May 3, 1955 W. J. NEWCOMB ET AL 2,707,383

FABRIC DYEING APPARATUS

Filed March 30, 1953

3 Sheets-Sheet 1

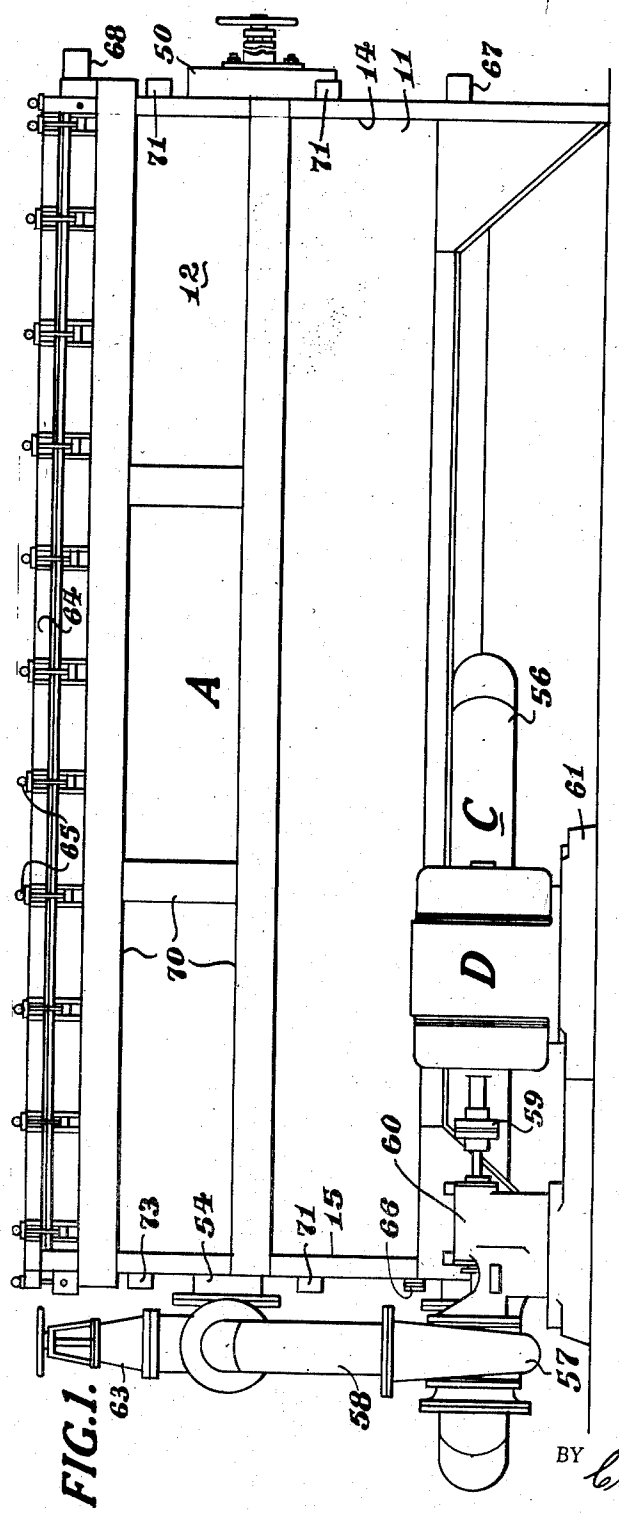


FIG. 1.

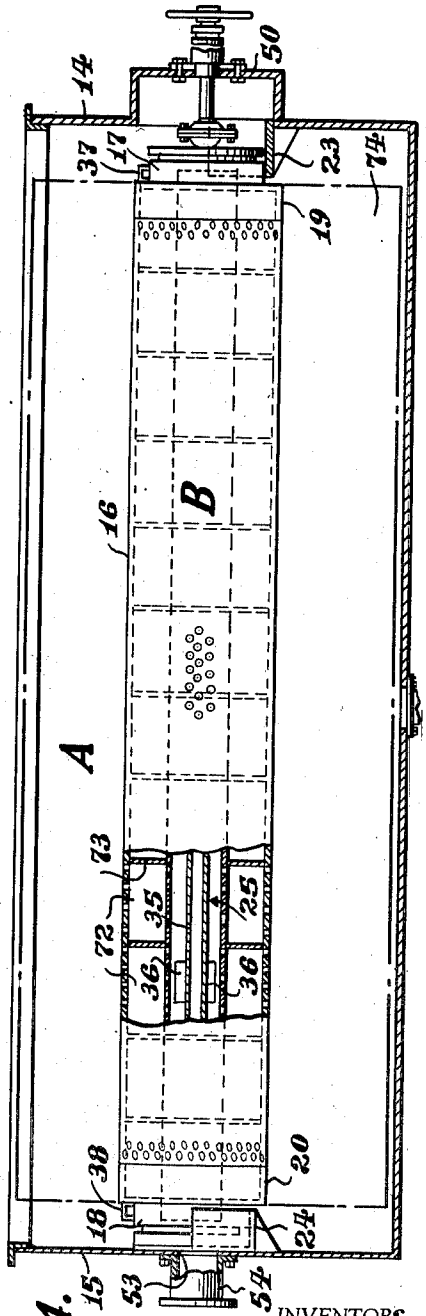


FIG. 4.

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3 Sheets-Sheet 2

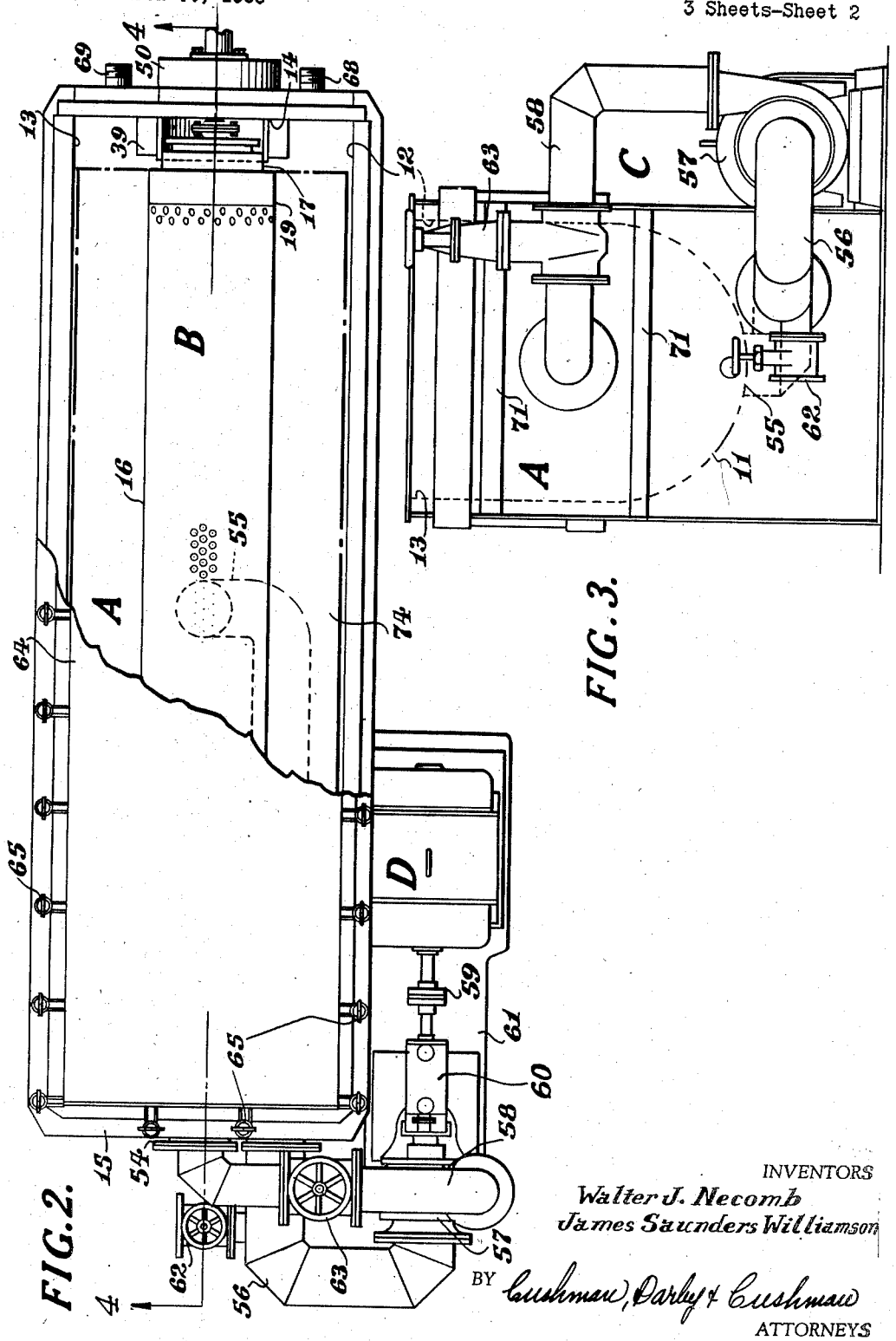


FIG. 2.

FIG. 3.

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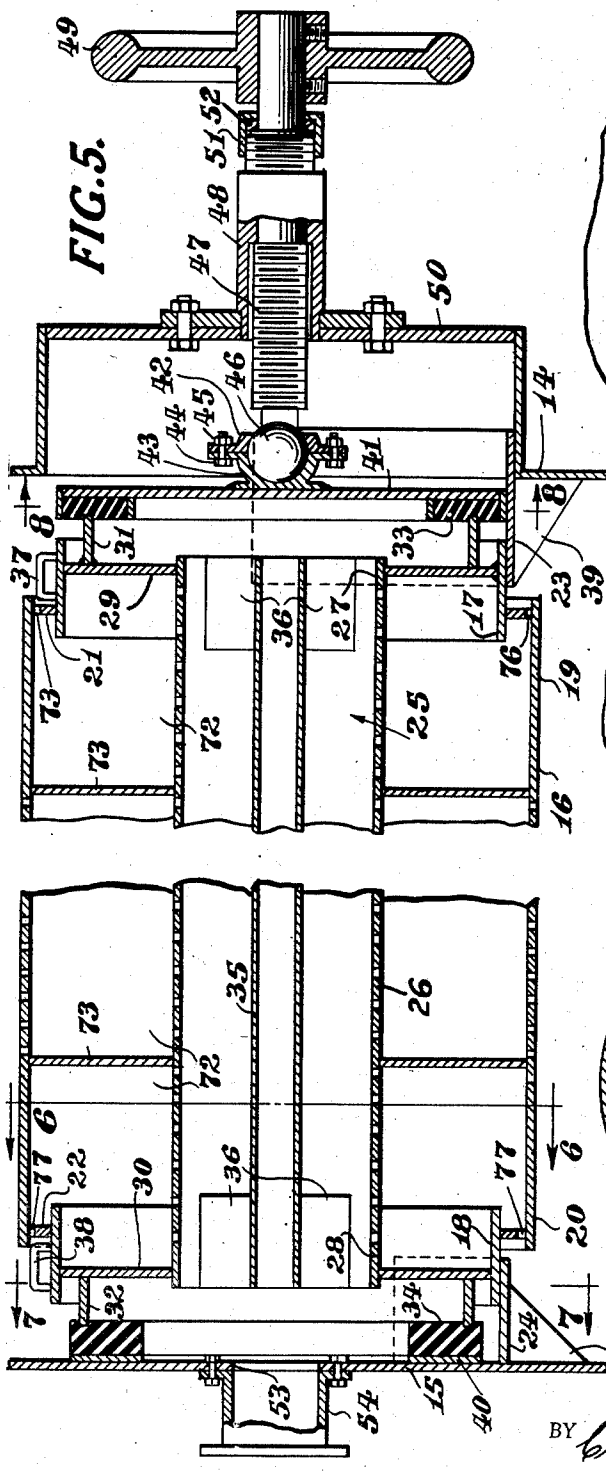


FIG. 5.

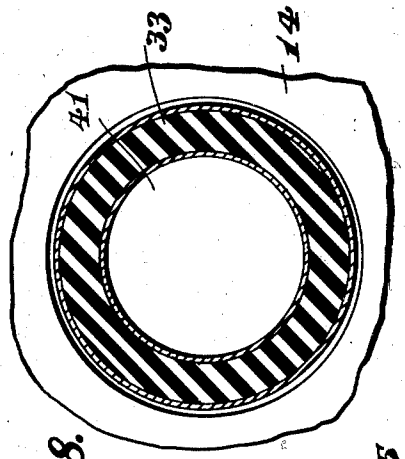


FIG. 8.

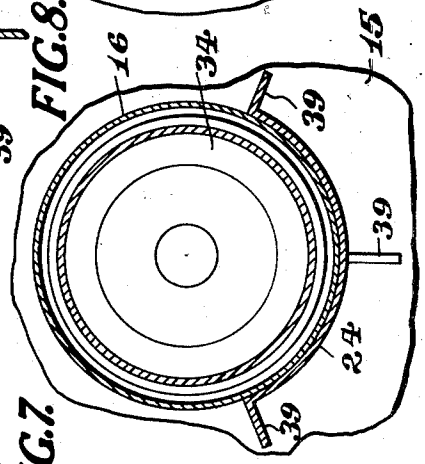


FIG. 7.

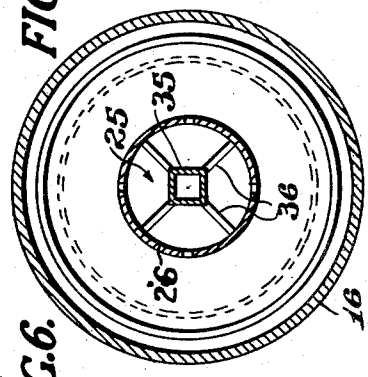


FIG. 6.

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2,707,383

FABRIC DYEING APPARATUS

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Application March 30, 1953, Serial No. 345,424

3 Claims. (Cl. 68—189)

This invention relates to improvements in apparatus for treating fabrics, and in particular to machines for dyeing fabrics on a stationary horizontal beam.

Textile materials, such as woven fabrics, and especially tricot fabrics, are subjected to many treatments with liquids, vapors, or gases for bleaching, dyeing, and other processes by winding them on perforated hollow cores and causing dye liquids or other fluids to pass through these fabrics radially from the inside of the core outward. In this process it is difficult to secure uniformity of treatment in all parts of the material, and accordingly, greatest care must be exercised in order to make sure that there has been complete penetration of the dyestuff in the fabric so as to produce even shades throughout.

It is also sometimes necessary to wash the goods at various stages of the operation and to dry them when finished. Inasmuch as each of these operations contributes to the final result, it is most necessary that all of the treatments used in processing this material be uniform throughout the fabric.

The present invention is an improved machine for dyeing fabrics, wherein a higher degree of uniformity of color is obtained than heretofore possible on similar apparatus.

In order to dye cloth in this machine, the cloth is first wrapped about a specially constructed hollow foraminous beam in some convenient place outside of the vat. When this operation has been completed, the beam is then lowered horizontally into the machine until the ends of the beam are seated in saddles integral to the opposite end portions of the vat. One end of the beam is engaged by an adjustable sealing gasket which thrusts the opposite end of the beam into sealing engagement with a fixed gasket secured to the vat adjacent this opposite end. The beam is adapted to receive liquid through one end wherein the liquid passes up through the center of the core, out through its foraminous wrapper and then outwardly through the cloth. The liquid percolates to the outer surface of the cloth and then flows to the bottom of the vat where means are provided for recirculation of the liquid.

This vat which houses the foraminous beam consists of two end panels flanged on all edges and a wrapper with a semi-circular bottom and upstanding side portions.

The beam, when lowered into horizontal position in the vat, is stationary, and achieves uniform distribution of liquid through the layers of cloth wound thereupon by improvements in the core of the beam which insure uniform distribution of the liquid throughout the length of the beam.

It is a primary object of the present invention to provide an improved fabric treating machine of the character described, and more particularly to provide improvements in the non-rotating type beam upon which the fabric is wound.

Another object of this invention is to provide improved, inexpensive apparatus in which textile fabrics may be uniformly subjected to dye liquors and other solutions.

It is another object of our invention to provide improved apparatus in which fabrics may be dyed, washed, after-treated and dried in a thorough and uniform manner without handling.

It is still another object of this invention to provide improved apparatus which may be used to dye fabrics more efficiently and inexpensively than heretofore possible.

It is a still further object of this invention to provide improved dyeing apparatus which may be used in either open vat processes, or in processes requiring the use of treatment of the fabrics under pressure.

It is a still further object of this invention to provide an improved fabric mounting beam which is easily handled and quickly placed in its dye vat.

It is yet a still further object of this invention to provide improved dyeing apparatus which employs a hollow, horizontal, stationary foraminous beam having novel means for sealing its end portions so as to receive liquids through the core of the beam.

Another object of this invention is to provide an improved beam of the type described having novel means for distributing evenly to its outer foraminous wrapper liquids passing therethrough.

These and other features of the invention will be best understood and appreciated from the following description of a preferred embodiment herein selected for purposes of illustration and shown in the accompanying drawings, in which similar parts are designated by similar numerals.

Figure 1 is a side elevational view of this invention showing the motor, pump, and recirculatory system.

Figure 2 is a top plan view of the invention showing the cover hatch partially in section.

Figure 3 is a side elevational view of the invention showing how the recirculatory system enters the end portion of the tank.

Figure 4 is a side elevational section view of the invention taken substantially along the line 4—4 of Figure 2.

Figure 5 is a fragmentary sectional view of the invention showing in greater detail the beam and adjustable end sealing means.

Figure 6 is a sectional view of the beam taken along the line 6—6 of Figure 5.

Figure 7 is a fragmentary sectional view taken along the line 7—7 of Figure 5 and showing how the liquid receiving end of the beam rests in the adjacent saddle of the vat, and

Figure 8 is a sectional view of the adjustable beam end sealing means taken along the line 8—8 of Figure 5.

Referring now to the drawings, and in particular to Figures 1, 2 and 3, the particular form of this invention as illustrated, comprises a dye vat A, a beam B, a liquid recirculatory system C, and means for driving this system such as electric motor D.

The vat A is in general a rectangularly shaped tank having a semi-cylindrical bottom 11 and vertically projecting rectangularly shaped sides 12 and 13 extending upwardly from each side of the bottom. The ends of the tank are enclosed by end portions 14 and 15 which have suitable openings and fittings for receiving liquids necessary in dyeing processes. These end portions are also provided with saddles for horizontally supporting the ends of beam B. The structure of the vat will be pointed out and described in greater detail as the description of this invention progresses.

The beam B (Figure 5) comprises a perforated cylindrical outer wrapper 16 having end bands 17 and 18 concentrically secured within the end portions 19 and 20 of the wrapper by means of annular plates 21 and 22. The end bands 17 and 18 extend beyond end portions 19 and 20 to engage and rest in semi-cylindrical saddle supports 23 and 24 which are secured to the end portions 14 and 15 of the dye vat A by suitable means such as by

welding. A liquid distributor **25** comprising a hollow foraminous cylinder **26** has its end portions **27** and **28** (Figure 5) concentrically disposed within end bands **17** and **18** and secured thereto by means of annular plates **29** and **30**. These distributor end portions **27** and **28** while extending beyond the ends **19** and **20** of beam wrapper **16** do not extend as far beyond the wrapper end portions as do end bands **17** and **18**, accordingly, the distributor ends are received within end bands **17** and **18**. Also secured to annular plates **29** and **30** are annular sealing rings **31** and **32** concentrically disposed about the longitudinal axis of beam B, within end bands **17** and **18** and extending longitudinally beyond these end bands for sealing engagement with rubber gaskets **33** and **34** which are attached to opposite ends of the dye vat A as will be more fully described. A rectangularly-shaped hollow tube **35** (Figure 5), open at each end and unobstructed throughout, comprises the core of the beam and is secured to the inner periphery of distributor **25** by means of spider plates **36** which are provided in sufficient number to maintain this rectangular tube rigid and inflexible. It will be noted that the beam just described is uniformly symmetrical in all respects with the exception of lifting links **37** and **38** (Figures 4 and 5) which are secured to end bands **17** and **18** respectively. Accordingly, the side of the beam carrying these lifting rings will necessarily be in the top portion of the vat since these rings will be used to secure lifting hooks employed to place the beam in position in the vat.

The means for securing the beam in the vat will now be described in greater detail. Each end portion **14** and **15** of vat A has secured thereto the above-mentioned saddles **23** and **24** (Figures 5 and 7) which are arcuate in shape and have their open ends facing upwardly. Triangular gusset plates **39** are secured to the outside surfaces of the saddles and to the inside surfaces of the vat end portions. Rubber gasket **34** is permanently mounted on annular ring **40** which in turn is secured to end portion **15** so as to be concentric with the axis of beam B when end rings **17** and **18** rest in saddles **23** and **24** respectively. Rubber gasket **33** (Figures 5 and 8) is mounted on backing plate **41** which is longitudinally adjustable, as will be explained below. In order to provide clearance between gaskets **33** and **34** so as to permit beam B to be lowered into position with end bands **17** and **18** resting in saddles **23** and **24**, gasket **33** may be backed off toward end portion **14** until the desired clearance is obtained. When the beam is in position and resting in the saddles, gasket **33** may then be run in to engage the outer periphery of annular sealing ring **31**. Further inward pressure by gasket **33** against sealing ring **31** will exert an inward thrust thereby causing the entire beam to shift longitudinally toward end portion **15** whereupon annular sealing ring **31** is forced into sealing engagement with gasket **33** and similarly annular sealing ring **32** is forced into sealing engagement with gasket **34**.

The means for accomplishing this longitudinal adjustment of gasket **33** will now be described. Referring once more to Figure 5, backing plate **41** has secured to the center portion thereof a two piece socket composed of socket portions **42** and **43** which are secured together by means of suitable fasteners such as bolts **44** and nuts **45**. This socket is adapted to receive a ball **46** within its inner periphery for pivotal engagement therein. Ball **46** is integrally secured to the end portion of threaded shaft **47** which in turn is threadingly engaged in flange mounting **48**. Shaft **47** extends outwardly through flange **48** sufficiently far to attach a wheel **49** which is used for adjusting gasket **33** and in general locking and sealing beam B securely in place, as above described. Flange **48** is bolted to well portion **50** which in turn is secured to end portion **14**. Since the vat is substantially full of liquid when in operation, a packing nut **51** is mounted on shaft **47** to hold packing substance **52** in sealing engagement around the circumference of the shaft so as to prevent leaking of the vat at this point. An opening **53** (Figure 5) is provided in end portion **15** axially in line with the adjacent open end of beam B. This opening is enclosed by a flanged collar **54** used for connecting the input end of the circulatory system C to this portion of the tank.

The liquid is pumped through collar **54**, through distributor **25**, and outwardly through wrapper **16**, thence down to the bottom **11** of the tank where it enters drain **55** (Figures 2 and 3) and flows along pipe **56** (Figures 1, 2 and 3), into pump **57** where it is then forwarded through pipe **58** for return through collar **54** back into the beam B. Pump **57** may be powered by any suitable means such as an electric motor D. This motor is connected to the pump by standard means such as flexible coupling **59** and reduction gear transmission **60** (Figures 1 and 2). The reduction gear transmission **60** and motor D are firmly secured to a rigid base **61** which rests on the floor. Gate valve **62** (Figures 2 and 3) is placed at the lowest portion of the recirculatory system C and when opened will allow the fluid in vat A to drain, thereby providing means for emptying the tank after the dye operation has been completed. Gate valve **63** is used to throttle the flow of liquid into the tank.

This machine may be used either in open vat dyeing processes, or if the process requires temperatures over 212° F. a cover hatch **64** (Figures 1 and 2) may be provided and securely battened down by means of a series of quick release hold down clamps **65** spaced evenly about the periphery of the hatch. With this hatch securely in place the dyeing processes may be safely operated at elevated temperatures.

A threaded nipple **66** (Figure 1) is secured in end portion **15** near the bottom of the tank for coupling with a source of water supply used to fill the tank. Another threaded nipple **67** is secured in the opposite end portion **14** to be used for connection to a steam line (not shown). This steam line may be either an open coil used to raise the temperature of the liquid, or the connection may be a closed steam coil which may be placed in the bottom of the tank and used to maintain the temperature of the liquid. Skimmer drains **68** and **69** (Figures 1 and 2) are provided adjacent the top edge of end portion **14** for cleaning the surface of the liquid. The entire tank is constructed of stainless steel plate and fittings, and reenforced by U-shaped stiffening members **70** (Figure 1) which are secured to the sides of the tank, and U-shaped stiffening members **71** secured to the end portions thereof.

All parts of beam B are made of stainless steel. Lifting rings **37** and **38** (Figure 5) are welded on end rings **17** and **18**, the diameters of which are such that the end rings are either flush with or slightly below the outer surface of wrapper **16**. With the rings so disposed problems of handling and storing of the beams are reduced, and the rings so arranged do not interfere with the selvage ends of the cloth as they are wrapped about the beam. The outer wrapper **16** is perforated in the center section of the beam and is solid on the end portions **19** and **20**. The length of the perforated section is governed entirely by the width of the material to be used. Likewise the length of the beam and the length of the tank are also governed by this consideration. These solid end portions **19** and **20** of the wrapper **16**, Figures 2 and 4, are of such width as to allow the material being dyed to overlap these portions thereby reducing considerably the amount of seepage of liquid which will pass through the end portions of the rolled fabric.

Having now described the structure of this invention, the operation of this machine will be discussed in more detail. Prior to placing the beam in the machine, a rectangular wooden beam is placed through rectangular tube **35** and the beam ends are mounted in saddles for rotation. The cloth to be dyed is wrapped around the beam as the beam rotates, care being taken to keep the selvage ends smooth and the cloth as tight as possible on the beam. From 1,000 to 5,000 yards of cloth may be

conveniently wrapped on this beam and when this operation has been completed the beam is then lifted by lifting hooks attached to end rings **37** and **38** and is lowered horizontally into vat A until end rings **17** and **18** are received in saddles **23** and **24**. The tank may then be filled with water through water inlet **66** (Figure 1) and may be heated by means of an open steam line connected to steam fitting nipple **67**. A detergent or some other form of cleaner may then be added to the water and the pump **57** started, circulating this water through the distributor **25** (Figure 5) and up through compartments **72** formed by baffle plates **73**. The water then percolates through the cloth **74** (Figures 2 and 4) wrapped on the beam B and returns to the bottom of the tank for recirculation as previously described. This water is circulated at about 1400 gallons per minute for from 15 to 20 minutes. After scouring, fresh water is added to float off the suds, dirt etc. through the skimmer drains **68** and **69**. The water may then be cooled by adding cold water and a dye or bleach may be added. The pump then is started again and the dye liquor is also circulated at 1400 gallons per minute and may be heated as necessary. This circulating would normally be about 30 minutes. The pump is then stopped, gate valve **62** is opened and the dye bath is drained. When the dye bath has been drained, gate valve **62** is closed and the bath is refilled with cold or hot water one or more times and continually circulated by the pump in order to wash and rinse the fabric. The above operation may take place either with the open top vat, or with the cover hatch secured, depending on the temperature at which this process is operated.

Of prime importance in this operation is the achievement of an even distribution of dye liquor throughout the beam and the cloth rolled thereupon. In equipment of this sort presently available, difficulty of even distribution has always been experienced in that the tendency has been for the dye liquors to follow the path of least resistance through the beam and the cloth, thereby resulting in uneven dyeing of the fabrics. This nonuniform distribution of dye liquor has been overcome in the present beam by virtue of its novel arrangement of an interiorly disposed distributor **25** and spaced baffle plates **73** intermediate the distributor and the outer wrapper **16**. It will be noted that although both the distributor **25** and the outer wrapper **16** are perforated, the baffle plates **73** are solid. Thus, although the dye liquor upon entering the distributor may pass therethrough and enter any of the compartments **72** formed by the baffle plates **73** with the distributor **25** and wrapper **16**, once the liquid is in these chambers the liquor cannot surge from chamber to chamber or from one end of the beam to the other as conditions of pressure and friction vary. Instead, once the liquor has entered the chamber the pressure in the distributor will force the liquor outwardly through the wrapper **16** and the adjacent convolute cloth portion thereto, resulting in an even distribution of dye liquor throughout the width of the cloth. It will be appreciated that once the pressure in the first chamber adjacent the inlet side of the tank builds up, the liquor is forced in the next adjacent compartment and so on until the entire beam is filled and the pressure is equal throughout. Thereafter, additional pressure caused by entrance of additional liquor into the

distributor will exert equal pressure in all chambers and consequently equal amounts of dye liquor will pass uniformly through the wrapper into the fabric, resulting in an evenly dyed cloth. Air vent holes **76** and **77** are provided in annular plates **21** and **22** respectively (Figure 5) adjacent the wrapper to allow entrapped air to escape from the nonperforated wrapper end portions **19** and **20**.

With the above described invention it is now possible to employ a larger beam than has ever been used before in the industry. With the increased size of the beam its capacity is accordingly increased and enables the use of an increased high capacity, low pressure centrifugal pump. The use of this larger capacity pump enables increased production since more cloth can be dyed in each dyeing operation. With the increased capacity of the pump the cycles can be completed faster than ever before, and at the same time produce more evenly dyed cloth than has ever been obtainable in the past without the use of more complicated, time consuming and expensive operations and equipment.

Having thus explained and described this invention, it is to be understood that the form of the invention herewith shown is to be taken as a preferred example of the same and that various changes in the shape, size and arrangement of the parts may be resorted to, without departing from the spirit of our invention or the scope of the subjoined claims.

We claim:

1. Dyeing apparatus comprising a vat having bottom, side and end portions, one of said end portions having an inlet opening a resilient ring secured to the inner face of one of said end portions and encircling set inlet opening, a shaft in threaded engagement with and projecting through the other of said end portions for longitudinal movement relative to said vat, a second resilient ring mounted on a rigid backing plate, said backing plate being rotatably and pivotally engaged to the inner end of said shaft, a hollow, foraminous beam disposed between said annular rings, means for flowing liquid into said beam through said inlet opening, and means for returning lquid from the vat to said inlet opening.

2. Dyeing apparatus as defined in claim 1, wherein the backing plate is engaged to the inner end of said shaft by means of a ball and socket joint.

3. Dyeing apparatus as defined in claim 2, wherein said beam comprises a foraminous cylindrical outer wrapper and annular end plates, and air vents in said end plates adjacent said wrapper to preclude the entrapment of air within the end portions of said beam.

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