To all whom it may concern:

Be it known that Eugene Holt and Lafayette Holt, citizens of the United States, residing at Burlington, in the county of Alamance and State of North Carolina, have invented certain new and useful Improvements in Beam Dyeing-Machines, of which the following is a specification.

The object of the invention is to provide an apparatus for the treatment of yarns and similar materials in the operation of cleaning or boiling, bleaching, dyeing, oxidizing or fixing, developing, etc., of the type known in the art as beam dyeing machines, wherein the process may be secured, in the matter of preventing premature oxidation or fixing while insuring uniform oxidation and development at the proper stage in the procedure, and at the same time to attain this object by an arrangement of the dye liquors, steam and other chemicals and agents employed in this connection.

A further object of the invention is to provide an apparatus of the class indicated, wherein precipitation or stratification of the dyeing agents or other chemicals held in suspension in the treating fluid, may be prevented, and wherein the direction of application of the treating fluid to the material may be varied to suit the conditions and characteristics of such material.

With these and other objects in view, the invention consists in a construction and combination of parts, of which a preferred embodiment is illustrated in the drawings and is hereinafter specifically described, it being understood that various changes in the form, proportion and minor details of construction and arrangement may be resorted to, without departing from the spirit of the invention.

In the drawings, which, as above indicated, illustrate a preferred and typical form of the apparatus embodying the invention, -

Figure 1 is a plan view of the machine;
Fig. 2 is a vertical sectional view on the line 2-2 of Fig. 1;
Fig. 3 is a detail sectional view on the line 3-3 of Fig. 2, indicating an inclined port or nozzle forming one of the inlets and disposed to produce a circulatory movement of the incoming liquor or other agent.

The machine consists essentially of a main vat or receptacle 10 adapted to receive and contain during the progress of the operations a beam 11 upon which the yarn is warped or wound, as indicated at 12, said beam comprising upper and lower heads 13 and 14 connected by a hollow barrel 15, which is perforated or ported, or is of reticulated or open construction to permit of lateral circulation, either inwardly or outwardly thourough the course of operation, as hereinafter described. This barrel is closed at its upper end, as shown at 16, and is open at its lower end for communication with a port 17 formed, as illustrated, in the base or bottom of the vat, the beam being centered at its lower end in the vat by means of downwardly convergent guides 18 and being fitted steam-tight upon the seat 19 at the bottom of the vat around the port 17, to insure communication only between the port and the interior of the barrel when the beam is in place. This steam-tight seating of the beam is insured by means of a set screw 20 bearing upon the upper end of a center or core rod 21 in the beam and threaded in a cross bar 22, which bears against the under surface of the top or upper wall of the vat.

The vat is sealed at the top by means of a lid or cover 23 held in place by any suitable means, such as the pivotal locking bolts 24, and hand wheel nuts 25.

In communication (by means hereinafter described) with the main vat or receptacle and preferably surrounding the same, as illustrated in the drawings, is a circulating tank 26 acting in the nature of a jacket and serving, by reason of its contents to maintain the desired temperature in the main vat or receptacle, and provided with a relief port or vent 27 which may be valved, as shown at 28. Also an overflow is provided, as shown at 29, from the main vat or receptacle into the circulating tank, said overflow being provided with a controlling and regulating valve 30, and in communication with the interior of the vat and extending, as shown, through the circulating tank, is a pressure gage 31, which also serves to indicate the level of the surface of the required contents of the vat.

In cooperation with the receptacles above described, there is employed a circulating...
system for fluid, whether hot water, dyeing liquor, or other chemical or agent, air, steam, or a combination of any two or more thereof, designed to induce a circulation of such fluid for the purpose, primarily, of thoroughly saturating or impregnating the material within the vat, and arranged, for example, on the beam or holder, and adapted to be reversed in direction, so that the fluid may be forced or carried through the material on the beam or holder in either direction radially of the beam and also designed, secondarily, to maintain the liquor in the desired condition as to efficiency by maintaining an agitation sufficient to prevent precipitation or stratification when there are practically solid substances held either in suspension or solution. In the preferred embodiment of the invention, as applied to this circulating system, there is employed an inlet pipe 32 which may lead from any source of supply and which communicates with the main circulating pipes 33, 34 and 35; the pipes 34 and 35 being connected transversely by branch pipes 36, 37 and 38, which are respectively in communication by suitable ports 39, 40 and 17, in the bottom of the receptacle structure, the port 39 communicating with the circulating or mixing tank, the port 40 with the main receptacle or vat exteriorly of the beam, and the port 17 with the material within or around the beam, and thence back into the system, and this continuous circulation may be maintained for any required length of time and under any desired pressure. On the other hand, if the valves 38 and 37 and 35 are closed, and valves 37 and 36 are opened, the direction of the circulation will be to the vat exteriorly of the beam, thence through the yarn or material supported by the beam, and into the interior of the latter, and then through branch pipe 38 to the main pipe 35 and back to the pump. As hereinbefore indicated, the purpose of the mixing or circulating tank 26 is to provide an additional means for mixing and maintaining the liquor in the proper condition to treat the yarn, and when it is desired to direct the current of material through the valve 35 may be opened to communicate with the interior of the beam, valve 37 being opened to permit communication with the pipe 35, valve 35 being closed, valve 36 being opened to permit of a return current to the tank 26, from whence the liquor passes around to the port 42 and thence through the branch pipe 41 (the valve 41 being opened) to pipe 35, and back to the pump. Or the arrangement of the valves may be readjusted to reverse the direction of flow through the yarn and back to the circulating tank, as by closing valve 38 and opening valve 37, opening valve 38 and closing valve 37, the other valves remaining as last above explained.

A further function of the tank 26, as hereinbefore described, is to maintain the desired temperature in the vat, and for this purpose a valved steam inlet pipe 46 may be employed.
It is well known that in order to properly treat yarn with certain dyeing liquors, it is necessary to exclude air during the saturation or impregnation of the material, or during the deposit of the dyestuff material on the yarn, in order to prevent oxidation. This can be accomplished by reason of the use of a sealed vat, as already described, and after the saturation has been completed, the air necessary to produce oxidation may be introduced and circulated by the same circulating means as is described above, such as a forced circulation thereof through said material, either outwardly or inwardly in a radial direction and reverse said direction as may be necessary to accomplish the desired object, but to subsequently subject said material to a similar circulation in either direction, of an oxidizing or other fluid, for the purpose of fixing and developing the color, the direction of flow being controlled by the adjustment of the valves which also permit of entirely withdrawing the liquor or other agent from the apparatus when it has performed its function, and when it is desired either to substitute another agent or to permit of removing the beam from the vat.

It will be apparent, moreover, that a battery of vats may be operated in connection with a single circulatory system, as indicated, and that a plurality of beams may be arranged in a single vat.

What is claimed as new is:

1. A yarn treating apparatus including a closed receptacle, a mixing tank jacketing such receptacle, and a circulating system for circulating fluid from said mixing tank in different directions through said closed receptacle.

2. A yarn treating apparatus including a closed receptacle, a mixing tank jacketing such receptacle, a perforate yarn holding member within said receptacle, and means for circulating fluid from said mixing tank in more than one direction through said yarn holding member.

3. A yarn treating apparatus having a vat or closed receptacle, an inclosed perforate yarn holding member, a mixing tank jacketing said vat or receptacle, and a circulating system having main circulating pipes, means for inducing a forced circulation therein, and valved branch pipes communicating with the main circulating pipes and having ports in communication with the receptacle within and without the beam and with the tank, respectively.

4. A yarn treating apparatus having a vat or receptacle, an inclosed perforate yarn holding member, a circulating tank jacketing the vat or receptacle, a circulating system having inclosed ports in communication respectively with the receptacle within and without the beam and with the tank, and a valved supply pipe in communication with said tank and said vat and yarn holding member.

5. A yarn treating apparatus having a vat or receptacle, an inclosed hollow beam or yarn holder provided with lateral outlets, a mixing tank jacketing said vat or receptacle, and a circulating system having inclosed ports in communication respectively with the receptacle within and without the beam and with the tank, and a valved supply pipe in communication with said tank and said vat and yarn holding member.

6. A yarn treating apparatus having a vat or receptacle, an inclosed hollow beam or yarn holder provided with lateral outlets, a mixing tank jacketing said vat or receptacle, and a circulating system having inclosed ports in communication respectively with the receptacle within and without the beam and with the tank.

7. A yarn treating apparatus having a vat or receptacle, an inclosed hollow beam or yarn holder provided with lateral outlets, a mixing tank jacketing the vat or receptacle, and a circulating system having inclosed ports in communication respectively with the receptacle within and without the beam and with the tank, and a valved supply pipe in communication with said tank.

8. A yarn treating apparatus having a vat or receptacle, an inclosed hollow beam or yarn holder provided with lateral outlets, a circulating tank jacketing the vat or receptacle, a circulating system having inclosed ports in communication respectively with the receptacle within and without the beam and with the tank, and a valved supply pipe in communication with said tank.

9. A yarn treating apparatus including a vat, a perforate yarn holding member inclosed within said vat, a circulating system for inducing a flow of fluid from within to without said yarn holding member and vice versa, and means for causing said fluid to swirl in said vat during circulation.

10. A yarn treating apparatus including a vat, a perforate yarn holding member inclosed within said vat, and a circulating system communicating with said vat through inclined ports and adapted to induce a flow of liquid from within to without said yarn holding member and vice versa.

11. A yarn treating apparatus, including
a closed receptacle, a mixing tank jacketing such receptacle, an overflow connecting the tank and receptacle, and a circulating system for circulating fluid from one to the other.

12. A yarn treating apparatus including a vat having ports, a circulating system for introducing fluid into said vat through either port and withdrawing it through the other, a perforate yarn holding member inclosed within said vat and having an open end disposed over one of said ports, guides converging toward said last mentioned port to be engaged by and thereby guide said yarn holding member into position, and means for securing said holder in position.

13. A yarn treating apparatus including a vat having ports, a circulating system for introducing fluid into said vat through either port and withdrawing it through the other, a perforate yarn holding member inclosed within said vat and having an open end disposed over one of said ports, guides converging toward said last mentioned port to be engaged by and thereby guide said yarn holding member into position, and means for securing said holder in position.

In testimony whereof we affix our signatures in presence of two witnesses.

EUGENE HOLT.
LEFAYETTE HOLT.

Witnesses:
Erwin A. Holt,
J. A. Thompson.