Sept. 28, 1943. F. B. VOEGELI 2,330,645

METHOD OF MAKING FABRICS

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Fig. 2A.

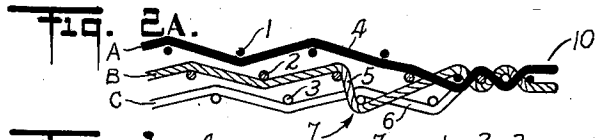


Fig. 1.

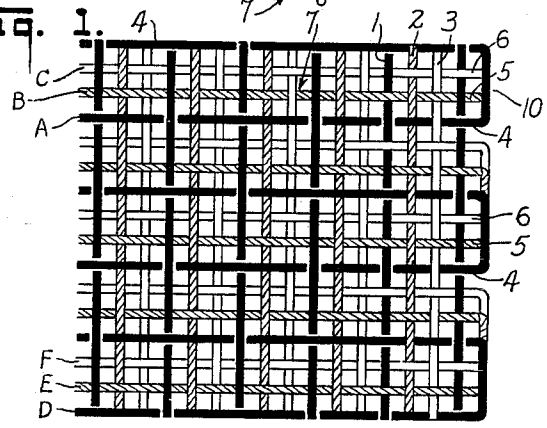


Fig. 2B.

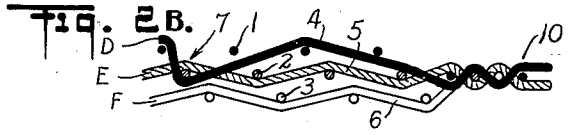


Fig. 3.

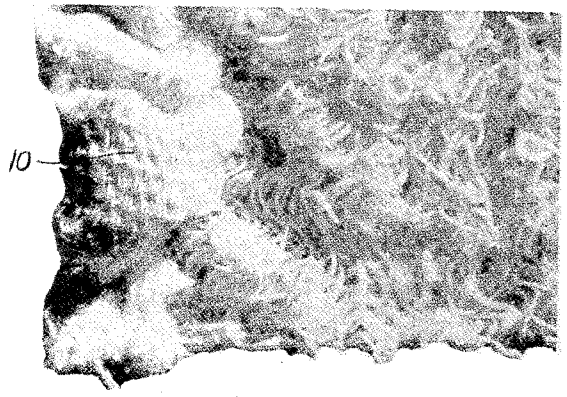


Fig. 4.



Fig. 4A.



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Fig. 5.

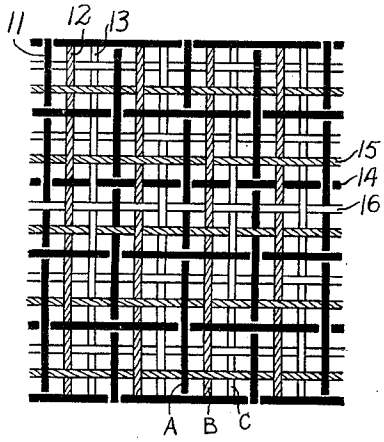


Fig. 6.

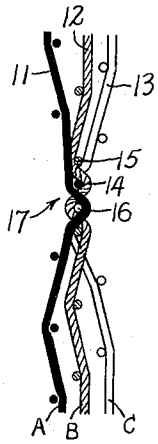


Fig. 8.

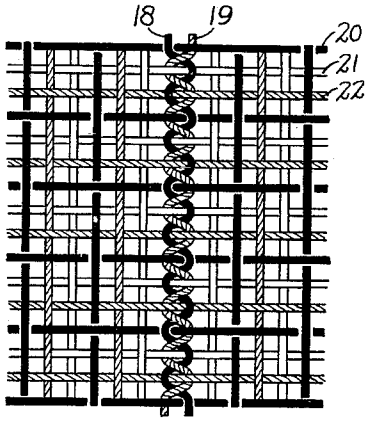
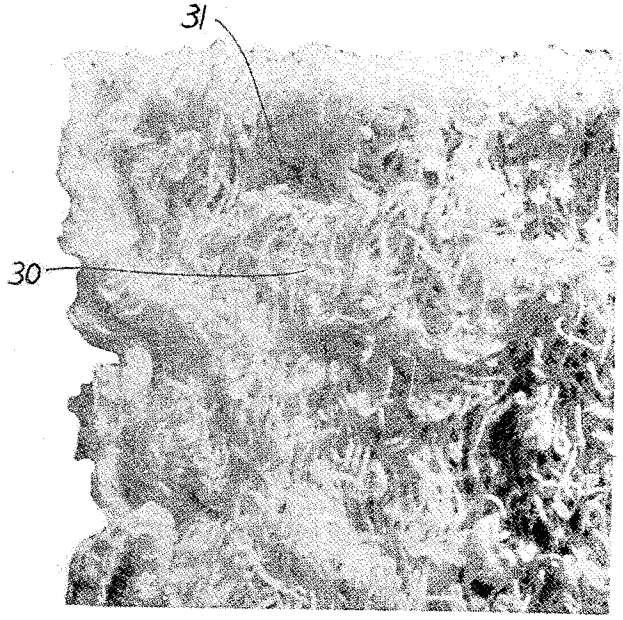


Fig. 7.



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METHOD OF MAKING FABRIC

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Application September 26, 1939, Serial No. 296,547

2 Claims. (Cl. 139—408)

This invention pertains to a novel fabric and to a process for making the same, and more particularly to a fabric having a relatively large bulk (i. e., occupying a relatively large space) per unit weight of the fabric, and to a process for manufacturing such a fabric.

This application is a continuation in part of my co-pending application Serial No. 230,910, filed September 21, 1938.

It is often desirable to have a fabric in which the bulk is large for the actual body of the material, i. e., the number of threads per inch making up the fabric. Such cloth has many uses, such, for example, as for bandages, surgical dressings (where absorbent materials are needed); for curtains where non-transparent material is needed which will not interfere with air circulation and which is capable of easy draping; for summer wear such as in beach robes, lounging robes, etc.; and also for blankets for covering purposes and many other uses.

One of the objects of the invention is to provide an improved cloth having relatively large bulk for the actual body of the material.

Another object is to provide an improved process for manufacturing such cloth.

Other objects will be in part obvious and in part pointed out hereinafter.

In the drawings, which show views of several modifications of cloth embodying the invention and which show the cloth in various stages of manufacture:

Figure 1 is a diagrammatic view of a multi-ply fabric at one stage in the process of manufacture;

Figure 2A is a composite cross-section therethrough taken on lines A, B and C to show the weft threads of the top, intermediate and bottom plies, respectively;

Figure 2B is another composite cross-section therethrough taken on lines D, E and F showing weft threads of the plies in the same order as shown in Figure 2A;

Figure 3 is a magnified plan view taken from a photograph of a fabric embodying the invention and made in accordance with the process embodying the invention and showing the cloth of Figure 1 at a later stage in the process of manufacture;

Figure 4 is a magnified sectional view taken from a photograph of the material shown in Figure 3;

Figure 4A is an enlarged diagrammatic view of a cross-section of the cloth shown in Figure 3;

Figure 5 is a diagrammatic view of another multi-ply fabric at the same stage in the process of manufacture as shown in Figure 1 but woven differently from that shown in Figure 1;

Figure 6 is a composite cross-section of the fabric shown in Figure 5 taken on lines A, B and C of the warp threads of the top, intermediate and bottom plies respectively;

Figure 7 is a magnified plan view taken from a photograph of a fabric embodying the invention, the fabric being the same as that shown in Figure 5 but after further processing; and

Figure 8 is a diagrammatic view of another fabric in the same stage of the process as that shown in Figure 1.

Corresponding reference characters refer to corresponding parts throughout the several views of the drawings.

Referring to Figure 1, the cloth there shown is what is commonly known as a multi-ply cloth, i. e., it is woven in such a way that a plurality of plies are formed, the plies having common selvages 10, and each of the plies being tied together, as by warp tie-ins in the well-known manner. This construction is shown in Figures 2A and 2B wherein there are three sets of warp threads, 1, 2 and 3, representing respectively the warp of the top, middle and bottom plies. The weft or filler threads of the respective top, intermediate and bottom plies are shown at 4, 5 and 6, respectively. In the present embodiment this cloth is preferably woven in such manner that the tie-ins are made at regularly spaced points as indicated at 7 in Figures 2A and 2B so that in subsequent processing the various plies are held together and support one another.

The fabric shown is a plain weave construction and is such that each ply has a relatively large open mesh structure. Thus, each ply may be formed of threads of from numbers 20 to 60 English or higher, and, for example, a construction of 12 x 8 threads per inch. The yarn used may have a normal twist in contradistinction to a high or hard twist. For example, yarns having a twist of from 4 to 4.5D may be used, although higher or lower twists may be used where desired. Thus the open mesh in each ply has a width much greater than the diameter of the threads. The units of twist 4D and 4.5D above referred to are the English units and represent the number of twists per inch obtained by multiplying the square root of the count number of the thread by the number. Thus, if the count number were 25, a yarn having a twist of 4D would have 20 twists to the inch. The English unit of count is based on the number of hanks (480 yards) per pound of thread.

This construction gives each ply a coarse and loose character and the cloth in this stage has relatively little body or bulk, and little solidity. Although the plies are interlaced by the warp threads, the construction is so loose the various plies may slide slightly with respect to each other. This renders the fabric capable of responding to a subsequent contracting step in the manufacturing process because the construction is such that the warp and filler threads are not tied to each other, but on the contrary each warp may easily move crosswise of associated weft strands, and vice versa, to permit the warp and weft threads to independently contract by looping at random.

The next step in the process of forming my new fabric is to treat the fabric just described to produce a relatively large so-called contracting of the warp and filler threads, the contracting being produced in such a way that each warp and filler thread contracts independently of the other warp and filler threads, so that they all curl or loop in different directions and out of the plane of their respective plies to form a fabric that looks and feels somewhat like terry cloth.

Thus by the term contracting, as referred to herein, is meant that action which causes the threads to assume looped or curled conditions which are natural to the threads when exposed to some medium, as hot soapy water, while the threads are in an untensioned state.

In this kind of contracting each length of warp between the adjacent filler threads is free to leave the plane of the particular ply in which the warp lies and to loop or tend to loop, as shown in Figures 3 and 4. The same action or contracting applies to the weft strands. The loose mesh construction of the several plies permits this kind of contracting because of the relatively long lengths of the strand between the two adjacent cross strands under which the strand passes as compared with the thread or strand diameters. Thus, although the contracting effectively brings closer together the crossing points of the strands in each ply, it does not closeup the fabric because of the looped and/or crinkled nature of the threads between the crossing points and because as to each ply the crossing points are still relatively far apart, i. e., the effective meshes are still relatively large although covered by the random positions of the loops and crinkles of the warp and filler threads.

Referring to Figures 4 and 4A, the loops and crinkles of the warp and filler threads of one ply extending into and contacting the loops and crinkles of the warp and filler threads of adjacent plies serve to give the fabric thus formed greater solidity than that existing in the fabric as shown in Figure 1.

Thus this contracting converts the transparent non-bulky and non-solid fabric shown in Figure 1 into a fabric which has a greatly increased bulk or thickness, as shown in Figures 3 and 4. The resulting fabric also has an appreciable bulk for the relatively light body of the fabric. Further, the fabric is soft and relatively solid. In this way cloth having these highly desirable characteristics or properties is formed inexpensively because of the small amount of bulk and because the loose construction of the various plies makes possible obtaining such contracting as described with only normally twisted thread and without the need of threads having a higher twist.

After the gray cloth, such as shown in Figure 1, has been woven, the contracting as above described may be brought about by subjecting the cloth in rope form while free of tension to the action of hot soapy water or other liquid treatments that will thoroughly wet the fibres making up the yarn and will thoroughly moisten the sizing in the warp threads and in the weft threads. The cloth thus wetted in rinsed and then dried, first by extracting and then by air-drying it while still loose as on a standard belt drying machine. Due to the kind of loose construction of the fabric, as above described, the warp and weft threads, even though having only normal twist, shrink at will to loop as shown in Figures 3, 4 and 4A, and in so contracting produce the above described bulky fabric. Such treatment causes a resultant overall contracting of the cloth, as shown in Figure 1, of at least 30%.

The cloth now dry is preferably stretched both weftwise and warpwise to practically its full grey dimensions and then released. When the cloth retracts, it has more bulk and is more uniform and even than before the stretching. Also the stretching operation sets the cloth in the sense that thereafter when the cloth is stretched it will always return upon release practically immediately to its original condition.

The construction of the gray cloth, as described in Figure 1, is one of the factors contributing to the kind of contracting obtained with this simple treatment which requires no agitation and which treatment is similar to that used in the usual dyeing and bleaching or cleaning operations generally used in mills. The plurality of plies of the cloth permits the subsequent tentering or stretching process to be performed upon the cloth without the use of special machinery. By varying the construction of the plies and by varying the manner in which the plies are interlaced with respect to each other, different degrees of contracting may be obtained while still obtaining the desired looped condition of the loose threads and also different design effects can be obtained by varying the nature of the tying in of the plies. Also, of course, the final appearance of the cloth can be varied by varying the construction of the individual plies and the weave of the individual plies.

Further, the nature of the gray cloth, as shown in Figure 1, is such that it tends to contract in the manner above described immediately upon its release from the loom due to the difference in the stiffness of the warp and weft yarns, the different tensions placed on the various warp threads and possibly for other reasons. This natural tendency of the gray cloth to shrink aids in the kind of contracting obtained during the liquid treating steps, as above described. Under some conditions, as for example when the plies are not woven simultaneously or tied in as they are woven it may be desirable to aid the contracting action caused by the hot soapy water treatment by agitating the cloth. Under such conditions, this step may be carried out by placing bundles of the cloth in a closed container partially filled with the hot soapy water, the container being mounted for agitation on a suitable shaking apparatus or may be mounted for rotary motion. In either event, the agitation causes the cloth to slap against the sides of the container. Both methods of contracting produce a large resultant overall contracting of the cloth.

After the cloth is treated by agitation, if it is

not formed from plies simultaneously woven and tied together, it is dried in such a manner as not to remove the loops and folds caused by the contracting and agitation treatment.

With reference to the construction of the fabric discussed in Figure 1, the number of threads per inch in each ply may be reduced, but as they are reduced it may be desirable to increase the number of plies to maintain about the same body or total number of threads per inch in the cloth. Or if it is desired to further increase the bulk of the finished cloth and at the same time to increase the number of threads per inch of the cloth, the number of plies may be increased without increasing the number of threads per inch in each ply.

And contrariwise, if desired, the body of the fabric may be increased by increasing the number of threads per inch in each of the plies of the fabric as shown, but the amount that the threads per inch can be increased is limited by the open mesh construction required in the contracting operation to permit the warp and weft threads to assume their loose looped or kinked positions. If the mesh construction is made too close the warp and weft strands instead of contracting as described simply contract slightly in straight paths, being held in the plane of the fabric by the weave construction. Thus the construction of threads per inch with respect to the diameter or count of the thread cannot be changed to the point of preventing the formation of the loose loops of the strands as above described.

Further, the weave may be varied in the several plies; thus, for example, it may not be necessary to use as many filler threads in the intermediate plies as in the outer plies to reduce the cost of manufacture, or use more warp threads to increase the bulk and give greater production of the loom. Thus the weave of the cloth may be varied to make a cloth having, for example, three plies, the outer plies of which are of a relatively loose open mesh construction and the intermediate ply of which is of a relatively looser and more open mesh construction. The weave may thus be varied so long as it is not of such a character as to prevent the random looping of the threads as above described. Further, the weave may be varied when desired to float the warp threads on either side of an intermediate ply, the warp threads being tied in as shown in Figure 5. With such a construction the outer plies of a three ply cloth are made of loose open mesh construction, and the inner ply may comprise floated warp threads, the various plies being tied in by the interweaving of the warp threads.

Referring to Figure 5, there is shown another embodiment of the invention in which the multi-ply cloth is woven in a different manner. In this modification the three sets of warp, 11, 12 and 13, are repeatedly interwoven with the weft threads 14, 15 and 16, to form relatively tightly woven bands which act as intermediate selvages generally indicated at 17. With this construction the cloth has more solidity and the warp threads are held in a more nearly aligned position during the subsequent contracting operation.

When this fabric is subjected to the contracting or creping action, as above described, the resulting cloth has a ribbed appearance, as shown in Figure 7, the raised parts of the ribs being indicated at 30 and the valleys at 31. The ribbed appearance may be varied as desired by varying the spacing or width of the selvages.

Referring to Figure 8 there is shown another modification of a multi-ply fabric which may be creped as described. In this fabric the various plies are tied together by leno warp threads 18, 19 which tie in along spaced paths some or all of the filler threads 20, 21, 22. These leno threads may be used to control the amount of contracting as above described. Thus, leno threads having a high twist may be used to aid in causing greater contracting, or medium twist leno threads may be used to limit the natural contracting; and leno threads having a sub-normal twist may be used to still further limit the natural contracting. Furthermore, these leno threads may be used when desired in the selvage formed during weaving between portions of the fabric to prevent undesired crinkling of the selvage during the contracting of the body of the fabric.

Fabric such as shown in Figure 8, when subjected to the contracting action above described results in a cloth which also has a ribbed appearance such as that shown in Figure 7, and the ribbed appearance may be varied by varying the application of the leno threads and the twist of the leno threads used.

Cloth embodying the invention and made in accordance with the process is particularly adapted for bandages and for surgical absorption pads. The highly porous nature of the cloth makes it permeable. The looseness of the thread construction plus the fact that it has had the hot soap and water treatment as well as treatments which result in the extraction of foreign materials, such as sizing, as well as materials naturally contained in the fibres (which materials it is desirable to remove for the production of nearly pure fibre) and the fact that the cloth is made from yarns of normal twist, renders the threads highly absorbent and soft. Hard twists result in wiry cloth.

As various embodiments might be made of this invention, and as various changes might be made in the construction herein described, all without departing from the scope of the invention, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. A process of manufacturing a cloth having a large bulk per unit of weight which comprises the steps of weaving a plurality of plies from light cotton warp and weft threads of about normal twist, said plies having common selvages and being interwoven only at spaced intervals and the warp threads thereof being of substantially the same length, each ply having a gray cloth construction of open mesh weave and sufficiently loose that in a subsequent contracting operation the individual threads thereof may loop out of the plane of each ply, subsequently subjecting the cloth to a water treatment while untensioned to wet the threads thereof to release their natural tendency to loop to cause them individually to loop out of the planes of the respective plies and contract the fabric, drying the cloth thus treated in an untensioned condition, tentering the dry cloth to approximately full gray dimensions and then releasing the tentering action whereby the cloth is given greater bulk and elasticity.

2. The process for manufacturing a cloth having relatively large bulk in comparison with its

body, comprising weaving three plies from cotton yarn having a twist of from 4 to 4.5 and from numbers which may vary from 20 to 60, the plies each being woven in a plain weave and each ply having a gray cloth construction of approximately 12 x 8 threads per inch, the plies being interwoven at intervals with respect to each other during the weaving, subjecting the cloth thus formed in rope form to the action of hot soapy water with or without agitation to cause the individual threads of each ply to loop at random out of the planes of the respective plies, drying the cloth thus treated in an untensioned condition, tentering the dry cloth to approximately full gray dimensions, and then releasing the tentering action whereby the cloth is given greater bulk and elasticity.

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