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TEXTILE FABRIC

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FIG. 1

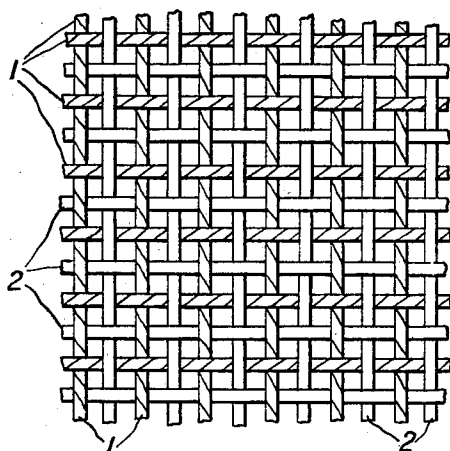
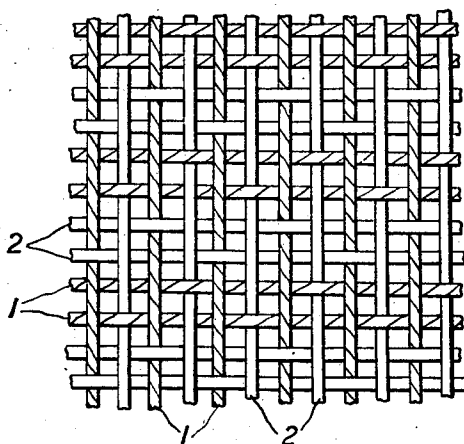


FIG. 2



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TEXTILE FABRIC

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This invention relates to textile fabrics and is especially concerned with woven fabrics that are rendered suitable for electrical insulating purposes by treatment with a drying oil or other insulating varnish.

Fabrics of this character are generally required to combine extreme thinness with a high degree of strength, for which purposes fine yarns of high tensile strength are necessary from which to weave the fabric. Many yarns, however, that possess a sufficiently high tensile strength have a relatively low extensibility, and insulating fabrics prepared from such yarns are very apt, after drying of the insulating varnish, to have poor resistance to tearing, notwithstanding the great strength of the yarns from which they are prepared. It is an object of the present invention to provide a fabric suitable for electrical insulating purposes in which this disadvantage is substantially reduced.

According to the present invention, a fabric suitable for oiling or varnishing for use, for example, as an electrical insulating fabric comprises in both warp and weft, yarns of great tensile strength and low extensibility and yarns of relatively low strength and high extensibility woven together in such a way that the yarns of low extensibility are not interlaced in any substantial degree, and preferably not at all, with other yarns of the same kind but depend entirely or almost entirely for their maintenance in the fabric structure on the presence of the yarns of high extensibility. When a fabric of this kind is treated with an insulating varnish it is found to possess a much higher resistance to tearing than a fabric of similar weight woven from the stronger yarns alone, apparently because there is no tendency for the stronger yarns, not being interlaced with one another, to cut into one another and so localise the strains on the yarns when the fabric is subjected to a tearing action.

In order to produce the desired effect on the fabric, that the low extensibility yarns should not interlace with one another, many different arrangements of the two kinds of yarn in the warp and weft are possible, with corresponding systems or patterns of weaving. The simplest arrangement is a plain weave in which both warp and weft consist of the stronger yarns alternating one and one with the more extensible yarns. It is often more convenient, however, in the operation of weaving, to insert picks of the same kind of yarn in pairs so that the yarns of the weft alternate two and two. In this case some other form of weave than a plain weave must be adopted, for

example a 4-shaft satin, the warps being arranged to alternate one and one. In such an arrangement, all the threads of one of the two warp sheets are of one kind for two successive picks and of the other kind for the next two picks and so on, the threads of the other sheet being always mixed. The effect required for the purpose of the present invention can thus be obtained by causing the weft picks to alternate two and two, as stated above, the weft inserted at each pick being different in kind from the thread of which the one warp sheet wholly consists. In both of the fabrics mentioned above, not only are the yarns of low extensibility not interlaced with one another, but the same is also true of the yarns of high extensibility, the coherence of the fabric depending upon the interlacing of the warps of one kind of yarn with the wefts of the other. Many other arrangements are also possible in which each of the two kinds of yarn does not interlace with its own kind but depends on yarns of the other kind to hold it in the fabric.

It is particularly convenient to employ as the stronger yarn in the fabric continuous filament yarns of regenerated cellulose of high tenacity, for example a tenacity in excess of about 2 grams per denier, accompanied by a low extensibility, e. g. of the order of 8% or less, the extensibility generally varying inversely with the tenacity achieved. Such high tenacity yarns may be made, for example, by the complete saponification of yarns of cellulose acetate or other organic ester of cellulose that has been stretched to a considerable extent while in a softened condition, for example in the presence of wet or saturated steam or hot water as described in U. S. Patents Nos. 2,142,717 and 2,142,722. Again, high tenacity yarns of an organic ester of cellulose, which may subsequently be saponified, can also be made by wet-spinning processes carried out under such conditions that the materials are drawn down considerably as they are extruded, for example by several hundred percent of the length they would have if extruded freely and without stretch. Again, regenerated cellulose yarns of high tenacity can also be made directly by spinning solutions of viscose or cuprammonium cellulose under suitable conditions, for example under such conditions that a considerable stretch is effected. Among other materials of which the stronger yarns in the fabric may be composed are unsaponified high tenacity cellulose ester materials of the kind referred to above and cellulose ether materials that in their manufacture have been

subjected to similar stretching processes for ensuring high tenacity.

Any suitable fine yarn having a relatively high degree of extensibility, as compared with the high-tenacity yarns, may be employed as the more extensible yarn; e. g. in association with high-tenacity yarns having an extensibility of 8% or less, low tenacity yarns having an extensibility of 12-20% or more may be used. Thus, for example, any of the types of yarn mentioned above as being capable of having a high degree of strength imparted to them by stretching them to a considerable extent in the course of their production may be employed without being stretched or, in the case of an organic ester of cellulose, without being stretched or saponified, so that the yarn remains thermoplastic. Again, other thermoplastic yarns that may be used are fine continuous filament yarns of a polymerised unsaturated artificial filament-forming substance, such as polyvinyl esters and ethers or copolymers of such substances, e. g. a copolymer of vinyl acetate and vinyl chloride. In the more extensible yarn as well as in the stronger yarn it is preferable that the yarn should consist of continuous filaments, as from such yarns thinner fabrics of a given weight may be produced than from yarns consisting of or containing staple lengths of fibre.

As typical of the high-tenacity low-extensibility yarns of regenerated cellulose previously described may be mentioned a continuous filament yarn made from cellulose acetate filaments by stretching such filaments in the presence of wet steam to about ten times their original length, and then completely saponifying them. The regenerated cellulose yarn thus produced may have a tenacity exceeding 4 grams per denier and an extensibility of 5-6%. Such high-tenacity yarns may be used in conjunction with continuous filament yarns of cellulose acetate spun in the ordinary way, which will generally have an extensibility of about 15% or somewhat more.

As the insulating varnish with which the fabric according to the present invention is to be treated to render it more suitable as an insulating material, any appropriate composition may be employed that has no injurious effect on the stronger yarn contained in the fabric, and preferably none on either of the kinds of yarn. Insulating varnishes of the type commonly employed and comprising a basis of a drying oil, such as linseed or China-wood oil, together with other ingredients, e. g., driers, softeners and the like may be used. Other varnishes, however, may be used having a basis of a material capable on drying of forming a flexible film, e. g. oil-modified resins such as oil-modified alkyd or phenol-formaldehyde resins. While it is generally preferable that the varnish should be without injurious effect on the more extensible as well as on the stronger yarns, it is possible, for particular purposes, so to select the varnish and the nature of the more extensible yarn that the latter is destroyed, or rendered very weak by the application of the varnish. By these means any tendency for even the more extensible yarns to localise the stresses on the stronger yarns is avoided. In this case the stronger yarns are held together in the finished product by the film that is formed by the varnish on drying.

The varnish may be applied to the fabric by any suitable means, e. g. by dipping or spraying or running the fabric through a bath of the varnish, and is then dried e. g. by being suspended

in or run through a hot tower for an appropriate period.

The following is given as an example of a fabric in accordance with the present invention:

Example

The warp of the fabric comprises yarns of 30 denier of continuous filaments made by stretching continuous filaments of cellulose acetate and subsequently saponifying substantially completely the stretched yarn. These yarns alternate with yarns of 45 denier made of unstretched and unsaponified cellulose acetate filaments, the two kinds of yarn alternating end and end in the warp. Similar yarns are employed in the weft but in this case the picks of weft alternate two and two instead of one and one. The warp and weft are woven together to form a 4-shaft satin fabric with 100 ends per inch in the warp and 140 picks per inch in the weft. The fabric so produced is treated with an insulating varnish having as its basis a glycerol/phthalic-anhydride resin in which has been modified with linseed oil, and containing about 60% of the modified resin together with a hydrocarbon thinner.

The fabric is run through a bath of the varnish and drawn vertically upwards, as it leaves the bath, past a doctor blade to remove excess varnish. The fabric then passes up a drying tower through which air heated to a temperature of 110° C. is passed. The amount of varnish taken up by the fabric may be adjusted by adjusting the temperature (and therefore the viscosity) of the varnish, and by varying the height of the doctor blade above the surface of the bath so as to vary the degree of drying of the fabric before it encounters the blade. A fabric of the kind described above may, in this way, be given a finished thickness of from 4 mils. upwards. Thicker fabrics may, of course, be produced by using yarns of greater weight.

While the invention has been described above in connection with fabrics intended to be used as electrical insulation, the invention is not limited in this respect, but may be used for the production of oiled or varnished fabrics generally, whatever their purpose.

Two forms of fabric in accordance with the present invention are shown in the accompanying drawing in which

Figure 1 is a diagrammatic view of a plain-woven fabric and

Figure 2 is a diagrammatic view of a 4-shaft satin fabric, both figures showing the manner in which the yarns of the fabrics are interlaced.

In Figure 1, which shows a plain-woven fabric, the yarns of high tensile strength and relatively low extensibility are shown at 1 and the yarns of low strength and high extensibility at 2, the yarns of the first kind being distinguished from those of the second kind by being shaded while those of the second kind are shown plain. It will be seen that the yarns of the two kinds alternate with each other in both warp and weft, and as a result all the shaded weft yarns lie over all the shaded warp yarns and are not interlaced therewith. Similarly all the unshaded weft yarns lie over all the unshaded warp yarns. Nevertheless, the cohesion of the fabric is brought about by the fact that the unshaded weft yarns, though passing over the unshaded warp yarns, pass under the shaded warp yarns while the unshaded warp yarns, though passing under the unshaded weft yarns, pass over the shaded weft yarns.

The fabric shown in Figure 2 is of the kind described in the example given above, i. e., a 4-shaft satin fabric. In this fabric, the warp yarns alternate one and one and the weft yarns alternate two and two. The two kinds of yarn are distinguished from one another as in Figure 1. It will be seen that the shaded warp yarns pass over all the shaded weft yarns and that the unshaded warp yarns pass over all the unshaded weft yarns. The coherence of the fabric is brought about, however, by the fact that the shaded warp yarns pass under one-half of the unshaded weft yarns while the unshaded warp yarns pass under one-half of the shaded weft yarns. This arrangement depends on the disposition of the shaded and unshaded pairs of weft yarns with reference to the plan according to which the warps are shedded. For each pick in the fabric, all the yarns passing under it are of one kind, and it is necessary that this pick should be of the other kind of yarn. When this is done it is found that the picks of the two kinds alternate two and two, as previously stated.

Having described our invention, what we desire to secure by Letters Patent is:

1. A fabric suitable for use as the basis of a varnished fabric, comprising in both warp and weft, yarns of high tensile strength and low extensibility and yarns of relatively low tensile strength and high extensibility, said yarns being so woven together that the yarns of low extensibility are not interlaced with one another to any substantial degree but depend substantially entirely for their maintenance in the fabric structure on the presence of the yarns of high extensibility.

2. A fabric suitable for use as the basis of a varnished fabric, comprising in both warp and weft, yarns of high tensile strength and low extensibility and yarns of relatively low tensile strength and high extensibility, said yarns being so woven together that the yarns of low extensibility are not interlaced with one another to any substantial degree and the yarns of high extensibility are not interlaced with one another to any substantial degree, the yarns of each of the two kinds depending substantially entirely for their maintenance in the fabric structure on the presence of the yarns of the other kind.

3. A fabric suitable for use as the basis of a varnished fabric, comprising in both warp and weft, yarns of high tensile strength and low extensibility and yarns of relatively low tensile strength and high extensibility, said yarns being so woven together that the yarns of low extensibility are not interlaced with one another to any substantial degree and the yarns of high extensibility are not interlaced with one another to any substantial degree, the yarns of each of the two kinds depending substantially entirely for their maintenance in the fabric structure on the presence of the yarns of the other kind, the fabric having a plain weave in which yarns of the two kinds alternate one and one in both warp and weft.

4. A fabric suitable for use as the basis of a varnished fabric, comprising in both warp and weft, yarns of high tensile strength and low extensibility and yarns of relatively low tensile strength and high extensibility, said yarns being so woven together that the yarns of low extensibility are not interlaced with one another to any substantial degree and the yarns of high extensibility are not interlaced with one another to any substantial degree, the yarns of each of

the two kinds depending substantially entirely for their maintenance in the fabric structure on the presence of the yarns of the other kind, the fabric having a 4-shaft satin weave wherein the yarns alternate one and one in the warp and two and two in the weft.

5. A fabric suitable for use as the basis of a varnished fabric, comprising in both warp and weft, regenerated cellulose yarns of low extensibility that have been subjected to a high degree of stretch in the course of their production to as to impart a high tenacity to them, and yarns of relatively low tensile strength and high extensibility, said yarns being so woven together that the yarns of low extensibility are not interlaced with one another to any substantial degree but depend substantially entirely for their maintenance in the fabric structure on the presence of the yarns of high extensibility.

6. A fabric suitable for use as the basis of a varnished fabric, comprising in both warp and weft, regenerated cellulose yarns of low extensibility that have been subjected to a high degree of stretch in the course of their production so as to impart a high tenacity to them, and yarns of relatively low tensile strength and high extensibility, said yarns being so woven together that the yarns of low extensibility are not interlaced with one another to any substantial degree, and the yarns of high extensibility are not interlaced with one another to any substantial degree, the yarns of each of the two kinds depending substantially entirely for the maintenance in the fabric structure on the presence of the yarns of the other kind, the fabric having a 4-shaft satin weave wherein the yarns alternate one and one in the warp and two and two in the weft.

7. A fabric suitable for use as the basis of a varnished fabric, comprising in both warp and weft, continuous filament yarns of low extensibility made by saponifying cellulose ester filaments that have been stretched so as to impart a high tenacity to them, and yarns of relatively low tensile strength and high extensibility, said yarns being so woven together that the yarns of low extensibility are not interlaced with one another to any substantial degree but depend substantially entirely for their maintenance in the fabric structure on the presence of the yarns of high extensibility.

8. A fabric suitable for use as the basis of a varnished fabric, comprising in both warp and weft, continuous filament yarns of low extensibility made by saponifying cellulose ester filaments that have been stretched so as to impart a high tenacity to them, and yarns of relatively low tensile strength and high extensibility, said yarns being so woven together that the yarns of low extensibility are not interlaced with one another to any substantial degree and the yarns of high extensibility are not interlaced with one another to any substantial degree, the yarns of each of the two kinds depending substantially entirely for their maintenance in the fabric structure on the presence of the yarns of the other kind, the fabric having a 4-shaft satin weave wherein the yarns alternate one and one in the warp and two and two in the weft.

9. A fabric suitable for use at the basis of varnished fabric, comprising in both warp and weft, yarns of high tensile strength and low extensibility, and thermoplastic yarns of relatively low tensile strength and high extensibility, said yarns being so woven together that the yarns of low

extensibility are not interlaced with one another to any substantial degree but depend substantially entirely for their maintenance in the fabric structure on the presence of the yarns of high extensibility.

10. An insulating fabric comprising a basis of woven fabric, comprising in both warp and weft, yarns of high tensile strength and low extensibility and yarns of relatively low tensile strength and high extensibility, said yarns being so woven together that the yarns of low extensibility are not interlaced with one another to any substantial degree but depend substantially entirely for their maintenance in the fabric structure on the presence of the yarns of high extensibility, said woven fabric being impregnated with an insulating varnish that is inert to the materials of which the low extensibility yarns consist.

11. An insulating fabric comprising a basis of woven fabric, comprising in both warp and weft, yarns of high tensile strength and low extensibility and yarns of relatively low tensile strength and high extensibility, said yarns being so woven together that the yarns of low extensibility are not interlaced with one another to any substantial degree and the yarns of high extensibility are not interlaced with one another to any substantial degree, the yarns of each of the two kinds depending substantially entirely for their maintenance in the fabric structure on the presence of the yarns of the other kind, the fabric having a 4-shaft satin weave wherein the yarns alternate one and one in the warp and two and two in the weft, said fabric being impregnated with an insulating varnish that is inert to the materials of which the low extensibility yarns consist.

12. An insulating fabric comprising a basis of woven fabric, comprising in both warp and weft, regenerated cellulose yarns of low extensibility that have been subjected to a high degree of stretch in the course of their production so as to impart a high tenacity to them, and yarns of relatively low tensile strength and high extensibility, said yarns being so woven together that the yarns of low extensibility are not interlaced with one another to any substantial degree and the yarns of high extensibility are not interlaced with one another to any substantial degree, the yarns of each of the two kinds depending substantially entirely for their maintenance in the fabric structure on the presence of the yarns of the other kind, the fabric having a 4-shaft satin weave wherein the yarns alternate one and one in the warp and two and two in the weft, said fabric being impregnated with an insulating varnish that is inert to the materials of which the low extensibility yarns consist.

13. A fabric suitable for use as the basis of a varnished fabric, comprising in both warp and weft, continuous filament yarns of low extensibility made by saponifying cellulose ester filaments that have been subjected to a high degree of stretch in the course of their production so as to impart a high tenacity to them, and yarns of relatively low tensile strength and high extensibility, said yarns being so woven together that the yarns of low extensibility are not interlaced with one another to any substantial degree, the yarns of each of the two kinds depending substantially entirely for their maintenance in the fabric structure on the presence of the yarns of the other kind, the fabric having a 4-shaft satin weave wherein the yarns alternate one and one in the warp and two and two in the weft, said

fabric being impregnated with an insulating varnish that is inert to the materials of which the low extensibility yarns consist.

14. An insulating fabric comprising a basis of woven fabric, comprising in both warp and weft, regenerated cellulose yarns of low extensibility that have been subjected to a high degree of stretch in the course of their production so as to impart a high tenacity to them, and yarns of relatively low tensile strength and high extensibility, said yarns being so woven together that the yarns of low extensibility are not interlaced with one another to any substantial degree and the yarns of high extensibility are not interlaced with one another to any substantial degree, the yarns of each of the two kinds depending substantially entirely for their maintenance in the fabric structure on the presence of the yarns of the other kind, the fabric having a 4-shaft satin weave wherein the yarns alternate one and one in the warp and two and two in the weft, said fabric being impregnated with an insulating varnish that is inert to the materials of which the low extensibility yarns consist, and has a basis of a drying oil.

15. A fabric suitable for use as the basis of a varnished fabric, comprising in both warp and weft, continuous filament yarns of low extensibility made by saponifying cellulose ester filaments that have been subjected to a high degree of stretch in the course of their production so as to impart a high tenacity to them, and yarns of relatively low tensile strength and high extensibility, said yarns being so woven together that the yarns of low extensibility are not interlaced with one another to any substantial degree, the yarns of each of the two kinds depending substantially entirely for their maintenance in the fabric structure on the presence of the yarns of the other kind, the fabric having a 4-shaft satin weave wherein the yarns alternate one and one in the warp and two and two in the weft, said fabric being impregnated with an insulating varnish that is inert to the materials of which the low extensibility yarns consist, and has a basis of a drying oil.

16. An insulating fabric comprising a basis of woven fabric, comprising in both warp and weft, regenerated cellulose yarns of low extensibility that have been subjected to a high degree of stretch in the course of their production so as to impart a high tenacity to them, and yarns of relatively low tensile strength and high extensibility, said yarns being so woven together that the yarns of low extensibility are not interlaced with one another to any substantial degree and the yarns of high extensibility are not interlaced with one another to any substantial degree, the yarns of each of the two kinds depending substantially entirely for their maintenance in the fabric structure on the presence of the yarns of the other kind, the fabric having a 4-shaft satin weave wherein the yarns alternate one and one in the warp and two and two in the weft, said fabric being impregnated with an insulating varnish that is inert to the materials of which the low extensibility yarns consist, and has a basis of an oil-modified alkyd resin.

17. A fabric suitable for use as the basis of a varnished fabric, comprising in both warp or weft, continuous filament yarns of low extensibility, made by saponifying cellulose ester filaments that have been subjected to a high degree of stretch in the course of their production so as to impart a high tenacity to them, and yarns of

relatively low tensile strength and high extensibility, said yarns being so woven together that the yarns of low extensibility are not interlaced with one another to any substantial degree, the yarns of each of the two kinds depending substantially entirely for their maintenance in the fabric structure on the presence of the yarns of the other kind, the fabric having a 4-shaft satin

weave wherein the yarns alternate one and one in the warp and two and two in the weft, said fabric being impregnated with an insulating varnish that is inert to the materials of which the low extensibility yarns consist, and has a basis of an oil-modified alkyd resin.

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