

(No Model.)

2 Sheets—Sheet 1.

A. HARMEL.  
APPARATUS FOR DYEING.

No. 382,977.

Patented May 15, 1888.

Fig. 2.

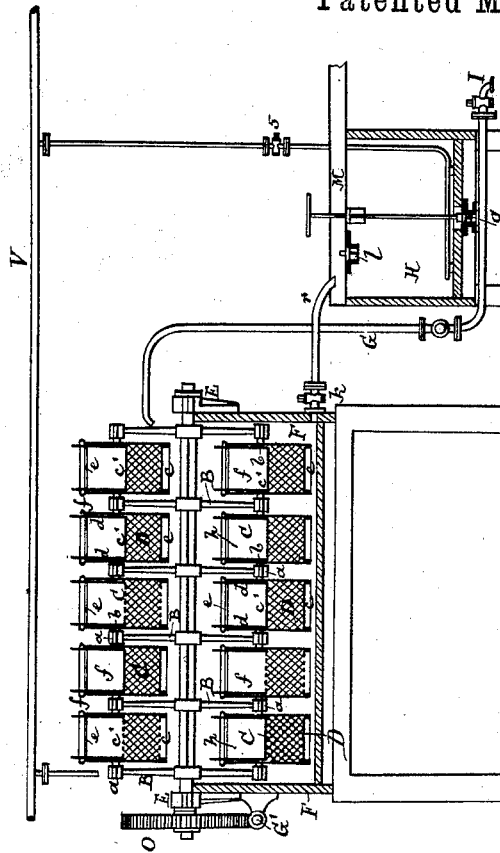
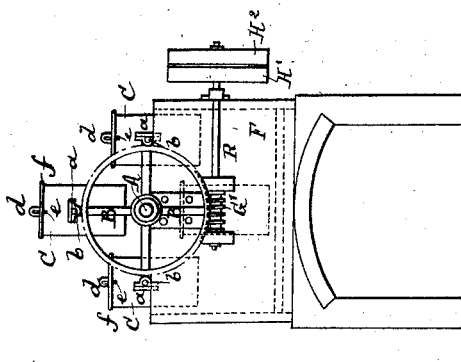


Fig. 1.



WITNESSES:  
*John A. Rennie.*  
*Paschal J. Ferraro*

INVENTOR:  
*Albert Harmel,*  
By his Attorneys,  
*Arthur G. Ineson & Co.,*

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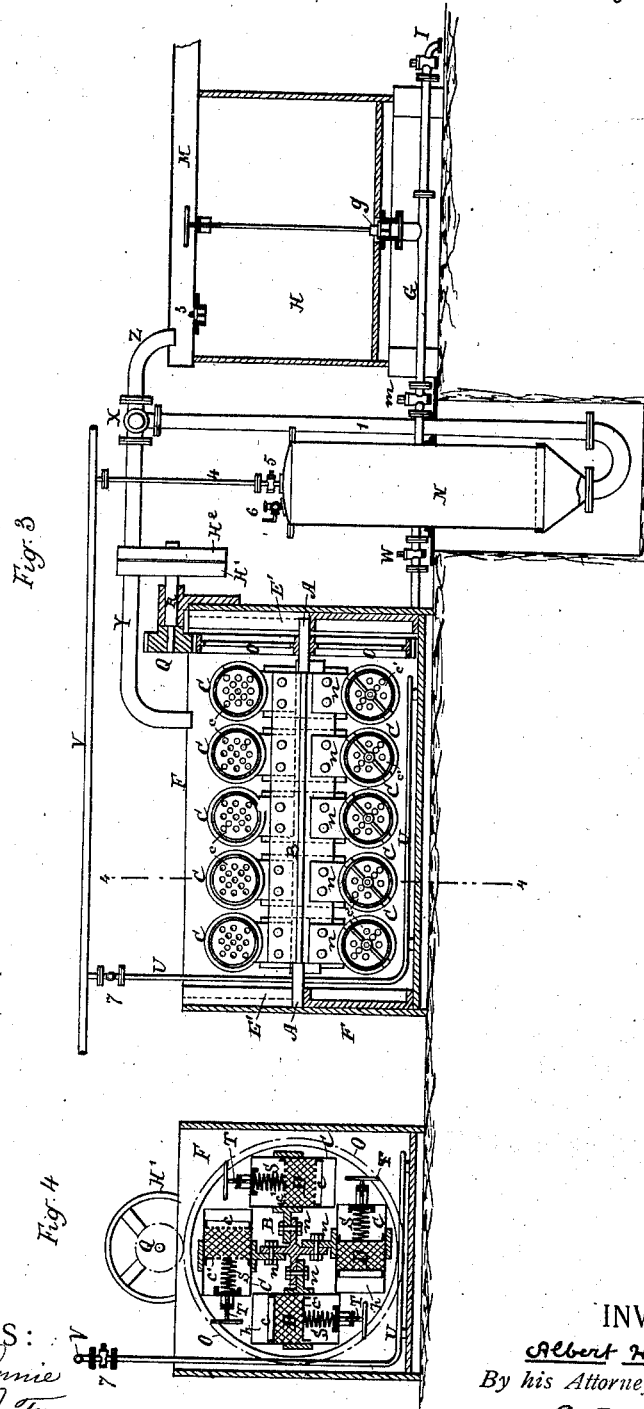
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Arthur C. Brown

# UNITED STATES PATENT OFFICE.

ALBERT HARMEL, OF VAL-DES-BOIS, NEAR WARMERIVILLE, FRANCE,  
ASSIGNOR TO SOCIÉTÉ HARMEL FRÈRES, OF SAME PLACE.

## APPARATUS FOR DYEING.

SPECIFICATION forming part of Letters Patent No. 382,977, dated May 15, 1888.

Application filed May 16, 1887. Serial No. 238,295. (No model.) Patented in France May 29, 1886, No. 176,245; in England August 21, 1886, No. 10,718; in Belgium September 8, 1886, No. 74,488; in Germany September 23, 1886, and in Spain January 22, 1887.

*To all whom it may concern:*

Be it known that I, ALBERT HARMEL, a citizen of the French Republic, residing in Val-des-Bois, near Warmeriville, France, have invented certain new and useful Improvements in the Dyeing of Combed Wool and other Fibers, of which the following is a specification.

This invention is the subject of patents in France, dated May 29, 1886, No. 176,245; in Belgium, dated September 8, 1886, No. 74,488; in Great Britain, dated August 21, 1886, No. 10,718; in Germany, dated September 23, 1886, and in Spain, dated January 22, 1887.

The object of this invention is to provide means for accomplishing mechanically the dyeing of wool or other fibrous substances in "tops" (called in French "bobines") or rolls of the sliver or roving as it comes directly from the combing operation, and also for subjecting it without removal from the machine to all the preparatory operations, such as gall-steeping, burnishing, rinsing, scouring, &c. To this end the tops are placed in separate receptacles, which should conform to them in shape and which are made with imperforate sides and foraminous top and bottom. These receptacles are placed in the bath of dye-liquor, and are moved therein in such manner as to cause a current of the liquor to flow through them longitudinally, either continuously in one direction or alternately in opposite directions, and under a slight pressure sufficient to insure its penetration into all parts of the wool. Thus a uniform circulation of the dye through the fiber is insured without the employment of sufficient force to cause the liquid to form special channels for itself through the fiber, as has been found to be the case heretofore in systems of dyeing where a forced circulation of the liquor has been maintained by means of a pump. My process thus insures the uniform and homogeneous coloring of the wool and avoids felting it, so that the necessity for re-combing is obviated, and consequently the loss by conversion into noils or short wool due to re-combing is avoided. The tops are by preference subjected to the operations of mordanting, rinsing, dyeing, and rinsing by successive manipulations in the same receptacle,

whereby handling and labor are saved and injury to the fiber is avoided.

It is essential to employ receptacles for the tops or other fibrous mass which shall have imperforate sides in order to confine the flow of the liquor to one direction and prevent lateral and irregular currents through the mass, which would result in unequal dyeing. The top and bottom of the receptacles are made perforated or foraminous in order to hold the fibrous matter in place while permitting free passage of the liquor.

In dyeing according to my method I prefer to employ the special mechanism for manipulating the receptacles which I have invented. In this apparatus the receptacles are mounted on a rotating frame, and are thereby passed into and out of or back and forth in the liquor in a suitable vat. I construct the machine in two ways. According to one construction the receptacles are freely suspended from a revolving frame, while in the other construction they are rigidly connected to the frame. In either case the action of the revolving frame causes the receptacles to move in or through the dyeing-liquid, and the latter is thereby caused to circulate through the receptacles and to permeate the wool-tops or other mass of fiber confined therein.

In the accompanying drawings, Figures 1 and 2 illustrate an apparatus constructed with flexibly suspended or pivoted receptacles, the former view being an end elevation and the latter a vertical longitudinal mid-section. Figs. 3 and 4 illustrate the other construction of machine, where the receptacles are rigidly connected to the revolving frame, Fig. 3 being a vertical longitudinal mid-section and Fig. 4 a transverse section cut in the plane of the line 4 4 in Fig. 3.

I will first describe the construction shown in Figs. 1 and 2.

Let F designate a vat or tank for containing the dye or other liquid to the action of which the material under treatment is to be subjected. A shaft, A, is rotatively mounted in bearings at opposite ends of the vat, and carries a frame, B, consisting of cross-arms fixed rigidly to it.

C C are the several foraminous receptacles for containing the wool-tops, these receptacles being pivotally connected to the rotative frame B. Each receptacle C is provided with pivotal studs *a a*, projecting from its opposite sides, and these studs are engaged by the bearings *b b*, formed on the ends of the cross-arms forming the frame B. The receptacles C C are preferably constructed in the form of cylinders closely fitting the wool-tops, so that a single top completely fills a receptacle with imperforate sides and with perforated bottoms *c c*. The tops are put into the receptacles, resting on the perforated bottoms, and perforated covers *c' c'* are set into the respective receptacles against the tops in order to hold the latter in place. These perforated covers are held down by means of transverse pins *ee*, which are passed through holes in the sides of the receptacles just beneath the upper flanges, *f*, thereof, and which pass through holes in vertical arms *d d*, which project upward from the perforated covers *c' c'*.

The receptacles C C are so constructed that when filled with a top the latter is at the lower portion of the receptacle, and the pivots on which the receptacles are mounted are considerably above the center of gravity of the receptacles when the latter are thus charged, so that the receptacles maintain always a vertical position, being freely suspended from their pivotal axes. The letters D D designate the wool-tops or other mass of fiber in the several receptacles.

The receptacles C are of such height that when the cover *c'* is fitted in against the wool-top D there is left a considerable space or basin, *h*, above it. This space constitutes a cup or reservoir for holding liquid, which is filled therewith each time the receptacle is lowered into the bath, and runs out therefrom by percolating down through the mass of fiber when the receptacle is lifted out of the liquid. The depth of this basin or reservoir *h* should be proportioned according to the amount of pressure required to cause the liquid to flow through the fibrous mass with the desired rapidity, being made deeper when the receptacle is designed to contain a top of greater density or height.

The shaft A is turned through the medium of a worm-wheel, O, which is fixed to it, and with which engages a worm or screw, G', on a short shaft carrying fast and loose pulleys H' H'. At each revolution of the shaft A the upper chamber or basin, *h*, of each receptacle C becomes filled with the liquid in the vat F while the receptacle is immersed in the liquid, and as by the continued rotation the receptacle is lifted out of the liquid the portion thereof confined in the upper basin, *h*, drains out through the perforated cover *c'* into and through the mass of fiber in the lower part of the receptacle, and escaping through the perforated bottom *c* drips back into the vat. Upon the further movement of the frame the receptacle descends into the liquid on the opposite side,

at which time the liquid is forced up through the perforated bottom *c* and through the mass of fiber and re-enters the upper reservoir, *h*. Thus at each revolution of the shaft there is set up in each receptacle a circulation of the dyeing-liquid through the mass of fiber, first in one direction and then in the other.

H designates one of a set of preparatory vats or tanks which are supplemental to the vat F, and in which the several liquids for dyeing, gall-steeping, rinsing, &c., may be prepared and stored. The several vats H are closed at the top, and into each a steam pipe, 4, leading from a pipe, V, projects, being fitted with a valve, 5. When it is desired to transfer the liquid from any one of the tanks H to the vat F, an outlet-valve, *g*, in the bottom of the tank is opened and steam is turned into the tank by opening the valve 5, whereupon the liquid is expelled by the pressure of the steam (after the manner of a monte-jus) through the valve *g* and through a pipe, G, into the vat F. The pipe G leads to the vat F at one end, and at its other end it terminates in a valve or faucet, I. This faucet is for the purpose of emptying the tank H, in order to wash it out. When the vat F is to be emptied, a valve, *k*, is opened, and the liquid flows out through this valve and through a pipe, *r*, into a gutter or channel, M, which passes over the tops of the several vats H H, and the liquid is directed into whichever tank may be desired by opening a valve, *l*, leading from the gutter into that tank.

Although it is preferable to make the wool-tops cylindrical and to fit them into cylindrical receptacles, yet it will be understood that the tops may be of other shapes and the shape of the receptacles be correspondingly altered. For fibrous matter that is not wound into a top or roll or ball the receptacles may be of any suitable shape.

I will now describe the construction illustrated in Figs. 3 and 4. In this apparatus the rotary frame B, carrying the several receptacles C C, is arranged wholly within the vat F. The frame B consists of a bar of cross-shaped section formed with journals A A at its opposite ends, which journals are lowered into bearings E' E' formed in the opposite ends of the tank. To the frame B are bolted a number of plates or flanges, *n n*, the outer portions of which are of annular form, and inclose, respectively, the several receptacles C C, which are thus fixed rigidly to the frame B. Each receptacle has a perforated bottom, *c*, and a perforated cover, *c'*, which fits into the receptacle. The charge of fibrous matter (represented at D) is placed on the bottom *c*, the cover *c'* is placed against the top of the charge, and a spiral spring, S, is arranged to press the cover against the fibrous matter with a tension, which may be adjusted as desired by means of a screw, T. Thus the wool-top or other fibrous charge is confined between the perforated bottom and top with a yielding pressure, so that all movement is prevented. The frame B, carrying the several recepta-

cles C C, is rotated at a suitable speed by means of a toothed wheel, O, which is fixed to one of the journals A, and which is engaged by a pinion, Q, on a short shaft, R, which carries fast and loose pulleys H' H<sup>2</sup>, which may be driven from any convenient source of power.

A steam-inlet pipe, U, arranged at the bottom of the vat F, leads from the main steam-pipe V, and serves to conduct steam into the liquid in order to maintain the bath at any desired temperature, the admission of steam being controlled by a valve, 7.

There are one or several reservoirs H for preparing and storing the liquids to be used in the vat F, and each tank H communicates by a valve, g, in its bottom, with a tube, G, which leads to a monte-jus, N, its communication therewith being controlled by a valve, n. At the opposite end of the tube G is an outlet-valve, I, which permits of emptying the tanks. The monte-jus N is employed for the purpose of effecting the transfer of the liquids from either of the tanks H to the vat F, or vice versa. A steam pipe, 4, leads from the pipe V and enters the top of the vessel N of the monte-jus, being controlled by a valve, 5, and the top of the vessel is provided with an air valve or vent, 6. From the bottom of the vessel N there leads an outlet-pipe, 1, which communicates through a three-way valve, X, with two discharge-pipes, Y and Z, the former of which empties into the vat F, and the latter of which communicates with the gutter or channel M, which leads over the series of tanks H and communicates with each tank through a valve, 3. From the bottom of the vat F an outlet-pipe leads into the vessel N, being controlled by a valve, W.

In order to fill the vat F from either of the tanks H H, the outlet-valve g of the tank from which the liquid is to be drawn is opened and the valve m is opened, whereupon the liquid flows through the tube G into the vessel N, which it fills. The valve m is then closed, the three-way valve X is turned to establish communication between the pipes 1 and Y, and the steam-valve 5 is opened, whereupon the steam entering the vessel N forces out the liquid therein through the pipes 1 and Y into the vat F. This operation is repeated as many times as may be necessary in order to give the desired depth of liquid in the vat F.

In order to empty the vat F, the valve W is opened, thereby drawing off enough liquid from the vat to fill the vessel N, whereupon the three-way valve X is turned to establish communication between the pipes 1 and Z, and the steam-valve 5 is opened, thereby expelling the liquid from the vessel N through the pipes 1 and Z into the gutter M, from which it is admitted into either tank H by opening the valve 3 thereof. This operation is repeated as many times as may be necessary to draw off all the liquid from the vat F.

The operation is as follows: When the wool-tops have been placed in the cylinders C C and submitted to the action of the springs S

and screws T, and when the dyeing-liquid has been suitably prepared in one of the tanks H, this liquid is transferred by means of the monte-jus N to the vat F in the manner already described, the operations of the monte-jus being repeated as many times as are requisite to attain in the vat a depth of liquid such as is considered necessary for commencing the operation. The frame B, carrying the receptacles C C, is then set in rotation either to the right or left and at such speed as is considered most suitable for the successful treatment of the wool. During this rotation the receptacles C C continually displace the liquid in the vat and the latter tends to pass through the wool-tops, either from bottom to top or from top to bottom, between the perforated plates c c'. After this operation has continued for a certain time the tops are found to be completely penetrated in all parts by the liquid and the dyeing is accomplished.

It should be remarked that in consequence of the rotative movement of the apparatus the bath is subjected to continual agitation, which keeps it in a homogeneous condition and prevents any deposit of the suspended matters on the wool, the latter being, as it were, continually washed, and the dyeing-liquid being incessantly agitated and being at no time in repose, there is no tendency to precipitation.

If preferred, the operation may be effected by turning the apparatus during half the time in one direction and during the other half of the time in the opposite direction. The action might thus be made more uniform throughout all the length of the tops.

When the operation is thought to be terminated, which may be ascertained by stopping the rotation and taking out and examining one of the tops, the dyeing-liquid is drawn off from the vat F by means of the monte-jus N, in the manner already described. After thus emptying the vat the apparatus may be again put in motion during a suitable time in order to partially dry the wool by means of the rotative movement.

The monte-jus N and its accessories, by means of which the liquids are transferred from the tanks H to the vat F, or vice versa, may be substituted by any other suitable apparatus for effecting such transference of the liquids—such, for example, as a Gifford injector or any suitable arrangement of pumps; or the same result may be partially accomplished by arranging the respective tanks at different levels in order that the liquid may flow from one to another by its own weight. Thus in Fig. 2 the tank H is shown on a lower level than the vat F, in order that the liquid may flow from the vat into the tank. This arrangement may be reversed, so that the liquid will flow naturally from the tank to the vat in order to fill the latter.

I may employ one or several reservoirs H H, and in the latter case the respective reservoirs may be employed to contain the separate preparatory solutions or baths. The respec-

ive baths having been used once may be regenerated, in order to be used again, by an addition to them of the dyeing materials.

The apparatus, whether constructed as shown in Figs. 1 and 2 or as shown in Figs. 3 and 4, may be constructed to contain as many tops as may be desired by providing it with a proportional number of receptacles C C. The number of receptacles C C which may be placed around the circumference of the frame by which they are carried may vary. I have shown four in the drawings; but it will be more advantageous to employ six, as thus the length of the vat F may be reduced for a given number of receptacles, and consequently less of the liquid will be employed. To the same end the bottom of the vat may be rounded. In this case there will also be an economy in the steam for heating the bath.

Any mechanism whatever may be provided for revolving the frame B, carrying the receptacles C C, in either direction or in alternately opposite directions. This rotation may be accomplished by hand instead of by power.

It will be understood that a liquid may be transferred from one reservoir H to the vat F, and after the tops have been treated therewith this liquid may be drawn off from the vat, the tops drained, and another liquid from some other tank H may then be transferred to the vat F for the further treatment of the tops, so that the latter may be treated with two or more liquids successively without being disturbed or removed from the receptacles C C. Thus they may first be treated with a mordant, then with a rinsing-liquor, then with the dye-liquor, and subsequently again with a rinsing-liquor. It is obvious that instead of thus changing the liquors in one vat the frame B, carrying the receptacles C C, may be transferred bodily from one vat containing one liquor to another vat containing a different liquor.

What I claim as my invention, and desire to secure by Letters Patent, is the following defined novel features, substantially as hereinbefore specified, namely:

1. The improved mechanism for mechanical dyeing, consisting of the combination of a vat for containing liquid, a rotatable frame journaled within said vat, and a series of receptacles for inclosing the fibrous matter carried by said frame, each of said receptacles having imperforate sides and foraminous ends, said ends being located within the receptacle, whereby open-mouthed chambers having closed sides and perforated bottoms are formed at both ends of the receptacles at all times when the mechanism is in operation.

2. The improved mechanism for mechanical dyeing, consisting of the combination of a vat for containing liquid, a rotatable frame journaled within said vat, and a series of receptacles for inclosing the fibrous matter to be treated carried by said frame, each receptacle having imperforate sides and foraminous ends between which the fibrous matter is confined, one of said foraminous ends being removable and adjustable, whereby the fibrous matter may be inserted in the receptacle and securely retained therein.

3. The improved mechanism for mechanical dyeing, consisting of the combination of a vat for containing liquid, a rotatable frame journaled within said vat, and a series of receptacles for inclosing the fibrous matter, each journaled in said frame, the journals of each of said receptacles being above its center of gravity, and each of said receptacles having imperforate sides and foraminous ends, the upper foraminous end being located below the rim of the receptacle, whereby an open-mouthed chamber is formed at the upper end of the receptacle.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

ALBERT HARMEL.

Witnesses:

CH. GARYINZ,  
EMILE REIMBEAU.