Patented Feb. 3, 1942 2,271,885

# UNITED STATES PATENT OFFICE

2,271,885

## CREPED TEXTILE FABRIC

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No Drawing. Application December 9, 1937, Serial No. 179,024

1 Claim. (Cl. 91—68)

This invention relates particularly to improvements in the production of crepe or pebble fabrics which are woven from natural, artificial, or mixed yarns, filaments, or fibers. This pebble effect, which is desirable because of the popularity created by its unusual, rough appearance, is obtained by causing either the warp or filler yarns or fibers, or both, to crinkle or corrugate after the fabric has been woven. Though most yarns and filaments will crinkle after having been twisted and stretched and then released, it is essential and requisite, in producing crepe fabric of fine quality that the crinkling or creping be both uniform and regular. Usually the size of the crinkles, their configuration, and structure, governs the texture and appearance of the finished goods, while the uniformity, as described, controls the quality, other factors being equal.

Of this invention, briefly, the principal objectives are to provide a simple method for obtaining large and uniform pebble configurations in finished fabric, to provide a simple method for making a variety of crepe fabrics of differing texture and appearance, and to provide a method and material for treating both fabrics and yarn, to make them amenable to creping and crinkling to pronounced degree.

The filaments of most of the fabrics now being produced are of rayon, regenerated cellulose, regenerated cellulose ester, and, to a limited degree, of silk. Since the regulation of the tension and twist of the fibers, both prior to and during the weaving process, results in the crepe effect, the filler and warp fibers, one or both, are twisted under tension and then woven. However, in the case of rayon, particularly, the filaments are plastic and so elongate under tension. They must, therefore, be protected by the application of a sizing or other protective coating. The type of coating or sizing used governs the quality and texture of the finished fabric, especially if the pebble size is large.

The creping of the yarns of fabrics is not produced until after the fabrics have been woven and otherwise are finished. Depending upon the amount of twist applied to a given yarn, the tensions which are applied during throwing, the physical properties of the yarn, and the nature of the sizing applied thereto prior to weaving, the yarn is caused to acquire a quality which, in this specification, is termed, "latent creping capacity," or, otherwise stated, a capacity to crepe or crinkle. This latent creping capacity of the yarn is released, after it has been woven into fabric, by immersing the fabric in an aqueous desizing solution, in which the filler or warp, or both sets of yarns are allowed to crinkle or crepe. In a copending application Serial No. 120,825, filed by one of the present inventors, the discovery is disclosed that the rapidity with which the latent creping capacity of yarns is released governs, to a large degree, the ultimate size and configuration of the crinkling or of the pebbles manifested in the finished fabric. The magnitude of the creping produced in the finished fabric generally is referred to in the art as the "pebble size."

It has been conventional in the past to determine the twist or stretch, or twist and stretch, applied to each given batch of yarn or filament by the creping effect intended in the finished fabric to be made from that batch of yarn or filament. In other words, the inherent creping power always has been adjusted and proportioned according to the desired appearance of the particular fabric intended to be made. If small pebble size was desired in the finished fabric, then the yarns were twisted or stretched only slightly. If large pebble size was desired in the finished fabric, then, the yarns were treated and woven to induce the formation of large crinkles.

In the past however, it has not been possible, to produce uniformly creped fabrics in which the pebbling was of large size and the texture and appearance even and pleasing. The primary difficulties in these respects have arisen through variations occurring from time to time in the filamentary character of the yarn and, sometimes, in its chemical qualities, and, more particularly, through the variations occurring in the successive manufacturing operations. For one to understand the nature of these variations, and the nature of the present advance, a brief review of the methods which heretofore have been used for manufacturing creped fabrics is requisite.

When the manufacturer, as is the usual case, receives raw yarn in the form of skeins, he first immerses it in the sizing solution and then dries it. Next, in the process, the yarn undergoes a winding operation in which it is distended into a round form and disposed over a swift. The fiber is then drawn from the swift and wound onto what is commonly known as a twisting spool, at which, in order to impart to the yarn the crepe character desired in the finished fabric, the yarn is twisted at a high rate of speed (sometimes as high as 10,000 R. P. M.). Either during, or after, this twisting, the yarn is steamed to set the twist, and then drawn (or redrawn) through a pair of closely set knives to remove any slubs or lumpy

formations which might be present. After being rewound, the yarn is drawn onto a cop, or quill, or bobbin, wherein the yarn is held in relatively firm position. Next the yarn is woven. The warp threads are placed in the loom in parallel relation, and the filler threads are passed under and over the warp by means of the conventional shuttle.

Because the yarn filaments are fragile and delicate and are subjected to a somewhat great amount of handling, abrasion, and tension, during the various processing operations, seemingly small variations cause pronounced fluctuations in the crinkling of the yarn and thus, in the quality, appearance, and effects in the finished fabric.

Whenever a change in the appearance or texture of the finished fabric was desired in the past, each of the processing machines was reset to suit the new conditions, or the new requirements, for instance in the twisting and the stretch. And the composition of the sizing bath likewise was altered to suit the new sizing requirements. For example, in the past, if it were desired to finish ten batches of fabrics in ten different creping effects, then it was necessary to make ten different batches of sizing solutions, one for each separate finish, and adjustments were required in each one of the processing machines.

Obviously, the variations occurring in the yarn and occurring in the processing operations, coupled with the necessity imposed upon the manufacturer, of resetting the processing machines each time a specific creped fabric was to be made, have tended to make the manufacture of the creped fabrics of specific texture largely a hit or miss proposition. The primary objective of the present invention has been to obviate the uncertainties of the manufacture whether they occur in the yarn or in the processing, and to obviate the necessity for alterations of machines for specific results, to the end that creped fabrics of predetermined quality and predetermined texture and appearance truly may be provided. In a further respect, the objective of the invention has been to provide a method for producing creped fabrics having large pebble configurations established uniformly throughout the fabric.

The present invention resides in the discovery that better quality and greater uniformity of texture of crepe fabrics can be obtained by controlling the pebble size after the capacity for creping has been imparted to the yarn and after the fabric has been woven, rather than by trying to control the capacity for creping by adjustments in both the sizing and the processing machines. The product of the invention, both in theory and in practice, is a fabric characterized by fine quality, large pebble configurations and effects, and a pleasing, unusual appearance.

In the present invention, various desired crepe effects are obtained first by establishment of a fabric having large and uniform capacity for pebbling, and secondly, by appropriate modifications of the high inherent crepeability of fabric which has been woven from the yarn, but of which the latent creping capacity has not yet been released. In the practice of the invention, one, or perhaps two "master" fabrics which possess latent creping capacity for producing a uniform pebble size as large as, or larger than, the largest pebble size desired in the finished fabric, are manufactured. Then, to obtain fabrics of other pebble finish, the latent creping capacity of such master fabric is modified by treatment thereof in a fabric-embossing machine consisting of a hard, heated roller and a relatively soft, furred paper roller. This fabric embossing machine is easily adjustable for modifying the creping capacity of the fabric to the desired degree or extent. Thus, the necessity for the separate adjustments in the sizing solutions, processing machines, and elsewhere, which have been necessary in the past are omitted. The objectives of the invention thus are accomplished first, by treating or, more particularly, sizing, the yarns in such a way as to provide a latent creping power in the fabric which is uniformly high, and which is releasable suddenly, next, by weaving a "master" batch, then in modifying the high crepeability of fabric of the master batch, if desired, to produce a fabric of small or modified, pebble size or texture, and finally in releasing the residual creping capacity, or the original capacity, if it has not been modified.

While the improvements have been disclosed particularly in relation to a process adapted for the manufacture of a variety of crepe fabrics of different texture and appearance from one or more master fabrics, the invention also contemplates a method for producing a master fabric susceptible, and amenable to such modifications and possessing creping power sufficiently high to produce pebbles as large as, or larger than, any of the pebbles desired to be provided in the finished fabrics. Moreover, these master fabrics are suited to use, by virtue of their uniform and pleasing appearance and large pebble dimensions, without being modified at all.

Not all of the conventional sizes which have been used in the past are adapted to use for sizing the yarns intended to be processed according to the present invention, since it is the concept to impart a high and uniform latent creping capacity to the yarns. The creping power imparted to the yarn must be released very suddenly and uniformly in order to get intense creping effect, and not all sizes can be removed from the yarn easily and quickly in the desizing operation. Moreover, the yarn treated to possess high crepeability imposes unusual requirements upon the sizing composition.

Briefly, we have discovered that gum arabic possesses those peculiar qualities which are necessary for the fulfillment of the purposes disclosed. Gum arabic, which is weak in tensile strength, per se, has usually been regarded as being useless for providing the fibers with enough tensile strength for the twisting and stretching which they must undergo. We have found, however, that the twisted filaments or fibers sized with gum arabic, exhibit a degree of tensile strength as great as, or greater than, the fibers sized with another solution, such as dextrin or gelatin starch, and also that the fabrics sized with gum arabic respond more uniformly and promptly by corrugating when the latent creping power is released. In substance, we have found that gum arabic possesses peculiar properties suiting it specifically to use for crepe fabric manufacture, despite the condemnation of its use for other modes of fabrication.

After the weaving operation is completed, it is necessary, usually, to remove all of the size from the fibers. Traces of the size remaining on the fiber may result in unevenness in the subsequent bleaching or dyeing operations. So, according to the invention, a size or coating is provided which is adapted to be applied evenly

and readily to the yarns, and removed evenly and quickly from the fabrics, without severe scouring and scrubbing or abrasion. This size comprises, gum arabic, water, chemically neutral inert oils such as paraffin oil, or preferably, light colored technical oils, and mahogany or oil soluble mineral oil sulphonates. Such sizing solutions are characterized particularly by their capacity to enable the production of large pebble crepe fabrics, their capacity to be removed quickly and conveniently from the fabric in order to release the creping power which has been imparted to the yarn, and their capacity to insure uniformity of pebbliness in the wrinkles.

A typical example of such a size, in base or stock condition and adapted to be diluted with water, is as follows:

| | Per cent (approximately) |
|---|---|
| Gum arabic | 25 |
| Water | 25 |
| Blend of white oil and mahogany sulphonates | 50 |

The percentage of mahogany sulphonates in the blend may vary anywhere from, approximately 10% to 70%. Too much oil or too little oil tends to produce an unbalanced condition in the size, and oil tends to separate therefrom if the size stands over a period of time, though, as will be noted, the range is relatively broad.

A feature of a size or soaking bath prepared from a stock or base solution, such as that disclosed in the example, is that it is the only size available at the present time, as far as we know, which may be fluctuated deliberately in quantity in the soaking formula over a relatively wide range without materially affecting the height or nature of the resultant pebbles of fabric made from yarn soaked therein. As previously stated, it formerly was necessary to adjust each size solution in relation to the pebble size desired to be produced.

Moreover, since the balance of components usually is disturbed when successive batches of yarn are soaked in the solution one after the other, it is not desirable to use a sizing solution which requires delicate adjustment of the proportions of its components. In other words, in sizing successive batches of fabrics in a given soaking solution, the adjustment of the components usually is disturbed through preferential absorption by the fabric of one component or another. However, when gum arabic is used as the principal sizing ingredient the balance is not critical, since variations in the soaking formula become relatively unimportant and the nature of the resultant pebble is not affected.

In preparing sizing solutions for soaking yarn to impart thereto high creping capacity, it is preferable to use approximately equal parts of base or stock size and blend of sulphonates and oil. For example, 8 to 14 pounds of stock size, 8 to 14 pounds of blend of mineral oil and sulphonates similar to that used in the preparation of the base size itself, and approximately 40 to 60 gallons of water makes a size bath well suited to use. Whatever tint is necessary is added. The mixture is stirred until it is homogeneous and is warmed to a temperature of approximately 130° F. When the yarn is sized on the spray type of skein sizing machine the liquor is sprayed continuously from a circulating bath over the skeins while the skeins are revolved for 4 to 10 minutes, after which the skeins are extracted and dried in the usual manner. When the yarn is soaked in stationary tubs, warp bundles of skeins are entered into the solution and soaked for from 20 to 30 minutes.

The quantity of gum arabic used in a given sizing solution may, as indicated, be altered by varying either the quantity of stock size added to water or the gum arabic content of the stock size itself, to suit particular purposes. This is true, likewise, in respect to the oil soluble mineral oil sulphonates and the mineral oil.

As a generality, approximately one-half part to six parts of gum arabic, per five hundred parts of water may be used, if desired, in making the sizing solution. Likewise, anywhere from approximately two to twenty-five parts of the blend of oil soluble mineral oil sulphonates and mineral oil per five hundred parts of water may be used, and the blend itself, may vary between ten to ninety parts of oil, to ninety to ten parts of sulphonates, respectively, all by weight. If desired, sulphonated tallow, sulphonated castor oil, or a blend of these or the like, may be used.

The soaked yarn is treated so that it receives a creping capacity sufficient to enable the production of creped fabrics having a pebble effect as high as the pebbles of any creped fabric desired to be produced. The processing machines and the loom are set to suit these conditions. The yarn is woven in the conventional manner and the woven fabrics are embossed, as previously described, if it is desired to modify the crepeability and to produce fabrics having smaller pebble size. The fabrics, in either event, then are desized in water, to release the latent or residual creping capacity. Finally in this finished form, the creped fabrics may be dyed.

The mineral oil sulphonates, which we prefer to use, are derived from the process of producing white and light-colored technical oils by treating mineral oil with fuming sulphuric acid or sulphur trioxide. In this treatment, two layers are formed. The upper layer is known as the A, or oil layer, and the lower layer is known as the B, or sludge layer. The sulphonates which are contained in the A or oil layer are highly oil soluble, while those in the B layer are water soluble.

In the practice of the invention, we prefer to use A layer, or oil soluble, or mahogany sulphonates. However, it may be mentioned in this respect that oil soluble sulphonation products, derived from brown coal tar oil, may also be used in certain instances in the practice of the present invention.

In many instances, and especially where fabrics of fine grade and high quality are being manufactured, it is desirable to use mineral oil sulphonates from which extraneous impurities have been removed to improve the properties of the sulphonates. When this is the case, oil soluble mineral oil sulphonates are readily purified, according to the processes shown in the Fischer-Reddish U. S. Patent No. 1,703,838 and in the Heckel-Reddish U. S. Patent No. 1,775,622.

While any stable, chemically inert mineral oil can be used in the process of the present invention, we prefer to use the white oils or light-colored technical oils which are produced when lubricating stock or mineral oil is treated with fuming sulphuric acid or sulphur trioxide. Paraffin oils and similar bodies also may be used. Less highly refined oils may be used in treating lower grade or dark-colored fabrics, but whatever type of oil is selected, its boiling point should be sufficiently high to avoid loss by evaporation during the operation.

Having described our invention, we claim:

The method of making a creped fabric which includes the step of sizing yarn, prior to the weaving of the fabric in an aqueous bath containing gum arabic, from approximately ½ to 6 parts, and an oil soluble mineral oil sulphonate and mineral oil blend from approximately 2 to 25 parts per 500 parts of water, the amounts present being sufficient to produce on the yarn a size enabling the production of a creped fabric having a high pebble effect.

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