

Feb. 3, 1948.

A. JOHNSON ET AL

2,435,543

TEXTILE FABRIC

Original Filed July 7, 1942

3 Sheets-Sheet 1

Fig. 1.

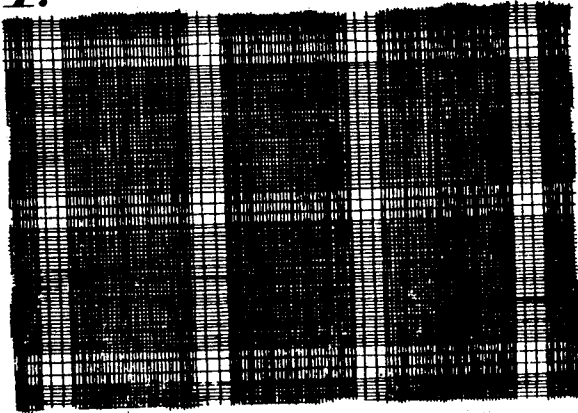


Fig. 2.

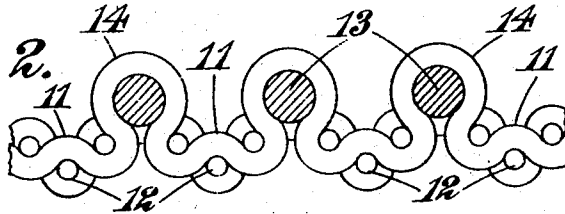


Fig. 3.

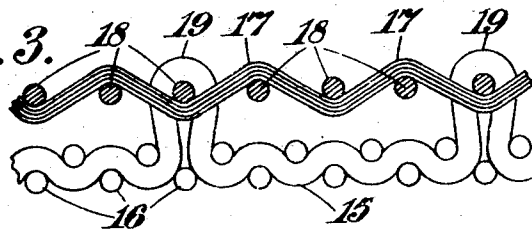


Fig. 4.

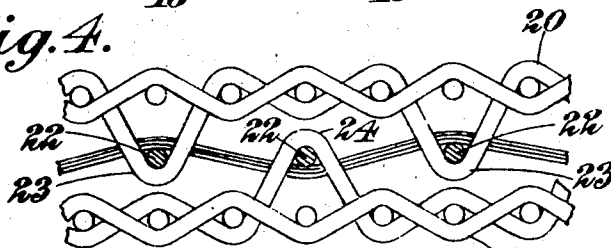
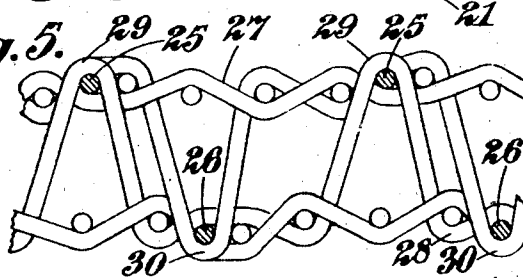


Fig. 5.



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Fig. 7.

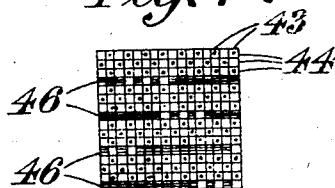
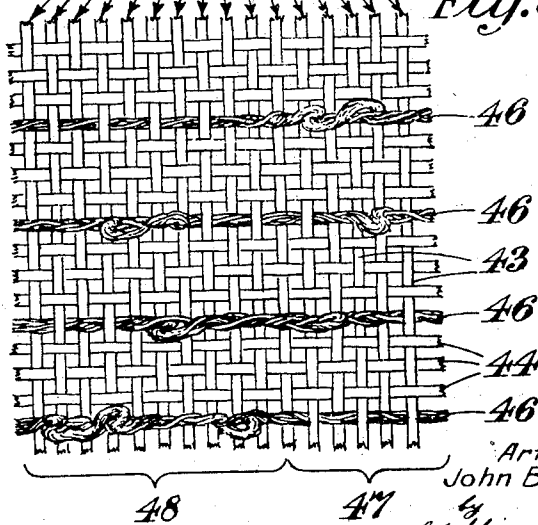


Fig. 8.



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Fig. 6.

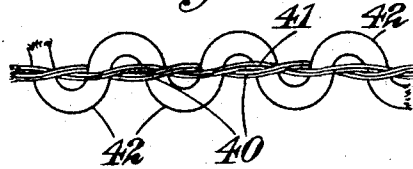


Fig. 9.

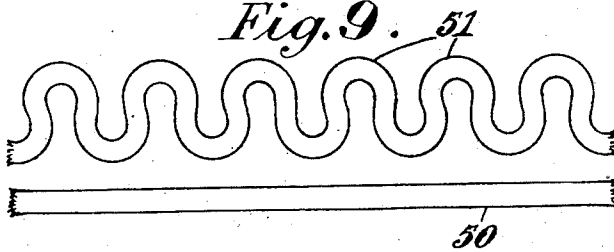


Fig. 10.

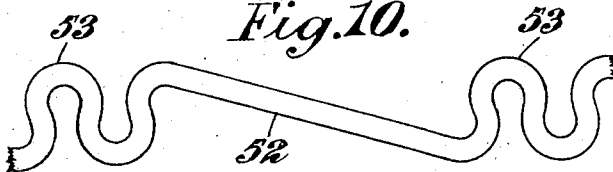


Fig. 11.

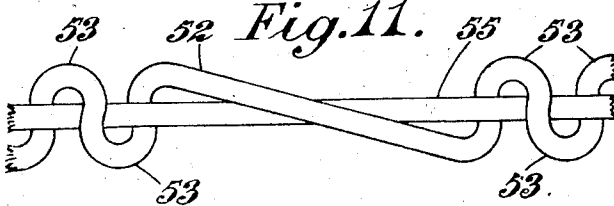
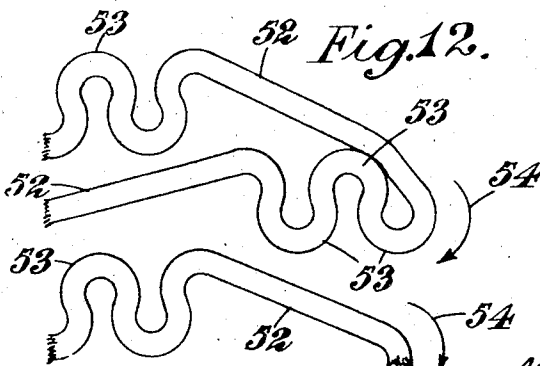


Fig. 12.



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UNITED STATES PATENT OFFICE

2,435,543

TEXTILE FABRIC

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Original application July 7, 1942, Serial No. 450,012. Divided and this application January 8, 1945, Serial No. 571,758. In Great Britain April 11, 1941

7 Claims. (Cl. 28—76)

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This application is a divisional of our co-pending United States application Serial No. 450,012, filed July 7, 1942, for improvements in "Textile fabrics."

This invention comprises improvements in or relating to textile fabrics.

In the weaving of textile fabrics it is known to use mohair yarns twisted with cotton threads, which are intended to remain in the fabric only temporarily, and after weaving to remove the cotton by treatment with sulphuric acid, drying and baking, whereby the cotton is carbonised and reduced to a powder, which is easily dusted out. The cotton and mohair yarns are twisted together in such a sense as to leave the mohair yarn in the twofold thread either twistless or deficient in twist so that when the cotton is removed in carbonising a soft and lustrous fabric is obtained. The process is unfortunately applicable only to fibres, such as those of wool, which are reasonably resistant to the acid treatment necessary to remove cotton. Moreover, even the wool fibres are liable to be damaged to some extent by the use of acid; other fibres are still more liable, so that the avoidance of the use of acid is a matter of importance.

The present invention comprises a process for the manufacture of textile fabric, characterised by producing a fabric, at least in part, from yarn consisting wholly or partially of soluble alginic fibres or filaments and thereafter modifying the fabric by dissolving or gelatinising some or all of the alginic fibres.

One application of the invention is to the production of fabrics in which the yarn, but for the presence of alginic fibres, would not be capable of being woven.

The invention further comprises a process for the manufacture of a woven or lace fabric characterised by producing composite yarn by twisting together soluble alginic fibres or filaments and relatively insoluble textile fibres or filaments, employing such composite yarn, with or without other yarn, in weaving of fabric and thereafter dissolving the said soluble alginic fibres or filaments out of the fabric so as to set the relatively insoluble fibres or filaments free.

Many alginic fibres, such for example as fibres of calcium alginate, are soluble in an aqueous solution of soap or sodium carbonate or can be

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converted to alginic acid by treating with an acid of such strength as will not injure cotton or wool fibres, in which converted state they are soluble in, say, sodium carbonate, and it is this soluble property of many alginic fibres which is utilised according to the present invention and the expression "soluble alginic fibres or filaments" is to be understood accordingly. The relatively insoluble textile fibres which may be employed in accordance with the invention are not necessarily totally insoluble in all agents, because, for example, wool fibres are attacked by boiling caustic soda, but they are such fibres as are insoluble in an agent or agents which would be sufficient to dissolve the soluble alginic material, or at least to gelatinise it, in those cases where, as hereinafter explained, gelatinisation is all that is contemplated. It is found that soluble alginic fibres can be employed successfully with all ordinary textile fibres, and not simply the acid-resisting fibres sometimes used with cotton, in processes which involve subsequent removal of the fibres. Soluble alginic fibres are known in themselves; for example, fibres of alginic acid and metal alginates like calcium alginate are known, both types being soluble in soap, soda and other alkaline solutions.

The process according to the invention also opens up other possibilities which are hereinafter detailed.

The phrase "fibres or filaments" is used in this specification as including both long filaments, such as those of silk and the relatively short fibres, such as those of cotton or wool.

The relatively insoluble fibres or filaments in the composite yarn may be substantially untwisted, or less twisted than would be necessary to withstand weaving stresses, whereby a softer or more lustrous or stronger fabric is produced. In explanation of this it may be pointed out that certain fabrics are distinguished by their soft and full-handling properties. Although these tactile qualities may often be enhanced by suitable finishing processes, they are largely determined by the structure of the yarns from which the fabrics are made. Ordinary yarns must, of necessity, be twisted sufficiently to withstand the strains imposed in weaving, but softness decreases as the twist increases. Thus certain yarns when twisted sufficiently to be suitable for weaving may

contain so much twist as to prevent the desired degree of softness being realised in the finished fabric. In the case where, according to the present invention, a yarn which is not soluble in soap or other mildly alkaline solution is twisted to form a composite thread with soluble alginic yarn, the alkaline wash removes the alginic fibres or filaments and if the composite yarn has been twisted in such a manner that the fibres or filaments which remain after washing are twistless, or at all events less twisted than would be necessary for weaving or otherwise making into fabric by themselves, the resulting fabric will be softer. In the case of mohair, for example, it is easy according to the invention to introduce twistless mohair yarns as warp or weft in a manner parallel with the known manner using mohair yarns twisted with cotton yarns, but without the disadvantage of having to remove the cotton by carbonisation in an extra process. Moreover, such a process gives a fabric possessing a higher lustre than one composed of yarns twisted so as to withstand weaving, and the same principle can, of course, be applied to increase the lustre of individual threads in a fabric, such as coloured and uncoloured striping threads. It will be observed that the word "yarn" is employed in a broad sense as including groups of fibres or filaments which are twistless, such as those left twistless in the finished fabric, according to this invention.

The effects according to the present invention can be obtained with ordinary textile fibres of all kinds, including cotton, silk, rayon, and even insoluble alginic fibres and not simply acid-resistant fibres such as wool and mohair. An important series of new types of fabric is thus made available for the first time.

One important advantage of the manufacture of fabrics in accordance with this invention from threads which are twistless or little twisted after removal of the soluble alginic yarn is that a twistless or little twisted thread develops the maximum strength of the fibres in the woven fabric. Thus, for example a fabric in which both warp and weft are woven from cotton in such a way as to leave the fibres twistless or little twisted in the finished fabric may for a given weight be as strong as or stronger than a normal linen fabric. The cotton threads could not be woven by themselves without being twisted, but by the use of the alginic yarn for binding them together during weaving, the weaving operation becomes possible with the twistless or little-twisted cotton.

The invention comprises a process for the manufacture of a woven fabric from composite yarn as hereinabove set forth wherein the relatively insoluble fibres are fibres so long or so wiry that if spun by themselves they would produce a yarn with fibres projecting from it and wherein the soluble alginic fibres or filaments are so spun around the others as to bind projecting fibres into the yarn and facilitate the weaving, knitting or like operation.

In a further modification of the process the alkali-resistant fibres may be spun so that they comprise knops, loops or irregularities of the relatively insoluble fibres or filaments temporarily bound in place by the fibres or filaments of the soluble alginic yarn, and set free when the latter are dissolved. In this way the knops, loops or irregularities when they have been introduced into the fabric are set free. One valuable application of this feature of the invention is to fancy

yarns. Many types of fancy yarn require additional binder threads whose purpose is to prevent the slipping of knops or loops during weaving. In most cases, the binder thread has no further utility once the yarn has been interlaced with other yarns in the cloth. Thus soluble alginic threads used according to this invention are ideal for this purpose, because they can conveniently be made to disappear in the scouring process to which the fabric would in any case be submitted. Other applications of this feature are hereinafter referred to.

In the manufacture of a twofold or multifold soluble alginic yarn, the component threads may be twisted with tufts of fibres or other objects, even of metal or wood, which can be gripped between the soluble alginic yarns. It thus becomes possible to weave such tufts or other objects into a fabric, using the two fold or multifold alginic yarn containing the object as warp or weft. After dissolving the alginic fibres away, the tufts or other objects remain isolated in the fabric into which they have been introduced, and no clue is given as to the manner of its manufacture.

The relatively insoluble fibres may be discontinuous in the composite yarn, that is to say groups of said fibres are carried at intervals by two or more threads of soluble alginic fibres or filaments so as to produce in the finished fabric insertions of groups of said relatively insoluble fibres at intervals.

According to a further feature of this invention a fabric comprising a composite yarn, as above referred to, of relatively insoluble fibres which are substantially untwisted or little twisted may be produced wherein the woven fabric is a compound fabric in which the composite yarn forms the centre portion of the fabric and is interwoven with outer cloth portions so as to constitute a soft filling between the outer cloths when the soluble alginic fibres have been dissolved. This soft filling, having little or no twist, has maximum filling power.

Again untwisted or little twisted fibres may be constituted by wadding threads and such composite yarns may be woven in a fabric so as to provide a wadded surface on one or both faces thereof when the soluble alginic fibres have been removed.

Again the composite yarn may be introduced into the fabric in accordance with a predetermined pattern so as to occur mainly, in certain areas, on the surface of the fabric, thus facilitating the production of raised effects after dissolving out the soluble alginic fibres or filaments.

The invention further comprises a process for the manufacture of woven or lace fabric characterised by producing composite yarn from normal textile yarn and soluble alginic yarn, the two kinds of yarn being fed at such rates in twisting that the normal yarn has a length advantage over the other, producing the fabric from such composite yarn in conjunction with other non-composite yarn and thereafter removing the soluble alginic yarn by dissolving it out of the fabric so as to leave in the fabric said normal yarn which was introduced as part of the composite yarn with a length advantage over the said non-composite yarn therein. It is known to weave fabrics in which special effects are desired by inserting warp or weft threads so that they have a length advantage over their neighbours. When the effect is made by warp, the two or more sets of threads are drawn off under different tensions

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from separate beams, while in weft, each set is woven from its own particular shuttle, using different tensions for the different shuttles. In the latter case, however, there is great difficulty in obtaining and maintaining a sufficient, constant friction on the looser weft threads. By employing a composite yarn, as just described, in accordance with the present invention in weaving, however, the soluble alginic yarn takes the tension. It can therefore be maintained at the same tension as other threads during the weaving operation and the length advantage of the normal yarn with which it is twisted only appears when the soluble alginic fibres have been dissolved out of the fabric after the weaving operation.

It is also possible for the two yarns, one of which is to have a length advantage over the other in the finished fabric, to be combined into a single composite yarn (in which the length advantage is incorporated) by the aid of soluble alginic binding yarn so that the desired effects are obtained by the use of a single shuttle, warp-beam thread carrier or equivalent member, as the case may be.

The length of yarn which the soluble alginic yarn carries into a cloth can be varied according to the type of fabric required. For example, when there is little difference between the length of the yarn in the finished fabric having a length advantage and the other yarn, the result is usually a crinkled effect on the cloth, whereas when the difference is sufficiently great, loops of the longer yarn may be formed in the fabric. In connection with the latter development, it is possible to arrange the weave so that pile fabrics may be formed of silk or wool or any other relatively insoluble fibres or filaments.

Thus, when used with thick mohair yarns, an imitation astrakhan lamb-skin can be made. The method also enables a setting process to be carried out in the fabric which considerably reduces the cost of manufacture of this type of astrakhan, when compared with other methods of producing imitation astrakhan lamb-skin. In the usual methods it is sometimes necessary before producing the fabric, to submit the pile yarn to a curling process in order to produce a crimp on the loops which are later to be formed in the cloth. In the method using soluble alginic yarn twisted with pile yarn it is possible to carry out the curling process after the yarn is woven in the cloth. The soluble and relatively insoluble yarns are in twisted form and, therefore, in an ideal situation for setting the relatively insoluble component. Furthermore, the soluble alginic yarn can withstand the action of setting media such as steam, boiling water, or boiling 1% sodium bisulphite solution, sufficiently well to mould the insoluble thread into the posture it has taken in the twisted form. When the soluble alginic yarn is removed, the pile thread possesses a degree of crimpiness determined by the amount of twist which the twofold thread contained and the efficiency of the setting method employed.

The utilisation of soluble alginic yarn in the formation of pile or loop fabrics, enables these types of cloth to be made without special pile-wire looms, hook Wilton looms, looms with warp-way wires or cord-weft looms. Furthermore, the pile can be produced on one or both sides of a fabric, and in combination with methods of printing alginic yarn to render it alkali-insoluble described elsewhere in this specification, will en-

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able patterned effects to be formed with bound sections and released sections as required.

It is known to produce fabrics with missed-thread effects but as usually produced there is a tendency for threads bordering the gaps to close up in the unfinished cloth and during finishing. The present invention comprises a process for the manufacture of a woven fabric, characterised by weaving as warp or weft, at intervals in the fabric, soluble alginic yarn and thereafter removing the soluble alginic yarn by dissolving it in whole or in part so as to produce openwork effects.

Thus, the closing up of the other threads is prevented, so that the gaps are more likely to be evident in the finished cloth, when the soluble alginic yarn is removed during scouring. Furthermore, the insertion of alginic threads as weft eliminates adjustments to shuttles and take-up mechanism, which might otherwise be necessary when forming missed pick effects across the cloth. It is also possible to produce on fabrics so woven patterned openwork effects by local printing on the fabric of reagents capable of rendering the alginic yarn resistant to the action of alkali, prior to scouring with, for example, soap and soda. The printed sections of alginic rayon remain in the scoured fabric and the remainder of the cloth shows an openwork weave.

The invention further comprises a process for the manufacture of woven pile fabric consisting in weaving into a fabric extra threads of soluble alginic yarn, such as to support pile loops therein, and subsequently dissolving out the soluble alginic yarn to leave the pile loops free. This may be effected in one method by using soluble alginic yarn which consists of thick ends or picks woven into a single fabric at intervals. Certain alkali-insoluble threads are made to rise over the thicker alkali-soluble threads. On dissolution of the latter the pile loops are produced. Alternatively a series of threads, or a complete fabric, of soluble alginic yarn may be woven as part of a double or multiple fabric, certain loops of relatively insoluble yarn from one or more layers of the fabric being made to loop around the soluble alginic yarn during weaving to produce the pile structure, which remains after the alkali-soluble alginic yarn has been removed by an alkaline scour. The fabric may be a double fabric or a treble fabric; in the latter case the soluble alginic yarn forms the central cloth so that when dissolved two separate pile fabrics are produced. When a double fabric is employed each cloth may contain soluble alginic threads around which pre-selected threads of the other cloth are looped, so that upon dissolving the soluble alginic threads the two fabrics are separated from one another without cutting.

The invention further comprises a process for the manufacture of woven fabric characterised by providing soluble alginic warp threads at the edges of a warp of relatively insoluble threads, weaving relatively insoluble weft threads therewith and subsequently dissolving the soluble alginic warp threads so as to leave a fringe of weft loops at the edges of the fabric. The loops may be superimposed on the main body of the cloth by suitable drafting of the threads in the heddles. Loops of weft may be coiled round soluble alginic warp thread or threads isolated a short distance from the main body of the warp. When the alginic threads are removed in scouring, a fringe of weft loops is left projecting from the body of the fabric. The width of the fringe

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will be determined by the number of heddles allotted to the isolated alginic threads. Thus it is possible to superimpose fringes on the edges of the main fabric, especially in narrow width goods, i. e., ribbons, braids and the like.

The invention further includes a process for the production of an ornamental fabric characterised by producing yarn in whole or in part from soluble alginic fibres or filaments, employing said yarn in producing fabric, rendering portions of the alginic fibres or filaments relatively insoluble either before or after the production of the fabric, and after these operations dissolving the remainder of the still-soluble alginic yarn from the fabric. In such a process the yarn may be rendered insoluble along separated sections of its length prior to the production of a fabric. The thread can then be woven as warp or weft alone or in combination with other yarns and then, after the removal of the soluble sections in scouring, the insoluble lengths will remain in the fabric to form a novel effect.

A more important development on similar lines may be carried out if the yarn is rendered relatively insoluble after weaving, over areas of the fabric in accordance with a desired pattern, by applying to such portions of the fabric insolubilising agents. The production of ornamental figuring or patterning on fabrics usually depends upon changes in the structure of a cloth in certain areas. The border of these changes is, therefore, the outline of the figure which is intended to be represented on the fabric. Such cloths, if beyond the scope of dobby looms, must be woven in jacquard looms and bear a relatively higher cost of production. Attempts are continually being made to produce figured fabrics by colour printing on plain, mass-produced fabric, but the possible structural interlacings of the ends and picks of the foundation cloth are much more simple than those of the ornamental jacquard fabric. The present invention produces a patterned structural effect on a basic fabric which can be mass produced far more quickly and cheaply than is possible on the Jacquard loom.

A simple fabric is made in which floats of soluble alginic rayon appear at intervals in warp or weft along with threads made from other fibres. Certain areas of the woven fabric are then printed to pattern with reagents capable of rendering the alginic rayon resistant to attack. The fabric is then scoured with a suitable solution to remove the soluble sections, thereby leaving the threads of insoluble alginic yarn interlaced with the foundation threads and forming a structural pattern in the fabric. Such a structure cannot be imitated except by the insertion of extra threads, a comparatively cumbersome and expensive method. Moreover, the designs thus produced are practically unlimited in scope as they depend only upon the method of printing employed.

Similarly, a cloth made entirely from soluble alginic rayon threads could be printed to pattern so that certain sections would resist attack by alkali. After the dissolution of the soluble sections, openwork effects would be formed which would be reminiscent of lace or fabrics which have been bored by drills to form openwork patterns. The latter type of fabric requires an attendant process of binding in order to preserve the structure at the edges of the bored sections. This precaution will not, however, be necessary

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when alginic rayon fabrics are made into openwork effects by the method of the present invention, as, after the removal of the alkali-soluble sections, the threads at the edges of the insoluble areas will be fused.

The invention further comprises a process for the production of an ornamental openwork fabric consisting in producing a woven fabric in which warp and weft consist of soluble alginic fibres as a foundation upon which braid or other stitches of relatively insoluble textile fibres are subsequently superimposed and thereafter dissolving the soluble alginic foundation fabric to allow the openwork structure formed by the braid or like stitches to remain.

The invention further comprises a process for the manufacture of a fabric characterised by producing a fabric, at least in part, from yarn comprising soluble alginic fibres and thereafter modifying the fabric by gelatinising, pressing and drying the alginic fibres for the purpose of stiffening the fabric or fixing fibres or tufts or pile loops in the fabric. After gelatinisation the gelatinised fibres may be rendered insoluble if desired by means of insolubilising agents, for example by treatment with beryllium salts as hereinafter referred to, and in this way they may be made resistant to washing.

The preferred form in which the soluble alginic threads are employed in accordance with this invention is in the form of calcium alginate which is soluble in soap or soda solutions. When calcium alginate is used the attack by the soap leads to the production of an insoluble metal soap, for example calcium oleate. In cases where the presence of this insoluble metal soap would be objectionable, say in dyeing, other alkaline scours can be substituted, for example, fatty alcohol sulphates with soda or a mixture of soap, soda and one of the known polymers of alkali phosphates which prevent precipitation of calcium soaps. Again the alginic yarn may be converted to alginic acid by a mild acid treatment followed by removal in sodium carbonate solution and this will ensure that no calcium soaps remain in the fabric after treatment.

In the accompanying drawings,

Figure 1 is a representation of a fabric produced in accordance with the invention showing a drawn thread work effect;

Figure 2 is a sectional view of a pile fabric produced in accordance with the invention;

Figure 3 is a similar view of an alternative pile fabric;

Figure 4 is a similar view of a further alternative showing two pile fabrics woven together before detachment from each other;

Figure 5 is a similar view of a further alternative pile fabric;

Figure 6 shows a composite yarn of mohair and calcium alginate;

Figure 7 shows a fabric design woven from the yarn of Figure 6;

Figure 8 is a diagram of the interlacing of the threads of Figure 7;

Figure 9 is a diagram of two threads of which one has a length advantage over the other;

Figure 10 is a diagram showing a single yarn having alternate sections, some sections having a length advantage over others;

Figure 11 shows a composite yarn including a thread similar to that of Figure 10;

Figure 12 shows threads such as those of Figures 10 and 11 after weaving into a fabric.

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The following examples, which are given by way of illustration, and some of which are shown in the accompanying drawings, afford more details of the application of some of the above-mentioned features of the invention.

Example I

A composite yarn is produced consisting of one thread of 1/30s cotton, which may be mercerised, twisted with a 100 denier calcium alginate rayon, so that the cotton thread is in a twistless form. This composite thread is used as a striping thread in a fabric, the alginate rayon enabling the twistless cotton to withstand the weaving strains. After weaving, the supporting thread of calcium alginate is removed by means of the normal alkaline scour which is used in finishing fabrics and leaves the 1/30s twistless cotton stripe. This cotton stripe will be found to have far greater covering power and to be much more prominent and lustrous than a stripe woven from an ordinary twisted mercerised cotton. Such a twisted cotton consists normally of two threads of 1/60s cotton twisted together with twenty-three turns per inch and the twist in the cotton detracts from its covering power and from its lustre as compared with the twistless 1/30s in accordance with the present invention.

Example II

A fabric is woven in which the warp and the weft both consist of 1/30s cotton yarn twisted with a 100 denier calcium alginate rayon to form a composite thread in which the cotton portion is twistless. After weaving, the calcium alginate threads are removed by the alkaline scour leaving a fabric entirely consisting of 1/30s twistless cotton threads. Such threads press flat, they afford the maximum possible strength to the fabric and owing to their flattened form they leave smaller apertures between the threads in the finished fabric. Such a fabric is stronger, thinner and requires less "dope" to fill the apertures than an equivalent fabric woven from ordinary twisted cotton; in fact the cotton fabric thus produced is equal to, or superior to, best ordinary linen fabrics of equal weight for the purpose of covering aircraft structures.

Example III

A wool fabric is woven in which there are incorporated at intervals warp and weft threads of soluble calcium alginate yarn. After weaving, the calcium alginate threads are removed by the normal alkaline scour yielding an openwork or drawn thread effect, such as is shown in Figure 1 hereof.

Example IV

A fabric is woven comprising warp threads 11 (see Figure 2 of the accompanying drawing) weft threads 12 and at intervals other extra thick weft threads 13, which latter are made of calcium alginate fibres of sufficient thickness to cause the warp threads 11 to stand up in pile loops 14. After weaving, the alginate threads 13 are removed by an alkaline scour and the pile loops remain in the fabric, having been set free in the scouring operation.

Example V

A double fabric is woven, one cloth of which consists of a warp 15 and weft 16 (Figure 3) of alkali-resistant fibres and the other cloth of which consists of a warp 17 and weft 18 of fibres

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of calcium alginate. At intervals, threads of the warp 15 are caused to stitch into the alginate threads to form pile loops as shown at 19. When the alginate is removed by an alkaline scour the projecting pile loops 19 remain.

Example VI

A treble fabric is woven consisting of two outer alkali-resistant cloths 20, 21 (Figure 4) and a central cloth 22 which consists of calcium alginate fibres. Into the central cloth, loops from the outer cloths are caused to stitch as shown at 23 and 24. After weaving, the alginate fibres are dissolved and two pile fabrics are formed from the cloth 20 and 21, which become separated from one another.

Example VII

As shown in Figure 5, calcium alginate threads 25, 26 may be strategically placed in the layers 27, 28 of a double fabric so that stitches 29, 30 from each component cloth loop over the alginate threads in the other cloth. After dissolving the alginate threads the two fabrics separate, leaving an uncut pile of each cloth.

Example VIII

Figure 6 shows a composite yarn consisting of mohair around which are twisted threads of calcium alginate. The mohair yarn is substantially untwisted and is curled into loops which are held firmly by the alginate. It is to be observed that there are two threads of calcium alginate 40 and 41 each of 200 denier which are twisted together and round the loops 42 of the mohair yarn the count of which is 2's worsted, the calcium alginate threads being taut while the mohair is loose. The alginate threads not only maintain the loops in the mohair but they also bind the long fibres of the mohair and prevent them from spreading into extraneous fibres at their ends which would be difficult to weave. In weaving, the calcium alginate will take the tension of the shuttle. Such a composite yarn is woven as weft on a cotton warp, separated by picks of alkali-resistant, e. g., cotton yarn, and the weaving is so carried out that the bulk of the loops come on one side of the fabric. A specimen design showing how, apart from interlacings necessary for binding, the mohair-alginate composite yarn is made to lie on the surface of the fabric is shown in Figure 7. A diagram (Figure 8) corresponding to the design of Figure 7 shows the interlacings of the warp and weft. Taking the lowest thread 46 in Figure 8, it will be noted that section 47 of the mohair-alginate composite yarn which is without loops is interlaced with warp threads in order to bind the yarn in the fabric, whereas section 48, containing loops, floats loosely on the surface of the cloth. Removal of the alkali-soluble alginate rayon releases the coils of mohair in section 48 so that they form free loops on the surface of the fabric.

After weaving, the fabric is washed with alkali, with or without previous setting in steam, boiling water or boiling 1% sodium bisulphite solution, depending on the type of curl desired. Scouring is carried out by treatment for 15 minutes with five times its weight of 2° Twaddell sodium carbonate solution, followed by rinsing in water, and a further treatment for 20 minutes with 1° Twaddell sodium carbonate solution and sufficient soap to form a lather. Calgon ($\text{Na}_2\text{P}_2\text{O}_8$) and related compounds may be added to the

scouring baths, if desired, to prevent precipitation of calcium soaps.

As a result, the calcium alginate fibres are removed, and a fabric is obtained with a cotton back and a mohair astrakhan face, which is very attractive.

Example IX

In this example, two types of yarn used to obtain a pile or crepe effect, namely the normal type and that having a length advantage, are combined in a single composite yarn by the aid of alkali-soluble alginic yarn. Figure 9 is a diagram showing two separate threads 50 and 51 of which the latter has a length advantage over the former. If two such threads are woven into a fabric alternately, as weft, a crepe or pile effect will be produced, depending on the degree of the relative length advantage of 51 over 50. Figure 10 is a diagram showing a single yarn having alternate sections 52 and 53, the sections 53 having a length advantage over the sections 52. Such a periodic or sectional length advantage cannot be woven into a fabric by normal means. Figure 11 shows the utility of the alkali-soluble alginic yarn 55 which is twisted with the relatively insoluble yarn comprising alternate sections 52 and 53 so as to provide a temporary support for the sections having the length advantage and to take the stresses of weaving. The composite yarn of Figure 11 is according to this example woven as weft with a plain cotton warp and after weaving the soluble alginic yarn 55 is dissolved out of the fabric. In Figure 11 the straight and curled sections are of shorter duration than the two separate yarns of Figure 9 but are still sufficient to produce the desired effect. Figure 12 shows the resultant form which the weft threads of the relatively insoluble yarn assume. The arrows 54 show the retrocession of the yarn at the selvage of the fabric, and it will be noted that in a number of cases the plain sections 52 are thus brought opposite the sections 53 which have the length advantage. In this way the desired weft effects are obtained by the use of a single shuttle.

If the composite yarn of Figure 11 is to be used as warp the alternate warp threads will be arranged so that plain sections alternate across the warp with those having a length advantage and a plain cotton or other weft can be used. Thus a single warp-beam suffices to produce the desired effect.

In the case of weft, the length advantage of the slacker thread may be far more precisely determined and more regularly controlled when carried by a soluble alginic yarn in the manner described than is possible when relying upon the relative friction applied to two yarns woven from different shuttles.

In the following claims the expression "fibres" is used in a sense broad enough to include continuous filaments; the expression "substantially untwisted" in relation to insoluble fibres in the composite yarn is used in a sense such as to include an amount of twist so small as would not enable the insoluble fibres by themselves to stand up to weaving stresses; and the expression "irregularities" is used in a sense which includes knops or loops of the relatively insoluble fibres.

We claim:

1. A process of making a fabric, which comprises producing composite yarn consisting of alkali-insoluble yarn curled into loops, a plurality of calcium alginate threads twisted together

and binding the loops of alkali-insoluble yarn in place between the twists of calcium alginate threads, the calcium alginate threads being taut while the alkali-insoluble yarn is loose, the alkali-insoluble yarn being incapable by itself of withstanding the strains imposed in weaving, employing said composite yarn in weaving a fabric and during the weaving causing the calcium alginate threads to bear the whole of the weaving strains of the composite yarn, and thereafter dissolving the calcium alginate threads out of the fabric by washing the fabric in an alkaline bath so as to set the alkali-insoluble yarn free.

2. A process of making a fabric, which comprises producing composite yarn consisting of alkali-insoluble yarn curled into loops, a plurality of calcium alginate threads twisted together and binding the loops of alkali-insoluble yarn in place between the twists of calcium alginate threads, the calcium alginate threads being taut while the alkali-insoluble yarn is loose, the alkali-insoluble yarn being substantially untwisted and incapable by itself of withstanding the strains imposed in weaving, employing said composite yarn in weaving a fabric and during the weaving causing the calcium alginate threads to bear the whole of the weaving strains of the composite yarn, and thereafter dissolving the calcium alginate threads out of the fabric by washing the fabric in an alkaline bath so as to set the alkali-insoluble yarn free.

3. A process of making a fabric, which comprises producing composite yarn consisting of alkali-insoluble yarn curled into loops, a plurality of calcium alginate threads twisted together and binding the loops of alkali-insoluble yarn in place between the twists of calcium alginate threads, the calcium alginate threads being taut while the alkali-insoluble yarn is loose, the alkali-insoluble yarn being incapable by itself of withstanding the strains imposed in weaving, employing said composite yarn in conjunction with other non-composite yarn in weaving a fabric and during the weaving causing the calcium alginate threads to bear the whole of the weaving strains of the composite yarn, and thereafter dissolving the calcium alginate threads out of the fabric by washing the fabric in an alkaline bath so as to set the alkali-insoluble yarn free.

4. A process of making a fabric, which comprises producing composite yarn consisting of alkali-insoluble yarn curled into loops, a plurality of calcium alginate threads twisted together and binding the loops of alkali-insoluble yarn in place between the twists of calcium alginate threads, the calcium alginate threads being taut while the alkali-insoluble yarn is loose, the alkali-insoluble yarn being substantially untwisted and incapable by itself of withstanding the strains imposed in weaving, employing said composite yarn in conjunction with other non-composite yarn in weaving a fabric and during the weaving causing the calcium alginate threads to bear the whole of the weaving strains of the composite yarn; and thereafter dissolving the calcium alginate threads out of the fabric by washing the fabric in an alkaline bath so as to set the alkali-insoluble yarn free.

5. A process as claimed in claim 3, wherein the loops of alkali-insoluble yarn are sufficiently small to produce a crepe effect in the finished fabric.

6. A process as claimed in claim 3, wherein the loops of alkali-insoluble yarn are sufficiently

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large to produce free loops in the finished fabric.
 7. A process as claimed in claim 4, wherein the loops of alkali-insoluble yarn are sufficiently large to produce free loops in the finished fabric and wherein the alkali-insoluble yarn consists of long-haired animal fibers whereby imitation astrakhan fabric is produced.

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