

[54] **SQUEEGEE DEVICE**

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[*] Notice: The portion of the term of this patent subsequent to Apr. 30, 1991, has been disclaimed.

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 164,332, July 20, 1971, Pat. No. 3,807,302.

[30] **Foreign Application Priority Data**

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[51] Int. Cl.² **B41F 15/42**

[58] Field of Search 101/115, 116, 119, 120, 101/123, 124, 129

[56] **References Cited**

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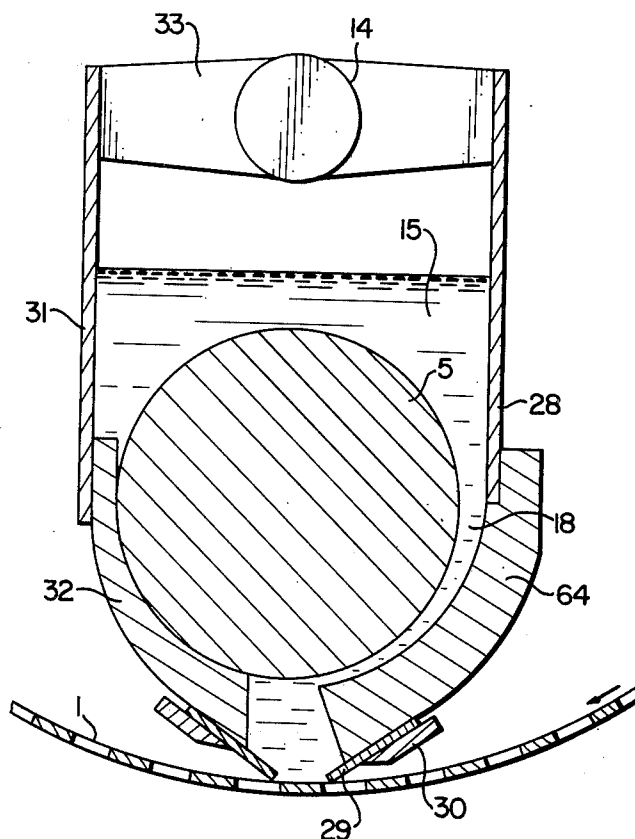
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[57] **ABSTRACT**

A squeegee device with a roller squeegee for applying a fluid through a perforated screen onto a material includes a guide wall or guide wall member positioned adjacent the periphery of the roller squeegee and extends to the region where the fluid is applied to the material to be worked. The guide wall has a concave face facing the roller squeegee with a gap formed therebetween. The gap is filled with the liquid or viscous compound so that the hydrodynamic pressure of the liquid in the gap is increased. The guide wall may also be formed as part of the limitation wall of a squeegee box, into which the roller squeegee is pivotally mounted. The roller squeegee is spaced from the screen and rotates at a speed much greater than the speed of movement of the screen.

10 Claims, 7 Drawing Figures



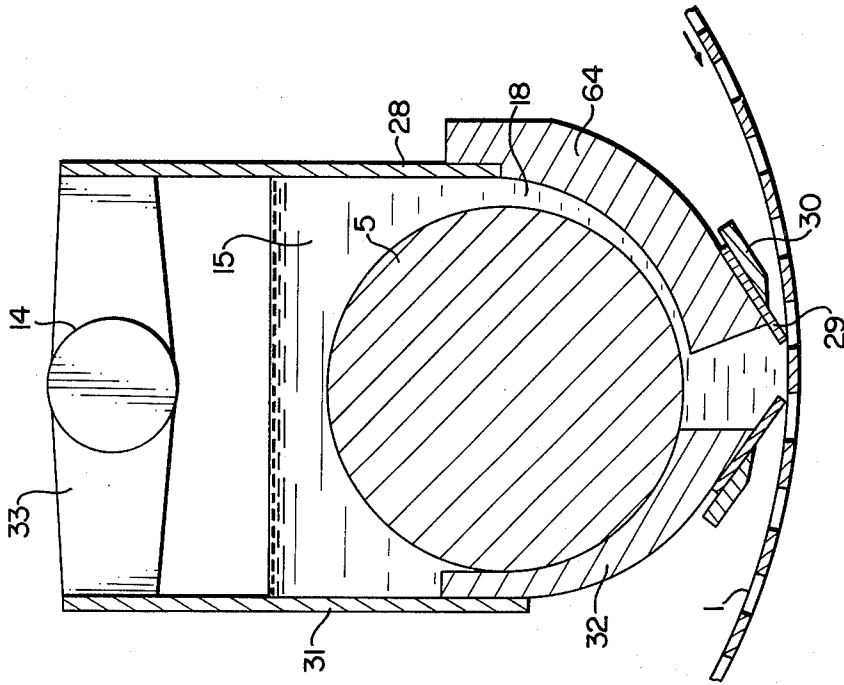


FIG. 3

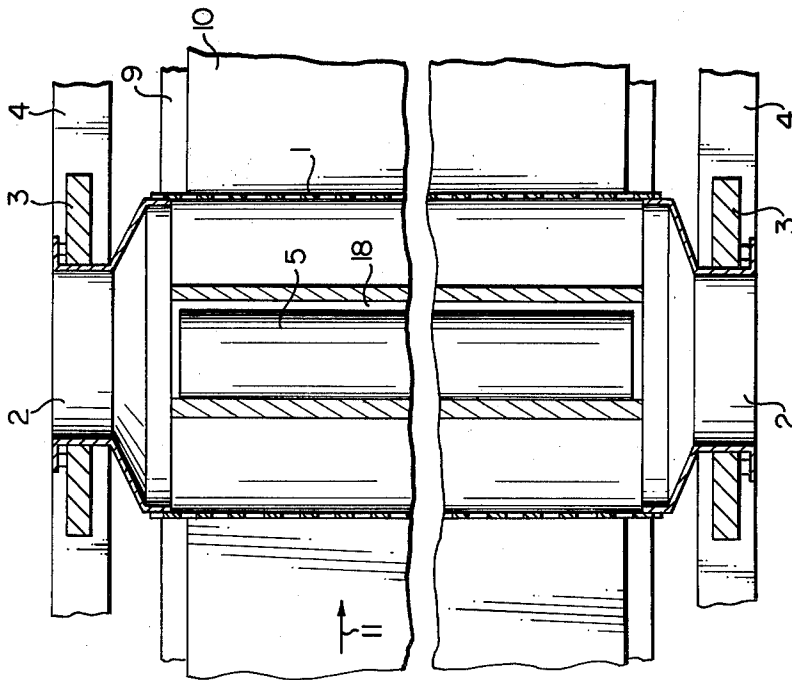
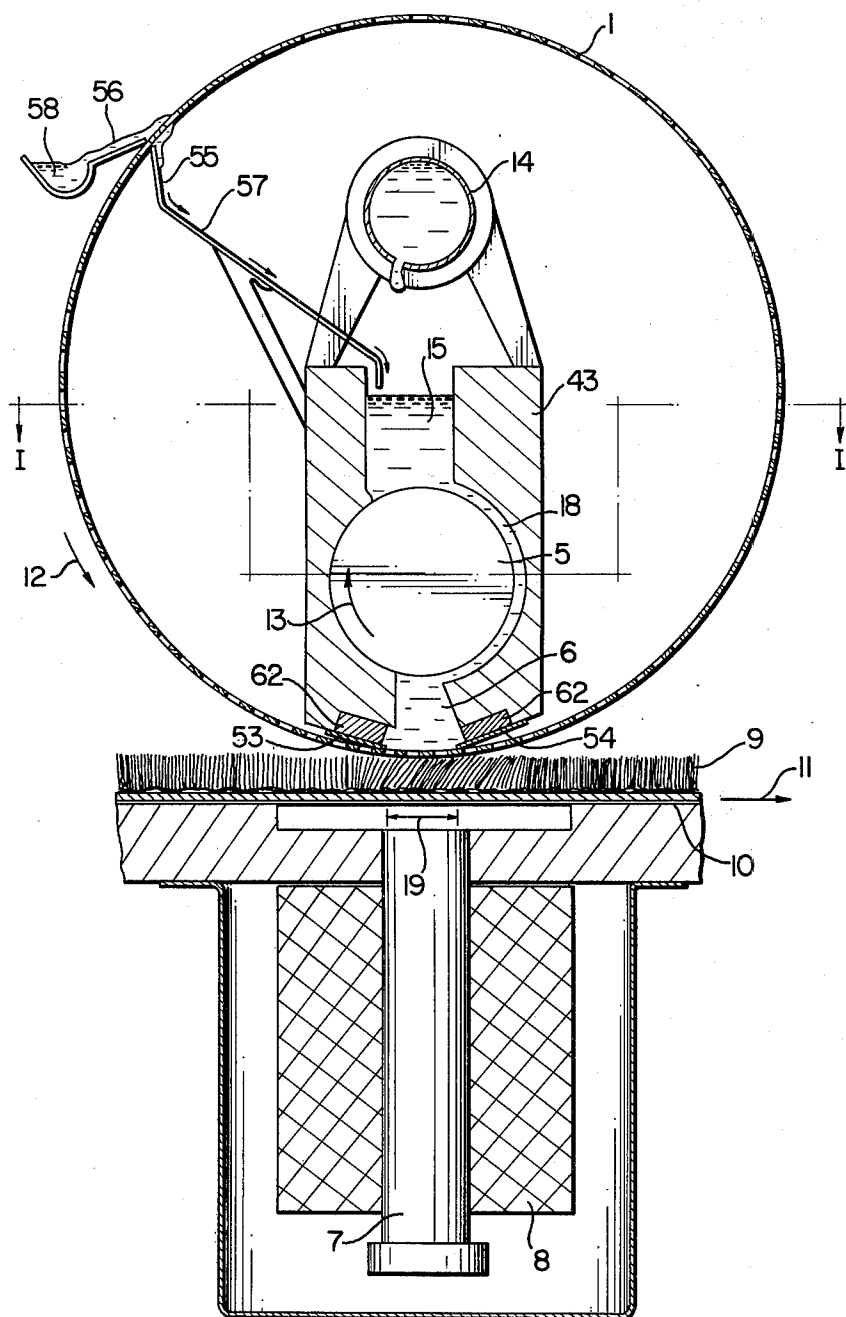


FIG. 1

FIG. 2



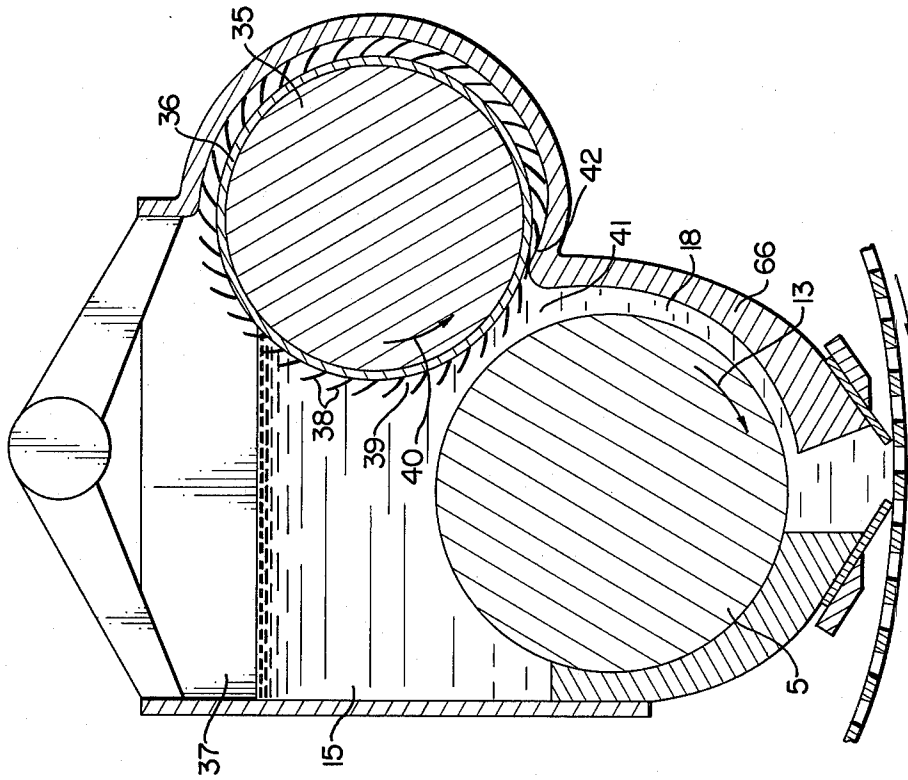


FIG. 5

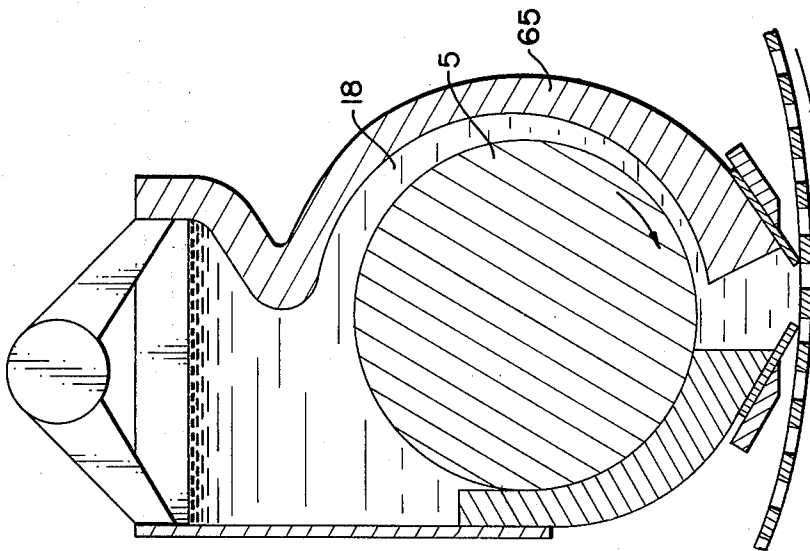


FIG. 4

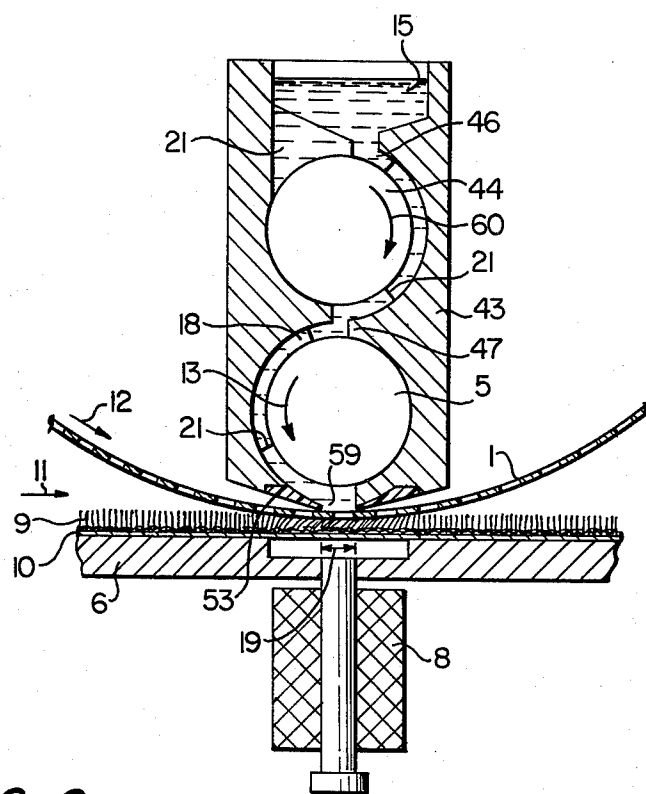


FIG. 6

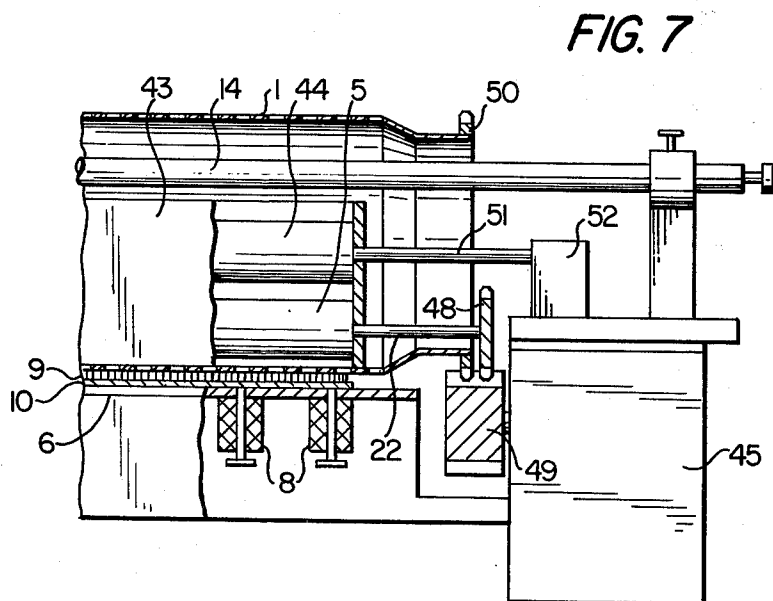


FIG. 7

SQUEEGEE DEVICE

The present application is a continuation-in-part of copending application Ser. No. 164,332, filed July 20, 1971, now U.S. Pat. No. 3,807,302.

BACKGROUND OF THE INVENTION

This invention relates to a squeegee device having a perforated screen and a rotating roller squeegee for applying a liquid, in particular a highly viscous compound, through the screen onto the surface of a material to be worked, the squeegee being spaced from the screen.

With known squeegee devices it is not possible to apply large quantities of liquid onto the material to be printed. This can result, e.g., in screen printing, in unsatisfactory permeation of the liquid into the textile goods. The reason for this shortcoming is that the increase in pressure of the liquid taking place adjacent the roller squeegee in the wedge-like region between the roller squeegee and the screen is insufficient to ensure sufficient application or penetration of the liquid into the material.

Mere increase in static pressure, e.g., by a feeding pump, would increase the amount of liquid applied to the material but, in screen printing, would result in a premature penetration of the screen and subsequently in blurred printing.

SUMMARY OF THE INVENTION

It is an object of the invention to increase the quantity of liquid applied to the material without premature penetration. This object is achieved by providing a guide wall or guide wall member adjacent a portion of the periphery of the roller squeegee to provide a gap therebetween. A concave face of the guide wall faces the roller squeegee, and the guide wall extends into the region where the liquid is applied to the material through the screen. Thus, the liquid is prevented from contacting the material in an uncontrolled manner. The pressure of the liquid in the gap is increased to ensure better penetration of the goods by the liquid. The gap may be of uniform thickness, in which case it is believed that the liquid pressure will increase from the top to the bottom of the gap due to the increased hydrostatic pressure of the fluid from the top to the bottom of the gap, and further due to an incremental increase in the hydrodynamic pressure exerted on the fluid within the gap due to the viscosity of the fluid and the rotation of the roller squeegee. Alternatively, the thickness of the gap may taper downwardly, thus increasing the fluid pressure from the top to the bottom of the gap. In a particularly advantageous embodiment, the roller squeegee is rotated at a much greater speed than the movement of the screen, thereby greatly increasing the pressure of the fluid. Also, the gap stabilizes the flow of the liquid. This is advantageous, particularly in the case of printing machines with a printing velocity of more than 100 m/min.

The bottom edge of the guide wall member projects into the region under the roller squeegee filled with the liquid.

In accordance with the present invention the space serving for the hydrodynamic increase in pressure between roller squeegee and the screen is enlarged by the gap formed between the guide wall and the roller squeegee so that a higher pressure can develop in the liquid. This results in a larger quantity of the liquid

being applied to the material to be worked by means of the squeegee device according to the invention. Also, due to the enlarged gap any detrimental turbulences are prevented in squeegee devices in fast operating machines (e.g., fast operating rotary screen printing machines).

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention are hereinafter described in detail with reference to the accompanying drawings, without, however, being limited thereto.

FIG. 1 is a section taken along lines I—I of FIG. 2 of a first embodiment of the present invention;

FIG. 2 is a vertical section of the device of FIG. 1; FIGS. 3-6 are vertical sections of modified embodiments of the present invention; and

FIG. 7 is a partial longitudinal section of a drive device for the modified embodiment of FIG. 6.

DETAILED DESCRIPTION OF THE INVENTION

In the following description, the invention will be described with reference to rotary screen printing devices. However, it is to be understood that the present invention is equally applicable to devices employing flat perforated screens.

The embodiment according to FIGS. 1 and 2 is a squeegee device for a rotary screen printing machine including a rotary screen 1 whose end pieces 2 are rotatably mounted in screen bearings 3 which are connected to the machine frame 4. A roller squeegee 5 is mounted within screen 1 and spaced therefrom to provide a dye chamber 6. The roller squeegee is rotated by any conventional device for this purpose (not shown). The material to be printed 9 is moved between the rotary screen 1 and the support base by means of a printing blanket 10. While the material to be printed 9 and the printing blanket 10 move in the direction of arrow 11, the rotary screen 1 rotates in the direction of arrow 12 and the roller squeegee 5 rotates within the screen in the direction of arrow 13. The dye is fed in a manner known per se by a dye tube 14 provided with outlet apertures to a dye supply 15 positioned above squeegee 5 and screen 1 upstream of the direction of rotation thereof.

A gap 18 is formed around a portion of the periphery of roller squeegee 5 by means of a squeegee box 43, which mounts the roller squeegee. Dye chamber 6 is formed by squeegee box 43 and spaces roller squeegee 5 from screen 1. Spacing of squeegee 5 from screen 1 serves to prevent any wear of the rotary screen 1, which may have a thickness of only some tenths of a millimeter according to modern galvanoplastic methods of production, even if the roller 5 is driven at a much higher circumferential speed than the rotary screen 1.

Roller 5 can be driven by a rotating device arranged outside the rotary screen 1, so that the speed of rotation is adjustable. Depending on the speed of rotation of roller 5, a predetermined pressure increase of the dye flowing through gap 18 is created. The pressure of the liquid in the chamber 6 beneath the roller 5 is determinative of the amount of dye forced through the holes of the rotary screen 1 in the area of zone 19 between the sealing lips 53 and 54.

It is not important whether the roller 5 rotates in the same direction or in the opposite direction as screen 1. It is an important feature of this invention that the roller 5 does not contact the rotary screen 1, this being attained by the position of roller 5' in the squeegee box

43. The sealing of the squeegee box 43 with rotary screen 1 is effected by sealing lips 53 and 54, which are pressed onto the wall of the screen by means of support means 62 of magnetizable material positioned at the bottom of the squeegee box. The support means are attracted by the electromagnets 8, whereby the squeegee box 43 and the sealing lips 53 and 54 are drawn toward the rotary screen 1. Any dye which passes sealing lip 54 is removed by squeegees or doctor blades 55 and 56. By means of member 57 linked to the squeegee 55, the dye removed from the interior of screen 1 is returned to the supply 15 of the squeegee box 43. The dye removed from the outside of the screen by the squeegee 56 is removed through a channel 58.

As can best be seen from FIG. 2 the lower edge of the guide wall member or squeegee box extends well into the printing area, i.e., the region 19 where dye is to penetrate through the screen 1 into the material 9.

If in such device, the roller, screen and material move in the directions of the arrows 13, 12 and 11, respectively, dye is conveyed by adhesion to the surface of roller 5 through the gap 18 between the roller 5 and the squeegee box 43 into chamber 6 at the printing region 19 where it is squeezed through the screen into the material. This requires considerable dye pressure which is achieved over the length of the gap 18, since from this entrance the dye is positively guided and prevented from flowing through the screen before reaching the printing region 19, and by high speed rotation of the roller 5.

On the contrary, in known devices, any liquid pressure build up occurs only approximately over the length of region 19, which length is much less than the length of gap 18. Accordingly, the maximum pressure obtainable with gap 18 will be much greater than without the gap, and because of the increase of pressure, the amount of liquid applied to the material increases.

FIGS. 3 to 7 are further embodiments of squeegee devices according to the invention, also for use in rotary screen printing machines.

According to FIG. 3 the roller squeegee 5 is arranged in a squeegee box having four generally vertical walls, two of which are shown as 28 and 31 and which extend parallel to the axis of roller 5, and the other two walls (not shown) are perpendicular to walls 28 and 31. A guide wall 64 is attached to wall 28, and its concave surface forms a gap 18, the thickness of which tapers from the top to the bottom, with roller 5 through which dye from the dye supply 15 is fed by the dye tube 14 to the lower dye chamber 6, thus effecting a gradual pressure increase in the dye during its passage through gap 18. The guide wall 64 is sealed off towards the rotary screen 1 by a flexible sealing member 29, secured to the guide wall 64 by means of a wedge fastener 30. The bottom part of wall 31 of the squeegee box has a low friction seal 32 providing a support for the roller squeegee 5 and thus sealing it. The squeegee box is fastened by clamps 33 to the dye tube 14. The lower end of seal 32 is sealed to screen 1 by means of a flexible sealing member 29, secured to seal 32 by means of a wedge fastener 30.

In the embodiment according to FIG. 4, the roller squeegee 5 is arranged in a squeegee box. Guide wall 65 differs from the embodiment of FIG. 3 in that it replaces wall 28 and that it extends over almost half the circumference of the roller squeegee 5. The pressure increasing gap 18 is therefore longer than in the afore-

mentioned embodiments and thus results in a higher pressure and greater flow of liquid.

The embodiment according to FIG. 5 is similar to that of FIG. 4, except that a cylinder 35 is mounted inside the squeegee box above roller squeegee 5 and offset horizontally with respect thereto. Cylinder 35 is provided on the surface thereof with a coating 36 having a series of resilient strips 38 extending parallel to the axis of cylinder 35 and inclined with respect to the direction thereof, radii of the cylinder passing through the bases of the strips. In the squeegee box the dye supply 15 has the level 37. A chamber 39 formed between adjacent strips 38 is filled with dye under level 37. If the roller squeegee 5 moves in the direction of arrow 13 and the cylinder 35 moves in the direction of arrow 40, the dye is transported to the entrance 41 of gap 18. When strips 38 reach this point, they are bent flat by nose 42, and the liquid within chamber 39 is forced downwardly into gap 18, thereby increasing the pressure. Within gap 18 between roller 5 and guide wall 66, a further increase of pressure is effected because of the rotation of roller squeegee 5 and the ensuing carriage of the dye in the gap 18. In this embodiment a very high pressure is produced.

Very high pressure can also be obtained by the arrangement according to FIGS. 6 and 7. In a squeegee box 43 a second roller 44 is arranged above the normal roller squeegee 5. The two rollers rotate in the opposite directions indicated by arrows 60 and 13. The surfaces of the inner walls of the squeegee box 43 follow closely the outer surfaces of the rollers 5 and 44 on one side thereof. On the other sides are formed gaps 46 and 18 through which dye is conveyed downwardly from supply 15 fed from a dye tube (not shown). While flowing through gap 46 the dye builds up a pressure as described above. Thus, when reaching the gap transition area 47 the dye has already a considerable pressure which is further increased when passing through gap 18. Spacing elements 21 extending through the gaps in the direction of flow assure proper spacing of the rollers. Area 47 provides compensation of the forces acting on roller 5. By the pressure increase in gap 18 at the lower portion of roller 5, higher specific pressures act on the bottom portion of the roller than on the upper portion thereof. These forces consequently tend to push roller 5 upwardly. This is compensated, at least partially, by the provision of area 47 which acts to some degree as a retaining surface.

The sealing of the dye under pressure in the lower dye chamber is effected by sealing lips 53, e.g., of polytetrafluorethylen. Sealing lips 53 extend parallel to the axis of the roller squeegee 5 and are attached to both bottom edges of squeegee box 43 and insure that the dye is forced through screen 1 over the distance 19.

By changing the absolute and relative speeds of rotation of the rollers, the pressure increase in the dye can be influenced and accordingly adapted as conditions may necessitate. The pressure increase can also be influenced by changing the relative thicknesses of the gaps 46 and 18.

An example for the drive of roller squeegee 5 and roller 44 can be seen in FIG. 7. Roller squeegee 5 has a shaft 22 projecting therefrom bearing a gear wheel 48. Gear wheel 48 meshes with a gear wheel 49 which also drives a gear wheel 50 secured to the end of the rotary screen 1. The gear ratios of gear wheels 48 and 50 are designed, in an understood manner, to bear a relationship with the diameters of roller squeegee 5 and rotary

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screen 1 such that the roller squeegee 5 and rotary screen 1 have desired relative speeds when gear wheel 49 is driven by drive means 45. Roller 44 is driven by a rotation device 52 via a shaft 51 permanently secured to the end of roller 44. The driving device 52 can be a continuous transmission gear receiving its driving motion from the drive means 45. Driving device 52 may also be an engine whose speed of rotation is variable to a desired gear ratio to the main drive means 45.

In all embodiments of the invention, the roller 5 is spaced from the screen 1. This prevents wear of the screen. Further, it is desirable that the speed of rotation of roller 5 be much greater than the speed of movement of the screen 1, thereby greatly increasing the pressure of the fluid in the gap 18 and the chamber 6.

The gap or gaps may be of uniform thickness, in which case it is believed that the liquid pressure will increase from the top to the bottom of the gap due to the increased hydrostatic pressure of the fluid from the top to the bottom of the gap, and further due to an incremental increase in the hydrodynamic pressure exerted on the fluid within the gap due to the viscosity of the fluid and the rotation of the roller squeegee. Alternatively, the thickness of the gap may taper downwardly, thus increasing the fluid pressure from the top to the bottom of the gap.

The above description has been with regard to specific structural embodiments of the invention. However, it will be understood that the scope of the present invention encompasses obvious modifications of these specific structural embodiments as well as combinations of the specific structural features thereof.

I claim:

1. A squeegee device for applying liquid, in particular highly viscous liquid, onto the surface of a material, said device comprising:

a perforated screen mounted for movement in contact at one surface thereof with said material; a rotatable roller squeegee having an outer extreme surface mounted at a position spaced from said screen;

means for rotating said roller squeegee at a speed greater than the speed of movement of said screen; a stationary guide wall member having a concave surface, said guide wall member being mounted such that said concave surface is spaced from the cylindrical peripheral surface of said roller squeegee, thereby forming a gap between said roller squeegee and said guide wall member, there being a plane extending through the axis of said roller squeegee and the line formed by the points on said roller squeegee positioned most closely to said screen,

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said guide wall member being mounted on that side of said plane wherein a point on the periphery of said roller squeegee and said screen approach each other during movement thereof, an edge of said guide wall member being positioned between said roller squeegee and said screen; and

sealing means sealing said guide wall member to said screen; whereby said liquid is conveyed on rotation of said roller squeegee, through said gap and towards the surface of the material and the pressure of said liquid in said gap is increased.

2. A device as claimed in claim 1, further comprising means forming a liquid chamber between said roller squeegee and said screen, said forming means comprising a squeegee box supporting said roller squeegee, said guide wall member forming a wall of said liquid chamber.

3. A device as claimed in claim 2, wherein said guide wall member is an integral part of said squeegee box.

4. A device as claimed in claim 3, wherein said guide wall member comprises a first wall of said squeegee box; and further comprising a second roller mounted in said squeegee box above said roller squeegee, said second roller being mounted for variable speed rotation; a second wall of said squeegee box defining a second gap with said second roller; said second gap being in communication with the first mentioned gap.

5. A device as claimed in claim 2, wherein said guide wall member is attached to said squeegee box and forms one wall thereof.

6. A device as claimed in claim 5, wherein said guide wall member forming one wall of said squeegee box extends over substantially half of the circumference of said roller squeegee.

7. A device as claimed in claim 5, further comprising a cylinder, rotatable in a direction opposite to that of said roller squeegee, mounted within said squeegee box at a position above and offset horizontally with respect to said roller squeegee, said cylinder being provided on the periphery thereof with inclined resilient strips extending parallel to the axis of said cylinder.

8. A device as claimed in claim 1, wherein said perforated screen comprises a cylindrical rotary mounted screen.

9. A device as claimed in claim 1, wherein the thickness of said gap is uniform.

10. A device as claimed in claim 1, wherein the thickness of said gap lessens in a tapered manner from an end thereof furthest from said screen to an end thereof closest to said screen.

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