

JOHN BRANDWOOD, THOMAS BRANDWOOD, AND JOSEPH BRANDWOOD.
 PROCESS FOR THE DYEING AND OTHER TREATMENT OF TEXTILE FIBERS IN THE LOOSE STATE.
 APPLICATION FILED MAY 14, 1921.

1,432,318.

Patented Oct. 17, 1922.

3 SHEETS—SHEET 2.

Fig. 1.

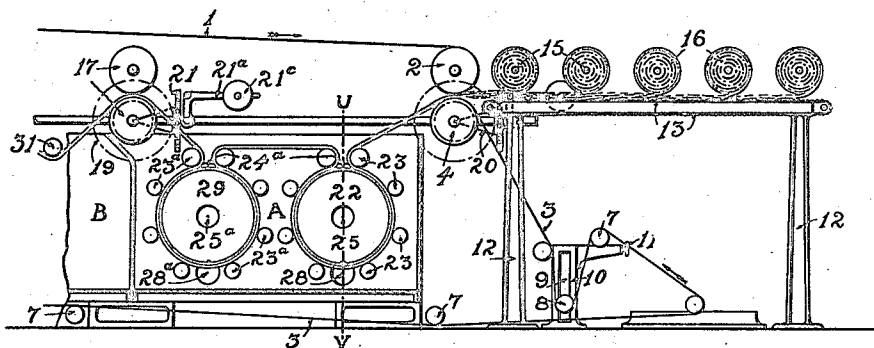
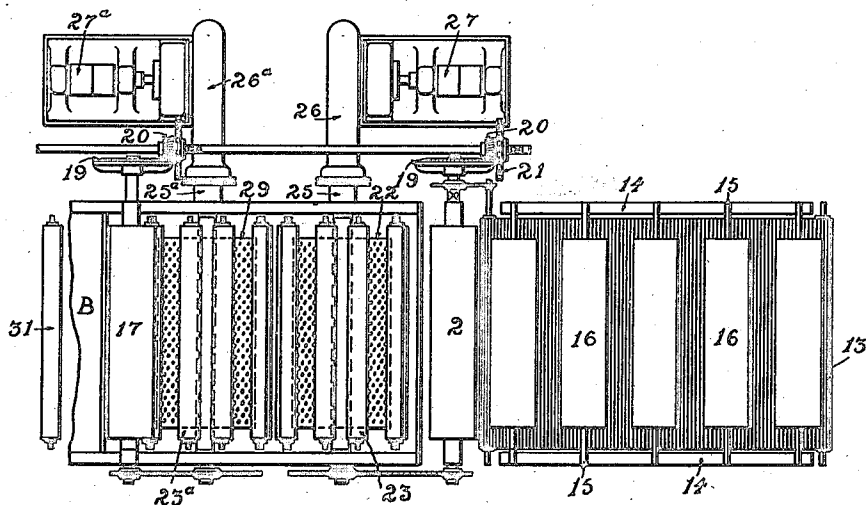


Fig. 2.



INVENTOR;

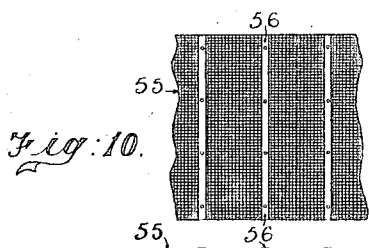
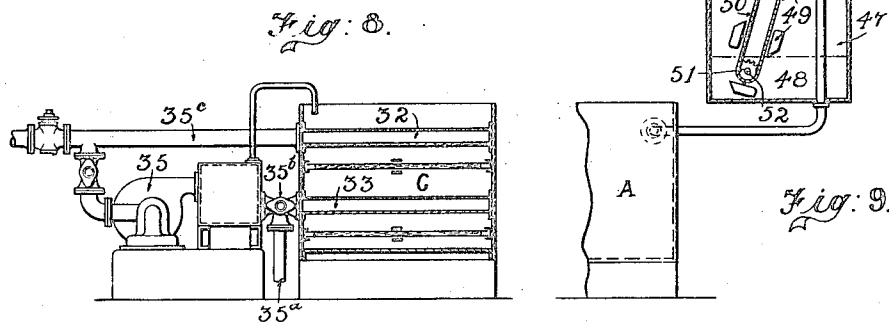
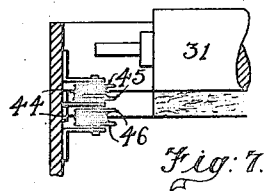
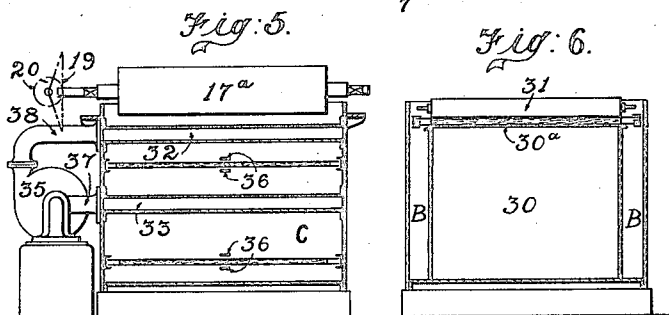
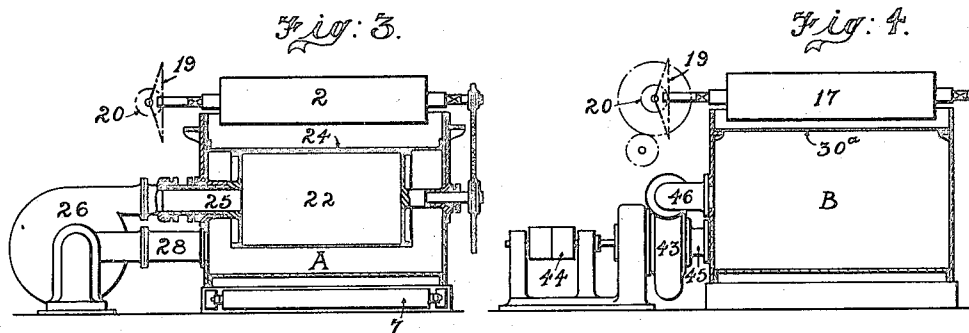
John Brandwood
 Thomas Brandwood
 Joseph Brandwood
 By *Wm. Wallace White*
 ATT'Y.

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UNITED STATES PATENT OFFICE.

JOHN BRANDWOOD, THOMAS BRANDWOOD, AND JOSEPH BRANDWOOD, OF ELTON, BURY, ENGLAND.

PROCESS FOR THE DYEING AND OTHER TREATMENT OF TEXTILE FIBERS IN THE LOOSE STATE.

Application filed May 14, 1921. Serial No. 469,726.

To all whom it may concern:

Be it known that we, JOHN BRANDWOOD, THOMAS BRANDWOOD, and JOSEPH BRANDWOOD, subjects of the King of Great Britain and Ireland, and residents of Elton, Bury, in the county of Lancaster, England, have invented certain Improvements in the Processes for the Dyeing and Other Treatment of Textile Fibers in the Loose State, of which the following is a specification.

In the methods at present commonly in use for the dyeing with liquids of cotton and other fibrous textile materials in the loose state, that is, before carding and spinning operations have commenced, the loose material is either put into a dye or other tank and moved about therein by rotating arms or other analogous means to ensure that the liquor will reach all parts of the mass, or the loose material is compressed in any convenient receptacle and the liquor forced through the compressed mass. It follows from such handling that the fiber is considerably deteriorated, the cotton wax, which is an important factor in the quality of the subsequent spinning, is destroyed, the staple is shortened, and the material is matted together, causing further deterioration in the subsequent separation. The treatment of compressing the material or rotating the loose material in the bath, besides resulting in deterioration of the fiber as mentioned, also consumes time and necessitates extra labour, thus lessening production and increasing costs. Further, it is difficult to guarantee that in dyeing one batch of dyeing will be of the same shade as another batch, and more important still, it is impracticable by the means at present in use to dye loose material satisfactorily with the oxidation, azo, or basic colours.

The object of our invention is a process of dyeing which will obviate the disadvantages enumerated above.

In carrying same into effect we take the material after the cleaning operation and in flat and compact form, say as it comes from the lap scutcher in the form of laps, and pass it between two open meshed or open woven conveyor belts, in several laps thickness, around perforated cylinders or over the perforated tops of closed chambers situated in the dye bath and below the level of the dye liquor in such a manner that the con-

veyors and material borne thereby, passing as a single thick belt around such perforated cylinders or over such perforated tipped chambers, make a liquid tight joint therewith, the dye liquor being drawn through such belt of material by means of pumps from the dye bath to the interior of the perforated cylinders or closed chambers and returned to the dyebath, or drawn from the dyebath to the interior of the perforated cylinders or closed chamber and thence forced through the cylinder walls or closed chamber top and through the material back to the dye bath. Or the dye liquor may be drawn and also forced through the material successively in the same apparatus. Similar means may be used for oxidizing where such operation is necessary, the dye pump in this case being of course substituted by an air pump and the same process may be applied to the final washing off with wash-water, the whole process from the feeding of the material into the dyebath to the final stripping from the conveyor of the dyed and otherwise treated material being continuous. In order to ensure level dyeing in such continuous process we may use, in connection therewith automatic means for supplying measured quantities of dye liquor to the dyeing apparatus, such supply being regulatable and ceasing when the passage of material through the dyeing apparatus ceases.

We will now fully describe a convenient method of carrying our process into effect, in an apparatus arranged as a general purpose apparatus wherein material may be treated with sulphur colours, oxidation, azo or basic colours at will, and in which apparatus the dyeing, any necessary oxidizing, and the necessary washing off process may be effected, as a continuous operation. From such description the application of any treatment with liquor or air of fibrous material in the loose state, this, previous to spinning, will be understood. The drawings are diagrammatic, and are not to any particular scale.

Fig. 1 (Sheets 1 and 2) is a side elevation partly in section of the complete apparatus, the feed end of same being at the right hand side.

Fig. 2 is a plan of the apparatus as shown in Figure 1.

Fig. 3 is a cross section on the line U—V of Figure 1,

Fig. 4, a view partly in cross section on the line W—X of Figure 1,

Fig. 5, a cross section on line Y—Z of Figure 1,

Fig. 6, shows a method of guiding the conveyors and keeping them stretched transversely,

Fig. 7, shows a detail of Figure 6 to a larger scale,

Fig. 8, shows the automatic means for supplying dyestuff in calculated quantities to a dye bath,

Fig. 9, shows a modification of the Figure 5; and

Fig. 10, a portion of the material preferably used for the conveyor.

In the drawings Figure 1 (two sheets) and Figure 2 (two sheets) 1 is an upper conveyor composed of open meshed material preferably of open woven cloth such as a brattice cloth across which flat stiffening rods are secured at intervals. This construction is very effective in preventing stretching or deformation of the conveyor as a whole as the transverse rods crossing it at intervals and preventing transverse shrinkage, longitudinal stretching is also prevented. A portion of such a form of belt is shown in detail in Figure 10. The conveyor belt passes over the apparatus in the direction shown by the arrows and enters the said apparatus around the roller 2. 3 is a similar conveyor belt, passing below the apparatus and entering it around the roller 4. The two endless belts thus converge and enter the apparatus together through the nip of the rollers 2 and 4, traverse the interior of the apparatus together and, diverging, leave it respectively over the rollers 5 and 6 to return to the feeding point 2—4. Guide rollers 7 are provided for the upper and lower conveyors and also tensioning rollers 8 adapted to move freely in a vertical slot 9 in the two tensioning frames 10, the conveyors 1 and 3 thus being kept in continual tension by gravity acting upon the tensioning rollers 8.

11, 11 indicate screws provided with hand wheels or like manipulating arrangements adapted to move one roller 7 of each of the tensioning frames for adjustment purposes when necessary. Adjustment bearings of this type are well known and they need not be further described.

12, indicates a table having fitted thereon the endless lattice feed 13, and provided with raised sides 14 (Figure 2) having vertical open bearings adapted to receive the ends or necks 15 of lap each bearing a lap 16 as it comes from the scutcher frame. In the figure five laps are shown in position on the table 12, but it is obvious that the table may be adapted to take any conven-

ient number of laps more or less than five. To feed the material of the laps into the dyeing apparatus the end of each lap is unrolled and superposed on the material of the lap behind it and which material is passing below it, borne by the lattice 13.

The conveyors 1 and 3 being started, being drawn by the rollers 2 and 4, 5 and 6, 17 and 17^a, which rollers are driven from shaft 18 through bevel gear wheels and pinions 19, 20 and the friction disc 21, the said conveyors travel in the directions indicated by the arrows and enter the apparatus as before mentioned through the nip of the rollers 2, 4. The material of the laps however, superposed as stated, has been brought to the roller nip 2—4 and thus enters between the conveyors 1, 3 the subsequent traverse of the conveyors through the apparatus drawing the material into the apparatus between the latter until they diverge on leaving the interior.

The apparatus shown in the drawings is adapted for dyeing with various dyestuffs and for convenience and clearness we will describe firstly the dyeing of loose cotton material in the lap form with a direct colour without after-treatment except washing off. The material having entered the apparatus between the conveyors 1, 3 is held between said conveyors while it passes around a cylinder 22 fitted transversely in a tank A filled with dye liquor, prepared in a suitable manner (see also Figure 3). The parts of the conveyors 1 and 3 between which the material is held during its passage through the apparatus are hereinafter referred to as the "container 1—3." The cylinder is perforated, and the container 1—3 is tightly held against the periphery thereof by the pressure rollers 23. A plate 24 is fitted longitudinally to the cylinder 22 over that part which is not covered by the container in its transit around the cylinder 22, in such a manner that there will be space for the container to pass between the edges of said plate and the two highest pressure rollers. The interior of the cylinder 22 communicates by a pipe 25 with a rotary suction pump 26 of any suitable type which is driven by the strap pulley gearing 27. The pump being started and the container passing around the cylinder 22, dye liquor is drawn through the material into the interior of the cylinder through the perforations, and is delivered to the pump through pipe 25 to be returned by pipe 28 to the dye tank A. After passing around the cylinder 22 the container with its contained material passes as shown to cylinder 29, having pressure rollers, pump and gearing similar to those of cylinder 22, and indicated by the same reference letters with the addition of the index letter *a*, 26^a being a pressure pump. The treatment of

the material as it passes over cylinder 29 is by pressure of the liquor through the material, that is, the pump 26^a draws the dye liquor from the tank A, and forces it by the pipe 25^a into the interior of cylinder 29, and the perforations therein through the material and thus back to the tank. Treatment of the material in two directions is thus effected, ensuring thorough and even dyeing. From the cylinder 29 the container passes between rollers 17—17 by which all surplus dye liquor is expressed therefrom, this surplus falling back into tank A. From the rollers 17, 17, the container may pass into tank B and between the flat top of a closed chamber 30 and pressure rollers 31, which although part of the general dyeing apparatus are not operated for the particular class of dyeing now in question and will be fully referred to and described later. The container then passes through the nip of a further pair of rollers 17^a and into tank C. The cylinders 22 and 29 are positively driven by means of a chain drive as shown in the drawings. They are mounted in bearings in the tank A in such a manner that the dye liquor may pass freely to or from their interior. Such bearings are well known, and any suitable known form may be used.

In the tank C Figures 1, 2 and 5 are fitted two closed chambers 32, 33 each of which is provided with a flat top, the latter being perforated, and guide rollers 34 so arranged that the container passing therearound must pass horizontally in its traverse of the chamber, over the aforesaid flat tops and in tight contact therewith. Guide plates 36 are provided as shown in Figure 1 between the guide rollers. This tank in the operation under discussion is the washing off tank and is filled with the water, which may be acidulated in any usual manner. The operation of washing off will be more clearly understood by a reference to Figure 5 in conjunction with the main Figure 1. In the figure 35 is a rotary pump which through pipe 37 draws the wash water from the tank C through the container and material passing over the flat perforated top of chamber 33 and the pump then delivers the said wash water through pipe 38 to the interior of chamber 32 and forces it via the perforations through that part of the container and material passing along the top of chamber 32. The wash water is thus passed twice through all parts of the dyed material once by suction and once by pressure. Instead of the arrangement of pump shown in Figure 5, we may employ that shown in Figure 8. In this latter figure similar letters of reference indicate similar parts as those in Figure 5, with the addition of the drawing off pipe 35^a and three way valve 35^b. In this modification the wash water proceeds from the pump 35 into cham-

ber 33 in the direction of the arrow the valve 35^b being open to the pump and chamber and closed to the drain, and the course of circulation is from the chamber 32 to pump 35, from pump to interior of chamber 33, thence through the material to tank C. Thus the material has the wash water successively drawn through it and pressed through it. When desired the valve 35^b may be operated to open communication between the pump and drain and water will therefore be drawn through the material passing over chamber 32 into the pump and thence to the drain. 35^c is a pipe allowing communication between chamber 32 and an air pump which air pump may be installed for exhausting the chamber 32 of air if necessary in any operation. The container then proceeds around the guide rollers 39 to the rollers 5 and 6 which squeeze the surplus wash water therefrom, this water falling back into tank C. To guard against any slipping on the guide rollers 39, some of them may be positively driven by means of a chain 39^a passing around chain wheels fitted on the said guide rollers and driven by a sprocket on roller 6.

The operation of dyeing and washing off being now completed the conveyors 1 and 3 diverge and pass back to the feeding point of the apparatus over their respective guide rollers as shown in Figures 1 and 2, the material being removed from them at their point of divergence by rotary brushes driven in any convenient manner and preferably composed of wooden rollers having stiff leather doctors 40^a fitted radially or nearly radially thereto. The brushes may however be of any other suitable form; for instance they may be composed of brushes set radially or otherwise in the wooden rollers. 41 is a conduit into which the material falls as it is brushed from the conveyors, being drawn thereinto by a fan 42 by which the material may be propelled by any suitable conduit to the drying chamber, the whole process from the feeding of the laps to the apparatus to the removal of the dyed material to the drying chamber being thus continuous.

In the dyeing of oxidation colours, e. g. indigo blue, where the color is developed and fixed on the material by exposure to the atmosphere of the material after the dyeing operation, the process may be followed exactly as described above in tank A. The tank B however, would be fitted up exactly as tank C is shown in the drawings, that is, with chambers 32 and 33, guides and guide rollers and the tank would be kept empty of liquor. After passing the squeezing rollers 17 the container and material would pass around the guide rollers and over the chambers in tank B equivalent to chambers 32 and 33 shown in the drawings tank C, but which chambers would be in communication with a

rotary air pump. The same procedure would be followed as described above in connection with the washing off with the difference that the treatment would be with air. The long traverse given to the container by the arrangement of guide pulleys would in this instance be favourable to the oxidizing process, as the material, even when not being treated by the air pump, is exposed to the air for a considerable period before it enters the washing off tank C through the rollers. This long traverse it may be noted is also beneficial in the washing off process in tank C.

For use in dyeing with the azo colors, or other "developing" colours or in any other operation where a short period of treatment with liquor is necessary after that afforded by the passage of the material around the cylinders 22 and 29, the azotizing or developing operation may be carried out in tank B. In this tank B as shown in the drawings, 30 is a closed chamber having a flat perforated top 30^a and divided by a partition 30^b and pressure rollers 31 arranged as shown to keep the container in tight contact with the said top. When making use of this chamber 30 the container proceeds from the squeezing rollers 17 and over the flat top of the chamber the tank B being filled with liquor. A pump 43 driven from suitable strap gearing 44 is in communication by pipe 45 with one side of the closed chamber 30, and by pipe 46 with the other side. Operation of the pump 43 draws dye liquor from the tank B through the material and into one side of the closed chamber 30 via the perforations in the flat top 30^a, this liquor being then forced by the pump into the other side of the chamber and through the material back to the tank, the treatment being thus analogous to that received by material passing around cylinders 22 and 29 when those cylinders are used. But the chamber 30 may be a single undivided chamber, and the process may be the same as with the cylinders 22 and 29, the perforated flat top of chamber 30 being substituted for the perforated peripheries of the cylinders 22 and 29.

It is essential with conveyors such as 1 and 3 used in connection with this apparatus that they should be kept at a constant tension, and provision much therefore be made to prevent the possibility of too much tension being put upon them at any time. We therefore provide a friction drive as shown at 21, between the shaft 18 and the bevel pinion 20 see Figures 1 and 2. Anything which may tend to slow the rollers 2-4, 5-6, 17-17 and 17^a-17^a, therefore, will not tend to tear the container, the friction disc 21 allowing the necessary slip and the drive being thus equalized.

Guide rails of U-section may be provided throughout the interior of the tanks to ensure that the container shall follow a straight

path therethrough, the edges of the container, strengthened if necessary, engaging in the guide rails. Or as shown in Figures 6 and 7 where the container is seen in section passing over the flat top of casing 30 in tank B, the longitudinal edges of the conveyors 1 and 3 may be provided with ropes or cables 44, and a pair of pulleys 45, 46 fitted as shown in that figure, and more clearly in the detail thereto, the ropes 44 engaging within the grooves of the pulleys. In all cases however the guides will be so fitted that a tight joint between the container 1-3 and the cylinder 22 and 29, or the casing 30, or the casings 33 and 34 will not be endangered.

Combined with the apparatus we may provide the automatic dye feed arrangement shown in Figure 9. In this figure 47 is a dye mixing tank, filled with the dye liquor 48 to any convenient height. Buckets 49, attached to a chain 50 adapted to dip in the liquid and travelling around chain wheels 51 fitted upon rollers 52 the upper one of which is driven from the shaft 18 (Figure 1) of the apparatus at any predetermined speed, carry the dye liquor to the top of the tank and on their passage around the upper chain wheel 51, empty their contents into a tundish 53 and through a pipe 54 to the dye tank which by way of example may be the tank A. Stoppage of the main drive of the apparatus will therefore involve the stoppage of the dye liquor feed, and further, the quantity of dye liquor required for any particular weight of material passing through the apparatus being determined, very exact calculations as to the rate of feed of dye liquor may be arrived at and the dye feed arrangement set at the necessary speed. In the general purpose apparatus shown in the drawings Figures 1 and 2 both tanks A and B may be provided with such dye feed arrangements separately, or an additional pipe may be led from the pipe 54 (Figure 8) to the second tank, a three-way valve controlling the supply of dye liquor to tank A or B as required.

As already stated Figure 10 shows the structure of a portion of one of the conveyors 55 is the open woven material of the conveyor, and 56 transverse bars fitted on both sides of the conveyor and which may be secured to the material 55 by rivets, stitching or other convenient means. In the drawing they are secured by means of rivets. Any material may be used for the conveyor so long as it will, whilst holding securely the material to be treated, allow of the passage of liquor and air therethrough.

Although we have shown an apparatus having three tanks A, B and C, it is obvious that we may modify the apparatus. Tank A, or tank B, may be omitted altogether or further tanks may be added as required.

Also, one only, or more than two, perforated cylinders may be fitted in tank B. Further only one closed casing, of appropriate dimensions, may be fitted in tank C. Or all the tanks may be fitted with perforated cylinders such as 22 and 29, or may be all fitted with closed flat topped perforated chambers as shown at 30 in Figures 1 and 2 of the drawings divided or single. It will be obvious that any process may be carried out by means of apparatus described, with the necessary addition or deletion of tanks. Details of construction may also be varied within wide limits without departing from the spirit of our invention.

What we claim as our invention and desire to secure by Letters Patent is:—

1. The process for treating textile material in the loose state, which consists in passing the material in compact form while held in a double conveyor over perforated surfaces located in the treating tanks, maintaining an air-tight contact between the material and the entire perforated surfaces thereby to prevent escape of air through any of the perforations without passing through the material, and causing a treat-

ing fluid to pass through the material and through the perforations in the surfaces over which it passes.

2. The process for treating textile material in the loose state, which consists in passing the material in compact form over perforated surfaces located in the treating tanks, and causing a treating fluid to pass twice through the material.

3. A continuous process for dyeing textile material in the loose state, which consists in feeding the material to an endless reticulated conveyor, passing the conveyor with the contained material over perforated cylinders located in the dye bath, passing the dye liquor through the material and through the cylinder perforations, and then passing the conveyor and its contained material over perforated surfaces in successive tanks for similar treatment with another bath and with air.

In testimony whereof we have hereunto set our hands.

JOHN BRANDWOOD.
THOMAS BRANDWOOD.
JOSEPH BRANDWOOD.