# United States Patent [19]

**Fekete**

[11] **3,928,699**

[45] **Dec. 23, 1975**


[54] **PAPERMAKERS FELTS**


[75] Inventor: **Eugene Zoltan Fekete,** East Greenbush, N.Y.

[73] Assignee: **Huyck Corporation,** Wake Forest, N.C.



[22] Filed: **Aug. 8, 1973**

[21] Appl. No.: **386,636**

[52] **U.S. Cl.** ..... **428/212;** 139/383 A; 162/358; 162/DIG. 1; 428/298; 428/300; 428/303; 34/95; 34/123

[51] **Int. Cl.²** ..... **D03D 3/00;** B22C 9/08

[58] **Field of Search** ..... 161/151, 152, 154, 155; 34/95, 123; 162/199, 358, DIG. 1; 28/72.2; 139/383 A; 428/298, 212, 303, 233, 234



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 2,765,247 | 10/1956 | Graham | 428/212 |
| 3,214,327 | 10/1965 | Wicker et al. | 162/358 |
| 3,214,329 | 10/1965 | Wicker | 162/358 |
| 3,214,330 | 10/1965 | Wicker et al. | 162/358 |
| 3,392,079 | 9/1968 | Fekete | 28/72.2 R |
| R21,890 | 8/1941 | Walsh | 139/383 A |



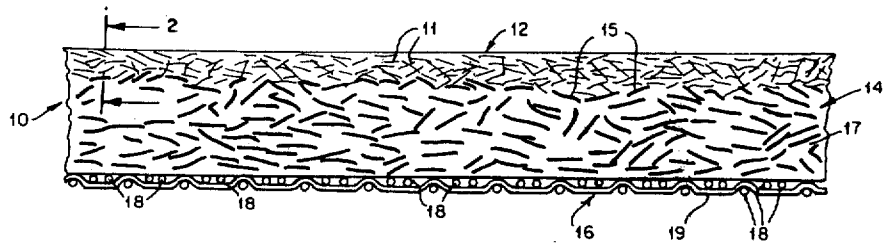
*Primary Examiner*—George F. Lesmes
*Assistant Examiner*—Paul J. Thibodeau
*Attorney, Agent, or Firm*—Robert F. Hargest; Sanford S. Wadler; William G. Rhines



[57] **ABSTRACT**

This invention relates to felts for use in papermaking machinery, comprising an underlayer made from relatively coarse, rigid, nondeformable fibers so that when the felt is compressed, as, for example, in the nip between press rolls, the constituent fibers of the underlayer form a semi-rigid lattice providing void volume for the reception and carrying of water through the press nip. Advantageously, such a structure may be used in combination with a surface layer made from relatively fine fibers for contacting the sheet of paper to be processed.


**19 Claims, 3 Drawing Figures**



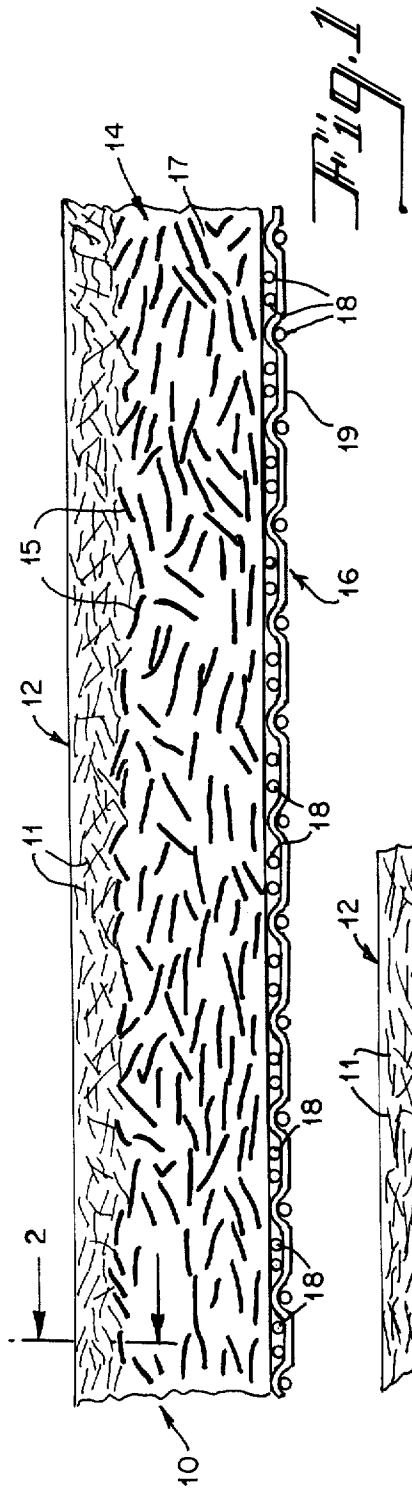



Fig. 1

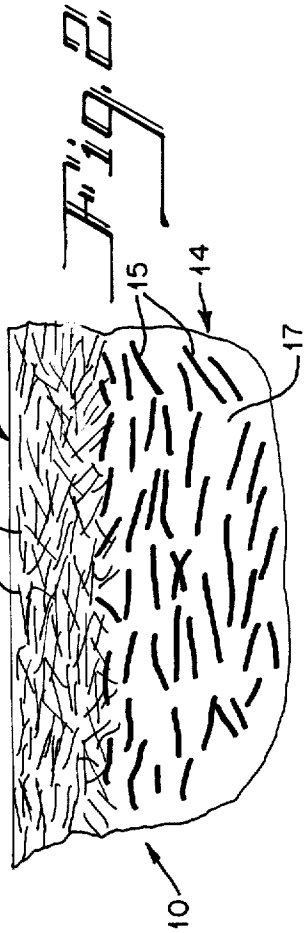



Fig. 2

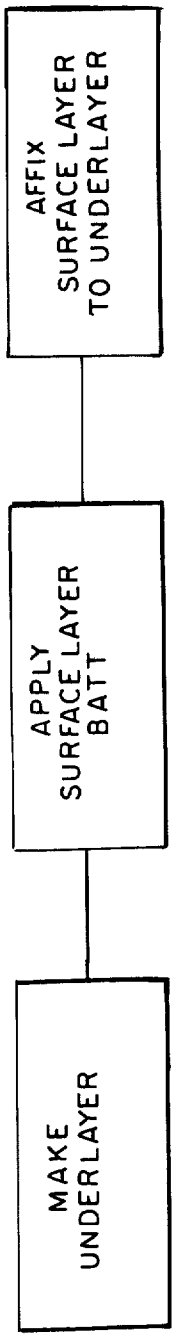



Fig. 3

# PAPERMAKERS FELTS

## BACKGROUND OF THE INVENTION

It is known in the field of papermaking that it is advantageous to provide, in a papermakers felt for use in the press section of a papermaking machine, void volume which will remain available through the nip between press rolls, thereby affording structural means to receive water pressed out of the sheet so as to carry it through the press nip, thereby avoiding a backflow of water relative to the direction of motion of the soft, tender paper web, with consequent "crushing", or hydraulic destruction, of the structural integrity of the web. As used herein, "paper" includes, without limitation, paper, pulp, and board. Various methods have been proposed for effectuating this desired result. In this connection, reference is made to Wicker et al, U.S. Pat. No. 3,214,327; Wicker, U.S. Pat. No. 3,214,329; Wicker et al, U.S. Pat. No. 3,214,330; Wicker, U.S. Pat. No. 3,214,331; and Wicker, U.S. Pat. No. 3,278,368. These solutions, however much they may have improved the water removal process over that previously known, still have various problems. For example, where structures are utilized which incorporate a relatively coarse, incompressible, woven base fabric to provide void volume, the very incompressibility of the yarns comprising the base fabric acting as intermittent backing elements to the associated fibrous layer tends to produce regions of varying pressure as the fabric passes through the press nip, and therefore, as explained in greater detail hereinafter, the felt is less efficient as a water removal device since a smaller portion of the surface area of the paper is effectively exposed to pressure being exerted upon it than if the fibrous layer were more uniformly supported underneath by the base fabric. The resulting adverse effects on the sheet of paper in terms of moisture content, sheet mark, etc., are desirably avoided since they may become so severe as to be not merely objectionable, but to affect adversely the manufacture of goods of acceptable quality.

Accordingly, it is an object of this invention to provide a papermakers felt that will at once provide void volume through the nip between press rolls while, at the same time, avoiding some of the objectionable results previously experienced.

## SUMMARY OF THE INVENTION

These and other objects, as will be apparent to those skilled in the art, may be achieved from practice of the present invention, one embodiment of which is a papermakers felt having a fibrous surface layer and an underlayer made from fibers which are substantially noncompressible and are rigid and coarse in comparison to the fibers in the surface layer whereby, when the fabric is subject to compression as, for example, in the nip between press rolls, the underlayer will provide a semi-rigid lattice-like structure to ensure that there is void volume present through the press nip, while the smooth surface layer will more effectively pass water from the associated web of paper and will cushion the surface of the paper against objectionable marking or other results of nonuniformity in pressure through the region of the press nip.

An understanding of this invention may be had from the detailed discussion which follows and from an examination of the drawings in which:



## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a cross-sectional representation of one embodiment of this invention.

FIG. **2** is an enlarged fragmentary view taken along the lines **2—2** of FIG. **1.**

FIG. **3** is a schematic description of a method for manufacturing papermakers felts which embody this present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. **1** and **2** generally depict a preferred embodiment of the present invention. Illustrated in FIG. **1** is a papermakers felt **10** made in accordance with the present invention which comprises a surface layer **12** and an underlayer **14.** There is also shown in FIG. **1** a base fabric **16** which optionally may be utilized in connection with the practice of the present invention.

Alternatively, base fabric **16** shown in FIG. **1** may be a woven or nonwoven structure such as, for example, a "compressible-incompressible" construction, as contemplated, for example, by Wicker, U.S. Pat. No. 3,214,327, a perforated plastic belt, as contemplated, for example, by Wicker, U.S. Pat. No. 3,214,331, a nonwoven, fillingless construction, as contemplated, for example, by Fekete, U.S. Pat. No. 3,392,079, or other known per se structure in the field of papermakers felts. Such a base fabric might commonly be used because it provides structural strength and stability to the fabric. When it is used, it can be made in accordance with any of a number of techniques that are well known in the cognizant arts. As illustrated in FIG. **1,** the base fabric **16** comprises interwoven yarns, some of which yarns **18** are oriented in the cross-machine direction (i.e., at right angles to the direction of travel of the felt when in use on a papermaking machine), and others, **19,** are oriented in the machine direction. When such a base fabric is used with the present invention, it may optionally be desirable in certain situations that it have compressible characteristics as hereinafter described.

The underlayer **14** may advantageously be made from fibers **15** of any of a number of well-known compositions, including natural fibers such as wool, but preferably will be made in whole or in part from synthetic materials such as nylon, dacron, etc. In this connection, it is desirable that these fibers be relatively coarse or of large diameter, in comparison to the fibers that are used in the manufacture of the surfacing layer. In the practice of this invention, these fibers advantageously are 40 microns or larger in diameter, to provide large intersticial areas as hereinafter described. The underlayer fibers advantageously will be selected for their stiffness, or "rigidity"; that is, their tendency to resist bending or deformation at fiber cross-over points, since this enhances their ability to produce a semi-rigid lattice as hereinafter discussed.

The surface layer fibers **11** can advantageously be made from a wide variety of materials, including natural fibers such as wool, or synthetic fibers such as nylon, dacron, and the like, or combinations of any of the foregoing. The surfacing layer **12** advantageously is made from fibers **11** which are relatively fine or small in diameter in comparison with those of the underlayer, and in no event larger than **27** microns. Preferably the fibrous surface layer is less than ⅓ of the thickness of the entire felt in the uncompressed state. In the prac-

tice of this invention, the ratio between the diameter of the surface fibers and the diameter of the fibers which comprise the underlayer **14** must be at least 1 to 1.75; that is, the diameter of the fibers which comprise the underlayer **14** must be at least about 1.75 times greater than the diameter of the fibers which comprise the surface layer **12.** For example, in a preferred embodiment of the present invention, the diameter of the underlayer fibers is about **2.8** times greater than the diameter of the surface layer fibers.

In certain prior art structures designed to provide void volume through the press nip, the construction consisted of a base fabric similar to that shown as Item **16** in FIG. **1,** with a fibrous batt needled to one side, the base fabric being made from comparatively incompressible materials. In this connection, reference is made to Wicker et al, U.S. Pat. No. 3,214,327. One of the disadvantages sometimes experienced with such structures, however, is that there is a tendency for the relatively incompressible constituent yarns of the base fabric to form local areas of high pressure on the web of paper which the felt was transporting through the papermaking machine. This was because of the very fact of the relative incompressibility of the constituent yarns of the base fabric which, of course, is a desired characteristic in order to ensure the preservation of void volume to act as a receptacle for water from the paper as it is transported through the nip of the press, However, the effect, as noted above, of such localized high pressure sometimes significantly reduces the efficiency of the felt as a water removal device, and/or introduces surface marks in the paper which are objectionable to users.

In part, this was due to the fact that the constituent relatively incompressible yarns of the base fabric, in addition to being relatively noncompressible per se, were not large in comparison to the constituent fibers of the associated fiber layer that the latter could not effectively bridge the interstices between adjacent yarns of the base fabric, but instead, were relatively yielding, particularly in the midspan portions where they were not directly backed by the base fabric yarns.

In the present invention, this drawback is overcome by using an underlayer made of fibers which are relatively coarse in comparison to those of the surface layer and individually exhibit a high resistance to cross-sectional deformation. By permitting such fibers to be arranged in a random array, the effect, when the entire felt is subjected to pressure from top and bottom, as, for example, where it passes through the nip of a press, is eventually for the underlying fibers to come into direct contact with each other and to produce a semi-rigid, open, lattice-work having a multiplicity of rather large, interstitial void areas **17** between the fibers. By "semi-rigid" is meant that, even though the fabric is flexible in the cross-machine direction and machine direction and is capable of resuming its "loft", or bulkiness, when the compressing pressures are removed, at the same time, its constituent fibers will reach a point during the compressing cycle at which each fiber interferes with the further movement of other adjacent fibers and, because the fibers are advantageously made from materials which are selected for their resistance to cross-sectional deformation or distortion (by which is meant a tendency of the corss-section of the fiber to be maintained in its original configuration when under the influence of opposing pressures acting on its side walls), this effectively restricts any significant further compression of the felt underlayer as a whole and holds the lattice formed thereby in an open condition with large interstitial volumes available for the reception of water that has been pressed from the paper.

overlying this underlayer is the surface layer **12.** Because the upper surface of the underlayer presents a multiplicity of openings to the constituent fibers of the surface layer, which openings are relatively small compared to those which would be presented to the fiber layer by the woven base of the prior art compressible-incompressible fabrics as described above for example, the surface layer tends to be more uniformly supported underneath by the constituent fibers of the underlayer, with less tendency therefore to yield or deflect in the midspan regions of the constituent fibers of the surfacing layer. By this means, not only is the pressure profile exerted by the felt on the paper more nearly uniform, without objectionable localized relatively hard spots which are likely to produce marks in the paper as noted above, but, in addition, the felt is more efficient as a water removal device since a greater portion of the surface area of the paper is effectively exposed to the pressure being exerted upon it by the felt. It will be apparent that if more water is pressed from the paper in a given press nip than can be accommodated by the associated felt, there will result a surplus of water at the ingress side of the nip which, relatively speaking, will effectively present to the still relatively tender paper web a flow of water which is counterdirectional to the direction of travel of the web, frequently producing "crushing" of the paper. Thus, the "void volume", or that portion within the physical limits described by the entire felt that is not occupied by the constituent material of the felt, that must be available to receive the water pressed out of the paper at a given press nip position and press loading must exceed the total volume of such water plus the water residing in the felt at the moment of greatest pressing. Void volume per se, however, is independent of fiber size. A well-known, illustrative example of this fact is that if cylindrical containers are filled, one with non-absorptive large balls and another with non-absorptive small balls, both will accommodate substantially the same volume of water added to the container. However, the case with which the water will flow through the balls is a function of surface friction and, therefore, surface area, so that water may be drained more easily and thoroughly and quickly from the container with the large balls than from the container with the small balls. Similar effects occur as between fibrous layers with larger fibers (and through larger interstitial regions), on the one hand, and such layers with smaller fibers. The ease of such removal will furthermore be an inverse function of the thickness of the fibrous layer, independent of constituent fiber size.

Thus, it will be clear that through practice of the present invention, it is possible to design a felt in which the underlayer will provide such void volume for a given press nip size opening and paper type that crushing may be avoided, while, at the same time, maximizing the proportion of the felt through which water may be relatively easily and effectively moved (i.e., the underlayer), while minimizing that proportion of the felt (i.e., the surface layer) through which it is relatively difficult to move water. In addition, since the latter portion is relatively thin in comparison to the underlayer and is readily accessible, it is possible to purge it substantially with relative ease since it is

readily accessible to well-known means for doing so, such as felt surface suction cleaners.

Referring again to FIG. **1**, it will be appreciated that in the practice of the present invention where a base fabric **16** is utilized, it is advantageous in certain instances to make the base fabric with a characteristic diametric to the prior art concept of using relatively incompressible base yarns to ensure retention of adequate void volume; that is, to make it from constituent yarns which are relatively compressible or susceptible to being "squashed" under pressures applied to the outer surface since, in the present invention, the base fabric is primarily for the purpose of providing strength and dimensional stability to the fabric and need not be so made as to be the source of the desired void volume since the desired void volume is achieved by the semi-rigid lattice perfected by the constituent fibers of the underlayer **14.** Furthermore, unlike the prior art structures where it is necessary to have a fairly substantial thickness of fibers covering the incompressible base in order to reduce the tendency of the base yarns to mark or otherwise objectionaly affect the paper being produced, through practice of the present invention, the surface layer **12** may be made relatively thin since its primary function is to present a smooth uniform surface to the associated web without the necessity of having to provide a cushion to offset the detrimental effect of portions of the structure causing nonuniformity in pressure, and this means, therefore, that the water removal efficiency of the felt can be greatly enhanced since, clearly, the porosity and permeability of the surface layer made from fine fibers will be significantly reduced if the thickness of the layer has to be great. Not only does this possibility enhance the effectiveness of the present invention in its water removal characteristics, but also, it makdes it easier to purge the felt of water after it leaves its association with the web of paper and the water is removed from it by purging means which are well known per se.

A method of practicing the present invention comprises the steps of (a) forming a fibrous surface layer which comprises fibers, the preponderance of which are 27 microns or less in diameter; (b) forming an underlayer from a material which comprises randomly arrayed fibers, the preponderance of which are at least 1.75 times greater in diameter than the fibers of the surface layer; and (c) affixing the surface layer and underlayer to each other. For example, FIG. **3** illustrates a method of practicing the present invention comprising the steps of first making an underlayer which, as noted above, may comprise a fibrous underlayer or, as also noted above, may comprise making a fibrous underlayer in combination with a reinforcing fabric that may optionally utilize compressible materials. To this underlayer, a surface layer is applied in the form of fibers which are fine as compared to those of the underlayer and, in the next step, the surface layer is affixed to the underlayer by known per se techniques such as needling, thermoplasticity, gluing, or a combination of any of the foregoing, and the like. Alternatively, a surface layer may be made to which an underlayer is applied in the form of fibers, the underlayer subsequently being affixed to the surface layer by known per se techniques.

## EXAMPLE

A base fabric was woven with a four-harness satin weave containing approximately 6.3 yarns/cm in the machine direction and 5.5 yarns/cm in the cross-machine direction in the finished felt. The machine direction yarn was a nylon staple spun yarn comprising 0.19 g/m nylon staple fiber having 342 turns per meter. The cross-machine direction yarn comprised 439 g/m nylon staple fiber having 181 turns per meter. The finished weight of the base fabric was about 373 g/m$^2$.

The coarse fiber portion of the underlayer was made of polyester fiber, approximately 51 microns in diameter and 76.2 mm long. It was needled on top of the woven base in three layers, each weighing 193.2 g/m$^2$.

The sheet-contacting layer was made of fine nylon fibers, approximately 12 microns in diameter and 38.1 mm long. It was needled on top of the coarse fiber structure in a single layer weighing 152,4 g/m$^2$.

The composite fabric was needled until the desired degree of fabric firmness was achieved. The finished felt weight was 1105.0 g/m$^2$.

This felt was tested on the second venta-nip press position of an experimental paper machine making bleached kraft paper weighing 65 g/m$^2$ under a range of varying speed and press loading conditions in accordance with the following table. A comparison was made of the performance of this felt against a control felt comprising a base fabric woven with a four-harness satin weave containing approximately 5.51 yarns/cm in the machine direction and 4.72 yarns/cm in the cross-machine direction in the finished felt. The machine direction yarn was a two-ply nylon staple spun yarn comprising 0.38 g/m nylon staple fiber having 342 turns per meter. The cross-machine direction yarn comprised 0.36 g/m nylon staple fiber having 200 turns per meter. The finished weight of the base fabric was about 398 g/m$^2$. The control felt had a coarse fiber portion similar in construction to the underlayer of the felt heretofore described embodying the present invention but lacked the fine-fiber sheet-contacting layer. Accordingly, the coarse fiber portion of the control felt, which was made of polyester fiber, approximately 51 microns in diameter and 76.2 mm long, was needled on top of the woven base in five layers, each weighing 152.4 g/m$^2$. The total weight of this felt was 1105.0 g/m$^2$. It had been previously determined that the minor differences in construction of the base fabrics and coarse fiber portions would not significantly affect the test results. Therefore, it can reasonably be assumed that within test limits, any difference in performance can be attributed primarily to the fine layer--coarse layer feature of the felt made in accordance with the present invention. Test results were as follows:

For a machine speed of 533 meters per minute:

| | Press Loading kg/linear cm of width | Water Removed (Grams Per Square Meter) | Percentage of Moisture in Felt |
|---|---|---|---|
| | 30.4 | 9.1 | 18.3 |
| Test | 39.3 | 12.0 | 19.5 |
| Felt | 50.0 | 14.5 | 20.4 |
| | 62.5 | 16.5 | 22.4 |
| | 31.2 | 4.4 | 39.2 |
| Control | 38.4 | 5.6 | 40.2 |
| Felt | 46.4 | 7.7 | 42.6 |
| | 53.6 | 9.0 | 45.0 |

From the foregoing data it is clear that for a given press loading and machine speed, the water removal capability of the test felt made in accordance with the present invention was nearly twice as great in most

cases as that of the control felt, and the percentage of moisture retained in the test felt (which is a function of the effectiveness with which water can be removed from the felt in preparation for the next press cycle) for the most part was less than one-half that retained in the control felt.

It is to be understood that the embodiments herein illustrated and discussed, and the terms and expressions which have been employed, are by way of illustration and not of limitation and that there is no intention in using any of them to exclude any equivalents of the features shown or described, or portions thereof, since it will be recognized by those skilled in the arts that this invention may be practiced in a wide variety of forms and embodiments without departing from the spirit and scope of this invention.

I claim:

**1.** A papermakers felt comprising

a fibrous surface layer and a fibrous underlayer characterized by the fact that

the surface layer comprises randomly arrayed fibers, the preponderance of which are 27 microns or less in diameter, and

the underlayer comprises randomly arrayed fibers a preponderance of which are substantially rigid and substantially nondeformable cross-sectionally, and the diameter of which are at least 1.75 times greater than the diameter of the fibers which comprise said surface layer; said fibrous surface layer being less than one-third the thickness of the entire felt in the uncompressed state.

**2.** The papermakers felt described in claim **1** further characterized by the fact that

the underlayer comprises fibers, the preponderance of which are 40 microns or larger in diameter.

**3.** The papermakers felt described in claim **2** wherein said underlayer is comprised substantially entirely of said fibers.

**4.** The pepermakers felt described in claim **3** wherein the long axes of the preponderance of the fibers forming said surface layer, at least in the region of the interface between said surface layer and said underlayer, lie substantially entirely in a plane parallel to the plane described by the upper surface of said underlayer.

**5.** The papermakers felt described in claim **1** wherein the underlayer includes a reinforcing base fabric.

**6.** The papermakers felt described in claim **2** wherein said underlayer includes a reinforcing base fabric.

**7.** The papermakers felt described in claim **3** wherein said underlayer includes a reinforcing base fabric.

**8.** The papermakers felt described in claim **4** wherein said underlayer includes a reinforcing base fabric.

**9.** The papermakers felt described in claim **5** wherein said base fabric comprises yarns having low resistance to cross-sectional distortion.

**10.** The papermakers felt described in claim **6** wherein said base fabric comprises yarns having low resistance to cross-sectional distortion.

**11.** The papermakers felt described in claim **7** wherein said base fabric comprises yarns having low resistance to cross-sectional distortion.

**12.** The papermakers felt described in claim **8** wherein said base fabric comprises yarns having low resistance to cross-sectional distortion.

**13.** A method of making a papermakers felt comprising the steps of forming a fibrous surface layer which comprises fibers the preponderance of which are 27 microns or less in diameter, said fibrous layer being less than one-third the thickness of the entire felt in the compressed state,

forming an underlayer from a material which comprises randomly arrayed fibers, the preponderance of which are substantially rigid, substantially nondeformable, cross-sectionally and at least **1.75** times greater in diameter than the fibers of said surface layer, and

affixing said surface layer and said underlayer to each other.

**14.** The method described in claim **13** wherein said step of applying said surface layer consists of

orienting the long axes of the preponderance of the fibers comprising said surface layer, at least in the region of the interface between said surface layer and said underlayer, substantially parallel to the plane of the top surface of said underlayer.

**15.** The method described in claim **13** wherein the step of forming said underlayer includes

forming a reinforcing base fabric, and

affixing said randomly arrayed fibers comprising said underlayer and said reinforcing base to each other.

**16.** The method described in claim **15** wherein the step of forming said underlayer includes

forming said base fabric from yarns which are substantially deformable cross-sectionally.

**17.** The method described in claim **14** wherein the step of forming said underlayer includes

forming a reinforcing base fabric, and

applying said randomly arrayed fibers comprising said underlayer to said reinforcing base fabric.

**18.** The method described in claim **17** wherein the step of forming said underlayer includes

forming said base fabric from yarns which are substantially deformable cross-sectionally.

**19.** A method of making a papermakers felt comprising the steps of

forming a fibrous surface layer which comprises fibers, the preponderance of which are 27 microns or less in diameter, said fibrous surface layer being less than on-third the thickness of the entire felt in the uncompressed state,

forming an underlayer from a material which comprises randomly arrayed fibers, the preponderance of which are substantially nondeformable cross-sectionally and which have a diameter which is at least about 1.75 times greater than the diameter of the fibers which comprise said surface layer,

applying said surface layer to said underlayer, and affixing said layer to said underlayer.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

# CERTIFICATE OF CORRECTION

PATENT NO. : 3,928,699

DATED : December 23, 1975

INVENTOR(S) : Eugene Zoltan Fekete

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 3, Line 37 - Change "not" to "so".
Col. 3, Line 65 - Change "corss-section" to "cross-section".
Col. 4, Line 5 - Change "overlying" to "Overlying".
Col. 4, Line 44 - Change "case" to "ease".
Col. 5, Line 36 - Change "makdes" to "makes".
Col. 6, Line 15 - Change "152,4 g/$m^2$" to "152.4 g/$m^2$".
Col. 7, Line 40 - Change "pepermakers" to "papermakers".

Signed and Sealed this

*twenty-fifth* Day of *May 1976*

[SEAL]

*Attest:*

**RUTH C. MASON**
*Attesting Officer*

**C. MARSHALL DANN**
*Commissioner of Patents and Trademarks*

# UNITED STATES PATENT OFFICE
# CERTIFICATE OF CORRECTION

Patent No. 3,928,699 Dated Dec. 23, 1975

Inventor(s) Eugene Zoltan Fekete

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 8, Line 50 - change "on-third" to "one-third".

Signed and Sealed this

Twentieth Day of July 1976

[SEAL]

*Attest:*

RUTH C. MASON
*Attesting Officer*

C. MARSHALL DANN
*Commissioner of Patents and Trademarks*

UNITED STATES PATENT AND TRADEMARK OFFICE

# CERTIFICATE OF CORRECTION

PATENT NO. : 3,928,699

DATED : December 23, 1975

INVENTOR(S) : Eugene Zoltan Fekete

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 8, Line 12 - change "compressed" to "uncompressed"

Signed and Sealed this

Twenty-first Day of September 1976

[SEAL]

*Attest:*

RUTH C. MASON
*Attesting Officer*

C. MARSHALL DANN
*Commissioner of Patents and Trademarks*