

Sept. 6, 1966

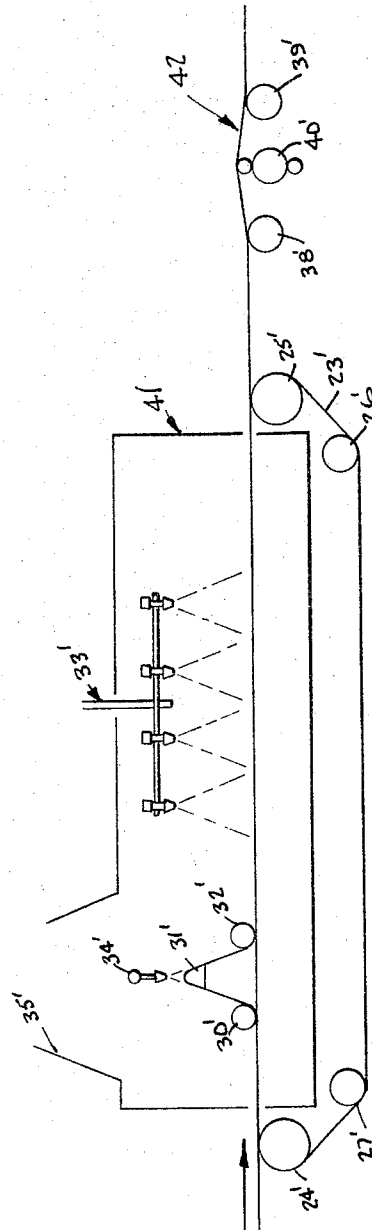
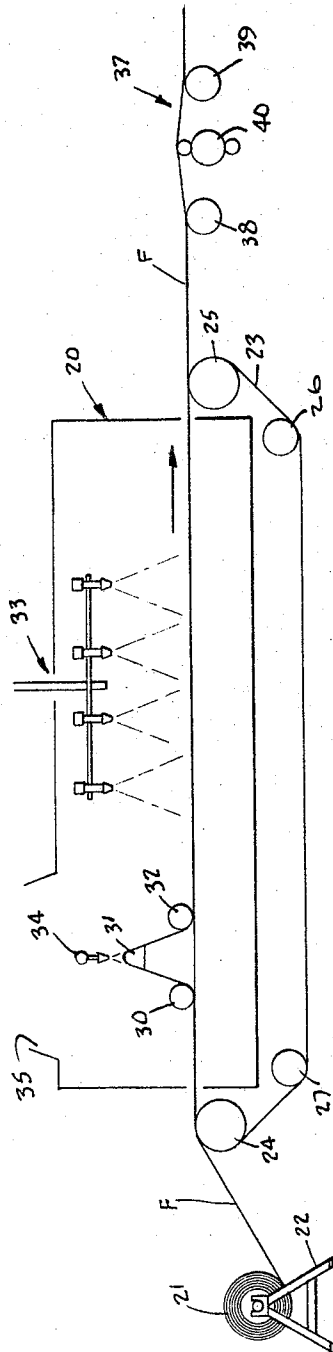
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3,271,102

SPRAY DYEING PILE FABRICS

Filed Nov. 24, 1961

8 Sheets-Sheet 1



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SPRAY DYEING PILE FABRICS

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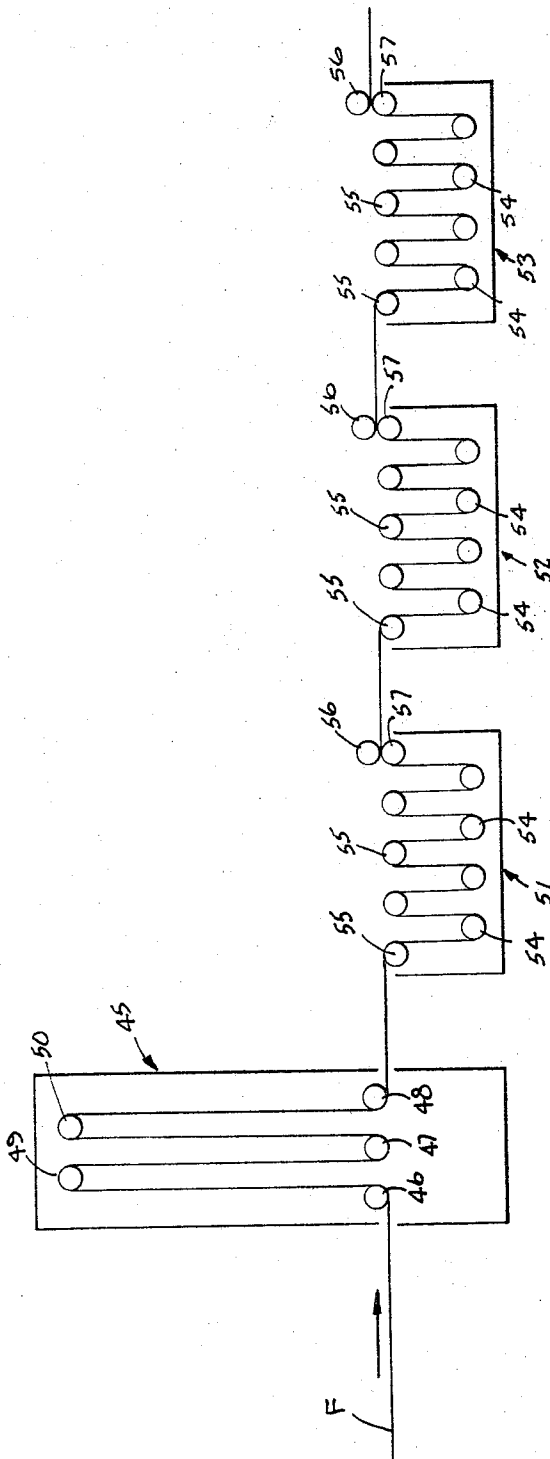


FIG. 1C

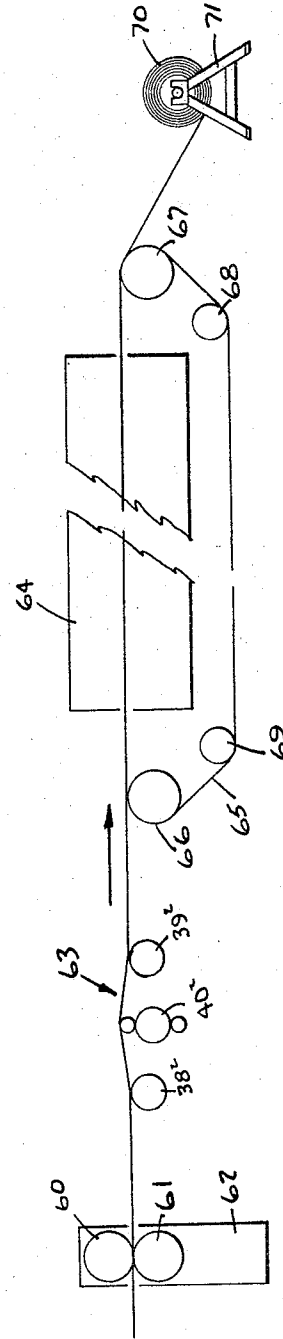


FIG. 1D

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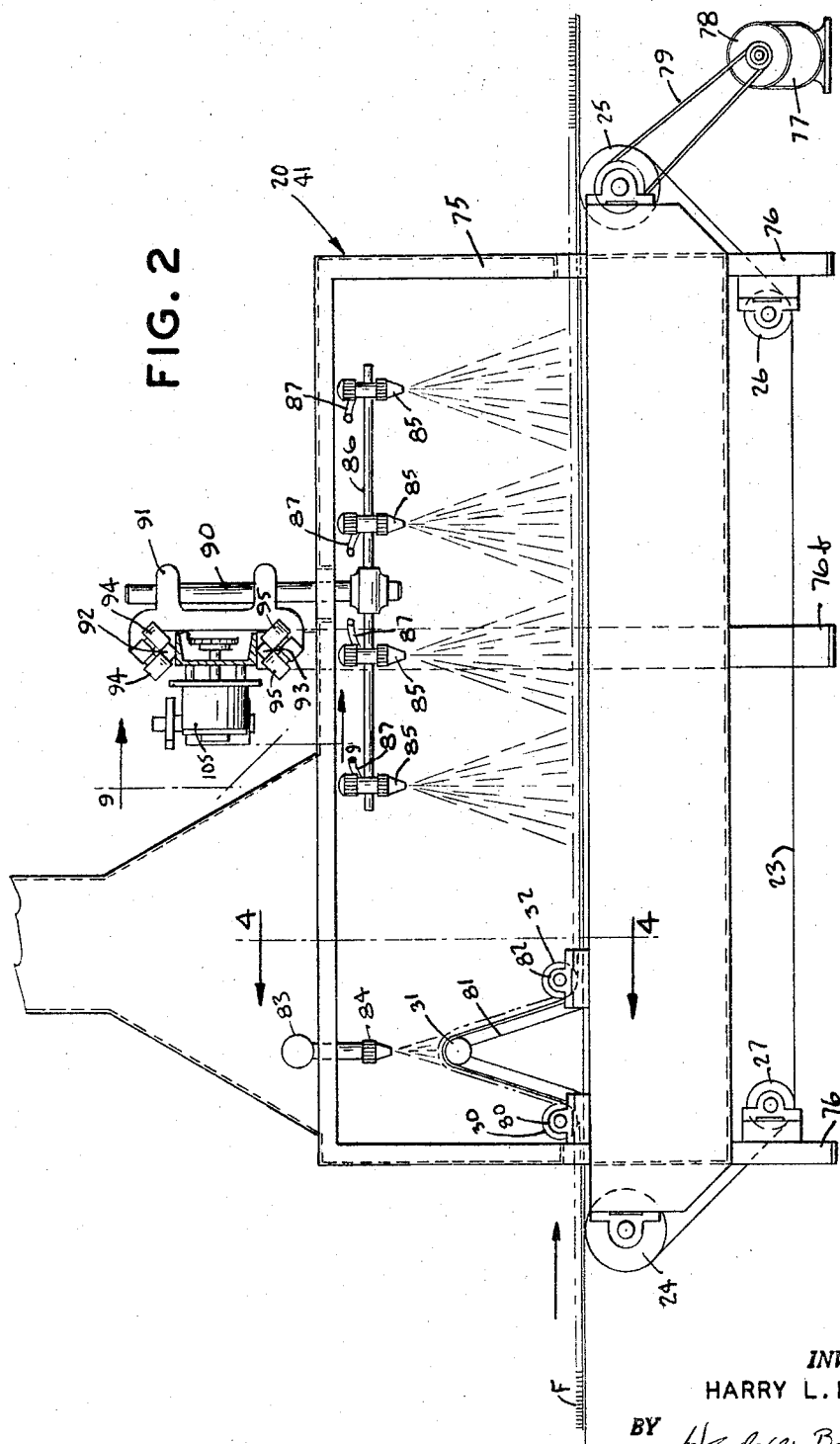
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SPRAY DYEING PILE FABRICS

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8 Sheets-Sheet 3



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SPRAY DYEING PILE FABRICS

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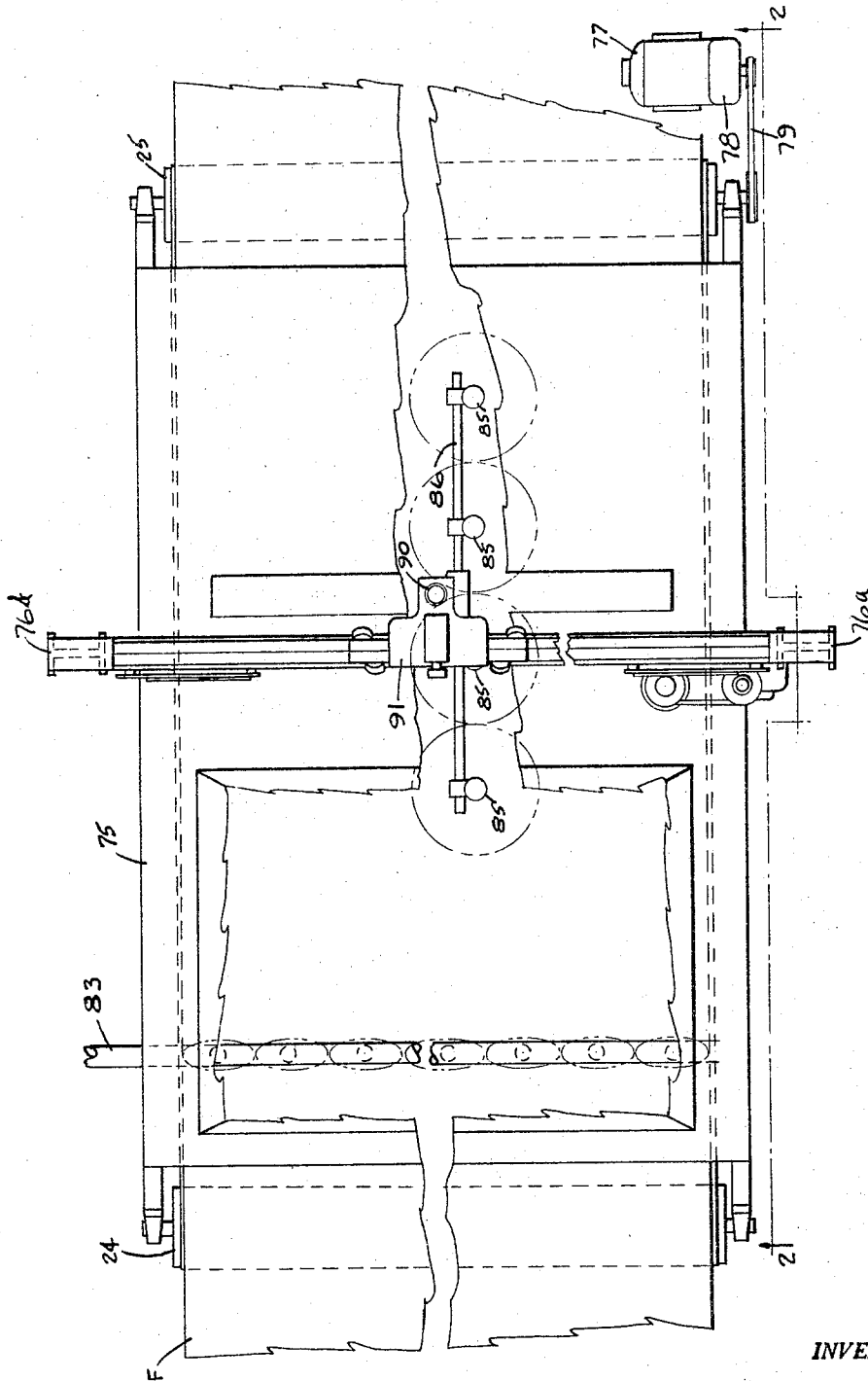


FIG. 3

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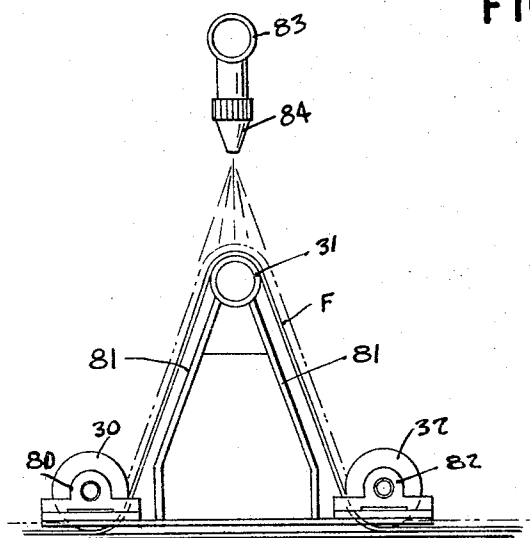
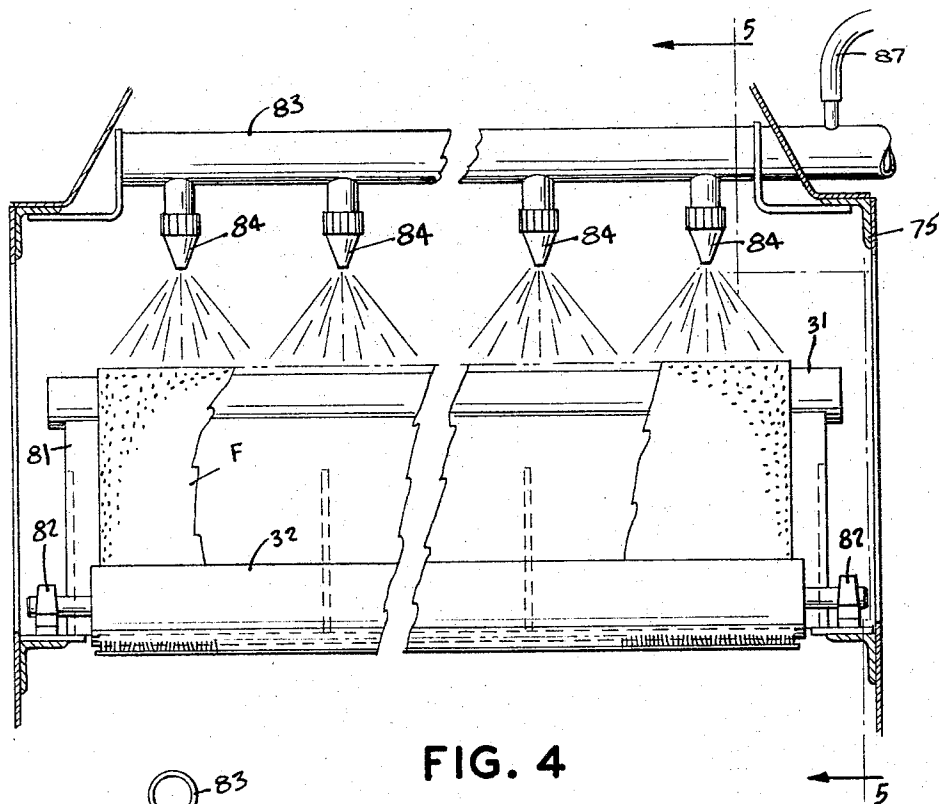
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SPRAY DYEING PILE FABRICS

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8 Sheets-Sheet 5



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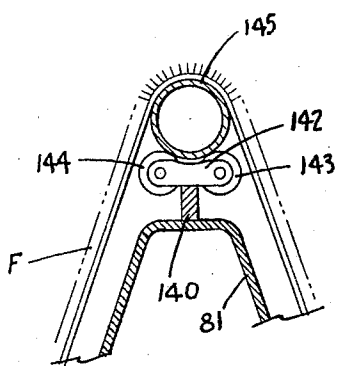
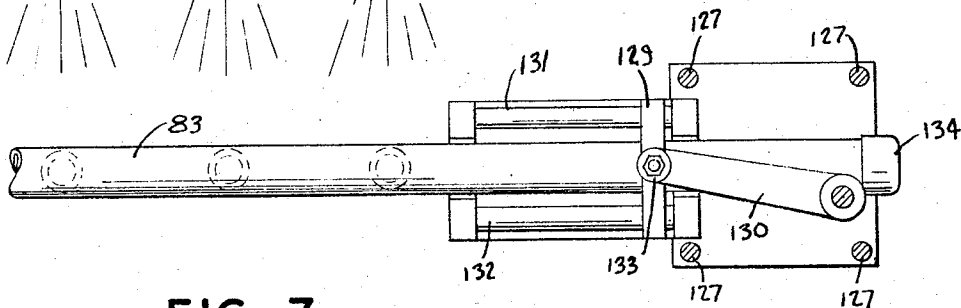
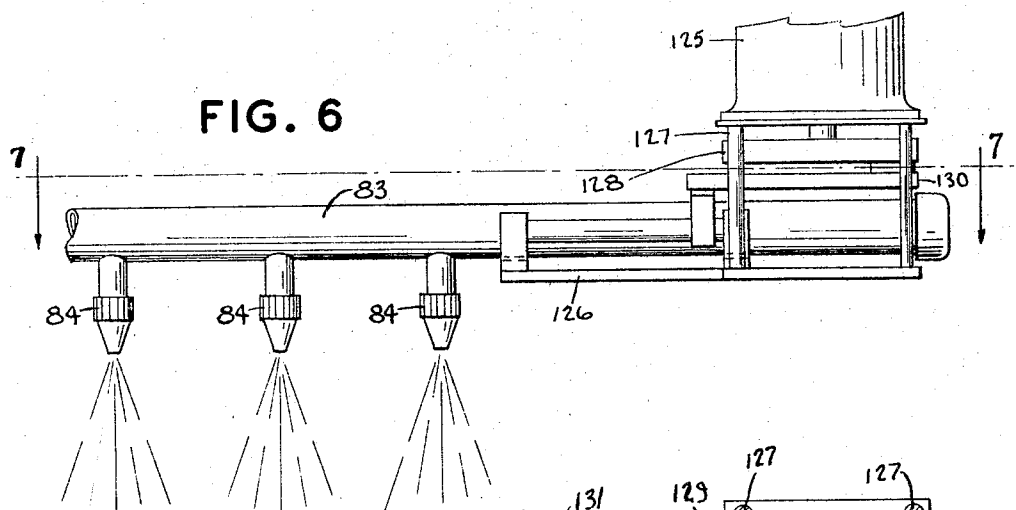
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SPRAY DYEING PILE FABRICS

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8 Sheets-Sheet 6



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SPRAY DYEING PILE FABRICS

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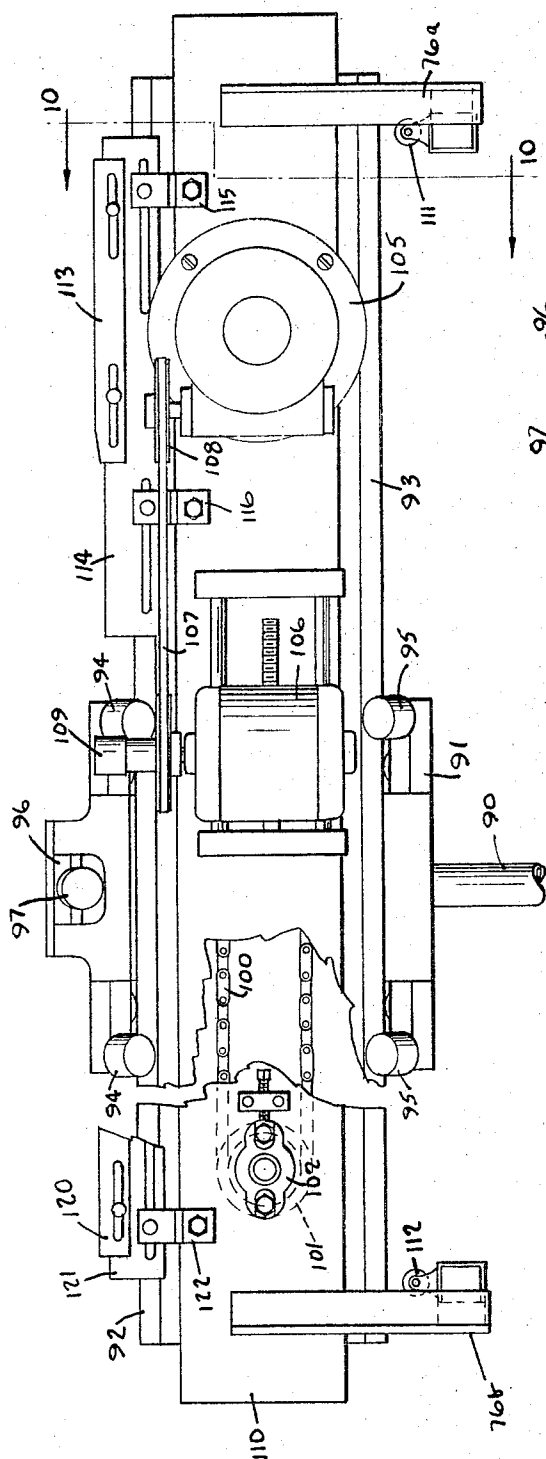


FIG. 9

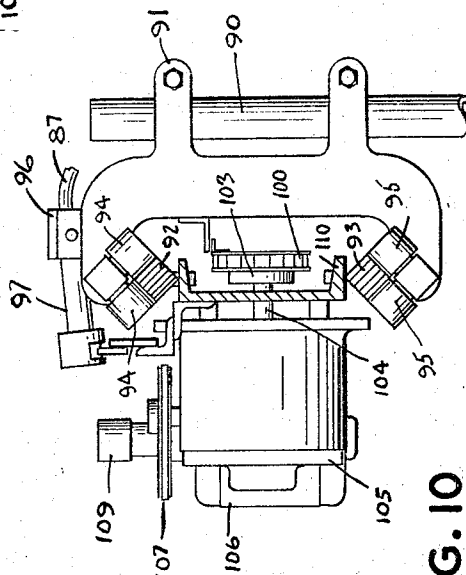


FIG. 10

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SPRAY DYEING PILE FABRICS

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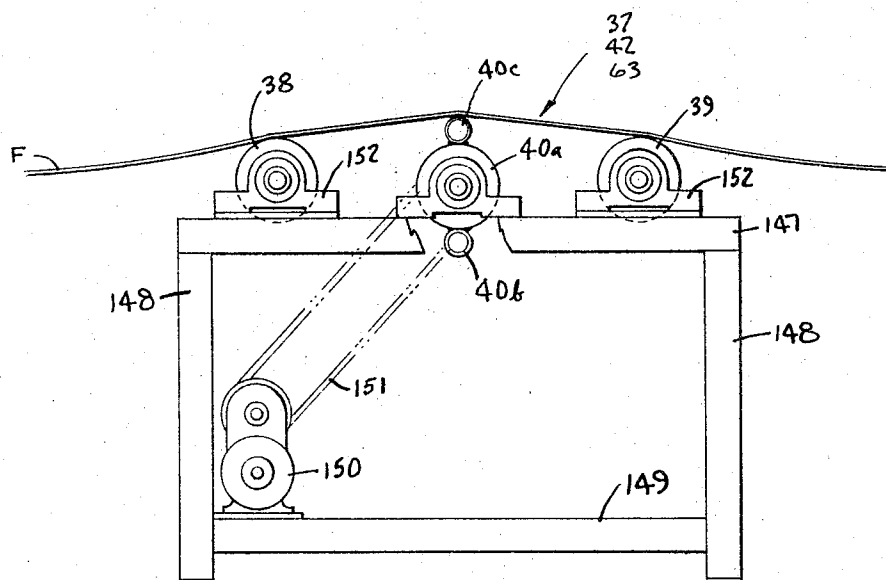


FIG. II

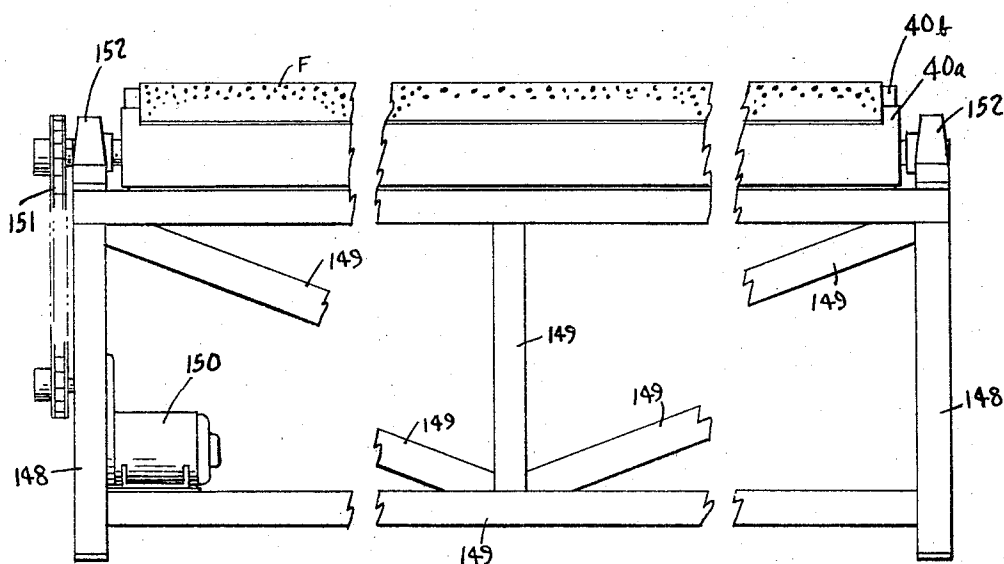


FIG. 12

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SPRAY DYEING PILE FABRICS

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4 Claims. (Cl. 8—151)

This invention relates to spraying equipment and to an improved method for spraying color onto running lengths of textile material having a pile surface.

The application of color in the sense of dyeing to textile fabrics and other materials is, of course, well known. One manner in which color can be applied to such materials is by means of a spray or jet of dye carried by a liquid vehicle. However, in the case of pile fabrics such as floor coverings having substantial pile depth, no method nor apparatus has been capable of achieving level dye application and uniform penetration of the pile. If the liquid dye is applied in sufficient quantities and under sufficient pressure to the pile fabric when flat, it has been found that by using excessive quantities of materials in high pressure, the outer face of the pile can be penetrated with reasonable satisfaction. However, the base of the pile does not receive the proper dye penetration and the result is, therefore, unsatisfactory. This disadvantage increases in proportion to the pile depth and is also affected by such factors as pile density, type of yarn, twist, etc.

A primary object of the present invention, therefore, is to provide an improved procedure for spray dyeing color onto a running length of pile fabric.

A further object of the invention is to provide an improved apparatus for opening up the pile during a liquid spray treatment of a running length of fabric.

A further object of the invention is to provide in a process for continuously spray dyeing a running length of pile fabric suitable liquid pre-treatment which assists in obtaining adequate penetration of the dye liquid to the base of the pile yarns.

A still further object of the invention is to provide an integrated liquid application and setting apparatus for continuously treating, dyeing, and finishing a running length of pile fabric.

Further objects will be apparent from the specification and drawings in which:

FIGS. 1a-1d show schematically the apparatus constructed in accordance with the present invention,

FIG. 2 is an enlarged section of one of the liquid application chambers of FIG. 1 and as seen at 2-2 of FIG. 3,

FIG. 3 is a top view partly broken away of the structure of FIG. 2,

FIG. 4 is an enlarged detail of the pile penetrating liquid application station as seen at 4-4 of FIG. 2,

FIG. 5 is a section of the structure of FIG. 4 as seen at 5-5,

FIG. 6 shows a modification of the liquid applying manifold shown in FIG. 4,

FIG. 7 is a section as seen at 7-7 of FIG. 6,

FIG. 8 is a sectional detail of a modification of the structure of FIG. 5,

FIG. 9 is an enlarged sectional detail as seen at 9-9 of FIG. 2,

FIG. 10 is a section as seen at 10-10 of FIG. 9,

FIG. 11 is a side view of one of the liquid beater stations shown in FIG. 1, and

FIG. 12 is an end view of the structure of FIG. 11.

The invention comprises essentially the provision of a continuous fabric handling machine having a plurality of liquid applying chambers through which the running length of fabric passes and having two liquid applica-

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tion stages in each chamber. The first chamber is utilized to apply certain preliminary materials which assist in the application and penetration of the liquid dye. The second chamber is utilized to apply the color or dye. In each chamber the first stage involves a device for breaking the fabric over a sharp radius to permit penetration of the liquid to the base of the pile. The second stage in timed sequence applies liquid to the flattened fabric to produce a level application of liquid to the pile surface whether pre-treating chemicals or color.

Referring now more particularly to the drawings, the apparatus for applying liquid to pile fabrics constructed in accordance with the present invention comprises a first liquid applying chamber 20 through which the fabric F is fed from a beam or roll 21 which may be mounted on any convenient stand 22. A driven conveyor belt 23 is trained over a series of rollers 24, 25, 26, and 27 in such a way that the upper pass of belt 23 carries the fabric F from end to end through chamber 20. As the fabric enters the chamber it passes under a guide element or bar 30, thence upwardly and over an opening member 31, and thence under a second guide or bar 32. The fabric then travels in a flat condition along the conveyor 23 and under the second stage liquid application spray 33. The first stage liquid application is applied at 34 directly above the opening or breaking element 31. Suitable exhaust ducts are supplied and may be connected to the chamber 20 at 35. These elements are not shown in detail since they form no part of the present invention. From chamber 20 the fabric F passes over a first beater station 37 comprising a pair of spaced guide elements 38 and 39 which straddle a rotating beater assembly 40. The fabric then passes directly into the second liquid chamber 41 which is constructed in the same way as chamber 20. Corresponding primed reference numbers are used for the details of chamber 41 since these two are substantial duplicates. The fabric then passes from chamber 41 onto the second beater assembly 42 which likewise is the same or similar to the beater assembly 37. Corresponding parts have been given primed numbers in FIG. 1b. In chamber 20 the fabric is treated with certain preliminary liquids to assist in the application and penetration of the color which is applied in chamber 41. In each case the same liquid is applied through the spray manifolds 33 and 34 whereas the color is applied through manifolds 33' and 34'.

After the preliminary liquid treatment in chamber 20 and the application of color in chamber 41 as well as suitable removal of excess liquid in beater assembly 42, the fabric F passes to a steam chamber 45 where it is festooned over a series of lower rollers 46, 47, and 48 and upper rollers 49 and 50. With proper application of heat in the steamer the fabric is passed through a series of wash boxes 51, 52, and 53, each one having a plurality of lower rollers 54, 54 and upper rollers 55, 55. Squeeze rollers 56 and 57 are mounted at the trailing edge of each wash box to reduce the liquid run-off in each phase. From the wash boxes the fabric is fed through a pair of squeeze rolls 60 and 61 mounted in roll stand 62. These squeeze rollers 60 and 61 remove any additional liquid that may remain after treating in the wash boxes. The fabric then passes over a third beater assembly 63 and through a tenter-drier assembly 64 having a conventional tenter frame 65 carried over rollers 66, 67, 68, and 69. The fabric after drying may then be handled in any desired manner but is preferably wound in rolls such as 70 on roll stand 71.

In the composite liquid treating and finishing apparatus described above the steamer wash boxes and drier are all conventional pieces of equipment well known in the art and require no further detailed description. The liquid

applying chambers 20 and 41 are a particularly important feature of the invention and they, together with the details of the beater assembly, will be described in greater detail.

Referring now to FIGS. 2-5, each of the chambers 20 and 41 comprises a housing 75 mounted on suitable columns or pedestals 76, 76. The conveyor 23 is driven by means of a suitable motor 77, reduction unit 78, and a driving connection 79 to roller 25. Roller 30 under which the fabric first passes is suitably journaled in pillow blocks 80, 80 and the breaking element 31 is supported in an elevated position on a series of standards 81, 81. Roller 32 is similarly journaled in pillow blocks 82, 82. The relationship between the height of breaking member 31 and the longitudinal distance between centers 30 and 32 determines the angle at which the fabric F passes over the element 31 and consequently the degree to which the pile will be opened up at this station. In the first stage of liquid treatment, whether pre-treating liquids or color, the fluid is supplied through a manifold 83 from which a series of nozzles or jets 84, 84 depend. In a preferred form, manifold 83 is stationary but this manifold may be oscillated transversely of the fabric as will be described more clearly in connection with FIGS. 6 and 7.

After passing under roller 32 the fabric is again deposited on the conveyor 23 and subjected to further liquid spray treatment from a series of traversing liquid nozzles or jets 85, 85 connected to a manifold 86 and having a series of flexible liquid hoses 87, 87 attached to each nozzle. The manifold 86 is suspended from a post 90 clamped in yoke 91 which traverses back and forth on tracks or ways 92 and 93 on a series of upper rollers 94, 94 and lower rollers 95, 95 (FIGS. 9 and 10). All of the flexible hoses 87, 87 are connected through a valve 96 mounted on top of yoke 91 and having an actuating handle 97. A chain 100 is trained over an idler sprocket 101 adjustable by means of a chain tightener assembly 102 and at the other end over a driving sprocket 103 keyed to the shaft 104 of a gear reducing unit 105. The yoke 91 is drivably connected to chain 100 through an angle bracket and pin 91a. Unit 105 is driven from a motor 106 through belt 107, pulley 108, and an adjustable sheave 109. Both the motor 106 and the reduction unit 105 are mounted on an upper cross member 110 secured to standards 76a and 76b. As the manifold and yoke oscillate transversely of the chamber, the direction of travel is reversed at the end of each pass by means of appropriate limit switches 111 and 112 also mounted on standards 76a and 76b, respectively. The spraying of the liquid is automatically stopped near the end of one pass by means of an adjustable flat cam 113 secured to a plate 114 and mounted on brackets 115 and 116. The proper adjustment is achieved by means of the elongated slots in the cam 113 as well as the plate 114. When the valve handle 97 contacts cam 113 at the end of the righthand pass as seen in FIG. 9, valve 96 is closed to stop further spraying of liquid. A similar cam 120 is mounted at the other side of cross member 110 and is likewise adjustable in plate 121 and brackets 122. This insures that the liquid spray stops as soon as the manifold 86 has passed each edge of the fabric thus avoiding unnecessary loss of liquid and the ample adjustments of cams 113 and 120 provide for varying widths of fabric in each chamber.

Referring now to FIGS. 6-8, in the event that the type of fabric or the liquid materials being sprayed require more than fixed nozzles in the first stages of either chamber 20 or 41, I may utilize an oscillating manifold 83 which is movable transversely by means of a motor 125 mounted on a plate 126 by means of four posts 127, 127. The motor 125 is provided with a crank 128 which drives a crosshead 129 through a connecting rod 130. Crosshead 129 is provided with suitable guides 131 and 132

which support the manifold assembly 83. The crosshead 129 may be adjustably secured to the manifold 83 by means of a clamping arrangement 133 and the manifold is provided with a suitable cap 134 for any overhang beyond crosshead 129. In this way maximum liquid penetration of the pile yarns or fibers may be achieved and the maximum utilization of the liquid pressure to force the liquid into the fiber base is thereby accomplished.

Referring now to FIG. 8, a modified form of breaking element will be described which is employed in the event the particular fabric being processed is of sufficient weight that it cannot readily be pulled over the breaking element 31 by means of the conveyor 23. In this case standards 81 are modified to incorporate a series of posts 140, 140 having cross arms 142 and opposed rollers 143, 144. A bar or tube 145 is rotatably supported on the series of rollers 143, 144 in such a way that the bar 145 is free to rotate as the fabric F passes under the first stage nozzles 84, 84.

The beater assemblies 37, 42, and 63 are shown in more detail in FIGS. 11 and 12. Each assembly comprises a platform 147 supported on legs 148, 148 and having suitable cross members and braces 149, 149. A motor 150 is mounted in the framework and drives the beater 40 through suitable driving connections 151. The rollers 38 and 39 are journaled on the platform 137 in pillow blocks 152, 152. The beater itself comprises a generally cylindrical tube or roller 40a to which I attach by welding or otherwise transverse bars 40b and 40c to extend slightly above the level of rollers 38 and 39. This gives ample displacement for the beating operation since the fabric normally sags between the rollers and the positioning of rollers 38 and 39 is such that the normal amount of this sagging gives the desired amplitude for the beating step.

It will thus be understood that I have provided improved apparatus for liquid treating and coloring of deep pile textile fabrics which achieves complete penetration of the pile yarns and fibers due to the two stage liquid application and which also provides highly satisfactory level dyeing results. The preliminary application of the liquids applied in chamber 20 is an important feature of the invention and these assist in achieving proper penetration and dispersal of the color. The liquid applied in both stages of the first chamber includes a solvent carrier and a wetting agent. Examples of such liquids are benzyl alcohol and a non-ionic wetting agent such as a polyether alcohol sold on the market under the name Deceresol NI. Another satisfactory liquid for the pre-treating stage is a mixture of butyl benzoate and a non-ionic wetting agent such as an aromatic polyglycol ether sold on the market under the name Neutronyx 600. This pre-treating step solubilizes the dyestuff and disperses it uniformly throughout the fiber during the steam treatment. The solvent is applied to the fabric in the first stage of chamber 20 under sufficient pressure so that the liquid actually bounces off of the ground or backing portion of the fabric. The particular solvent or wetting agent will be chosen to avoid damage to the fibers present in the fabric. The above chemicals in relatively weak solutions are all satisfactory for both natural and synthetic materials in pile fabrics. The subsequent application of the pre-treating liquid to the face of the pile of the fabric is also important in obtaining the level dyeing effect which is essential. It is preferred to apply the color to the fabric under conditions of substantially less pressure and in areas where color penetration is not actually achieved mechanically the liquid carriers assist the penetration so that an extremely satisfactory and thorough dyeing result is produced. The steaming operation completes the dispersion and transfer of the color to all parts of the fabric and also fixes the color.

Having thus described my invention, I claim:

1. The method of continuously dyeing a textile pile fabric which comprises the steps of continuously passing

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the fabric through a first liquid spray zone, bending the fabric at said first liquid spray zone to open up the pile and expose the base of the pile, applying conditioning liquid to the open up pile in said first spray zone to aid and assist in the subsequent dye penetration, continuously passing the fabric through a second spray zone in a straight line path and applying liquid dye under pressure to the fabric at said second spray zone by oscillating liquid dye spray means transversely across the fabric while it is being fed.

2. The method of claim 1 in which the liquid in the first zone is applied under greater pressure than the liquid in the second zone.

3. The method of continuously dyeing a textile pile fabric which comprises the steps of continuously feeding a length of pile fabric through a first spray zone, bending the fabric, spraying a conditioning liquid into the base of the pile in said first spray zone while in a bent state, continuously passing the fabric through a second spray zone, bending the fabric in said second spray zone, spraying a dye solution onto the fabric while in a bent state by oscillating the liquid spray dye means transversely across the fabric while it is being fed, and further spraying a liquid dye onto the pile of the fabric in said second spray zone while moving in a straight line path by oscillating liquid dye spray means transversely across the fabric while it is being fed.

4. The method of continuously dyeing a textile pile fabric which comprises the steps of continuously feeding a length of pile fabric through a first spray zone, spraying a conditioning liquid against the pile side of the fabric in said first zone, thereafter continuously feeding the fabric in a straight line path through a second spray zone,

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spraying a second conditioning liquid onto the pile of the fabric in the second zone, thereafter continuously passing the fabric in a straight line path to a third spray zone and spraying a liquid dye onto the pile of the fabric in said third zone by oscillating liquid dye spray means transversely across the fabric while it is being fed.

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