APPARATUS FOR LIQUID TREATMENT OF SHEET MATERIAL

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3 Sheets-Sheet 1

FIG. 1
APPARATUS FOR LIQUID TREATMENT OF SHEET MATERIAL

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13 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for a liquid treatment of sheet material wherein the treatment tank is divided into front and rear tanks, with a partition wall provided in a space permitting a sheet material to pass through the wall without contacting any portion thereof, and the liquid which has a tendency to move from the front tank to the rear tank through the space together with the sheet material and any of the liquid in either liable to flow through the space is sucked by a suction pipe positioned at the space, and returned to the front and rear tanks respectively.

The present invention relates to an apparatus used for treating sheet material continuously with liquid.

The feature of the liquid treating apparatus of sheet material according to the present invention resides in that, when a sheet material is to be treated successively with liquid of two kinds having different temperatures or concentrations, the sheet material is transferred from the front tank to the rear tank while sucked in the first liquid without removal of the liquid at all, the sheet material being passed from the front tank liquid to the rear tank liquid which may be different in temperature or concentration respectively through a shortest distance without contact between both, or either, side of the sheet material and the roller, the guide, the wall of the tank or the partition wall so that the sheet material is treated rapidly with liquid of different temperatures or concentrations.

A liquid treatment process of sheet material like this is required when producing sheet material such as artificial leather with wet coagulation or treating sheet material which has liquid coating surfaces.

An example thereof will be presented hereinafter producing polyurethane elastomer film having a fine layer of nearly equal thickness on the face and the back and also having macroporous spongy structure therewith by flowing polymer solution composed mainly of polyurethane elastomer over the supporting belt conveyor and making it wet-coagulated within coagulation bath, it is preferable to perform coagulation in several steps. Namely, to control the coagulation conditions with several steps is effective, such as, in the coagulation bath of the first step, coagulation is carried out only in the surface layer of the polymer solution, and the interior thereof is held in uncoagulated condition, and then it is led to the second step coagulation bath and thereupon the coagulation of the interior is completed under a different condition from that of the first step. The present apparatus will demonstrate a very excellent effect as an apparatus for such treating device.

According to the present invention, the liquid treating apparatus for sheet material is a device wherein the treatment tank is divided into front and rear tanks, with a partition wall provided with a space to permit a sheet material to pass through the partition wall without contacting at either side thereof and wherein the liquid that has a tendency to move from the front tank to the rear tank through the space together with the sheet material and a part of the liquid that is in the front and rear tanks is liable to flow also through the space is sucked by a suction pipe having an opening adjacent the portion of said space, and the liquid sucked up is returned into the front and rear tanks respectively. Hereinafter, the structure of the treating apparatus of sheet material according to the present invention will be explained in detail referring to the drawing, and to make understanding more easily, an example is cited, wherein the treating tank is divided into two, with front and rear tanks, for different temperature liquids.

FIG. 1 is a diagrammatic view showing a liquid treating apparatus for sheet material according to the present invention.

FIG. 2 and FIG. 3 are diagrammatic views showing modified examples of partition walls respectively,

FIG. 4 is a vertical transverse cross section of the apparatus of FIG. 3, and
FIG. 5 is a longitudinal section.

In FIG. 1, numeral 1 shows the treating tank, which is divided into the front tank 3 and the rear tank 4 with a partition wall 2. In the partition wall 2 is provided a space 6 permitting the sheet material 5 to pass through. The sheet material 5, entering the front tank 3 from the upper right, changing the direction thereof to horizontal and being guided by the front roller 7, enters the rear tank 4 through the space 6, guided by the rear roller 8, goes out of the rear tank 4 at the upper left. To the front tank 3 is annexed a circulation system comprising the heat exchanger 9, a pump 10 and piping 11, so that the liquid within the front tank 3 is kept at a constant temperature. Similarly, to the rear tank 4 is annexed a circulation system comprising the heat exchanger 12, pump 13 and piping 14, so that the liquid within the rear tank 4 is also kept at a constant temperature.

Adjacent to the space 6 of the partition wall 2 are provided the suction pipes 15 and 15', the suction ports of which are opened toward the sheet material 5 respectively, the liquid at this portion being sucked by the pump 16, and returned to the front tank 3 and the rear tank 4 through the piping 17 and 18. By means of these circulation systems, the liquid within the front tank 3 never enters the rear tank 4 and vice versa. And, so there is no danger of contact of sheet material 5 with the suction port of the suction pipes 15 or 15', a tension strong enough to overcome the suction power of the pump 16 is imparted to the sheet material 5 by adjusting the difference between the relative rotational speeds of the front roller 7 and the roller 8.

In the apparatus shown in FIG. 1, as the suction pipes 15 and 15' are provided on the lower side and the upper side of the sheet material 5, the sheet material 5 is never contacted by any portion of the apparatus between the front roller 7 and the rear roller 8. On the contrary, FIG. 2 is an example, wherein the partition wall 2 is provided with a transverse middle roller 19. That is, in this apparatus, above the space 6 of the partition wall 2 is located the middle roller 19 and the upper face of the sheet material 5 is to be advanced in contact thereto. FIG. 3 is an example, wherein the partition wall comprises a large diametral transverse front roller 7. In this example, as the diameter of the front roller 7 is larger and the upper end thereof is disposed above the surface of the liquid, the partition wall above the space 6 is unnecessary.

The example shown in FIG. 3 will be explained in detail by reference to FIGS. 4 and 5. The partition wall comprises the front roller 7, the suction pipe 15, and the side seal plate 20 and 20' that seal the space between them and the tank wall of the treatment tank 1, the side seal plate 23. The suction pipe 15 is supported by bearings 24 and 25, and is constructed to be rotatable by means of the sealed gland packing 27 provided at the
end of the suction pipe side sealing box 26 projecting from the tank wall of the treatment tank 1. The rotation of the suction pipe 15 is performed by the handle 28, the worm gear 29 and the worm wheel 30, and the angle of rotation of the suction pipe is indicated on the dial 31. The interval between the lower surface of the front roller 7 and the upper opening of the suction port of the suction pipe 15 is the space 6 through which the sheet material passes, but it is needless to say that the space is preferably as small as possible to a degree that the front end of the suction port does not contact the sheet material. By means of sucking the liquid from the space portion 6 through the suction pipe, the liquid never enters from the front tank 3 into the rear tank 4 or vice versa. Also, the ratio of the quantity of the liquid sucked from the front tank 3 and the rear tank 4 may be adjusted by selecting properly the angle of the suction pipe.

A portion of the piping from the suction pipe 15 to the pump 16 (shown in FIG. 1) is indicated by numeral 32. For the purpose of sucking the liquid uniformly at the suction port of the suction pipe 15, the suction pipe 15 is connected to the piping 32 with a number of flexible pipes 33, 33', etc. By using a number of flexible pipes, the suction pipe 15 may be rotated easily while being supported by the bearings 24 and 25.

Claims:

1. Apparatus for continuous treatment of a moving web of sheet material by a plurality of liquids having different characteristics, comprising a treating tank for the liquids, means to guide a moving web of sheet material through said liquids in said treating tank, said treating tank being subdivided into first and second tanks by partition means extending transversely with respect to the moving web to confine the respective liquids separately on opposite sides thereof, said partition means being provided with an opening for unimpeded passage of the web therethrough while submerged in said liquids, at least one boundary of said opening being defined by suction pipe means having an inlet closely adjacent one surface of the web, and pump means including piping means connected with the suction pipe means and at least one of the tanks for withdrawing liquid at said opening and returning it to the tank.

2. The apparatus as defined in claim 1, wherein said opening is also defined by second suction pipe means having an inlet closely adjacent the opposite surface of the web, and the second suction pipe means is connected with said pump means.

3. The apparatus as defined in claim 1, wherein said piping means connects said pump means with said first and second tanks to return said withdrawn liquid to both said tanks.

4. The apparatus as defined in claim 1, wherein said opening is also defined by roller means extending transversely with respect to the web and mounted for rotation in contact with the surface of the web opposite to said suction pipe means.

5. The apparatus as defined in claim 4, wherein said roller means is horizontally disposed wholly submerged in the liquids, and said partition means includes a vertical wall extending above said roller means.

6. The apparatus as defined in claim 4, wherein said roller means is horizontally disposed, the diameter of said roller means being such that a portion of the peripheral surface thereof extends above the level of at least one of the liquids.

7. The apparatus as defined in claim 6, wherein said means to guide the moving web through said liquids includes said roller means.

8. The apparatus as defined in claim 1, wherein said suction pipe means comprises a tubular member extending transversely with respect to the web, the tubular member having a narrow inlet facing the surface of the web, said tubular member being mounted for rotation about its axis to vary the proportions of each of said liquids withdrawn thereby.

9. The apparatus as defined in claim 8, wherein said opening is also defined by roller means extending transversely with respect to the web and mounted for rotation in contact with the surface of the web opposite to said suction pipe means.

10. The apparatus as defined in claim 9, wherein the axes of said roller means and said suction pipe means are horizontal and the diameter of the roller means is such that a portion of the surface thereof extends above the level of at least one of the liquids.

11. The apparatus as defined in claim 10, wherein said pump means includes flexible pipes connected to said tubular member.

12. The apparatus as defined in claim 10, wherein said piping means is connected with both said first and second tanks for returning liquid.

13. The apparatus as defined in claim 12, wherein said pump means also includes heat exchanger means for said withdrawn liquid.

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