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3,068,545

**NAPPED FIBROUS REGENERATED SPONGE
STRUCTURE AND PROCESS OF MAKING SAME**

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4 Claims. (Cl. 28—72)

This invention relates to regenerated cellulose sponge structures having improved surface properties.

It is known that a regenerated cellulose sponge cloth can be formed by spreading into a sheet a doughy plastic viscous mass of viscose containing Glauber's salt, reinforcing fibers and colorants which is subsequently coagulated and cellulose regenerated from the viscose. It is also known to form sponge yarn by extruding a viscose-Glauber's salt mixture onto the surface of a yarn followed by coagulation and regeneration of cellulose from the viscose.

The viscose solution is prepared by xanthating alkali cellulose, i.e., reacting cellulose with potassium or sodium hydroxide and carbon disulfide and allowing the solution to age to a critical index point, after which reinforcing fibers, colorants and Glauber's salt crystals are kneaded into the solution to form a uniform consistency. This mixture is then spread into sheet form or extruded onto a yarn. It is also possible to form the sheet by pressing the viscose composition between two plates to the desired thickness, usually about twice the ultimately desired thickness of the finished product. After the viscose-fiber-salt mixture is formed into a sheet or yarn coating, it is heated in an aqueous alkaline or acid medium to coagulate the viscose. This is usually accomplished by immersing into a boiling aqueous alkaline or acid solution of Glauber's salt which regenerates the cellulose and also melts and partially dissolves out the salt crystals to form the cellulose sponge structure. The sponge structure is then withdrawn from the salt solution, washed and dried. During regeneration of the cellulose and drying of the sponge structure, it shrinks in thickness as much as 50%. For a more detailed description of the manufacture of regenerated cellulose sponge, reference is made to U.S. Patent 2,329,239.

It is also known to form the sponge cloth with a reinforcing fabric embedded within the cellulose sponge.

The sponge structures produced as described above have a skin surface on each side which is more dense than the interior of the sponge. The skin surface on such a sponge is slick and clammy when wetted with water and does not readily slide over a surface to be cleaned or from which water is to be removed by absorption. The dense skin surface also tends to reduce the suppleness and draping qualities of the sponge and gives the product a harsh "hand."

It is an object of this invention to provide a sponge structure with improved "hand," i.e., one having good drapability, suppleness and when wet with water having reduced resistance to slipping or sliding over a surface to be cleaned, such as, automobile bodies, glass windows, kitchen sinks, kitchen table tops made from stainless steel, "Formica," wood, floors, etc.

These and other important objects are accomplished by mechanically abrading or removing the outer skin surface from a regenerated cellulose sponge structure having staple reinforcing fibers distributed throughout, whereby the ends of at least a portion of the individual reinforcing fibers are teased to the surface from the main body of the sponge to form a fibrous nap.

In carrying out my invention, I first produce a pasty mass by mixing together a viscose solution, staple fibers

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and crystals of Glauber's salt which is also known as sodium sulfate decahydrate. The crystals are relatively small, i.e., 70–80% of which will pass a 20 mesh screen and be held on a 30 mesh screen. The viscose solution contains 5–10% cellulose and is prepared by dissolving cellulose in aqueous sodium hydroxide and carbon disulfide. The salt crystals are incorporated in the viscose solution to form between 50 and 90% by weight of the total sponge forming mixture. The fibers are preferably vegetable fibers, such as, e.g., flax, cotton, jute or hemp and represent between 0.1% and 5.0% of the total sponge forming mixture.

The sponge-forming mixture after being stirred and kneaded to uniform consistency is formed into a flat sheet or coated on each side of an open type fabric having interstices which allows the sponge forming mixture to permeate the fabric and form a coating on each side which is joined in the interstices. The wet thickness of the sheet material formed from the foam forming mixture is about $\frac{1}{8}$ " to $\frac{3}{8}$ " thick.

The sheet thus formed is immersed into an aqueous acid solution of Glauber's salt at about 40% concentration which is maintained at or near its boiling point to coagulate the viscose and regenerate the cellulose.

In an alternate form of the invention, the viscose-fiber-salt mixture is extruded around a cotton yarn and then immersed in the boiling aqueous acid Glauber's salt solution to coagulate the viscose, regenerate the viscose, and dissolve out a portion of the Glauber's salt from the sponge structure. For a more detailed description of the manufacture of the sponge coated yarn, reference is made to U.S. Patent 2,409,660.

During the coagulation and regeneration step, the Glauber's salt in the sponge forming mixture is melted and partially dissolved from the sponge forming composition to form cellulose sponge structure. After the coagulation, regeneration and partial extraction step described above, the cellulose sponge is purified by washing in water and dried. In the case of the sponge cloth, the dried product has a thickness of approximately .05"–.20" and each side of the sponge coated fabric has a skin surface which is more dense than the interior of the sponge. In the case of the sponge coated yarn, the dried product has an approximate diameter of $\frac{1}{8}$ – $\frac{1}{4}$ " and a skin surface.

Each side of the dried sponge cloth prepared as described above is next passed over and around abrasive covered rolls (No. 120 sandpaper) to remove the outer dense portion of the sponge and tease or pull the ends of a substantial portion of the reinforcing staple fibers from the sponge body. The teasing out of the ends of the reinforcing fibers from the main body of the sponge produces a slight nap or pile on the surface of the sponge cloth.

For certain uses, it is desirable to remove the skin and form a nap on only one side of the sponge cloth. The unnapped skin side of the sponge cloth has properties similar to a chamois skin. A sponge cloth having an unnapped and skin surface on one side and a napped and skin-free surface on the other side combines the properties of a chamois and cleaning fabric.

In the case of the sponge coated yarn, a plurality of the continuous strands are passed between abrasive (No. 120 sandpaper) covered relatively soft rubber rolls under slight pressure and rotating in a direction counter to the movement of the yarn which tend to flatten the sponge yarn, abrade the skin surface and raise a fibrous nap on both sides of the flattened yarn.

A Curtin-Hebert Company, Gloversville, New York, "Lightning Shaving and Buffing Machine" which is also referred to as a drum sander, is particularly useful for

removing the skin and napping the surface of the sponge yarn and sponge cloth of this invention. The Curtin-Hebert Company drum sueder comprises a sand paper (No. 40 to No. 400 grit surface) covered cylinder 41" in circumference, which operates at 300 r.p.m. with an oscillation (along the axis) motion of $\frac{1}{8}$ " at 120 cycles per minute. A soft rubber covered feed roll of approximately 20" in circumference presses the sponge products against the sandpaper covered cylinder. To facilitate the feed of the sponge yarn or cloth to the sandpaper covered cylinder, an idling roll runs as a nip roll on the soft rubber covered roll in front of the nip formed by the soft rubber covered roll and the sandpaper covered cylinder.

First, one side of the sponge cloth or flattened sponge yarn is napped, then the other. It is also possible to nap both sides in one pass through the napper or sueder by threading the work through the machine so each side comes in contact with the sandpaper covered cylinder.

The type of abrasive used for the sandpaper is not critical. It can be silicon carbide, alumina, silica, garnet, flint or emery.

In place of the preferred vegetable staple fibers which are incorporated into the viscose solution, useful products can be made by incorporating other staple fibers into the sponge forming mixture, such as, e.g., those made from nylon, polyacrylonitrile, polyethylene, polyethyleneterephthalate, polyvinylidene chloride, etc. The preferred length of the staple fibers is about .25 to 1.5 inches; however, shorter or longer staple fibers can be used. The denier of the synthetic staple fibers can vary over a wide range, about .5 to 3.0 denier per filament being preferred. It is also possible to use cut yarns in place of staple fibers.

As indicated above, useful products can also be made in accordance with this invention by eliminating the open weave fabric from the sponge cloth. The types of fabrics which may be used in making the products of this invention include leno cloths, scrim and nets made from natural or synthetic fibers. In the case of sponge coated yarns, it is within the scope of this invention to employ any type of yarns such as those made from natural and synthetic fibers. It is also possible to use a synthetic yarn, such as e.g., one made from continuous multiple or monofilaments.

The napped sponge surface when wet has greatly reduced resistance to sliding over a surface to be cleaned or wiped, i.e., it has reduced drag. The napped surface on the sponge products greatly facilitates the removal of excess water by a hand squeezing action.

The sponge cloth products of this invention are particularly suited for use as cleaning cloths for the washing of dishes, woodwork, table tops, kitchen sinks, automobiles, glass windows, or any other surface. The sponge coated yarns are useful as floor mops to be used in connection with aqueous cleaning solutions. They are highly absorbent and can absorb more than their own weight of water which makes them particularly suited for removing excess water from various surfaces, such as encountered

in general cleaning operations. When only slightly damp with water, the sponge cloths of this invention will find use as a household dust removing cloth.

The sponge products of this invention can be readily cleaned by rinsing in water or washing in mechanical washing machines. They can be sterilized by boiling in water.

While there are above disclosed but a limited number of embodiments of the structure, process and product of the invention herein presented, it is possible to produce still other embodiments without departing from the inventive concept herein disclosed, and it is desired therefore that only such limitations be imposed on the appended claims as are stated therein, or required by the prior art.

I claim:

1. A regenerated cellulose sponge structure having reinforcing staple fibers distributed throughout, the ends of at least a portion of said fibers extending outside the sponge structure.

2. The product of claim 1 in which said structure is in the form of a cloth approximately .05 to .20 inch thick when dry.

3. The product of claim 1 in which said structure is in the form of a yarn having a maximum cross-sectional width of approximately .0125 to .25 inch when dry.

4. In the process of preparing a regenerated cellulose sponge structure which comprises dispersing reinforcing staple fibers and Glauber's salt crystals in a viscose solution, shaping the composition, regenerating cellulose from the viscose, removing said salt crystals from said structure and drying said structure, whereby a skin of regenerated cellulose is formed on said structure, the improvement which comprises mechanically abarading said skin from said structure and simultaneously teasing the ends of a substantial portion of said fibers from the regenerated cellulose.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

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Cyril William Stiner

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 3, line 14, for "spongle" read -- sponge --; column 4, line 25, for ".0125" read -- 0.125 --; line 33, for "abarading" read -- abrading --; line 34, for "simutlaneously" read -- simultaneously --.

Signed and sealed this 28th day of May 1963.

(SEAL)

Attest:

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