

April 10, 1973

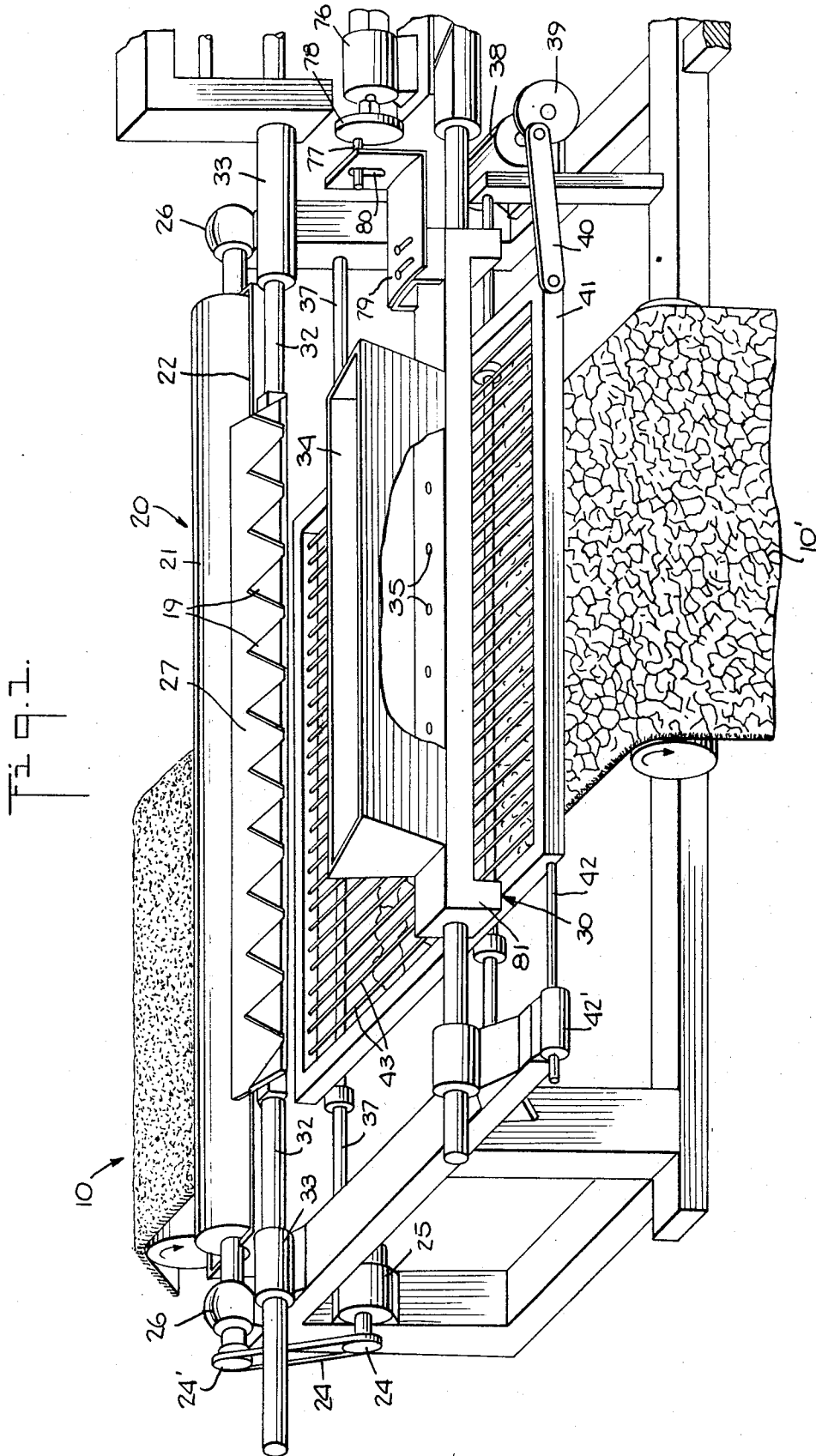
NASSIR TAKRITI ET AL

3,726,640

METHODS TO PATTERN AND TO DYE SINGLE COLORED TEXTILES,
ESPECIALLY CARPETS, WITH DIFFERENT COLORS OR TONES

Original Filed June 9, 1969

4 Sheets-Sheet 1



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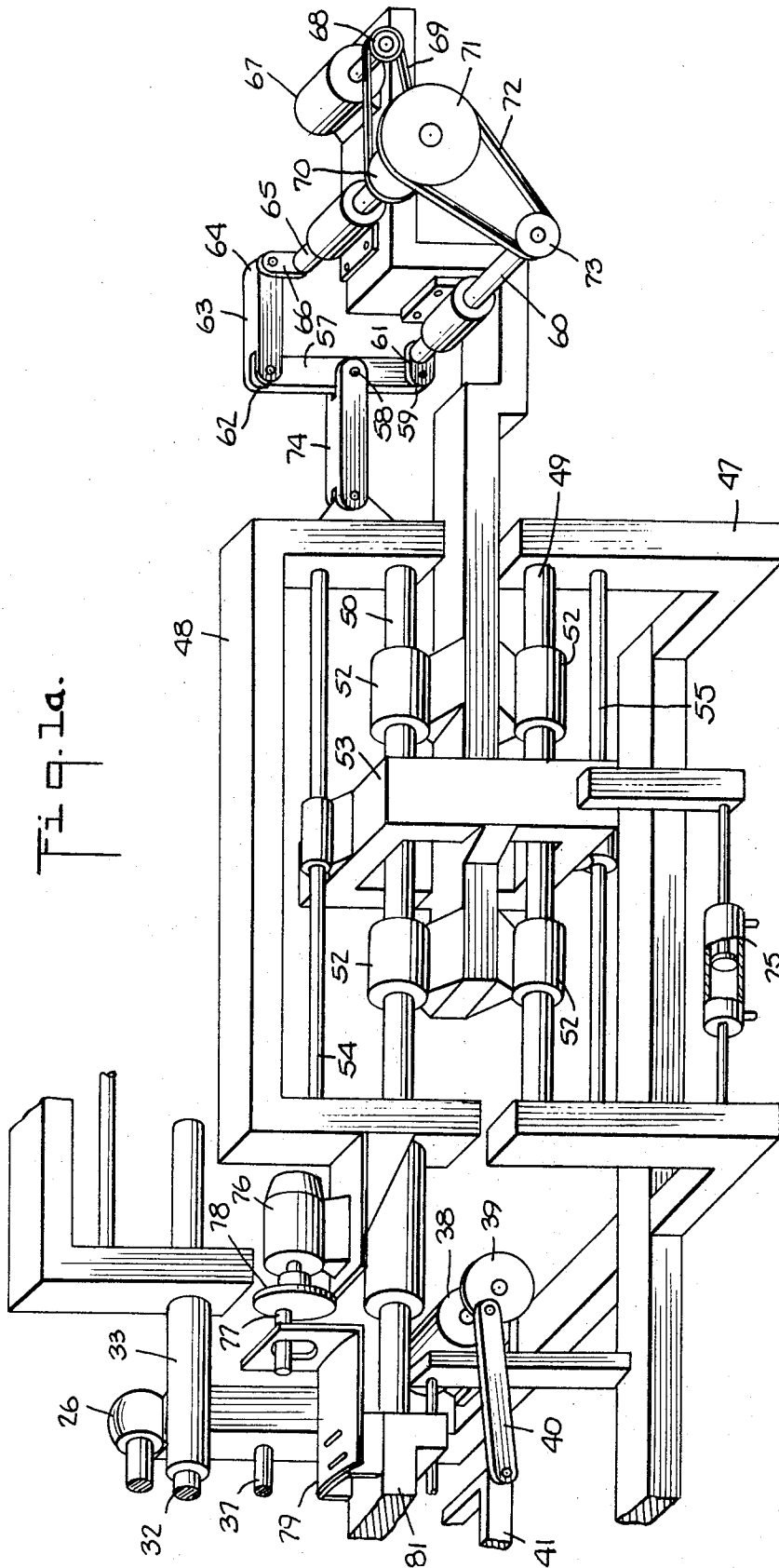
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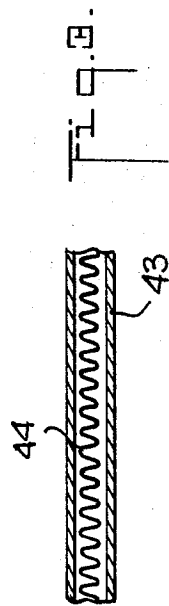
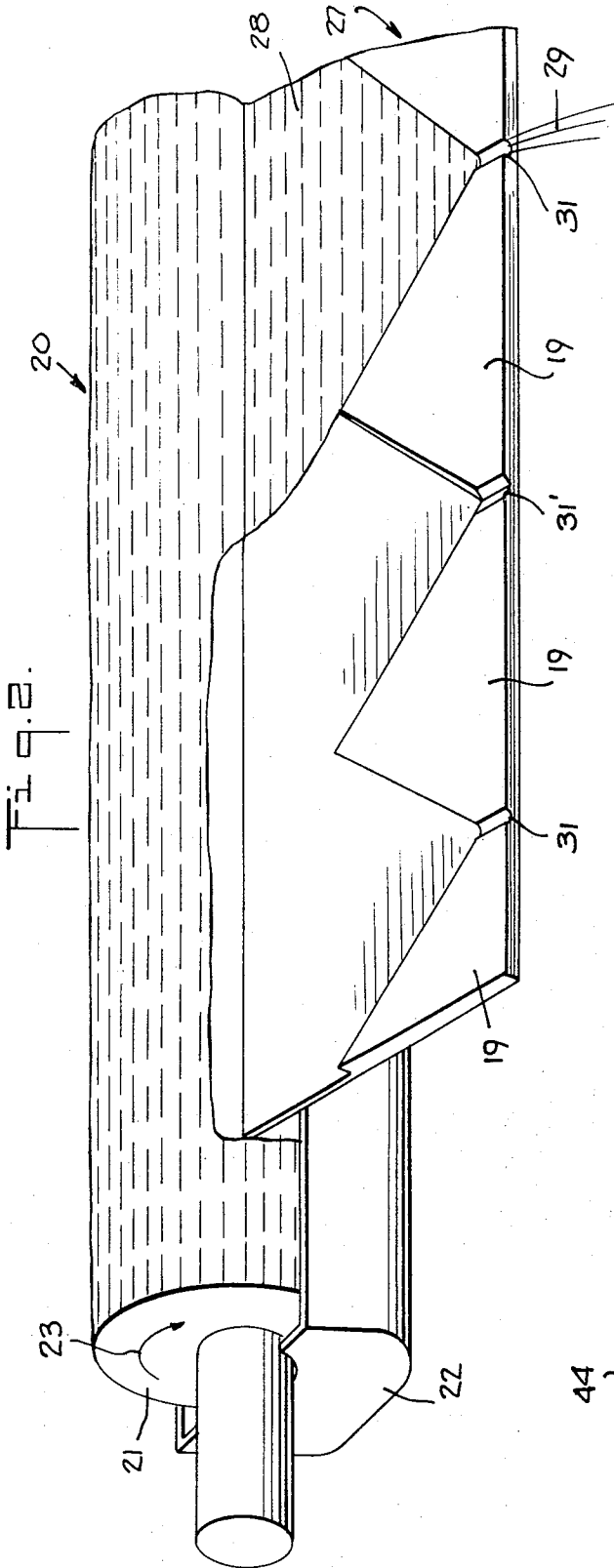
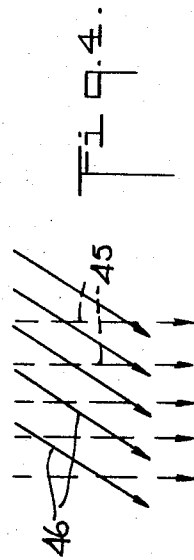
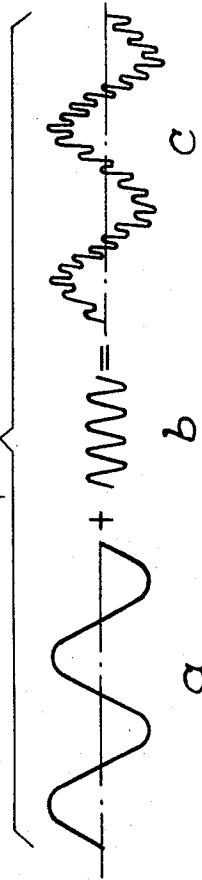


Fig. 5.



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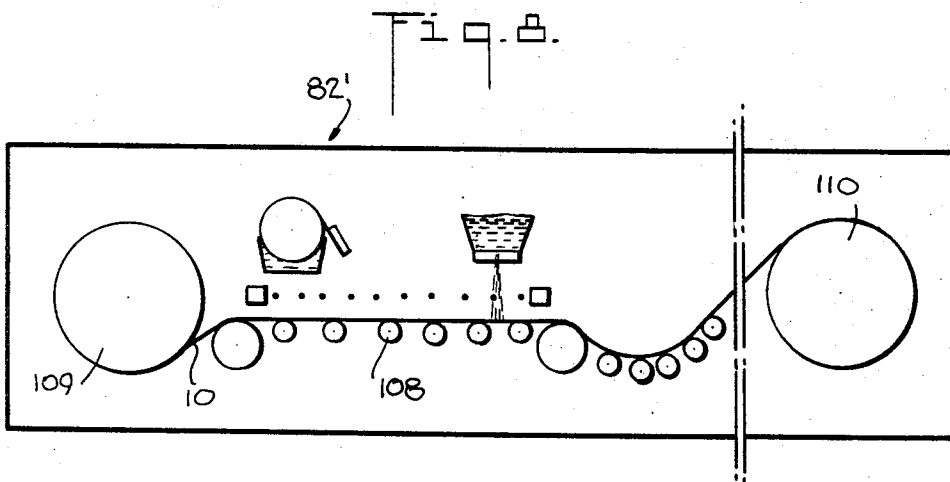
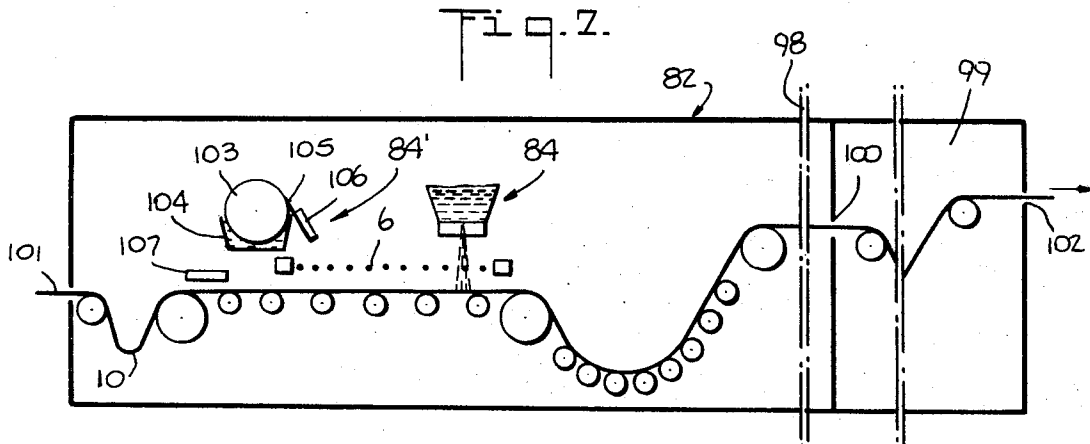
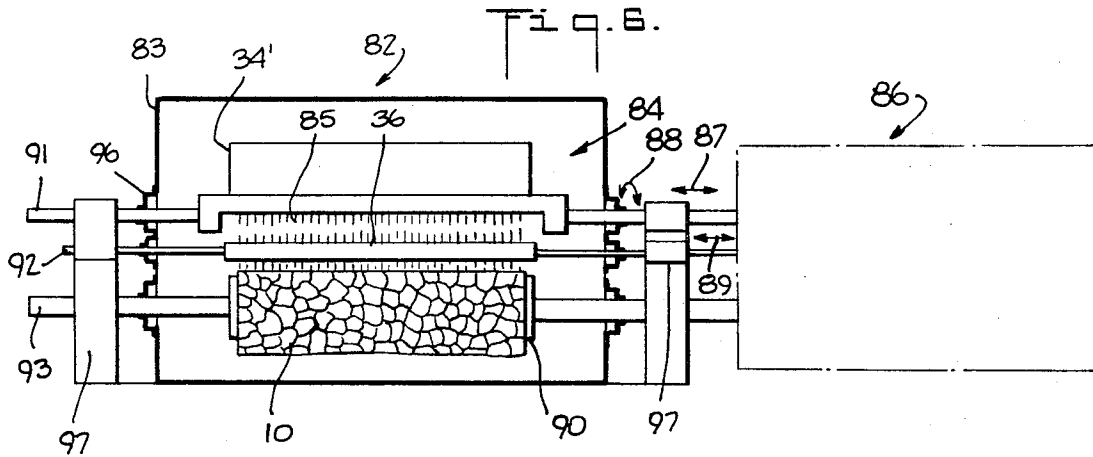
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METHODS TO PATTERN AND TO DYE SINGLE COLORED TEXTILES, ESPECIALLY CARPETS, WITH DIFFERENT COLORS OR TONES

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Original application June 9, 1969, Ser. No. 831,297, now Patent No. 3,683,649, Divided and this application Nov. 30, 1971, Ser. No. 203,314

Int. Cl. D06p 5/00

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8 Claims

ABSTRACT OF THE DISCLOSURE

A method of dyeing textiles by applying the color or colors in a spotted fashion by means of individual dye droplets in an equal volume over the surface of the textile breadth which is continuously transported. The application of the dye droplets is effected according to the random colors or random tones to be desired without any repeated pattern or design.

This is a division, of application Ser. No. 831,297, filed June 9, 1969, now Pat. No. 3,683,649.

This invention relates to a method for dyeing textiles, especially carpets, having a single basic color with different colors or tones without clinging to an apparent or perceptible or visible uniformity or pattern, and more particularly to repeated patterns, by means of pile thread or top side color application to the continuously transported textile or especially carpet breadths.

Recently it has become more and more desirable to finish a single color carpet in such a way that although the single color remains the predominant base tone, a liveliness or an optically improved effect is obtained by dissolving the single color to achieve differing tones up to a degree of color differences or by interspersing it in this manner. Despite of the optically unified appearance of the total surface the color differences shall not appear in regularly recurring designs or patterns and not regularly as portions of a geometrically defined outline or the like or as repeated portions, but they shall rather have a certain unified effect of a randomness which is pleasant to the eye.

Such a type of carpet dyeing process has been commonly designated as "Space Dyeing."

Recently this type of patterning has further achieved significance in other fabrics, as for example decorative fabric materials so that this invention which is preferably intended for carpets, is not limited to the same.

Various proposals have already been made to achieve the above mentioned dyeing and patterning process.

One of these proposals has been to apply different dyes and colors to thread spool sections and to tuft the differently dyed threads. Alternatively, it has been proposed to print the threads with different colors prior to tufting. Another proposal includes making a stocking of undyed threads, priming the stocking, printing it with color, steaming it, ravelling it again and then tufting the thus colored thread. As may readily be seen, these processes are inherently expensive. For example, such a great quantity of prepared threads must be maintained in storage as will probably be required by the most different carpet colors without being able to immediately meet any demand which is beyond the scope of these probable requirements.

It is the principal object of the present invention to provide a method for dyeing of the above mentioned type

which is based upon the piece material, that is to say, upon the undyed carpet, and which, in spite of its simple and economic realisation, results in perfect dyeing or patterning of a desired liveliness.

According to the present invention this problem has been solved in that following to a base tone application or preceding a base tone application or onto the raw undyed fabric the color or colors are applied in a spotted fashion by means of individual dye droplets in an equal volume over the surface of the carpet breadth which is continuously transported. The application of the dye droplets is effected according to the random colors or random tones to be desired without any repeated pattern or design.

By usage of a repeatable control of droplet application the total impression of a dyed carpet breadth may be reproduced which is an important feature if carpet breadths are to be installed side by side in large rooms.

By usage of a constant quantity of dye liquid per unit area disruptions due to limited dye accumulation of the total area to be dyed are avoided. Further, by the application of dye droplets it is guaranteed that the color, if possible, penetrates onto the rear or backside of the carpet and thereby allows the carpet to retain its uniform appearance even after it has been worn. If the desired color so requires, the coloring created by the single droplets may be blended. It is preferred that the droplets are not smaller than a minimum size. As a minimum size under which the droplets should not remain, a droplet diameter of 2 millimeters may be regarded as appropriate. For this kind of carpet manufacturing threads of inferior quality may also be used without impairing the result of the dyeing process.

The spraying of color for single color dyeing of carpets is already known. Substantially, spraying includes that the dye liquid, sometimes together with a gas mixture, is fed under pressure through a nozzle and that the jet leaving the nozzle is widened more or less conically towards the surface to be sprayed causing the dispersion of minute droplets. Such a process is limited in that it may only be used in a single color dyeing operation.

It has already been attempted to pattern carpets by means of spray nozzles in which case the spray nozzles located over the entire width and in several rows one after the other are to be switched on and off individually. Switching of these individual nozzles is to be effected via a contact patterned and endless pattern foil. Apart from the fact that a control of this kind always results in a repeated design although of a certain length, these attempts have not been favorably accepted by the manufacturers because individual control of these spray nozzles is far too expensive.

An improvement of the dyeing process according to the present invention may be achieved in that application of the dye droplets onto the breadth is effected in a steam atmosphere.

Accordingly it will be possible to freely choose the physical conditions for the penetration of the dyeing liquid into the fiber layer forming the carpet and for attaching onto the individual fibers within a certain range and to adjust them to varying requirements which will have to be considered because of the difference in fiber materials, their conditions of treatment, especially swelling and expansion, the structure of the carpet fleece and the dyeing substances to be applied. In a preferred embodiment of the present invention application of the dye droplets onto the breadth is effected in a substantially closed steamer.

With respect to attachment of the dye to the fiber as well as the penetration, that is to say, penetration of the dye to the bottom of the carpet, it is favorable if the dyeing liquid to be applied in droplets has an elevated tem-

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perature especially near its boiling point or that of its component having the lowest boiling point.

It may also be possible to heat the breadth to be dyed prior to application of the dye droplets.

The possibilities provided by the present invention with respect to influencing the dyeing conditions are particularly favorable in the dyeing of textiles, especially textile breadths consisting of polyacrylonitrile fibers.

A means embodying this method comprises, above the single color dyed carpet or the carpet to be single color dyed or the raw material without single color dye and over its entire width measured transversally towards the direction of movement of the material, channels dispensing uniformly distributed dye liquid jets, preferably controllable, without pressure or at a small pressure and at a low speed, at the same time providing mechanical means effecting dispersion of the jets into droplets. As a mechanical means for the dispensing means oscillations of a suitable direction, amplitude and frequency may be used. Dimensioning of the oscillating motion may be effected by means of corresponding means. Mechanical motions of the dispensing means in the direction of their longitudinal axis, that is to say, in a transverse direction to the movement of the material, proved to be especially favorable in which case using an amplitude between ± 2 and 4 millimeters and a frequency between 4 and 10 Hz. proved to be preferable.

To prevent dye accumulations upon reversal of the motion direction on the carpet, this motion may be overlapped with another motion in the same direction but having a greater amplitude. Instead of such an overlapped motion it is also possible to oscillate the carpet in a direction transverse to its travel. Further it is also possible to maintain the dispensing means in an oscillating motion.

It has been found that the liquid dispensing means should be positioned at a vertical distance between the outlet of the dye jets and their hitting the carpet. According to the desired pattern this vertical distance should be between 400 and 1000 millimeters.

To further prevent any linear pattern it is favorable to interrupt the falling droplets by means of a grid which may also be maintained in an oscillating motion. The grid consists of thin rods having a diameter between 0.5 and 2.5 millimeters. The material from which the rods are made is preferred to be a liquid repellent type to preclude adherence of liquid droplets thereon. For instance, the grid rods may be made from polytetrafluorethylene tubular rods or highly polished stainless steel wire. According to the viscosity of the dyeing liquid the tubular rods may be heated.

The grid is positioned parallel in a plane with respect to the carpet. Arrangement of the rods in the grid is effected substantially in the direction of travel of the carpet. However, the direction of the rods may be subject to a certain angular deflection towards the direction of travel of the carpet according to the desired pattern. The oscillating frequency of the grid is preferred to be between 0 and 7 Hz. at an amplitude between 0 and 70 mm. dependent upon whether a coarse or fine pattern is desired.

The minimum fineness of the pattern is limited by the depth of penetration of the dye onto the carpet. If possible, the size of the droplets should not be less than a diameter of 2 mm. so that the dye droplet, as far as possible, completely penetrates through the pile onto the rear or backside of the carpet.

The liquid dispensing means may be designed according to a variety of principles. As the simplest means a dyeing liquid trough is recommended of a length sufficient to cover the width of the carpet and the bottom of which has been provided with nozzles. The distance between the nozzles is always the same. The nozzle bores have a diameter between 1.2 and 3 mm. according to the desired pattern. To prevent undue turbulence or spillage of the liquid dye during oscillation of the dye liquid trough, the trough may be filled with a coarse capillary type material.

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The speed at which the carpet is passed may be adjusted in accordance with the volume of dye to be discharged through the nozzles. The volume to be dispensed by the nozzles may be somewhat regulated by proper selection of the dyeing liquid level in the liquid trough. When using a dispensing means in the form of this trough the results are substantially rounder patterns which, due to the oscillating motion of the screen or grid to be described later, are somewhat distorted in the transverse direction of the carpet.

With another type of the dispensing means the pattern may be distorted predominantly lengthwise with respect to the carpet. In this case open nozzles are provided with a relatively deep cross section. With the second type of dispensing means a roller rotates in a dye liquid trough and carries the adherent dye liquid film upward and onto a contiguously spaced blade member. The blade is designed such that the dye film is removed from the roller along the entire effective length, but accumulated by shaped members provided on the blade in a regular manner and subsequently drops therefrom through nozzles or channels which are open towards one side and form a comparatively deep recess. The blade is subject to a similar oscillating motion as provided for the first dispensing means.

The individual dispensed jet is dispersed into the direction effected by the mechanical movement onto the carpet at the same time being distributed into droplets and then distorted by the grid located below the same into a still greater dispersion width.

In order to provide for a repeatability of the individual patterns it is proposed to effect the adjustment and control of the total machine by means of a punch card system or the like. The same type of pattern once adjusted may be repeated as frequently as desired.

The channels dispensing the dye liquid and being subject to oscillation as well as the material breadth may be located in a steamer during application of the dye droplets.

It may also be possible to provide the dispensing means as well as the means moving the material breadth in the steamer during application of the dye droplets.

To prevent excessively high tensions, especially when treating thermoplastic materials of synthetics the mechanical stability or strength of which is reduced at elevated temperatures, the material breadth may be supported within the steamer at close distances, especially by rolls.

The effectiveness of the means according to the present invention is improved if, within the steamer, the dispensing means are followed by means for a prolonged treatment, thus application of the dye may immediately be followed by a fixation process.

More particularly it may also be possible, that, if required by color or fiber, the steamer in which the dye application means are provided, may be followed by a second steamer chamber being subject to other atmospheric conditions, especially to an elevated temperature and an elevated pressure which is entered by the material breadth via a sluice.

Preferably, the drives for the dye application means and for the material guide means are provided on the outside of the steamer and connected to the same via support and drive members entering the steamer through packed apertures in the steamer wall.

Finally, it will also be possible to provide the dye application means and the total material guide means including feed roll and take up roll within a closed steamer. Due to the lack of slots for feeding and taking up of the material breadth it will be possible to operate at higher steamer pressures and temperatures.

These and other objects, advantages and features of the present invention will become more apparent from the following description taken in conjunction with the accompanying drawing wherein:

FIG. 1 is a perspective and longitudinal view of an

embodiment of the present invention providing for two dispensing means;

FIG. 1a shows the oscillating drive means of the front dispensing means;

FIG. 2 is a fragmentary perspective view of a dispensing means together with a roller;

FIG. 3 shows a tubular grid member containing a heating element therein;

FIG. 4 depicts an alternative grid construction in which the grid rods are inclined towards the direction of travel of the carpet;

FIG. 5 illustrates the overlapping of two oscillating motions;

FIG. 6 is a schematically sectional view in a transverse direction towards the passing material together with the steamer;

FIG. 7 is a longitudinal section showing the supporting means of the material breadth as well as a following prolonged contact station or a second steamer chamber respectively;

FIG. 8 is a longitudinal section of another embodiment in which all means are provided in a closed steamer.

Referring to the drawings, a uniformly dyed carpet being fed into the machine is indicated at 10. The embodiment shown in FIG. 1 is provided with two successive dispensing means of different types, one of which is generally indicated as 20 and the other as 30. It is to be understood that either of these may be used singularly, in identical pairs, or in combination with each other as illustrated. Each of the liquid dispensing means 20 and 30 is positioned to extend over the entire width of the carpet to be treated. Each is equipped so that channels at equal distances are provided through which, preferably controllable, dye jets are dispensed without pressure or at a low pressure and at a low speed which jets are dispersed to droplets by mechanical means.

In FIG. 1 the liquid dispensing means 20, illustrated in greater detail in FIG. 2 and first to be passed by the carpet, includes a rotatable roller 21 which immerses into a trough 22 which is filled with a dye liquid. The direction of rotation of the roller 21 is indicated by the arrow 23. Rotating drive means is provided by the V-belt 24 mounted on pulleys 24' and driven by an electric motor 25 mounted on the machine frame. The driving side bearing of the roller shaft is indicated at 26. The rotational speed of the electric motor 25 is adjustable to permit the blade 27 to lift the desired quantity of dye film from the roller thereby causing the desired quantity of dye liquid to be dispensed. Blade 27 being inclined downward into the direction not facing the roller, contacts the roller on the side falling during rotation. The blade removes the dye film carried along by the roller. In FIG. 2 the dye film is indicated at 28. The dye film is carried downward by the blade. A dispersion of the film into individual jets 29 is caused by the triangular shaped members 19 which are separated from each other at the lower blade edge by nozzles 31 which are open towards above. The nozzles may have a lower circular cross-sectional shape and may be provided with a comparatively deep cross section. A preferred cross-sectional shape is depicted at 31' in the form of a V-shape again having a substantially deep length. Blade 27 is mounted at its ends 32 of the supporting rod in friction bearings 33 to permit an oscillating motion as described in detail for the other dispensing means 30. A level control means may be provided for the trough 22. The speed at which the carpet is passed through the machine may be adjustable.

The second dispensing means 30 illustrated in FIG. 1 comprises a trough 34 extending over the entire width of the carpet and provided to contain the liquid dye and equipped with nozzles 35 located at equal distances in its bottom. The trough may be filled with a coarse capillary type material which has not been shown. The nozzle bores preferably have a diameter between 1.5 and

3 mm, dependent upon the type of pattern desired. As previously discussed, the speed of the carpet may be adjustably regulated in accordance with the volume of dye being discharged by the nozzles. The volume of dye discharged by the nozzles may be regulated to some degree by the height of the dye fluid maintained in the trough. When using the dispensing means 30 the type of spots formed by the dye droplets is primarily circular in which case the pattern may be somewhat distorted in a transverse direction of the carpet due to the oscillating motion of the screen or grid 36 to be described below.

The distance between the dispensing means and the carpet ranges approximately between 400 and 1000 mm.

A grid 36 which is subject to oscillation, is provided between the dispensing means and the carpet. The grid is mounted on the rods 37 which permits an oscillating movement in a direction transverse to the direction of carpet travel. Oscillation is accomplished by means of the pulley 39 which is driven by an electric motor 38 and which has eccentrically mounted thereto a lever 40. The other end of the lever 40 is attached to the grid frame 41. The opposing side of the frame 41 is supported by means of the rod 42 which is slideably mounted in support block 42'. The grid comprises a plurality of thin rods 43 preferably with a diameter between 0.5 and 2.5 mm, and which are mounted into frame 41. The material from which the grid or grid rods are made, is liquid repellant material such as polytetrafluorethylene or highly polished stainless steel wire. If the grid rods 43 are made from polytetrafluorethylene tubes, they may be heated by providing an electric heating element 44 in the tubes. The oscillation of the grid has a frequency between 0 and 7 Hz. with an amplitude of 0 to 70 mm.

The grid rods may be positioned parallel to the direction of carpet travel, as shown in FIG. 1. It may also be possible to position the rods angularly with respect to the direction of carpet travel in the manner illustrated in FIG. 4. The arrows 45 indicate the direction of carpet travels whereas the arrows 46 indicate the direction of the grid rods.

The oscillation generating means provided for the liquid dispensing means which is the same both for the dispensing means 20 and the dispensing means 30, but which has been shown for the dispensing means 30 only, comprises a lower stationary member 47 and an upper support 48 which is movable in a direction transverse to the direction of carpet travel (see FIG. 1a). Each support provides for a rod 49 and a rod 50 on the lower and upper supports respectively on which a carriage 51 is slidably mounted. The bearings 52 are connected to each other via an inner frame 53 which is slidably mounted on rod 55 of the lower stationary support 47 and on rod 54 of the upper slidable support 48.

The oscillation means are mounted on the projecting portion of the carriage 51 which means are provided for the upper support comprising a double armed lever 57 having its turning point at 58. At the lower end 59 of the lever 57 there is a shaft 60 attached via a crank 51. At the other end 62 of the lever 57 one end of the plate 63 has been linked. At the other end 64 of the plate 63 there is attached a shaft 65 via a crank 66. The shafts 60 and 65 are driven by a motor 67 via pulleys 68, V-belt 69, pulley 70 and pulley 71 of a major diameter and also provided on shaft 65, V-belt 72 and pulley 73 on shaft 60 at different speeds. The turning point 58 of the lever 57 is connected to the upper support by means of the plate 74, said support thus being oscillated, while the oscillations are caused by the oscillation generating means and comprise two overlapping oscillations so that the oscillation diagram as shown in FIG. 5 is obtained. In FIG. 5 the letter *a* indicates the oscillations caused by crank 66 and the letter *b* indicates the oscillations caused by crank 61, while the letter *c* indicates the resulting oscillation of both oscillations.

In the lower stationary support the inner frame 53

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is connected to an hydraulic cylinder 75 which causes an oscillating movement of the inner frame along with the carriage. This oscillating motion is of a larger amplitude than previously described and prevents excessive dye accumulation to be caused on the carpet by the reversal of the motion.

With reference to FIG. 1, the support 81 of the trough 34 is also engaged by a motor 76 by means of the eccentrically mounted pin 77 on disc 78 and the angular member 79, pin 77 engaging the elongated slot 80 of said angular member 79, to generate an oscillating motion around the supporting pins.

The patterned carpet leaving the machine, in FIG. 1, has been identified by 10'.

In FIG. 6, the wall of the steamer 82 has been identified by 83. The steamer 82 encloses an application means completely identified by 84 as well as the carpet breadth 10 passing below said dye application means. For instance, the dye application means 84 may be a dye trough 34' from which dye jets 85 are discharged which, among others due to the grid 36, are dispersed into individual drops before they hit the carpet 10. The trough 34' is oscillated by a drive 86 which, in FIG. 6, has only been indicated by an empty field, in a direction transverse to the carpet travel which has been indicated by the arrow 87, and/or subjected to a tilting motion indicated by the arrow 88 around an axis extending in a direction transverse to the carpet travel. The grid 36 is also subjected to an oscillating motion which has been indicated by the arrow 89.

The movable dye application means 84 and the guide rollers 90 of the carpet 10 are supported by support and drive members 91, 92, 93 passing the wall 83. At the points where they are passing the wall, they are provided with packings 96 which permit a movement of the support and drive members, but prevent the atmosphere of the steamer 82 from escaping. In the embodiment shown the bearings 97 of the support and drive members as well as the drive 86 are provided outside of the steamer 82.

The separating lines 98 in FIG. 7 indicate that in the steamer 82 a prolonged contact station may follow in which the carpet 10 is, for instance, guided via loops and by means of which the presence of the carpet 10 in the atmosphere of the steamer 82 is prolonged resulting, for instance, in a subsequent fixation of the dye.

In FIG. 7 the steamer 82 is further followed by a steamer chamber 99 which is entered by the material breadth through the sluice 100 and in which there is another atmosphere than that in the steamer 82.

The carpet enters the steamer unit at 101 and leaves the same at 102.

Apart from the dye application means 84 FIGS. 7 and 8 show another dye application means 84' which may be provided in addition to or instead of the dye application means 84 and comprises a dye roller 103 from which dye carried upward from the trough 104 is removed by a blade 105 collecting the removed dye stream by means of the baffle plates 106 into individual channels and dis-

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tributing the same again into individual jets. Prior to dye application the carpet 10, as indicated in FIG. 7 at 107, may be additionally heated by steam or radiation. Within the steamer the carpet is supported by closely spaced rolls 108 upon which it rests as far as possible without any tensional stresses.

The embodiment shown in FIG. 8 differs from that shown in FIG. 7 in that the slots 101 and 102 for feeding and taking up of the carpet have been omitted whereas the feed roll 109 and the take up roll 110 are also located in a steamer 82' so that all sides of the latter may be closed permitting operation at correspondingly higher pressures and temperatures.

What is claimed is:

1. A method for dyeing textiles, especially carpets, having a single basic color with different colors or tones without clinging to an apparent or perceptible or visible uniformity or pattern, and more particularly to repeated patterns, by means of pile thread or top side color application to the continuously transported textile, especially carpet breadth, characterized in that following or preceding a base tone application or onto the raw undyed material the color or colors are applied in a spotted fashion by means of individual dye droplets in an equal volume over the surface of the carpet breadth which is continuously transported.

2. A method according to claim 1, characterized in that application of the dye droplets is effected according to the random colors or random tones to be desired without any repeated pattern or design.

3. A method according to claim 1, characterized in that the size of the droplets to be applied is greater than 2 millimeters in diameter.

4. A method according to claim 1, characterized in that application of the dye droplets onto the material breadth is effected in a steam atmosphere.

5. A method according to claim 4, characterized in that application of the dye droplets onto the material breadth is effected in a substantially closed steamer.

6. A method according to claim 4, characterized in that the dye liquid to be applied in droplets has an elevated temperature, especially near its boiling point or that of its component having the lowest point.

7. A method according to claim 4, characterized in that the material breadth to be dyed is heated prior to application of the dye droplets.

8. A method according to claim 4 characterized by its utilisation for textiles, especially carpets, of polyacrylonitrile fibers.

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WILLIAM I. PRICE, Primary Examiner

U.S. Cl. X.R.

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