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MacHenry et al.

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[54] **METHOD AND APPARATUS FOR SPACE DYEING STRAND MATERIAL**

[75] Inventors: **Richard MacHenry,** Prospect Park, Pa.; **Pei Tsing Chang,** Wilmington, Del.

[73] Assignee: **FMC Corporation,** Philadelphia, Pa.

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[52] **U.S. Cl.** ..... **8/149,** 8/151.2, 68/203, 68/205 R, 118/DIG. 21, 118/325, 239/8

[51] **Int. Cl.** **D06p 5/00**

[58] **Field of Search** ..... 68/200, 203, 205 R, 68/5 E, 5 D; 8/149, 151.2, 149.1, 149.2; 118/DIG. 21, 325; 239/8, 101

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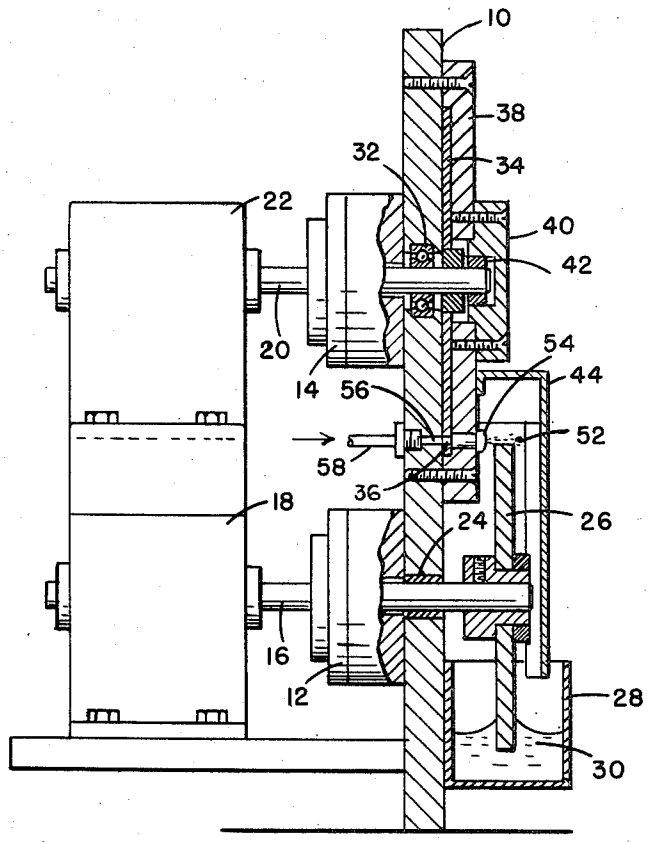
Primary Examiner—William I. Price

Attorney—Thomas R. O'Malley et al.

[57] **ABSTRACT**

The disclosed method and apparatus involve pulling a strand, e.g., a yarn, past a portion of the periphery of the wheel which is rotated so as to constantly pick up dye liquid from a bath into which a lower segment of the wheel extends. An air jet is directed toward the running strand across a peripheral segment of the wheel so as to blow dye liquid from the wheel onto the strand. A shield having apertures therein is moved so as to alternately align apertures and solid areas with the air jet whereby the dye liquid is blown onto the yarn only when an aperture in the shield is aligned with the jet to thus produce a strand having spaced dyed and undyed portions.

11 Claims, 2 Drawing Figures



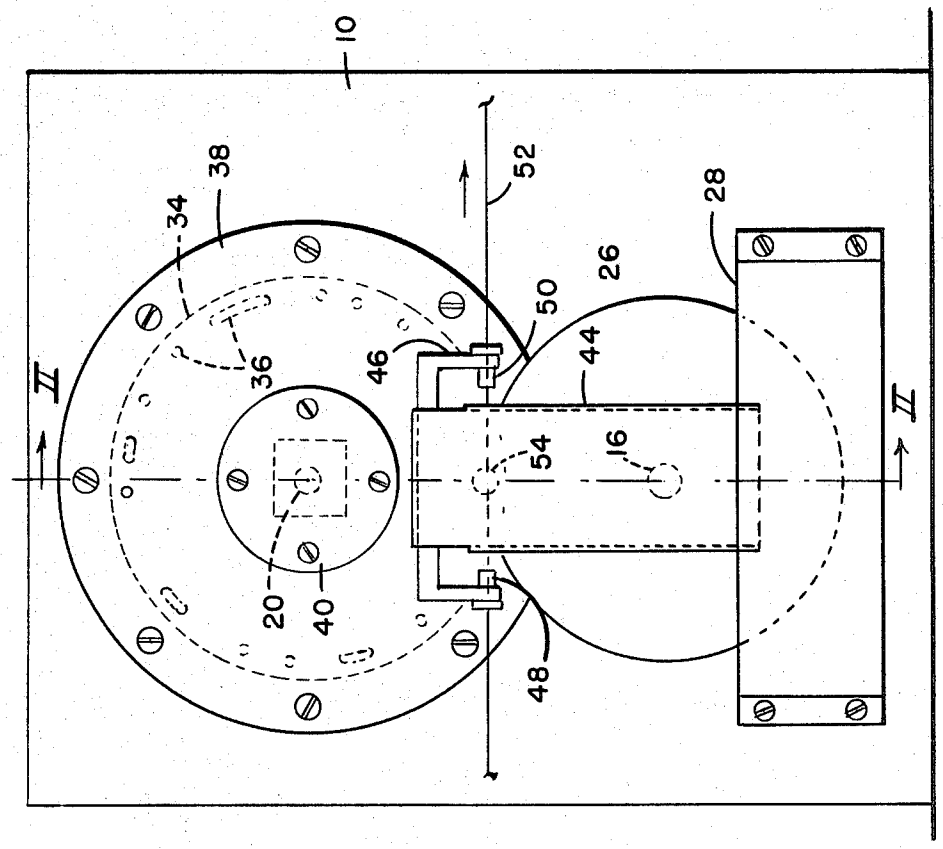

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Fig. 1

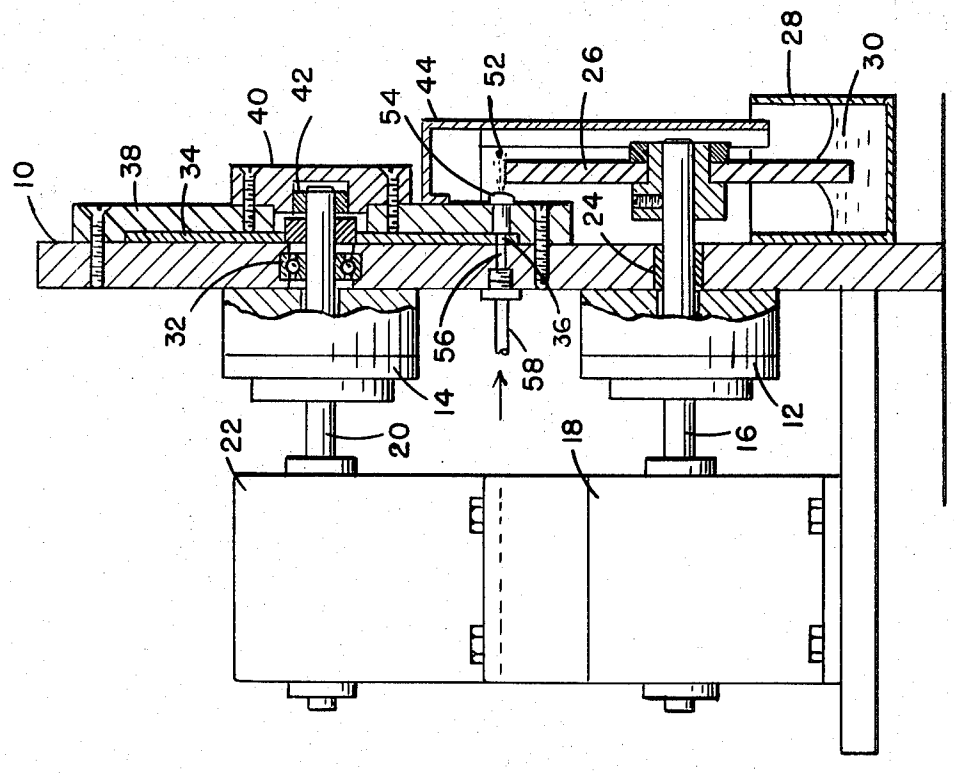
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Fig. 2

METHOD AND APPARATUS FOR SPACE DYEING STRAND MATERIAL

The present invention relates to an improved method of and apparatus for making a space-dyed strand especially a space-dyed yarn, and more particularly a yarn having uneven spacing between dyed segments and dyed segments of unequal length. The term "space dyed" is not intended to imply that other portions of the strand are necessarily devoid of dye but only that the strand has alternating segments of a different color, hue or shade.

It is well-known to produce rugs and fabrics both woven and knitted having a pleasing appearance by forming the fabric of yarn having space-dyed segments. It is also known to be desirable to have the dyed portions of the yarn spaced unevenly and of unequal lengths; in other words, for the yarn itself to appear as though the dyeing is completely random. In the absence of an absolutely completely random application of dye, it is desirable that the dye be applied in a pattern that repeats only at infrequent intervals. Frequent repetition of the dye pattern of the yarn results in a rug or fabric having normally undesirable regularly occurring spots, lines, etc.

It is an object of the present invention to provide an improved method of making a space-dyed strand, especially yarn, where the dye pattern appears to be and is in fact substantially random.

Another object of the invention is to provide an improved apparatus for making a substantially random space-dyed strand, especially a yarn strand.

A further object of the invention is to provide a strand space-dyeing apparatus which is so operable as to produce an almost infinitely varying dye pattern.

A still further object of the invention is to provide a yarn space-dyeing apparatus capable of high speed operation and economical use of dye.

Yet another object of the invention is to provide a space-dyeing apparatus wherein there is no dye applicator making contact with the strand being dyed whereby there is no applicator to be fouled or contaminated by dye which may have been previously applied to the strand.

Other and further objects, features and advantages of the invention as well as the means of achieving the same will become apparent as the description of a preferred embodiment thereof proceeds.

Referring now to the drawing:

FIG. 1 is a side elevational view of a preferred form of apparatus; and

FIG. 2 is a section taken along the line II—II of FIG. 1.

The apparatus comprises a framework including a plate **10** to which bearing members **12** and **14** are secured. Bearing **12** supports a shaft **16** driven by a variable speed drive **18** and bearing **14** supports a shaft **20** driven by a variable speed drive **22.** Variable speed drives **18** and **22** may be driven from a common motor, not shown, or may have individual drive motors or indeed may, within the scope of this invention, be variable speed motors. To assure proper alignment, universal joints not shown, may be provided between shafts **16** and **20** and their respective drives.

Shaft **16** extends through plate **10** and is supported by a sleeve bearing **24.** On the opposite side of plate **10** from bearing **12** shaft **16** has secured thereto a disk or wheel **26** the lower portion of which extends into a trough or tank **28** which may if desired be suitably secured to plate **10.** Tank **28** contains a bath **30** of dye liquid and as wheel **26** rotates it picks up dye liquid from the bath so that the entire periphery of the wheel becomes coated therewith. Wheel **26** must of course be made of or have a peripheral rim of a suitable material to carry a liquid film and one such material that has been found to be satisfactory is Formica.

Shaft **20** also extends through plate **10** and is further supported by the plate in a bearing **32.** Secured to shaft **20** on the opposite side of plate **10** from the bearing **14** is a disk **34** which is substantially solid or impervious but which is provided with a series of apertures **36** arranged in a circle concentric with the axis of rotation of the disk. As shown in FIG. **1** apertures **36** vary in size and the space between them is not uniform. If desired a cover plate **38** secured to plate **10** may be provided to enclose disk **34** and secured to the cover plate is a bearing support **40** fitted with a bearing **42** carrying the end of shaft **20.**

Secured to cover plate **38** at a point above wheel **26** is a shield **44** which extends downwardly to within the confines of tank **28.** Secured to the shield is a bracket **46** carrying a pair of guides **48** and **50** for guiding a running strand **52** to within the vicinity of but offset from a selected portion of the periphery of wheel **26.** In the apparatus illustrated, the strand passes near the uppermost point of the wheel but the invention can be practiced by having the strand guided past any part of the periphery of the wheel above the level of dye liquid in tank **28.** Preferably the strand should run parallel to a tangent to the wheel so that it passes by only one section of the periphery of the wheel. Secured in and extending through cover plate **38** is a nozzle **54** which is aimed across the periphery of wheel **26** toward the strand. The entrance end of nozzle **54** is aligned with a passageway **56** extending through plate **10** and a compressed air line **58** leads into said passageway.

The disk **34** extends into the space between nozzle **54** and passageway **56** and that circular band of the disk containing the apertures **36** passes between the nozzle and the passageway whereby when the disk is rotated apertures and solid portions of the disk become alternately aligned with the nozzle and passageway. When an aperture is aligned with the nozzle a jet of air issues from the nozzle and blows dye liquid from the periphery of wheel **26** onto strand **52.** When a solid portion of the shield or disk **34** passes between the passageway and the nozzle, the flow of air is interrupted and dye liquid is not blown onto the passing strand. Any dye liquid blown from the wheel and not caught by the strand strikes shield **44** and runs back into tank **28.**

Various effects may be obtained by varying the sizes and arrangement of apertures **36** and/or varying the speed of disk **34** and/or varying the speed at which the strand is drawn past the nozzle. The actual amount of dye blown onto the strand when an aperture becomes aligned with nozzle **54** can be varied within limits by changing the speed of wheel **26** to thus change the amount of dye picked up by the wheel in a given unit of time. With one particular disk driven at a constant speed a considerable length of strand will be covered before the pattern of dye spots begins to repeat if the circle of apertures has a reasonable radius. There are a number of commercially available speed varying systems and by constantly varying the speed of the disk an

almost infinitely varying dye pattern may be applied to the strand.

As previously indicated the invention is particularly useful for producing yarn and the apparatus may be used to apply dye to a previously undyed yarn or to a yarn which has been previously dyed a uniform color or two or more such apparatuses may be used in tandem to produce a multicolored yarn. It is this tandem arrangement that evidences one of the particular advantages of the apparatus in that the dye is not applied to the strand with an applicator that makes contact with the strand and, therefore, there is no applicator which may be contaminated by contact with previously applied but still unset dye. After the dye liquid is applied the strand is suitably subjected to heat to set the dye.

The apparatus can be adapted to dye a number of parallel strands at the same time by providing additional wheels on shaft **16** for bringing up dye from the bath and by suitably piping air through the apertures of disk **34** to the vicinity of the additional wheels across from the running strand associated with the particular wheel.

Having thus described a preferred form of the invention, what is claimed is:

1. The method of space-dyeing strand material comprising drawing the strand through a path slightly offset from a segment of the periphery of a wheel a portion of which extends into a dye bath, rotating the wheel so that substantially the entire periphery thereof becomes coated with dye from the bath, directing a jet of air across that segment of the periphery of the wheel adjacent the running strand in such manner that dye is blown from the wheel onto the running strand, and at intervals interrupting the blowing of dye onto the strand whereby to produce a strand having portions dyed with the dye blown from the wheel intercepted by portions not so dyed.

2. The method set forth in claim **1** wherein the interrupting of blowing of dye onto the strand is accomplished by moving an apertured member between the wheel and the source of the jet of air in such manner that apertured areas and non-apertured areas of the member become alternately aligned with the jet of air.

3. Apparatus of the class described comprising a tank containing a dye liquid, a wheel having a portion thereof extending into the dye liquid, means for rotating said wheel whereby dye liquid is picked up from the tank to coat substantially the entire periphery of said wheel, guide means for guiding a running strand near but offset from a portion of the periphery of said wheel above the level of dye liquid in the tank, an air jet aimed at the periphery of said wheel adjacent the running strand, a movable shield between the source of said air jet and the strand, said shield having a multiplicity of apertures therein, and means for moving said shield so that said apertures and a solid portion of the shield become alternately aligned with the source of said air jet, the air jet blowing dye liquid from said wheel onto the running strand only when an aperture in the shield becomes aligned with the source of the jet.

4. The apparatus set forth in claim **3** wherein said shield comprises a rotatable disk having spaced apertures arranged in a circle concentric with the axis of rotation of the disks.

5. The apparatus set forth in claim **4** wherein said apertures are spaced non-uniformly.

6. The apparatus set forth in claim **4** wherein said apertures are of various sizes.

7. The apparatus set forth in claim **4** comprising means for varying the speed of rotation of said disk.

8. The apparatus set forth in claim **4** wherein said disk is so mounted that said apertures become aligned with the air jet between the source of the jet and said wheel.

9. Apparatus of the class described comprising a rotatable wheel, means for supplying a dye liquid to the periphery of said wheel, guide means for guiding a running strand near but offset from a portion of the periphery of the wheel, and means for intermittently blowing dye liquid from the periphery of the wheel onto the strand.

10. The apparatus set forth in claim **9** wherein the last mentioned means comprises a fluid jet aimed across the periphery of said wheel toward the strand, means for supplying fluid under pressure to said jet, and valve means for regulating the flow of fluid from the jet.

11. For use in a method of space-dyeing strand material comprising drawing the strand through a path passing in the vicinity of a constantly renewed supply of dye liquid and at irregular intervals blowing dye liquid from the constantly renewed supply onto the strand passing thereby whereby to produce a strand having portions dyed with the aforesaid dye liquid intercepted by portions not so dyed; apparatus comprising a tank containing a dye liquid, means having a movable surface for extracting dye liquid from the tank and producing a constant supply of said dye liquid at a preselected position, guide means for guiding a running strand in the vicinity of said preselected position, a fluid jet aimed across the supply of dye liquid and toward the running strand, a movable shield between the source of said fluid jet and the strand, said shield having a multiplicity of apertures therein, and means for moving said shield so that said apertures and a solid portion of the shield become alternately aligned with the source of the fluid jet, whereby dye liquid is blown from said preselected position onto the running strand only when an aperture in the shield becomes aligned with the fluid jet.

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