

- [54] **DEFECT-DETECTING METHOD AND APPARATUS**
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- [22] Filed: **Apr. 11, 1974**
- [21] Appl. No.: **459,943**
- [52] U.S. Cl. **73/160**
- [51] Int. Cl.² **G01N 21/06**
- [58] Field of Search **73/160**

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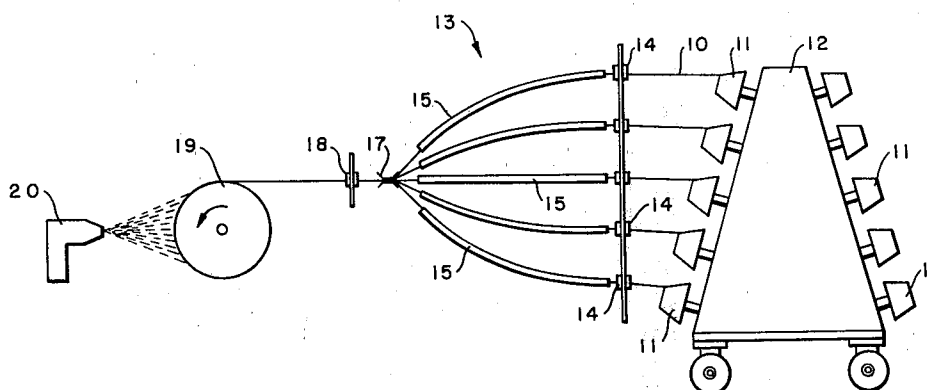
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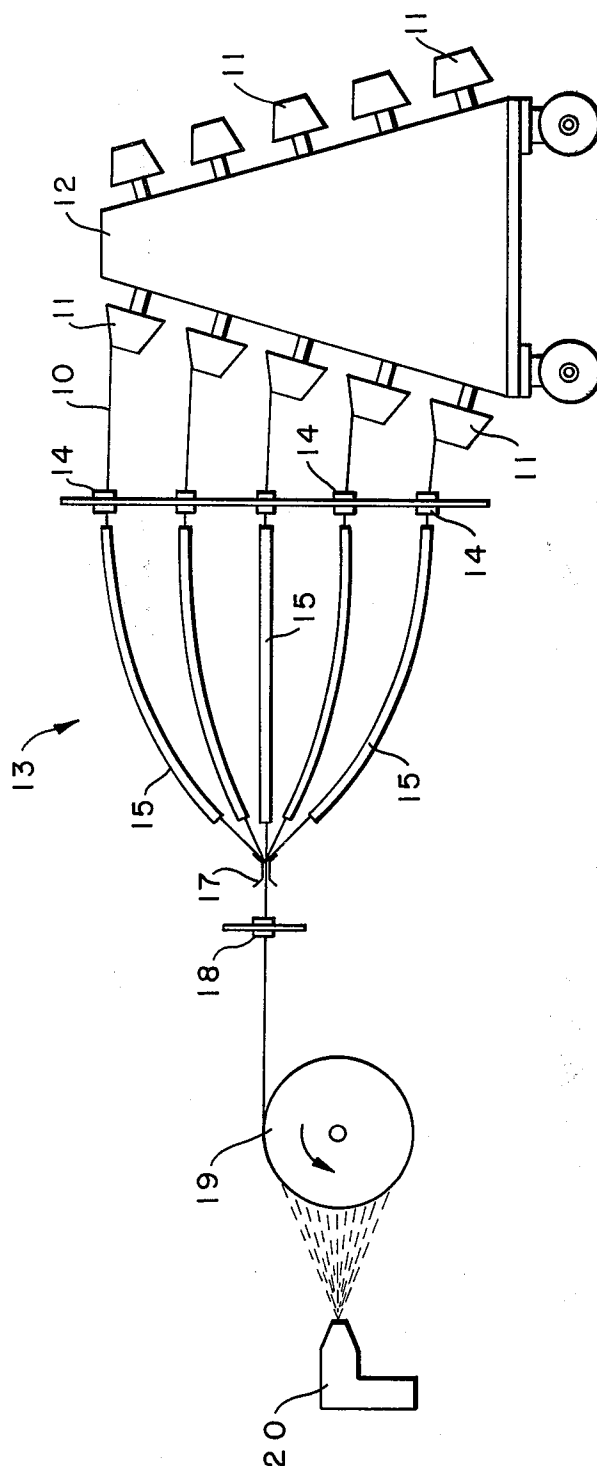
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[57] **ABSTRACT**

A method for detecting defects in textile yarns comprising the steps of withdrawing yarns from packages, winding each yarn a plurality of wraps around a support surface with the wraps of each yarn being displaced from the wraps of adjacent yarns, applying a composition comprising a colorant and a solvent mixture to the yarn wraps on the support surface, permitting the composition to undergo phase separation, and comparing the resulting depths of shade of the respective yarn wraps. Also, apparatus for conducting such method.

3 Claims, 2 Drawing Figures





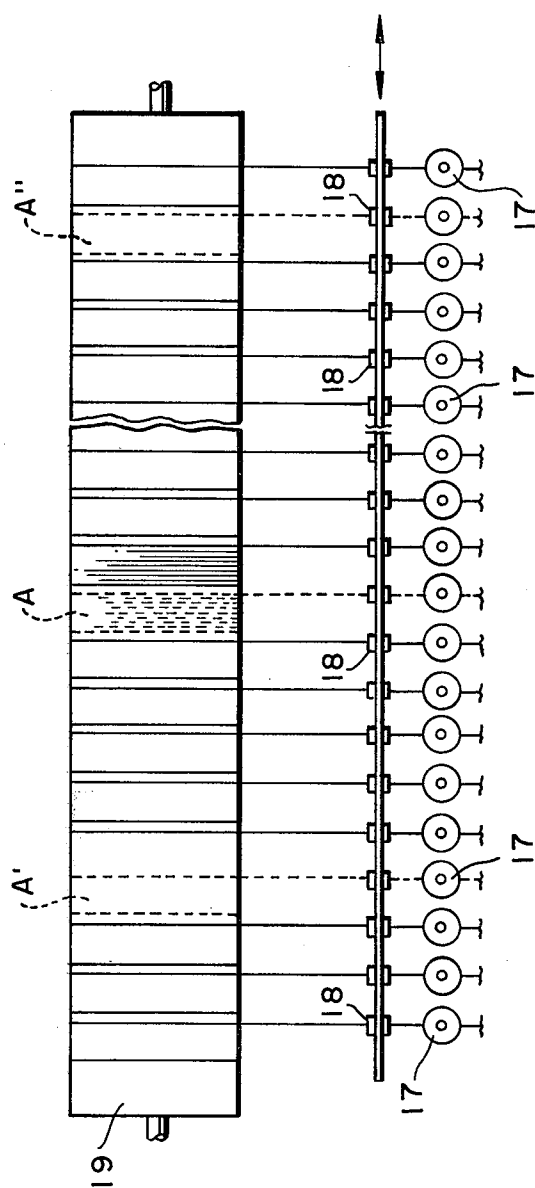


FIG. -2-

DEFECT-DETECTING METHOD AND APPARATUS

A dependable, efficient system for a preliminary test to insure uniform dyeing has long been needed by the textile industry. Likewise, there has been a need for a means to detect at an early stage physical defects in fabrics that are continuous and/or repetitive due to mechanical malfunctions of the machines, varying tensions on the ends of yarn, and the like.

The problem of fabric defect detection is further compounded by the use of textured synthetic yarns which possess different dye affinity depending upon the type of yarn, the number of filaments or fibers in a yarn bundle, the heat history of the yarn during texturing, the particular texturing process utilized, and similar factors. In the respective texturing processes, there are certain variables that introduce different dye characteristics to yarns produced by the particular process. For example, where the yarn is heated to a plastic state and a twist is set therein as in a false twist process, different heat histories of the yarns so processed can well affect the dyeing of the yarn. Likewise, in an edge crimping process where the yarn is passed over an edge, variations in the sharpness of the edge may create different characteristics in the yarn which may affect the dyeing of the yarn.

These differences in dyeing generally result in fabric defects which are referred to as barre or warp streaks. If the conditions are not detected until the goods are dyed, second-quality goods are produced which must be segregated and sold at a lesser price. It is advantageous to check the yarn prior to its inclusion into a fabric so those yarns which exhibit propensities for barre may be segregated.

An article in *Modern Knitting Management*, February 1973, pages 18-22, sets forth the advantages of dye testing fabrics containing textured yarns to permit segregation of the textured yarns into uniform lots prior to fabrication into woven or knitted goods. The article states that two techniques, group segregation and comparative segregation, are commonly employed. Either technique may be based on visual or instrumental assessment of dye depth.

A polyester fiber identification system has been proposed in *Knitting Industry*, November 1972, page 44. In this system, colorants are applied to a fabric or group of fibers in a two-step operation with a preparation solution being brushed onto the fabric and after thirty seconds a special blue colorant is sprayed onto the fabric. Heat then is applied to hasten development. This technique is said to allow identification or separation of basic dyeable polyester from regular polyester.

U.S. application Ser. No. 361,994 filed May 21, 1973 is directed to a defect-detecting composition comprising a colorant and a solvent mixture containing at least two solvents of differing polarity which are substantially immiscible under certain conditions. This application discloses a method of detecting defects in substrates in which the above composition is applied to a substrate and permitted to undergo phase separation whereby the colorant migrates with one of the solvents to a portion of the substrate to facilitate inspection thereof.

The present invention provides a simple and quick method for identifying differences in yarns. Further, the invention provides a single-step method which permits the visual or instrumental observation of defects of a physical, chemical and/or optical nature in textile

yarns. The present invention also provides a technique for predicting the propensities of textile fabrics for barre before the fabrics are knitted.

A method for detecting defects in textile yarns comprises the steps of withdrawing yarns from packages, winding each yarn a plurality of wraps around a support surface with the wraps of each yarn being displaced from the wraps of adjacent yarns, applying a composition comprising a colorant and a solvent mixture to the yarn wraps on said support surface, permitting said composition to undergo phase separation, and comparing the resulting depths of shade of the respective yarn wraps.

The colorant composition employed in the method of the invention may be any of a variety of dyestuffs, colorants, pigments, UV absorbers or the like and advantageously is of the type described in U.S. application Ser. No. 361,994. It is intended that the disclosure of that patent application be incorporated herein. The amount of the colorant composition applied to the yarn generally is not critical with visual comparison but may be with instrument comparison.

The invention will be described in greater detail with reference to the drawings in which:

FIG. 1 is a schematic illustration of one form of apparatus of the invention; and

FIG. 2 is a longitudinal view of the yarn-collecting means shown in cross section in FIG. 1.

As shown in the drawings, a doffing truck 12 including yarn packages 11 is positioned adjacent a yarn transfer frame 13. Frame 13 includes a plurality of guides 14 and transfer tubes 15. The frame also includes tension devices 17 and outlet guides 18 for each yarn passing through the frame.

Adjacent the delivery portion of the frame is disposed a yarn-collecting support surface 19. A spray nozzle 20 is located adjoining the support surface 19 to direct a spray of the colorant composition against the surface. As shown in FIG. 2, the individual yarns are wrapped around the support surface with the wraps of each yarn being displaced from the wraps of adjacent yarns as shown in FIG. 2.

In the operation of the apparatus shown in the drawings, doffing truck 12 is wheeled to a position adjacent frame 13 and each yarn 10 from one of the packages 11 is threaded through guide 14, transfer tube 15, tension device 17, outlet guide 18 and then wrapped about support surface 19. In the same way, other yarns are transferred from packages 11 on doffing truck 12, through frame 13 and wrapped about the surface 19. When a sufficient number of wraps of each of the yarns have been formed on cylinder 19, shown in FIG. 2 until contact with the adjacent yarn band, the colorant composition is sprayed from nozzle 20 onto the yarns.

The composition after being applied to the yarns changes in character and one of the components thereof preferentially migrates to a particular portion of the yarn band on the support surface, thus facilitating visual or instrumental comparison of the yarns. When one or more yarns (yarn bands A, A' and A'' of FIG. 2) are observed to have a different depth of shade as compared with the remaining yarns on the support surface, the packages from which these yarns have been taken can be segregated and used as a group to produce a fabric by knitting or weaving. By segregating these yarns prior to the knitting or weaving operations, barre or warp streaks in the resulting fabrics can be avoided. Thus, off-quality fabrics are not produced and

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the resultant loss in production efficiency does not occur.

The convenience of using the apparatus shown in the drawings is facilitated by the transfer frame which permits the yarn from the packages 11 to be tied onto yarn ends adjacent guides 14. This avoids the necessity for threading the transfer frame for each group of yarn packages being tested and eliminates the necessity for threading yarn on the yarn-collecting support surface 19. In this way a large number of packages can be inspected quickly and conveniently by successively rolling a series of doffing carts into position adjacent the frame 13.

Various compositions disclosed in the specific examples of application Ser. No. 361,994 are useful in the method of the present invention and provide results similar to those achieved in the previous application. It has been found that where a difference in dyeing characteristics is observed by the detection tests of the present invention, fabrics produced from such yarns after dyeing show similar differences. Likewise, if the yarns are segregated into groups of similar dyeing characteristics according to the method of the invention, fabrics formed using such segregated yarns as a group exhibit a similar uniformity in color.

The above description and drawings show that the present invention provides a novel method and apparatus for quickly and simply identifying differences in yarns. Also, the identification of physical, chemical and/or optical defects in textile yarns may be achieved in accordance with the invention. Thus, the invention results in the production of fewer seconds fabrics and

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increases production rates through the segregation of yarns of different quality prior to the inclusion thereof into fabrics.

It will be apparent that various modifications may be made in the apparatus and procedures described in detail above without departing from the scope of the invention. For example, the yarn-collecting support surface may be of a different configuration from the cylindrical surface shown in the drawings, e.g. a flat plate, spaced rods, etc. Likewise, the colorant composition may be applied by other means, e.g. brushing, roller coating and similar methods either continuously or intermittently. Therefore, the invention is to be limited only by the following claims.

That which is claimed is:

1. A method for detecting defects in textile yarns comprising the steps of withdrawing yarns from packages, winding each yarn under substantially equal tension a plurality of wraps around a support surface with the wraps of each yarn being displaced from the wraps of adjacent yarns, applying a composition comprising a colorant and a solvent mixture to the yarn wraps on said support surface, permitting said composition to undergo phase separation, and comparing the resulting depths of shade of the respective yarn wraps.

2. A method according to claim 1 wherein each yarn is wound around the support surface until contact with adjacent yarn wraps is achieved.

3. A method according to claim 1 wherein said composition is applied to the yarn wraps by spraying.

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