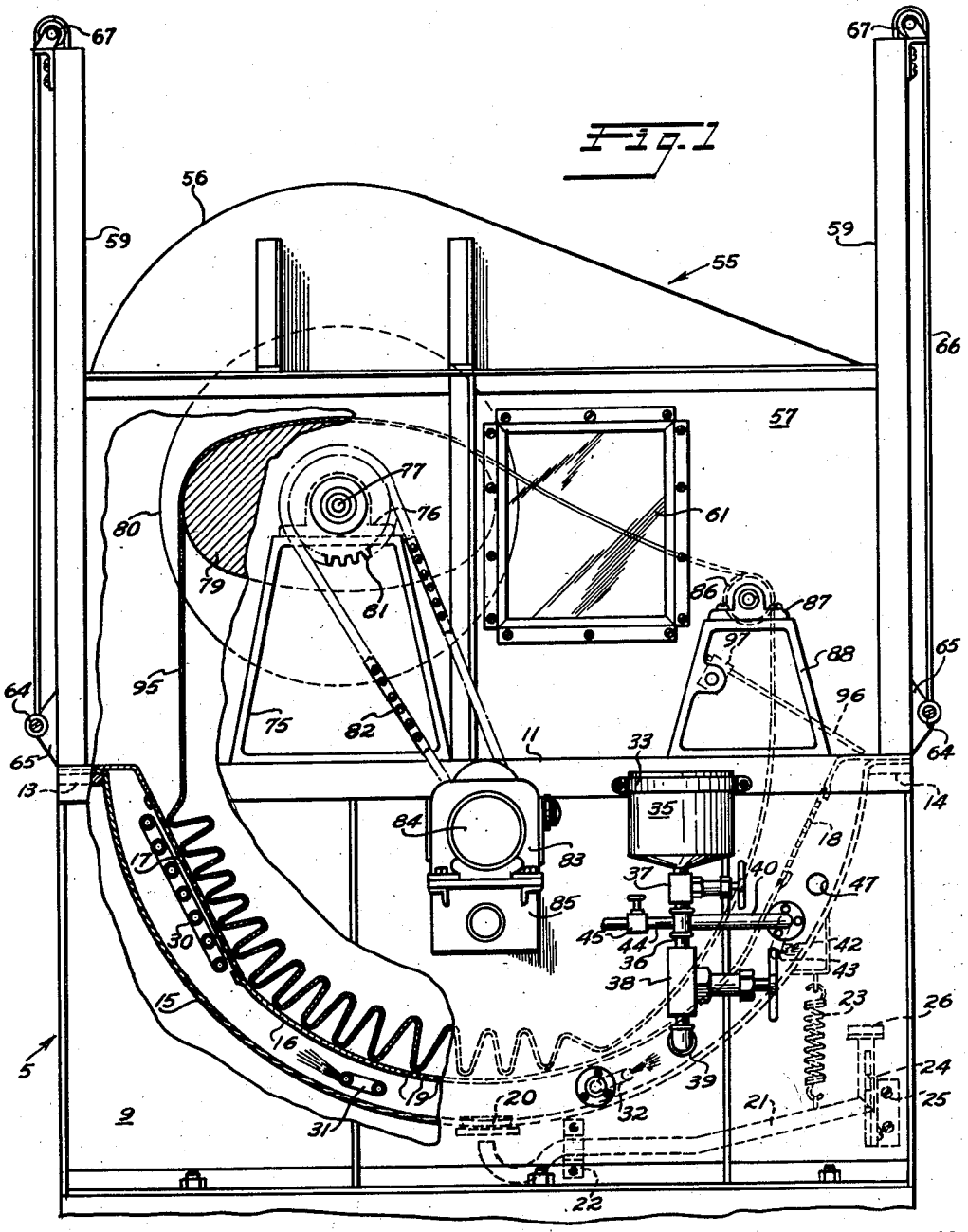
April 19, 1955 H. H. BELCHER ET AL 2,706,391

DYE KETTLE

Filed Nov. 30, 1950 2 Sheets-Sheet 1

Fig. 1



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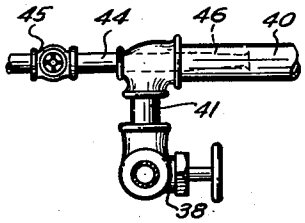

Fig. 4

Fig. 2

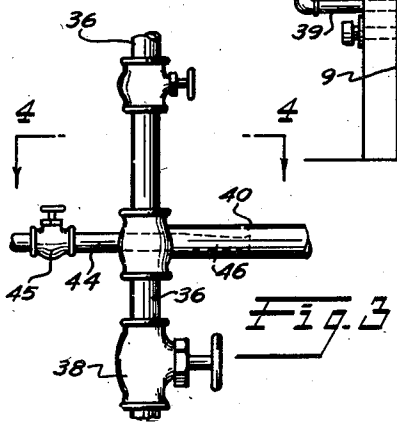

Fig. 3

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DYE KETTLE

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4 Claims. (Cl. 68—177)

This invention relates to apparatus for treating textiles and more particularly to apparatus for dyeing fabrics and the like.

The dyeing of fabrics or the like is usually carried out by passing the fabric through a liquid dye bath and to secure the proper intensity or depth of color it is usually necessary to hold or soak the fabric in the dye bath for a period of time. This is usually done by folding or piling the fabric in loose folds in the dye kettle between the point where the fabric enters and the point where it leaves the tub or kettle so that the fabric is subjected to the action of the dye liquors for a long period of time regardless of the speed of entrance or withdrawal.

Many modern dyeing processes are most effectively carried out at a temperature at or near the boiling point of water and the efficacy of the dye bath depends upon the maintenance of a relatively uniform temperature throughout the entire bath. In order to secure uniform dyeing it is also essential that the concentration of dye in the dye liquor itself be maintained substantially constant throughout the tub, even though new dye must be added from time to time to maintain the proper concentration of dye in the liquor. It is therefore highly important that both the composition and temperature of the dye liquor be uniform throughout the tub or kettle in order to secure uniform results. Relatively minor variations of temperature or composition of the dye liquor may produce variations in the final shade of the material and may result in uneven dyeing and render the material unsuitable for commercial use.

For many years the art has sought to provide dye kettles and dye becks which would establish and maintain uniform conditions of temperature and composition of the dye bath. Most of these prior dye kettles and dye becks have, however, deficiencies and defects and could not maintain uniformity of conditions nor produce uniform results.

In many of these prior dye becks or kettles steam has been used to maintain the temperature and this steam has been injected adjacent the end of the tub where the fabric is being withdrawn. This steam will maintain the temperature adjacent the point of injection, but the tubs are usually of fairly large size and there is usually a substantial temperature drop toward the other end of the tub. Because of the loosely piled fabric on the bottom of the tub, prior art dye becks or kettles have avoided substantial movement or circulation of the dye liquor since such circulation can upset the folds of material and bring about tangling in the tub.

I have found that the temperature and composition of the dye liquor throughout the tub can be kept uniform and maintained within close limits so that uniform dyeing can be accomplished. The apparatus of the present invention avoids the temperature gradients and lack of uniformity of the prior art and provides a simple and efficient apparatus for uniformly dyeing fabrics. The dye liquor may be maintained at substantially uniform temperature and composition throughout the tub and circulated without upsetting or tangling the piled fabric within the tub.

In accordance with the present invention, the dye is thoroughly mixed with the liquor and is introduced into the tub at the point where the fabric is moving in a line and its rate of travel is greatest. In the present apparatus the dye liquor is circulated through the tub without upsetting the fabric and the circulation paths may be

changed depending upon the requirements and conditions of the particular operation.

Accordingly, it is a primary purpose and object of the present invention to provide an improved dyeing apparatus which assures the production of dyed goods of a uniformly high quality with greater speed, simplicity, and economy.

It is a further object to provide a dye kettle in which the circulation of the dye liquor may be controlled and varied.

It is another object to provide a dye kettle in which the concentration of the dye in the dye liquor may be established and maintained at a uniform predetermined level.

It is a further object to provide a dye kettle in which the dye liquor can be maintained at a substantially uniform temperature.

It is a still further object to provide a novel arrangement for circulating the dye liquor around and through the fabric.

It is another object to provide a dye kettle in which a portion of the dye liquor is recirculated through the kettle.

It is also an object of the invention to provide a new and improved apparatus for injecting dye into a dye kettle.

It is also an object to provide a dye injection system which may be readily and easily cleaned and flushed.

It is another object to provide an improved dyeing apparatus which is compactly arranged permitting a saving in manufacturing, transportation, installation, and maintenance cost.

Further objects and advantages will become apparent as the description proceeds in connection with the accompanying drawing in which:

Figure 1 is a side elevation of an apparatus embodying the invention partially cut away to show interior details of construction;

Figure 2 is an end elevation of the apparatus of Figure 1 similarly cut away;

Figure 3 is an enlarged fragmentary elevation showing the operation of the dye injector; and

Figure 4 is a fragmentary plan view of the dye injector taken on line 4—4 of Figure 3.

Referring now more particularly to the drawing, **5** indicates generally a dye kettle having spaced vertical side walls **9** and **10**, each having upper and lower longitudinally extending flanges **11** and **12**. Extending between walls **9** and **10** at their opposite upper ends are transverse frame members **13** and **14**. A curved bottom **15** is welded at its ends to members **13** and **14** and along its sides to walls **9** and **10**, defining with the latter a liquid-tight tub or tank for dye liquor or the like. A baffle or false bottom **16**, of generally the same configuration as the dye kettle bottom **15**, is welded to side walls **9** and **10**, and at its ends to the bottom member **15** with which it is in spaced relation. Perforated plates **17** and **18** are removably secured to the baffle **16** near the top of the tub and baffle **16** is also provided with perforations **19** at its lowermost portion. The plates **17** and **18** are secured in any suitable manner and may be removed for access to the pipes or coils between wall **15** and baffle **16**. At its lowermost portion, the bottom **15** is provided with a quick-acting, gravity seated drain plug **20** which is opened by a lever **21**, pivotally mounted on a bracket **22** secured to side wall **10**. Lever **21** is actuated by a foot pedal **26** at the front of the dye kettle and is raised to its upper position by a spring **23**. The lever **21** may be held in its depressed position by a bracket **25** having notches **24** in which the lever **21** engages.

Mounted by any suitable means, not shown, between bottom **15** and baffle **16** at an elevated position in the rear of the dye kettle **5** adjacent perforated plate **17** in baffle **16** is a heating coil **30** which is preferably closed and may be supplied with hot water or steam from any suitable source, not shown. A pair of T-type heating coils **31** and **32** are similarly mounted between bottom **15** and baffle **16** adjacent the bottom of the kettle **5** opposite an imperforate section of baffle **16**. Heating coils **31** and **32** are supplied with steam from any suitable source, not shown, and are provided with spray jets or

openings, which expel the steam outwardly and upwardly between the bottom 15 and the baffle 16 as shown in Figure 1.

Rigidly mounted on side wall 9 as by a strap 33 is a dye pail 35. A conduit 36 extends downward from the dye pail 35 and has an upper valve 37 and a lower valve 38. At its lower end, conduit 36 is connected with the interior of the dye kettle 5 between the bottom 15 and baffle 16 through a conduit 39. At a point intermediate valves 37 and 38, conduit 36 is connected to a conduit 40 through a horizontal conduit 41. At one end, conduit 40 is connected to a T coil 42, similar in construction to coils 31 and 32, positioned between baffle 16 and bottom 15 and provided with a plurality of spray openings 43 which are directed upwardly against the bottom 15.

Steam is supplied to the dye injector from a suitable source not shown through a conduit 44 controlled by a valve 45. As shown in Figures 3 and 4, steam conduit 44 is provided with an injection nozzle 46 which extends into the conduit 40. When steam is supplied to the nozzle 46, aspirating action will entrain any surrounding fluid from pipe 41 causing it to flow into coil 42 after thorough mixing with the steam. As indication of the flexibility of this dye injection system, it will be seen that, by opening valves 37 and 45, a hot mixture of steam and dye is positively injected into the dye kettle regardless of the level or static head of the fluid in dye pail 35. If valves 37, 45 and 38 are all opened, a portion of the dye liquor is recirculated and thoroughly mixed with the steam and undiluted dye stuff from dye pail 35. When only valves 38 and 45 are open, the dye liquid is mixed with steam from the injector 46 and reintroduced through pipe 40. Plain steam may be injected by closing all valves except 45. Further, at the completion of a dyeing operation, the pail 35 may be filled with clean water and valves 37 and 45 and, if desired, valve 38 may be opened for flushing out the entire system.

One or more inlets 47 are provided to fill the dye kettle 5 with water to the level of a pair of skimmer drains 48, mounted at opposite sides of the dye kettle, having drain slots 49 at their upper ends and drain pipes 50 at their lower ends.

An upper housing indicated generally at 55, consisting of a roof 56 and a pair of side walls 57 and 58 is removably attached to the dye kettle 5 by straps 60. The members 57 and 58 are preferably provided with sealed windows 61 through which the operation may be observed.

The walls 57 and 58 are each provided at opposite ends with vertical channels 59 which face each other so as to provide a vertical slide at each end of the upper housing 55. Inspection doors 62 are slidable in the channels 59 and each inspection door is preferably provided with one or more inspection windows 63. These inspection doors and the operating mechanism therefore are substantially identical so that only one door and mechanism will be described. Each door 62 is provided with an operating handle 64 attached to brackets 65 adjacent the lower edge of the door 62. Flexible chains or cables 66 extend upward from each end of the handle 64 over pulleys 67 on a shaft 68 journalled on the top of channels 59 and are preferably provided with counterweights, not shown, which are movable within the channels 59. The opening and closing of the door 62 is thus facilitated for ready access to the interior of the dye kettle.

A pair of spaced support brackets 75 are secured on the top of flanges 11 adjacent the rear of the tub or tank 5 and a shaft 77 is rotatably mounted in journals 76 carried by the brackets 75. A suitable feeding and plaiting mechanism such as the ovate drive reel 79 having side flanges 80 is fixed on the shaft 77 within the housing 55 above the rear end of the tank or tub 5. A variable speed motor 84 is mounted on a bracket 85 secured to the wall 9 and drives a sprocket 81 fixed on the shaft 77 externally of the housing 55 through a speed reducer 83 and chain 82.

A flanged guide reel 86 is rotatably supported at its opposite ends in a pair of journals 87, attached to support members 88, in turn mounted externally of housing 55 on flanges 11 and 12 of walls 9 and 10. This guide reel 86 is mounted above the front end of the tub or tank 5.

The cloth 95 to be treated, which may be in the form of one or more continuous lengths is positioned over reels 79 and 86, the slack portion being loosely supported in the dye liquor on the upper surface of baffle 16 as shown

in Figure 1. When the cloth is made into ropes or strings, guide pins 96, which are removably mounted at spaced intervals on a transverse bar 97, are provided to guide and "balloon" the individual strings as more fully described in United States Patent 2,062,943.

In operation, the dye kettle 5 is partially filled with heated water and with valves 37 and 45 opened, and valve 38 closed, steam is supplied to injector 46 introducing the dye stuff into the kettle. After the desired concentration is reached in the dye liquor, valve 37 is closed and valve 38 may be opened to recirculate the dye liquor through coil 42 to insure thorough mixing and to provide additional heating as required. Further mixing and heating is also effected by operation of coils 31 and 32.

With the cloth in the position shown in Figure 1, the motor 84 is energized driving reel 79, depositing the cloth in a series of loose plaits on the rear of baffle 16 and removing cloth from the front of the baffle over roller 86. It is to be noted that the curvature of baffle 16 is such that the plaited cloth slides along the curved baffle 16 toward the reel 86 and the tension on the cloth between roller 86 and the baffle 16 is thus minimized. The length of the portion of cloth under tension is also greatly decreased over that common in prior installations, allowing a greater proportion of the cloth to be submerged in the dye liquor, thereby materially increasing the speed of the dyeing operation.

As pointed out above, the effectiveness of the dyeing operation is dependent upon fully controlled conditions of heat, homogeneity of dye liquor, and thorough exposure of the cloth to the dye liquor. In the present apparatus, the application of heat is subject to rigorous control at four places in the dye kettle. The heating coils 30, which lie adjacent to perforations 17 in the baffle 16 are used to control the heat of the liquor at the rear of the kettle 5 where the cloth enters the liquor and where it has been found that the proper temperature should be maintained. The coil 31 may be employed to effect additional heating of the rearward part of the dye kettle, while coils 32 and 42 may be used to heat the forward portion of the kettle. Coils 31, 32 and 42, in addition, function as means for circulating the heated liquor through the cloth at three points, coil 31 directing the liquor rearwardly through the perforated area 17 and the adjacent cloth and back through the cloth and perforated area 19 in the baffle 16, and the coils 32 and 42 directing the fluid in an opposite symmetrical path through perforated areas 18 and 19. The circulation path is substantially a figure eight. It will be seen that by proper employment of coils 30, 31, 32 and 42 the temperature gradient throughout the dye kettle may be reduced to zero and may be kept at any desired level.

It is to be noted, also, that in the treatment of lightweight fabrics or fabrics likely to tumble or tangle, the operation of the heating and circulating coils 31 may be discontinued to eliminate flow upward through perforated area 17 against the bottom of the piled fabric. Adequate circulation, heating, and injection of dye stuff may then be effected by coils 32 and 42 which confine the higher circulation velocities to a space in which the cloth is relatively straight and is traveling at its highest speed, and which circulates the liquor toward and through the piled fabric and then through perforated areas 17 and 19. This type of circulation tends to hold the piled fabric against the baffle 16 and thus tends to prevent floating, tumbling or tangling of the fabrics.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. Apparatus for treating textiles comprising, a tank adapted to contain a treating fluid and having a first curved member forming the bottom, front and rear walls thereof, a second curved member substantially parallel to said first curved member, spaced perforate sections in said second curved member adjacent the bottom, front and rear walls, said perforate sections being separated by imperforate sections, means positioned between said first and second curved members for introducing a heated

fluid to heat said treating fluid and to direct said heated fluid upwardly through the perforate sections adjacent the front wall thence through the perforate sections adjacent the bottom and rear walls, and means for moving said textile over said second curved member from the rear toward the front of said tank and for removing said textile from said tank rearwardly of a vertical plane containing the lower edge of said perforate section adjacent the front wall.

2. Apparatus as defined in claim 1 in which said means for introducing a heated fluid comprises a steam jet positioned between the perforate sections of said second member and directed toward the perforate sections adjacent said front wall.

3. Apparatus for treating textiles, comprising a tank adapted to contain a treating fluid and having a curved member forming the bottom, front and rear walls thereof, a second member substantially parallel to said curved member, spaced perforate sections in said second member adjacent said bottom, front and rear walls, means positioned between said curved and second members for introducing a heated fluid to heat said treating fluid and direct it upwardly through the perforate section adjacent said front wall to the perforations adjacent said bottom wall, additional means positioned between said first and second members intermediate the perforate sections adjacent the bottom and rear walls for introducing a heated fluid to heat said treating fluid and direct it upwardly through the perforate section adjacent said rear wall and to the perforate section adjacent said bottom wall, whereby said treating fluid is circulated through said tank in a figure 8 pattern and means for moving said textile over said second member from the rear toward the front of said tank and for removing said textile from said tank rearwardly of a vertical plane containing the lower edge of the perforate section adjacent the front wall.

4. Apparatus for treating textiles, comprising a tank

adapted to contain a treating fluid and having a curved member forming the bottom, front and rear walls thereof, a second member substantially parallel to said curved member, spaced perforate sections in said second member adjacent the bottom, and front walls, means for plaiting a textile onto said second member adjacent said rear wall, means for moving said textile along a portion of said second member and removing it from said tank rearwardly of a vertical plane containing the lower edge of the perforate section adjacent the front wall thereof, means positioned between said first and second members intermediate the spaced perforate sections at the bottom and front walls for introducing a heated fluid to heat said treating fluid and direct it upwardly through said perforate section at said front wall and thence through the perforate section adjacent said bottom wall, and additional means positioned between said first and second members intermediate the perforate sections adjacent said bottom and front walls for introducing additional treating fluid and directing it together with said heating fluid upwardly through the apertures in said front wall through said textile and through the apertures at the bottom wall.

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