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W. O. P. SCHUTTE
YARN COLORING APPARATUS

3,335,583

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FIG. 1

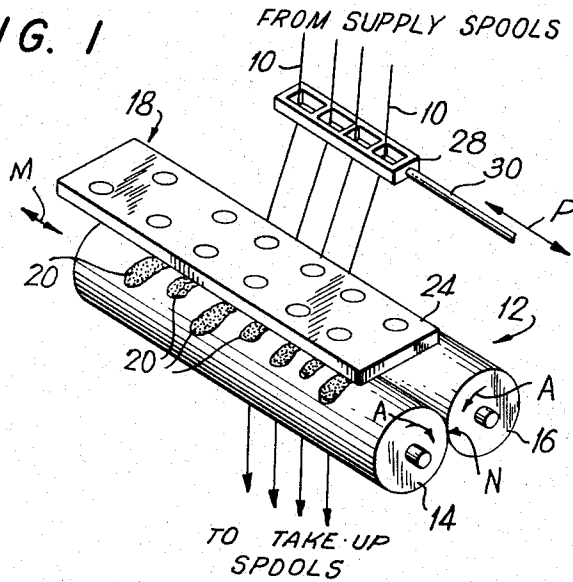


FIG. 2

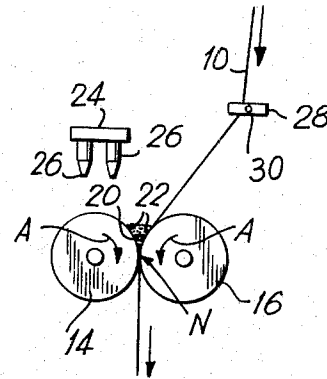


FIG. 3A

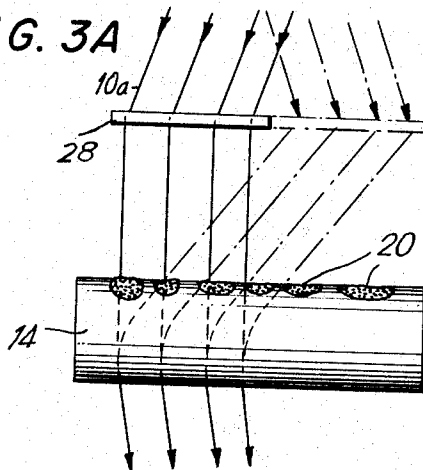


FIG. 3B

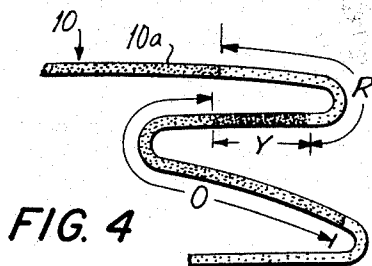
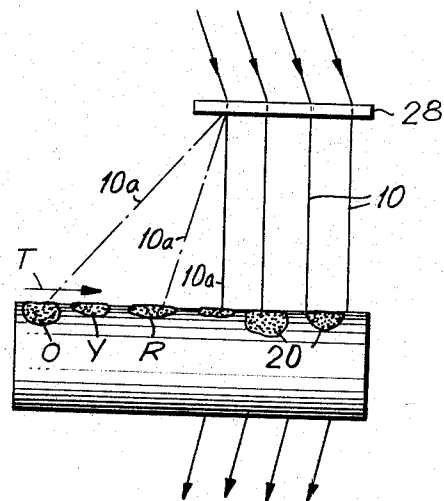


FIG. 4

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3,335,583

YARN COLORING APPARATUS

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The present invention relates to the printing or coloring of yarn, and more particularly to apparatus for providing an improved random application of coloring to yarn and like materials.

Yarn and like materials in a decorated condition wherein successive length portions are printed or dyed in different colors have considerable utility in the production of numerous products for which it is desirable to have a random decorative color pattern. A notable case in point is the production of rugs or like products where such decorated yarn when ultimately tufted into a base material in the production of the rug is intended to provide this completely random decorative color pattern to the product. The extent of randomness of the color pattern in the final rug product is of course a function of the random nature in which the coloring is applied to the yarn. If the color application to the yarn is truly random and non-repetitive, the color pattern in the product produced with such yarn will likewise have these desirable attributes, and the reverse is also generally true. Yarn which is decorated as just indicated and intended for rug manufacture is commonly referred to as being "space dyed."

The commercial interest in space dyed yarn is sufficiently keen that there are currently available several types of coloring apparatus for producing this product. Exemplifying a popular embodiment of available prior art apparatus is that which utilizes plural printing rollers arranged at spaced locations along a printing station. These printing rollers are effective to print different length portions of the yarn as it is fed through the printing station. The peripheral surface of each printing roller is usually recessed in select areas to carry the printing or coloring medium into contact with those length portions on the yarn aligning with such recessed areas, and by proper arrangement of said recessed areas of the several printing rollers it is possible to apply coloring completely along the length of the yarn. Although much can be and is done in the use of this apparatus to apply random coloring to the yarn, there must necessarily be a repeat in the sequence of the applied color in each succeeding revolution or turn of the printing rollers. Thus, this and other yarn coloring apparatus such as are currently available and exemplify the prior art solution to the problem of producing random space dyed yarn are not completely satisfactory.

Broadly it is an object of the present invention to overcome the foregoing and other shortcomings of the prior art. Specifically, it is an object to provide yarn coloring apparatus capable of producing space dyed yarn characterized by a degree of random color application heretofore not readily possible to produce with prior art yarn coloring apparatus.

A further object of the present invention is to provide improved yarn coloring apparatus capable of producing space dyed yarn having a random variation both in the sequence of the applied color and also in the successive length portions of the yarn applied with these differing colors.

Still another object of the present invention is to provide yarn coloring apparatus characterized by a simplicity of construction and mode of operation. Further, the mode of operation is such as to readily lend itself to sub-

stantial variation which in turn further assures a truly and completely random application of coloring to the yarn.

Yarn coloring apparatus demonstrating features and advantages of the present invention may vary considerably in its specific form wherein it is adapted to present movable surfaces converging with each other at a pressure nip oriented substantially transversely of the direction of movement of the surfaces. In its simplest embodiment, such surfaces may take the form of peripheral surfaces of a pair of rollers, each journaled for rotation and appropriately pressed against each other at a pressure nip. These cooperating roller surfaces form a trough along the pressure nip for dye or coloring medium which is deposited in a multitude of colors in the trough by any appropriate liquid metering or supply means. The yarn to be space dyed is fed directly through the trough so as to make contact with the coloring medium therein. An essential functioning of the apparatus concerns the selective orientation of the feed path of the yarn at an angle into the trough (and thus at an angle to the pressure nip) such that rotation of the rollers is effective to feed the angled yarn not only lengthwise through the trough but also along a path lengthwise of the trough until the yarn assumes a path straight through the pressure nip. In this manner, different length segments of the yarn are successively moved through the different colors of coloring medium in position at plural locations along the trough.

The above brief description, as well as further objects, features and advantages of the present invention will be more fully appreciated by reference to the following detailed description of a presently preferred, but the nonetheless illustrative embodiment in accordance with the present invention, when taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a diagrammatic illustration, in perspective, of yarn coloring apparatus demonstrating features of the present invention;

FIG. 2 is a side elevation of said apparatus showing the coloring medium trough formed by a cooperating pair of rollers of said apparatus;

FIGS. 3A and 3B are front elevational views of said apparatus showing the parts in certain positions of movement which are effective to produce yarn movement transversely of the rollers, to wit:

FIG. 3A illustrates in full line and phantom perspective a change in relative positions of certain parts of the apparatus which modifies the feed path of the yarn through the apparatus; and

FIG. 3B similarly illustrates by full line and phantom perspective the succeeding transverse positions across the rollers which are assumed by one yarn strand as a result of this angled feed path; and

FIG. 4 shows a sample length of the colored yarn product, on an enlarged scale, which is produced by the apparatus hereof.

Reference is now made to the drawings, and in particular to FIG. 4 wherein there is shown a sample length of yarn 10 having different portions dyed or printed in different colors such as the specifically delineated portions R, Y and O (which will be understood to represent the colors red, yellow and orange respectively). The yarn 10 may be fabricated either of man-made or natural fibers and in the condition illustrated herein, wherein successive segments of length are differently colored, has considerable utility in the production of numerous products having a random decorative pattern. A notable case in point is the production of rugs or like products where it is highly desirable that the yarn which is ultimately tufted into a base material in the production of a rug provide a completely random decorative pattern. For this to be achieved, the successive segments of the yarn 10 must be printed in different non-repetitive sequences of colors, and in order

to produce a completely random pattern in the final rug product, the lengths of these segments of yarn should also differ from each other in a completely random fashion throughout the overall length of the yarn. This decorating technique for yarn, particularly in the rug making art, is sometimes referred to as "space dyeing."

Reference is now made to the drawing diagrammatically illustrating a yarn coloring apparatus, generally designated 12, capable of producing space dyed yarn 10 characterized by a degree of random color application heretofore not possible to produce with prior art yarn coloring apparatus. The apparatus 12 is susceptible of many specific forms, the one form which is preferred being that including a pair of rollers 14, 16 appropriately journaled for rotation in the direction of the arrows A and engaging with each other along a line of contact or pressure nip N which is substantially parallel to the axis of rotation of these rollers. Appropriately mounted in an elevated position above the roller 14 is a printing medium depositing apparatus 18 which is effective to deposit charges 20 or printing medium onto the roller 14. As best shown in FIG. 2, the peripheral surfaces of the rollers 14 and 16 cooperate at a location just prior to the pressure nip N to form a trough 22 for the printing medium charges 20 which are carried into the trough by rotation of the roller 14. These charges 20, in an obvious manner, are backed-up within the trough 22 to form discrete supplies of different colors of such medium. In this manner, different colors of printing medium charges 20 are made available at plural locations along the trough 22 for application to the yarn 10.

While the printing medium depositing apparatus 18 may take any one of several forms, the form preferred is that including a tray 24 appropriately supported in an elevated position above the roller 14 and optionally either stationary in this position or reciprocated along a path M parallel to the axis of rotation of the roller 14. Supported on the tray 24 are a plurality of storage containers 26 for storing conventional printing ink, dye, or other suitable printing medium preferably of a highly viscous nature. Each container 26 is adapted to permit the printing medium or liquid to drip by gravity or controlled pressure onto the surface of the roller 14. These printing medium charges 20, as previously indicated, are carried by rotation of the roller 14 into the trough 22. A random arrangement of different colors of printing medium along the trough 22 may be obtained simply by changing the colors of the printing medium which are supplied through the different containers 26, or by changing the position of the apparatus 18 along the path M between successive deposits of such charges.

In the interest of economical operation of the apparatus 20, it is desirable for obvious reasons to handle several lengths or strands of yarn 10 at the same time. Since each individual strand behaves in a similar fashion, the portions of the description which follows when directed to one specific yarn stand will be understood to be equally applicable to the other yarn stands being simultaneously handled by the apparatus 12. Each yarn 12 destined for "space dyeing" treatment by the apparatus 12 is obtained from a suitable supply such as a conventional spool, and it continuously unwound therefrom and threaded along a feed path through the pressure nip N of the rollers 14, 16 to an appropriate take-up spool located on the other or remote side of the rollers 14, 16. This feed path of the yarn 10 in an obvious manner exposes the yarn 10 to the printing medium since the yarn is actually fed through the printing medium charges 20 in the trough 22.

An essential functioning of the apparatus 12 is the selective changing of the angle of the feed path of the yarn 10 into the trough 22 such that in addition to lengthwise feed travel of the yarn through the trough 22 there is also movement of the yarn lengthwise of the trough 22. This yarn movement lengthwise of the trough 22 is effective to expose successive lengths of the yarn to the different colors of printing medium in position along the trough.

As may be best appreciated by a consideration of FIGS. 1, 3A and 3B, the yarn 10, prior to being threaded between the rollers 14 and 16, is threaded through a grate 28 which maintains the spacing and substantially parallel relationship of the several stands of yarn relative to each other. Appropriately operatively connected to power the grate 28 through reciprocating movement along a path P substantially parallel to the horizontal direction of orientation of the rollers 14, 16 is a piston rod 30 of an air or hydraulic cylinder, or other powering device.

As is shown in FIGS. 3A, 3B, one possible feed path for the yarn 10 is that shown in full line in FIG. 3A and consists of lengthwise movement of the yarn 10 straight through the pressure nip N. It is contemplated that upon the attainment of this feed path for the yarn 10 that the grate 28 will be shifted to the position shown in phantom perspective in FIG. 3A wherein the yarn feed path is set at an angle to the pressure nip N. Once this angled feed path condition is achieved, continued rotation of the rollers 14 and 16 will result in ultimately providing the yarn 10 with the full line position shown in FIG. 3B wherein the yarn will again be fed straight through the pressure nip N, but this time at the opposite end of the rollers 14, 16. As is best illustrated by the singled-out yarn 10a in FIG. 3B, the movement of this yarn in changing from an angled feed path back to a straight feed path through the pressure nip N is along a path T oriented lengthwise of the rollers 14, 16. This movement is thus effective to move the yarn 10a successively through the printing medium charges 20 and, as specifically illustrated in FIG. 3B, through those charges specifically identified as O, Y and R to thereby produce the successively colored length portions O, Y and R, respectively, on the yarn 10a of FIG. 4.

From the foregoing it should be readily appreciated that the yarn coloring apparatus 12 hereof is capable of space dyeing yarn in a completely arbitrary and non-repetitive manner such that commercial products produced from such yarn are provided with a decorative, completely random color pattern. This is of particular importance and significance in the production of rugs and similar products and accordingly the apparatus 12 hereof represents a noteworthy technical advance in production equipment for this industry.

A latitude of modification, change and substitution is intended in the foregoing disclosure and in some instances some features of the invention will be employed without a corresponding use of other features. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the spirit and scope of the invention herein.

What is claimed is:

1. A yarn coloring apparatus comprising means presenting movable surfaces converging with each other at a pressure nip oriented substantially transversely of the direction of movement of said surfaces, said surfaces cooperating with each other to form a trough along said pressure nip for yarn coloring medium, means effective to supply different colors of said coloring medium at plural locations along the trough, means effective to maintain yarn along a feed path through said pressure nip for applying the coloring medium within the trough to said yarn, and means for selectively holding said yarn in an angled feed path into the trough such that movement of said surfaces is effective to produce a degree of movement of the yarn lengthwise of the trough and thus successively through the different colors of coloring medium in position at said plural locations along the trough.

2. A yarn coloring apparatus as defined in claim 1 wherein a plurality of lengths of yarn in substantially parallel relationship are extended from a suitable source of supply through said pressure nip.

3. A yarn coloring apparatus as defined in claim 2 wherein prior to being threaded through said pressure

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nip said plural lengths of yarn are threaded through a grate to maintain the spacing and substantially parallel relationship of said respective lengths of yarn.

4. A yarn coloring apparatus as defined in claim 3 wherein the means for selectively determining the angle of the yarn feed path into said trough includes said grate and means operatively connected to reciprocate said grate through movement substantially lengthwise of said trough.

5. A yarn coloring apparatus as defined in claim 1 wherein said pressure nip is formed by a pair of rotatably mounted rollers pressed against each other.

6. A yarn coloring apparatus as defined in claim 5 wherein said rollers are horizontally oriented and a supply of coloring medium for application to said yarn is effectively backed-up in the trough formed along the pressure nip of said rollers.

7. A yarn coloring apparatus as defined in claim 6 wherein plural strands of yarn are threaded from a suit-

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able source of supply through a grate and thence between said rollers through said backed-up supply of coloring medium within said trough.

8. A yarn coloring apparatus as defined in claim 7 wherein the means for selectively changing the angle of said yarn feed path into the trough includes said grate and means operatively connected to reciprocate said grate through movement substantially lengthwise of said trough.

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