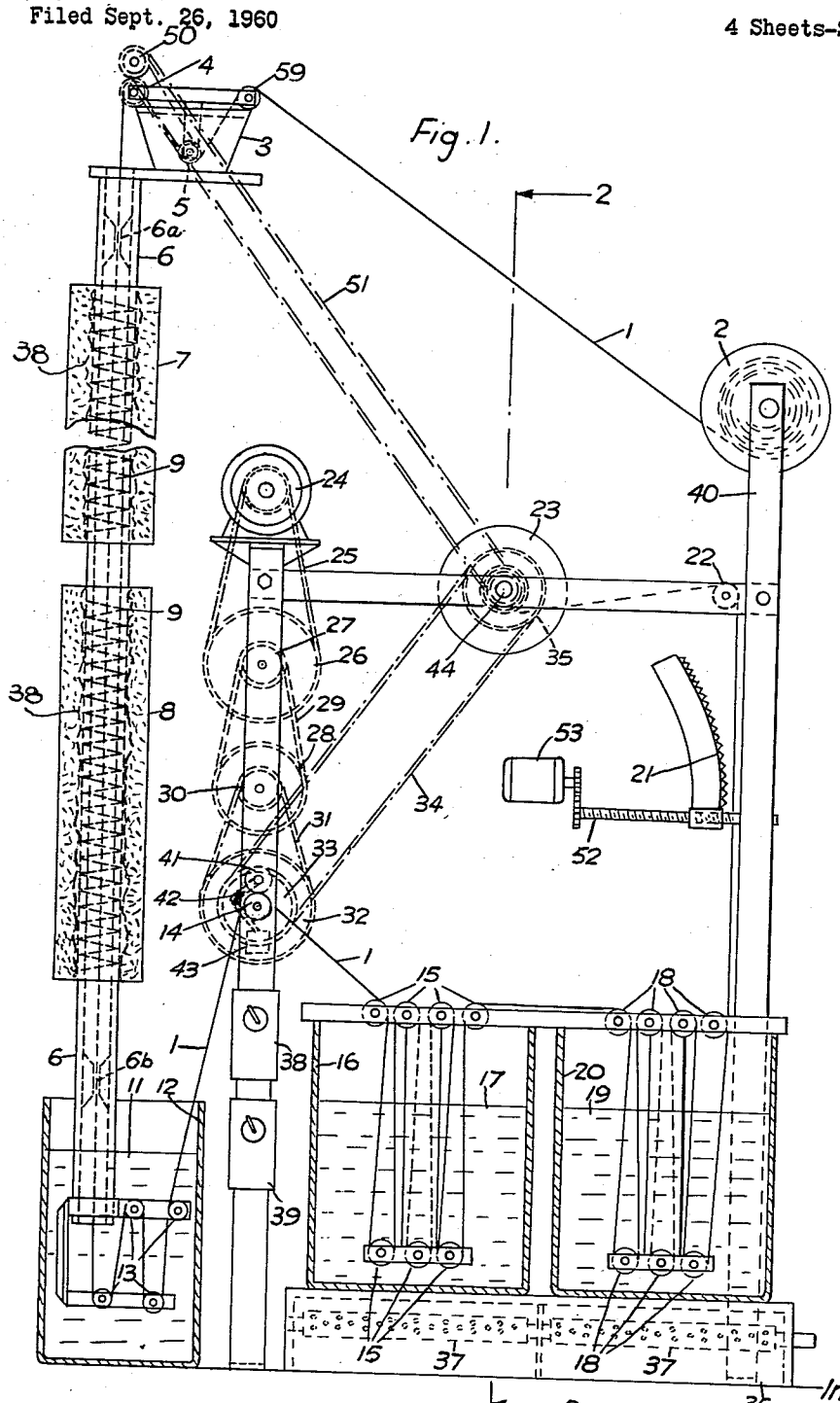
Oct. 1, 1963 W. F. LUCZYNSKI ETAL 3,105,374

DYEING APPARATUS

Filed Sept. 26, 1960 4 Sheets-Sheet 1

Fig. 1.



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DYEING APPARATUS

Filed Sept. 26, 1960 4 Sheets-Sheet 2

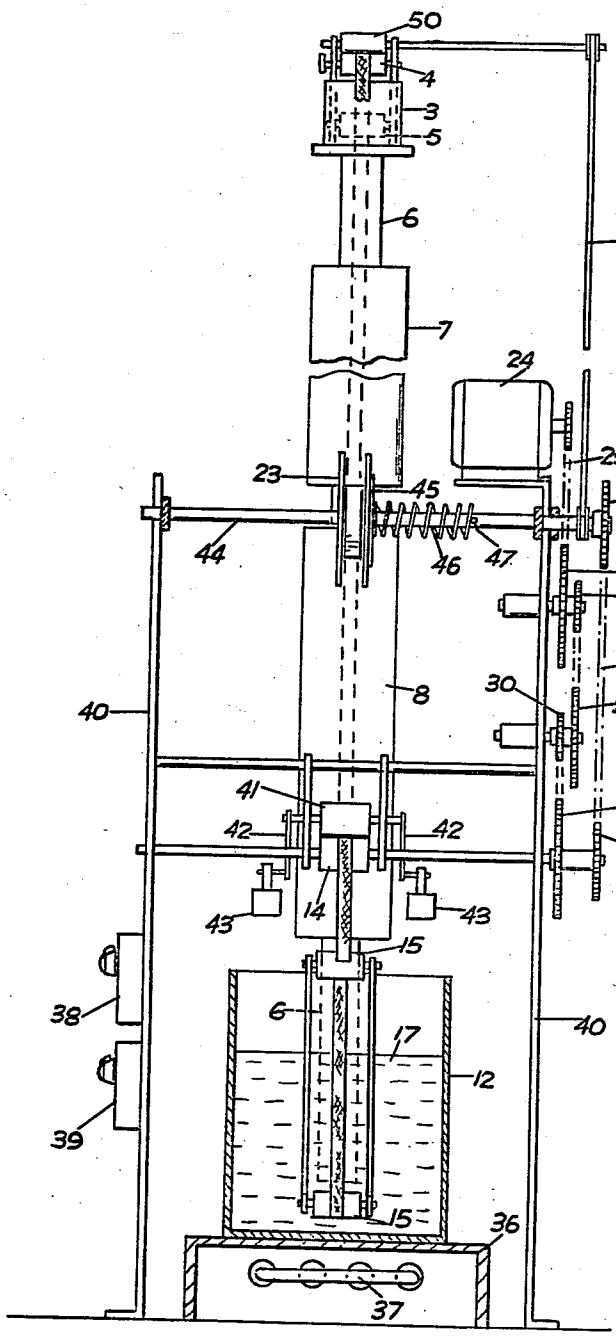


Fig. 2.

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DYEING APPARATUS

Filed Sept. 26, 1960 4 Sheets-Sheet 3

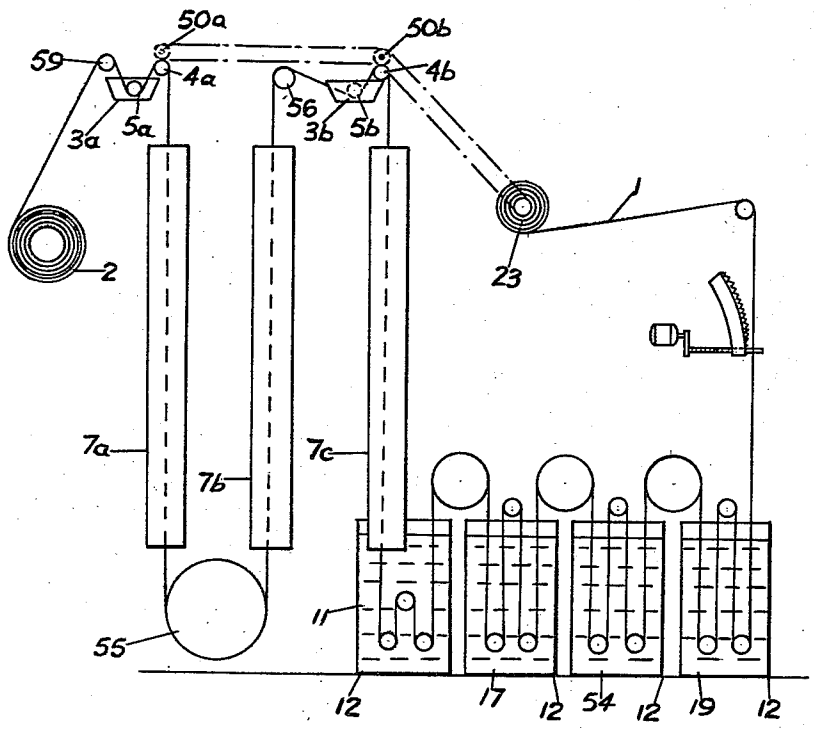


Fig. 3

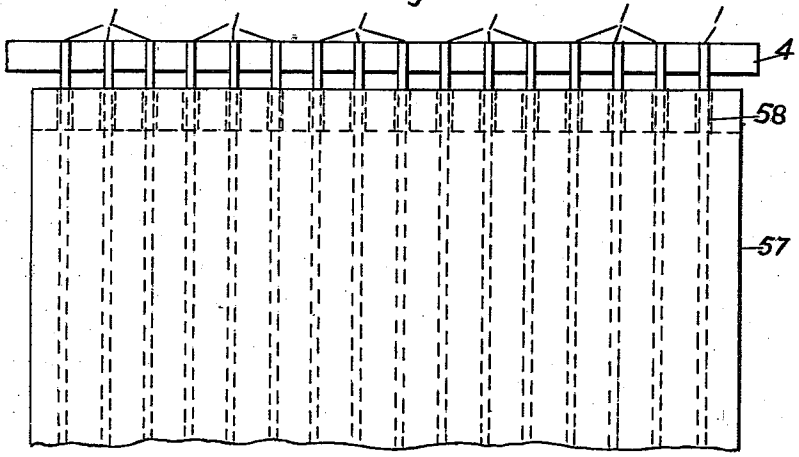


Fig. 4.

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DYEING APPARATUS

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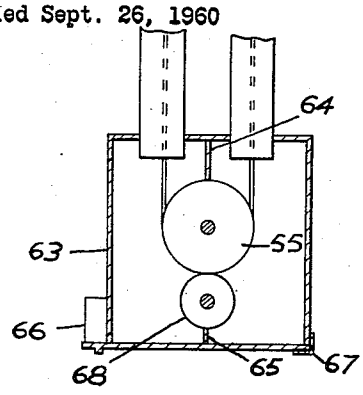


Fig. 5.

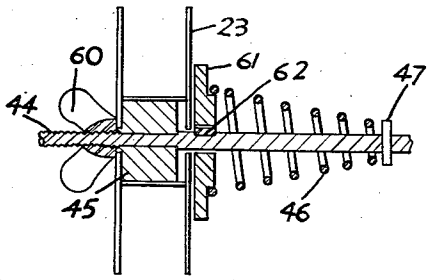


Fig. 6.

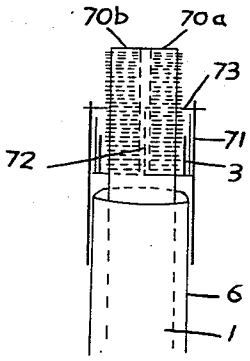


Fig. 8.

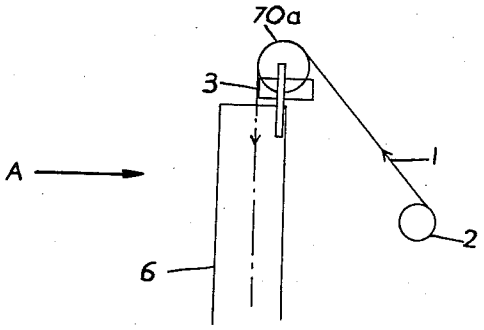


Fig. 7.

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United States Patent Office 3,105,374 Patented Oct. 1, 1963

3,105,374

DYEING APPARATUS

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Filed Sept. 26, 1960, Ser. No. 58,437
7 Claims. (Cl. 68—5)

This invention relates to improvements in apparatus for the dyeing of textile material and is particularly concerned with apparatus for the continuous dyeing of textile fabric.

One object of this invention is to provide improved apparatus for the continuous dyeing of textile material.

With this and other objects in view the invention may be said to reside in the provision of apparatus for the continuous dyeing of textile material comprising means for impregnating the material with a suitable dye solution, an elongated chamber, means for heating said chamber, means for passing said impregnated material through the said chamber, the temperatures of the chamber and the speed at which the material is passed therethrough being relatively adjusted so that at the exit of the material from said chamber (*a*) the material is dry, (*b*) the color is fixed. In order that the material may be subjected to a temperature which may be accurately controlled it is preferable to prevent a current of air from passing through the chamber. Accordingly there may be provided a chamber having means for inhibiting the flow of an air current through the chamber. This may conveniently be achieved by sealing the fabric exit end of the chamber against the passage of gases. If the chamber is substantially vertical a liquid seal may be employed for example the lower or exit end of the chamber may be immersed in water in which case the material after passing through the chamber enters the water then around rollers or the like thereafter to other parts of the apparatus for subsequent after dyeing treatment. Other forms of seals such as for example passing the fabric between two felt strips biassed together may be employed.

It will be appreciated that if the material enters the chamber at its uppermost end and immediately after impregnation with the dye solution, the material is wet and consequently steam will be produced at the top of the chamber. As the material passes down the chamber the moisture will be expelled from it. Since no current of air passes through the chamber the gasses in the chamber will remain substantially static, their movement depending upon convection and upon movement of the fabric down the chamber. Thus there will be a humidity graduation of the gasses in the chamber ranging from approximately 100% at the upper end of the chamber to almost nil at the lower end. The material after leaving the means for impregnation with a dye solution passes into the chamber which at the uppermost end has a steam zone, graduating through a super heated steam zone to a dry heat zone. The material after leaving the chamber may conveniently be subjected to suitable after dyeing treatment for example a hot soap bath followed by a hot rinse in plain water followed by a cold rinse in plain water or other customary dyeing treatment. The material may then be passed in front of a heated member in order to dry the material and subsequently wound onto a take-up spool.

According to this invention any number of heating chambers may be employed. Preferably they are located with the longitudinal axes parallel to each other and substantially vertical. The material after leaving the lower end of one chamber may either pass into the lower end of the next chamber or travel upwards to enter the next chamber at its uppermost end. The number of chambers, their total length, and the respective temperature to which

they are heated are determined by the dyestuff solution employed and the nature of the material to be dyed. By having more than one chamber the humidity zones may be more accurately controlled individually.

This invention is particularly suitable for the continuous dyeing of a plurality of narrow textile materials simultaneously. The chamber or chambers may therefore be rectangular in cross section to accommodate the plurality of narrow textile materials simultaneously. The heating chambers conveniently having electrical heating elements secured to the exterior thereof and encased within a thermal insulating jacket or jackets to prevent undue loss of heat.

It is often desired to dye textile material in bands of widths of different colors. This can be achieved simultaneously by the present invention which provides apparatus to enable a textile material to be impregnated with different dye liquors containing different colored dye stuffs which material is then treated as aforesaid. Specifically the apparatus provided by this invention comprises at least a pair of rollers located at the upper end of the elongated chamber and an equal number of baths for dye liquors. The rollers are mounted on a common shaft and arranged for a part thereof to be immersed in a dye liquor. Preferably the rollers have a serrated peripheral edge. The material to be dyed is first passed over and in contact with the rollers so that selected areas of predetermined width are impregnated with dye liquors containing different colored dyestuffs appropriate to the fibres forming the material.

The control of the said heating elements is obtained by switching means which connect the said heating elements to a source of electrical supply for a predetermined period then disconnect the said elements from the said source for a predetermined period, the operation being continuously repeated. In an alternative arrangement a thermostatic control is employed in which a heat sensitive device is located within the chamber at an appropriate point and adapted to switch the heating elements to the source of electrical supply, as the temperature within the chamber falls below a predetermined minimum and to disconnect the said source of supply if the temperature rises above a predetermined maximum.

If desired a combination of the aforesaid two methods of temperature control may be employed.

In order that the invention may be more readily understood reference will now be made to the accompanying drawings in which:

FIGURE 1 shows in part section a side elevation of apparatus according to the present invention;

FIGURE 2 shows a sectional view along line 2—2 of FIG. 1,

FIGURE 3 shows in part section a side elevation of an alternative apparatus according to this invention,

FIGURE 4 is a part side elevation of an alternative chamber for use with a plurality of different textile materials,

FIGURE 5 is an enlarged view of part of FIG. 3,

FIGURE 6 is detailed view of a take-up spool,

FIGURE 7 is an end view of part of apparatus according to the present invention,

FIGURE 8 is an end view of FIG. 7 looking in the direction of the arrow "A."

Referring firstly to FIGURE 1 a strip of Terylene and cotton fabric is wound upon a supply spool 2 rotatably mounted on a shaft located in a frame 40. The fabric 1 is passed over roller 59 into the trough 3 and under roller 5 and thence between padding rollers 4 and 50. The rollers 4 and 50 are positively driven by a belt 51 from a drive pulley 35. Dye solution is contained in the

trough 3 and the padding rollers 4 and 50 remove surplus dye liquid from the fabric.

Example I

In a particular example this dye solution may be made up as follows:

Serisol Fast Scarlet GD (Yorkshire Dyeworks Co. Ltd.) —1% solution.
Durazol Orange 2G (I.C.I. Ltd.)—1% solution.
Sodium alginate (thickener)—0.2% solution.
Wetting Agent (sodium lauryl sulphate)—0.2% solution.

The fabric then passes down the center of a tube **6**, surrounded by heating jackets **7** and **8** and which are disposed between the vertically spaced felt sealing strips **6***a* and **6***b*. These jackets conveniently comprise electrical heating windings **9** located within a thermal insulating material **38** such as for example corrugated asbestos. The control of the supply of electrical current to the said heating elements is obtained through control switches which automatically and continuously connect the electrical supply to the heating elements for a predetermined period and then disconnect the supply from the heating elements for another predetermined period.

By the regulation of these switches the predetermined periods may be altered. By suitable regulation of these switches the temperature within the tube may be accurately adjusted. Conveniently there is provided visual means for informing an operative when either of the heating elements is connected to the source of electrical supply.

At the lower end of the said tube the fabric passes into a liquid **11** which may conveniently be water located within a vessel **12**, the lower end of the tube **6** is also immersed into the liquid **11** thus sealing off the lower end of the tube and preventing any current of air from passing up the tube while the fabric is passing down the tube. The fabric then passes over guide rollers **13**, over a driving roller **14**, through guide rollers **15** so as to immerse the fabric into a fluid **17** contained within a container **16**. Thereafter over guide rollers **18** so as to immerse the fabric into another liquid **19** contained within a container **20**. In a particular application the liquid **17** is a soap solution and the liquid **19** is plain water. If desired the fabric may be passed over similar guide rollers or the like so as to immerse the fabric in further after dyeing solutions, for example another clear water rinse. The fabric is then passed in front of a heating element **21** so that as the wet fabric first approaches the heating element **21** it is close thereto. A shaft **52** driven by a motor **53** ensures that when the fabric ceases to move through the apparatus the heater **21** is swung to one side (as well as switched off) to prevent scorching of the fabric. As it passes upwards the fabric will be dried and is displaced further from the said element.

In one particular arrangement the heating element comprises an electrical heating wire located in a heat resistant former. The fabric is then passed over a guide roller **22** and is wound onto a take-up spool **23** mounted on a shaft **44**. The drive for the continuous movement of the fabric is imparted from a motor **24** driving a pulley **26** through a belt **25**. The pulley **26** is mounted on the same shaft as a pulley **27** which drives a pulley **28** through a belt **29**. On the same shaft as the pulley **28** is a further pulley **30** which drives a pulley **32** through a belt **31**. The roller **14** is mounted on the same shaft as the pulley **32** and the fabric is urged onto the roller **14**, by a roller **41** biased against the roller **14** by cranks **42** loaded with weights **43**. The friction drive for the take-up pulley is imparted to a pulley **35** through a belt **34** driven by a pulley **33**. The pulley **35** is mounted on the shaft **44** which has a core **45** keyed thereto and biassed against the interior of the flange of the spool **23** by means

of a coil spring **46** which is anchored at the end by means of a peg **47** extending through the shaft **44**.

In an alternative arrangement illustrated in FIGURE 6 the coil spring **46** is biassed to a friction plate **61** splined at **62** to the shaft **44** into contact with the flange **23**. The flange **23** is carried on a core **45** rotatable about the shaft **44**. A wing nut **60** is screwed onto the shaft **44** to hold the flange **23** against the friction plate **61**.

It will be appreciated that it is convenient for the after dyeing baths to be heated since their action will be accelerated by higher temperature. Accordingly the containers **16** and **20** may be mounted on a stand **36** having burners **37** located therebeneath. The burners may for example be gas burners and have means for permitting air to mix with the gas and thereby providing a reasonably hot platform for maintaining the temperature of the liquid within the containers. In operation the fabric to be dyed is wound onto the spool **2** and is then threaded through the machine as previously described but with the level of the liquid in the container **12** low enough to enable a current of air to pass through the tube **6**; the temperature of the after dyeing baths being adjusted as desired. When all is ready for the commencement of the continuous dyeing process the motor **24** and drier **21** are switched on so that the fabric commences to pass through the apparatus and at the same time liquid is added to the container **12** so as to immerse the lower end of the tube **6** therein. This prevents a current of air passing through the tube **6** and immediately the temperature inside the tube adjacent the jackets **7** and **8** rises. The fabric is impregnated with the dye solution which is developed partially by steam heat in the location of the jacket **7** and by dry heat in the location of the jacket **8** as it passes down the tube **6**. The fabric is subjected to suitable after dyeing treatment and as previously described is dried after the last of the after dyeing baths and is wound onto the take-up spool in a dyed and dried condition.

In FIGURE 3 three chambers **7***a*, **7***b* and **7***c* are located with their longitudinal axes parallel and vertical. Fabric passes into chamber **7***a* around a roller **55** of the nip roller and thence into chamber **7***b* at its lowermost end. The fabric then passes around roller **56** and may if desired be re-impregnated with the same dye solution as contained in bath **3***a* or may be impregnated by passing under roller **5***b* in bath **3***b* with a different dye or other solution.

In some instances bath **3***a* contains color containing solution which after dyeing of the fabric develops the color on the surface of the fibres forming the fabric but does not adhere the color to the fibres. A further solution in bath **3***b* may be arranged to secure or adhere the colors to the fibres of the fabric. An additional after dyeing bath **54** is provided for further washing or other desirable after dye treatment of the fabric.

In the case where more than one chamber is employed and material after leaving the lower end of one chamber enters the lower end of the next chamber, means are provided to stop a change of condition of the material during this passage and to prevent a current of air passing through both chambers. To do so the lower ends of the two chambers enter a box **63** which contains a pair of nip rollers **68**, **55**, mounted with their axes in the plane of the width of the fabric. These rollers are sealed at the ends, and sides diametrically opposite the point of nip, by plates so that these rollers and the plates form a vapor tight wall between the two chambers. These rollers are sealed against the sides of the box by flexible seals **64** and **65**, so that the seals and rollers form a vapor tight seal between the two chambers (FIG. 5). The bottom of the box **63** is hinged at **67** and closed by an electromagnet **66** to allow access to the rollers. The electromagnet is connected in circuit with the driving motor so that the magnet is de-energized when the motor is stopped and the bottom is released

and falls open to admit air to the heated chambers. The bottom is sealed against the sides of the box by a gasket to prevent air leakage when closed.

In FIGURES 7 and 8 material 1 passes upwardly over and in contact with the edge of two rollers 70*a* and 70*b* both of which have a serrated peripheral edge. The rollers 70*a* and 70*b* are mounted for rotation about an axle 73 secured in bearings to a standard 71. The rollers 70*a* and 70*b* have a part of their peripheral surface extending into the trough 3 which contains an appropriate dye liquor.

A central division 72 divides the trough 3 into two compartments such that different dye liquors may be placed into each compartment. From the rollers the tape passes downwardly through the heated jacket 7 substantially as described above. The material is subjected to the after-treatments as previously described.

Example II

In a particular example, a narrow fabric made of Terylene yarn and approximately 1½" wide was passed over the rollers 70*a* and 70*b* from a supply spool 2. In one of the compartments of the dye bath 3 the dye liquor was composed as follows:

	Gm. per litre
Tinosol Brilliant Pink 5b	12
Sodium lauryl sulphate	5
Calgon	1
Ammonium thiocyanate	2
Sodium alginate	2

The dye liquor in the other compartment was made up as follows:

	Gm. per litre
Tinosol Yellow V	12
Sodium lauryl sulphate	5
Calgon	1
Ammonium thiocyanate	2
Sodium alginate	2

The tape after being duly impregnated with the appropriate dye liquor was then passed down the heated jacket 7 and the resultant tape was a tape on which one half was dyed yellow and the other half pink.

Conveniently the rollers 70*a* and 70*b* are arranged to be spaced apart approximately ¼". This ensures that the dye liquor which is carried by the serrations of the rollers to impregnate the tape and to merge with each other at the join but not to overlap.

A plurality of textile fabrics, particularly narrow fabrics may be dyed continuously and simultaneously. In FIGURE 4 a chamber 57 of substantially rectangular form in cross section is substituted for the circular chamber 6 of FIGURE 1. Sixteen separate textile fabrics 1 are fed over roller 4 and between guides 58 into the chamber 57 which is heated and controlled in the same manner as described above with reference to jacket 7. The invention may conveniently be adapted for the dyeing of larger widths of fabric by the use of a tenter pin track engaging with the fabric immediately after the fabric has been impregnated with the dye solution and guiding and maintaining the fabric in a tensioned condition during its passage through the heated chamber 6 and disengaging with the fabric after its emergence from the said tube in the liquid container 12.

It will be appreciated that in accordance with the present invention tapes may be dyed two different colors, the colors being separated by a longitudinal common edge or alternatively fabric of larger widths may be dyed either two, three or any number of desired colors according to the number of rollers which are rotatably mounted in separate compartments containing different dye liquors.

It will be appreciated that this invention provides apparatus for the continuous dyeing of textile fabrics. The

apparatus of this invention is particularly suitable for the carrying out of the method of dyeing described in the specification of British Patent 784,394.

What we claim is:

1. Apparatus for the continuous dyeing of textile material comprising a trough means adapted to contain coloring matter, means for conveying said textile material through said trough whereby the material is impregnated with dye, an elongated substantially vertical chamber means having an entry mouth and an exit mouth for the passing of said textile material therethrough as the same is withdrawn from said trough, said trough being arranged above and adjacent to the entry mouth of said chamber, roller guide means disposed externally of said chamber means and adapted to guide said textile material from said trough and through said chamber means without contact with the sides thereof, heating means for said chamber comprising an electrically controlled resistance heating jacket arranged therearound for subjecting the dye impregnated textile material to a heating and drying treatment immediately after being drawn from said trough and as the same passes through said elongated chamber, felt means arranged in said elongated chamber adjacent the top and bottom ends of said chamber, and means for holding liquid arranged below the lower end of said elongated chamber which is adapted to provide a liquid seal for the exit mouth of said chamber.

2. Apparatus according to claim 1, and wherein said substantially vertical chamber means consists of a pair of chambers mounted side-by-side, an air tight container adjacent to the lower end of each of said chambers, and a pair of nip rollers enclosed in said container, so that the material passes from the lower end of one chamber into the container between the nip rollers and then upwardly to the other chamber.

3. Apparatus according to claim 1, wherein said chamber means is of extended cross-sectional shape so as to allow a plurality of separate narrow textile materials to pass through said chamber means simultaneously.

4. Apparatus according to claim 1, wherein said electrical heating means for heating said chamber means comprises a pair of heating jackets arranged about said chamber and which are adapted to develop both steam heat and dry heat in said chamber during passage of the textile therethrough.

5. Apparatus according to claim 1, further having means for impregnating textile material with dye liquors containing different colored dyestuffs to dye the material in different colors simultaneously.

6. Apparatus according to claim 5, and wherein said means comprise at least a pair of rollers located adjacent the upper end of the elongated chamber means, and a separate bath for a dye liquor associated with each roller.

7. Apparatus according to claim 6, and wherein said rollers have a serrated peripheral edge.

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