

[54] DYEING APPARATUS

[75] Inventor: Myron E. Leslie, Wayne, Pa.

[73] Assignee: Hussong-Walker-Davis Co.,
Philadelphia, Pa.

[22] Filed: Mar. 16, 1972

[21] Appl. No.: 235,172

[52] U.S. Cl. 68/206

[51] Int. Cl. B05c 8/02

[58] Field of Search 68/206, 165-167,
68/159, 160, 163

[56] References Cited

UNITED STATES PATENTS

607,834	7/1898	Corron.....	68/206
1,417,825	5/1922	Halter.....	68/160
2,090,385	8/1937	Faigle et al.	68/160
2,168,479	8/1939	Johnson et al.	68/206 X
2,573,047	10/1951	Neu	68/206

FOREIGN PATENTS OR APPLICATIONS

478,552	2/1953	Italy	68/206
122,568	5/1926	Switzerland.....	68/206

Primary Examiner—Harvey C. Hornsby

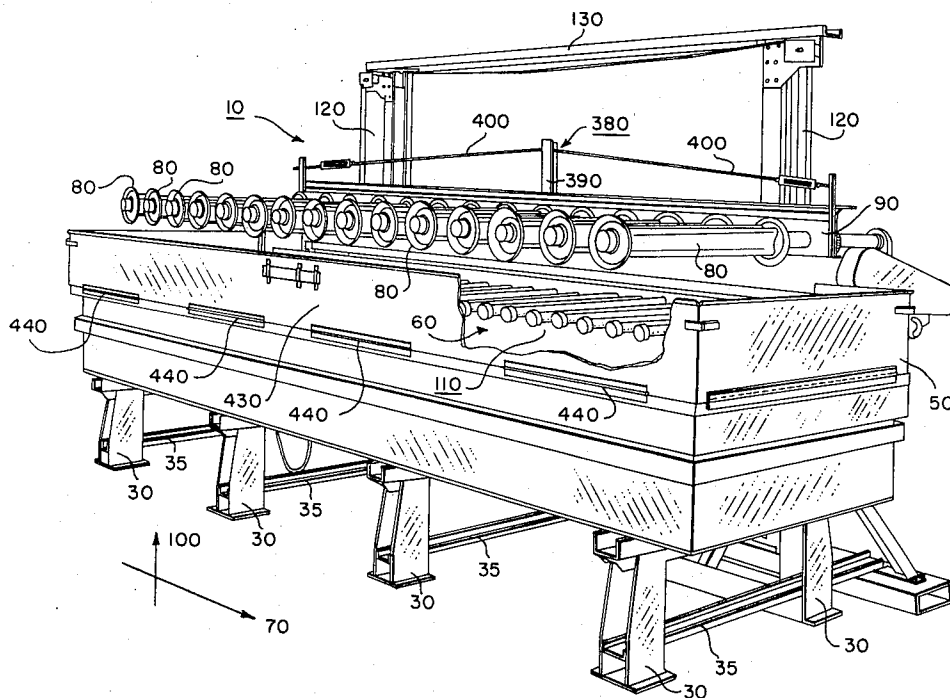
Assistant Examiner—Philip R. Coe

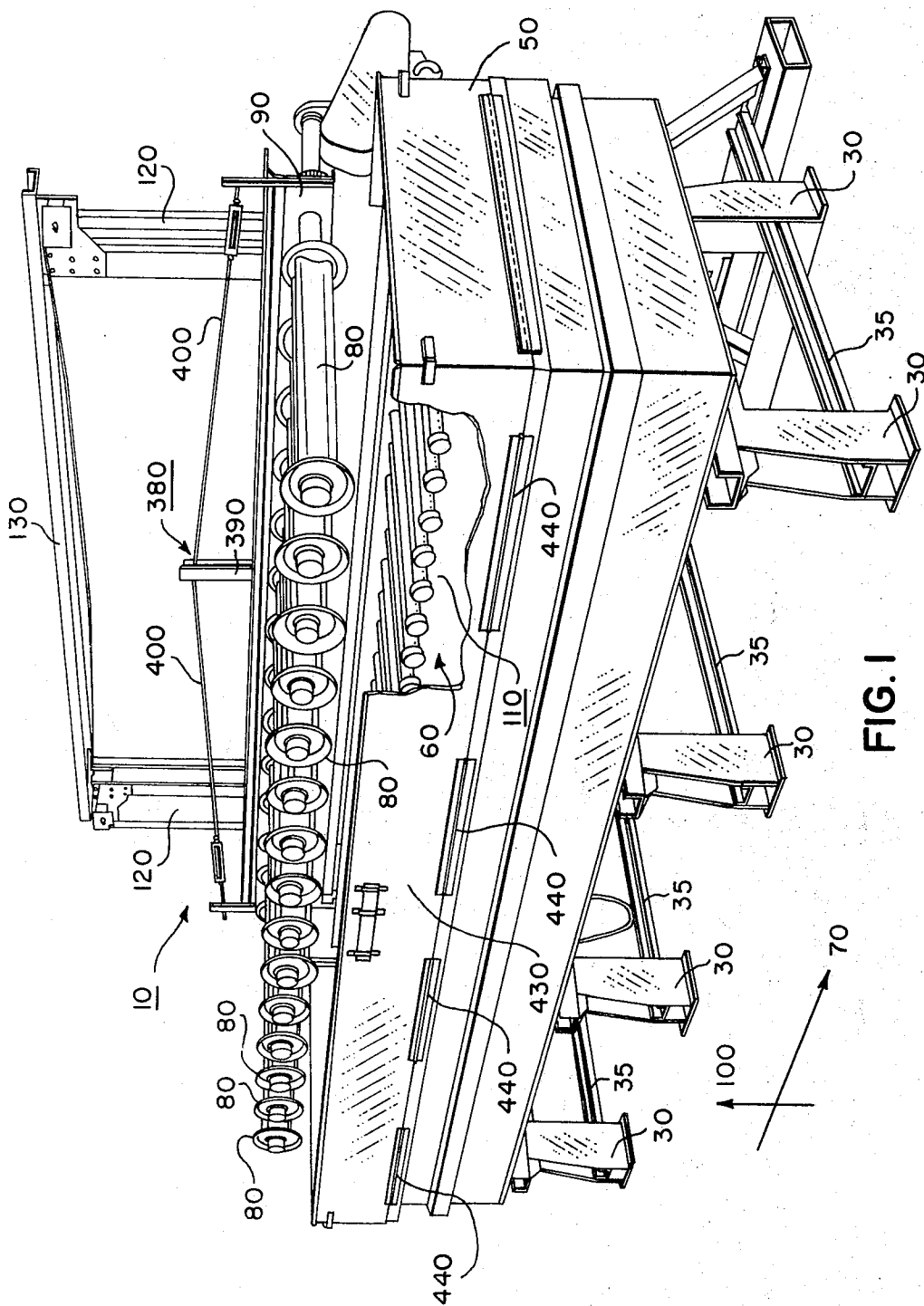
Attorney, Agent, or Firm—Paul Maleson

[57] ABSTRACT

A dyeing apparatus for dyeing skeins of yarn. Yarn skeins are mounted over reels which are rotatable through varying angular displacements. The reels are mounted to a reel frame which may be vertically displaced thereby elevating or lowering the yarn carrying reels. Spray mechanisms are mounted to a base frame below and parallel each of the reels for spraying dye liquid on the skeins. The spray pattern of liquid emitted from the spray bar mechanisms is controlled to a predetermined flow angle. A bending displacement mechanism adjusts for the weight of skeins positioned on the reels and maintains the reels in a horizontal plane after being loaded. A longitudinal inclination adjusting mechanism maintains the reel frame in a horizontal plane when the longitudinal loading of the reels is unbalanced.

27 Claims, 6 Drawing Figures





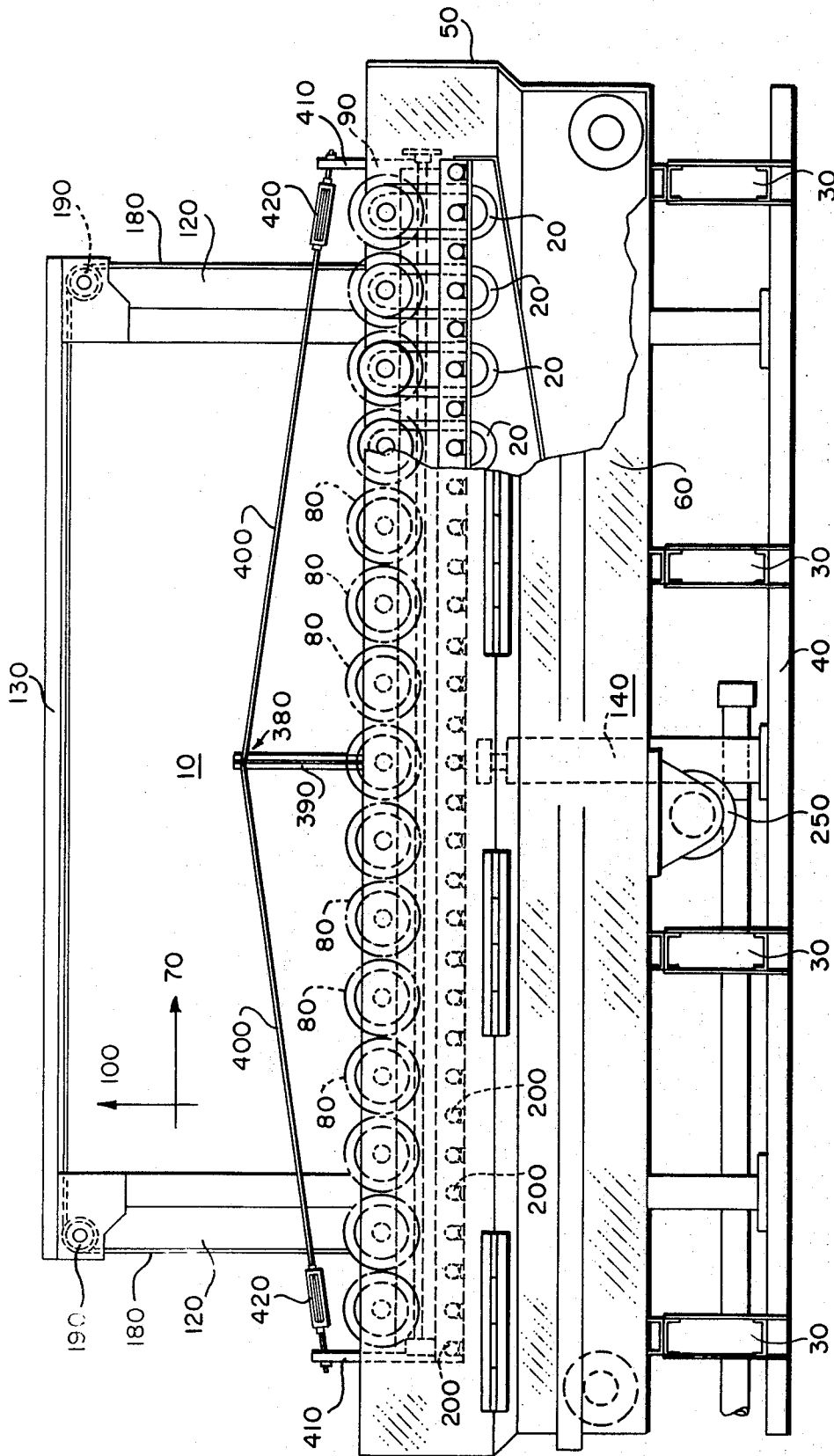


FIG. 2

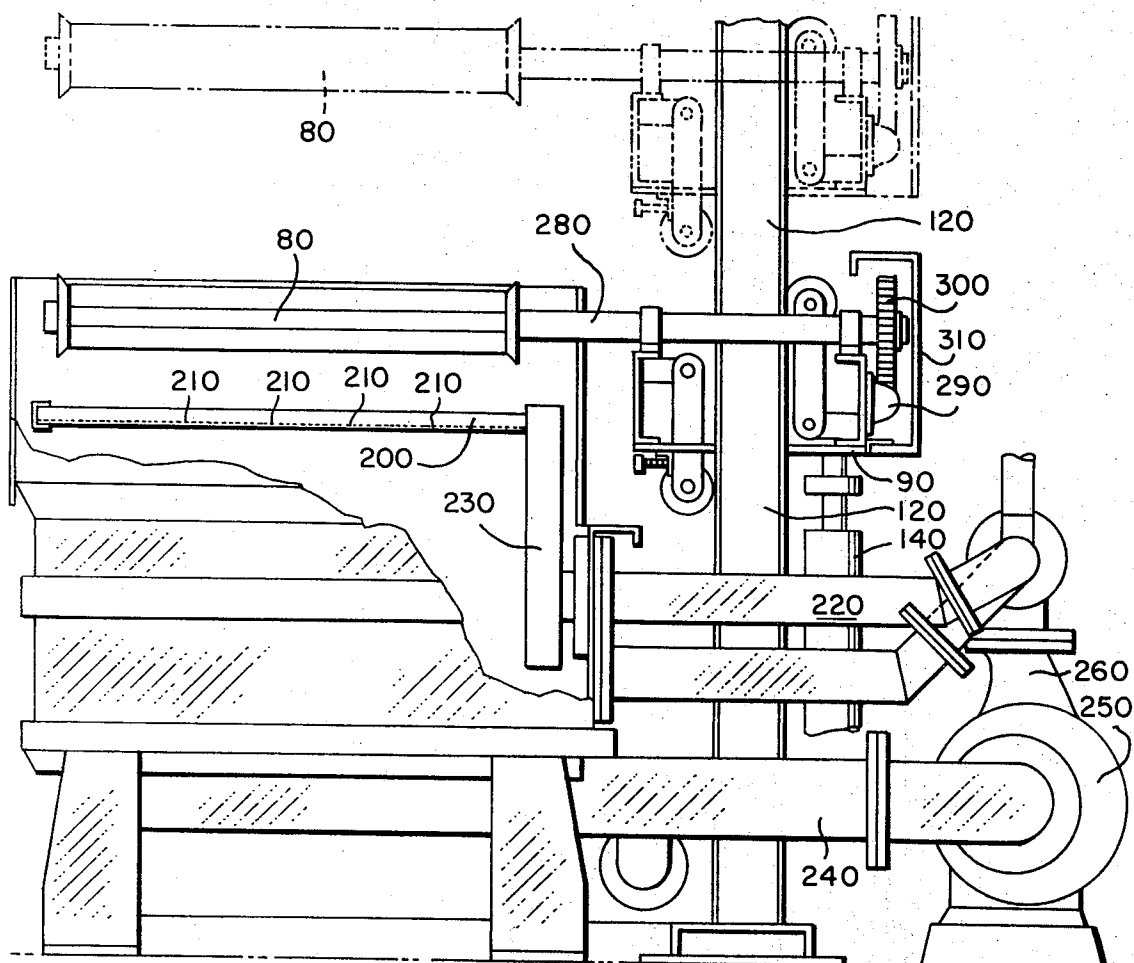


FIG. 3

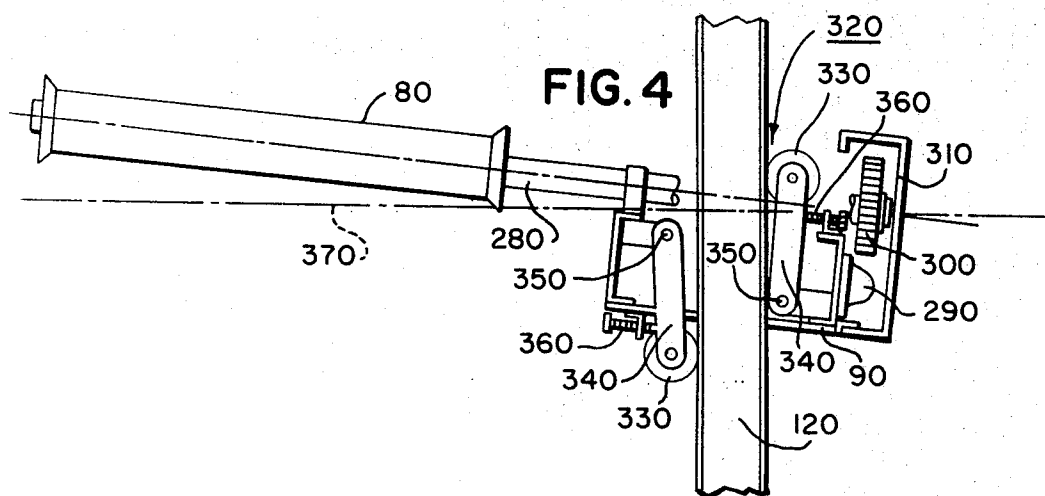


FIG. 4

FIG. 5

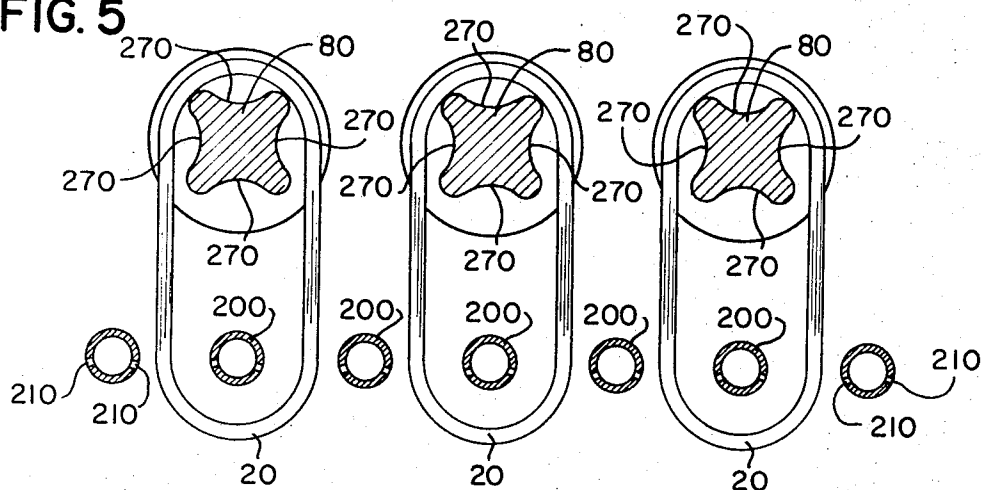
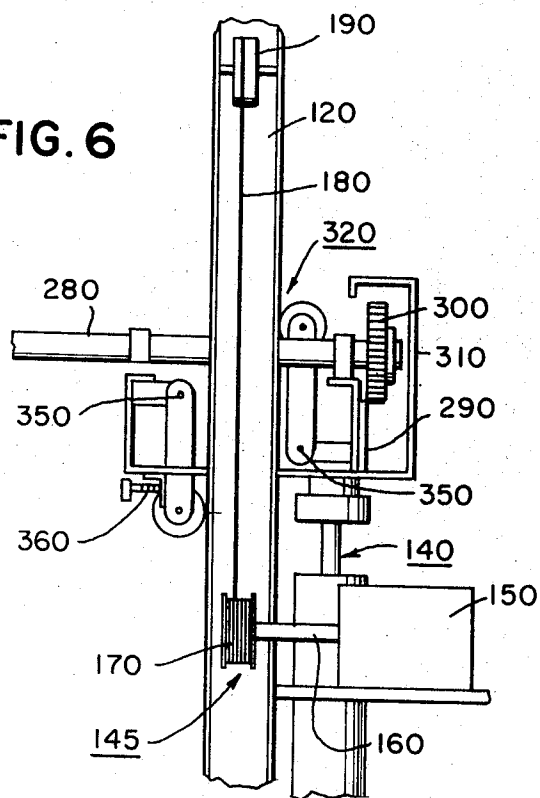


FIG. 6



DYEING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the field of dyeing apparatus. In particular this invention pertains to the field of apparatus for dyeing skeins of yarns or textiles. More in particular this invention pertains to dyeing apparatus having yarn carrying reels and dye spray mechanisms for spraying liquid dye into a predetermined area of the skeins of yarn.

2. Description of the Prior Art

Dyeing apparatus for dyeing skeins of yarn or textiles is known in the art. However, such prior apparatus have yarn carrying reels which are vertically fixed in positional relation to any liquid dye spray mechanisms. Such prior apparatus do not permit varying sized yarn contours to be dyed. Further, the areas of dyeing the skeins cannot be varied by raising or lowering the reels.

Other prior apparatus do utilize spray bars having openings through which the liquid dye is passed. However, such prior art does not positionally align the openings in order to achieve a particular spray pattern. Consequently, such spray patterns often cause splashing of the liquid dye external to the dyeing apparatus.

In the prior art, when yarn carrying reels are loaded with skeins of yarn, a bending displacement occurs causing the skeins to move and become bunched at one end. Such apparatus do not include a bending displacement compensating mechanism to keep the loaded reels in a horizontal plane.

In other prior mechanisms, where a portion of the reels are loaded with skeins of yarns such causes an unbalanced loading of the reel frame to which the reels are mounted. This has the effect of causing an inclination of the reel frame and consequently of consecutively spaced reels. This may cause different areas of individual yarn skeins to be dyed. Further, prior mechanisms do not provide for any mechanism to adjust for deflections at opposing ends of the frame reel thus causing structural integrity loss as well as non-repeatable area dyeing of different skeins of yarn.

SUMMARY OF THE INVENTION

An object of this invention is to provide a dyeing apparatus where skeins of yarn are mounted on rotatable reels and are intersected by a spray pattern of liquid dye being emitted by a spray mechanism.

Another object of the instant invention is to provide a dyeing apparatus where the yarn carrying reels may be vertically adjusted with respect to the spray mechanism.

A further object of the subject invention is to provide an apparatus where the spray pattern of the liquid dye strikes the skeins of yarn at a predetermined angle to minimize external splashing.

A still further object of the current invention is to provide an apparatus whereby the yarn carrying reels may be adjusted to compensate for bending displacement.

A dyeing apparatus for dyeing skeins of textiles which includes a longitudinally extended base frame having a tank rigidly secured thereto for collecting liquid. At least one reel is mounted to the base frame in

a transverse direction with respect to the longitudinal extension. The skeins of yarn are in a closed contour shape and frictionally movable with respect to the reel. A mechanism is included for translating the reel vertically with respect to the base frame. Dye spray mechanisms are mounted transverse to the base frame and are positionally located substantially parallel and below said reel.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view partially in section of the dyeing apparatus;

FIG. 2 is a frontal view partially in section of the dyeing apparatus;

FIG. 3 is a side view of the dyeing apparatus showing the reel frame in a lowered positional placement and an upper placement in phantom line construction;

FIG. 4 is a side view of the bending displacement mechanism;

FIG. 5 is a frontal view of yarn carrying reels showing the spray bar mechanism; and,

FIG. 6 is a side view of the reel frame translating and longitudinal adjusting inclination mechanism.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIGS. 1 and 2 there is shown a dyeing apparatus or machine 10 for applying liquor, or in general dyeing liquid to skeins of textile or yarn 20 mounted on one or more dyeing reels 80. Dyeing apparatus 10 includes floor mounts 30 for stabilization to some external surface of floor 40 as well as cross-beams 35 for structural integrity as is shown. The basic components of dyeing apparatus 10 includes base frame 50 which is extended in a longitudinal direction defined by the direction orientation of arrow 70. Tank 60 is rigidly mounted to base frame 50 and serves the purpose of collecting the liquor which is not absorbed by skeins of yarn 20. A plurality of reels 80 are mounted to base frame 50 in a transverse direction with respect to the longitudinally defined direction 70. Skeins of yarn or textiles 20 are mounted on each of reels 80 and are frictionally attached to a respective reel 80 to move in a closed contour path as a function of rotation of each of the reels 80. A multiplicity of textile or yarn skeins may be mounted on each dyeing reels 80 in a transverse direction with respect to said longitudinal direction 70. Reel frame 90 is movable in a direction defined by the vertical arrow 100 and has mounted thereto each of reels 80. Dye spray mechanism 110 is mounted and passes transverse to base frame 50 and comprises a number of elements positionally located substantially parallel and below each of reels 80. In this manner skeins of yarn 20 may be positioned in a transverse pattern along each of reels 80 and thus form a closed contour path as a function of the rotation of reels 80. Dye spray mechanism 110 passes liquid through the skeins of textile and dyes a particular portion of each skein. The unused liquid falls into tank 60 and may be recirculated through dye spray mechanism 110. After a particular portion of the skeins of textile are dyed each reel 80 may be rotated to bring another section of the closed contour skeins of yarn 20 into an intersecting path with respect to the liquid spray being emitted from dye spray mechanism 110.

Base frame 50 includes a pair of vertically extending base frame members 120 which are longitudinally dis-

placed each from the other as is clearly shown in FIGS. 1 and 2. Cross member 130 is mounted securely to each of the opposing vertically extending base frame members 120 to form an arch contour. Each of base frame members 120 is rigidly mounted through bolts, welding or some like mechanism to base frame 50 thereby providing a unitary structure. Each of base frame members 120 may have a longitudinal channel such as that formed by an I-beam for providing a vertical guide path for moving reel frame 90 to be described in the following paragraphs.

Reel frame 90 extends substantially the longitudinal length of base frame 50 as is shown. Each of reels 80 is rotationally movable with respect to reel frame 90 in a plane normal to the transverse direction as defined by the extended reels 80. As shown in FIGS. 1, and 6 reel frame 90 defines a portion of translating mechanism 140 which permits reel frame 90 to slidably move in vertical direction 100 with respect to stationary base frame 50. Translating mechanism 140 includes a hydraulic piston arrangement well known in the art for lifting and lowering frame reel 90 in vertical direction 100. Translating mechanism 140 is mounted substantially central the longitudinal extension of reel frame 90 and acts on a lower displacement. On an opposing vertical end, mechanism 140 may be secured to stationary base frame 50 or external surface 40 not important to the inventive concept.

When being loaded with textile skeins 20, lifting or reel frame 90 may be forced into an inclined contour in longitudinal direction 70 due to an unbalanced load on reels 80. In order to compensate for this unwanted inclination, stabilization mechanism 145 is provided as shown in FIGS. 1, 2 and 6. Mechanism 145 includes motor 150 which is attached to motor shaft 160 which in turn is mounted to pulley system 170 to rotate in a plane substantially normal to the transverse direction as defined by the longitudinal extension of base frame 50. Cables 180 pass vertically from the driven pulley 170 over upper pulleys 190 which are rotationally movable with respect to base frame 50. Cables 180 pass substantially adjacent to cross member 130 and over each of the longitudinally displaced upper pulleys 190. Cables 180 are attached to reel frame 90 on opposing longitudinal ends of the reel frame 90. In this manner, actuation of motor mechanism 150 causes a responsive rotation in double pulley system 170 which either rotates in a clockwise or counter clockwise manner. Cables 180 which are attached to frame 90 have increased tensile load applied to them and since they are mounted on opposing ends of reel frame 90 may be used to adjust for reel frame 90 inclination due to an unequal longitudinal load balance on frame 90. In this way, different sized textile skeins may be mounted over each of reels 80 in order to optimize the use of the apparatus 10. As will be clearly understood, motor mechanism 150 is automatic in nature however, such may be replaced by a hand wheel which may be rotated manually to have the same effect on driving reel frame 90 in vertical direction 100. As has been described, vertically extending base frame members 120 may have channel sections extending in the vertical direction 100 to allow restraint of reel frame 90 in any positional location with exception of a vertical displacement.

Dye spray mechanism 110 includes a plurality of spray bars 200 which are mounted substantially below and passing parallel with respect to the plurality of reel

members 80. Each of spray bars 200 include a multiplicity of openings 210 which extend through a wall of each of the spray bars. Openings 210 are of substantially equal diameter and equally displaced with respect to the transverse direction to permit dye liquid to be sprayed substantially in longitudinal direction 70. In this manner the liquid passing through spray bars 200 is reoriented in flow direction profile from a transverse direction into a substantially longitudinal spray pattern before striking the skeins of textile 20 which are frictionally mounted on reels 80. Following the path flow of the dye liquid, it is seen that the liquid passes through upper conduit 220 into manifold 230 which passes the longitudinal length of tank 60. The fluid or liquid dye then passes into spray bars 200 and is dissipated therefrom through spray bar openings 210. The liquid which is not absorbed by the skeins of textiles 20 falls to the lower portion of tank 60 and is drawn through suction line 240 into pump 250 wherein it may be passed through conduit 260 for recirculation through spray bars 200.

As is seen in FIG. 5, spray bar openings 210 are positionally located below a horizontal plane passing through each of the spray bars and thus the spray pattern is directed at a predetermined angle unto skeins of textile 20 adjacent each of spray bars 200. Openings 210 are positioned within the walls of bars 200 in order to allow the spray pattern to have a respective angle having an approximate range between 5 and 10 angular degrees below the horizontal plane. Additionally, the openings 210 are preferably positioned below the horizontal plane at an angle approximating 7.5 angular degrees in order that the spray will be contained within tank 60 and minimize a splashing effect that may occur to force the liquid dye external to dyeing apparatus 10. Each of reels 80 include at least three spray bars 200 mounted transverse to base frame 50. One of the spray bars is vertically displaced with respect to each skein reel 80 and the other two spray bars 210 are mounted in a longitudinally displaced and parallel manner to the vertically displaced spray bar 200. Openings 210 appear on opposing sides of the walls of each of the spray bars 200 so that it is evident that the spray being emitted from the vertically displaced bar 200 passes into opposing longitudinal sides of a skein of yarn 20 mounted on a reference reel 80. Additionally, each of spray bars 200 placed on opposing sides of the vertically displaced spray bar 200 likewise have openings on opposing longitudinal walls and therefore one set of openings allows spray of the reference skein of yarn on reference reel 80 whereas the opposing openings provide for a spray pattern to the next consecutively placed skein of yarn on the next reel 80. In this manner, it is seen that the number of spray bars 200 utilized in apparatus 10 is twice the number of reels 80 mounted to reel frame 90 plus one.

As is shown in FIGS. 3 and 5 the plurality of reels 80 upon which skeins of textile 20 are mounted in the transverse direction are preferably of the type known commercially as Buhlman reels. Characteristic of this type of reel are four concave surfaces 270 which make up the periphery of reel 80. Each of reels 80 is rigidly connected to reel mounting shaft 280 which is connected to a worm wheel gear 290 in association with pinion worm 300. In this manner the plurality of reels 80 may be rotated in a plane substantially normal to the transverse extension of each reel 80 for rotating the

frictionally attached skeins of textiles 20. As is evident, worm wheel 290 extending the length of base frame 50 and further mounted to reel frame 90 is rotated about an axis extending in the longitudinally defined direction 70. The pinion worm gear 290 causes a change in axis rotation through an angle of 90° to give the desired rotation to the plurality of Buhlman reels 80. Gear guard 310 is mounted to reel frame 90 and passes longitudinal with respect to base frame 50 in order to protect an operator or other person from having injury inflicted by touching the moving worm wheel 290 and pinion worm gear 300. The rotation of reels 80 may be through manual actuation of the gearing mechanism or through an automatic motor mechanism not shown and not part of the inventive concept as herein described.

Referring now to FIG. 4 there is shown reel cantilever compensation mechanism 320 which is mounted on reel frame 90 for adjusting a reel bending moment displacement when skeins of textiles 20 are frictionally attached to reel 80. Where a plurality of skeins of textiles 20 are mounted on a reel 80 in a transverse direction it is apparent that due to the bending moment there will be a downward displacement of each reel 80 so loaded. Where this occurs, skeins of textiles 20 may be forced through gravity displacement to the outward end of reel 80. In order to prevent the bunching up or movement of skeins of textiles 20 on each reel 80, reel frame 90 may be initially displaced or compensated in an upward direction in order that once skeins of yarn are mounted on a reel 80, that the reel 80 be moved to a horizontal plane. Mechanism 320 includes a pair of vertically displaced rollers 330 which are mounted in frictional contact with opposing transverse sides of vertically extending base frame member 120. Displaced rollers 330 are rotationally connected to arm members 340 which are in turn pivotally mounted to the main frame of reel frame 90 at pivot point 350. Set screws 360 are in turn mounted to reel frame 90 and positionally located to provide transverse movement to each of arm members 340. In operation, the reel frame 90 is vertically positioned on base frame 50 in a predetermined displacement. Set screws 360 may be loosened from contact with arm members 340 in order to allow angular displacement of the reels 80 through a predetermined angle above a horizontal plane. Each of set screws 360 are then tightened and force rollers 330 against opposing transverse sides of vertically extending base frame members 120 to hold reel frame 90 in a particular angular orientation. With the addition of the closed contour skeins of yarn 20 placed transverse on reels 80 there is affected a bending moment which forces reels 80 substantially back to the horizontal plane as defined by center line 370 in FIG. 4. In this manner, the skeins of textiles remain on, and are frictionally attached to reels 80 in substantially a horizontal manner and no transverse translation of skeins 20 occurs while machine 10 is in operation.

In like manner, reel frame 90 includes a vertical bending displacement when taken along in the longitudinal direction 70 away from the center of the central dimension of reel frame 90. Longitudinal bending compensation mechanism 380 is mounted to reel frame 90 substantially central the longitudinal extension and also to opposing longitudinal ends of reel frame 90 for compensating the bending displacement throughout the longitudinal extension. Compensation mechanism 380 includes vertically extending bar member 390 which is

mounted in rigid fashion through bolts, welding, or like means to reel frame 90. Cables 400 extend on opposing sides of bar member 390 and pass to opposing longitudinal ends of reel frame 90 as is shown. Cables 400 are rigidly mounted or secured to opposing vertical members 410 which are in turn secured to reel frame 90. Cables 400 are interrupted by turn buckles 420 which allow for an increase or decrease in the tensile loading of cables 400. The attachment of cables 400 to vertically extending bar member 390 must be vertically displaced in an upward direction with respect to the attachments of cables 400 to opposing vertical bar members 410. In this manner there is then an upward force placed on the opposing ends of longitudinal ends of reel frame 90 whenever a tensile loading is manifest in each of cables 400. In this manner the opposing longitudinal ends of reel frame 90 may be vertically directed until a horizontal line is effected between all of the plurality of reels 80.

For ease of insertion and removal of textiles skeins 20 from each of reels 80 an opening mechanism for tank 60 is provided and clearly shown in FIG. 1. Frontal door element 430 is rotationally mounted to tank 60 about an axis passing in the longitudinal direction and about hinges 440 as is shown. In this manner tank 60 may be opened for inspection or may be opened for insertion and/or removal of yarn skeins 20 when the liquid level within tank 60 has not been vertically positioned or located above the hinges 440 as shown. In a similar manner the opposing longitudinal side walls of tank 60 may also be hinged to provide access from either opposing longitudinal sides of base frame 50.

Thus it will now be understood that an improved dyeing apparatus is provided whereby skeins of textile yarns may be dyed in an automatic fashion. Large quantities of skeins may be dyed in one operation with the area of dyeing governed by vertical displacement mechanisms for a reel frame containing the yarn reels. In the drawings and specification, a preferred embodiment has been described, however, it is to be understood that the invention is not limited to any specific construction and may be applied to various forms without departing from the spirit of the invention or the scope of the appended claims.

What is claimed is:

1. A dyeing apparatus for dyeing skeins of textiles, comprising:
 - a. a longitudinally extended base frame having a tank rigidly secured thereto for collecting liquid;
 - b. a reel frame having at least one reel mounted thereon and being carried by said base frame, said at least one reel being in a transverse direction with respect to said longitudinally extended base frame, said skeins of textiles being in closed contour and frictionally movable with respect to said reel;
 - c. means for translating said reel vertically with respect to said base frame;
 - d. dye spray means mounted transverse said base frame, being positionally located substantially parallel and below said reel to spray said skeins of material, excess liquid from said dye spray means being collected in said tank; and,
 - e. means for preventing the longitudinal inclination of said reel frame, said inclination preventing means being mounted to opposing longitudinal ends of said reel frame for maintaining said reel frame in a substantially horizontal plane.

2. The dyeing apparatus as recited in claim 1 where said means for preventing the longitudinal inclination of said reel frame includes:

- a. at least a pair of pulleys rotatably mounted to said base frame above each of said reels;
- b. at least a pair of cables passing over each of said pulleys and mounted on opposing longitudinal ends of said reel frame, said cables attached to an upper portion of said reel frame; and,
- c. means for driving said cables in vertical linear translation for vertically displacing said reel frame.

3. The dyeing apparatus as recited in claim 2 wherein said drive means includes motor means connected to each of said cables for displacing said cables vertically, said motor means being secured to said base frame.

4. The dyeing apparatus as recited in claim 2 wherein said drive means includes a manual drive wheel connected to each of said cables for displacing said cables vertically, said drive wheel being secured to said base frame.

5. The dyeing apparatus as recited in claim 2 where said pair of pulleys are mounted respectively to a pair of vertically extending base frame members being longitudinally displaced each from the other, said pulleys being rotatable about an axis passing transverse said longitudinal extension of said base frame.

6. The dyeing apparatus as recited in claim 5 wherein each of said vertically extending base frame members includes a vertically extending channel within which one end of said reel frame is mated for providing a vertical guide for said reel frame.

7. The dyeing apparatus as recited in claim 1 wherein said dye spray means includes a plurality of spray bars mounted transverse said base frame.

8. The dyeing apparatus as recited in claim 7 wherein each of said spray bars includes a plurality of openings extending through a wall of each of said spray bars, said openings being of substantially equal diameter and equally displaced each with respect to the other in said transverse direction.

9. The dyeing apparatus as recited in claim 8 wherein said plurality of openings reorient the flow profile of said liquid flowing through said spray bars from said transverse direction, into a substantially longitudinal spray pattern for striking skeins of textiles frictionally mounted to said reels.

10. The dyeing apparatus as recited in claim 9 wherein each of said spray bars is tubular in construction having a through opening in said transverse direction coincident with a transverse axis of said tubular spray bars.

11. The dyeing apparatus as recited in claim 10 wherein said equal diameter openings are positionally located below a horizontal plane passing through each of said spray bars transverse axes for directing said spray pattern at a predetermined angle onto said skeins of textiles.

12. The dyeing apparatus as recited in claim 11 wherein said openings are positioned below said horizontal plane at a respective angle having an approximate range between 5 and 10 angular degrees.

13. The dyeing apparatus as recited in claim 11 wherein said openings are positioned below said horizontal plane at an angle approximating 7.5 angular degrees.

14. A dyeing apparatus for dyeing skeins of textiles, comprising:

- a. a longitudinally extended base frame having a tank rigidly secured thereto for collecting liquid;
- b. a reel frame passing in a longitudinal direction and being slideably mounted to at least one vertically extending base frame member for translation of said reel frame in a vertical direction;
- c. at least one reel mounted to said reel frame and passing in a transverse direction to said longitudinal extension of said base frame, said reel being cantilever mounted to said reel frame;
- d. reel cantilever compensation means mounted to said reel frame for adjusting a reel bending moment displacement when skeins of textiles are mounted to and frictionally movable with respect to said reel; and,
- e. dye spray means mounted transverse said base frame for spraying said skeins of textiles with said liquid when said skeins of textiles are mounted on said reel.

15. The dyeing apparatus as recited in claim 14 where said cantilever compensation means is movably mounted to said vertically extending base frame member.

16. The dyeing apparatus as recited in claim 15 where said cantilever compensation means angularly inclines said reel at a predetermined angle above a horizontal plane passing substantially perpendicular said vertical direction.

17. The dyeing apparatus as recited in claim 16 where said cantilever compensation means applies vertically displaced and opposing transversely directed forces on said vertically extending base frame member.

18. The dyeing apparatus as recited in claim 14 where said cantilever compensation means includes a pair of vertically displaced rollers pivotally connected to said reel frame, said rollers for contacting opposing transverse sides of said vertically extending base frame member.

19. The dyeing apparatus as recited in claim 18 including means for constraining said rollers to said vertically extending base frame member.

20. The dyeing apparatus as recited in claim 19 where said constraining means includes:

- a. a pair of arm members rotationally mounted to each of said rollers on one end and pivotally mounted to said reel frame on an opposing end; and,
- b. a pair of set screws mounted to said reel frame for contacting each of said arms in said transverse direction for frictionally constraining each of said rollers against respective sides of said vertically extending base frame member.

21. The dyeing apparatus as recited in claim 14 including longitudinal bending compensation means mounted to said reel frame substantially central said longitudinal extension and to opposing longitudinal ends of said reel frame for compensating for a bending displacement of said reel frame throughout said longitudinal extension.

22. The dyeing apparatus as recited in claim 21 where said longitudinal bending compensation means includes a vertically extending bar member securely fastened to said reel frame substantially central said reel frame extension, said bar member being connected

to opposing longitudinal ends of said reel frame in a manner vertically displacing said opposing ends in an upward direction.

23. The dyeing apparatus as recited in claim 22 where said vertically extending bar is connected to each of said opposing reel frame ends through a cable extending in longitudinal direction in a downwardly inclined manner from said vertically extending bar to a respective reel frame end.

24. The dyeing apparatus as recited in claim 23 where each of said cables includes a turnbuckle for adjusting a tensile force load in each of said cables.

25. The dyeing apparatus as recited in claim 14 including means for opening said tank for insertion and

removal of said textile skeins from each of said reels.

26. The dyeing apparatus as recited in claim 25 where said opening means includes a frontal door element of said tank, said frontal door being rotationally mounted to said tank about an axis passing in said longitudinal direction.

27. The dyeing apparatus as recited in claim 14 where said dye spray means includes means for directing said liquid spray into said textile skeins at a predetermined angle with respect to a horizontal plane passing normal said vertically extending base frame member.

* * * * *

15

20

25

30

35

40

45

50

55

60

65