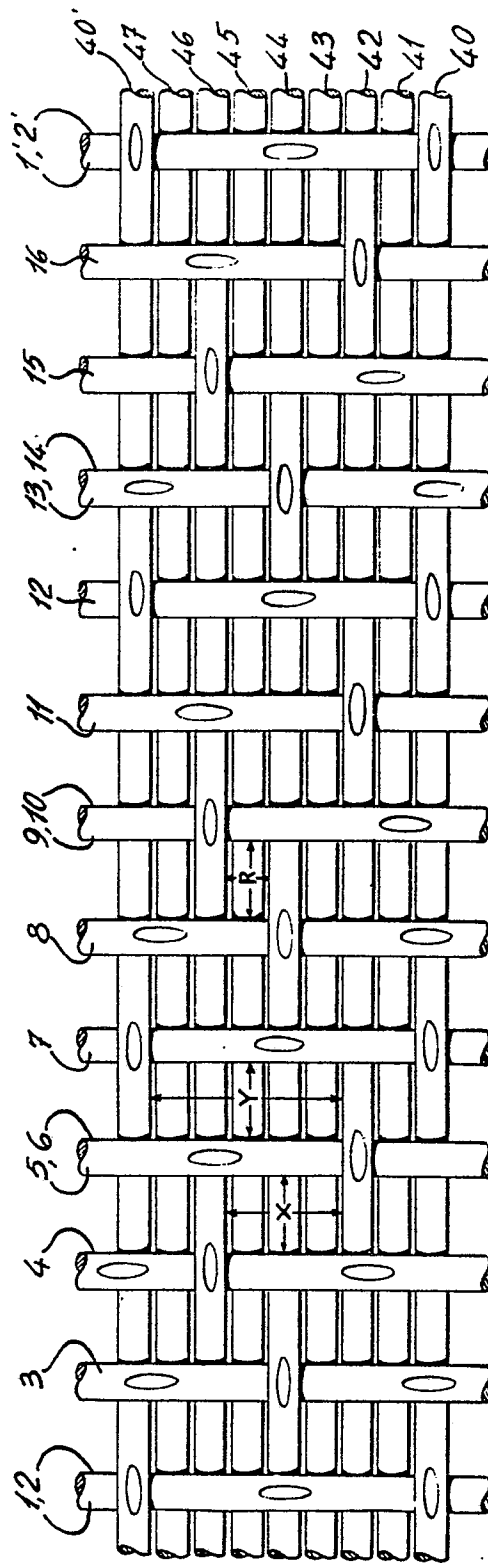


Fig. 3B

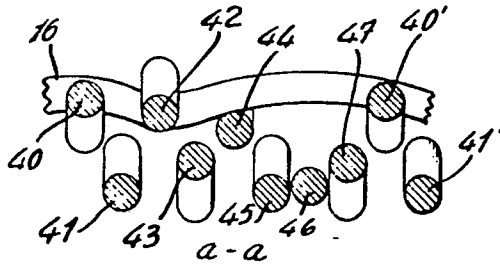


Fig. 3c

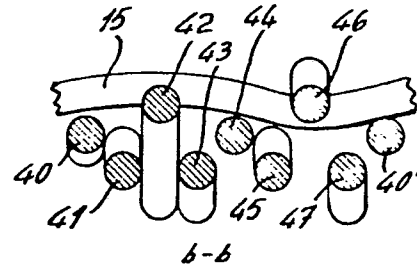


Fig. 3d

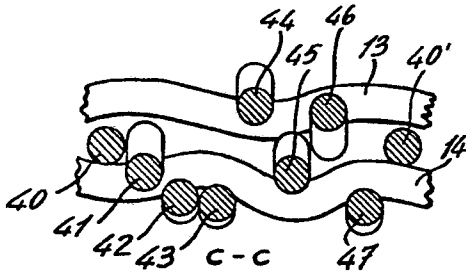


Fig. 3e

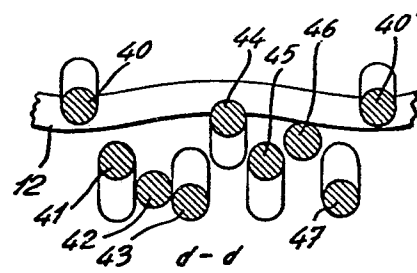


Fig. 3f

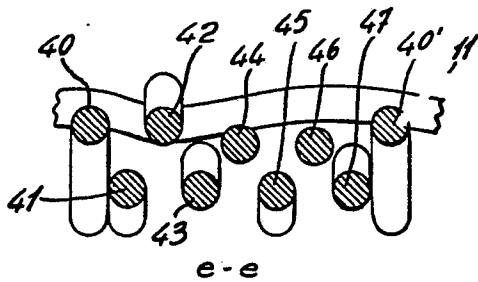


Fig. 3g

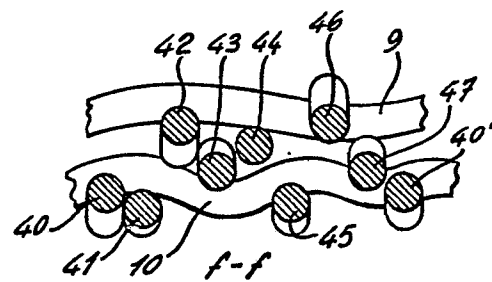


Fig. 3h

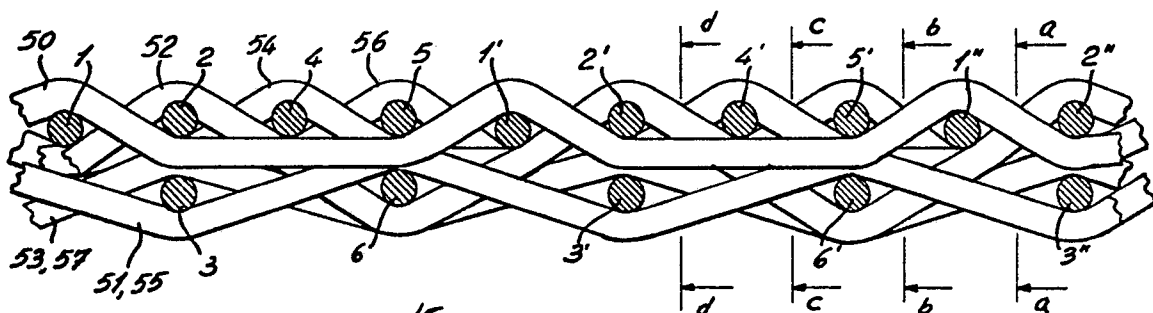


Fig. 4A

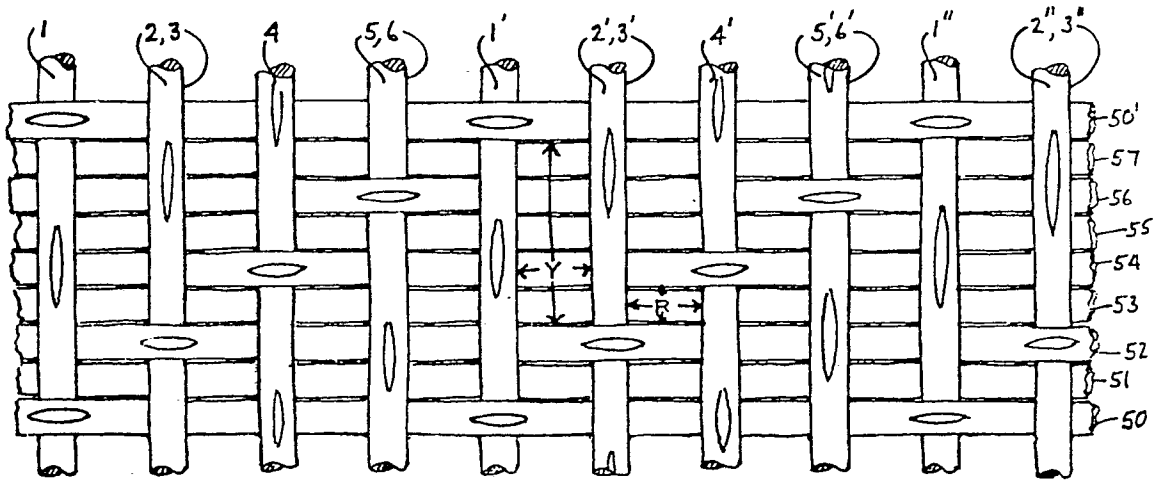
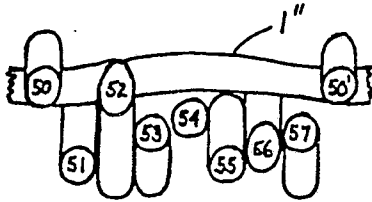
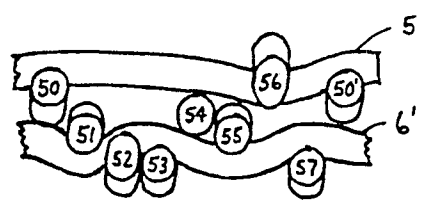


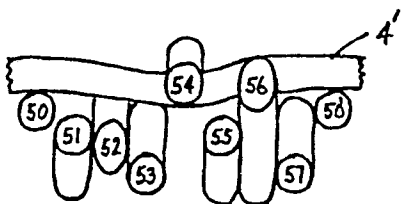
FIG. 4 B



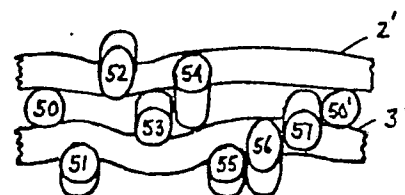
a-a
FIG. 4 C



b-b
FIG. 4 D



c-c
FIG. 4 E



d-d
FIG. 4 F