Oct. 19, 1943. W. E. ROWLANDSON, JR 2,332,346

DYEING MACHINE

Filed June 12, 1942 2 Sheets-Sheet 1

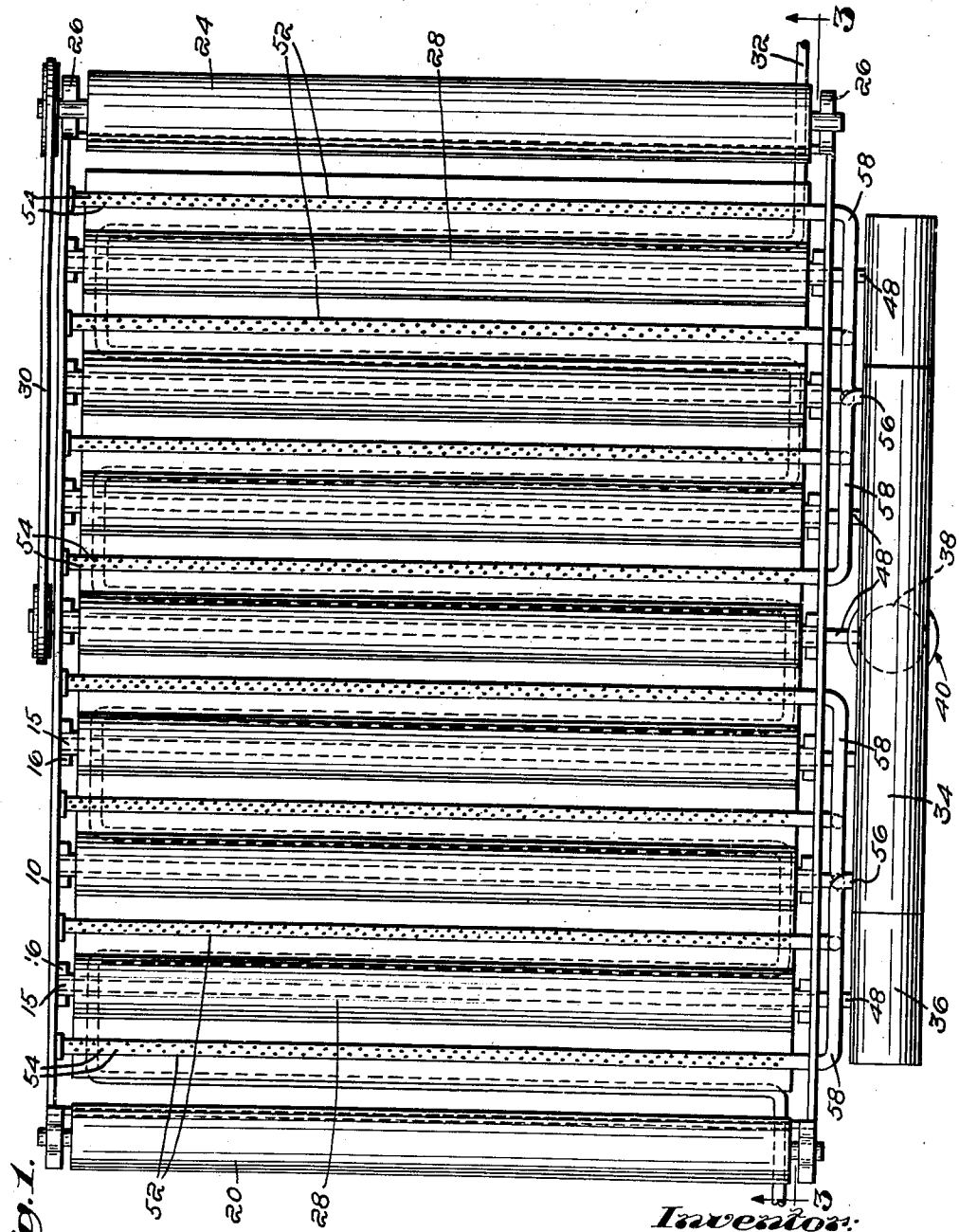


Fig. 1.

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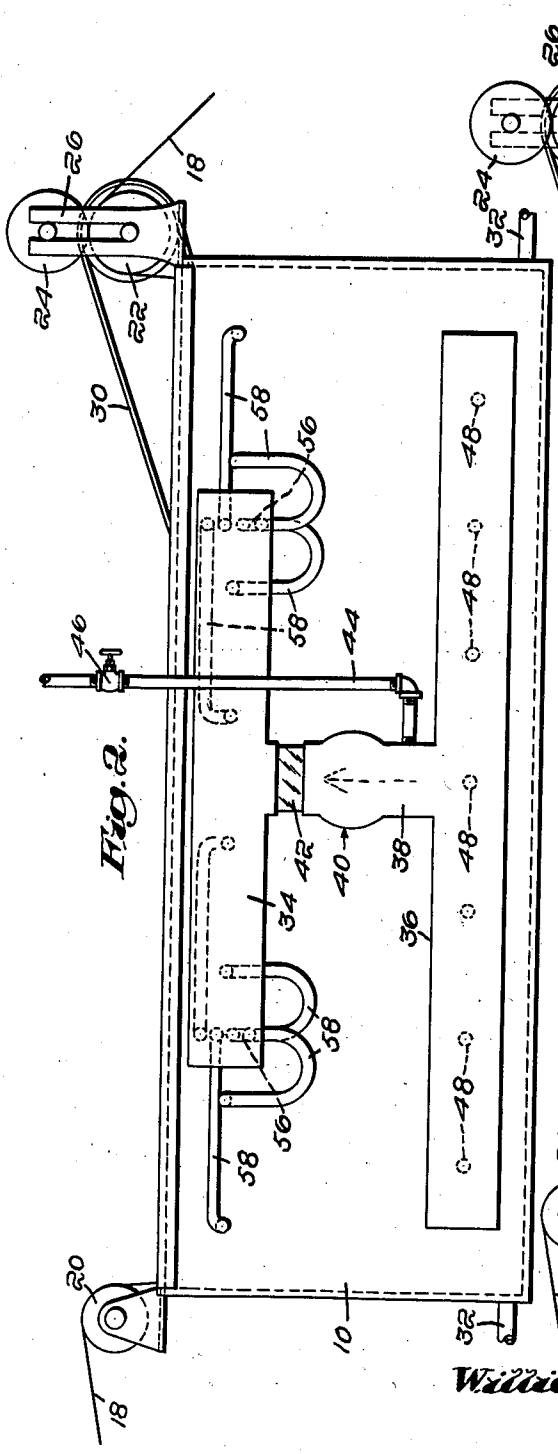


Fig. 2.

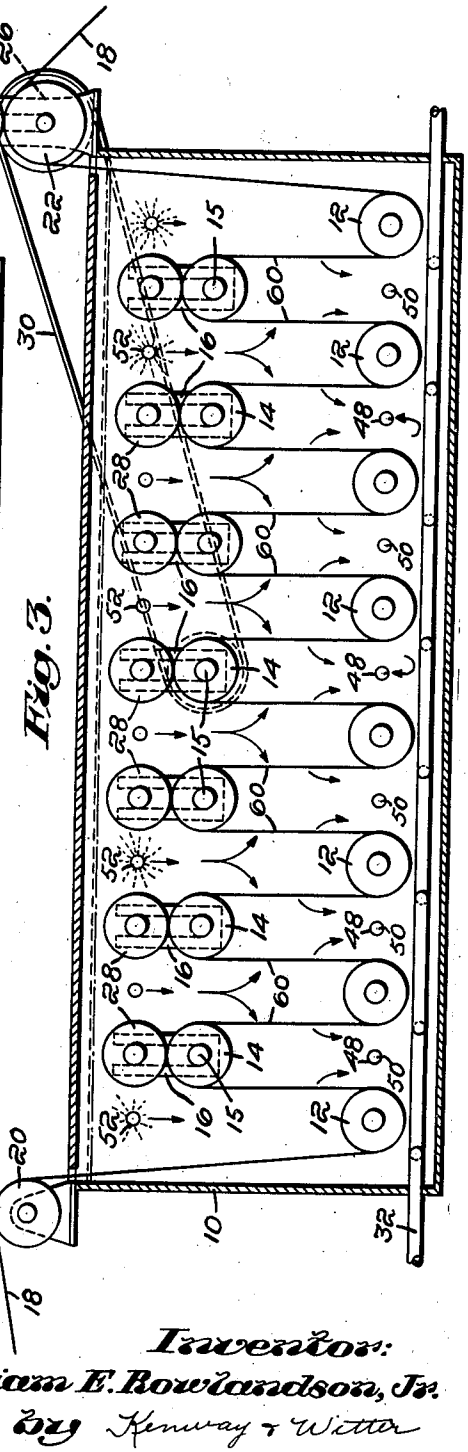


Fig. 3.

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DYEING MACHINE

William E. Rowlandson, Jr., Lowell, Mass.

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5 Claims. (Cl. 68—51)

This invention relates to dyeing machines and more particularly to the indigo-dyeing of fabrics in continuous strip form. Indigo-dyeing has heretofore been most commonly performed on wool yarn or warp since it has been impossible to indigo-dye in the piece with satisfactory uniformity of shade and color as compared to the dyeing of the wool before weaving. The primary object of the invention is the production of an improved method and machine particularly adapted for efficient indigo-dyeing in the piece with a superior uniformity heretofore impossible and to the end of producing fabric of even shade and superior color character throughout.

My invention contemplates a dyeing machine employing a tank and means for conducting a continuous strip of fabric therethrough in a plurality of substantially vertical loops, together with means for circulating the dyeing liquid through the tank and fabric in a manner keeping the entire liquid of uniform character and impregnating the fabric uniformly throughout its length. The dye circulating means embodies a mixing reservoir outside of the tank and a novel piping arrangement therefrom to the tank together with means for drawing the liquid from the fabric loop areas open to the bottom of the tank and delivering it to the loop areas open to the top of the tank, whereby keeping the liquid fully agitated and uniform and circulating it through the fabric located between the said areas. Means is provided for feeding fresh dye to the reservoir, thoroughly mixing it with the dye bath therein and bringing the mixture uniformly to the dyeing tank and into contact with the fabric, together with the provision of means whereby the liquid can be observed and kept in the necessary condition by the addition of fresh dye and chemicals in accordance with the requirements indicated by its color.

Other features of the invention relate to the complete submergence of the fabric in the dyeing liquid throughout the entire operation while alternately squeezing and exposing the fabric to the liquid whereby completely to impregnate it with dye while maintaining the fabric and dye from exposure to the air which would cause oxidation of the liquid and crocking or smudging of the fabric. The production of a new and improved dyeing method and machine embodying these and other novel features hereinafter more specifically described comprises a further object of the invention.

These and other features of the invention will be best understood and appreciated from the following description of a preferred embodiment thereof selected for purposes of illustration and shown in the accompanying drawings in which,

Fig. 1 is a plan view of a dyeing machine embodying my invention,

Fig. 2 is a side elevation thereof,

Fig. 3 is a longitudinal sectional view taken on the line 3—3 of Fig. 1,

In the drawings 10 indicates a tank of rectangular configuration. Mounted within and extending transversely across the tank adjacent to its bottom are a plurality of fabric-supporting rolls 12, and in alternating relation thereto adjacent to the top of the tank are a plurality of like rolls 14. The rolls 12 are supported in fixed bearings at their ends and the rolls 14 are supported by end trunnions 15 in U-shaped guideways 16. The rolls are adapted to support a continuous strip 18 of fabric in a plurality of substantially vertical loops around the rolls, the loops over the bottom rolls 12 being open to the top of the tank and the loops over the top rolls 14 being open to the bottom of the tank. The fabric strip passes into the tank over a supporting roll 20 and passes out of the tank between a pair of squeeze rolls 22—24 supported for rotation by end trunnions in vertical guideways 26.

Also supported by end trunnions in the guideways 16 are squeeze rolls 28 resting of their own weight in peripheral contact with the rolls 14, all of the rolls, 12, 14 and 28 being located well within and below the top of the tank. The strip 18 is drawn through the tank by the squeeze rolls 22—24 and by the mid-pair of rolls 14—28, a chain or belt 30 being adapted to drive the mid-roll 14 from the roll 22 at equal surface speeds. The roll 22 can be driven from any convenient source of power. The tank is filled with dyeing liquid to a level fully submerging the rolls 12, 14 and 28 and is kept at the proper temperature by a steam pipe 32 in the tank beneath the rolls 12.

Cooperating with the tank and extending horizontally along one side wall of the machine outside the tank is a mixing reservoir having an upper portion 34 and a lower portion 36. The reservoir conveniently comprises two relatively large pipes 34 and 36 connected intermediate of their ends by a pipe 38 having a circulating pump 40 therein and also a glass observation portion 42 above the pump. A pipe connection 44 is also made to the pipe 38 below the pump, the pipe 44 extending upwardly to a source of fresh dye supply and having a flow-controlling valve 46 therein.

Pipes 48 in communication with the lower reservoir portion 36 extend into the tank and transversely therethrough between the rolls 12 and adjacent to the bottom of the tank. The lowermost wall portions of these pipes within the tank are slotted at 50 to permit the dye liquid to pass into the pipes. Other pipes 52 in communication with the upper reservoir portion 34 extend into the tank and transversely therethrough between the rolls 14 and adjacent to the

top of the tank. The portions of these pipes within the tank are perforated therearound and therealong at 54 to permit the dye liquid therein to spray outwardly into the tank bath. As hereinafter more specifically described, it is desirable that these pipes 52 shall be at substantially equal dye-flowing distances from the fresh dye supply entrances 44. To this end the pipes 52 join the pipe 34 at points 56 equally spaced from the pipe 44, and the pipe sections 58 connecting the pipes 52 to the pipes 34 are all of equal length.

Indigo-dyeing embodies requirements and conditions peculiar to itself and the degree to which these are satisfied is quite reflected in the perfection of the product. The machine herein described and comprising my invention has been developed to the end of satisfying these requirements to the maximum and especially in the dyeing of continuous strip fabric.

The rolls 12 and 14 are arranged to support the fabric in a plurality of zig-zag loops in the tank, the loops being substantially vertical, i. e. up and down rather than horizontal, and extending from a position well toward the bottom of the tank to a position approaching the top thereof. Each roll 12 and 14 supports two reaches 60 of fabric and each such reach is located between a loop area of a roll 12 open to the top of the tank and a loop area of a roll 14 open to the bottom of the tank. The pipes 48 are located in the loop areas below the rolls 14 and are adapted to draw dye from the tank, and the pipes 52 are located in the loop areas above the rolls 12 and are adapted to return the dye to the tank.

The tank is well filled with the dyeing liquid to a level completely submerging all the rolls 12, 14 and 28 and the pipes 38 and 52, and also completely filling the reservoir 34—38. As the strip 18 is drawn through the tank, the circulating dye is continuously passed through the reaches 60 whereby thoroughly impregnating the fabric, it being understood, as illustrated in Fig. 1, that the rolls 12, 14 and 28 and the fabric strip thereon extend substantially across the entire width of the tank whereby requiring the dyeing liquid to pass through the fabric in its circulation from the pipes 52 to the pipes 48. The impregnated fabric thereupon passes through and between the squeeze rolls 14—28 which expresses the dye therefrom, the several alternately operating saturating and expressing steps which take place as the fabric passes through the tank serving thoroughly to impregnate the fabric. Furthermore, the entire operation takes place wholly beneath the bath and without exposure to the air, thus not only preventing oxidation of the dyeing liquid and keeping it in maximum reduced state but also preventing crocking and other like deleterious effects caused on the fabric when it is exposed to the air during the dyeing treatment.

The circulating mechanism, including the upper and lower reservoir portions 34 and 36, is arranged to keep the dyeing liquid to maximum uniformity. The pipes 48, being slotted in their lowermost portions 50, serve to pick up any heavier portions which might tend to settle in the tank and circulate the same through the reservoir wherein the liquid is quite thoroughly agitated and rendered thoroughly uniform as it is returned to the tank. The pipes 52, being perforated therearound, serve to spray the liquid into the bath whereby aiding further in agitating the liquid and keeping it uniform. The character of the bath is determined primarily by its color and the introduction of the observation glass 42 within the reservoir permits the operator to keep close check thereon and add fresh dye as needed. It will be observed that this fresh dye is added ahead of the pump 40 whereby aiding its thorough mixing in the bath before it comes in contact with the fabric. It will also be noted that the liquid passing through the pump is required to travel equal distances through pipes 58 to the several pipes 52 whereby further supplementing uniformity of the dying operation.

Having thus disclosed my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A dyeing machine comprising a tank for holding a dyeing liquid, means for conducting a continuous strip of fabric in a plurality of substantially vertical loops through the tank, a dye-holding and mixing reservoir outside the tank and including upper and lower portions respectively adjacent to the top and bottom of the tank and extending horizontally therealong, pipes extending from the upper portions into and through the top portions of the tank along and in the loop areas open thereto and from the lower portion into and through the bottom portion of the tank along and in the loop areas open thereto, the portions of the pipes within the tanks being perforated along the loop areas, and means for circulating liquid dye in one direction through the reservoir, pipes and tank.

2. The machine defined in claim 1 in which the last named means comprises a circulating pump in the reservoir between said upper and lower portions thereof.

3. The machine defined in claim 1 plus means for feeding fresh dye into the reservoir between said upper and lower portions thereof.

4. A dyeing machine comprising a tank for holding a dyeing liquid, means for conducting a continuous strip of fabric in a plurality of relatively spaced reaches through the tank, a dye-holding reservoir outside the tank, means for feeding fresh dye into the reservoir, and means for circulating the liquid from the reservoir through the tank and including a plurality of reservoir to tank conducting pipes having perforated portions extending into the tank and through areas adjacent to said reaches, said pipes being in communication with the reservoir at substantially equal dye-flowing distances from the fresh dye-receiving entrance into the reservoir.

5. A dyeing machine comprising a tank for holding a dyeing liquid, means for conducting a continuous strip of fabric in a plurality of substantially vertical loops through the tank, a dye holding reservoir outside the tank and extending horizontally therealong, means for feeding fresh dye into the reservoir, and means for circulating the liquid from the reservoir through the tank and including a plurality of pipes having perforated portions extending into and through the top portion of the tank along and in the loop areas open thereto, said pipes being in communication with the reservoir at equal distances from the fresh dye-receiving entrance thereinto and the lengths of said pipes outside the tank being equal.

WILLIAM EDWARD ROWLANDSON, JR.