This Invention relates to permanently cockled fibrous products of the non-woven fabric type characterized by high tenacity in both the wet and dry state, and to a method of making such products.

The cockled products of the invention are made by associating fibers of a fiber-forming cellulose ester with discontinuous fibers of a material which is not affected as much by aqueous saponifying agents for the ester, or with felt-like products formed from such fibers so that the fibers of the product occur in a condition of potential unbalance, bonding or coalescing the cellulose ester and other fibers together, treating the structure with an aqueous saponifying agent for the cellulose ester to decrease the ester content by removal of some or all of the ester groups, subsequently wetting the structure with water and then drying the structure while it is relaxed.

Treatment of the structure with the aqueous saponifying agent converts the cellulose ester fibers, either in whole or in part, depending upon the conditions employed, to reconstituted cellulose. When the product is wet out with water and dried while it is relaxed, the fibers comprising cellulose reconstituted from the ester shrink strongly, causing cockling of the remaining fibers bonded to them, and the product as a whole undergoes marked shrinkage in the direction of the components comprising the reconstituted cellulose, with acquisition of a cockled or crinkled effect which is permanently set in the product and is not removed when it is subjected to tension applied in any direction.

By a “condition of potential unbalance” is meant that the relative distribution of the fibers must be such that when the product is treated with the saponifying agent and dried relaxed, the cellulose ester fibers are free to shrink and draw the other fibers with them to cause cockling of the other fibers, to produce a crepe effect.

The associated cellulose ester fibers and the other fibers may be bonded or coalesced together by (1) treating the product comprising them with a solvent for the cellulose ester and then drying it, (2) by means of a coating of a compatible film-forming material which is not affected by the saponifying medium and serves to hold the ester fibers in contact with the product, or (3) by means of heat, if the cellulose ester contains a plasticizing agent. In any case the proportion of cellulose ester fibers present is critical to the production of a creped article, and depends upon whether the cellulose ester fibers are intimately intermingled with the other fibers at all portions of the product, or occur at localized areas only.

The conditions of potential unbalance of the fibers may result from the presence of a preponderant proportion of the cellulose ester fibers, or from random lay of the fibers in the product, or it may result from bonding of the cellulose ester fibers to a surface or the surfaces of a felt-like product, either locally or at all portions thereof, or both.

In one embodiment of the invention the fibers of a material which is not affected as much by the saponifying agent, and fibers of a plasticized cellulose ester are associated to form a felt-like fibrous structure in which the two types of fibers are intimately commingled at all portions of the structure. The structure thus obtained is then subjected to heat to develop the latent adhesive property of the plasticized cellulose ester fibers and bind fibers in the structure, to form a structure in which the fibers are autogenously adhered or bonded together at their points of contact. Thereafter, the fibrous product comprising the autogenously bonded fibers is treated with the aqueous saponifying media. It may be washed free of the saponifying agent and dried relaxed to develop the creped effects immediately, or, after washing, it may be dried under a tension sufficient to inhibit the development of crepe effects, and at some subsequent time wet out with water and dried relaxed to obtain the desired creped effects. In this embodiment of the invention, when the fibers are more or less parallelized, as occurs during carding, the cellulose ester fibers must predominate and must be present in an amount of not less than 55% by weight. Preferably in those cases, the cellulose ester fibers are present in an amount of from 55 to 70% by weight. If the fibers are commingled by some method resulting in random lay or pronounced heterogeneity of distribution of the fibers, the proportion of cellulose ester fibers may be less but must be at least 25% by weight and between 25 to 70%.

The felt-like products may be formed in any suitable manner. For example, the two types of fibers may be formed into a web, bat or mat by feeding the mixed fibers to a carding machine, by depositing the mixed fibers on a collecting surface from an inert conveying fluid, or by commingling the cellulose ester fibers with other fibers concurrently with their formation, i.e. a stream of a solution of the cellulose ester in a volatile solvent may be projected into a mixing chamber under conditions resulting in disruption.
of the stream and evaporation of the solvent with formation of fibers, the other fibers being blown into the chamber separately and commingled with the cellulose ester fibers being formed. Such method of associating the fibers yields a web or felt-like reticulated structure comprising discontinuous fibers in which the fibers are either arrayed in heterogeneous arrangement or more or less parallelized as occurs in the carding operation, and the cellulose ester fibers which are less uniformly at all portions of the product. One or more thin webs may be superimposed upon one another to produce a web of increased thickness.

The plasticized cellulose ester fibers may be brought to the adhesive condition by exposing the product to hot air, or by contact thereof with heated surfaces, or in any other appropriate manner, for example by means of radiant heat. While the ester fibers are in the adhesive condition the product is preferably subjected to a squeezing or compacting treatment to promote adhesion of the associated fibers, and thereafter cooled to set the fibers in the bonded relation.

The products produced in accordance with this embodiment of the invention are shrunken or cockled and crinkled at all portions of their cross-section, the extent of the shrinkage and cockling depending on the proportion of plasticized cellulose ester fibers used in the range stated, and the conditions of the saponification.

In accordance with another embodiment of the invention, the fibers of the cellulose ester, whether plasticized or unplasticized, are bonded to the surface of a felt-like product, such as a non-woven fabric, e.g., a paper sheet, either after or during its manufacture, a shaped paper product, or the like, formed from fibers of a material which is not affected as such by the saponifying agent, either at localized areas over the entire area, and after saponification of the cellulose ester, a product is obtained which is shrunken and exhibits cocked, creped or crinkled effects which are localized at the surface. If the cellulose ester contains a plasticizing agent, the fibers may be affixed to the surface of the felt-like product by means of heating. If a plasticizing agent is not present, the cellulose ester fibers may be fixed to the surface of the product by means of a solvent for the ester, such as by means of acetone when the cellulose ester is cellulose acetate, or by means of a thin coating of a compatible film-forming material such as cellulose regenerated from viscose. In this last-mentioned embodiment of the invention, the final products may have creped effects which are localized in a pattern depending upon the disposition of the cellulose ester fibers on the surface of the product, and in such case the proportion of cellulose ester fibers may be comparatively low, but not less than 7% by weight.

For example, the cellulose ester fibers may be distributed on the surface of the fibrous product in the form of parallel, uniformly or non-uniformly spaced, vertical, horizontal or diagonal strips, bands or ribs, or a thin mat, web, bat or the like of cellulose ester fibers may be deposited on one surface of a web formed from the fibers which are not affected as such by the saponifying agent, or the two types of fibers may be deposited in separate layers, one on top of the other, to obtain a product one surface of which comprises the cellulose ester fibers which are in a condition of unbalanced distribution with respect to the base. When the cellulose ester fibers occur on or adjacent the surface of the felt-like product, they must be used in an amount of at least 7% by weight.

One method of making a creped paper is to deposit an aqueous suspension of the cellulose ester fibers on a web of fibers which are not affected by the saponifying agents for the ester, as the last-mentioned fibers are carried on a wire screen from the head-box of conventional paper making machinery, so that the cellulose ester fibers occur at or adjacent the surface of the web obtained when the water is removed with little or no intermingling of the two types of fibers, except at their adjacent surfaces, drying the web, subjecting it to heat to convert the cellulose ester fibers to adhesive condition, as by passing it between heated calender rolls, treating the web with the selected saponifying agent, and thereafter wetting the paper with water and drying it relaxed, to shrink the cellulose ester fibers and cause cockling or creping of the paper. In the accompanying drawing.

Fig. 1 illustrates, diagrammatically means for carrying out this last-mentioned embodiment of the invention, the portion of the paper making machine located in general proximity to the head box being shown. As shown, the paper making wire screen 1 travels continuously, in the direction of the arrows, under idling roller 2, around roller 3, through head box 4 and between rollers 5 and 5a. An aqueous suspension of fibers of a material which is not affected as such by aqueous saponifying media, for example cellulose fibers, flows through inlet 6 into the head box 4. The suspension flows through the head box toward the continuously travelling inclined wire screen and, as the fibers reach the screen they are deposited on the screen, the water of suspension passing through the screen to a collector 7 and being returned to the system through pipe 8. The base fibers are indicated by fine lines 9 in the drawing. The sheet of paper is not completely formed until it reaches the point 10 which is the point of contact of the level of the fiber suspension in the head box with the moving screen. From 10, the paper proceeds to the couching and drying stages in the usual paper making procedure.

At point 11, a water suspension of plasticized cellulose ester fibers 12 is deposited on the base fibers from an inclined trough 13. The outlet of trough 13 extends completely across the wire screen. The suspension of cellulose ester fibers may be deposited on all portions of the surface of the web on the screen, or trough 13 may be provided with an automatically operated trap door or the like, to permit deposition of the suspension of cellulose ester fibers on localized areas of the web of other fibers, if desired. The plasticized cellulose ester fibers remain at or adjacent the surface of the web and when the web is dried, as by passing it between heated calender rolls 14 and 15, at which time, also, the cellulose ester fibers are converted to the adhesive state and, after cooling of the product, are autogenously bonded to the fibers of the paper web surface on the sheet, and as in a state of unbalanced distribution with respect to the paper. When the paper is treated with the saponifying medium, and thereafter wet out with water and dried, shrinkage of the de-esterified cellulose ester fibers causes the remaining fibers to cockle, the extent of cockling
depending on the proportion of cellulose ester fibers used.

If a suspension of cellulose ester fibers in unplasticized condition is deposited on the web on the paper making screen, they may be fixed to the surface of the web by passing it through a dilute viscoso solution, and then regenerating the cellulose from the viscoso. Means for practicing this last mentioned embodiment of the invention is shown diagrammatically in Fig. 2 of the drawing, only a portion of the apparatus being illustrated. As shown in the drawing, the cellulose acetate fibers, and moving away from the calender rolls 14 and 15, between which the web is dried and the cellulose acetate fibers are pressed against the base fibers, is passed under the slit-like orifice of the extruding device 16 and a thin film of viscoso of from 2 to 5% cellulose concentration is deposited on the web. The web is then passed through vessel 17 containing an aqueous sulfuric acid coagulating and regenerating bath of conventional composition, to obtain a paper which, after drying, comprises cellulose ester fibers which are disposed on or at its surface and fixed in place thereon by a thin film of regenerated cellulose.

The cellulose ester fibers, whether occurring throughout the felt-like product or on or at the surface thereof only, may be present in the form of individual discontinuous fibers or they may be in the form of fiber bundles resulting from cutting or chopping continuous filament yarns obtained by twisting, doubling, spinning or otherwise associating two or more continuous strands of the cellulose ester together. Further, when the cellulose ester fibers are bonded to the surface of the product, they may be in the form of a continuous filament or continuous filament yarn, disposed in the desired pattern on the surface of the felt-like product. The term "cellulose ester fibers," as used herein, includes the fibers in the form of such fiber bundles or yarns, whether discontinuous or continuous. The term "creped felt-like fibrous product" as used herein includes both the left-like fibrous products in which the de-esterified cellulose ester fibers occur throughout the product, as well as felt-like fibrous products in which those fibers occur only at the surface, and further includes thin products such as the so-called non-woven fabrics e.g. paper or paper-like sheets as well as thicker, more bulky products.

The cellulose ester fibers may comprise any fiber-forming organic ester of cellulose, such as cellulose acetate, propionate, butyrate, etc., or mixed cellulose esters such as cellulose acetate-butyrate. Any plasticizer for lowering the softening point of the cellulose ester may be used. The presence of the plasticizer in the final product is not harmful and in those cases when the ester is completely de-esterified by treatment with the saponifying agent, the plasticizer, if it is present, has no effect on the sensitivity of the reconstituted cellulose fibers to heat, solvents, or the like.

Activation of the cellulose ester fibers may be carried to the stage at which the cellulose ester fibers flow to form a film, but in a preferred embodiment, the cellulose ester fibers are retained in essentially fiber form throughout the process and exist in the fiber form in the final creped product. Neither type of fiber exists in the final product in its original condition, that is in the condition in which it existed prior to the saponification step, since, as a result of the saponifying treatment, when the product is wet out and dried in the relaxed state, the fibers comprising cellulose reconstituted from the ester are shrunken, while the remaining fibers are cockled as a result of such shrinkage, to produce the creped effect.

The fibers other than the cellulose ester fibers may be formed from any material which is not affected as such by the saponifying medium employed. Examples of suitable fibers which may be associated with the cellulose ester fibers are those of such natural materials as wood pulp, cotton, linen, jute, kapok, cellulose, silk or the like, as well as fibers of artificial origin and composition and consisting of or comprising regenerated cellulose, cellulose derivatives such as cellulose ethers, mixed cellulose ethers, cellulose hydroxy ethers, cellulose carboxy ethers, cellulose ether xanthanes, cellulose xantho fatty acids, cellulose thioetheranhes, natural and synthetic rubber and derivatives thereof, alginic acid, gelatin, casein, mineral fibers such as those of spun glass, asbestos, mineral wool, and the like, fibers obtained from natural and synthetic resins of a type which is not rendered adhesive by heating, and the fibers made by slitting, cutting, or shredding non-fibrous films such as waste cellulose.

The saponifying medium used for treating the fibrous product to decrease the cellulose ester content may be, for example, an aqueous solution of an inorganic acid, e.g. hydrochloric acid, or of an organic acid, e.g. formic acid or oxalic acid, or it may be an aqueous solution of a caustic alkali such as sodium hydroxide or potassium hydroxide, or an alkali metal salt of a weak acid, e.g. sodium carbonate, as well as an aqueous solution of sodium sulfide, which may also contain other alkaline agents, for example sodium carbonate.

The particular saponifying agent chosen, the concentration used, and the time and temperature will depend upon whether it is desired to effect saponification throughout the cross-section of the fibers or only at the surface thereof. When a partial deesterification only is desired, aqueous solutions of the saponifying agents of low concentration are suitable, for example, aqueous solutions of from 0.5 to 3% by weight of caustic soda or sodium carbonate may be used, the treatment being performed at elevated temperatures of from 100 to 120° C.

However, in the preferred embodiment of the invention, the fibrous product is treated with an aqueous nitrogenous de-esterifying medium consisting of ammonium hydroxide or an aqueous solution of a lower alkylene amine such as methylene diamine or ethylene diamine. The concentration of nitrogenous de-esterifying agent, the temperature at which the fibrous product is treated, and the duration of the treatment are inter-related. If low concentrations of ammonia or alkylene amine are used, higher temperatures and longer drying times are usually required, or vice versa. However, the de-esterifying medium is maintained in the liquid phase throughout the treatment. Preferably, I use aqueous solutions of ammonia or of the alkylene amine of from 6 to 35% concentration at room temperature, that is 25 to 30° C. The aqueous solutions of nitrogenous de-esterifying agents are preferred, particularly when complete de-esterification at all portions of the cross-section of the cellulose ester fibers is desired, because as I have found, those agents are specific in that they effect the com-
complete de-esterification without degradation of the cellulose. This specificity of the nitrogenous de-esterifying agents is in contrast to other of the saponifying agents mentioned, which do not effect complete de-esterification of the cellulose ester fibers except under conditions such as cause serious damage to the cellulose, which is thereby degraded and weakened. Such other saponifying agents can be used, however, when partial de-esterification of the fibers is to be effected.

As previously mentioned, the final products obtained in accordance with the invention and characterized by pronounced crepe effects can be of any desired thickness. For example, they may be of a weight and thickness corresponding to conventional non-woven fabrics. The known so-called non-woven fabrics comprising, for instance, fibers of cellulose acetate and fibers of regenerated cellulose from viscose have a hand or feel which resembles that of a smooth, calendered paper more closely than it resembles a woven fabric. Surprisingly, when such non-woven fabrics are treated in accordance with this invention to de-esterify the cellulose ester either partially or completely and shrink the product as a whole, with development of crepe effects, the creped product has an improved hand or feel which is much closer to the hand or feel of a woven fabric than it was prior to the shrinking and creping step.

The creped non-woven fabrics of the invention are useful for many and diverse purposes. They may be used in the manufacture of draperies, bed spreads, table covers, guest towels, napkins, for decorative purposes in general, and for all purposes for which non-woven fabrics are suitable. The felt-like fibrous products comprising the cellulose ester fibers may be printed with any desired design prior to treatment with the saponifying agent.

The invention provides a new method of making very interesting and attractive permanently creped paper products. Such products may be obtained by bonding or coalescing the cellulose fibers to the surface of a paper sheet, and then saponifying the ester, wetting the paper with water and drying it relaxed. In this way there is obtained a permanently creped paper which is useful for many purposes. Creped papers may also be obtained by mixing the cellulose acetate fibers with the paper pulp in the Hollander, provided that the paper finally obtained is thin and the cellulose acetate fibers are present in a proportion of at least 25% by weight. The weight and character of the paper depends on the density of the layer of fibers deposited on the paper making screen. In the case of heavy papers, for example of the kraft type, the layer of fibers deposited on the screen is very dense. Papers of such high density do not crepe, even when the percentage of cellulose acetate is 25% or more. If the ester fibers are added to the beater, because, as a result of the dense structure, the cellulose ester fibers are not free to shrink, when the paper is dried, after the saponifying treatment. The cellulose ester fibers may be added to the pulp when the pulp is to be used in the manufacture of a thin, flexible readily conformable paper such as tissue or similar light weight papers because in such papers the cellulose ester fibers have freedom to shrink and cause buckling of the remaining fibers, to produce the desired creping effect.

The de-esterification is performed by immersing the structure comprising the bonded fibers in a vessel containing the aqueous saponifying medium, until the desired decrease in the ester content is obtained. After withdrawal from the bath, the product is washed thoroughly and preferably suspended from a rod or the like and dried at temperatures of from 90 to 95°C. under which drying conditions it undergoes marked shrinkage in the direction of the de-esterified components with acquisition of the crepe effect.

When discontinuous cellulose ester fibers (or fiber bundles) are used the fibers may vary in length, but in general it is preferred to use cellulose ester fibers having a length of about 1/8". Exposure of the fibrous product to the saponifying medium does not disturb the bonds existing between the fibers of the product. The final creped product, in which the fibers are united by a coalescence of the fibers, i.e. by cellulose fibers when the fibers other than the cellulose ester fibers are cellulose, is characterized by unusually high tenacity and resistance to tear, especially when the cellulose ester fibers are intermingled with the other fibers at all portions of the product.

The following examples, in which the parts are by weight, will serve to illustrate the invention:

Example I

A non-woven bonded fabric was prepared, by carding, from a mixture of 40% fibers of regenerated cellulose from viscose and 60% plasticized cellulose acetate staple fibers, the mixed fibers being subjected to heat and pressure to render the plasticized acetate fibers adhesive and bind fibers in the product. The product comprising the bonded fibers was immersed in 14% ammonium hydroxide at room temperature (25-30°C.) for 10 hours. The fabric was withdrawn from the bath, washed with water at 25 to 30°C. and dried relaxed at 90 to 93°C. The fibers which initially consisted of cellulose acetate were de-esterified at all portions of their cross-section with reconstitution of the cellulose and during the drying step the fabric acquired a pronounced crepe effect which was permanently set therein. The creped fabric was dimensionally stable to washing.

Example II

A porous paper of sufficient thinness and flexibility to be readily conformed generally to a shaped object and made from a cellulose pulp, was provided with a thin coating comprising 2% by weight of cellulose, applied as a diluted solution of viscose containing 8.8% sodium hydroxide, 7% cellulose. A 300 denier/39 filament cellulose acetate yarn (commercial secondary acetate) was cut to 1/4", 1/2" and 1" lengths. These yarn lengths were bonded or coalesced to the surface of the stock paper by means of acetone, in varying patterns, and so that the cellulose ester comprised about 20% by weight of the product. The sheets were then immersed in 14% ammonium hydroxide at room temperature, withdrawn, washed, and dried relaxed. During the drying, marked shrinkage occurred in the direction of the embedded reconstituted cellulose components as a result of removal of the acetate groups at all portions of the cross-section of the yarns initially comprising the cellulose ester state. The surfaces of the sheets were creped at those portions occupied by the reconstituted cellulose components.

Example III

As in Example II except that the sheets having
the lengths of cellulose acetate yarn-bonded or coalesced to their surfaces were immersed for 25 minutes at 55° C. in an aqueous bath containing 0.60% sodium sulfide and 0.50% sodium carbonate. The percent combined acetic acid dropped from 54% to 30% and, after drying them in a relaxed condition, the portions of the surface of the sheet at which the partially esterified cellulose ester yarns occurred were creped or crinkled, and the sheet as a whole was shrunk in the direction of the de-esterified cellulose components. Instead of bonding or coalescing the lengths of cellulose ester yarn to the surface of the paper by means of a solvent such as acetone, plastized cellulose acetate may be used which permits the yarn lengths to be bonded to the surface of the paper or the like by heat at temperatures which do not damage the remaining fibers.

**Example IV**

A 300 denier/80 filament cellulose acetate yarn was cut ½” lengths. 20% by weight of such yarn lengths were placed on the surface of a paper sheet just prior to passing the sheet between the calender rolls. The cellulose acetate yarn lengths were disposed on the surface of the paper sheet in a form of parallel, horizontal rows spaced apart a distance of 1”. After calendering, the sheet was passed through a viscose solution obtained by diluting a commercial viscose (7.4% sodium hydroxide) to obtain a treating solution having a cellulose concentration of from 1 to 5%. The viscose impregnated sheet was passed through an aqueous sulfuric acid bath, washed free of acid, and calender-dried. The sheet carried a thin coating of cellulose ester resin obtained from the viscose which adhered strongly to the surface of the sheet and served to bond the cellulose acetate fibers to the paper. When the sheet was immersed in 1% sodium hydroxide solution for one hour at 70° C., washed with water, and dried under relaxed conditions, the sheet developed a pronounced crepe or crinkle. The coating obtained by treating the paper sheet carrying the cellulose acetate yarn lengths with the viscose solution of from 1 to 5% cellulose concentration does not effect crinkling or creping of the paper during the drying step, and merely serves to fix the cellulose acetate fibers to the surface of the paper.

**Example V**

Using apparatus as shown in Fig. 1 of the drawing, a suspension of plasticized cellulose ester fibers was deposited on the surface of a web of cellulose fibers, as the web was carried on a wire screen from the head box of a conventional paper making machine, the proportion of cellulose fibers on the web being 15% by weight. The web carrying the plasticized cellulose ester fibers was passed between heated calender rolls. Thereafter, the paper was immersed in a 1% sodium hydroxide solution for one hour at 70° C., washed with water, and dried relaxed, with development of a marked crepe or crinkle which was permanently set in the paper.

If desired, the cellulose ester fibers may be bonded to both the face and back surfaces of a felt-like fibrous product, provided that the distribution of the cellulose ester fibers on both surfaces of the product is unbalanced, both with respect to each other, and with respect to the felt-like product. As an example, the cellulose acetate fibers, desirably in the form of bundles or yarns, may be bonded to the face of a felt-like product comprising fibers which are not affected by aqueous saponifying media, in the form of ribs or strips spaced 1” apart, and to the other face, at the same distance apart, but in staggered relation to the other cellulose ester fibers. In Fig. 3 of the drawing there is shown a paper base 18 having cellulose ester fibers 16 bonded to the surface of the base, in the form of strips or ribs; and in Fig. 4, the product is shown in the creped condition resulting from drying it relaxed, after it has been treated with the saponifying medium and washed.

Modifications and variations may be made in practicing the invention without departing from the spirit and scope thereof, and therefore the invention is not to be limited except as defined in the appended claims.

I claim:

1. A new article of manufacture, a cocked, felt-like, fibrous non-woven fabric comprising a mixture of two types of fibers in an unbalanced condition, the fibers of one type being fibers of a material which is not affected by such as aqueous alkaline saponifying media and the other fibers being shrunk, de-esterified cellulose ester fibers, the latter fibers constituting between 50% and 70% by weight of the fibers in the fabric, said fabric comprising cocked areas, the first-mentioned fibers being adhesively bonded to, and held in cocked disposition by, de-esterified fibers in said cocked areas.

2. A new article of manufacture, a cocked, felt-like, fibrous non-woven fabric comprising a mixture of fibers of a material which is not affected by such as aqueous alkaline saponifying media and shrunken de-esterified cellulose ester fibers, the latter fibers constituting 50% to 70% by weight of the fibers in the fabric, the de-esterified fibers being in a condition of pronounced heterogeneity of distribution in the fabric, said fabric comprising cocked areas, the first-mentioned fibers being adhesively bonded to, and held in cocked disposition by, de-esterified fibers in said cocked areas.

3. A new article of manufacture, a non-woven fabric according to claim 2 characterized in that it comprises a mixture of the shrunk de-esterified fibers and cocked cellulose fibers.

4. A new article of manufacture, a non-woven fabric according to claim 2 characterized in that it comprises a mixture of the shrunk de-esterified fibers and cocked regenerate cellulose fibers.

5. A new article of manufacture, a cocked, felt-like, fibrous, non-woven fabric comprising a carded mixture of a material which is not affected as such by aqueous alkaline saponifying media and shrunken de-esterified cellulose ester fibers, the latter fibers constituting 50% and 70% by weight of the fibers in the fabric, said fabric comprising cocked areas, the first-mentioned fibers being adhesively bonded to, and held in cocked disposition by, de-esterified fibers in said cocked areas.

6. A new article of manufacture, a non-woven fabric as in claim 5, characterized in that it comprises a mixture of the shrunk de-esterified fibers and cellulose fibers.

7. A new article of manufacture, a non-woven fabric as in claim 5, characterized in that it comprises a mixture of the shrunk de-esterified fibers and regenerated cellulose fibers.

8. A method of making a cocked non-woven fabric which comprises treating a felt-like fibrous product comprising a mixture of fibers of a ma-
material which is not affected as such by aqueous saponifying media and cellulose ester fibers in unbalanced condition and in which the cellulose ester fibers constitute between 25% and 70% by weight of the fibers in the product, fibers in the product being autogenously bonded together, with an aqueous saponifying medium for the cellulose ester to de-esterify the same, washing the product, and thereafter drying the product in a relaxed condition whereby the fibers of the de-esterified cellulose ester shrink causing cockling of the remaining fibers.

2. The method of claim 1 in which the product comprising the autogenously bonded fibers is treated with aqueous ammonium hydroxide of from 6% to 35% concentration at room temperature.

ORLANDO A. BATTISTA.