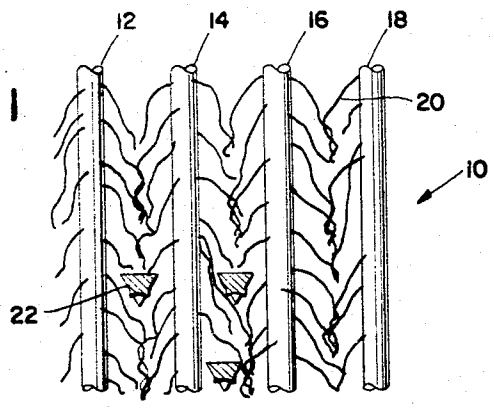
July 9, 1968 E. Z. FEKETE 3,392,079

PAPERMAKERS' FELT

Filed May 22, 1964 2 Sheets-Sheet 1

FIG. 1



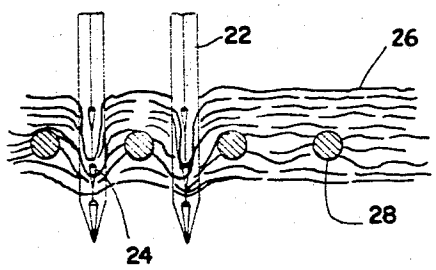




FIG. 2

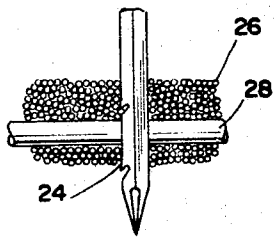



FIG. 3

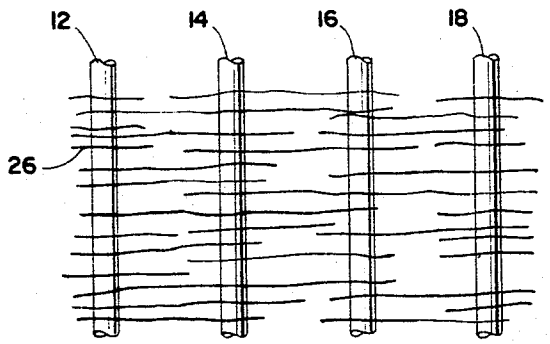



FIG. 4

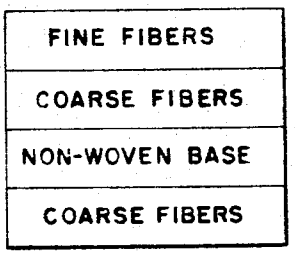



FIG. 5

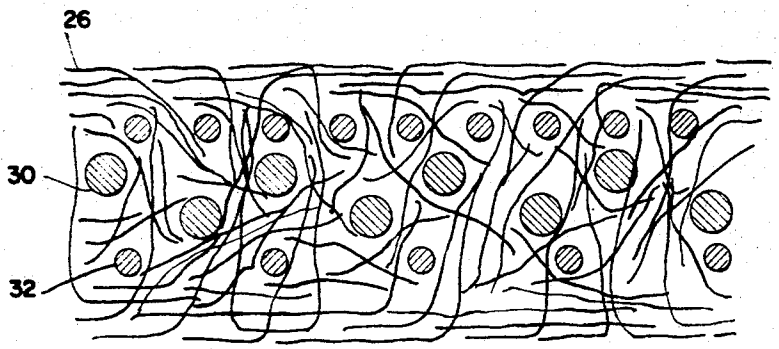



FIG. 6

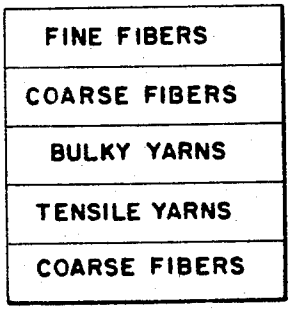



FIG. 7

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# PAPERMAKERS' FELT

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Filed May 22, 1964, Ser. No. 369,561
12 Claims. (Cl. 161—59)

This invention relates to papermakers' felts and to a process for making them, and more particularly relates to papermakers' felts formed by needling oriented fibers to a non-woven base.

It has long been desired to devise a papermakers' felt which has a non-woven structure and which may be made at relatively high speed and without the necessity for weaving a base. An article which attempted to meet such requirements was the non-woven papermakers' felt described in U.S. Patent 2,943,379, issued July 5, 1960, which utilized a single array of longitudinal yarns. However, felts made in accordance with that patent are believed to be unsuitable for use as a papermakers' felt. Such prior art felts were unstable and weak in the cross machine direction.

The prior art felts are further believed to be deficient because they are comprised of randomly oriented fibers which fail to provide adequate tensile strength to the assembled papermakers' felt. Also, use of pre-felted batts, as in the prior art, tends to make relatively fewer fibers and fiber ends available for interlocking and binding the felt into a compact and cohesive structure.

It has been found that by pretreating yarns to cause them to cohere to each other and by using non-felted, carded fibers, the maximum number of loose fibers and fiber ends are available for entanglement and needling into a felted compact mass, and a practical papermakers' felt is produced. The prior art patent did not teach the criticality and advantage of using carded fibers in non-felted form. Neither did it teach the use of oriented fibers or the advantage of entangling fibers from the carded mass with fibers from the yarns.

It is an object of the present invention to provide a papermakers' felt which may be constructed without the use of conventional knitting, braiding or weaving operations on yarns made from fibers such as wool, cotton, nylon and other natural and synthetic fibers, and which has improved water drainage and air permeability as well as improved tensile strength.

It is another object of this invention to provide a papermakers' felt which is economical in preparation, may be prepared without costly equipment set-ups and may be made at high speeds.

It is another object of this invention to provide a papermakers' felt having a paper-web-contacting surface of improved smoothness, softness, uniformity, resilience and freedom from objectionable patterns and which will not cause strike-through during normal papermaking operations.

It is still another object of this invention to provide a papermakers' felt of improved flexibility which is more efficient than felts of equivalent weight per unit area, which has a long life and which is economical in manufacture and use, which has improved dimensional stability and which is not susceptible to drawing-in.

It is another object of this invention to provide a papermakers' felt having a non-woven base in which non-woven yarns are oriented in one direction, and which has improved characteristics imparted by needling to it fibers oriented in the cross yarn direction.

It is another object of this invention to provide a papermakers' felt in which fibers from the surfacing layers are entangled with fibers from the yarns.

Other objects will be apparent to those skilled in the art from consideration of the present disclosure taken in conjunction with the drawings, in which:



FIGURE 1 is a schematic view showing on an enlarged scale, the construction of the non-woven base, and the relative position of a number of barbed needles in applying fibers thereto;

FIGURES 2 and 3 are schematic cross-sectional views through a non-woven base and a plurality of layers of fibers thereon and show two barbed needles in their lowermost position, FIGURE 2 being taken in a direction perpendicular to the yarns, and FIGURE 3 being taken in a direction parallel to the yarns;

FIGURE 4 is a schematic plan view, on an enlarged scale, showing the relationship between yarns and the fibers disposed at right angles to them;

FIGURE 5 is a diagrammatic view of an alternate embodiment of the papermakers' felt of this invention;

FIGURE 6 is a schematic cross-sectional view through then non-woven base and a plurality of layers of fibers thereon showing another embodiment in which a plurality of layers of yarns of different natures are used; and

FIGURE 7 is a diagrammatic view of still another embodiment of the papermakers' felt of this invention.

While this invention will be described with regard to papermakers' wet felts, it is to be understood that the invention is applicable as well to dryer felts, which conduct a paper web through drying apparatus. Wet felts convey wet paper webs through a portion of papermaking apparatus. Wet felts run as endless bands through a press section where water is squeezed from the web effectively increasing its solids consistency, as a step in drying the web. Dryer felts run as endless bands through the drying section of papermaking machines and dry a paper web by passing it over rotating, steam heated rolls or cans. The dryer felts hold the web in contact with the surfaces of the rolls, and also remove additional water by wicking.

The objects of the present invention may be accomplished by forming a loosely cohesive, gossamer base fabric from a plurality of spaced warp yarns and, in place of weft or filling yarns, needling fibers to one or both sides of the base fabric. The preferred gossamer base fabric for the present invention is one which is lightly self-cohesive and may be handled in processing. The present invention is directed to an array of yarns to which successive layers of unfelted, highly oriented fibers have been attached and then felted by needling together. The fibers serve not only as finishing layers to present a smooth surface of soft material to the paper web but also act as transversely arranged mechanical reinforcing devices.

It is a feature of this invention that the yarns which are used to form the base fabric are abraded or fuzzy yarns, which are laid parallel to each other and, due to fuzziness or spurious fibering, tend to interlock with each other and entangle one with the other.

A feature of such an assembly lies in the novel combination of parallel fuzzy or spuriously fibered yarns along with fibers which are oriented substantially at right angles to the yarns and intimately entwined with the yarn fuzz or spurious fibers. Without wishing to be bound by a theory of operation of the present invention it is believed that the yarns act as catenaries and so aid in increasing transverse strength. A parallel array of strong, fuzzy fibered yarns are structurally associated with the encompassing batt material in such a fashion that cross-machine forces applied to the batts are transferred to and supported by the yarns. This is achieved by tangling fibers from the batts with the fuzzy or spurious fibers from the yarns and may be likened to tying strings directly to cables. The same effect is produced by intimately entangling fibers from a batt layer on one side of the yarn array with fibers from the batt layer on the other side of the yarn array which would be analogous to tying strings around a

support cable. By this means, the batt fibers having been oriented generally in a direction at right angles to the axes of the yarns, cross-machine direction forces will be transmitted through the entangled fibers to the yarns themselves. Since the batts are laid in soft (that is, not pre-felted) a multitude of batt fibers are available for entanglement with each other and with the spurious fibers from the yarns. This is different from the prior art, particularly due to the number of batt fibers which can be made to effectively bridge between the batts and the yarns. In the prior art, the limited yarn exposure available for penetration by batt fibers and the greater possibility of such fibers tearing free from the yarns will effect a strength transfer medium capable of tolerating much lower pressures or forces than those of the present invention.

The maximum advantages of the present invention may be obtained by the use of embodiments which the base yarns are oriented in the machine direction of the papermakers' felt. Without wishing to be bound by a theory of operation and without detracting from the catenary theory explained above, it is possible that in such embodiments the yarns act as warp yarns and provide strength in the machine direction, while the oriented fibers act as weft yarns and provide strength in the cross-machine direction. However, some advantages are obtained in embodiments in which the base yarns are oriented in the cross-machine direction of the papermakers' felt. In the latter embodiments the particular advantages of the present invention are realized to a great extent in that the oriented fibers add a high degree of tensile strength in the machine direction that was not achievable by prior art processes in which the product was made by use of pre-felted batts and particularly where use was made of non-oriented, pre-felted batts. The orientation of the fibers is preferably such that at least 70 percent of the fibers are laid with their longitudinal axes within 15 degrees of the normal to the longitudinal axes of the yarns. In another embodiment of the invention multiple layers of fibers are oriented at substantially right angles to each other and disposed at substantially 45 degrees to the longitudinal axes of the yarns.

It will be appreciated that the fibers are not strictly linear, but have a wavy configuration. Therefore, orientation of the fibers will be understood as referring to the general longitudinal axis of the fibers in the carding of the fibers. Also it will be appreciated that in the carding of fibers it is not possible or practicable to align their axes entirely in the desired direction. However, in accordance with the present invention, it is highly desirable to align the axes of the fibers to the extent of at least 70% in one direction.

It has been found that greater strength characteristics are obtained by needling oriented fibers to the base fabric, rather than utilizing pre-felted batts of fibers, even batts with oriented fibers. This is believed to be due to the fact that the relative freedom and looseness of the fibers in the non-felted cards effectively provide more ends for needling and thus permit a greater interlocking of the fibers with each other, on both sides of the yarns, and with the fibers of the yarns themselves. However, in applications where tensile strength requirements are not rigorous, it may be possible to utilize oriented fiber, pre-felted batts in the preparation of the papermakers' felt. It has been found that oriented fiber pre-felted batts provide substantially increased tensile strength over non-oriented fiber pre-felted batts when utilized in the preparation of papermakers' felts.

It is another feature of this invention that the penetration of individual yarns by the needle barbs is not necessary in order to achieve a coherent self-sustaining papermakers' felt. The interlocking of the fuzzy, spurious fibers of the abraded yarns is sufficient to hold the base fabric together. Thus, the fibers forming opposite sides of the felt are not, of necessity, needled into the yarns but more importantly are needled to each other and to the spurious fibers in order to form a compact self-sustaining papermakers' felt. These features distinguish the present invention from prior art where it was necessary to needle through the individual yarns. In some embodiments it is advantageous to limit the maximum spacing of the yarns by the length of the spurious fibers and their degree of overlap in order to interlock.



The product of the present invention is a papermakers' felt which has a high tensile strength and little tendency to shrink or draw-in in the weft direction, and which has better drainage, air permeability, and resistance to marking or strike-through. Also, because the yarn crossings are eliminated the felt has a higher degree of flexibility than felts having a woven base fabric of the same density.

The base fabric is preferably formed in endless fashion, as will be described below. The yarns extend in the machine direction, and the fibers in the cross-machine direction of the belt-like felt being produced. If the fabric is formed flat, the yarns will normally be positioned in the machine direction of the felt to be produced therefrom, and the fibers will be positioned in the cross-machine direction and the ends joined to form an endless belt. It will be understood that the base fabric may be produced of any desired width or length from yarns of any suitable character.

In a preferred embodiment of this invention the yarns are laid parallel to each other in a flattened helical configuration. The spurious fibers on adjacent yarns interlock forming an endless base fabric. Also, at least one continuous yarn may be abraded and disposed in a helical pattern such that fibers on adjacent yarn segments engage each other. In addition at least one spurious yarn may be disposed in a side-by-side pattern so as to interlock fibers extending from adjacent segments thereof. Carded, oriented fibers are laid across both sides of the base fabric with the fibers oriented at right angles to the yarns. The fibers are then needled to form a felted, compact papermakers' felt.

The unique step of abrading the yarns as they are laid in order to cause fuzziness or spurious fibering is a feature of the process of the present invention. The optimum results are achieved with yarns which are readily abraded to produce fuzziness or spurious fibers, such as plated yarns. Other features of the present process include entangling the fibers with the yarns and entangling the fibers of the yarns with each other.

The felts of this invention may be produced by needling the fibers to the non-woven base. However, a further improved felt is produced by needling the fibers to a non-woven base under conditions insuring high tensile strength of the felt in both the machine and the cross-machine direction. For this purpose it has been found advantageous to provide a special relationship among the barbs of the felting needles and the direction in which yarns of the base fabric extend and the general direction in which the longitudinal axis of the fibers of the batt extend. The method and apparatus for needling a felt in this manner is described in application Ser. No. 250,806, filed Jan. 11, 1963, by McKew et al, now Patent No. 3,230,599.

In accordance with a preferred embodiment of that invention the barbs provided on each needle extend in only one direction, or at most in two directions, from the longitudinal axis of the needle. Thus, a needle having a triangular cross-section in the barbed region thereof will have the barb extending outwardly from the axis of the needle at only one corner or edge of the triangular configuration, or will have the barbs similarly extending outwardly from two corners or edges from the triangular configuration. When such needles are used in a needling machine, care is exercised to have all of the barbs on the multiplicity of needles extend in substantially the same direction or the same two directions.

Also according to that invention, the direction in which the barbs extend from the needles should bear a quite

definite relationship to the direction in which the yarns and the longitudinal axes of the fibers extend. When the needle is of such character that its barbs extend only in one direction, the direction should be parallel to the yarns and perpendicular to the general or major direction in which the fibers extend. If the needles employed have barbs extending in two directions, these should preferably be at an angle of at least 120° to each other, and they should preferably be pointed at not more than 30° to the direction in which the yarns extend, and preferably at least 60° to the direction in which the general longitudinal axes of the fibers extend.

By performing the needling operation as described, the resulting felt has a high tensile strength in the yarn direction, and also a higher than usual tensile strength in the fiber or "weft" direction. The preservation of tensile strength in the yarn direction results in part from the minimum damage done to the yarns, by virtue of having the needle barbs extend in a direction parallel with, or at an angle of preferably not more than 30° to the yarns. Improved tensile strength in the fiber direction results from the fact that any cutting or nicking of the fibers is more than offset by the fibers which are firmly secured to the yarns and extend in the cross yarn direction to add to the tensile strength in that direction.

In order to insure the desired extent of needling of the fibers into the base, it is preferable to cycle the material through the needling zone a number of times. The number of passes required to bring about the desired attachment of the fibers to the base will depend upon the penetration depth and density of needling, that is, penetrations per unit area, the latter being governed by the relative speeds of the reciprocating head of the needling machine and the advance of the work.

Fibers which may be used in the present invention are those useful in textile manufacture and include natural and synthetic fibers, including plant fibers, such as cotton, jute, etc., natural animal fibers, such as wool, manufactured fibers, such as rayon, nylon, polyacrylics, polyvinyl chloride, polyesters, etc., and copolymers of such synthetics.

The base yarns may be formed from either natural or synthetic materials, or a combination of these by well-known methods. Preferably, the synthetic fibers used in such yarns are staple fibers. The relatively coarse card fibers are preferably entirely synthetic fibers, but may be comprised entirely of wool, or a blend of wool and synthetic fibers, if desired. The relatively fine fibers are preferably a blend of wool fibers and synthetic fibers, but may be comprised entirely of wool fibers or entirely of synthetic fibers, if desired. Where synthetic materials are used for the card fibers they should be in the form of spun staple fibers.

The lightly cohesive, gossamer base of the present invention is illustrated in FIGURE 1. There, the base **10** is shown to be comprised of yarns **12**, **14**, **16** and **18**. Extending from each of these yarns are hair-like spurious fibers, or fuzz, **20**. The yarns **12**, **14**, **16** and **18** are placed sufficiently close together that the hair-like fibers **20** from one yarn becomes entangled with the hair-like fibers of the other yarns adjacent to it. By this mechanism the yarns are made to cohere to each other to an extent sufficient for the purposes of further fabrication in accordance with the practice of this invention. A number of barbed needles **22** are shown in order to indicate the relative position of the needles and the yarns during needling.

FIGURES 2 and 3 are views taken at right angles to each other through the felt as it is being needled. As is shown in these figures, the needles **22** have a number of barbs **24** engaging the oriented fibers **26** which are disposed on both sides of the yarns **28**. The fibers are driven into each other resulting in an entanglement of fibers with each other and with the hair-like fibers **20** appended from the yarns, causing an interlocking of the fibers **20** and **26** both with similar fibers and with each other, resulting in a compacted felt-like structure.

In the region of the needling machine in which a reciprocating head or a plurality of such heads is provided, a large number of needles **22** are forced downwardly through the fibers and through the base fabric. The barbs of the needles will carry portions of groups of fibers downwardly and will leave them in substantially U-shaped loop form, as indicated in FIGURE 2, to present parallel leg portions in planes perpendicular to the direction in which the barbs extend from the axes of the needles, or parallel with direction of orientation of the fibers. It will be appreciated that in the final product, the loops of fibers so produced will have their legs much closer together and more nearly parallel than is shown in the enlarged schematic view of FIGURE 2. It will be further understood that the needles **22** are provided in a plurality of rows which extend completely across the width of the material to be needled. The reciprocating head or heads carrying the needles may be reciprocated at a suitable speed through a distance of say three inches, to carry the pointed ends of the needle downwardly through the fibers and the base fabric, from a point above the fibers to a point about a half inch below the base fabric.

FIGURE 4 is a plan view of a needled felt, greatly enlarged, showing the general orientation of the needled fibers **26** and the yarns **12**, **14**, **16** and **18** after needling.

The fibers which are oriented normal to the yarns may be all of one nature as to strength, fineness, etc., but two or more different kinds of fibers in the direction perpendicular to the yarns may be used. The fibers may all be applied to one side of the fabric but are preferably applied to both sides thereof. A papermakers' felt having good water removal and freedom from plugging, as well as reduced tendency to mark, may be made by needling relatively coarse fibers to a non-woven base fabric and further needling relatively fine fibers to the sheet side of the relatively coarse fibers.

The term "relatively coarse fibers" when used herein is to be understood to mean one or more layers of fibers having a coarseness of 10 denier or more, as defined by ASTM procedure D–540–60 with regard to synthetic or man-made fibers, and a coarseness of 44 wool grade or coarser, as defined by ASTM procedure D–419–61 with reference to natural fibers.

The term "relatively fine fibers" when used herein is to be understood to mean one or more layers of fibers having a coarseness of less than 10 denier with regard to synthetic fibers and a coarseness finer than 44 wool grade with regard to natural fibers.

The fine fibers next to the paper web improve the smoothness of the sheet and aid in water removal in certain applications by offering a surface of smaller capillary structure to the sheet. The outer, relatively fine, fibers contact the paper web without marking the web because of the resiliency and the fine textured pattern of the surface layer. Moreover, the relatively coarse fibers between the fabric and the relatively fine fibers provide physical strength, resistance to bending and a relatively high void space. The strength and resistance to bending of the relatively coarse fibers bridge over low spots or suction holes in the paper machine rolls and further reduce the tendency of the weave pattern or suction hole pattern to strike through, etc. The relatively high void space in the coarse fiber layers provides volume for the storage of water expressed from the web, reduces the tendency of water to back up at the press roll nip and prevents destruction of the web by crushing, etc.

Another advantage of this embodiment of the papermakers' felt is that any debris passing through the relatively fine fiber layer passes freely through the coarse layer. Thus the felt is less susceptible to clogging and plugging. Relatively coarse fibers on the drive side of the felt adjacent the paper machine rolls increase the life

of the felt, apparently acting as a wear shield of durable character.

FIGURE 5 is a diagrammatic view showing a preferred embodiment of the present invention in which a non-woven base similar to those described above is used, and a plurality of layers of different fibers are disposed in an oriented arrangement adjacent the non-woven base and needled to it. As shown in FIGURE 5, a layer of relatively coarse fibers is needled to each side of the non-woven base. A layer of relatively fine fibers is needled to the layer of relatively coarse fibers on the sheet side of the papermakers' felt and runs in contact with the paper web as it is being transported through the papermaking machine. The fine fiber layer provides a smooth flexible surface which is free from the tendency to objectionable strike-through.

Where fibers are applied to both surfaces of the base fabric, the fibers may be first needled to one surface, and the resulting product then inverted, and the second fibers applied to and needled to the opposite surface of the base. Relatively coarse fibers are preferably needled in such a way as not to disturb earlier applied relatively fine fibers. This may be advantageously accomplished by applying the relatively fine fibers after the relatively coarse fibers have been applied, but may also be accomplished by needling in such a manner that the relatively coarse fibers are not driven through the relatively fine fibers.

While the preferred embodiment of the present invention makes use of only one type of warp yarns arranged substantially in a plane, other advantageous embodiments make use of two or more arrays, or layers of yarn in multiple planes. It has been found advantageous to utilize two or more arrays of longitudinally extending yarns which have substantial structural and functional differences from each other. Thus, one array of yarns may be made relatively large in diameter to supply cushion or bulk, even though they do not have sufficient tensile strength for purposes of the structure. The second array may then be made of longitudinally extending high tensile yarns which are needled to give added tensile strength in the longitudinal direction and to make up for the tensile strength not supplied by the first yarns. Thus, the function of the first yarns are to supply cushion or bulk, while the function of the second yarns are to supply tensile strength.

FIGURE 6 is directed to the embodiment of the present invention in which a plurality of yarns of different characteristics are used. As shown in FIGURE 6, the oriented fibers **26** have been needled and interlocked with the spurious fibers of the yarns which are comprised of two different types. The yarns **30** are relatively large and serve to add bulk and void volume to the finished felt but may have relatively low tensile strength. The yarns **32** may be somewhat smaller than the bulk yarns **30** but have a relatively high tensile strength and provide strength in the yarn direction to the finished felt. The tensile and bulk yarns may be placed in separate layers or may be mixed in the same layer.

FIGURE 7 is an alternate embodiment of the structure shown in FIGURE 6 in which a plurality of bulk yarns and tensile yarns are used to form a non-woven base. Coarse fibers are then needled to both sides of the non-woven base and fine fibers are needled to the sheet side, or paper web contacting side, of the papermakers' felt in order to obtain the advantages of a smooth, flexible surface, as described above.

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

What is claimed is:

1. A papermakers' felt comprising a non-woven array of yarns having an abundance of spurious fibers, at least one fibrous batt having one surface substantially contiguous with one surface of said non-woven array of yarns, substantial numbers of the fibers in said fibrous batt being oriented substantially at right angles with respect to the yarns in said non-woven array, the fibers in said fibrous batt being entangled with said spurious fibers, said spurious fibers also being entangled with one another to form a cohesive felt having improved strength characteristics.

2. A papermakers' felt as described in claim **1** wherein said non-woven array of yarns comprises more than one layer of substantially parallel yarns.

3. A papermakers' felt as described in claim **1** wherein the fibers in said fibrous batt are relatively coarse fibers; and further including a second fibrous batt of less coarse fibers, one surface of said batt of less coarse fibers being substantially contiguous with the surface of said batt of relatively coarse fibers not contiguous with said non-woven array of yarns, the less coarse fibers being entangled with said relatively coarse fibers to form a papermakers' felt.

4. A papermakers' felt as described in claim **1** wherein at least 70% of said oriented fibers are laid with their longitudinal axes within 15 degrees of the normal to the longitudinal axes of said non-woven parallel of layer yarns.

5. A papermakers' felt as described in claim **1** having a batt of oriented fibers substantially contiguous with each surface of said non-woven array of yarns.

6. A papermakers' felt as described in claim **5** wherein the fibers in one of said batts of oriented fibers are relatively coarse and the fibers in the other of said batts of oriented fibers are relatively less coarse.

7. A papermakers' felt for transporting webs of paper through papermaking machinery comprising a base fabric having first and second layers of non-woven, substantially parallel, fuzzy spuriously fibered yarns, said first layer of yarns being relatively large in diameter and supplying cushion and bulk to the felt, said second layer of yarns being relatively small in diameter and having high tensile strength, a plurality of fibers oriented substantially at right angles with respect to the direction of said yarns disposed on each side of said base fabric, said fibers being needled to and entangled with the spurious fibers of said yarns, said spurious fibers also being needled to and entangled with one another, to form a compact porous papermakers' felt.

8. A papermakers' felt for transporting webs of paper through papermaking machinery comprising a base fabric having first and second substantially parallel fuzzy spuriously fibered yarns, said first yarns being relatively large in diameter and supplying cushion and bulk to the finished felt, said second yarns being relatively small in diameter and having relatively high tensile strength, at least one layer of relatively coarse fibers disposed on each side of said base fabric and oriented substantially at right angles with respect to said base fabric yarns, at least one layer of relatively fine fibers disposed on one side of said relatively coarse fibers and being oriented at substantially right angles with respect to said base fabric yarns, said coarse fibers being needled to and entangled with the spurious fibers of said base fabric yarns, the spurious fibers of said base fabric yarns being needled to and entangled with one another, and said fine fibers being needled to and entangled with at least the adjacent coarse fibers to provide a soft non-marking uniform surface to a paper web as it is transported to the papermaking machinery.

9. A papermakers' felt as described in claim **8** wherein said relatively coarse fibers are selected from the group consisting of synthetic fibers having a coarseness of at least 10 denier and natural fibers having a coarseness of at least 44 wool grade and said relatively fine fibers are selected from the group consisting of synthetic fibers having a fineness of less than 10 denier and natural fibers having a coarseness finer than at least 44 wool grade.

10. A process for making a papermakers' felt for transporting paper webs to papermaking machinery comprising the steps of:

(a) disposing at least one yarn in a predetermined nonwoven pattern such that a plurality of yarn segments are disposed in side by side relation, each of said yarn segments having a plurality of spurious fibers extending therefrom, said yarn segments being spaced and so disposed such that the spurious fibers on adjacent yarn segments intermingle with each other so as to form a cohesive base fabric;

(b) placing a plurality of textile fibers on at least one side of said base fabric with the longitudinal axes of said textile fibers being oriented substantially at right angles with respect to the longitudinal axes of said yarn segments; and

(c) needling the textile fibers to said base fabric so that the textile fibers are entangled with the spurious fibers without substantial breaking of the yarn segments and so that the spurious fibers are entangled with one another to form a pepermakers' felt having improved strength.

11. A process of making a papermakers' felt for transporting paper webs through papermaking machinery comprising the steps of abrading at least one continuous yarn to form a plurality of spurious fibers thereon; disposing same in helical patterns such that spurious fibers on adjacent yarn segments engage one other to form a cohesive base fabric with the longitudinal axes of said yarn segments lying in the desired machine direction of the finished fabric; disposing a plurality of textile fibers on at least one side of said base fabric with the longitudinal axes of said textile fibers being oriented substantially at right angles with respect to the longitudinal axes of said yarn segments; and needling said textile fibers to said base fabric to entangle said textile fibers with said spurious fibers and to entangle the spurious fibers from adjacent yarn segments with one another, said needling occurring without substantial breakage of said yarn segments in order to form a felt having increased strength in the direction of the orientation of the textile fibers and to provide a smooth surface to the paper web.

12. A process for making a papermakers' felt for transporting paper webs through papermaking machinery comprising the steps of abrading at least one continuous yarn to form a plurality of spurious fibers thereon; disposing same in a helical pattern such that spurious fibers on adjacent yarn segments engage each other and form a cohesive base fabric, the longitudinal axes of said yarn segments lying in the desired machine direction of the finished felt; disposing a plurality of relatively coarse textile fibers on each side of said base fabric with the longitudinal axes of said relatively coarse textile fibers being oriented substantially at right angles with respect to the longitudinal axe(s) of said yarn segments; needling said relatively coarse textile fibers to said base fabric in order to entangle said relatively coarse textile fibers with said spurious fibers and to entangle the spurious fibers from adjacent yarn segments with one another, without substantial breakage of said yarn segments; disposing a plurality of relatively fine textile fibers on at least one side of the already needled structure with the longitudinal axes of said relatively fine fibers being oriented substantially at right angles with respect to the longitudinal axes of said yarn segments; and needling said relatively fine fibers to the already needled structure in order to entangle said relatively fine textile fibers with the already needled structure without substantial breakage of said yarn segments so as to form a felt having increased strength in the direction of the textile fibers and to provide a smooth surface to the paper web.

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