

P. MacINTYRE.
METHOD FOR DYEING RAW FIBROUS STOCK.
APPLICATION FILED SEPT. 15, 1919.

1,355,797.

Patented Oct. 12, 1920.

2 SHEETS—SHEET 1.

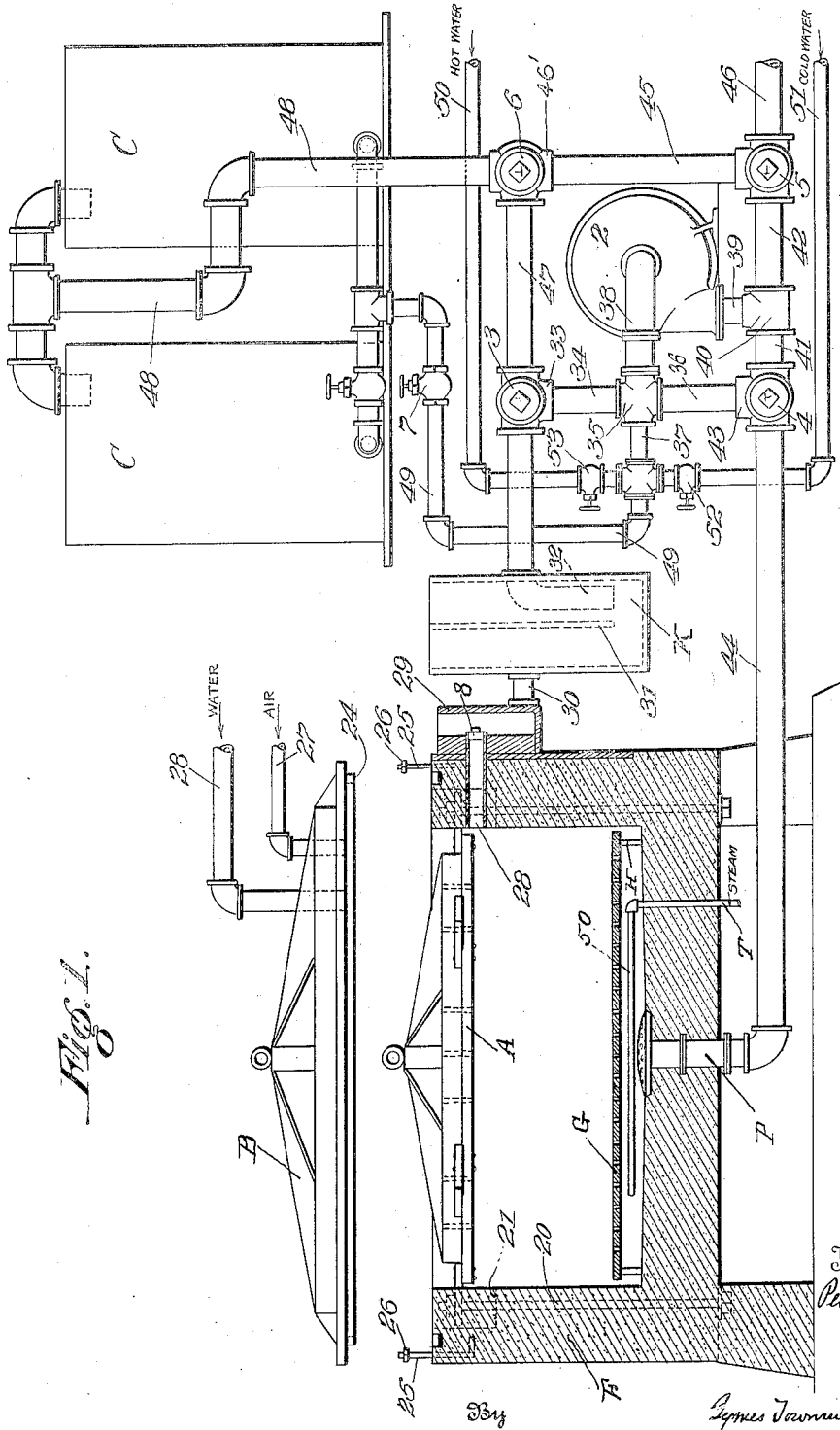


FIG. 1.

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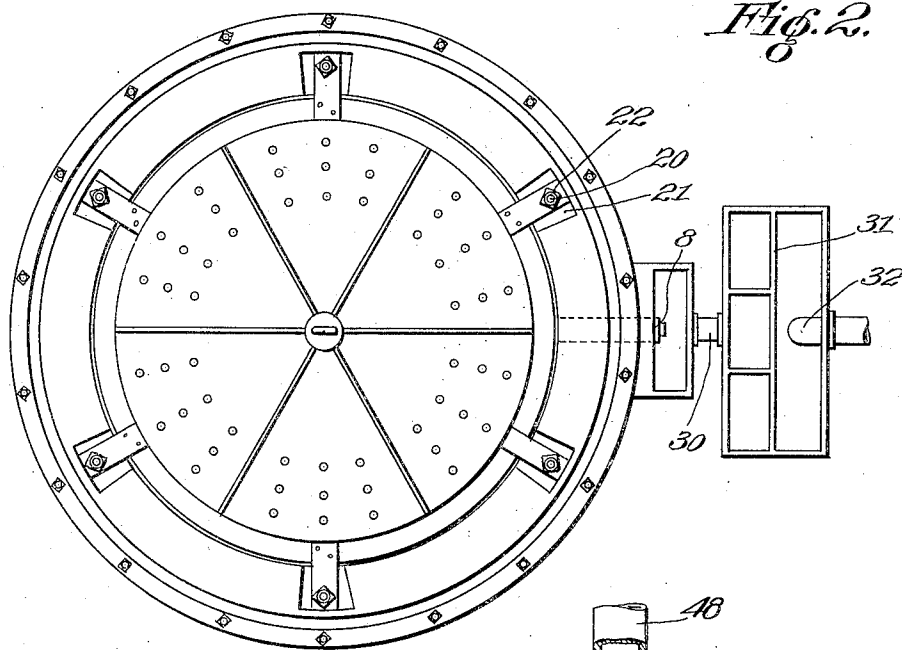


Fig. 2.

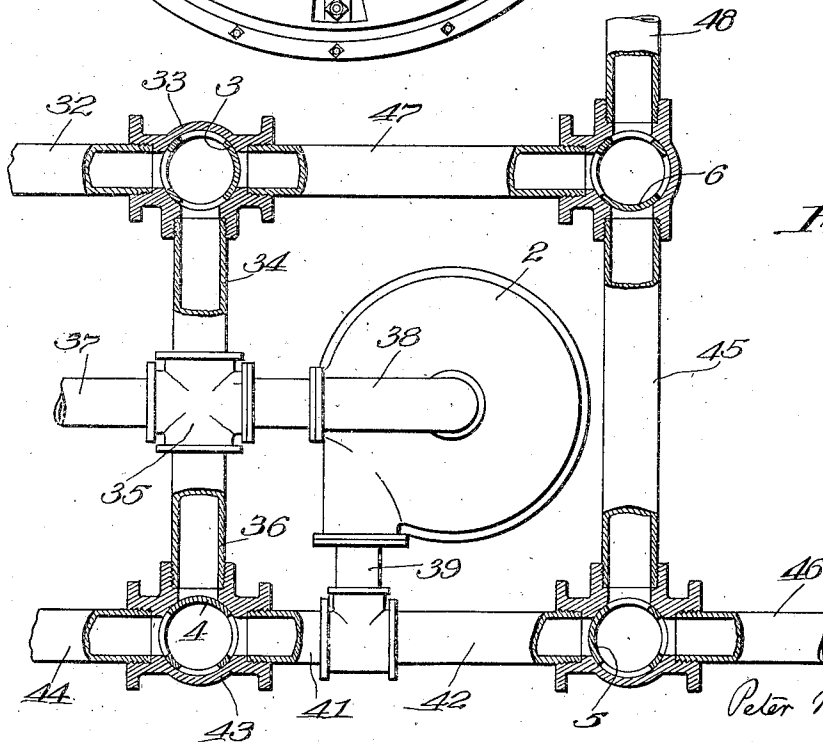


Fig. 3.

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METHOD FOR DYEING RAW FIBROUS STOCK.

1,355,797.

Specification of Letters Patent.

Patented Oct. 12, 1920.

Application filed September 15, 1919. Serial No. 323,707.

To all whom it may concern:

Be it known that I, PETER MACINTYRE, a citizen of the United States, residing at Clinton, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Methods for Dyeing Raw Fibrous Stock, of which the following is a specification.

My invention relates to a new method for dyeing raw fibrous stock and particularly raw cotton by either natural or synthetic indigo.

By my method large quantities of raw stock can be dyed with indigo, with the production on the fibers of an indigo color far superior in quality and durability to any that can be obtained by dyeing yarn. The color resulting is faster, more brilliant and durable and does not fade so easily by light, washing, crocking or rubbing.

My invention relates also to the apparatus in which my method is practised, this apparatus being so constructed and arranged that large quantities of material can be treated and the steps of boiling out the raw stock, dyeing, oxidizing, washing and extracting the water, or other liquor, or as many of these steps as may be desired, can all be carried out in the same machine, thereby producing economy of material, time and labor and getting the dyed stock into suitable condition for carding and subsequent spinning into yarn.

The process will be readily understood from the accompanying description and drawings, in which—

Figure 1 is an elevation of the system, parts being shown in section;

Fig. 2 is a partial plan of Fig. 1; and

Fig. 3 is a somewhat diagrammatic cross-section, showing the circulating system and its connections.

Referring to the drawings F is a tank, shown as made of concrete, though it may be made of metal, if desired. The tank is provided with a perforated false bottom G, spaced, as by legs H, above the real bottom, which has opening into it a delivery pipe, P. A steam coil 50 is located beneath the false bottom, steam being delivered through pipe T from a suitable source of supply.

Arranged to fit loosely within the tank is a perforated steel or iron cover A having projecting therefrom a series of radial tongues having openings therein to fit over bolts 20, the shanks of which are embedded

in the concrete, while the free screw-threaded ends project into cavities 21, formed in the concrete wall. These cavities are deep enough to allow the heavy perforated cover to adjust itself to the quantity of raw stock in the tank.

When the cover is resting upon the stock the nuts 22 are screwed down, so that the cover is prevented from rising, when liquid is forced therethrough in the operations to be presently described.

The tank is also provided with a second cover B, large enough in diameter to extend over the upper rim of the tank F. The upper rim has a packing ring which may be located in an annular groove and the cover B has a corresponding depending ring 24. The cover B is held in air-tight engagement with the tank by means of a series of bolts 25 secured to the wall of the tank either fixedly or pivotally, the shanks of the bolts passing into perforations or slots in the rim of the cover. When the cover is lowered into place, the nuts 26 are screwed down to hermetically close the tank. The tank and covers A and B are preferably so proportioned that the cover B may be secured in place while the cover A is still within the tank F.

This cover B has extending therethrough, an air pipe 27 and may also have a similarly arranged water pipe 28. These pipes are provided with flexible connections, or couplings to suitable sources of pressure air, and water-supply.

Extending through the wall of the tank near its upper portion is an opening, 28, which is provided with a removable screw-plug closure, 8. 29 is a receiving chamber having a delivery pipe 30 connected to tank K. 31 is a partition extending downwardly to near the bottom of the tank. Additional partitions may be used to divide this tank into several compartments, as indicated in Fig. 2. Extending into the tank K is the pipe 32 by which liquor is delivered from tank K into the circulating system. By this arrangement external air is prevented from being drawn into the system, thereby preventing oxidation of the dye liquor and giving an even circulation all the time the stock is being dyed.

The outer end of pipe 32 is connected to a T-fitting or chamber, 33, provided with a three-way valve, 3.

Extending downwardly from this valve-

chamber; 3, is pipe 34 connected to the fitting 35, into which are connected pipes 36, 37 and 38. Pipe 38 connects to the suction end of a centrifugal pump 2, from which liquor is delivered by pipe 39 into a fitting 40, having also connected thereto pipes 41, 42. Pipe 41 is connected to a T-fitting 43 to which are connected pipes 36 and 44, this fitting having therein a three-way valve, 4.

10 Pipe 42 is connected to another T-fitting having therein three-way valve 5 and provided with pipes 45 and 46, the latter being a drain pipe. Pipe 45, at its upper end is connected into a three-way fitting 46',

15 having therein three-way valve, 6, and connected thereto are pipes 47 and 48. Pipe 47 is connected at its other end into fitting 33, and pipe 48 is a return pipe for delivering liquor into storage tanks C, C.

20 From these storage tanks liquor is delivered through pipe 49, provided with valve, 7, into pipe 37. Valved hot and cold water connections 50, 51 are also connected to pipe 37. The three-way valve comprises a conical shell having three quadrantly arranged

25 openings, the fourth side being closed. As each of the fittings has three openings, with the fourth side closed, the valve can be adjusted to bring any two of these openings

30 into open connection with the third opening closed. The squared stem by which the valve is operated, preferably has some indication thereon, as shown in Fig. 1 to indicate its position.

35 In operating the machine to dye raw stock with indigo, the raw stock is put into the tank F and the perforated cover A lowered until it rests upon the stock. The nuts are then screwed down on bolts 20

40 into engagement with the cover, which is thus prevented from rising, the cover itself holding the stock firmly in the tank so that it may not float about in the dye liquor.

Cold water is then admitted by opening

45 valve 52, until the tank F is filled. The cold water flows in through pipes 37, 38, pump 2, pipe 39, valve 4 and pipe 44 into the bottom of the tank. The valve 52 is then closed and the requisite amount of

50 caustic (such as a solution of caustic soda and soda ash at about 72° Twaddell) is added, as into tank K. The pump is then started and the valves 3, 4, 5 and 6 being so set that the liquor will be pumped from

55 tank "K" (into which it has overflowed from tank F) through pipe 32, valve 3, pipes 34, 38, pump 2, pipes 39, 41, past valve 4, into the tank F. Steam is also turned through pipe T, into the coil in the bottom of tank

60 F. The stock is then boiled for about 30 minutes, and the stock is thus thoroughly cleaned and wetted down so as to have it in condition to be dyed with indigo. Steam is then shut off and cold water is allowed

65 to run through the system until the water

and mass of raw stock are cold—the valves 3, 6 and 5 being set to allow the water to flow into the drain pipe 46. Valve 5 is then set to shut off pipe 42, and dye liquor is admitted through valve 7 and pipe 49 to fitting 35, thence through the pump to pipes 39, 40 and 41, past valve 4, through pipe 44 into and up through the mass of raw stock in tank F, until the system is filled with indigo liquor. The indigo liquor, after

75 shutting off valve 7, is then circulated through the mass of raw stock for about an hour. The valve 6 is then set to shut off pipe 47, valve 3 to shut off pipe 34, valve 4 to shut off pipe 41 and valve 5 to close

80 the drain pipe. The pump is then used to pump the liquor out of the tank F and back into tanks C.

The raw-stock thus thoroughly cleaned, wetted down and saturated with indigo

85 liquor is now ready to be oxidized to develop the color. Instead of subjecting the mass to oxidation after removal from the tank or by movement through the air, as now practised in oxidizing dyed yarn in the

90 chain, I subject the mass of now dyed raw stock to air under considerable pressure, say from 10 to 30 pounds.

The apparatus is arranged for this purpose by placing the air-tight cover B in

95 place on top of the tank F, and bolting it down, so that an air-tight closure is effected. The plug 8 is screwed into place, and the valves 3, 4, 5 and 6 are set so that air admitted through pipe 27 will pass down

100 through the raw stock and out through valves 4 and valve 5. The air pressure is maintained for about twenty minutes, with the result that the color is developed on every fiber of the mass of raw stock.

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I have thus succeeded in dyeing with indigo, raw stock in large masses, 800 to 900 pounds at a time, which is a result never, as far as I am aware, heretofore attained. To wash the dyed mass, the air is shut off,

110 plug 8 removed, and valves 3, 4, 5 and 6 set so that water is admitted through valve 52 into the pump and thence forced through valve 4 into the tank and out past valves

115 3, 6 and 5 to the drain. Washing will require about twenty minutes. Washing may also be done by admitting water through pipe 28 in cover B.

If the fiber is to be subjected to any further preparation, the requisite liquors

120 can be added to tank K and circulated in the manner previously described. In order to remove the water or other liquor from the dyed mass of stock, the plug 8 is screwed into place, and air is again introduced under

125 pressure through the cover B. The valve 5 being opened to the drain, and intermediate valves properly set, a large amount of the water will be driven off, to such an extent that no further water extraction in ex-

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tractors, as now commonly used, is necessary. After shutting off the air supply and removing the covers A and B, the dyeing process is completed and the mass of dyed stock is ready for removal from tank F to be dried and is then without any further treatment ready for carding.

While I have described the apparatus in some detail, my invention is in no way limited to the specific arrangements or constructions specified. Thus instead of a concrete tank, an iron or steel tank has been used, such tank being provided with suitable means for holding down the perforated cover and for holding down the cover B, air-tight, on the tank F.

So also the process has been described, as used by me for dyeing with indigo, but the method may also be available for other vat dyes requiring to be oxidized.

It is to be further noted that my system effects great economy in the use of dye liquor, since the surplus liquor is not wasted, but is pumped back into the storage tanks. While primarily designed for indigo dyeing, the apparatus may be used with other vat dyes, either hot or cold.

I claim:

1. The method of dyeing raw stock which consists in subjecting the raw-stock in bulk to the action of a dye liquor and then oxidizing the dye by forcing an oxidizing agent through the mass.

2. The process as claimed in claim 1 in which the mass of raw stock is dyed with indigo and oxidized by air under pressure.

3. The process of dyeing raw stock in bulk which consists in circulating the dye liquor through the mass of raw stock and then oxidizing the dye by forcing air through the said mass of stock.

4. The process as described in claim 1 in which the mass of dyed stock is washed by forcing water through the said mass.

5. The process as described in claim 2 in which the mass is first treated by forcing a caustic solution therethrough.

6. The process as described in claim 3 in which the mass is first treated by forcing a caustic solution therethrough, and the dyed stock is washed by forcing water through the mass.

7. The process as claimed in claim 3 in which the excess dye liquor is removed from the mass by air-pressure.

8. The process claimed in claim 3 in which the mass of dyed stock is washed by

forcing water through the mass and the excess water is removed from the mass by air pressure.

9. The process of dyeing raw stock, in bulk, with indigo which consists in subjecting the mass of raw stock to an indigo dyeing liquor, removing the excess liquor, oxidizing the dye fibers of said mass by forcing air through the said mass, and then washing the said mass by forcing water therethrough.

10. The process as claimed in claim 9 in which the excess water is removed by air pressure.

11. The process of dyeing raw cotton stock, in bulk which consists in boiling out the said mass with a caustic solution, washing the same, then subjecting the said mass of raw stock to an indigo dyeing liquor, removing the excess liquor, oxidizing the dyed fibers of said mass by forcing air through the said mass, and then washing the said mass by forcing water therethrough.

12. The process of dyeing raw fibrous cotton stock which consists in confining a mass of said stock in a chamber, forcing indigo dye liquor through said mass, and removing the excess dye liquor and oxidizing the saturated fibers by forcing air through said confined mass.

13. The process as claimed in claim 12 in which the oxidized mass is washed by forcing water therethrough.

14. The process as claimed in claim 12 in which the oxidized mass is washed by forcing water therethrough, and the excess of wash water is removed from the confined mass by air under pressure.

15. The process of dyeing raw fibrous stock which consists in confining a mass of said stock in a chamber, washing said stock by forcing hot washing liquid therethrough, removing said washing liquid and cooling said mass by forcing cold water through said mass, circulating dye liquor through said mass, removing the excess dye liquor and oxidizing the saturated fibers by forcing air through said mass, forcing water through said mass to wash the same, and removing the excess wash water from said mass by air under pressure.

16. The process claimed in claim 15 in which raw fibrous cotton is washed with caustic and dyed with indigo.

In testimony whereof I affix my signature.

PETER MACINTYRE.