APPARATUS FOR EFFECTING LIQUID PENETRATION OF FABRICS

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By: [Signature]
APPARATUS FOR EFFECTING LIQUID PENETRATION OF FABRICS

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1. This invention relates to improvements in apparatus for effecting liquid penetration of fabrics and it refers particularly to apparatus of the type described in my co-pending application Serial No. 86,514, filed April 9, 1949, and now abandoned.

The principal object of my present invention is to provide an improved construction of apparatus for effecting the liquid penetration of fabrics—such as in the dyeing, sizing, or proofing of fabrics. A further object is to provide, in fabric dyeing apparatus, an improved construction of filter which will require relatively little attention for the cleansing of it. A still further object is to devise improved means for automatically adjusting the effective width of the suction tubes to compensate for variations in the width of the material being treated.

With these and other objects in view I have devised an improved construction of apparatus for effecting the liquid penetration of fabrics of the type described in my co-pending application Serial No. 86,514, filed April 9, 1949, including at least one conduit adapted for mounting in a vat wherein the dye or other liquid is contained, the conduit having formed in it an opening or a series of openings extending longitudinally of its length whereby liquid may be drawn into the conduit, means for drawing the fabric through the liquid in the vat and directly past the opening or openings in the conduit, and means for drawing liquid suctionally through the fabric and into the conduit. The conduit has associated with it means for automatically varying the effective width of the conduit by altering the length of the opening or openings according to the width of the fabric being treated and there is a filter extending longitudinally of the conduit. The conduit is so constructed that its end covering may be readily removed to permit withdrawal of the filter for purposes of cleaning and it is preferred that the opening in the conduit be constructed by forming a longitudinal slot in its wall and then inserting a pair of parallel spaced edge members so as to fit about the edge portions of the slot.

In order that the invention will be readily understood and conveniently put into practical effect reference will now be made to the accompanying sheet of illustrative drawings wherein there is depicted one construction of apparatus made according to my invention. In these drawings:

Fig. 1 is a diagrammatic view showing a transverse section of a dyeing jigger incorporating apparatus according to this invention.

Fig. 2 illustrates in perspective the apparatus for suctionally drawing liquid through the fabric. Fig. 3 shows a transverse cross-sectional view of a conduit, on the line and in the direction of the arrows 3—3 of Fig. 2.

Fig. 4 is a longitudinal cross-section of part of the conduit taken on the line and in the direction of the arrows 4—4 of Fig. 3. Figs. 3 and 4 are drawn to larger scale than Fig. 2 and Fig. 1 is drawn to smaller scale than Fig. 2.

The jigger is of generally conventional construction, having a sheet metal vat 10 mounted on a rigid angle-iron framework 11. Associated with the vat are six parallel longitudinally disposed rollers. Two similar rollers 12 are located above the vat, one to each side thereof, the shafts of the rollers being rotatably mounted at their ends in bearing blocks 13 secured to the end portions of the frame 11. Secured to each bearing block and extending outwardly and upwardly therefrom is an outrigger 14 having an open bearing 15 at its outer end. A further pair of rollers designated 16 are rotatably mounted within the upper portion of the vat, one towards each side thereof, and the third pair of rollers, designated 17, are rotatably mounted within the bottom portion of the vat 10. Means of usual type (not shown) are provided to rotate either one or the other of rollers 12, in opposite directions, and braking means (not shown) are provided in usual manner whereby the rotation of either one of rollers 12 may be retarded.

An outlet pipe 18 leads from the bottom of the vat 10, and is adapted to be closed by a plug 19.

Located in the vat 10 is a pair of suction pipes 20 parallel to each other and to the rollers 12, 16 and 17 and disposed at a height intermediate of the two pairs of rollers 16 and 17.

The suction pipes 20 are so located that a roll of cloth, designated 21, wound on one of the rollers 12, may be carried down outside one roller 16, inside one suction pipe 20, outside and under one roller 11, under and outside the other roller 17, up outside the second suction pipe 20, inside the second roller 16, and onto the second roller 12, as shown in Fig. 1.

It will be apparent that when the cloth is conducted as above described and as shown in Fig. 1, one surface of the cloth is carried past and in contact with one of the suction pipes 20, and the other surface of the cloth is carried past and in contact with the other suction pipe 20. In the portion of each suction pipe 20 which is contacted by a length of cloth conducted in this fashion...
there is formed a longitudinal opening 22, as shown in Figs. 2 and 3. These openings extend a substantial part of the length of the pipes 20 and the parallel edge portions of each opening consist of a bar 23 formed with a longitudinal groove adapted to engage with the edge of a slot formed in the pipe 20. The two bars 23 are secured together in parallel spaced relationship by means of gusset plates 24 provided at desired intervals in the length of the bars 23. The bars 23 and plates 24 are welded together prior to assembly in the pipes 20 and are fitted correctly in position by sliding each assembly longitudinally of the slot in the relative pipe so that the opposite edge portions of the slotted pipe engage firmly in the longitudinal grooves in the bars 23.

Each pipe 20 is made so that the longitudinal slot in it extends from its one end and when the bar assembly 23—24 has been slid into position a short length of piping 25 of the same size as the pipe 20 is welded on to the end of the pipe 20 and then closed at both its ends and the bar assembly cannot be removed.

Each of the suction pipes has fitted to its own end a cap 26 which is secured to the relative end of the vat 10 and each of said caps 26 has formed through it an axial aperture wherein is located the end of a connecting pipe 27 positioned exteriorly of the vat 10 in such manner that the two suction pipes 20 are interconnected.

As clearly shown in Fig. 4, the opposite end portion of each of the short pipe lengths 25 has a flange plate 28 secured to it, and, outwardly of that plate, there is fastened a second flange 29. The flange plate 28 acts to hold the composite pipe 20—25 securely within the other end of the vat 10 and that portion of the pipe 25 exteriorly of the flange plates 28 projects outwardly through the end of the vat 10. The flange 28 is located a very short distance inwardly of the end of the pipe length 25 so that the end of the pipe acts as a spigot whereon is located a sealing washer 30 and the open end of the pipe 25 is closed by means of a plate 31 of substantially the same external size as the flange 28. This plate 31 is firmly secured in position by means of a clamping member 32 having jaws which fit about the flange 28 and a clamping screw 33 engaging in the boss 34 in such manner that upon rotation of the screw in the requisite direction it will press the plate 31 inwardly on to the washer 30 so as to securely close the end of the length of pipe 25. The screw 33 has a handwheel 35 by means of which it can be conveniently rotated.

The end plate 31 may be conveniently removed by loosening the screw 33 and sliding the clamping member 32 off the flange 28, when the end plate 31 can be lifted clear of the pipe extension 25.

In order that the effective length of each suction pipe 20 may be varied automatically in accordance with the width of the particular piece of cloth to be treated the I provide the slot-covering devices illustrated in Fig. 4. Each of these devices consists of a longitudinally collapsible bellows connected at one end to a suitable fixture (as the flange plate 28 at one end of the pipe 20 or the cap 26 at the opposite end of the pipe) and at its opposite end to a slidable member which fits relatively neatly about the pipe 20 but can slide relatively freely thereon.

As shown in Fig. 4 the slidable member consists of a substantially circular plate 36 having an axial opening formed in it. The edge of that opening is rounded so that there will be a relatively small surface contact between the plate and the external surface of the pipe 20 and the opening is shaped similarly to the external contour of the said pipe 20. Securely fastened to the outer side of the plate 36 is an angled member 37 also formed with an axial opening of the same shape as the external contour of the pipe 20 and the edge portion of the opening in the member 37 is rounded, for the same reason.

The one end of a collapsible bellows member 38 is clamped about the angled portion of the member 37 and the opposite end is clamped about a second angled member 39 which is secured to the relative fixture (the flange plate 28 or the cap 26). The bellows member 38 is supported interiorly by means of a helical spring 40, and this spring also serves to press the slidable member 38—39 away from the relative fixture so that inward radial pressure upon the bellows member 38, as well as outward longitudinal pressure upon the plate 36, caused by the suction within the pipe 20 will be adequately resisted.

According to variations in the width of the cloth which is being treated so the slidable members 38—39 move on the pipes 20 to compensate automatically for those variations.

A filter screen is mounted in each of the pipes 20 and each filter is of the construction illustrated particularly in Figs. 3 and 4. Each filter screen consists of a substantially rectangular frame 41 to which a strip of stainless steel wire mesh 42 is fastened. The frame 41 is slidable mounted in channel or U-shaped guides 43 secured in substantially diametrically opposite positions within the pipe 20. The suction outlet from the pipe 20 is taken from the side of the filter opposite the opening 22 so that the filter extends between the suction outlet and the longitudinal opening 22. Consequently the liquid sucked through the fabric 21 and thence through the openings 22 will pass through the mesh screen 42 so that foreign matter drawn through or from the fabric will be deposited upon that screen. Orifical to the substantially large effective surface area of the screen it will require to be cleaned relatively infrequently and owing to its particular construction, as well as the manner in which the end plate 31 is clamped on to the end of the pipe 20, the filter screen 41, 42 may be removed from the pipe 20 relatively easily.

The connecting pipes 27 are interconnected through flow control adjusting cocks 44 and they are connected to a main suction pipe 45 through a main flow control cock 46. The pipe 45 leads to the inlet of a pump 47 adapted to be operated by a motor 48 and a vacuum gauge 49 is connected to the pipe 45 so as to indicate the pressure in the suction line. A return pipe 50 leads from the exhaust of the pump 47 to the bottom of the vat 10 at a substantially central position, and a bye-pass pipe 51 from the pipe 45 leads through the cock 52 to the return pipe 50 so that when the cock 52 is opened the pump 47 is by-passed. The return pipe 50 has a flow-control cock 53 incorporated in it for the purpose of regulating the volume of liquid returned from the pump 47 and, therefore, the volume of liquid drawn suctionally into the pipes.

Assuming for the purpose of illustration that a roll of cloth 21 is required to be dyed to a desired colour, the shaft on which the cloth is initially rolled is mounted in the bearings 15 of a longitudinally opposite pair of outriggers 14, an end of the cloth being passed around the
near roller 12 which is then rotated by means provided to wind the cloth onto the said roller 12. An end of the cloth is then conducted through the vat 10 and the opening in the side of the vat 10 covered by the second roller 12, and the vat is filled above the level of the suction pipe 20 with the dye liquid. The plates 36 of the collapsible bellows devices are moved slidably to such adjusted positions that they touch the side edges of the cloth, so that the portion of the openings in the plates 36 covered by the bellows devices will be covered by the cloth passing over the said openings. The motor 48 is set in operation to operate the pump 41, cock 52 being closed, and the cocks 44 and 46 being open, and the means provided are caused to rotate the second-mentioned roller 12 so as to draw the cloth through the vat 10, the first-mentioned roller 12 being braked so as to impart tension to the cloth. As, then, the cloth is drawn through the liquid in the vat 10, quantities of the dye liquid are drawn continuously through the cloth in one direction and by way of the opening 22 into one suction pipe 20, and dye liquid is also drawn through the cloth in opposite direction and through the opening 22 into the other suction pipe 25, the liquid withdrawn in this manner being ejected back into the bottom of the vat 10 through the return pipe 80. Small particles of cloth drawn into the suction pipes 20 and any particles of sediment are collected by the filter screens 41, 42. It will be found that the liquid penetration of the cloth is very greatly accelerated, and the dyeing process is very thoroughly effected. It will also be found that there will be a considerable saving in the quantity of dye liquid used in any particular operation. If the cloth be of a delicate nature, and the suction effect is deemed likely to result in damage thereto, the suction may be reduced by opening the cocks 44 and 46 to any desired degree; and the degree of suction exerted may at all times be read on the vacuum gauge 49. However, the construction of devices for compensating for variations in the width of the cloths to be treated—the collapsible bellows 36–40—will be found to be particularly useful when engaged with relatively heavy material such as will have sufficient lateral strength when drawn tightly over the pipes 20 to move the plates 36 outwardly against the pressure of the springs 40.

When the cloth 24 has been wound from the one roller 12 on to the other, and has therefore undergone dyeing, rotation of the second roller 12 is stopped.

If desired, the cloth may be passed through the vat 10 two or more times to dye it to required depth of colour; but the accelerated liquid penetration brought about by the use of my invention will result in considerably fewer such operations being required than would be necessary with apparatus hitherto used. The continuous ejection of dye liquor into the bottom of the vat 10 by way of return pipe 50 will be found to effectively agitate the dye and prevent settlement of suspended particles.

When the dyeing has been completed, the dye liquor may be drained out of the vat, by removing the plug 19 of the outlet pipe 18 and the filter screens, pump, pipes and vat may be flushed out. Once again, the cloth may be passed through the vat as described and illustrated, and the operation as before described may be carried out again with the difference that no liquid is introduced into the vat. Consequently, air will be drawn through the cloth, first in one direction and then in the other, carrying to the suction tubes 20 excess moisture from the cloth. After this operation has been concluded, the cloth may be wound from a roller 12 onto a shaft journaled in a pair of outriggers 14 and carried away for final drying and any other operations. Alternatively, the cloth may be wound directly onto a shaft not journaled in a pair of outriggers 14 at the conclusion of the dyeing operation and then placed in another, similar, apparatus for the drying operation so that the one vat 10 will be used continuously for dyeing operations and another vat will be used continuously for the drying operations. But it will be appreciated that the operations of dyeing and removal of a very considerable proportion of excess moisture may be carried out very rapidly, saving much time and labour, without removing the cloth from the Jigger.

If desired a scouring operation may also be effected, in the same manner as heretofore described, before the dyeing operations, the scour liquid being removed and the apparatus cleaned prior to the filling of the vat 10 with the dye liquid.

What I do claim is:

1. In apparatus for effecting the liquid penetration of fabric the combination with a conduit formed with a longitudinally arranged opening through which liquid is adapted to be drawn suctionally through a length of fabric into the conduit, of a fixture secured to a surface face adjacent one end of the conduit, a slidable member consisting of a face plate and an angulated member secured thereto, each of the face plate and the angulated member having an opening of such size and shape that the slidable member is adapted to move freely upon the surface of the conduit without permitting a ready flow of liquid past the inner peripheries thereof, a collapsible bellows member fastened at its opposite ends to the fixture and to the slidable member, and a helical compression spring within the collapsible bellows member having its opposite ends pressing upon the fixture and upon the slidable member, the spring being adapted to balance the suctional pressure within the bellows member and being adapted to permit the slidable member to move so as to adjust the effective length of the opening in the conduit according to the width of the fabric being treated.

2. In apparatus for effecting liquid penetration of fabrics according to claim 1 wherein the conduit has formed in its wall a longitudinal slot of which the opposite edges are parallel, the slot having fitted in it a pair of bars each formed with a longitudinal recess in its outer portion and the bars being connected together in parallel spaced relationship with the edges of the slot fitting into the recesses formed in the outer portions of the bars.

3. In an apparatus as defined in and by claim 1 wherein there is a filter means mounted within the conduit coextensive with the opening and adapted to separate the solid material from liquid as it is drawn suctionally into the conduit.

4. Apparatus as defined in and by claim 3 in which the filter means consists of a screen within a framework and a pair of oppositely disposed guides fastened to the said framework the conduit in which the framework is mounted.

5. Apparatus as defined in and by claim 1 wherein one end of the conduit is closed by a
removable end plate and a clamping means adapted to securely fasten the end plate in position to effectively close the end of the conduit.

In an apparatus as defined in and by claim 5 wherein the end of the conduit has a flange plate fastened to its external surface beyond the fixture and a gasket clamped against and between the flange and end plate by the clamping means so as to effectively seal the end of the conduit.

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REFERENCES CITED

The following references are of record in the file of this patent:

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