Description

This invention relates to improvements in and relating to a perforated cylindrical beam apparatus for dyeing or otherwise treating fabrics in the form of cloth, tapes, yarns and other elongate materials. Such an apparatus is disclosed in the document DE-OS-2 207 670

Attempts have been made in providing means of achieving uniform distribution of a treatment liquor through the layers of fabric both axially and radially of the beam on which the fabric is wound. One such attempt is disclosed in Japanese Patent Publication No. 58-5301 (% DE-A -2 515 645) in which a horizontally mounted beam apparatus is provided with flow communication ports at the upper front end and at the central lower portion of a partly dually structured treatment vessel in which the beam is accommodated, the ports being connected to piping, heat exchanger and pump all installed externally of the apparatus. This prior apparatus however has a drawback in that the apparatus as a whole becomes bulky and costly and requires complicated, tedious maintenance work.

With the foregoing difficulties of the prior art apparatus in view, the present invention seeks to provide an improved beam treatment apparatus which is ralatively compact and simple in construction and which is capable of treating fabric materials effectively and homogeneously.

This and other objects and features of the invention will appear apparent from reading the following detailed description with reference to the accompanying drawings which illustrate by way of example a preferred embodiment to which however the invention is in no way limited.

According to the invention, there is provided a perforated beam apparatus for dyeing or otherwise treating fabric materials which comprises: a horizontally mounted cylindrical treatment vessel having a dished end cover at one end and a rear end wall at the opposite end; a perforated cylindrical beam concentrically mounted within the treatment vessel and provided at opposite ends with outwardly extending annular rims defining therebetween a material winding zone in which the fabric is wound on the beam; a vertically disposed partition disc member having a pair of diametrically opposed peripheral recesses and defining with the rear end wall of the vessel a heat exchange chamber, separating this chamber from a treatment chamber extending the majority of the beam length; a pair of perforated flow rectifier plates fitted respectively in the peripheral recesses and extending horizontally between the disc member and the inlet end of the vessel and defining with the inner wall of the vessel an upper and a lower flow rectifier zone, the rectifier plates being spaced apart from the outer surface of the fabric on the beam; a recycle pump for feeding a treatment liquor through a feed tube extending horizontally into the interior of the beam; and a pressure reserve tank communicating with the interior of the vessel and supported in position above the upper rectifier zone.

Figure 1 is an elevational, partly sectional, view of a beam treatment apparatus embodying the invention;

Figure 2 is a cross-sectional view taken on the line II - II of Figure 1;

Figure 3 is a plan view of a partition plate incorporated in the apparatus of Figure 1; and

Figure 4 is a perforated rectifier plat used in the apparatus of Figure 1.

Referring now to the drawings and Figure 1 in particular, there is shown a beam dyeing or treating apparatus 10 for dyeing or otherwise treating woven or knitted fabrics F in the form of cloth, tapes, yarns and other elongate materials. The apparatus 10 comprises a horizontally mounted cylindrical treatment vessel 11 having a circular cross section (Figure 2) and provided at one or front end with an outwardly dished end cover 12 and at the opposite or rear end with a similarly dished end wall 13.

Designated at 14 is a perforated cylindrical beam concentrically mounted within the vessel 11 and having at opposite ends a pair of outwardly extending annular support rims 15 and 16 defining therebetween a material winding zone in which the fabric F is wound onto the beam body. The beam 14 has a multiplicity of perforations 17 formed in its periphery and uniformly distributed therearound so that treatment or dye liquor pumped into the interior of the beam passes out through the perforations 17 and wets the fabric F wound thereon. A vertically extending annular support flange 18 is provided adjacent to the rear end of the beam 14 for supporting a feed tube 19 horizontally extending from a recycling pump 20 through the flange 18 into the interior of the beam 14. The support flange 18 also serves to receive and fit with an inwardly directed annular rear end wall 14a of the beam 14.

The beam 14 may be inserted into the vessel 11 as it is transported on a cradle (not shown) or a suspension device (not shown) until the rear end wall 14a of the beam 14 engages in sealing relation with a horizontal extension 18a of the flange 18. In this position, a sealing disc 21 is brought into sealing engagement with an inwardly directed annular front end wall 14b of the beam 14, the sealing disc being connected via dished end cover 12 to a handle 22 with which to manipulate the mounting and dimounting of the beam 14. The end cover 12 is clamped in place with respect to the treatment vessel 11 as its peripheral edge is sealingly received in a clamping member 23.

Referring to Figure 3, there is shown a vertically disposed flow rectifier partition disc member 24 having a pair of peripheral recesses 24a, 24b located in diametrically opposed positions and a concentric

annular flange 24c of a diameter slightly smaller than that of the cylindrical beam 14. The partition disc 24 is fitted in place with its flange 24c engaged sealingly with the support flange 18 and defines with the dished rear end wall 13 of the vessel 11 a heat exchange chamber 25 and separates this chamber from a treatment chamber 26 extending the majority of the beam length. The two chambers are in flow communication with each other through an annular passageway for treatment liquor defined between the inner wall of the vessel 11 and the periphery of the partition disc 24 as seen in Figures 1 and 2.

There is provided a perforated flow rectifier plate 27 which is in the form of a trough configured to fit in the recess 24a (24b) of the partition disc 24 and which extends horizontally between the disc 24 and the inlet end of the vessel 11. As better shown in Figure 4, the perforated rectifier plate 27 comprises a base portion 27a, and upwardly directed opposed longitudinal edge portions 27b, 27c interconnected at one end by an unperforated end portion 27d, the opposite end 27e being left open to allow flow communication between the treatment chamber 26 and the heat exchange chamber 25. The unperforated end portion 27d of the plate 27 is welded or other affixed to the inner wall of the vessel 11 adjacent to the clamping member 23 at the front end of the vessel 11, whilst the open end portion 27e terminates at the partition disc 24 disposed adjacent to the rear end of the vessel 11 as shown in Figure 1. In the illustrated embodiment, two of these rectifier plates 27 are provided, one of which defines with the inner wall of the vessel 11 a first or upper flow rectifier zone 28 and the other of which defines a second or lower flow rectifier zone 29, the two rectifier zones being disposed in diametrically opposed relation as better shown in Figure 2. Each rectifier plate 27 extends in spaced apart or separated relation to the wound fabric F on the beam 14.

Designated at 30 is a pressure reserve tank supported externally on the treatment vessel 11 above the upper rectifier zone 28 by means of conduits 31, 32 and 33 through which the tank 30 is in flow communication with the interior of the vessel 11.

The pump 20 is a recycle pump capable of reversing the direction of flow of treatment liquor, a preferable example being disclosed in Japanese Publication No. 47-17106.

A heat exchange piping unit 34 is arranged in the heat exchange chamber 25 and connected to a steam inlet valve 35, a steam trap 36, a coolant inlet valve 37 and a coolant outlet valve 38. Designated at 39 is a liquor drain valve connected to the lower rectifier zone 29 in the vessel 11, and at 40 is a liquor feed valve connected to the feed tube 19 adjacent to the pump 20. The pump 20 is driven by a reversible motor 41.

The beam 14 with fabric F wound thereon having been mounted in position within the interior of the vessel 11, a dyeing or treatment liquor is introduced via feed valve 40 and pumped to pass in the direction of the arrows though the feed tube 19 and its perforated end baffle 42 into the interior of the beam 14 and continued to be fed until a predetermined level of liquor inventory is established in the tank 30, while steam of a predetermined temperature is supplied to the heat exchanger 34. The treating liquor is forced to pass outwardly through the perforations 17 of the beam 14 into the layers of fabric F and forms a main suction stream each in the upper and lower flow rectifier zones 28, 29 in the treatment chamber 26 leading through widened flow gates 43, 44 into the heat exchanger chamber 25 and a sub-suction stream elsewhere in the treatment chamber 26 leading through constructed circumferential flow gate 45 into the heat exchanger chamber 25. The main and sub-suction streams of liquor are thus merged in the heat exchanger chamber 25 and returned to the recycle pump 20 for recirculation into the beam 14. The main suction stream of liquor is oriented on entry to the respective rectifier zone (28, 29) to follow a substantially horizontal path and increases its speed gradually toward to widened flow gate (43, 44). Advantageously, since the rectifier plate 27 is isolated from the outer surface of fabric F on the beam 14, it is made possible to eliminate the turbulant flow of liquor which would otherwise occur in the vicinity of the support rim 16 on suction side, resulting in objectionable dye speckles or irregularities in the finish of fabric F.

Also advantageously, since the upper rectifier zone 28 is communicated through the conduits 31 and 32 with the tank 30 and the tank 30 is in turn communicated through the conduit 33 with the heat exchanger chamber 25, it is possible to eliminate air bubbles by suction into the tank 30 which would entrain with part of liquor stream passing out through the fabric F.

Further advantageously, it is possible to improve homogeniety or uniformity in the treatment finish of the fabric F particularly over the length thereof by increasing the porosity or pore volume per unit area of the perforated rectifier plate 27 progressively toward the unperforated end 27d.

If necessary as in treating fabric F of increased layered thickness the recycle pump 20 may be switched to reverse the direction of flow of the liquor so as to cause the liquor to be sucked from through the fabric F into the interior of the beam 14.

Experiments indicate that successful treatment can be achieved for example by design considerations in which the flow rates of liquor are allocated 50 - 60% at the upper rectifier zone 28; 30 - 50% at the lower rectifier zone 29; 10 - 15% at the constricted circumferential flow gate 45; and about 1/5 of the flow from the rectifier zone 25 into the tank 30.

* C L M S *

Claims

1. A perforated beam apparatus (10) for dyeing or otherwise treating fabric materials (F) which comprises: a horizontally mounted cylindrical treatment vessel (11) having a dished end cover (12) at one end and a rear end wall (13) at the opposite end; a perforated cylindrical beam (14) concentrically mounted within said treatment vessel (11) and provided at opposite ends with outwardly extending annular rims (15, 16) defining therebetween a material winding zone in which the fabric (F) is wound on said beam (14); characterized in a vertically disposed partition disc member (24) having a pair of diametrically opposed peripheral recesses (24a, 24b) and defining with the rear end wall (13) of said vessel (11) a heat exchange chamber (25), separating this chamber from a treatment chamber (26) extending the majority of the beam length; a pair of perforated flow rectifier plates (27) fitted respectively in said peripheral recesses (24a, 24b) and extending horizontally between said disc member (24) and the inlet end of said vessel (11) and defining with the inner wall of said vessel an upper and a lower flow rectifier zone (28, 29), said rectifier plates (27) being spaced apart from the outer surface of the fabric (F) on the beam (14); a recycle pump (20) for feeding a treatment liquor through a feed tube (19) extending horizontally into the interior of said beam (14); and a pressure reserve tank (30) communicating with the interior of said vessel (11) and supported in position above said upper rectifier zone (28).

2. Apparatus as claimed in claim 1, wherein said perforated flow rectifier plate (27) is in the form of a trough configured to fit in the recess (24a; 24b) of said disc member (24) and has one unperforated end (27d) affixed to the front end wall of said vessel and the opposite end open to allow flow communication between said treatment chamber (26) and said heat exchange chamber (25).

3. Apparatus as claimed in claim 1, wherein said perforated flow rectifier plate (27) has a pore volume per unit area progressively increasing toward its unperforated end (27d).

4. Apparatus as claimed in claim 2, wherein said perforated flow rectifier plate (27) has a pore volume per unit area progressively increasing toward its unperforated end (27d).

5. Apparatus as claimed in claim 1, wherein said tank (30) is communicated with said vessel through a plurality of conduits (31, 32, 33) extending into said upper rectifier zone (28) and said heat exchange chamber (25), respectively.

6. Apparatus as claimed in claim 1, wherein said recycling pump (20) is operative to feed the treatment liquor in reversible directions of flow.

Patentansprüche

1. Vorrichtung (10) mit einem perforierten Warenbaum zum Färben oder anderweitigen Behandeln von Textilmaterialen (F), umfassend: ein horizontal gelagertes zylindrisches Behandlungsgefäß (11), das an einem Ende eine gewölbte Endabdeckung (12) und am gegenüberliegenden Ende ein hintere Endwand (13) hat; einen perforierten, zylindrischen Warenbaum (14), der in dem Behandlungsgefäß (11) konzentrisch gelagert und an gegenüberliegenden Enden mit nach außen ragenden Ringflanschen (15,16) versehen ist, die zwischen sich eine Material-Aufwickelzone begrenzen, in der das Textilmaterial (F) auf den Warenbaum aufgewickelt ist, **gekennzeichnet** durch eine vertikal angeordnete Trennscheibe (24), die zwei diametral gegenüberliegende Umfangsaussparungen (24a,24b) hat und mit der hinteren Endwand (13) des Gefäßes (11) eine Wärmeaustauschkammer (25) begrenzt und die diese Kammer von einer sich über die überwiegende Länge des Warenbaums erstreckenden Behandlungskammer (26) trennt; zwei perforierte Strömungsleitbleche (27), die in die Umfangsaussparungen (24a,24b) eingesetzt sind und sich horizontal zwischen der Scheibe (24) und dem Einlaßende des Gefäßes (11) erstrecken und mit der Innenwand des Gefäßes eine obere und eine untere Strömungsleitzone (28,29) begrenzen, wobei die Leitbleche (27) im Abstand von der Außenfläche des auf dem Warenbaum (14) befindlichen Textilmaterials (F) angeordnet sind; eine Umwälzpumpe (20) zum Zuführen einer Behandlungsflüssigkeit durch ein Zuführrohr (19), das sich horizontal in das Innere des Warenbaums (14) hinein erstreckt; und einen Drucktank (30), der mit dem Innenraum des Gefäßes (11) in Verbindung steht und der über der oberen leitzone (28) angeordnet ist.

2. Vorrichtung nach Anspruch 1, wobei das perforierte Strömungsleitblech (27) die Form eines Troges hat, der in die Aussparung (24a;24b) der Trennscheibe (24) paßt und ein nicht-perforiertes Ende (27d) hat, das an der vorderen Endwand des Gefäßes befestigt ist, und ein gegenüberliegendes offenes Ende hat, um eine Strömungsverbindung zwischen der Behandlungskammer (26) und der Wärmeaustauschkammer (25) zu ermöglichen.

3. Vorrichtung nach Anspruch 1, wobei das perforierte Strömmungsleitblech (27) eine zu dem nichtperforierten Ende (27d) hin zunehmende Perforationsdichte hat.

4. Vorrichtung nach Anspruch 2, wobei das perforierte Strömungsleitblech (27) eine zu dem nichtperforierten Ende (27d) hin zunehmende Perforationsdichte hat.

5. Vorrichtung nach Anspruch 1, wobei der Behälter (30) mit dem Gefäß über mehrere Kanäle (31,32,33) in Verbindung steht, die in die obere Leitzone (28) bzw. in die Wärmeaustauschkammer (25)

münden.

6. Vorrichtung nach Anspruch 1, wobei die Umwälzpumpe (20) die Behandlungsflüssigkeit in umkehrbaren Strömungsrichtungen zuführt.

Revendications

1. Appareil (10) à ensouple perforée pour teindre ou traiter de toute autre manière des tissus (F), cet appareil comprenant : une cuve de traitement cylindrique (11) montée horizontalement et comportant un couvercle d'extrémité bombé (12) à une de ses extrémités et une paroi d'extrémité arrière (13) à son extrémité opposée ; une ensouple cylindrique perforée (14) montée concentriquement à l'intérieur de ladite cuve de traitement (11) et pourvue à ses extrémités opposées de rebords annulaires (15, 16) s'étendant vers l'extérieur et définissant entre eux une zone d'enroulement de tissu dans laquelle le tissu (F) est enroulé sur ladite ensouple (14), caractérisé par un disque de cloisonnement (24) disposé verticalement et comportant une paire d'évidements périphériques (24a, 24b) opposés diamétralement et définissant avec la paroi d'extrémité arrière (13) de la cuve (11) une chambre d'échange de chaleur (25) séparant cette chambre d'une chambre de traitement (26) s'étendant sur la majeure partie de la longueur de l'ensouple ; une paire de plaques perforées (27) de redressement d'écoulement montées respectivement dans lesdits évidements périphériques (24a, 24b) et s'étendant horizontalement entre le disque (24) et l'extrémité d'entrée de la cuve (11) en définissant avec la paroi intérieure de la cuve des zones supérieure et inférieure (28, 29) de redressement d'écoulement, les plaques (27) de redressement étant espacées de la surface extérieure du tissu (F) se trouvant sur l'ensouple (14) ; une pompe (20) de recyclage pour envoyer une liqueur de traitement à travers un tube d'alimentation (19) s'étendant horizontalement jusque dans l'intérieur de l'ensouple (14) ; et un réservoir (30) de pression communiquant avec l'intérieur de la cuve (11) et supporté dans une position au-dessus de la zone supérieure (28) de redressement d'écoulement.

2. Appareil selon la revendication 1, dans lequel la plaque perforée (27) de redressement d'écoulement se présente sous la forme d'une auge configurée de manière à s'ajuster dans l'évidement (24a, 24b) du disque (24) et comporte une extrémité non perforée (27d) fixée à la paroi d'extrémité avant de la cuve et une extrémité ouverte pour permettre une communication d'écoulement entre la chambre de traitement (26) et la chambre (25) d'échange de chaleur.

3. Appareil selon la revendication 1, dans lequel la plaque perforée (27) de redressement d'écoulement présente un volume de pores par unité de surface qui augmente progressivement en direction de son extrémité non perforée (27d).

4. Appareil selon la revendication 2, dans lequel la plaque perforée (27) de redressement d'écoulement présente un volume de pores par unité de surface qui augmente progressivement en direction de son extrémité non perforée (27d).

5. Appareil selon la revendication 1, dans lequel le réservoir (30) communique avec la cuve par une pluralité de conduits (31, 32, 33) s'étendant jusque dans la zone supérieure (28) de redressement et jusque dans la chambre (25) d'échange de chaleur, respectivement.

6. Appareil selon la revendication 1, dans lequel la pompe de recyclage (20) agit de manière à envoyer la liqueur de traitement dans des sens d'écoulement réversibles.