Nov. 15, 1938. F. C. WEDLER 2,136,571

JIG DYEING MACHINE AND METHOD

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Fig. 1.

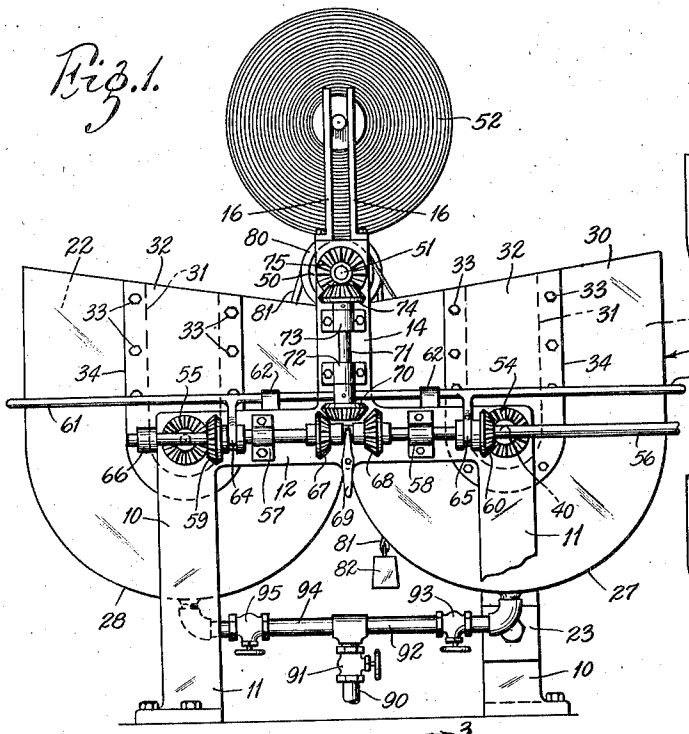


Fig. 2.

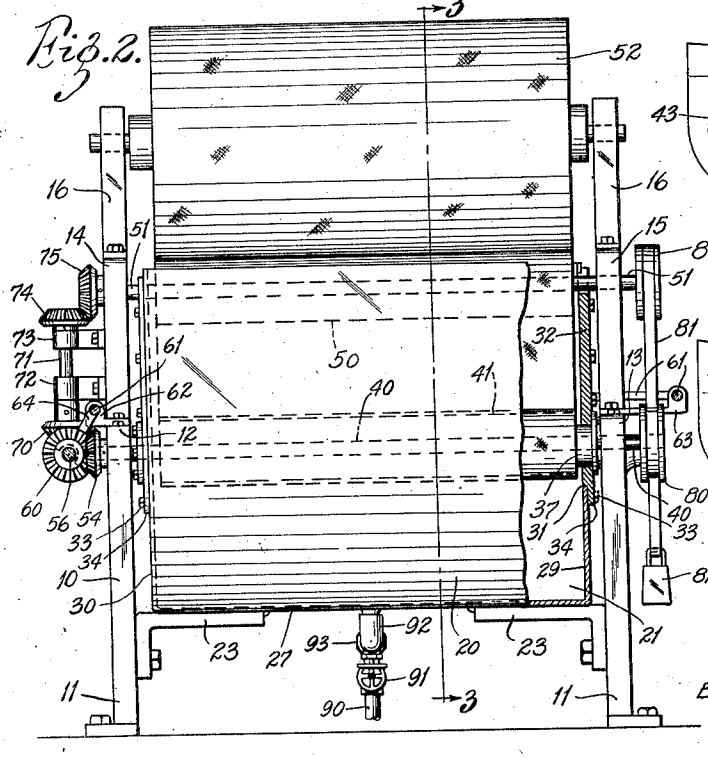


Fig. 6.

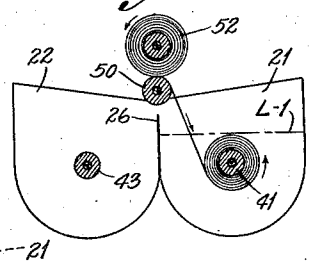


Fig. 7.

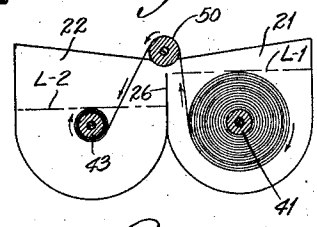


Fig. 8.

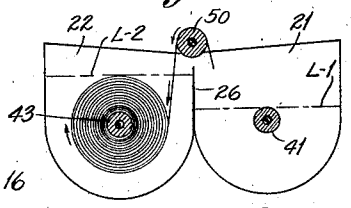
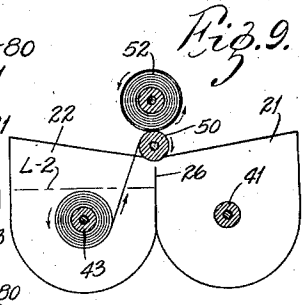


Fig. 9.



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Fig. 3.

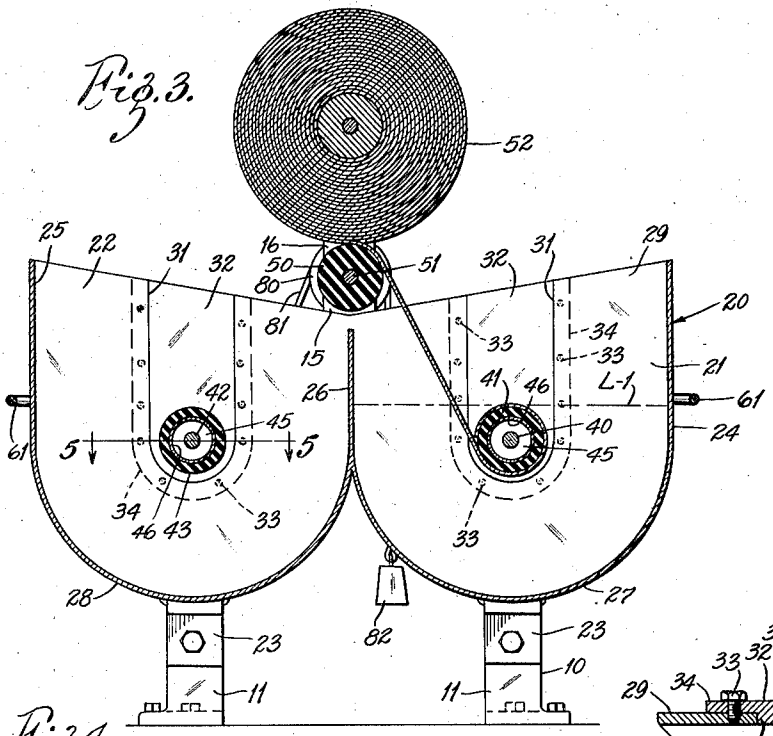


Fig. 5.

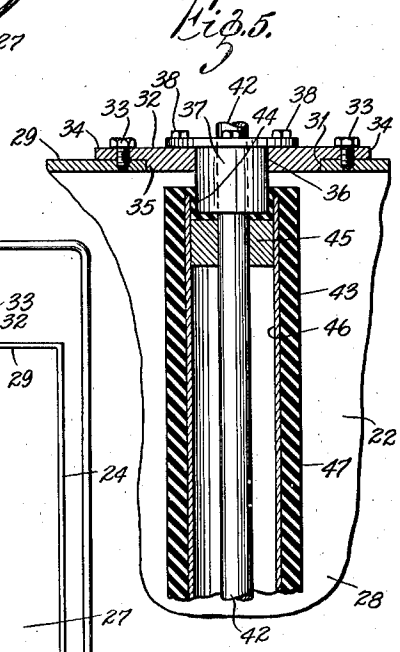
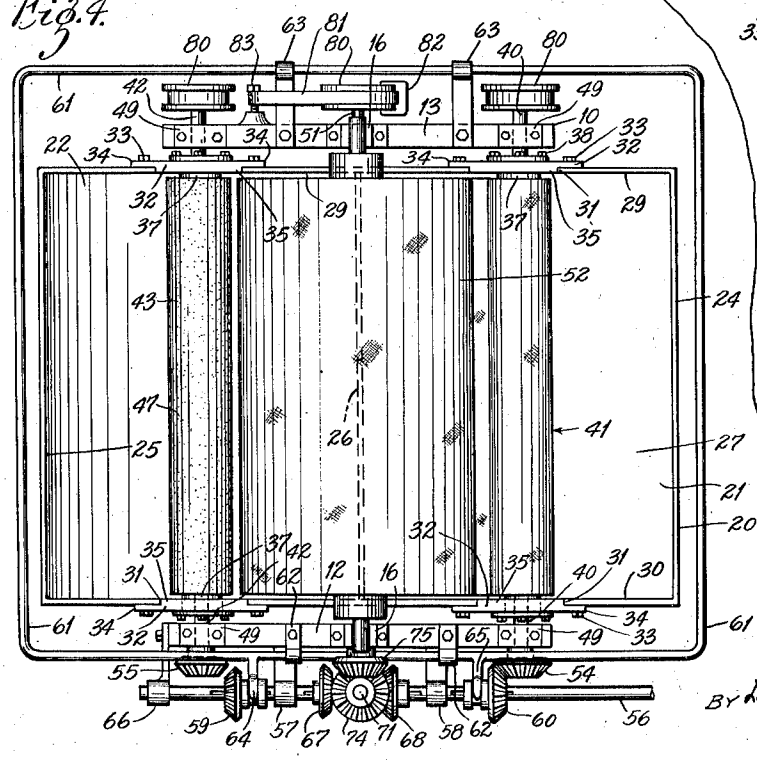


Fig. 4.



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UNITED STATES PATENT OFFICE

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JIG DYEING MACHINE AND METHOD

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Application December 16, 1935, Serial No. 54,532

16 Claims. (Cl. 8—151)

The present invention relates to a machine for treating material with liquors, and is designed to provide such a machine that achieves a better distribution of the liquors through the material, one wherein the cost of operation is reduced, and wherein the time necessary for the operation is reduced. The machine is especially applicable to dyeing fabric piece goods, although as will be apparent from the ensuing description, it is capable of much more extensive uses, such as bleaching, washing etc. of such goods. The description is related to its use for dyeing, since this illustrates the principles involved.

In general, there are three kinds of dyeing that are employed for coloring fabrics and the like. These are direct color dyes, sulphur dyes and fast or vat color dyes. It will be understood that there may be other categories, or the above may be grouped differently, but it represents a satisfactory separation. In direct color and sulphur color dyeing, the coloring material is put into vats where it exists in a solution of the proper concentration. In the third class, the color may be applied in the same way, or it may be padded onto a fabric in pigment form and subsequently run through liquid chemicals that dissolve the color and impregnate the material with the solution. The present invention is adapted for use with any of these three kinds of dyeing. In view of the obvious similarity in the processes, the description will be limited to its use in connection with fast vat color dyeing, since this should clearly show how it would apply to all of them, and will also demonstrate its applicability to other operations such as those above noted.

As stated, the dye chemicals are reduced to a solution with water and located in suitable vats. The dye chemicals are normally insoluble in water, a condition necessary to their being fast, particularly when used for washable goods. Consequently, in order to get the dye chemicals into solution, they are mixed with proper agents. Generally these are reducing agents, such as sodium hydrosulphite and caustic soda, the chemicals employed being such that when thus reduced, they are soluble in water. The cloth to be dyed is then moved through the dye solution and in its passage therethrough the interstices between the fibers of the material become charged with the dye solution. After the material has been run through the dye solution enough times to obtain the proper coloration, it is subjected to oxidizing agents that react with the dye chemical and set it in the cloth in a state that is not soluble in water. The dyeing action is partially mechanical in the impregnation of the cloth by the liquid and partially chemical, the latter including both the oxidizing function described and in all probability certain reactions between the chemicals and the fibers of the material.

The above dye materials are expensive. It, therefore, is an object of this invention to provide a method and apparatus reducing the quantity of materials necessary.

In particular, air acts as an oxidizing agent which will set the dye. Where the material is being run several times through the dye solution, if it is exposed to air in between these passages, the dye will at least partially oxidize, so that when it returns to the dye liquid, the reducing agents there present will act upon the thus oxidized dye, thereby decreasing the concentration of the supply of reducing agents. Consequently, it is an object of this invention to substantially eliminate any exposure to air during the process of impregnating the cloth with dye material.

It is a further object of the invention to reduce the time required for the dyeing process. Ordinarily the material is run from one roll to another roll through a vat of dye solution, both of the rolls being out of this solution. Consequently, the time a given section of cloth is actually submerged in the dye solution is only a very small proportion of the total time of the operation of this old process. In the present invention, the cloth is almost constantly exposed to the solution during the entire time of the dye process.

It is a further object of this invention to produce superior impregnation of the coth by the dye. Where the cloth roll is outside of the dye vat, when the cloth is wound onto the roll, the tension in the cloth and the squeezing of it forces the liquid dye out. Instead of flow through the cloth, it has a tendency to flow toward the opposite edges of the roll, with the result that the selvedges of the cloth have greater concentration of dye than do the center portions. Furthermore, the spreading action is irregular. In the present invention, it is an object to provide a squeezing of the dye through the cloth material by a rolling action to cause superior impregnation and to avoid irregularity of the distribution of dyeing material across the surface of the cloth.

It is a further object of the invention to design a machine, the shape of which reduces the quantity of dye material necessary. Specifically, it is an object to provide such a machine wherein the displacement of the dye solution, produced by the increasing diameter of the roll of cloth, causes the level of the solution in the vat to be raised

so as to be maintained above the roll, thus reducing the initial quantity of dye solution.

It is a further object to provide a dye machine having no crevices on the inside thereof that collect the dyestuffs and resist cleaning.

It is a further object of the invention to provide a special safety control device that releases anyone becoming entangled with the rolls.

Other objects will appear as detail discussion proceeds. In the drawings:

Fig. 1 is a side elevation of the device embodying the invention, a portion being broken away.

Fig. 2 is an end elevation with a portion broken away on one of the roller axes.

Fig. 3 is a section on the line 3—3 of Fig. 2.

Fig. 4 is a plan view of Fig. 1.

Fig. 5 is a section on the line 5—5 of Fig. 3.

Figs. 6–9 are views showing successive steps in the operation of the device.

In the drawings, 10 indicates a frame support secured to the floor or other foundations, the frame comprising four legs 11 formed in pairs, one pair being joined across the top by a horizontal cross member 12 and the other pair being joined by a corresponding horizontal cross member 13. Projecting upwardly from the cross member 12 is an upright 14, and projecting upwardly from the cross member 13 is an upright 15. Each of the uprights is provided with paired brackets, providing a vertical track 16 in which a roll is supported with its center core stayed by the elements of each bracket.

A dual vat member 20 having two sections 21 and 22 is supported by the legs 11. Brackets 23 extending from opposite legs are welded to the bottoms of the sections 21 and 22 and bolted to the legs. The vat member 20, in section 21 has an end wall 24. In section 22 it has an end wall 25. A common intermediate partition wall 26 joints the section 21 with the section 22 and it not as high as the ends walls for a reason to be described. The section 21 is provided with a semi-cylindrical bottom wall 27 and the section 22 with a similar bottom wall 28. The brackets 23 are secured to the outside of the bottom walls 27 and 28.

Side walls 29 and 30 extend across both sections. Each of these side walls is provided with a cutout 31 extending downwardly from the top thereof, into which cutouts are fitted plates 32, the plates being bolted to the walls by bolts 33. Preferably the bolts terminate short of the inside face of the respective walls as shown in Fig. 5, thus avoiding the presence of irregularities in the inner surface of the vats. The plates 32 are provided with flanges 34 through which the bolts 33 extend and each is also provided with an offset 35 extending in flush with the inner face of the vat wall, so as to provide smooth inner surfaces for the vats.

Each plate 32 is provided with an opening 36 adapted to receive a packing gland 37 that may be removably secured in place as by bolts 38. Through the pair of packing glands 37 in the vat 21 extend the axle ends 40 of the roller 41. Through the packing glands 37 of the vat 22 extend the axle ends 42 of the roller 43. These axle ends are journaled by removable bearings 49 in the horizontal cross bars 12 and 13 of the supporting frame 10. As is shown, the packing glands extend a certain distance into the respective vats. In order to accommodate for this and to reduce the width of the device, the rollers 41 and 43 are countersunk, providing pockets as at 44, in Fig. 5, to receive the packing glands 37.

Each of the rollers 41 and 43 comprises a spacer element 45 fixed to its axle, outside of which is a supporting shell 46 and a suitable coating material 47. The coating material may extend around into the pockets 44, providing a close fit with the packing glands 37. The coating material may be any desired substance, such as rubber.

A roller 50, having an axle 51 is journaled in the uprights 14 and 15. The supply roll of cloth 52 rests upon the roller 50, is supported thereby, and guided in the track 16.

Outside the cross bar 12 of the frame, the axles 40 and 42 have secured thereto clutch members 54 and 55 respectively including the beveled elements as shown. A shaft 56 is supported by brackets 57 and 58 on the cross member 12. Slidably, but not rotatably, mounted on the shaft 56, are a clutch member 59 complementary to clutch member 55 and a clutch member 60 complementary to clutch member 54. An operating bar 61 extending all the way around the machine is supported on the cross member 12 of the frame by slide bearings 62 and to the cross member 13 by slide bearings 63. A fork 64 engages the clutch 59 to slide it on the shaft 56 and a fork 65 engages the clutch element 60 for such movement. It will be seen that when the clutch element 59 is in engagement with its element 55, the clutch element 60 will be out of engagement with the element 54 and vice versa. Also a neutral position may be assumed wherein both rolls are free. The shaft 56 is driven from a suitable power source. If desired, an end bracket 66 may be secured to the frame for additional support for the shaft 56.

At the middle of the shaft 56 is a two-way clutch device comprising two opposite clutch elements 67 and 68 mounted for rotation with the shaft, and slidable therealong. A lever 69 is provided for actuating this clutch. Either of these two elements 67 or 68 may then, by operation of the lever 69, be brought into engagement with a driven element 70, on the end of a vertical shaft 71. The shaft 71 is journaled to the upright 14 by suitable journals 72 and 73. At the upper end of the shaft 71 is a bevel gear 74 meshing with a corresponding bevel gear 75 on the axle 51 of the intermediate roller 50. It thus is apparent that the roller 50 may be rotated in either direction by operation of the lever 69, or may idle when the lever 69 is in a neutral position.

On the opposite ends of all of the axles 40, 42 and 51 are pulley wheels 80 over any of which may be looped a brake strap 81 having a weight 82 at one end thereof. The strap is secured at its other end to a peg 83. The weight 82 causes friction and by such braking action prevents the rolls, over which the strap is looped, from overriding.

A dye by-pass drain 90 controlled by a valve 91 is connected to a pipe 92 leading from the vat 21 through a control valve 93; and to a pipe 94 leading from the vat 22 by way of a control valve 95. As will be shown, these valves provide for directing dye solution from either vat to the other, from either vat to drain into pipe 90, or from both vats to drain into pipe 90.

The operation of the device is as follows:

Referring first to Figs. 3 and 6–9, wherein the operation is disclosed sequentially, the operation may be explained. In Fig. 3, a supply roll of cloth, 52, is placed in the track 16 to rest on the intermediate roller 50. The level L—l within the

vat 21 is raised until it just covers the roller 41. The clutches are at this time all in neutral position. The end of the cloth from the roll 52 is then drawn down and wrapped around the roller 41, as shown in Fig. 3. If desired, the liquor level may be maintained below the roller until the cloth is thus started thereon, and then brought up over the same. Such procedure obviates the necessity of the operator's dipping his hands into the solution. The brake strap 81 is looped over the pulley 80 of the roller 50. The bar 61 is shifted to engage the clutch elements 54 and 60 to rotate the roller 41 in a counterclockwise direction. This causes the cloth to be drawn off of the roll 52 across the roller 50 now operating as an idler, retarded by the brake strap, and to be wound onto the roller 41. At this time, of course, the roller 43 is not operating. The cloth being drawn through the dying fluid becomes impregnated thereby. As the diameter of the roll of cloth on the roller 41 increases, its displacement of the liquid increases and the level L—1 thereof is raised, as shown in Fig. 6, so that this level always remains at least slightly above the top of the roll. Rotation of the roller 41 is continued until the cloth is entirely wound thereon.

Shortly before all of the cloth is wound onto this roller 41, the level L—1 will have been raised to such a point that a certain portion of the fluid within the vat 21 will have been displaced over the center wall 26 into the vat 22. When the entire roll 52 is wound onto the roller 41, the core of this roll 52 may be removed, if desired.

The end of the cloth from the roller 41 is now carried over the roller 50 and looped onto the roller 43. The dyeing liquor level L—2 within the vat 22 may now be raised until it comes just over the top of the roller 43. This raising may be effected by closing the valve 91, and opening valves 93 and 95 so that liquor from vat 21 will seek its level in the vat 22, and any necessary additional liquor added to provide the proper level and concentration within the vat 22. However, this operation of transferring from one vat to another may be restricted, since it is desirable to maintain the roll of cloth on roller 41 submerged so as not to be exposed to air. The controller arm 61 is now shifted to disengage the member 60 from the member 54. The brake strap is now looped over the pulley 80 of the roller 41, this roller being free in the next operation. Following this, the arm 61 is further shifted to engage the member 59 with the member 55 so that the roller 43 is rotated clockwise and the roller 41 is free. The cloth is then wound, as shown in Fig. 7, from the roller 41 onto the roller 43, the level L—2 rising with the increasing displacement of the cloth wound onto the roller 43 and the level L—1 dropping correspondingly with the decreasing displacement of the roller 41. The supply of liquor in the container 21 will be reduced to some point such as shown in Fig. 8, since a portion thereof is carried over into the vat 22 by the previously described cataract action over the wall 26, and the absorption thereof by the cloth. As the displacement in the vat 22 approaches its maximum, the cataract action back from this vat to the vat 21, over the partition 26, takes place.

The action back and forth between the rolls is repeated as many times as is necessary to secure the desired dyeing. Since the leading end originally run onto the roller 41 from the roll 52 is immersed longer than the trailing end rolled thereon, the back and forth action between the rollers should always end after winding onto the roller 43 since this compensates the above effect, as the trailing end becomes the leading end with respect to the roller 43. After the cloth has been run a suitable number of times, as described, the core of the roller 52 is replaced within the track 16, and the trailing end of the cloth is then run over the roller 50 and wrapped around the core. The shifting arm 61 is moved to neutral position so that both the rollers 41 and 43 may be idle. The brake strap at this time is hung over the pulley 80 on the roller 43. As the cloth is wet, it will adhere to the core 52. The lever 69 is shifted to rotate the roller 50 in a clockwise direction. As the core 52 rests upon the roller 50, it will be rotated in a counterclockwise direction and will take up the clutch, unwinding it off the now brake retarded idling roller 43.

It will thus be seen that the cloth throughout the dyeing operation is always entirely submerged in the dyeing fluid, save for the small amount in passage over the roller 50. Consequently the time of operation of the dyeing process is substantially reduced since the absorption of dye is a function of the time the cloth is exposed to the liquor. Furthermore, the oxidation of the dye materials by exposure to air is reduced to an insignificant quantity, giving a more even coloration and eliminating the waste of chemicals. The evenness of coloration is further aided by the fact that, as the cloth is rolled onto one of the submerged rollers, a pocket between the on coming cloth and the roller is formed. This pocket catches and holds liquor that is squeezed directly through the cloth uniformly across the width thereof as it is wound onto the roll. This is in contra-distinction to the action of rolls suspended in the air, wherein, as previously described, the tendency of the squeezed liquor is to flow laterally toward the edges of the bolt. In the present device squeezing the liquid through the cloth causes superior impregnation, and more even distribution of the dye.

In addition to the above, the necessary quantity of chemicals is reduced. The peculiar shape of the vats, so as to employ the displacement of liquor caused by the increase in diameter of the rolls, reduces the required quantity of dyeing fluids to a minimum. Likewise in shifting from one vat to another, the overflow across the middle wall 26 saves in chemicals, since this overflow contributes to the quantity of dye available for a subsequent operation of rolling the cloth onto the other roll. In addition to this, dye may be passed from one vat to the other by operation of the valves 91, 93, and 95. Also, the rollers are extended substantially to the side walls of the device, the pockets 44 permitting the use of packing glands without increasing the volume of the vats.

As will be evident from the previous description, the interior of the vats is almost entirely smooth. Crevices and pockets are reduced to a minimum, the interior surface of the vats being entirely smooth and all of the working parts being on the outside. It will be observed that there are no frameworks or bearings within the vats where they would be subject to the destructive action of the dyestuffs, and also would involve the presence of many pockets and crevices. Crevices and the like, if present, will entrain quantities of dye material that in any event necessitate completely washing out the machine every time it is used. However, in most cases, these quantities of entrained dye elude the washing action and remain pocketed. Should the

machine be used for a different color or a different shade, this entrained dye will gradually come forth and mix in indeterminate quantities with the mass of liquid within the vats, affecting the color of the dye and even causing streaks and specks in the material. This problem has been minimized by the construction and design of the present device, wherein crevices are eliminated.

When it is desired to remove the rolls, the plates 32 may be unbolted, the bearings 49 removed and the rolls lifted out. The stuffing boxes are likewise detachable, by removal of the screws 38.

The provision of the shifting bar 61 extending all the way around the machine is a factor both for convenience and safety. Obviously, it may be shifted from any side of the machine. Should the operator, when manipulating the cloth onto either roller 41 or 43, become entangled, he will be drawn against the bar and will shift and disengage the respective clutch. If he strikes the bar with sufficient force, he will not only disengage the one clutch, but will engage the other clutch and reverse the action of the machine.

Having described the invention, what is claimed is:

1. In the method of liquor treating material, the steps of successively collecting the material into a liquor containing vat beneath the liquid level therein, the liquid level being initially below the potential maximum height of the material, maintaining said level above the mass of collected material by the displacement caused by the increasing mass of material in the vat, passing the material successively into another vat, the liquid level of which is initially below the potential maximum height of the material, and maintaining the latter level above the increasing height of the collecting material by the displacement caused by said material.

2. In a method of dyeing material, the steps of successively collecting the material into a liquor containing vat beneath the liquid level therein, the liquid level being initially below the potential maximum height of the material, raising said level by the displacement caused by the increasing mass of material in the vat, until said level reaches a predetermined height, causing said further displaced liquor to pass into a second vat, and then successively collecting the material into said second vat.

3. In a method of dyeing material, the steps of rolling material onto a roller in a dye-containing vat, the liquid level in said vat being below the potential height of the completed roll of material in the vat, raising the liquid level in said vat by the displacement caused by the increasing roll of cloth, so that the roll is maintained submerged in the liquid, then transmitting the material to another dye-containing vat, rolling it on a roller therein while unrolling it from said first roller, and maintaining the roll of cloth in said second vat beneath the liquid level therein.

4. In a method of dyeing material, the steps of rolling material from outside onto a roller inside a dye-containing vat, the roller being underneath the dye level therein, raising the dye-level in accordance with the increasing diameter of, and consequent displacement by, the roll of material so that said level is maintained above the roll, until said level reaches a predetermined height, conducting any further displaced liquid into a second vat containing a second roller, until at least substantially all the cloth is onto said first roller, adding any necessary additional dye into said second vat to obtain the proper concentration thereof, and to raise the level thereof above the roller, winding said material onto said second roller from said first, raising the liquid level in the second vat by displacement caused by the increasing diameter of the roll of material so that said level is maintained above the material on the roll, and finally unwinding the material from one of said rolls to collect the same outside the vats.

5. In an apparatus of the kind described, a vat adapted to contain liquor, and to have a quantity of material successively collected therein, said vat being adapted to contain liquor at a level initially below the potential height of the entire final mass of collected material, said vat being so shaped and dimensioned that the liquor level will be elevated by the displacement caused by the increasing mass of the material and will be maintained above said mass, and discharge means permitting outflow of the liquor from the vat when the level reaches approximately a maximum height equal to the top elevation of the material when the total mass thereof is disposed in the vat.

6. In an apparatus of the kind described, a vat, a roller in the vat, axles on the roller extending into the opposite walls of said vat, said vat having cut-out portions in said walls extending down from the top thereof to below said roller axles, and removable plates having openings to receive said axles, and mounted in said cut-out portions to close the same.

7. In an apparatus of the kind described, a vat, a roller in the vat, axles on the roller extending into opposite walls of said vat, said vat having cut-out portions in said walls extending down from the top thereof to below said roller axles, removable plates having openings therein to receive said axles, packing glands mounted in said openings about said axles, and the plates having the inner surfaces thereof extending flush with the inner surfaces of the walls in which they are mounted.

8. In an apparatus of the kind described, a vat, a roller therein, axle ends on said roller adapted to extend into opposite walls of said vat, packing glands mounted on said walls, surrounding said axle ends, and extending into the interior of the vat, and said roller extending over and closely surrounding at least part of the inwardly extending portions of said glands.

9. In an apparatus of the kind described, a container comprising two vats, each of said vats having a bottom portion in the shape of a half-cylinder, slots in opposed walls of the vats, and plates of a configuration to overlap said slots removably bolted to said walls to cover said slots.

10. In an apparatus of the kind described, a vat, slots in opposed walls of the vat, a plate fixed to each wall and overlying the respective slot, and an aperture in each plate adapted to receive a packing gland for a shaft adapted to extend therethrough.

11. In an apparatus of the kind described, a vat, slots in opposed walls of the vat, a plate fixed to each wall and overlying the respective slot, each of said plates including a raised portion fitting into a slot of a configuration and size of the slot and of a thickness of the wall of the vat, and an aperture in each plate adapted to receive a packing gland for a shaft adapted to extend therethrough.

12. A method of jig dyeing permitting the use of a minimum volume of liquor which comprises

winding a cloth web into roll form while submerged in a bath of liquor confined to substantially the shape of the lower half of the completely wound roll and initially of a height less than that of the completely wound roll, the liquor being confined sufficiently closely to the dimensions of the completely wound roll so that the level of the liquor will remain at all times above the upper portion of the roll during the winding operation.

13. A method of transferring cloth between successive separate baths of liquor which comprises unwinding the cloth from roll form while completely immersed in one bath of liquor and rewinding it directly into roll form while completely immersed in a successive separate bath of liquor to avoid entrapment of air between the plies as the cloth is wound into roll form and exposure of the selvedges of the cloth to contact with the atmosphere in excess of the exposure of the body of the cloth to the atmosphere.

14. In an apparatus of the kind described, a pair of vats adapted to contain liquor, a roller in each vat adapted to have material rolled and collected thereon, said rollers being disposed so that one winds while the other unwinds material, said vats being adapted to contain liquid, the vat receiving material being adapted to have liquor therein initially above the roller but below the ultimate height of the material, and the vats being so shaped that the said liquor will be elevated by the displacement caused by the increasing mass of the enlarging roll of cloth and will be continuously maintained above said roll.

15. In a cloth dyeing machine, a pair of adjacent vats, each adapted to contain a wound up roll of material and a quantity of treating liquor sufficient to completely cover the roll, a wind-up roll located within each vat at such a level that material wound thereon may be maintained below the surface of treating liquor therein, means for guiding material from one wind-up roll to the other, and means for selectively operating said wind-up rolls to unwind material from one roll while completely immersed in one bath of liquor and to rewind the material directly into roll form in the outer vat while completely immersed in a separate bath of liquor.

16. In an apparatus of the kind described, a container, a partition therein dividing said container into two vats, said partition terminating below the upper edges of the outside walls of said container, means in each vat to collect material, means to conduct the material from one means in one vat to the other means in the other vat, each vat being adapted to contain liquor to act upon said material the level of which is adapted to be raised by the displacement caused by the mass of material in the vat in which it is collected, the height of the partition being such as to maintain the liquor at least substantially to the top or the material accumulated in the vat and to permit excess liquor to pass into the other vat.

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