

Sept. 28, 1954

S. B. SCHWARTZ ET AL  
DESIGN DYEING APPARATUS

2,690,118

Filed Jan. 15, 1952

4 Sheets-Sheet 1

FIG. 2

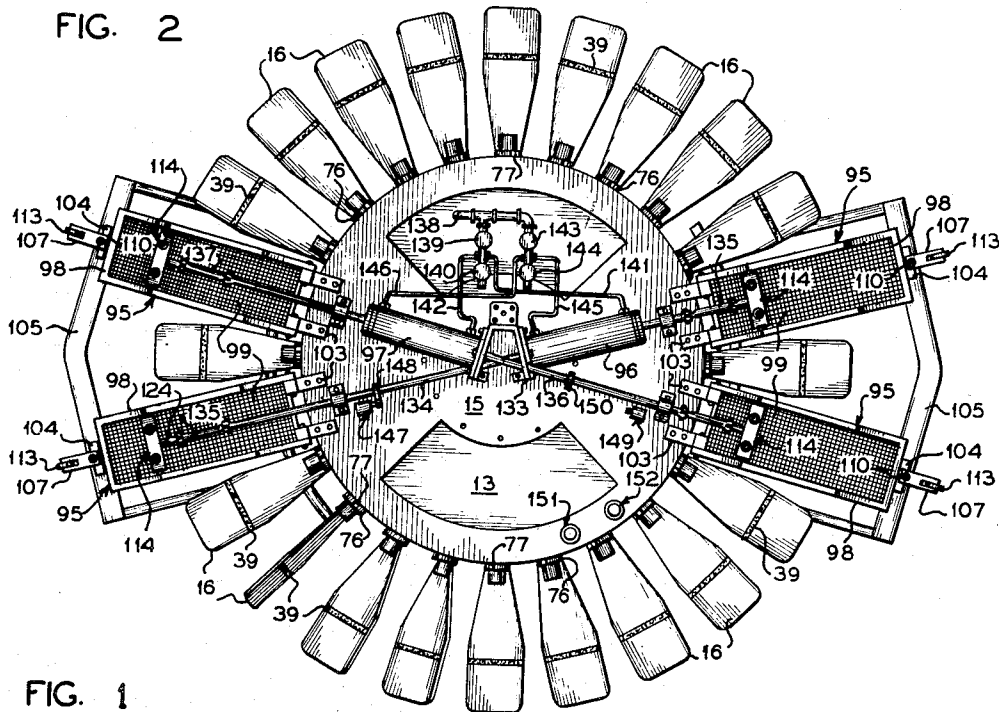
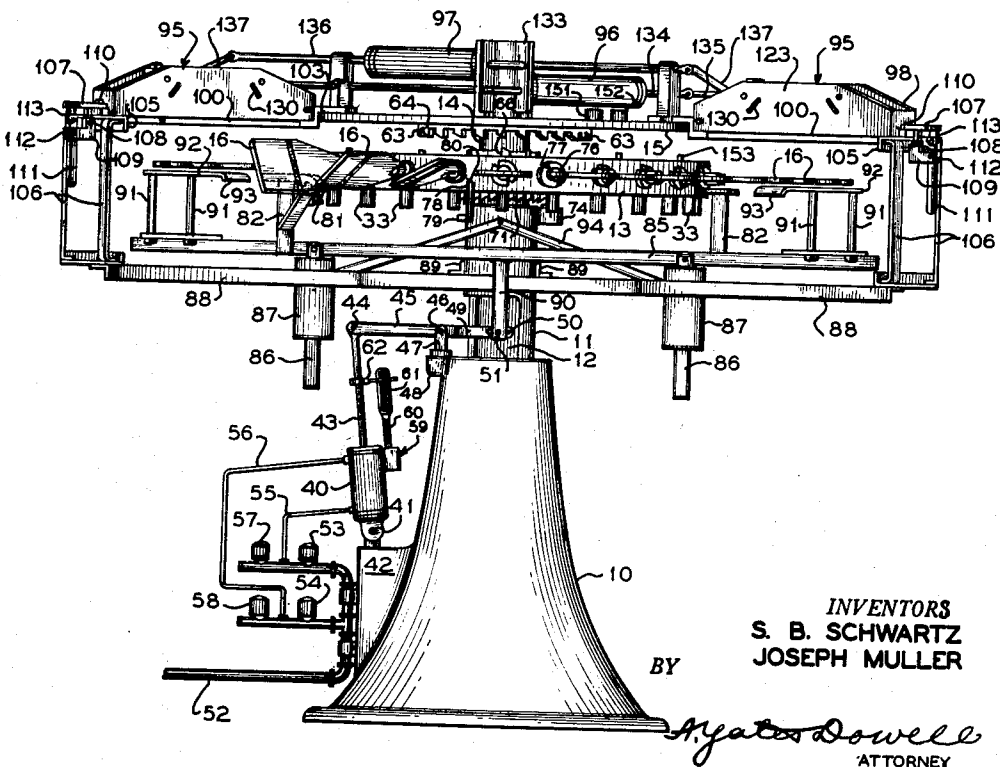


FIG. 1



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FIG. 3

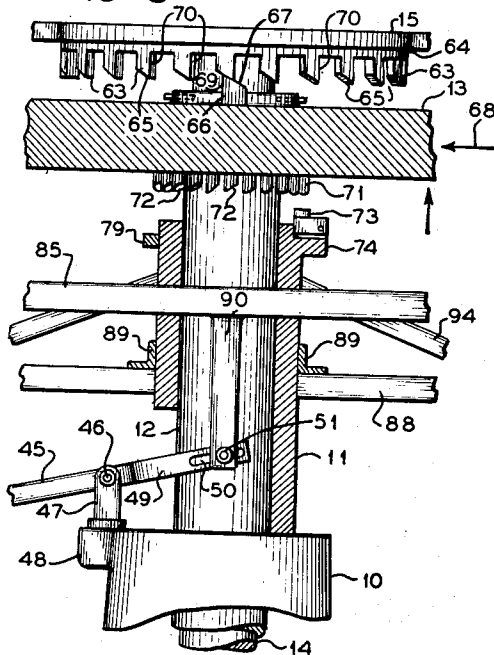


FIG. 4

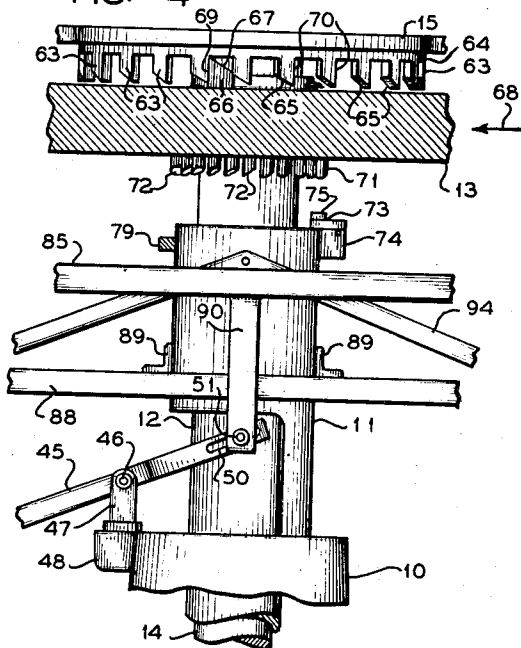


FIG. 5

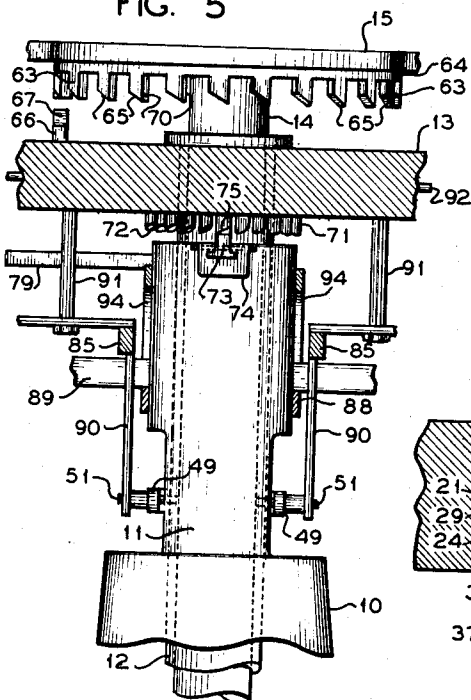


FIG. 6

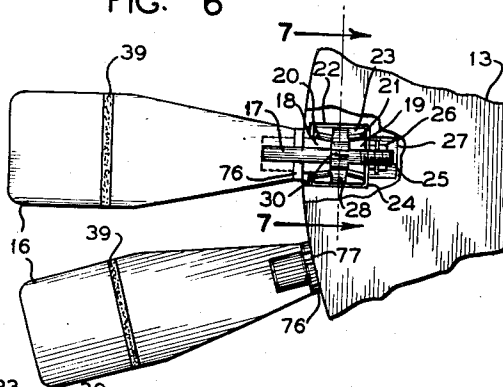
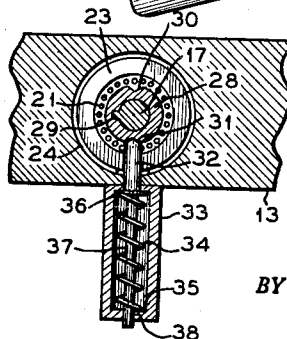


FIG. 7



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FIG. 9

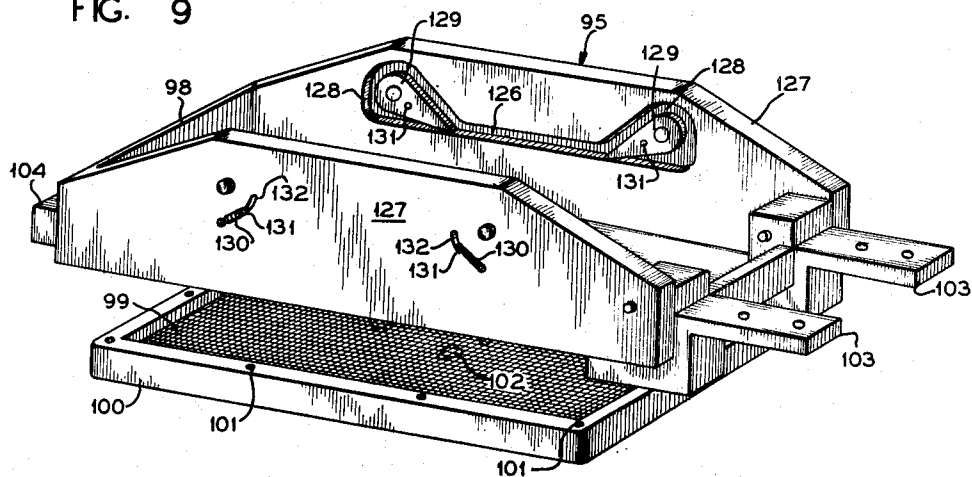


FIG. 10

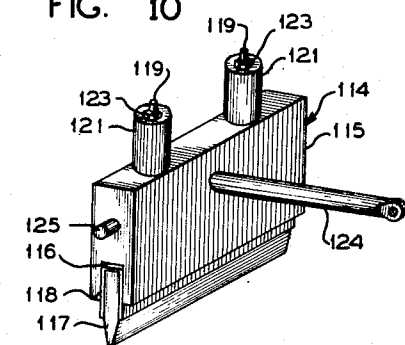


FIG. 12

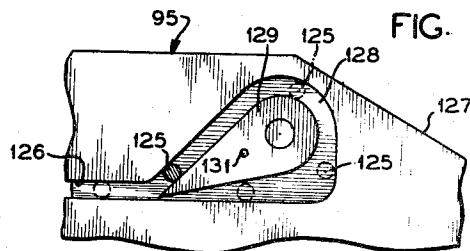


FIG. 13

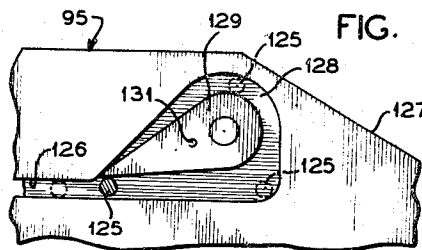
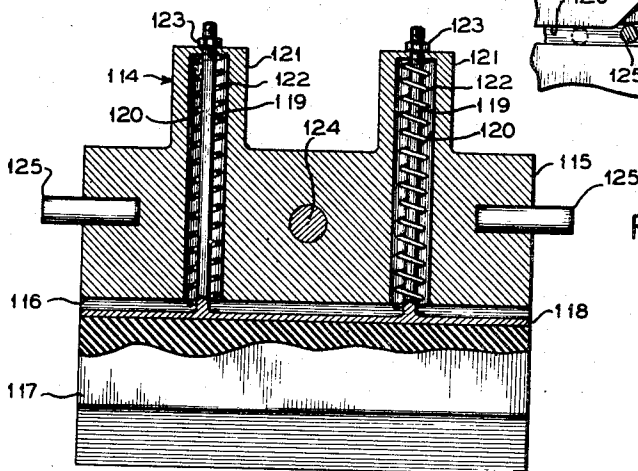


FIG. 11



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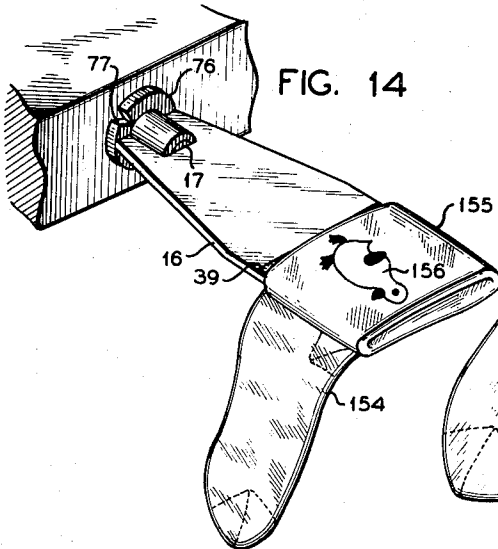


FIG. 14

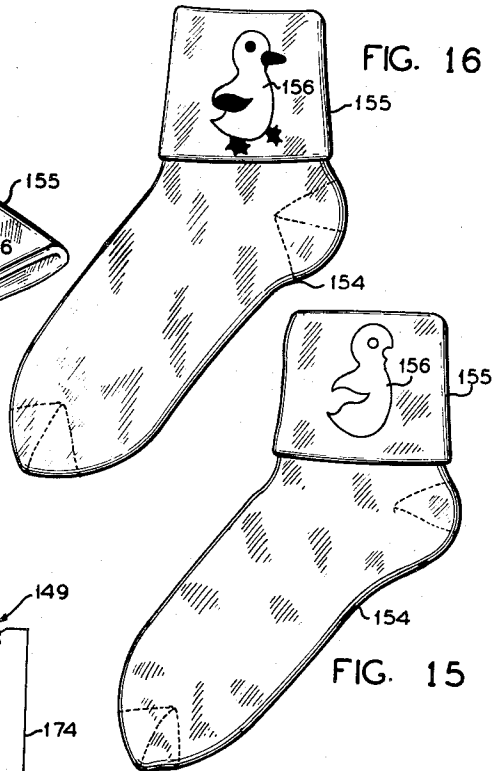


FIG. 16

FIG. 15

FIG. 17

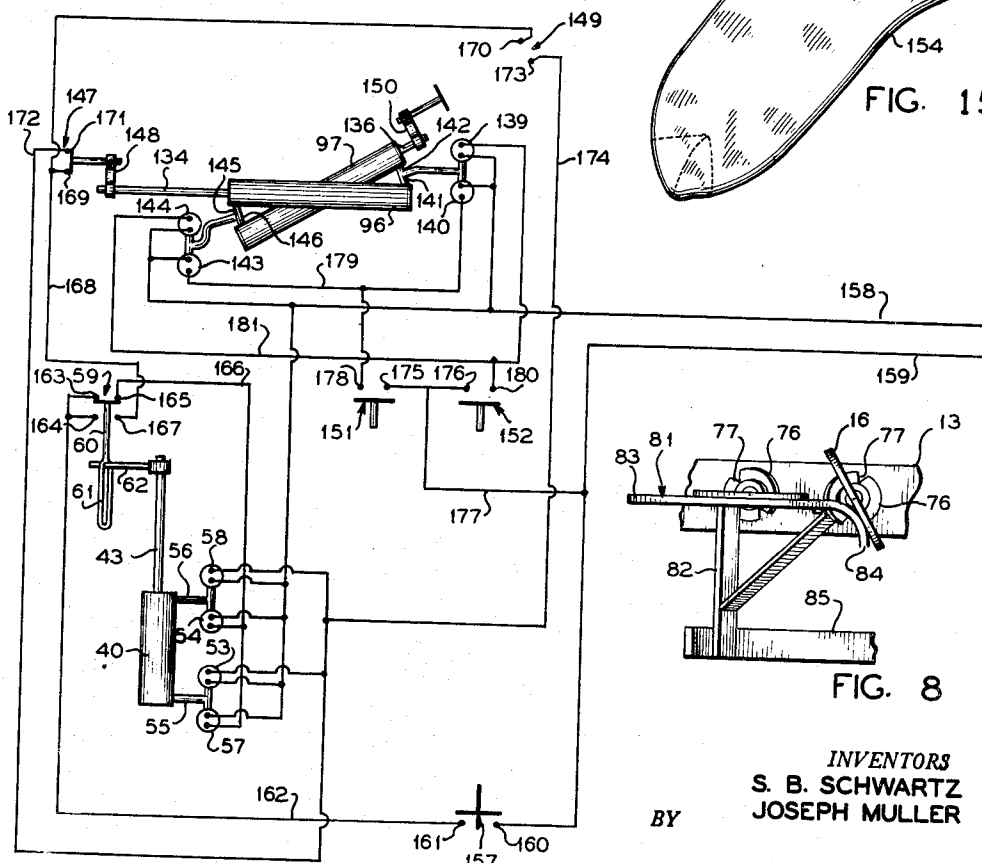
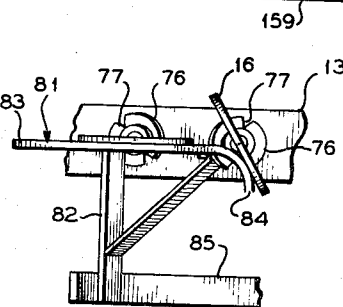


FIG. 8

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## UNITED STATES PATENT OFFICE

2,690,118

## DESIGN DYEING APPARATUS

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Application January 15, 1952, Serial No. 266,612

20 Claims. (Cl. 101—115)

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This invention relates to ornamentation and more particularly to design dyeing and apparatus for accomplishing the same.

One specific use of the invention is the application of a single or multi-colored design for purposes of ornamentation to finished or fabricated textiles such as for example, to hosiery or the like. The method does not pertain to woven piece goods which is printed continuously by such means as roller printing with intaglio cylinders.

Ornamentation has been accomplished in many ways including the printing of designs on piece goods and on some finished articles such as blouses, T shirts, overalls and the like, however this type of ornamentation has either been very limited as to color and durability or has required the use of much skilled labor in the production thereof. In other words the use of a plurality of colors in a design offered substantial problems as for example a multi-colored design where the colors were applied singly they were difficult to apply in proper relation or registration.

Hosiery has also been heretofore produced with designs which have been knitted into the hosiery. This is a very costly process requiring the use of special colored yarns in knitting and requiring special machinery. The designs possible by this method are extremely limited due to the inherent limitations of knitting machines. Intricate and sharp designs are not possible by this method. Further the design has not been permanent when applied by a thermoplastic or thermosetting transfer which is inexpensive. Also the application of a design to finished or fabricated articles of textile apparel has not been adapted to low cost quantity production being accomplished by manual operations using the screen process or the like. The roller printing process utilizing the same types of dyes or printing pastes as utilized in the invention of this application is not adaptable to finished or fabricated articles of textile apparel such as hosiery. Initial cost of machinery and engraving of intaglio cylinders precludes utilization of that process for fabricated textiles such as hosiery where yardage is small compared to that normally run on one design of piece goods. Also the roller process has not been adapted mechanically for the printing of fabricated articles such as hosiery but is utilized exclusively for the printing of piece goods in continuous flat form.

The apparatus of this invention has been specifically created for application of a single or multi-colored design to hosiery. It is desirable that the application of designs to articles such as

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socks be accomplished rapidly and inexpensively in order that these articles may be sold at a comparatively low price in the present highly competitive market where competition is keen thereby precluding the manual application of such designs.

The process utilized with the apparatus of this invention is a true dyeing process in that the dye is applied to the fabric and allowed to penetrate and completely color the fibers therein. An aqueous solution of a textile coloring component such as a vat dye may be incorporated in the printing paste or a pigmented oil in water, or water in oil two phase emulsion with resin binder may be utilized. These printing pastes are well known to those skilled in the art of textile printing. Consequently the resulting product is completely washfast and the design will retain substantially its original brilliance and character throughout the life of the fabric.

It is therefore an object of this invention to provide a relatively simple and inexpensive apparatus for design dyeing in which any desired design in a single or multiplicity of colors may be easily applied to socks.

Another object of the invention is to provide apparatus for design dyeing in which any desired design may be applied to one or both sides of the socks.

A further object of the invention is to provide an apparatus for design dyeing of articles particularly hosiery and utilizing flexible fine mesh screening, the design portion of which is open and the remaining portion covered with a material impervious to the printing paste and through which design portion the dye or color paste is applied to the article.

A still further object of the invention is the provision of a design dyeing apparatus for printing any desired design on fabric articles such as socks which is entirely automatic in operation and which only requires the application and removal of the socks and which may be controlled by the operation of a single foot operated switch.

A further object of the invention is the provision of a design dyeing apparatus for printing a multi-colored design on fabric articles such as socks and in which means is provided for accurately registering each color of the design with respect to the other colors.

Another object of the invention is to provide apparatus for design dyeing in which means is provided for properly initially positioning the articles relative to the apparatus whereby the design will be properly located on the article.

A still further object of the invention is the provision of a design dyeing apparatus which may be economically manufactured from readily available materials with the use of little skilled labor and one which will not be susceptible to frequent breakdowns and consequent high maintenance cost.

Further objects and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is an elevational view of a design dyeing apparatus constructed in accordance with this invention;

Fig. 2, a plan view of the design dyeing apparatus shown in Fig. 1;

Fig. 3, a fragmentary elevational view with parts in section for greater clarity and showing the movable table in intermediate position;

Fig. 4, a view similar to Fig. 3 but showing the movable table in uppermost printing position;

Fig. 5, a view taken at right angles to Figs. 3 and 4 and showing the movable table in lowermost position;

Fig. 6, a fragmentary detail plan view with parts in section for greater clarity and showing the mounting means for the sock supporting boards.

Fig. 7, a sectional detail view taken on the line 7-7 of Fig. 6;

Fig. 8, a fragmentary elevational view showing the means for turning the sock supporting boards from an intermediate position to operative printing position;

Fig. 9, an exploded perspective view showing a portion of the screen printing mechanism;

Fig. 10, a perspective view of the squeegee used in conjunction with the mechanism of Fig. 9;

Fig. 11, a sectional view showing the structure of the squeegee shown in Fig. 10;

Fig. 12, a fragmentary elevational view showing the position of one of the gate members as the squeegee nears one end of its stroke;

Fig. 13, a view similar to Fig. 12 but showing the position of the gate member as the squeegee commences its return stroke;

Fig. 14, a view in perspective showing the sock holding board with a sock in place thereon and upon which sock a design has been printed;

Fig. 15, an elevational view of a sock upon which the first color of a design has been printed;

Fig. 16, a view similar to Fig. 15 but showing the complete full color design; and

Fig. 17, a schematic diagram of the control circuit for the apparatus of this invention.

With continued reference to the drawing the design dyeing apparatus of this invention is supported upon a pedestal type base 10 from which there extends upwardly a hollow column 11. Column 11 serves to slideably receive a tubular member 12 which in turn supports a table 13, table 13 being mounted for rotation upon the tubular member 12 and moving upwardly and downwardly therewith. Disposed within the tubular member 12 is a supporting member 14 which may be either tubular or solid, member 14 serving to support an upper plate 15 upon which a portion of the apparatus is carried. The particular details of plate 15 and the associated apparatus carried thereby will be later described.

Extending radially from the outer circumference of table 13 and supported thereby are a plurality of boards 16, each of these boards serving to receive and support a sock or another article to be printed. Board 16 may be formed

of metal, wood or any other suitable material and as best shown in Figs. 6 and 7 these boards are supported for rotation about their longitudinal axis in the table 13. For this purpose boards 16 are provided at their inner ends with a stub shaft 17 which may be secured to the board by welding or by any other suitable means, shaft 17 serving to receive the inner races 18 and 19 of anti-friction bearings 20 and 21, the outer races of which 22 and 23 are snugly received in a bore 24 in the edge of table 13. The inner end of shaft 17 is threaded as at 25 and serves to receive a nut 26 which clamps the shaft 17 in position and retains the boards 16 on the table 13. Threaded extension 25 and nut 26 may be received in a counterbore 27 which forms an extension of the bore 24 in the table 13.

Since it is necessary during operation that the boards 16 occupy one printing position and a position 180° removed therefrom during the next printing operation, mechanism is provided to maintain the boards in these two positions which mechanism may conveniently comprise a collar 28 secured to the stub shaft 17 between the anti-friction bearings 20 and 21 by a key 29 or other suitable securing means, collar 28 being provided with diametrically disposed notches 30 which serve to receive the beveled end 31 of a detent 32 slidably mounted in a cylinder 33 which may be secured to the table 13 by any suitable means such as screw threads, welding or the like.

As will be seen from an inspection of Fig. 1 there is one cylinder 33 for each board 16 and these cylinders extend slightly below the table 13. Disposed within each cylinder 33 is a compression spring 34 which at one end engages the inner end 35 of cylinder 33 and at the opposite end engages a washer 36 fixed to the detent 32. Detent 32 may be conveniently guided by an elongated rod which extends through an aperture 38 in the lower end of cylinder 33. It will thus be seen that by means of this detent mechanism each board 16 is releasably held in positions 180° removed from each other and the mechanism for moving the boards from one position to another will be later described.

The boards 16 may be shaped as shown in Figs. 2, 6 and 14 or they may be formed in any other desired manner to accommodate the particular articles to be printed but in the present instance where socks are being printed the formation shown has proven most satisfactory.

In order to facilitate positioning the socks or other articles on the board 16 a strip or bar 39 of contrasting color or other distinguishing mark may be provided which serve as a gage or guide to position the sock thereon, it only being necessary to locate the sock with one edge of the cuff contacting the bar or strip 39 in order to insure that the printing impression will be made at the proper place on the sock.

Mechanism is provided to raise and lower the table 13 carried by the tubular member 12 and this mechanism may well comprise an air or hydraulic cylinder 40 pivotally mounted at 41 on a boss 42 extending from the side of the pedestal base 10. While a cylinder 40 is shown as being utilized to raise and lower the table 13 other suitable means for this purpose may of course be employed. Cylinder 40 is provided with a piston to which is attached a piston rod 43 extending upwardly and pivotally connected at 44 to a lever 45 pivotally mounted at 46 on a bracket 47 secured to a boss 48 extending from

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the upper edge of pedestal base 10. Lever 45 terminates at its inner end in a yoke 49 in the ends of which are disposed slots 50. Slots 50 serve to receive pins 51 which extend through the slots and into the tubular member 12 whereby upon pivotal movement of the arm or lever 45 about the pivot 46 tubular member 12 will be moved upwardly or downwardly to raise and lower the table 13 and boards 16 carried thereby.

Cylinder 40 is supplied with air or other suitable motive fluid through a conduit 52 and inlet solenoid valves 53 and 54. Valve 53 controls the supply of fluid through a conduit 55 to one end of the cylinder 40 and inlet valve 54 controls the supply of fluid through another conduit 56 to the opposite end of cylinder 40. The exhaust of fluid from the cylinder 40 is controlled by a solenoid valve 57 through the conduit 55 and a solenoid valve 58 which exhausts fluid through the conduit 56. Also mounted on the cylinder 40 or other convenient place is a limit switch 59 from which extends a rod 60 having an elongated slot 61 therein, there being an arm 62 secured to the piston rod 43 and extending into the slot 61 to provide a lost motion connection. As will be seen from an inspection of Fig. 1 upon movement of the piston rod 43 downwardly the tubular member 12 and table 13 carried thereby will be raised and the arm 62 will move downwardly in the slot 61 until it contacts the end thereof at which time the limit switch 59 will be actuated. Upon reverse movement of the piston rod 43 the tubular member 12 and table 13 will move downwardly and the arm 62 will move upwardly in the slot 61 until it contacts the upper end thereof at which time the limit switch 59 will be actuated in the reverse direction.

Since it is necessary that during each up and down movement of the table 13 that the same rotate a distance equal to that between adjacent boards 16 mechanism is provided for accomplishing this rotation including a series of annularly arranged downwardly depending teeth 63 which may be formed as a ring 64 secured to the lower surface of the upper plate 15. The lower ends of teeth 63 as best shown in Figs. 1, 3, 4 and 5 are beveled as at 65 for a purpose to be presently described. A single tooth 66 is secured to the upper surface of table 13 and projects upwardly therefrom, the upper end of tooth 66 being beveled as shown at 67. The angle of bevel 67 is substantially the same as that of bevel 65 on the downwardly depending teeth 63. Bevel surfaces 65 and 67 cooperate in the nature of cams and as shown in Figs. 1 and 3 the table is in one rotary position and as the table 13 moves upwardly the surface 67 on tooth 66 engages the bevel surface 65 on the corresponding downwardly depending tooth 63 and continued upward movement of the table 13 results in rotation of the same in a clockwise direction as viewed in Fig. 2 or in the direction of the arrow 68 as shown in Fig. 3. Rotation of the table 13 in this direction will continue until the leading edge 69 of tooth 66 contracts the edge 70 of tooth 63 at which time as shown in Fig. 4 tooth 66 will pass into the space between adjacent teeth 63 and securely lock the table 13 in position against further rotation. It is in this position that each printing operation is accomplished and such printing operation will be later described.

Since it is obvious that if the table 13 merely moves downwardly from the position shown in

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Fig. 4 and then is moved upwardly again the tooth 66 would merely move into the space between the adjacent teeth 63 which it formerly occupied and the table 13 would not be rotated.

It is therefore necessary during the downward movement of table 13 to rotate the same a portion of the distance between adjacent boards 16 and for this purpose there are provided on the lower side of table 13 an annularly arranged downwardly depending series of teeth 71 which are provided with beveled cam surfaces 72 on their lower ends. These cam surfaces 72 are intended to cooperate with a fixed upwardly extending tooth 73 supported upon the upper end of column 11 in a boss 74 extending therefrom, tooth 73 having a beveled cam surface 75 for cooperating with the cam surfaces 72 on downwardly depending teeth 71.

As will be seen from an inspection of Fig. 5 upon movement of the table 13 to lowermost position the bevel cam surface 72 on one of the downwardly depending teeth 71 contacts the cam surface 75 on fixed upwardly extending tooth 73 which upon continued downward movement of the table 13 results in rotation thereof in the direction of the arrow 68 as shown in Figs. 3 and 4 or in a clockwise direction as viewed in Fig. 2. The table 13 will remain in this position until it again moves upward at which time teeth 63 and 66 cooperate to complete the rotational movement thereof. It will thus be seen that this rotational mechanism requires very few additional parts and results entirely from the upward and downward movement of the table 13 which in any event is necessary for completing the printing operations and consequently this mechanism utilizes a necessary movement of the apparatus which results in a very efficient operation thereof.

As stated above it is necessary to rotate the boards 16 about their longitudinal axes 180° during rotational movement of the table 13 and for accomplishing this operation each shaft 17 which supports a board 16 is provided adjacent the outer edge of the table 13 with a collar 76 having diametrically disposed notches 77 in the outer edge thereof. Notches 77 are intended to cooperate with an upwardly extending tooth 78 which is supported upon a bar 79 secured to the column 11. As will be seen from an inspection of Fig. 1 upon downward movement of the table 13 the upper beveled edge 80 of tooth 78 engages in a notch 77 of the collar 76 and partially rotates the shaft 17 and board 16 carried thereby to move the beveled end 31 of detent 32 out of engagement with the notch 30 in collar 28 carried by the shaft 17. This results in positioning the board 16 substantially in the position shown in Fig. 1 immediately to the left of the center of the figure. The movement of board 16 to a position 180° from that first occupied is completed by engagement of the board with a track 81 supported upon a bracket 82. As best shown in Fig. 8 track 81 comprises a horizontal portion 83 and a curved leading end 84. It is to be noted that the track 81 is located slightly below the center line of shaft 17 which carries board 16 and as the table 13 rotates the curved leading end 84 will contact the lower portion of the board 16 which has been partially rotated by action of the tooth 78 and as the table 13 continues to rotate the board 16 will move upwardly over the inclined surface of end 84 of track 81 and will engage the horizontal surface 83 at which time the board 16 will occupy a

position 180° from that formerly occupied. The purpose of this rotation of the board in connection with the printing operation will presently appear.

Bracket 82 is supported from spaced substantially parallel bars 85 which extend across the apparatus on each side of the column 11 and these bars 85 are provided with downwardly extending guide rods 86 which are slideably received in guides 87 supported by bars 88 which extend across the machine and are secured to the column 11 by welding or the like. Bars 88 may be reinforced by angle irons 89 also secured to the column 11 and bars 88 by welding or other suitable means. In order that bars 85 will move upwardly and downwardly with the table 13, they are provided with downwardly depending link members 90 provided at their lower ends with apertures for receiving pins 51 which are moved upwardly and downwardly by the yoke 49. Located adjacent the outer ends of bars 85 are upwardly extending rods 91 which serve to support shoes 92 these shoes being disposed directly beneath the boards 16 and serving to prevent undue deflection of such boards during the printing operation. As will be seen from an inspection of Fig. 1 the ends 93 of the shoes 92 are curved in order to prevent interference of the boards 16 therewith during rotary motion of the table 13 and boards 16. If desired the bars 88 may be further supported by diagonal braces 94 secured thereto and to the column 11.

Plate 15 serves to support the inner ends of dye applying means 95 and plate 15 likewise carries cylinders 96 and 97 which supply power for operating the dye applying means in a manner to be presently described. As best shown in Figs. 1, 2 and 9, the dye applying means 95 may conveniently take the form of a rectangular frame or box 98 the bottom opening of which is closed by a fine mesh screen 99 carried by a rectangular frame 100 which may be provided with apertures 101 for receiving screw-threaded or other suitable fastening means to secure the frame 100 and screen 99 carried thereby to the rectangular frame or box 98. Screen 99 may be formed of silk or steel wire, but obviously any other suitable material may be employed. This screen must have sufficient tensile strength and resistance to wear to afford long life, but must also possess sufficient flexibility to conform to irregularities in the surface of the fabric material to which a design is to be applied. The inner surface of screen 99 is coated with a material impervious to the dye being used except for a portion representing the outline of the desired design as indicated at 102 in Fig. 9.

Box 98 of the dye applying means 95 is provided at one end with brackets 103 which are secured to the plate 15 and the opposite end of the box 98 is provided with a boss 104 which is designed to be supported upon an angle bar 105 which as shown in Fig. 1 is supported by upstanding bracket members 106 which are secured to crossbars 88. Box 98 may be clamped in operative position by a clamping arm 107 pivotally mounted at 108 on a bracket 109 secured to the angle bar 105. Clamping arm 107 may be provided with adjusting means in the form of a bolt 110 which extends therethrough and contacts the boss 104, movement of the bolt 110 upwardly or downwardly determining the clamping pressure exerted on the boss 104. Means for operating the clamping arm 107 is provided in the form of a handlever 111 pivoted at 112 on the bracket 109,

the lever 111 being connected by a link 113 to the outer end of the clamping arm 107. This mechanism provides a toggle arrangement whereby upon movement of the hand lever 111 to the position shown in Fig. 1 the bolt 110 will engage the boss 104 to clamp the box 98 in position, and upon movement of hand lever 111 outwardly, away from the apparatus, the clamping arm 107 will pivot about the pivot point 108 and raise the bolt 110 away from the boss 104 and permit removal of the box 98 in order to clean the same or to replace the screen 99 with another screen carrying a different design.

For the purpose of forcing dye or printing paste through the design portions 102 of the screen 99 each dye applying or printing means 95 is provided with a squeegee 114 which as best shown in Figs. 10 and 11 comprises a rectangular block 115 which is provided in the lower edge thereof with a groove 116 in which is slideably disposed a blade 117 which may be formed of rubber or other suitable flexible material. Blade 117 may be reinforced by a backing of metal or other suitable material 118. As shown in Fig. 11 guide rods 119 are attached to the reinforcing backing 118 and these rods 119 extend upwardly through bores 120 in the rectangular block 115. Bores 120 extend upwardly through bosses 121 which project from the upper surface of the block 115, bores 120 being closed at the upper end thereof except for apertures to permit passage of the guide rods 119. Disposed about the guide rods 119 within the bores 120 are compression springs 122, the upper end of which engages the upper surface of the ends of bores 120 and urge the squeegee 117 carried by the reinforcing backing 118 downwardly. Downward movement of the squeegee 117 is adjusted by nuts or other suitable means 123 received on the upper ends of guide rods 119.

An actuating bar 124 extends from one side of the block 115 and from each edge of the block 115 there extend guide pins 125. Guide pins 125 are adapted to be received in grooves 126 formed in the opposed faces of the side walls 127 of box 98. Grooves 126 as best shown in Figs. 9, 12, and 13 terminate at each end in enlarged recesses 128 and in each of these recesses there is pivotally mounted a gate member 129. Gate member 129 is normally urged into the position shown in Figs. 9 and 12 by a tension spring 130 connected to a pin 131 secured to each gate member 129 and projecting through an arcuate slot 132 in the side walls 127 of the box 98.

In the operation of the printing mechanism dye or printing paste is applied to the inner surface of the screen 99 and as the squeegee 114 moves back and forth over the screen, such paste or dye is forced through the design 102 in the screen 99 and imprints such design on the sock or other article disposed therebeneath. Obviously in this operation, if the squeegee 114 merely moved back and forth over the screen 99 the paste or ink would in a very short time become concentrated at each of the screen 99, and there would not be a sufficient quantity to provide a proper impression of the design 102. It is for this reason that the gate members 129 are provided, and as best shown in Figs. 12 and 13, these gate members operate to raise the squeegee 114 at each end of its stroke in order to pass over and move the ink or paste accumulated at that end of the screen 99 back across the screen in order to insure that there will always be a sufficient quantity to provide a proper impression of the design 102.

As shown in Fig. 12, the squeegee 114 is approaching the right-hand end of its extreme movement and in this position the guide pins 125 ride upwardly over the gate member 129 and through the recess 128 this action raising the squeegee 114 so that the blade 117 passes over the accumulated dye or printing paste at that end of the screen 99. Further movement of the squeegee 114 allows the pins 125 to pass downwardly within the recess 128 so that the blade 117 reengages the screen 99 to the rear of the accumulated printing paste or dye and movement in the opposite direction moves such paste or dye over the surface of the screen resulting in a proper impression of the design 102. During such return movement the pins 125 force the gate members 129 upwardly about their pivot points and against the action of springs 130 as shown in Fig. 13, and as soon as pins 125 have moved out of engagement with the gate members 129 they will return to the position shown in Fig. 12 by reason of the action of tension springs 130.

It will thus be seen that by the above described mechanism there has been provided means whereby the entire quantity of printing paste or dye which is applied to the upper surface of screen 99 will be utilized without accumulating unused portions thereof at each end of the screen, and this operation will continue until all of such printing paste has been utilized or until it is necessary to replenish the supply thereof.

As best shown in Figs. 1 and 2 the squeegee 114 may be conveniently operated by fluid pressure cylinders 96 and 97, these cylinders being supported in angular relation to each other upon a bracket 133 extending upwardly from the plate 15. Cylinder 96 is provided with a piston rod 134 extending therethrough, this piston rod being connected at each end through links 135 with squeegees 114 located in diametrically disposed boxes 98. Similarly cylinder 97 is provided with a piston rod 136 extending therethrough, this piston rod being connected by links 137 with squeegees 114 disposed in another pair of diametrically located boxes 98.

Fluid pressure for operating the pistons disposed within cylinders 96 and 97 may be supplied through a conduit 138, the supply of fluid pressure to the outer end of cylinder 96 and the inner end of cylinder 97 being controlled by a solenoid valve 139 and the exhaust from such ends of these cylinders being controlled by a solenoid valve 140. Valves 139 and 140 are connected to the outer end of cylinder 96 by a conduit 141, and to the inner end of cylinder 97 by a conduit 142. The supply of fluid pressure to the inner end of cylinder 96 and to the outer end of cylinder 97 is controlled by a solenoid valve 143, and the exhaust from such ends of these cylinders is controlled by solenoid valve 144. Valves 143 and 144 communicate with the inner end of cylinder 96 through conduit 145, and with the outer end of cylinder 97 through conduit 146.

As shown in Figs. 1 and 2, there is provided a sufficient number of dye applying means 95 to imprint a design in two colors, but obviously any desired number of printing means may be utilized when it is desired to apply a design having more than two colors. The operation, however, would be the same, and consequently, for the purposes of description and illustration, it is believed only necessary to disclose and describe a two-color printing mechanism.

For proper control of the printing mechanism, there may be provided on the plate 15 a limit

switch 147 which is operated by an arm 148 carried by the piston rod 134 and a second limit switch 149 which is operated by an arm 150 carried by the piston rod 136. The connections and operation of these limit switches 147 and 149 will be described in connection with the operation of the machine and a description of the control circuit therefor.

The plate 15 also serves to support control switches 151 and 152 which are operated by pins 153 extending upwardly from the upper surface of table 13, switches 151 and 152 being operated upon upward movement of this table, and the particular manner in which they control the operation of the machine will be presently described.

In Fig. 14 there is shown a sock 154 in which the cuff 155 thereof is applied over the outer end of the board 16, it being noted that the inner edge of the cuff is positioned in engagement with the marking line or gage 39 on the board 16. This results in proper positioning of the cuff 155 to receive a design 156 which is to be imprinted thereon. Fig. 15 shows the sock 154 with the first color of the design 156 printed thereon, and Fig. 16 shows the same sock with the complete design in two colors thereon.

The electrical control circuit for the printing apparatus is shown schematically in Fig. 17 and starting and stopping of the apparatus is controlled by a foot switch or other convenient means 157. As shown in Fig. 17 electrical current for actuation of the control means comprises line conductors 158 and 159, conductor 158 serving as a common return from solenoid valves 53, 54, 57, 58, 139, 140, 143 and 144.

Conductor 159 leads to one contact 160 of single pole, single throw foot switch 157, the other contact of this switch 161 being connected through conductor 162 with contacts 163 and 164 of double pole, double throw switch 59. Contact 165 of switch 59 is connected through conductor 166 with solenoid valves 54 and 57. The other contact 167 of switch 59 connects through conductor 168 with contact 169 of single pole, single throw switch 147 and with contact 170 of single pole, single throw switch 149. Contact 171 of switch 147 connects through conductor 172 with solenoid valves 53 and 58 and contact 173 of switch 149 connects through conductor 174 with these same solenoid valves 53 and 58.

The operation of solenoid valves 139, 140, 143 and 144 is controlled by single pole, single throw switches 151 and 152 which are actuated by pins 153 located on the table 13, these switches being actuated upon upward movement of table 13. As will be seen from Fig. 17 contact 175 of switch 151 and contact 176 of switch 152 are supplied with current through conductor 177 from line conductor 159. Contact 178 of switch 151 is connected through conductor 179 with solenoid valves 140 and 143 while contact 180 of switch 152 is connected through conductor 181 with solenoid valves 139 and 144.

In operation and assuming the table 13 to be in the extreme lowermost position and the piston rod 43 of cylinder 40 in uppermost position depression of the foot switch 157 will result in energizing solenoid 54 which will admit fluid pressure to the upper end of cylinder 40 and will likewise energize solenoid 57 which will permit exhaust of fluid from the lower end of cylinder 40. This will result in downward movement of piston 43 and upward movement of table 13. This is by reason of the fact that contacts 163

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and 165 of double pole, double throw switch 163 are closed and this switch will remain in this condition until table 13 reaches the uppermost limit of travel. Upon this condition being reached and assuming one of the pins 154 to be directly beneath the actuating plunger of switch 151 this switch will be closed to energize solenoid valves 140 and 143 which will admit fluid pressure to one end of cylinder 96 as well as one end of cylinder 97. This will cause movement of piston rods 134 and 136 to the right as viewed in Fig. 17 and at the same time due to the fact that arm 52 has reached its lowermost point of travel, switch 59 will operate to open contacts 163 and 164 thus deenergizing solenoid valves 54 and 57 and contacts 164 and 167 will be closed to supply current to contact 169 of switch 147 and contact 170 of switch 149.

Upon piston rods 134 and 136 reaching their limit of travel to the right as viewed in Fig. 17 at which time one printing operation will have been completed contacts 170 and 171 of switch 149 will close thus energizing solenoids 53 and 58 which will introduce fluid pressure to the lower end of cylinder 40 and permit exhaust of fluid pressure from the upper end of this cylinder. This will result in upward movement of piston 43 and downward movement of table 13. Upon downward movement of this table contacts 175 and 178 of switch 151 will open thus deenergizing solenoid valves 140 and 143 and as soon as table 13 reaches its lowermost point of travel and arm 62 reaches its uppermost point contacts 163 and 165 of switch 59 will be again closed to energize solenoid valves 54 and 57 thus causing table 13 to again move upwardly. Since during the cycle of operation above described, the table 13 has rotated in a clockwise direction the distance between adjacent boards 16 and the pin 153 which was formerly beneath the plunger of switch 151 has moved away from this position and the next succeeding pin will be positioned below the plunger of switch 152. Upon table 13 reaching its uppermost position contacts 176 and 180 of switch 152 will be closed thus energizing solenoid valves 139 and 144 which will result in piston rods 134 and 136 moving toward the left as viewed in Fig. 17 and upon completion of this movement contacts 169 and 171 of switch 147 will be closed to energize solenoid valves 53 and 58 which will again result in downward movement of the table 13. Assuming that the foot switch 157 is maintained in the depressed or closed condition the above described cycle of operations will continue indefinitely as long as desired. Upon release of the foot switch 157 operation of the apparatus will cease.

It will be seen that by the above described invention there has been provided a highly efficient printing apparatus for applying designs in as many colors as desired to the cuffs of socks or other fabric articles and in which it is only necessary for the operator to apply the cuffs of these socks to the boards 16, the location of such socks being determined by the line or gage marking 39 on the board 16, after which the foot switch or other control means 157 is actuated and the design is applied to the articles. These articles are automatically advanced and turned in order that all colors of the design may be applied to both sides of the socks. The only power that is required for the operation of the apparatus is air pressure in sufficient quantity to operate the cylinders 40, 96 and 97 and a low voltage, low current electrical supply for actuating the solenoid

valves which control the operation of these cylinders. The screen printing process utilized permits the application of many desired designs to the articles and in any variety of colors. The designs may be changed in a minimum of time by merely removing the boxes or dye applying mechanism 95 and changing the screens 99 thereon which carry the design. This is easily accomplished since a quick release mechanism for clamping the boxes 98 in place has been provided and suitable designs may be made up in advance in order to materially speed up the operation of changing designs and permitting substantially continuous production.

It will be obvious to those skilled in the art that various changes may be made in the invention without departing from the spirit and scope thereof and therefore the invention is not limited by that which is shown in the drawings and described in the specification but only as indicated in the appended claims.

What is claimed is:

1. Apparatus for design dyeing of fabric articles comprising in combination a base, a horizontal table rotatably and reciprocally mounted on said base for vertical movement, a pneumatic cylinder pivotally mounted on said base, a piston rod extending from said cylinder, linkage means connecting said piston rod and said table whereby upon reciprocation of said piston rod said table will be raised and lowered, solenoid valves for controlling the operation of said piston rod, a limit switch operable by said piston rod at each end of its stroke, a plurality of article supporting boards rotatably mounted about their longitudinal axes on said table and extending radially therefrom, a plate disposed above said table and supported by said base, means to rotate said table a distance equal to substantially one half the distance between adjacent boards during each upward movement of said table and to lock said table against rotation when in uppermost position comprising a series of annularly disposed spaced teeth depending from said plate, a beveled cam surface on the lower end of each depending tooth, an upwardly extending tooth on said table having a beveled cam surface on the upper end thereof whereby upon upward movement of said table said cam surfaces will engage to cause rotation of said table until said upwardly extending tooth moves into the space between adjacent depending teeth to lock said table against rotation, means to rotate said table a distance equal to substantially one half the distance between adjacent boards during each downward movement of said table comprising a series of annularly disposed teeth depending from said table, a beveled cam surface on the lower end of each of said last mentioned teeth and an upwardly extending tooth fixed to said base and end having a beveled cam surface on the upper end thereof whereby upon downward movement of said table said last mentioned cam surfaces will engage to cause rotation of said table, detent means for releasably retaining each board against rotation about its longitudinal axis in either of two positions spaced 180° apart, means to partially rotate said boards comprising a collar secured to each board adjacent the inner end thereof, diametrically disposed notches in each collar, an upwardly extending tooth carried by said base and engageable with one of said notches upon downward movement of said table to partially rotate the associated board, means to complete the rotation of said boards through 180°

comprising a substantially horizontal track movable up and down with said table but non-rotatable therewith, said track being disposed below the longitudinal axes of said boards and having a downwardly curved leading end engageable with said partially rotated boards whereby upon rotation of said table the engagement of said track with said partially rotated boards will complete the rotation thereof through 180°, dye applying means comprising a plurality of diametrically disposed boxes supported by said plate above said boards, a screen secured to each box and forming the bottom thereof, said screen being coated with a material impervious to the dye except in a portion forming the outline of the design to be applied, a squeegee reciprocally mounted in each box and engaging the upper surface of said screen, means for raising said squeegee out of contact with said screen as it approaches each end of its stroke and for causing reengagement with said screen at each end of its stroke whereby said dye will be prevented from collecting at each end of said box, means to reciprocate said squeegees comprising a pneumatic cylinder for each diametrically disposed pair, a piston rod extending through each cylinder and connected to diametrically disposed squeegees, solenoid valves for controlling the operation of said cylinders, a limit switch electrically connected to said first mentioned limit switch and operable by each of said last mentioned piston rods for controlling the operation of said first mentioned solenoid valves, spaced switches mounted on said plate for controlling the operation of said last mentioned solenoid valves, a series of annularly disposed upstanding pins on said table for actuating said last mentioned switches and shoes disposed beneath said boxes and said boards to prevent undue deflection of said boards whereby upon upward movement of said table articles carried by said boards will engage the lower surfaces of said screens and said squeegees will move across said screens to force dye therethrough and apply said design to said articles.

2. Apparatus for design dyeing of fabric articles comprising in combination a base, a horizontal table rotatably and reciprocally mounted on said base for vertical movement, a pneumatic cylinder pivotally mounted on said base, a piston rod extending from said cylinder, linkage means connecting said piston rod and said table whereby upon reciprocation of said piston rod said table will be raised and lowered, solenoid valves for controlling the operation of said piston rod, a limit switch operable by said piston rod at each end of its stroke, a plurality of article supporting boards rotatably mounted about their longitudinal axes on said table and extending radially therefrom, a plate disposed above said table and supported by said base, means to rotate said table a distance equal to substantially one half the distance between adjacent boards during each upward movement of said table and to lock said table against rotation when in uppermost position comprising a series of annularly disposed spaced teeth depending from said plate, a beveled cam surface on the lower end of each depending tooth, an upwardly extending tooth on said table having a beveled cam surface on the upper end thereof whereby upon upward movement of said table said cam surfaces will engage to cause rotation of said table until said upwardly extending tooth moves into the space between adjacent depending teeth to lock said table against rotation, means

to rotate said table a distance equal to substantially one half the distance between adjacent boards during each downward movement of said table comprising a series of annularly disposed teeth depending from said table, a beveled cam surface on the lower end of each of said last mentioned teeth and an upwardly extending tooth fixed to said base and having a beveled cam surface on the upper end thereof whereby upon downward movement of said table said last mentioned cam surfaces will engage to cause rotation of said table, detent means for releasably retaining each board against rotation about its longitudinal axis in either of two positions spaced 180° apart, means to partially rotate said boards comprising a collar secured to each board adjacent the inner end thereof, diametrically disposed notches in each collar, an upwardly extending tooth carried by said base and engageable with one of said notches upon downward movement of said table to partially rotate the associated board, means to complete the rotation of said boards through 180° comprising a substantially horizontal track movable up and down with said table but non-rotatable therewith, said track being disposed below the longitudinal axes of said boards and having a downwardly curved leading end engageable with said partially rotated boards whereby upon rotation of said table the engagement of said track with said partially rotated boards will complete the rotation thereof through 180°, dye applying means comprising a plurality of diametrically disposed boxes supported by said plate above said boards, a screen secured to each box and forming the bottom thereof, said screen being coated with a material impervious to the dye except in a portion forming the outline of the design to be applied, a squeegee reciprocally mounted on each box and engaging the upper surface of said screen, means for raising said squeegee out of contact with said screen as it approaches each end of its stroke and for causing reengagement with said screen at each end of its stroke whereby said dye will be prevented from collecting at each end of said box, means to reciprocate said squeegees comprising a pneumatic cylinder for each diametrically disposed pair, a piston rod extending through each cylinder and connected to diametrically disposed squeegees, solenoid valves for controlling the operation of said cylinders, a limit switch electrically connected to said first mentioned limit switch and operable by each of said last mentioned piston rods for controlling the operation of said first mentioned solenoid valves, spaced switches mounted on said plate for controlling the operation of said last mentioned solenoid valves and a series of annularly disposed upstanding pins on said table for actuating said last mentioned switches whereby upon upward movement of said table articles carried by said boards will engage the lower surfaces of said screens and said squeegees will move across said screens to force dye therethrough and apply said design to said articles.

3. Apparatus for design dyeing of fabric articles comprising in combination a base, a horizontal table rotatably and reciprocally mounted on said base for vertical movement, a fluid pressure cylinder pivotally mounted on said base, a piston rod extending from said cylinder, linkage means connecting said piston rod and said table whereby upon reciprocation of said piston rod said table will be raised and lowered, solenoid valves for controlling the operation of said pis-

ton rod, a limit switch operable by said piston rod at each end of its stroke, a plurality of article supporting boards rotatably mounted about their longitudinal axes on said table and extending radially therefrom, a plate disposed above said table and supported by said base, means to rotate said table a distance equal to substantially one half the distance between adjacent boards during each upward movement of said table and to lock said table against rotation when in uppermost position comprising a series of annularly disposed spaced teeth depending from said plate, a beveled cam surface on the lower end of each depending tooth, an upwardly extending tooth on said table having a beveled cam surface on the upper end thereof whereby upon upward movement of said table said cam surfaces will engage to cause rotation of said table until said upwardly extending tooth moves into the space between the adjacent depending teeth to lock said table against rotation, means to rotate said table a distance equal to substantially one-half the distance between adjacent boards during each downward movement of said table comprising a series of annularly disposed teeth depending from said table, a beveled cam surface on the lower end of each of said last mentioned teeth and an upwardly extending tooth fixed to said base and having a beveled cam surface on the upper end thereof whereby upon downward movement of said table said last mentioned cam surfaces will engage to cause rotation of said table, detent means for releasably retaining each board against rotation about its longitudinal axis in either of two positions spaced 180° apart, means to partially rotate said boards comprising a collar secured to each board adjacent the inner end thereof, diametrically disposed notches in each collar, an upwardly extending tooth carried by said base and engageable with one of said notches upon downward movement of said table to partially rotate the associated board, mean to complete the rotation of said boards through 180° comprising a substantially horizontal track movable up and down with said table but non-rotatable therewith, said track being disposed below the longitudinal axes of said boards and having a downwardly curved leading end engageable with said partially rotated boards whereby upon rotation of said table the engagement of said track with said partially rotated boards will complete the rotation thereof through 180°, dye applying means comprising a plurality of diametrically disposed boxes supported by said plate above said board, a screen secured to each box and forming the bottom thereof, said screen being coated with a material impervious to the dye except in a portion forming the outline of the design to be applied, a squeegee reciprocally mounted in each box and engaging the upper surface of said screen, means for raising said squeegee out of contact with said screen as it approaches each end of its stroke and for causing reengagement of said screen at each end of its stroke whereby said dye will be prevented from collecting at each end of said box, means to reciprocate said squeegees comprising a fluid pressure cylinder for each diametrically disposed pair, a piston rod extending through each cylinder and connected to diametrically disposed squeegees, solenoid valves for controlling the operation of said cylinders, a limit switch electrically connected to said first mentioned limit switch and operable by each of said last mentioned piston rods for controlling

the operation of said first mentioned solenoid valves, spaced switches mounted on said plate for controlling the operation of said last mentioned solenoid valves and a series of annularly disposed upstanding pins on said table for actuating said last mentioned switches whereby upon upward movement of said table articles carried by said boards will engage the lower surfaces of said screens and said squeegees will move across said screens to force dye therethrough and apply said design to said articles.

4. Apparatus for design dyeing of fabric articles comprising in combination a base, a horizontal table rotatably and reciprocally mounted on said base for vertical movement, a fluid pressure cylinder mounted on said base, a piston rod extending from said cylinder and connected to said table whereby upon reciprocation of said piston rod said table will be raised and lowered, solenoid valves for controlling the operation of said piston rod, a limit switch operable by said piston rod at each end of its stroke, a plurality of article supporting boards rotatably mounted about their longitudinal axes on said table and extending radially therefrom, a plate disposed above said table, means to rotate said table a distance equal to substantially one-half the distance between adjacent boards during each upward movement of said table and to lock said table against rotation when in uppermost position comprising a series of annularly disposed spaced teeth depending from said plate, a beveled cam surface on the lower end of each depending tooth, an upwardly extending tooth on said table having a beveled cam surface on the upper end thereof whereby upon upward movement of said table said cam surfaces will engage to cause rotation of said table until said upwardly extending tooth moves into the space between the adjacent depending teeth to lock said table against rotation, means to rotate said table a distance equal to substantially one-half the distance between adjacent boards during each downward movement of said table comprising a series of annularly disposed teeth depending from said table, a beveled cam surface on the lower end of each of said last mentioned teeth and an upwardly extending tooth fixed to said base and having a beveled cam surface on the upper end thereof whereby upon downward movement of said table said last mentioned cam surfaces will engage to cause rotation of said table, means for releasably retaining each board against rotation about its longitudinal axes in either of two positions spaced 180° apart, means to partially rotate said boards comprising a collar secured to each board adjacent the inner end thereof, diametrically disposed notches in each collar, an upwardly extending tooth carried by said base and engageable with one of said notches upon downward movement of said table to partially rotate the associated board, means to complete the rotation of said boards through 180° comprising a substantially horizontal track movable up and down with said table but non-rotatable therewith, said track being disposed below the longitudinal axes of said board and having a downwardly curved leading end engageable with said partially rotated boards whereby upon rotation of said table the engagement of said track with said partially rotated boards will complete the rotation thereof through 180°, dye applying means comprising a plurality of diametrically disposed boxes supported by said plate above said board, a screen secured to

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each box and forming the bottom thereof, said screen being coated with a material impervious to the dye except in a portion forming the outline of the design to be applied, a squeegee reciprocally mounted in each box and engaging the upper surface of said screen, means for raising said squeegee out of contact with said screen as it approaches each end of its stroke and for causing reengagement with said screen at each end of its stroke whereby said dye will be prevented from collecting at each end of said box, means to reciprocate said squeegees comprising a fluid pressure cylinder for each diametrically disposed pair, a piston rod extending through each cylinder and connected to diametrically disposed squeegees, solenoid valves for controlling the operation of said cylinders, a limit switch electrically connected to said first mentioned limit switch and operable by each of said last mentioned piston rods for controlling the operation of said first mentioned solenoid valves, spaced switches mounted on said plate for controlling the operation of said last mentioned solenoid valves and a series of annularly disposed upstanding pins on said table for actuating said last mentioned switches whereby upon upward movement of said table articles carried by said boards will engage the lower surfaces of said screens and said squeegees will move across said screens to force dye therethrough and apply said design to said articles.

5. Apparatus for design dyeing of fabric articles comprising in combination a base, a horizontal table rotatably and reciprocally mounted on said base for vertical movement, a fluid pressure cylinder mounted on said base, a piston rod extending from said cylinder and connected to said table whereby upon reciprocation of said piston rod said table will be raised and lowered, solenoid valves for controlling the operation of said piston rod, a limit switch operable by said piston rod at each end of its stroke, a plurality of article supporting boards rotatably mounted about their longitudinal axes on said table and extending radially therefrom, a plate disposed above said table, means to rotate said table a distance equal to substantially one half the distance between adjacent boards during each upward movement of said table and to lock said table against rotation when in uppermost position comprising a series of annularly disposed spaced teeth depending from said plate, a beveled cam surface on the lower end of each depending tooth, an upwardly extending tooth on said table having a beveled cam surface on the upper end thereof whereby upon upward movement of said table said cam surfaces will engage to cause rotation of said table until said upwardly extending tooth moves into the space between the adjacent depending teeth to lock said table against rotation, means to rotate said table a distance equal to substantially one half the distance between adjacent boards during each downward movement of said table comprising a series of annularly disposed teeth depending from said table, a beveled cam surface on the lower end of each of said last mentioned teeth and an upwardly extending tooth fixed to said base and having a beveled cam surface on the upper end thereof whereby upon downward movement of said table said last mentioned cam surfaces will engage to cause rotation of said table, means for releasably retaining each board against rotation about its longitudinal axes in either of two positions spaced 180° apart, means operable

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upon downward movement of said table to partially rotate one of said boards, means to complete the rotation of said board through 180° comprising a substantially horizontal track movable up and down with said table but non-rotatable therewith, said track being disposed below the longitudinal axes of said boards and engageable with said partially rotated boards whereby upon rotation of said table engagement of said track with said partially rotated boards will complete the rotation thereof through 180°, dye applying means comprising a plurality of diametrically disposed boxes supported by said plate above said board, a screen secured to each box and forming the bottom thereof, said screen being coated with a material impervious to the dye except in a portion forming the outline of the design to be applied, a squeegee reciprocally mounted in each box and engaging the upper surface of said screen, means for raising said squeegee out of contact with said screen as it approaches each end of its stroke and for causing reengagement with said screen at each end of its stroke whereby said dye will be prevented from collecting at each end of said box, means to reciprocate said squeegees comprising a fluid pressure cylinder for each diametrically disposed pair, a piston rod extending through each cylinder and connected to diametrically disposed squeegees, solenoid valves for controlling the operation of said cylinders, a limit switch electrically connected to said first mentioned limit switch and operable by each of said last mentioned piston rods for controlling the operation of said first mentioned solenoid valves, spaced switches mounted on said plate for controlling the operation of said last mentioned solenoid valves and a series of annularly disposed upstanding pins on said table for actuating said last mentioned switches whereby upon upward movement of said table articles carried by said boards will engage the lower surfaces of said screens and said squeegees will move across said screens to force dye therethrough and apply said design to said articles.

6. Apparatus for design dyeing of fabric articles comprising in combination a base, a horizontal table rotatably and reciprocally mounted on said base for vertical movement, a fluid pressure cylinder mounted on said base, a piston rod extending from said cylinder and connected to said table whereby upon reciprocation of said piston rod said table will be raised and lowered, solenoid valves for controlling the operation of said piston rod, a limit switch operable by said piston rod at each end of its stroke, a plurality of article supporting boards rotatably mounted about their longitudinal axes on said table and extending radially therefrom, a plate disposed above said table, means to rotate said table a distance equal to substantially one half the distance between adjacent boards during each upward movement of said table and to lock said table against rotation when in uppermost position comprising a series of annularly disposed spaced teeth depending from said plate, a beveled cam surface on the lower end of each depending tooth, an upwardly extending tooth on said table having a beveled cam surface on the upper end thereof whereby upon upward movement of said table said cam surfaces will engage to cause rotation of said table until said upwardly extending tooth moves into the space between adjacent depending teeth to lock said table against rotation, means to rotate said table a distance

equal to substantially one half the distance between adjacent boards during each downward movement of said table comprising a series of annularly disposed teeth depending from said table, a beveled cam surface on the lower end of each of said last mentioned teeth and an upwardly extending tooth fixed to said base and having a beveled cam surface on the upper end thereof whereby upon downward movement of said table said last mentioned cam surfaces will engage to cause rotation of said table, means for releasably retaining each board against rotation about its longitudinal axis in either of two positions spaced 180° apart, means operable upon downward movement of said table to partially rotate one of said boards, means engageable with said boards to complete the rotation thereof through 180°, dye applying means comprising a plurality of diametrically disposed boxes supported by said plate above said boards, a screen forming the bottom of each box, said screen being coated with a material impervious to the dye except in a portion forming the outline of the design to be applied, a squeegee reciprocally mounted in each box and engaging the upper surface of said screen, means for raising said squeegee out of contact with said screen as it approaches each end of its stroke and for causing reengagement with said screen at each end of its stroke whereby said dye will be prevented from collecting at each end of said box, means to reciprocate said squeegees comprising a fluid pressure cylinder for each diametrically disposed pair, a piston rod extending through each cylinder and connected to diametrically disposed squeegees, solenoid valves for controlling the operation of said cylinders, a limit switch electrically connected to said first mentioned limit switch and operable by each of said last mentioned piston rods for controlling the operation of said first mentioned solenoid valves, spaced switches mounted on said plate for controlling the operation of said last mentioned solenoid valves and a series of annularly disposed upstanding pins on said table for actuating said last mentioned switches whereby upon upward movement of said table articles carried by said boards will engage the lower surfaces of said screens and said squeegees will move across said screens to force dye therethrough and apply said design to said articles.

7. Apparatus for design dyeing of fabric articles comprising in combination a base, a horizontal table rotatably and reciprocally mounted on said base for vertical movement, a fluid pressure cylinder mounted on said base, a piston rod extending from said cylinder and connected to said table whereby upon reciprocation of said piston rod said table will be raised and lowered, a plurality of article supporting boards rotatably mounted about their longitudinal axes on said table and extending radially therefrom, a plate disposed above said table, means to rotate said table a distance equal to substantially one half the distance between adjacent boards during each upward movement of said table and to lock said table against rotation when in uppermost position comprising a series of annularly disposed spaced teeth depending from said plate, a beveled cam surface on the lower end of each depending tooth, an upwardly extending tooth on said table having a beveled cam surface on the upper end thereof whereby upon upward movement of said table said cam surfaces will engage to cause rotation of said table until said

upwardly extending tooth moves into the space between adjacent depending teeth to lock said table against rotation, means to rotate said table a distance equal to substantially one half the distance between adjacent boards during each downward movement of said table comprising a series of annularly disposed teeth depending from said table, a beveled cam surface on the lower end of each of said last mentioned teeth and an upwardly extending tooth fixed to said base and having a beveled cam surface on the upper end thereof whereby upon downward movement of said table said last mentioned cam surfaces will engage to cause rotation of said table, means for releasably retaining each board against rotation about its longitudinal axes in either of two positions spaced 180° apart, means operable upon downward movement of said table to partially rotate one of said boards, means engageable with said boards to complete the rotation thereof through 180° during rotation of said table, dye applying means comprising a plurality of diametrically disposed boxes supported by said plate above said boards, a screen forming the bottom of each box, said screen being coated with a material impervious to the dye except in a portion forming the outline of the design to be applied, a squeegee reciprocally mounted in each box and engaging the upper surface of said screen, means for raising said squeegee out of contact with said screen as it approaches each end of its stroke and for causing reengagement with said screen at each end of its stroke whereby said dye will be prevented from collecting at each end of said box, means to reciprocate said squeegees comprising a fluid pressure cylinder for each diametrically disposed pair, a piston rod extending through each cylinder and connected to diametrically disposed squeegees and means to control the up and down movement of said table and the reciprocation of said squeegees whereby upon upward movement of said table articles carried by said boards will engage the lower surfaces of said screens and said squeegees will move across said screens to force dye therethrough and apply said design to said articles.

8. Apparatus for design dyeing of fabric articles comprising in combination a base, a horizontal table rotatably and reciprocally mounted on said base for vertical movement, a fluid pressure cylinder mounted on said base, a piston rod extending from said cylinder and connected to said table whereby upon reciprocation of said piston rod said table will be raised and lowered, a plurality of article supporting boards rotatably mounted about their longitudinal axes on said table and extending radially therefrom, a plate disposed above said table, means to rotate said table a distance equal to substantially one half the distance between adjacent boards during each upward movement of said table and to lock said table against rotation when in uppermost position comprising a series of annularly disposed spaced teeth depending from said plate, a beveled cam surface on the lower end of each depending tooth, an upwardly extending tooth on said table having a beveled cam surface on the upper end thereof whereby upon upward movement of said table said cam surfaces will engage to cause rotation of said table until said upwardly extending tooth moves into the space between adjacent depending teeth to lock said table against rotation, means to rotate said table a distance equal to substantially one half the distance between adjacent boards during each downward move-

ment of said table comprising a series of annularly disposed teeth depending from said table, a beveled cam surface on the lower end of each of said last mentioned teeth and an upwardly extending tooth fixed to said base and having a beveled cam surface on the upper end thereof whereby upon downward movement of said table said last mentioned cam surfaces will engage to cause rotation of said table, means for releasably retaining each board against rotation about its longitudinal axes in either of two positions spaced 180° apart, means operable upon downward movement of said table to partially rotate one of said boards, means engageable with said boards to complete the rotation thereof through 180°, dye applying means comprising a plurality of diametrically disposed boxes supported by said plate above said boards, a screen forming the bottom of each box, said screen being coated with a material impervious to the dye except in a portion forming the outline of the design to be applied, a squeegee reciprocally mounted in each box and engaging the upper surface of said screen, means for raising said squeegee out of contact with said screen as it approaches each end of its stroke and for causing reengagement with said screen at each end of its stroke whereby said dye will be prevented from collecting at each end of said box, means to reciprocate said squeegees and means to control the up and down movement of said table and the reciprocation of said squeegees whereby upon upward movement of said table articles carried by said boards will engage the lower surfaces of said screens and said squeegees will move across said screens to force dye therethrough and apply said design to said articles.

9. Apparatus for design dyeing of fabric articles comprising in combination a base, a horizontal table rotatably and reciprocally mounted on said base for vertical movement, means to raise and lower said table, a plurality of article supporting boards rotatably mounted about their longitudinal axes on said table and extending radially therefrom, a plate disposed above said table, means to rotate said table a distance equal to substantially one half the distance between adjacent boards during each upward movement of said table and to lock said table against rotation when in uppermost position comprising a series of annularly disposed spaced teeth depending from said plate, a beveled cam surface on the lower end of each depending tooth, an upwardly extending tooth on said table having a beveled cam surface on the upper end thereof whereby upon upward movement of said table said cam surfaces will engage to cause rotation of said table until said upwardly extending tooth moves into the space between adjacent depending teeth to lock said table against rotation, means to rotate said table a distance equal to substantially one half the distance between adjacent boards during each downward movement of said table comprising a series of annularly disposed teeth depending from said table, a beveled cam surface on the lower end of each of said last mentioned teeth and an upwardly extending tooth fixed to said base and having a beveled cam surface on the upper end thereof whereby upon downward movement of said table said last mentioned cam surfaces will engage to cause rotation of said table, means for releasably retaining each board against rotation about its longitudinal axes in either of two positions spaced 180° apart, means operable upon downward movement of

said table to partially rotate one of said boards, means engageable with said boards to complete the rotation thereof through 180°, dye applying means comprising a plurality of diametrically disposed boxes supported by said plate above said boards, a screen forming the bottom of each box, said screen being coated with a material impervious to the dye except in a portion forming the outline of the design to be applied, a squeegee reciprocally mounted in each box and engaging the upper surface of said screen, means for raising said squeegee out of contact with said screen as it approaches each end of its stroke and for causing reengagement with said screen at each end of its stroke whereby said dye will be prevented from collecting at each end of said box, means to reciprocate said squeegees and means to control the up and down movement of said table and the reciprocation of said squeegees whereby upon upward movement of said table articles carried by said boards will engage the lower surfaces of said screens and said squeegees will move across said screens to force dye therethrough and apply said design to said articles.

10. Apparatus for design dyeing of fabric articles comprising in combination a base, a horizontal table rotatably and reciprocally mounted on said base for vertical movement, means to raise and lower said table, a plurality of article supporting boards rotatably mounted on said table and extending radially therefrom, a plate exposed above said table, means to rotate said table during each upward movement thereof and to lock said table against rotation when in uppermost position comprising a series of annularly disposed spaced teeth depending from said plate, a beveled cam surface on the lower end of each depending tooth, an upwardly extending tooth on said table having a beveled cam surface on the upper end thereof whereby upon upward movement of said table said cam surfaces will engage to cause rotation of said table until said upwardly extending tooth moves into the space between adjacent depending teeth to lock said table against rotation, means to rotate said table during each downward movement thereof comprising a series of annularly disposed teeth depending from said table, a beveled cam surface on the lower end of each of said last mentioned teeth and an upwardly extending tooth fixed to said base and having a beveled cam surface on the upper end thereof whereby upon downward movement of said table said last mentioned cam surfaces will engage to cause rotation of said table, means for releasably retaining each board against rotation about its longitudinal axes in either of two positions spaced 180° apart, means operable upon downward movement of said table to partially rotate one of said boards, means engageable with said boards to complete the rotation thereof through 180°, dye applying means comprising a plurality of diametrically disposed boxes supported by said plate above said boards, a screen forming the bottom of each box, said screen being coated with a material impervious to the dye except in a portion forming the outline of the design to be applied, a squeegee reciprocally mounted in each box and engaging the upper surface of said screen, means for raising said squeegee out of contact with said screen as it approaches each end of its stroke and for causing reengagement with said screen at each end of its stroke whereby said dye will be prevented from collecting at each end of said box, means to reciprocate said squeegees and means to control

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the up and down movement of said table and reciprocation of said squeegees whereby upon upward movement of said table articles carried by said boards will engage the lower surfaces of said screens and said squeegees will move across said screens to force dye thereto and apply said design to said articles.

11. Apparatus for design dyeing fabric articles comprising in combination a base, a horizontal table rotatably and reciprocally mounted on said base for vertical movement, means to raise and lower said table, a plurality of article supporting boards rotatably mounted on said table and extending radially therefrom, a plate disposed above said table, means to rotate said table during each upward movement thereof and to lock said table against rotation when in uppermost position comprising a series of annularly disposed spaced teeth depending from said plate, a beveled cam surface on the lower end of each depending tooth, an upwardly extending tooth on said table having a beveled cam surface on the upper end thereof whereby upon upward movement of said table said cam surfaces will engage to cause rotation of said table until said upwardly extending tooth moves into the space between adjacent depending teeth to lock said table against rotation, means to rotate said table during each downward movement thereof comprising a series of annularly disposed teeth depending from said table, a beveled cam surface on the lower end of each of said last mentioned teeth and an upwardly extending tooth fixed to said base and having a beveled cam surface on the upper end thereof whereby upon downward movement of said table said last mentioned cam surfaces will engage to cause rotation of said table, means operable upon downward movement of said table and rotation thereof to rotate said boards through 180°, dye applying means comprising a plurality of diametrically disposed boxes supported by said plate above said boards, a screen forming the bottom of each box, said screen being coated with a material impervious to the dye except in a portion forming the outline of the design to be applied, a squeegee reciprocally mounted in each box and engaging the upper surface of said screen, means for raising said squeegee out of contact with said screen as it approaches each end of its stroke and for causing reengagement with said screen at each end of its stroke whereby said dye will be prevented from collecting at each end of said box, means to reciprocate said squeegees and means to control the up and down movement of said table and the reciprocation of said squeegees whereby upon upward movement of said table articles carried by said boards will engage the lower surfaces of said screens and said squeegees will move across said screens to force dye therethrough and apply the said design to said articles.

12. Apparatus for design dyeing of fabric articles comprising in combination a base, a horizontal table rotatably and reciprocally mounted on said base for vertical movement, means to raise and lower said table, a plurality of article supporting boards rotatably mounted on said table and extending radially therefrom, a plate disposed above said table, means to rotate said table during each upward movement thereof and to lock said table against rotation when in uppermost position comprising a series of annularly disposed spaced teeth depending from said plate, a beveled cam surface on the lower end of each depending tooth, an upwardly extending tooth

on said table having a beveled cam surface on the upper end thereof whereby upon upward movement of said table said cam surfaces will engage to cause rotation of said table until said upwardly extending tooth moves into the space between the adjacent depending teeth to lock said table against rotation, means to rotate said table during each downward movement thereof comprising a series of annularly disposed teeth depending from said table, a beveled cam surface on the lower end of each of said last mentioned teeth and an upwardly extending tooth fixed to said base and having a beveled cam surface on the upper end thereof whereby upon downward movement of said table said last mentioned cam surfaces will engage to cause rotation of said table, means operable upon downward movement of said table and rotation thereof to rotate said boards through 180°, dye applying means comprising a plurality of diametrically disposed boxes supported by said plate above said boards, a screen forming the bottom of each box, said screen being coated with a material impervious to the dye except in a portion forming the outline of the design to be applied, a squeegee reciprocally mounted in each box and engaging the upper surface of said screen, means to reciprocate said squeegees and means to control the up and down movement of said table and the reciprocation of said squeegees whereby upon upward movement of said table articles carried by said boards will engage the lower surfaces of said screens and said squeegees will move across said screens to force dye therethrough and apply said design to said articles.

13. Apparatus for design dyeing of fabric articles comprising in combination a base, a horizontal table rotatably and reciprocally mounted on said base for vertical movement, means to raise and lower said table, a plurality of article supporting boards rotatably mounted on said table and extending radially therefrom, means to rotate said table a distance equal to substantially one half the distance between adjacent boards during each upward movement of said table and to lock said table against rotation when in uppermost position, means to rotate said table a distance equal to substantially one half the distance between adjacent boards during each downward movement of said table, means operable upon downward movement of said table and rotation thereof to rotate said boards through 180°, dye applying means comprising a plurality of diametrically disposed boxes disposed above said boards, a screen forming the bottom of each box, said screen being coated with a material impervious to the dye except in a portion forming the outline of the design to be applied, a squeegee reciprocally mounted in each box and engaging the upper surface of said screen, means to reciprocate said squeegees and means to control the up and down movement of said table and the reciprocation of said squeegees whereby upon upward movement of said table articles carried by said boards will engage the lower surfaces of said screens and said squeegees will move across said screens to force dye therethrough and apply said design to said articles.

14. Apparatus for design dyeing of fabric articles comprising in combination a base, a horizontal table rotatably and reciprocally mounted on said base for vertical movement, means to raise and lower said table, a plurality

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of article supporting boards rotatably mounted on said table and extending radially therefrom, means to rotate said table during each upward movement thereof and to lock said table against rotation when in uppermost position, means to rotate said table during each downward movement thereof, means operable upon downward movement of said table and rotation thereof to rotate said boards through 180°, dye applying means comprising a plurality of diametrically disposed boxes disposed above said boards, a screen forming the bottom of each box, said screen being coated with a material impervious to the dye except in the portion forming the outline of the design to be applied, a squeegee reciprocally mounted in each box and engaging the upper surface of said screen, means to reciprocate said squeegees and means to control the up and down movement of said table and the reciprocation of said squeegees whereby upon upward movement of said table articles carried by said boards will engage the lower surfaces of said screens and said squeegees will move across said screens to force dye therethrough and apply said design to said articles.

15. An apparatus for design dyeing of fabric articles as defined in claim 14 in which said boards are provided with a band of contrasting color to indicate the proper position of said articles thereon.

16. For use in an apparatus for design dyeing of fabric articles, a dye applying means comprising a box having sidewalls and end walls, a screen secured to said box and forming the bottom thereof, said screen being coated with a material impervious to the dye except in a portion forming the outline of the design to be applied, a horizontal groove in the inner faces of said sidewalls, said grooves terminating at each end in enlarged recesses, wedge-shaped gate members pivotally mounted in each recess, resilient means for biasing said gate members into engagement with the lower surfaces of said grooves, a squeegee disposed in said box and comprising a rectangular block, pins extending from opposite edges of said block and slidably disposed in said grooves, a groove in the lower edge of said block, a flexible blade slidably disposed in said last mentioned groove, resilient means urging said blade outwardly of said last mentioned groove and into engagement with said screen and means to limit outward movement of said blade whereby upon movement of said squeegee in one direction said pins will ride up and over said gate members to raise said blade out of contact with said screen said pins moving downwardly within said recesses to cause reengagement of said blade with said screen and upon movement of said squeegee in the opposite direction said pins will slide on the lower surfaces of said grooves and move said gate members out of the way against the action of said first mentioned resilient means whereby said dye will be prevented from collecting at each end of said box.

17. For use in an apparatus for design dyeing of fabric articles, a dye applying means comprising a box having sidewalls and end walls, a screen secured to said box and forming the bottom thereof, said screen being coated with a material impervious to the dye except in a portion forming the outline of the design to be applied, a horizontal groove in the inner faces of said sidewalls, said grooves terminating at each end in enlarged recesses, gate members

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mounted in each recess, resilient means for biasing said gate members into engagement with the lower surfaces of said grooves, a squeegee disposed in said box and comprising a rectangular block, pins extending from opposite edges of said block and slidably disposed in said grooves, a groove in the lower edge of said block, a flexible blade slidably disposed in said last mentioned groove, resilient means urging said blade outwardly of said last mentioned groove and into engagement with said screen and means to limit outward movement of said blade whereby upon movement of said squeegee in one direction said pins will ride up and over said gate members to raise said blade out of contact with said screen said pins moving downwardly within said recesses to cause reengagement of said blades with said screen and upon movement of said squeegee in the opposite direction said pins will slide on the lower surfaces of said grooves and move said gate members out of the way against the action of said first mentioned resilient means whereby said dye will be prevented from collecting at each end of said box.

18. For use in an apparatus for design dyeing of fabric articles, a dye applying means comprising a box having sidewalls and end walls, a screen secured to said box and forming the bottom thereof, said screen being coated with a material impervious to the dye except in a portion forming the outline of the design to be applied, a horizontal groove in the inner faces of said sidewalls, said grooves terminating at each end in enlarged recesses, gate members mounted in each recess, resilient means for biasing said gate members into engagement with the lower surfaces of said grooves, a squeegee disposed in said box and comprising a block, pins extending from opposite edges of said block and slidably disposed in said grooves, a flexible blade carried by said block, resilient means urging said blade outwardly of said block and into engagement with said screen and means to limit outward movement of said blade whereby upon movement of said squeegee in one direction said pins will ride up and over said gate members to raise said blade out of contact with said screen said pins moving downwardly within said recesses to cause reengagement of said blade with said screen and upon movement of said squeegee in the opposite direction said pins will slide on the lower surfaces of said grooves and move said gate members out of the way against the action of said first mentioned resilient means whereby said dye will be prevented from collecting at each end of said box.

19. For use in an apparatus for design dyeing of fabric articles, a dye applying means comprising a box having side walls and end walls, a screen secured to said box and forming a bottom thereof, said screen being coated with a material impervious to the dye except in a portion forming the outline of the design to be applied, a horizontal groove in the inner faces of said side walls, said grooves terminating at each end in enlarged recesses, gate members mounted in each recess, resilient means for biasing said gate members into engagement with the lower surfaces of said grooves, a squeegee disposed in said box and comprising a block, pins extending from opposite edges of said block and slidably disposed in said grooves, a flexible blade carried by said block and engaging said screen whereby upon movement of said squeegee in one direction said pins will ride up and over said gate members to raise said

blade out of contact with said screen said pins moving downwardly within said recesses to cause reengagement of said blade with said screen and upon movement of said squeegee in the opposite direction said pins will slide on the lower surfaces of said grooves and move said gate members out of the way against the action of said resilient means whereby said dye will be prevented from collecting at each end of said box.

20. For use in an apparatus for design dyeing of fabric articles, a dye applying means comprising a box having side walls and end walls, a screen secured to said box and forming the bottom thereof, said screen being coated with a material impervious to the dye except in a portion forming the outline of the design to be applied, a horizontal groove in the inner faces of said side walls, said grooves terminating at each end in enlarged recesses, gate members mounted in each recess and normally engaging the lower surfaces of said grooves, a squeegee disposed in said box and comprising a block, pins extending from opposite edges of said block and slidably disposed in said

grooves, a flexible blade carried by said block and engaging said screen whereby upon movement of said squeegee in one direction said pins will ride up and over said gate members to raise said blade out of contact with said screen said pins moving downwardly within said recesses to cause reengagement of said blade with said screen and upon movement of said squeegee in the opposite direction said pins will slide on the lower surfaces of said grooves and move said gate members out of the way whereby said dye will be prevented from collecting at each end of said box.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

| Number    | Name             | Date          |
|-----------|------------------|---------------|
| 1,029,544 | Horvath          | June 11, 1912 |
| 1,815,021 | Bland            | July 14, 1931 |
| 2,462,376 | Fleischer et al. | Feb. 22, 1949 |
| 2,462,447 | Wellborn         | Feb. 22, 1949 |
| 2,485,289 | Jane             | Oct. 18, 1949 |
| 2,571,685 | D'Autremont      | Oct. 16, 1951 |