

July 16, 1963

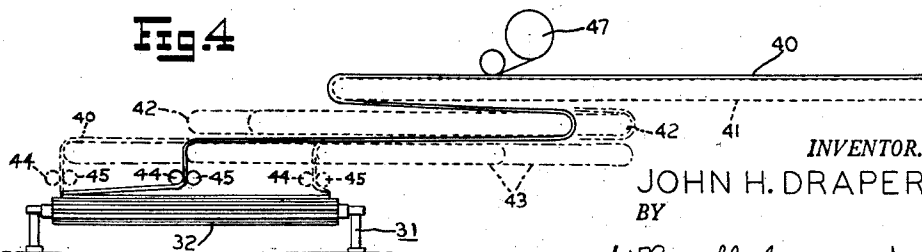
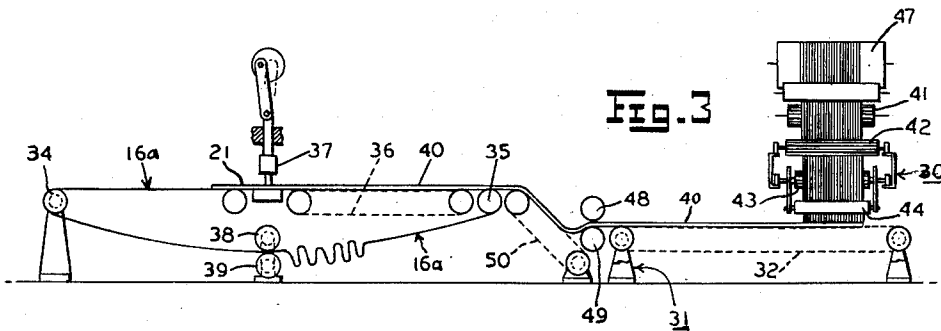
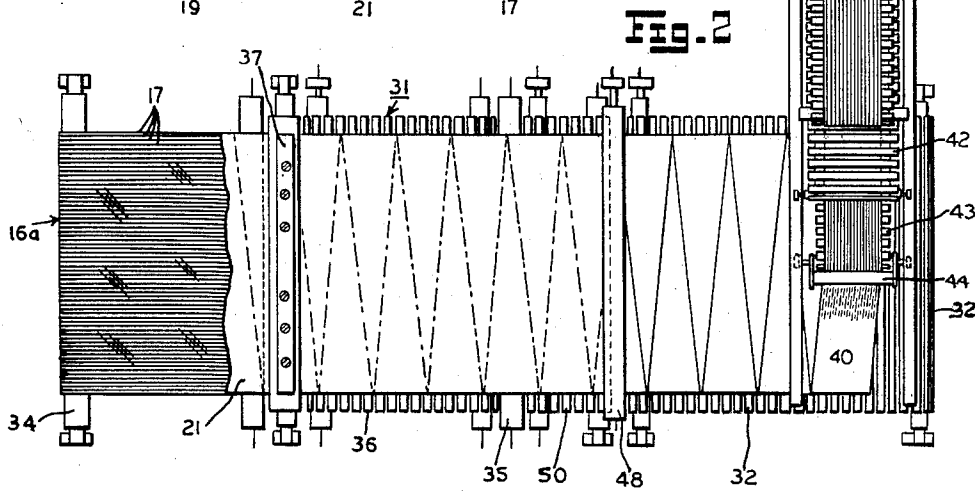
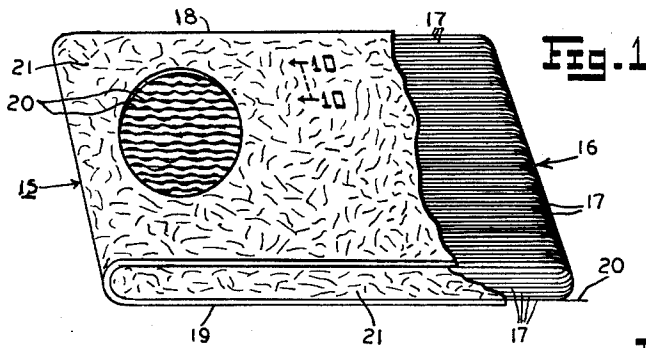
J. H. DRAPER, JR

3,097,413

UNWOVEN PAPERMAKER'S FELT

Filed May 26, 1960

2 Sheets-Sheet 1



INVENTOR.
JOHN H. DRAPER, JR
BY

W Russell Greenwood
ATTORNEY

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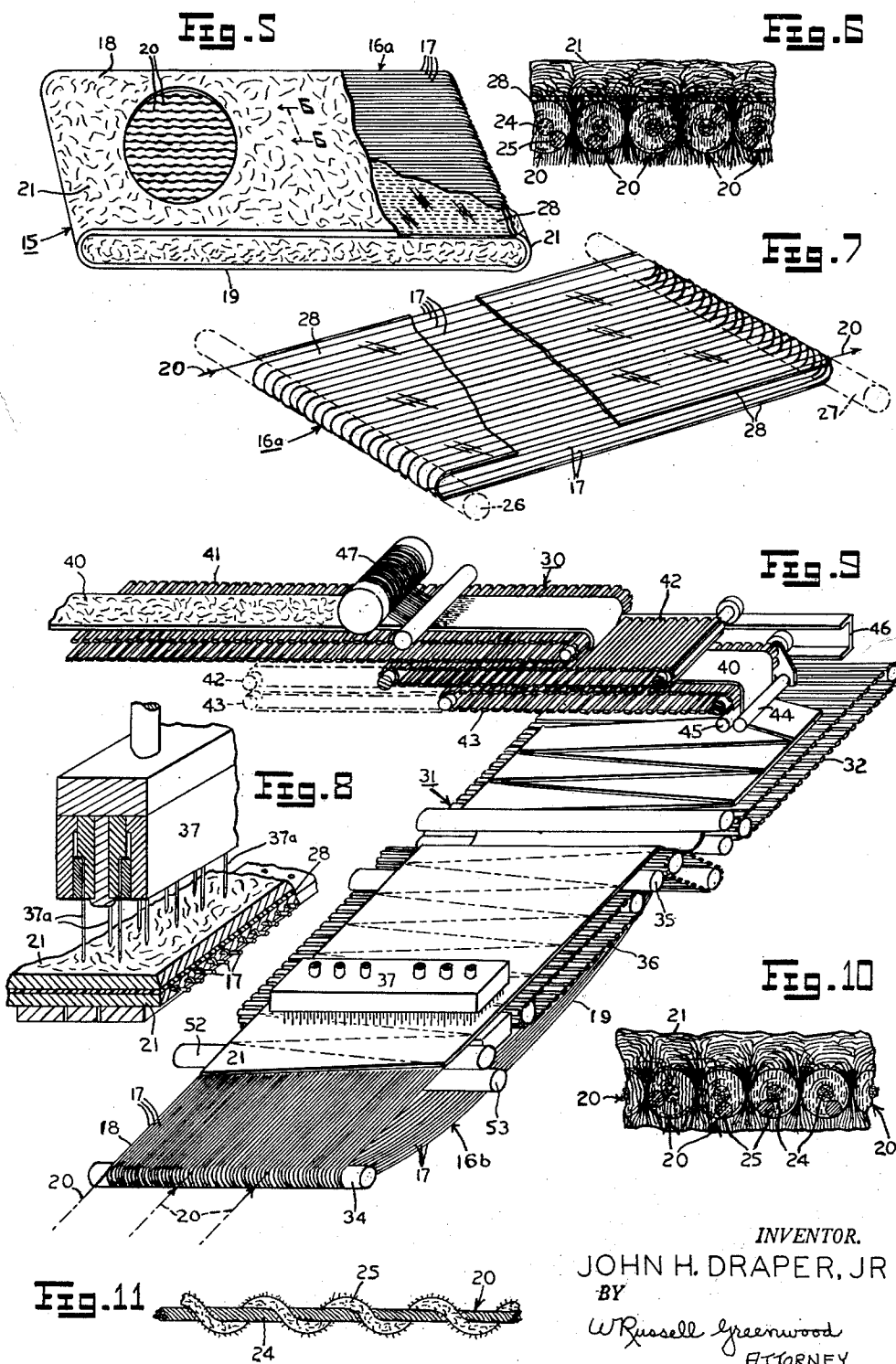
J. H. DRAPER, JR

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2 Sheets-Sheet 2



INVENTOR.
JOHN H. DRAPER, JR

BY

W Russell Greenwood
ATTORNEY

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UNWOVEN PAPERMAKER'S FELT

John H. Draper, Jr., Canton, Mass., assignor to Draper Brothers Company, Canton, Mass., a corporation of Massachusetts

Filed May 26, 1960, Ser. No. 31,847
2 Claims. (Cl. 28—79)

The present invention relates to improvements in endless felts for use in paper manufacture and for certain industrial purposes, and particularly to an unwoven endless felt structure and methods of making the same.

The usual known papermaker's wet felts utilize in their structure a base fabric of woven material, usually wool, which serves as a foundation into which wool fibers of an upper facing layer or fibrous body are incorporated and united thereto by a needling process. This requires use of conventional weaving facilities and methods of forming woven fabrics, such as looms, yarn storage, cloth inspection, etc. for making the base fabrics for such prior felts. However, these textile operations are prone to the various difficulties and troubles associated with loom operation, such as mechanical breakdowns, loss of production while the looms are being set up for the weaving process, cloth defects and the necessity for mending the same, time loss in joining or splicing the yarn ends, etc.

It is therefore a general object of the present invention to provide improved endless felts for use in paper manufacture and a process or method of making the same which will eliminate the use of woven base fabrics in the manufacture and structure of such felts and consequently will obviate the need for weaving equipment and the various facilities and services which are attendant thereto.

It is another general object of the invention to provide an unwoven needled endless felt for use in papermaking machines or for industrial purposes.

Another object of the invention is to provide unwoven endless papermaker's felts which can be made to desired predetermined lengths and widths to meet particular customer installation requirements and intended use of such felts on papermaking machines.

With the foregoing objects and other features in view, the present invention now will be described in greater detail with reference to the accompanying drawings, in which

FIG. 1 is a perspective view of an unwoven needled felt embodying the invention with parts broken away at one end to expose the base thread sheet thereof, and further showing in a broken enlarged top section the composite plied character of the threads which form such base thread sheet of the felt structure;

FIG. 2 is a top plan view of a combined assemblage of lapping and needling machine units of one form of apparatus for carrying out the process or method of the present invention to produce the unwoven endless felt structure of FIG. 1 embodying the invention;

FIG. 3 is a diagrammatic view, in longitudinal elevation and partly in section of the needling machine unit of the FIG. 2 machinery assemblage;

FIG. 4 is an elevational view diagrammatically representing the forward parts of the lapping machine unit of the machinery assemblage shown in FIG. 2 and depicting certain stages of the cycle of cross-laying operations as carried out by the two reciprocating and continuously rotating endless belts or aprons thereof in forming a lap in zig-zag fashion on the lap receiving conveyor member of the needling machine unit of the FIG. 2 assemblage;

FIG. 5 is a perspective view, with parts broken away, representing an unwoven needled endless felt embodying the invention in its penultimate stage of manufacture ac-

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ording to one form of initial construction and method of the present invention;

FIG. 6 is an enlarged fragmentary cross-sectional view taken substantially on the line 6—6 of FIG. 5 showing the construction of the needled felt in its penult state;

FIG. 7 is a pictorial view illustrating diagrammatically the continuous helically wound spaced generally parallel arrangement of threads constituting the unwoven base sheet of threads which forms the initial foundation member of the improved endless felt according to the invention;

FIG. 8 is a fragmentary pictorial view, in section, illustrating the manner in which the FIG. 5 felt structure is subjected to the needling operation of the needling machine unit of the combined machinery assemblage illustrated in FIG. 2;

FIG. 9 is a pictorial view illustrating diagrammatically the lap forming and needling steps in the cycle of operations of the combined machine units of the FIG. 2 apparatus for carrying out a modified process of the invention, in a continuous process, in the manufacture of the endless unwoven needled felt product illustrated in FIG. 1 according to an alternate manner of intermediate construction embodying the invention;

FIG. 10 is an enlarged fragmentary cross-sectional view taken substantially on the line 10—10 of FIG. 1 illustrating the structure of the felt product as manufactured in accordance with either of the methods of the invention illustrated in FIGS. 2 and 9 of the drawings; and

FIG. 11 is an elevational view on greatly enlarged scale of a length of composite plied thread desirable for use in the practice of the present invention.

Referring to the drawings, in FIG. 1 there is shown a broken pictorial view of an unwoven endless felt constructed and made in accordance with the invention, such felt being suitable for use in paper manufacture and being designated generally in this figure by the reference numeral 15. It will be noted that the woven base fabric customarily used in the construction of felts of this class has been eliminated and in lieu thereof my felt 15 utilizes for its foundation or base layer a prefabricated endless belt-like thread body 16 which may be initially prepared in either of the forms indicated at 16a or 16b (see FIGS. 2, 3, 5, 7 and 9), which will be hereinafter described in greater detail. It now will suffice to say that the thread body 16, in either of its forms 16a and 16b, comprises a plurality of longitudinal linear thread portions 17 disposed side by side in spaced generally parallel relationship to one another lengthwise in the upper and lower runs 18 and 19 respectively of the felt 15, said thread portions 17 being formed of continuous helically wound threads 20.

The continuous threads 20 may be composed of one length of thread, or of several lengths joined together, or of a plurality of thread ends wound helically at a time from at least three spools to form corresponding arrays thereof widthwise to make the initial sheet or base thread body 16 in either of its forms 16a or 16b herein disclosed.

Integrally united to the thread body 16 is an outer fibrous covering sheet or facing 21 composed of textile fibers in the form of a batt or lap made up of a number of carded webs the fibers of which have been needled through the base thread body 16a or 16b, as the case may be, by the action of a needle punching operation in accordance with a known needling process whereby they are interlocked with the respective longitudinal thread portions 17 thereof (see FIGS. 6 and 10), as will be hereinafter described.

It will be understood that each of the helically wound threads 20 in addition to its single continuous nature also

has a composite or plied construction which is illustrated in FIG. 11 and consists of a central strand or core 24 made up of a number of fine synthetic filament yarns, preferably filament nylon, around which is longitudinally wrapped a helically wound staple yarn 25. The staple yarn 25 may be an all-wool yarn or a blend of wool and synthetic, or an all-synthetic staple yarn. The composite thread 20 may be made on a twisting frame by twisting together the core strand 24 and the wool yarn 25 in accordance with known practice in the textile art to form a plied thread of the desired size so that specific details of such manufacturing process need not be described herein.

To effect the manufacture of the improved felt 15 the present invention contemplates two alternative processes or methods of manufacture presently to be described and the practice of either of which will produce the same resultant felt product as illustrated in FIG. 1.

In carrying out the manufacture of the felt 15 represented in FIG. 1, according to one method of the invention as illustrated in FIGS. 2 through 8 inclusive, the thread body 16 which is utilized for the initial base layer or foundation of the felt structure will be made as a prefabricated unit and constructed of a single continuous thread 20 which is helically wound back and forth over and across a pair of parallel cylindrical supporting members or rolls 26 and 27 spaced a predetermined distance apart whereby the overall length of the endless thread body 16a will correspond to the particular length requirements to fit the rolls of the paper-making machine upon which the completed felt 15 is to be installed.

The thus-wound longitudinal threads 17 of the thread body 16a then are maintained in their spaced generally parallel arrangement by the application of a temporary layer or overlay 28 of a soluble binding material in film or thin sheet form which preferably consists of a water-soluble vinyl plastic film. The binding sheet or overlay 28 may be coated on its under surface with a suitable water-soluble adhesive material (not shown) and the thus-coated sheet then laid over and wrapped lengthwise around the parallel arrangement of helically wound threads 17 to entirely surround and cover the same so that the binder sheet and its coating will maintain the belt-like form and generally parallel position of the threads 17 of the thread body 16a for its use as a foundation upon which is to be built up the final endless felt 15.

As illustrated in FIGS. 2, 3, 4, 5 and 8 of the drawings, there is shown somewhat diagrammatically one schematic form of apparatus which may be employed for carrying out in a continuous process the improved method of the present invention for the manufacture of an unwoven endless papermaker's felt 15, as illustrated in FIG. 1, and utilizing as its initial base layer or foundation the prefabricated belt-like thread body 16a just-described.

The apparatus illustrated in the above-named figures comprises a machinery assemblage made up of a lapping machine unit 30 and a needling machine unit 31, which machines are longitudinally disposed at right angles to each other with the discharge or delivery end of the lapping machine 30 situated above and overhanging the usual slatted lap receiving conveyor member 32 at the input end portion of the needling machine 31.

The prefabricated endless thread body 16a is placed around the cylindrical rollers 34 and 35 of the needling machine 31 in which position the upper run of the thread body is horizontally supported and moved by the positively driven conveyor apron 36 and extends therefrom in a longitudinal direction under the needling head 37, see FIG. 3. The lower run of the thread body 16a passes between a pair of gripper rolls 38 and 39 which maintain the proper tension on the upper run of the thread body 16a as it is progressively advanced under the needling head 37 of the needling machine.

A web 40 of carded fibers produced by a Garnetting machine or woolen card (not shown) and delivered from

the usual doffing mechanism thereof upon the slatted feeder apron 41 at the input end section of the lapping machine 30, is fed thereby to its delivery end section where it is deposited onto the lap receiving conveyor apron 32 of the input end section of the needling machine 31 in a continuously moving strip which is overlaid in a zig-zag fashion thereon.

The lapping machine 30 is of well-known construction and as shown in FIGS. 2 and 3 includes a continuously moving slatted feeder apron 41, of which only the delivery portion thereof is illustrated in FIG. 4, and two superposed slatted aprons 42 and 43 which, respectively, serve as a carrier apron and a distributing apron and rotate at uniform speed but traverse bodily at different speeds in order to form the lap on the lap receiving apron 32. The feeder apron 41 receives the carded fibrous web 40 delivered from the Garnetting machine or a woolen card, and feeds it to the carrier apron 42 arranged partially beneath the forward end portion of the feeder apron 41 but rotating continuously in the opposite direction to the latter at the same surface speed whereby the carded web 40 is fed at constant speed so that it will not pull apart or bunch when it is transferred by the carrier apron 42 to the distributing apron 43 which reciprocates beneath the carrier apron.

The carrier apron 42 is traversed bodily backwardly and forwardly across the lapping machine 30 by automatic mechanism (not shown), and both aprons 42 and 43 reciprocate transversely in a widthwise direction across the transversely moving lap receiving apron 32 at the input end portion of the needling machine 31. The distributing apron 43 is traversed bodily backwardly and forwardly across the lapping machine 31 at twice the speed of the carrier apron 42 in order to lay the web 40 (as it comes off the distributing apron 43 and is delivered by the rolls 44 and 45) in zig-zag fashion upon the progressively moving apron 32 of the needling machine 31 to form thereon a lap or fibrous sheet of the required thickness and width. This reciprocating movement of the carrier apron 42 is utilized to rotate the same.

The mechanism (not shown) for rotating the distributing apron 43 includes pinions moving with the apron along stationary racks (not shown) as this apron is traversed which through reversing racks (not shown) maintain the rotation of the distributing apron 43 continuously in the same direction even though the traversing movement of such apron is reversed periodically during the cross-laying operations. The lapping machine 30 is provided with tracks 46 upon which run the wheeled carriages (not shown) which rotatably support the carrier apron 42 and the distributing apron 43.

In the course of the feeding of the continuously moving web 40 additional lengthwise yarns may be incorporated therewith by being deposited on the surface of the web as it passes beneath a jack spool 47 carrying such yarns.

The lap formed by the lapping machine 30 just-described may constitute the fibrous covering or facing 21 on one or both sides of the felt 15 (see FIG. 1) and, in either instance, such lap is fed by the conveyor apron 32 to and between the ironing rolls 48 and 49, thence passes onto the inclined conveyor apron 50 which deposits it onto the forward portion of the upper run of the moving thread body 16a, which is advanced by the conveyor apron 36, and is carried along therewith to pass under the needling head 37 of the needling machine 31. Thus, the facing of facings 21 are united to the thread body 16a by the needling action of the needle head 37 as the fibers of the respective laps are forced downwardly by the needles 37a thereof (see FIG. 8) through the plastic binder sheet or overlay 28 so as to become interlocked with the composite threads 20 of the thread body 16a. When the moving thread body 16a has made one complete revolution it will be completely covered on one or both of its peripheral faces with the needled fibrous facing or

facings 21 and the felt will be in its penultimate stage as illustrated in FIG. 5.

Following the needling process the felt thus fabricated is removed from the needling machine 31 and is completed by subjecting it to treatment in a solvent or water bath to remove the soluble binder sheet 28, after which it is stretched and dried to a predetermined desired size and subjected to the usual finishing operations but without fulling, if desired.

In FIG. 9 there is shown a modified form of the thread body 16 and herein designated 16b, which is used in the practice of the alternative method of the invention above-mentioned. In this case the thread body 16b is formed directly in the needling machine 31 by helically winding a set of continuous threads 20, of the composite or plied character shown in FIG. 11, over and across the rolls 34 and 35 of the needling machine 31. These are the same rolls which were used to support the thread body 16a described above. In this embodiment of the invention, the longitudinal threads 17 are maintained in parallel spaced relation under suitable tension by means of the rolls 52 and 53 until the fibrous lap or facing 21 has been needled to and entirely covers the threads 17 forming the thread body 16b, thereby completing the felt 15.

The completed needled felt is then removed from the rolls 34 and 35 and stretched to a predetermined desired size and subjected to the usual finishing operations but without fulling.

It will be understood, of course, that in the practice of this alternative method of making my felt 15, the lapping machine 30 represented in FIG. 9 will function in the same manner as it performed in carrying out the cross-laying and lap forming operations above described in connection with its use in the practice of the method disclosed and illustrated in FIGS. 2, 3 and 4 of the drawings to provide a lap in a zig-zag fashion upon the lap receiving conveyor apron 32 of the needling machine 31.

It further will be understood that the needled fibrous facing 21 may cover either one or both sides of the felt 15, and/or may be multi-layered, as desired.

In view of the foregoing description, it will be seen that a felt product, especially adapted for industrial or paper-making use, can be custom-made endless to any predetermined total length and width and within an infinite variety of sizes used in papermaking machines. Also, the method or process of this invention has eliminated the use of a woven base fabric in making such felts. The felt thus-produced has lengthwise strength due to the longitudinal warp threads which make up the unwoven thread body 16 and widthwise stability of the felt is obtained because the web fibers are disposed crosswise of the thread body 16 due to the cross-laying built-up of the web 40 in that direction.

While two preferred embodiments and methods of the invention have been disclosed, it is to be understood that the foregoing description is intended to be illustrative only and not in limitation thereof, and that changes and variations may be made in the above-described invention without departing from the spirit or scope thereof as defined by the appended claims, and therefore it is my intention

not to limit my invention in any manner whatsoever except by the terms and scope of the appended claims.

What is claimed is:

1. A new article of manufacture comprising a paper-maker's felt of endless belt-like formation for use in papermaking machinery for supporting, transporting, and draining wet papermaking fibre material comprising a foundation layer having a non-woven fibrous porous structure consisting of a thread sheet assembly made up of a multiplicity of helically-arranged continuous thread lengths, the convolutions of which are disposed widthwise of the felt and the linear runs of which extend longitudinally thereof in a general predetermined spaced parallel relationship to one another so as to form definite liquid drainage passages between them for rapid draining of liquid through the felt from the outer side to the inner side thereof, said helically disposed thread lengths each being of a composite yarn structure and consisting of a central core strand made up of a plurality of fine synthetic textile filament yarns around the exterior of which longitudinally extends a single helically-wrapped staple fiber yarn length of any of the usual textile fabric yarn materials, an intermediate layer in the form of a thin flat temporary binder sheet and composed of a water-soluble vinyl plastic film material superposed upon and enveloping said foundation thread sheet, said binder sheet being adherently secured to the threads of said foundation layer by a coating of a suitable water-soluble adhesive material and said vinyl plastic binder sheet and its water-soluble coating material further being capable of subsequent removal easily from the final manufactured felt product when the latter is readied for use with wet papermaking material, and an outer covering body of unwoven fibrous material superposed upon and co-extensive with said binder sheet layer, said fibrous covering body being integrally united with the threads of said foundation layer by having considerable fibers needled in a depthwise direction through both said binder sheet and said thread sheet layers and interlocked with the threads of the latter and also with the respective helical yarns carried by such threads, the outer face of said fibrous body serving as the active supporting surface of said felt for draining and transporting wet papermaking fibre material in a papermaking machine.

2. A new article of manufacture comprising a paper-maker's felt as claimed in claim 1 in which the helically-wrapped staple fiber yarn carried by the several convolutions of threads of said foundation thread sheet is chiefly an all-wool yarn.

References Cited in the file of this patent

UNITED STATES PATENTS

Re. 21,890	Walsh et al.	Aug. 26, 1941
2,526,324	Bloomfield	Oct. 17, 1950
2,881,505	Hoffman	Apr. 14, 1959
2,893,105	Lauterbach	July 7, 1959
2,943,379	Foltz	July 5, 1960
2,958,113	Lauterbach	Nov. 1, 1960
2,970,365	Morgenstern	Feb. 7, 1961
3,010,180	Hoffman	Nov. 28, 1961