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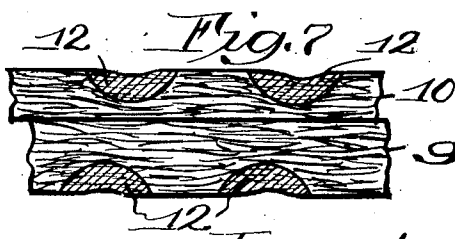
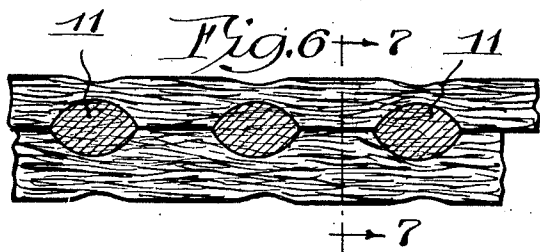
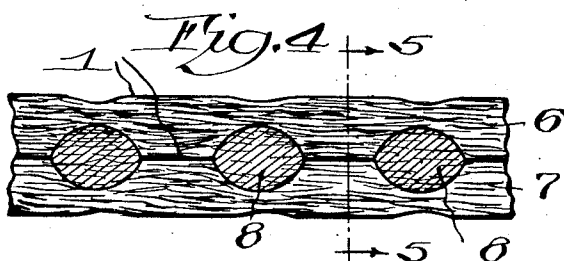
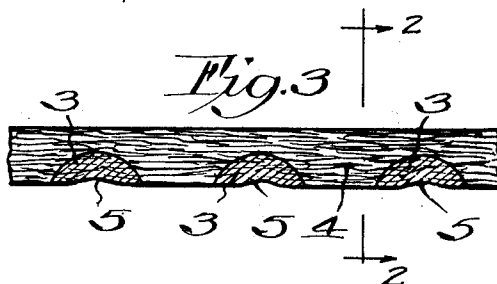
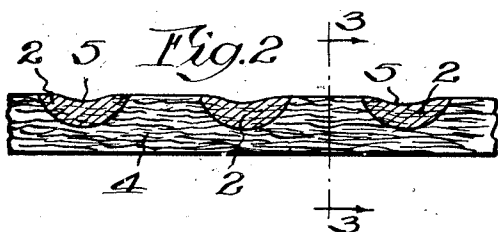
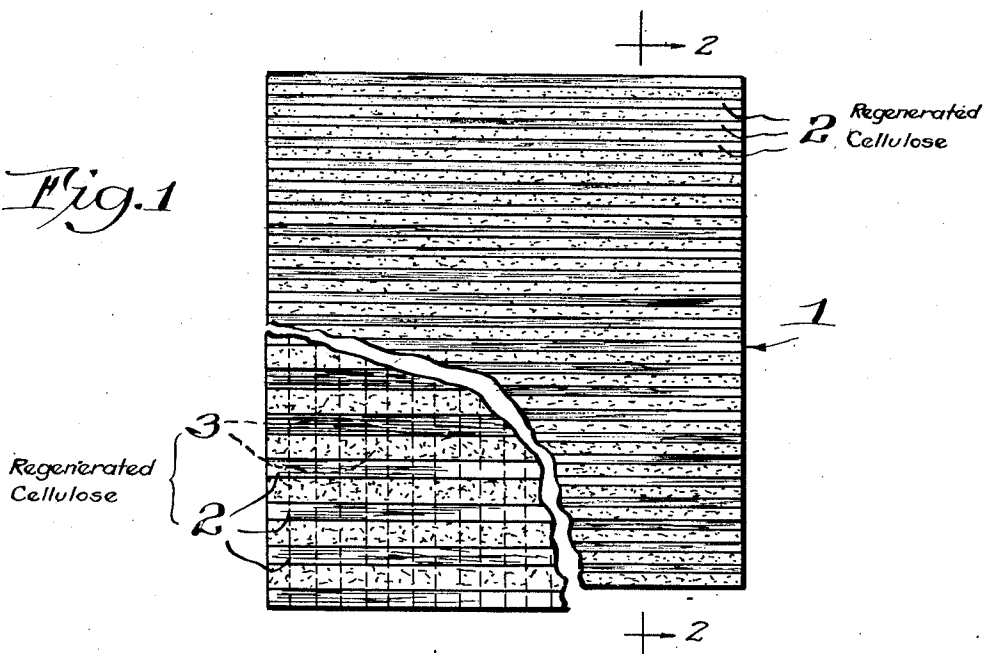
M. J. SHOEMAKER

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CLOTH LIKE FABRIC

Filed Aug. 13, 1928

Fig. 1



Inventor,

Milton J. Shoemaker,
George Raymond Jones, Atty.

Witness:
Chas. R. Toursh.

UNITED STATES PATENT OFFICE

MILTON J. SHOEMAKER, OF MADISON, WISCONSIN, ASSIGNOR TO C. F. BURGESS LABORATORIES, INC., OF MADISON, WISCONSIN, A CORPORATION OF DELAWARE

CLOTH-LIKE FABRIC

Application filed August 13, 1928. Serial No. 299,454.

This invention relates to the production and composition of cloth-like fabrics produced from unwoven fibers.

The object of this invention is to produce a soft and flexible water-absorbent fabric from unwoven fibers, such as wood pulp, which is cheap, washable, and resistant to disintegration by water.

This invention covers a method of making fabrics from unwoven fibers such as wood pulp which are water-absorbent and may be used as wash cloths, towels, napkins and the like without disintegrating when wetted. Furthermore, the fabric which is described and claimed may be washed in the usual way without disintegration.

At the present time towels are made of paper but such towels are without strength when wet and must be discarded after being used. The resistance to disintegration by water of such towels may be increased by hydrating some of the pulp by prolonged beating. This increased resistance to disintegration is obtained, however, at a sacrifice of pliability and speed of absorption of water. Such towels cannot be used as wash cloths. Consequently wash cloths are made almost exclusively of knitted or woven fabrics. With my process I produce a satisfactory wash cloth from unwoven fibers, which need not be hydrated mechanically.

Ordinary fibers, especially cellulose fibers such as wood pulp, when felted into a sheet, such as a soft absorbent paper, have little strength when wet with water. Such a paper may be coated with a sizing material or a varnish to increase the water resistance. However, the water absorption is decreased thereby as varnishes, lacquers and the like are water repellents. The utility of the product is decreased thereby. If viscose or other cellulose ester is substituted for varnish and the like and the cellulose then regenerated in the usual manner, the fibers are held in an insoluble mass of regenerated cellulose which does not disintegrate in water. In contrast to the water-repellent nature of varnish, lacquer and the like, the regenerated cellulose is water-absorbent so that the impregnated sheet loses little or none of this desirable

property. However, if the sheet is coated over its entire surface the resulting product is not soft, pliable, but is stiff and crackles much like paper. By applying the cellulose ester in discontinuous films as hereinafter described, a soft and pliable cloth-like product results.

The discontinuous cellulose films may be obtained by applying cellulose dissolved in appropriate solvents or as a cellulose ester, ether or other compound from which the cellulose is subsequently regenerated. Viscose is a very cheap and suitable form of cellulose wherewith to attain objects of this invention. Viscose is prepared in solutions of varying concentrations but for the purposes of this invention it is best used as a viscous solution containing about 7% of cellulose, 6% of caustic soda and a salt index of 3 to 4. However, other concentrations and qualities may be used. The properties of the cellulose ester are varied to suit the fibrous product which is to be impregnated but should in general slowly penetrate the sheet without flooding.

The fibers which are used are preferably cellulosic. Wood fibers are especially suitable because of their cheapness and availability. Since the product is to be water absorbent it is best to use sheets of wood fibers or pulp which contain little or no sizing and which are not calendered. It is also preferable to use a long-fibered stock for reasons which will become apparent as the process is described further. Long fibered pulp may be made from spruce, tamarack or jack pine. Spruce is especially suitable since it not only is long fibered but it yields when bleached, a product of high white color which is usually desirable. If the pulp is mercerized the absorption is increased as the alpha cellulose fibers swell. Its pliability also increases and this is desirable.

In the accompanying drawings the invention is illustrated by one exemplary embodiment thereof, but it will be understood that the invention is not to be considered as limited by the illustrated disclosure.

Fig. 1 is an illustration of the simplest form of my invention with a portion broken

away and somewhat further enlarged more clearly to show the structure of the sheet.

Fig. 2 is a transverse sectional view of the sheet shown in Fig. 1, along line 2—2 thereof and along line 2—2 of Figure 3.

Fig. 3 is a sectional view along lines 3—3 of Fig. 2.

Fig. 4 is a transverse sectional view of a composite sheet comprising two of the sheets of Fig. 1 superimposed upon each other.

Fig. 5 is a sectional view along lines 5—5 of Fig. 4.

Fig. 6 is a transverse sectional view of a modified form of my invention.

Fig. 7 is a sectional view along lines 7—7 of Fig. 6.

To make a thin product suitable for towels or napkins, I use for the base a thin sheet 1 of suitable fibers such as bleached sulphite pulp. A sheet weighing from .07 to .09 lbs. per square yard gives excellent results. I coat this sheet with a discontinuous film of viscose preferably of the concentration and quality hereinbefore described. The discontinuous film may be produced in any one of a number of ways. I prefer applying it in the form of lines 2 by means of a corrugated roller, the ridges applying the cellulose ester to the sheet. For the above long fibered, sulphite pulp a coater of 12 lines per inch with ridges .025 inches wide may be used with a viscose of the previously described quality. The viscose is thereby applied discontinuously over the sheet and if it is of the correct viscosity it does not flood the space between the lines. It spreads only slightly on either side of the lines and also through the sheet. The areas between the lines of viscose are substantially free from viscose but most of the uncoated fibers are anchored at one or the other end in the contiguous lines of impregnating cellulose ester. The lines may be straight as shown or they may be in the form of curves or any other desired configuration or pattern. The viscose may also be applied in the form of a series of dots. Other methods will suggest themselves to those skilled in the art. I do not wish to be limited to the exact methods described but comprehend any method which gives a product which has the ester or soluble cellulose distributed discontinuously throughout the sheet forming fibrous areas, substantially free from the ester, most of the fibers in the unimpregnated areas being anchored by contiguous portions of the ester.

Although a suitable product may be made by impregnating the pulp sheet on one side in discontinuous areas with a cellulose ester such as viscose, I prefer to impregnate both sides of the sheet in a similar manner. If one side of the sheet has been impregnated with parallel lines of viscose as hereinbefore described and as illustrated in Fig. 2, I then impregnate the other side in the said way

except that the impregnating lines 3 as shown in Fig. 3, are substantially at right angles to the lines 2 on the first side. This results in a reinforcement of impregnated cellulose ester in the form of lines, squares or other configurations. This produces a product of excellent strength and anchors practically all of the fibers 4 of the unimpregnated areas on both sides of the sheet. In general the maximum dimension of the unimpregnated areas is at most equal to the average length of the fibers.

The impregnated sheet is then passed through the various baths for regenerating and washing the cellulose as is well known to those skilled in the art. In regenerating the cellulose from viscose I prefer passing the sheet into a bath containing 1% to 2% of sulphuric acid plus 15% to 20% of sodium sulphate to coagulate the viscose. An ammonium sulphate bath may be used followed by a dilute mineral acid bath instead of the above bath. The cellulose is thereby regenerated from the ester in a highly hydrated condition. The fabric is then passed into about 0.2% caustic soda after which it is washed in water. It is then bleached in a weak sodium hypochlorite bath containing 0.1% to 0.2% available chlorine followed by 0.5% to 1.0% hydrochloric acid. It is again washed with water. The fabric may be dried but I prefer to pass it through an emollient bath. Various emollients may be used, such as glycerine alone, or associated with other materials, paraffine, oil, etc. I prefer to use a bath containing about 1% ivory soap, 2% sulphonated castor oil and 4% glycerine. The fabric retains a small portion of this emollient which softens it, thereby producing a fabric with a soft cloth-like texture.

The fabric is dried either before or after passing it through the emollient solution. It is first squeezed as dry as possible. I prefer to dry it under slight tension. If it is allowed to dry without any tension the shrinking of the regenerated cellulose causes it to have a rough, wrinkled appearance. If it is dried under high tension the fabric has a flat paper-like appearance. If dried under slight tension it stays flat but the greater shrinkage of the regenerated cellulose causes it to be depressed below the surface of the unimpregnated areas of fibers as shown at points 5 in Fig. 2 and the corresponding points in Figs. 3, 5 and 7. This gives the fabric a pleasing appearance and a feel similar to a woven fabric, which is desirable. The fabric may be colored and embossed to give pleasing effects similar to those on woven fabrics.

A paper towel made in the above manner has a decided advantage over ordinary paper towels in that it is non-linting, highly absorbent, and has a higher wet strength. Such a towel made from thin pulp sheets weighing from .07 to .09 lbs. per square yard may con-

tain from 7.0 to 8.0 grams of regenerated cellulose per square yard, when coated on both sides.

The above procedure is satisfactory for thin fabrics. For heavier fabrics such as wash cloths and pads the procedure and raw materials are changed somewhat. I prefer making a heavy fabric by packing several thin fabrics such as fabrics 6 and 7, shown in Figs. 4 and 5, and pressing them into a unitary structure, the cellulose ester 8 with which they are lined serving as the adhesive to cement the several sheets together. A heavy single fabric of fibers cannot be impregnated thoroughly without flooding the top surface as the cellulose ester travels more readily along the surface fibers which are in general in parallel relation to the surface of the sheet. Such a heavy fabric may therefore have an unsaturated plane in the center along which it will cleave readily when used in the wet condition. The impregnating agent should penetrate sufficiently inward from the surface toward the opposite surface to prevent such cleavage.

In one method of carrying out my invention in which the hereinbefore described viscous viscose is used as the cellulose ester in conjunction with a plurality of cellulosic fiber sheets, I prefer using a heavier sheet 9 (see Figs. 6 and 7) of pulp as the fabric base than those previously described. Instead of using a pulp sheet, which is preferably mercerized bleached sulphite stock, of .07 to .09 lbs. per square yard, I use a sheet weighing from .15 to .17 lbs. per square yard. I pass this heavier sheet through the hereinbefore described coater and line or otherwise coat one side of said pulp sheet with discontinuous films 11 of cellulose ester. A second sheet 10 of similar pulp but weighing .07 to .09 lbs. per square yard is then placed on the coated side of said heavier first sheet and said stacked sheets are then passed through squeeze rolls which cause the two sheets to adhere firmly to each other since the cellulose ester on the heavier sheet penetrates the fibers of the thinner sheet and causes adherence between the two sheets.

The above composite sheet is then passed through the coater to line or otherwise coat the two outside surfaces with films 12 of ester, the pattern preferably being applied in a direction at right angles to the first coat. This insures the proper anchoring of the fibers in the unimpregnated areas. The sheet may then be passed through cellulose regenerating, washing and other baths as described previously. Instead of using but two pulp sheets, additional thin sheets of pulp may be added by the same method before regeneration, and the fabric built up by the same procedure into any desired thickness. Two sheets, one thick and one thin, are sufficient to serve as a wash cloth. By this method

the final product consists of a plurality of sheets of unwoven fibers which have a reinforcement comprising regenerated cellulose distributed discontinuously throughout the sheet and forming fibrous areas or sections substantially free from regenerated cellulose, most of the fibers in the unimpregnated areas or section being anchored by contiguous portions of the regenerated cellulose. The reenforcing material extends in all directions and cements or ties the sheets together into a unit.

Although I have referred to regenerated cellulose obtained from cellulose esters, such as viscose, I may also use as a source of such regenerated cellulose, cellulose dissolved directly in a reagent as in caustic soda at temperatures below 0° C., cuprammonium, sulphocyanides, and strong mineral acids. I, therefore, include in the term "regenerated cellulose" cellulose recovered or regenerated not only from its esters but also from solutions. I designate cellulose whether in the form of an ester or dissolved in caustic soda or rendered soluble by some other reagent as "soluble cellulose".

My invention relates to a method and product resulting from the application of a soluble cellulose made prior to its application to the fibers as distinguished from cellulose dissolved in situ as would be the case if strong zinc chloride, caustic soda or sulphuric acid were applied to the untreated fibers in discontinuous areas. I have called soluble cellulose applied by my method as "added" cellulose.

The invention is not limited to the process above described for adding a cellulose-yielding cement to the fibers. It is not necessary to produce a regular relation of the cementing areas, as exemplified by lines and dots mechanically applied, for it is contemplated that a spray, controlled in character and in proportion to fiber, be applied to felted fibers or to individual fibers or groups of fibers to be felted or in process of being felted, so that contacting fractions of fibers, or a fractional portion of the fibers are cemented together in the finished product, leaving a substantial area of the untreated fiber.

It will be noted that whatever method is employed, the sheet or mass which results is supported by a continuous network of cellulose which comprises a fraction of the fiber cemented into a supporting structure by added regenerated cellulose without weakening any fiber entering the network.

Various other modifications of the process and of the product are contemplated as falling within the scope of the invention as defined by the appended claims.

I claim:

1. A reenforced water-absorbent sheet of unwoven fibers, the reenforcing material comprising added regenerated cellulose distributed discontinuously throughout said sheet

forming fibrous areas substantially free from said regenerated cellulose, most of the fibers in said areas being anchored by contiguous portions of said regenerated cellulose.

2. A reenforced water-absorbent sheet of unwoven cellulosic fibers, the reenforcing material comprising added regenerated cellulose distributed discontinuously throughout said sheet forming fibrous areas substantially free from said regenerated cellulose, most of the fibers in said areas being anchored by contiguous portions of said regenerated cellulose.

3. A reenforced water-absorbent sheet of unwoven cellulosic fibers, the reenforcing material comprising added cellulose regenerated from viscose distributed discontinuously throughout said sheet forming fibrous areas substantially free from said regenerated cellulose, most of the fibers in said areas being anchored by contiguous portions of said regenerated cellulose.

4. A reenforced water-absorbent sheet of unwoven cellulosic fibers, the reenforcing material comprising added regenerated cellulose distributed discontinuously throughout said sheet forming fibrous areas substantially free from said regenerated cellulose, the maximum dimension of said areas being at most equal to the average length of said fibers.

5. A reenforced water-absorbent sheet of long-fibered wood pulp, the reenforcing material comprising added regenerated cellulose distributed discontinuously throughout said sheet forming pulp areas substantially free from said regenerated cellulose, most of the pulp fibers in said areas being anchored by contiguous portions of said regenerated cellulose.

6. A reenforced water-absorbent sheet of mercerized long-fibered wood pulp, the reenforcing material comprising added cellulose regenerated from viscose distributed discontinuously throughout said sheet forming pulp areas substantially free from said regenerated cellulose, most of the pulp fibers in said areas being anchored by contiguous portions of said regenerated cellulose.

7. A reenforced water-absorbent sheet of unwoven cellulosic fibers comprising a multiplicity of closely packed thin sheets of said fibers cemented together by discontinuous reenforcing material, the reenforcing material comprising added regenerated cellulose distributed discontinuously throughout said sheet forming fibrous areas substantially free from said regenerated cellulose, most of the fibers in said areas being anchored by contiguous portions of said regenerated cellulose.

8. A reenforced water-absorbent sheet of long-fibered wood pulp comprising a multiplicity of closely packed thin sheets of said pulp cemented together by discontinuous reenforcing material, the reenforcing material

comprising added cellulose regenerated from viscose distributed discontinuously throughout said sheet forming pulp areas substantially free from said regenerated cellulose, most of the pulp fibers in said areas being anchored by contiguous portions of said regenerated cellulose.

9. A reenforced water-absorbent sheet of unwoven cellulosic fibers, the reenforcing material comprising regenerated cellulose distributed discontinuously throughout said sheet forming fibrous areas substantially free from said regenerated cellulose, the maximum dimensions of said areas being at most equal to the average length of said fibers, said sheet being impregnated with a small amount of emollient.

10. The method for producing a reenforced water-absorbent sheet of unwoven fibers which comprises impregnating a sheet of unwoven fibers with a discontinuous film of added soluble cellulose to leave fibrous areas substantially free from said soluble cellulose and anchor most of the fibers in said areas by contiguous portions of said soluble cellulose, and regenerating the cellulose from said solution.

11. The method for producing a reenforced water-absorbent sheet of unwoven fibers which comprises impregnating a sheet of wood pulp with a discontinuous film of an added cellulose ester to leave pulp areas substantially free from said cellulose ester and anchor most of the pulp fibers in said areas by contiguous portions of said cellulose ester, and regenerating the cellulose from said ester.

12. The method for producing a reenforced water-absorbent sheet of unwoven fibers which comprises applying viscous solution of cellulose in a discontinuous film to a sheet of wood pulp to leave pulp areas substantially free from said cellulose solution and anchor most of the pulp fibers in said areas by contiguous portions of said cellulose solution, applying a similar discontinuous film to the opposite side of said sheet, and regenerating the cellulose from said solution.

13. The method for producing a reenforced water-absorbent sheet of unwoven fibers from a plurality of sheets of said unwoven fibers, which comprises applying viscous solution of a cellulose ester in a discontinuous film to a sheet of wood pulp to leave pulp areas substantially free from said cellulose ester, immediately applying a second sheet of said wood pulp to the coated surface of said first sheet and applying pressure to unite the two sheets, the distribution of the cellulose ester in said compound sheet being such that most of the pulp fibers in the unimpregnated areas are anchored to contiguous portions of said cellulose ester, and regenerating the cellulose from said ester.

14. The method for producing a reenforced

water-absorbent sheet of unwoven fibers from a plurality of sheets of said unwoven fibers, which comprises applying viscous solution of viscose in a discontinuous film to a sheet of wood pulp to leave pulp areas substantially free from said viscose, immediately applying a second sheet of said wood pulp to the coated surface of said first sheet and applying pressure to unite the two sheets, applying a discontinuous film of viscose to the two exposed surfaces of said compound sheet, the distribution of the viscose in said compound sheet being such that most of the pulp fibers in the unimpregnated areas are anchored to contiguous portions of said viscose, and regenerating the cellulose from said viscose.

15. The method for producing a reenforced water-absorbent sheet of unwoven fibers which comprises impregnating a sheet of unwoven cellulosic fibers with a discontinuous film of an added cellulose solution to leave fibrous areas substantially free from said cellulose solution and anchor most of the fibers in said areas by contiguous portions of said cellulose solution, regenerating the cellulose from said solution, washing said sheet and drying said sheet under slight tension.

16. The method for producing a reenforced water-absorbent sheet of unwoven fibers which comprises impregnating a sheet of unwoven cellulosic fibers with a discontinuous film of an added cellulose ester to leave fibrous areas substantially free from said cellulose ester and anchor most of the fibers in said areas by contiguous portions of said cellulose ester, regenerating the cellulose from said ester, washing said sheet, introducing an emollient into said sheet and drying said emollient-containing sheet.

17. The method for producing a reenforced water-absorbent sheet of unwoven fibers which comprises applying viscous solution of a cellulose ester in parallel lines to one surface of the fiber sheet, applying said viscous solution of cellulose ester to the opposite surface of said sheet in similar, parallel lines but substantially at right angles to said first lines, said parallel lines being spaced at a distance apart which anchors most of the uncoated fibers in the contiguous cellulose ester lines, and regenerating the cellulose from said ester.

18. A fibrous sheet comprising water-absorbent cellulose fibers, fractional portions of individual fibers being cemented together by added regenerated cellulose into a supporting net-work to leave uncemented substantial portions of said cemented fibers.

19. A fibrous sheet comprising water-absorbent cellulose fibers reenforced by a network of cellulose, said network comprising contiguous fibers cemented together by added regenerated cellulose, said cemented fibers comprising a fractional portion of the total mass of fibers to leave substantial unce-

mented areas, most of the fibers in said areas being anchored in the regenerated cellulose of said contiguous network.

20. An article of manufacture comprising a mass of water-absorbent cellulose fibers carried by a continuous network of cellulose, said network comprising contiguous fibers cemented together by added regenerated cellulose, said cemented fibers comprising a fractional portion of the total mass of fibers, to leave substantial uncemented areas, most of the fibers in said areas being anchored in said regenerated cellulose.

21. Fibrous cellulosic material in an aggregate of fibers having portions of single fibers cemented to portions of other single fibers by added cellulose regenerated in situ from viscose, whereby to unite the aggregate into a cemented whole.

In testimony whereof, I have subscribed my name.

MILTON J. SHOEMAKER.