

[54] APPARATUS FOR PRINTING AND/OR DYEING OF HIGH PILE WEBS

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[57] ABSTRACT

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A system for printing and/or dyeing pile web, in particular high pile web wherein dye is applied to the pile side of the carpet and then the carpet is introduced into a steamer in a position, in which the pile side of the carpet faces downwardly. The carpet remains in this position at least during a first period of its passage through the steamer.

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19 Claims, 6 Drawing Figures

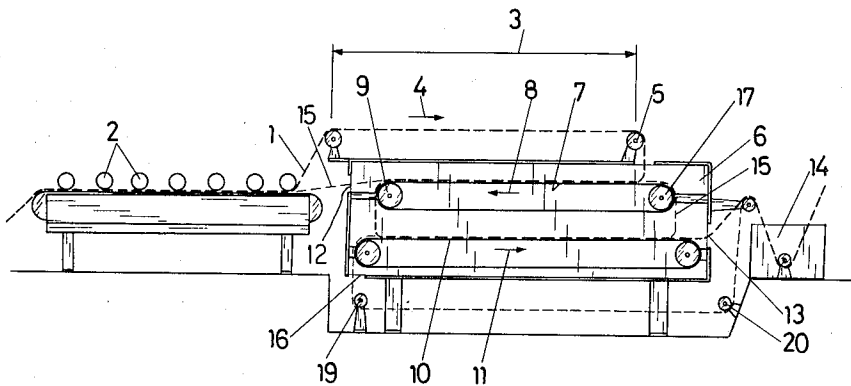


Fig. 1

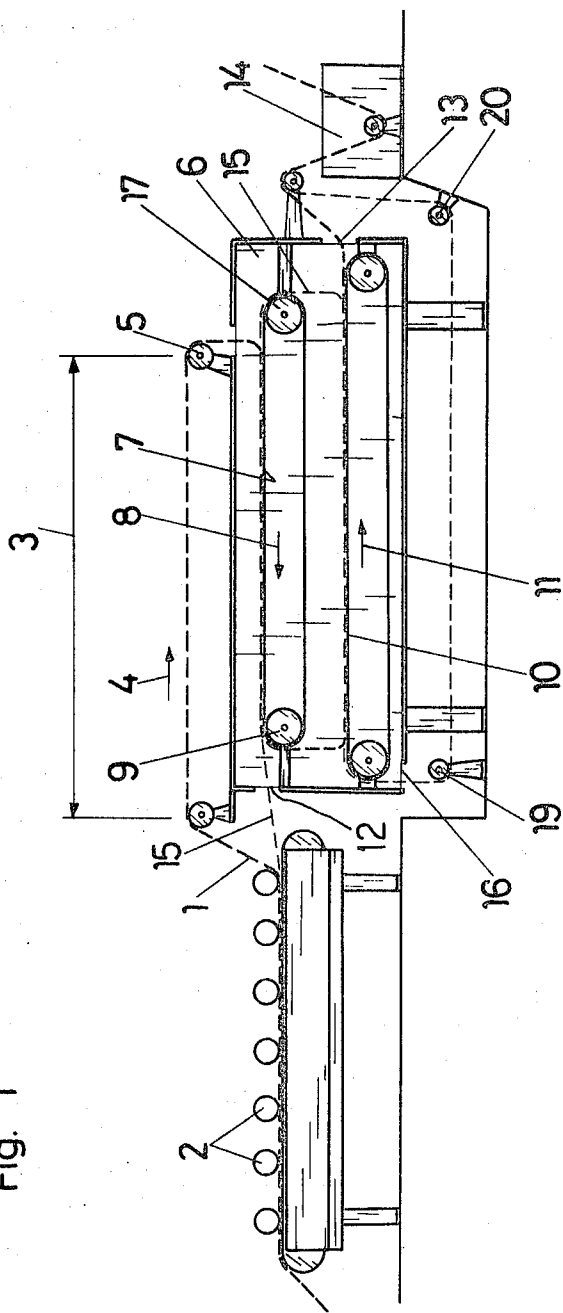


Fig. 3

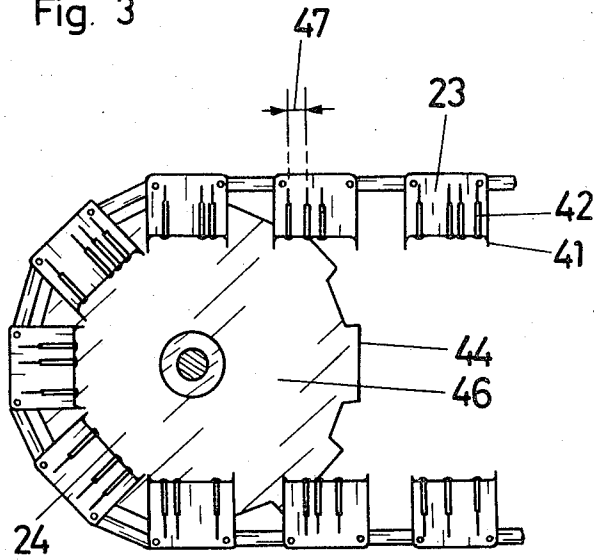


Fig. 4

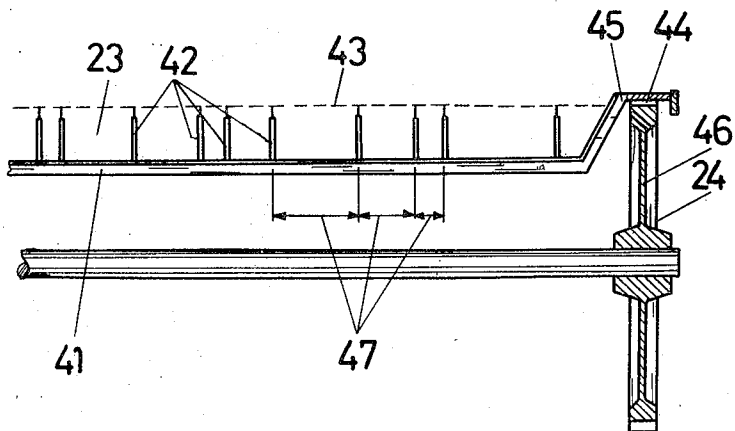


Fig. 5

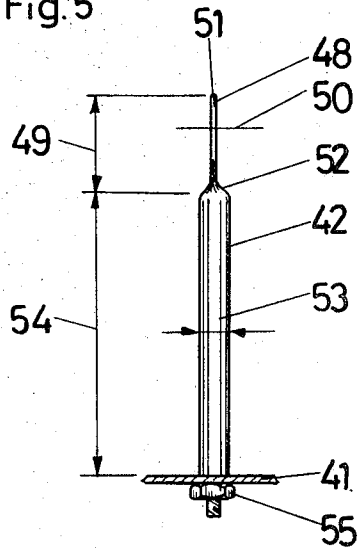
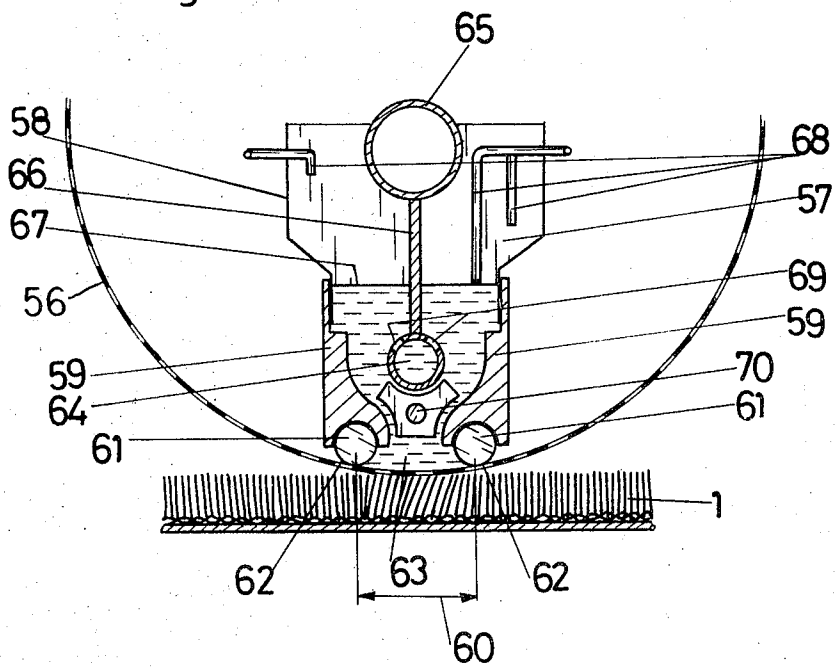


Fig. 6



APPARATUS FOR PRINTING AND/OR DYEING OF HIGH PILE WEBS

The present invention provides to a device for printing and or dyeing of high pile webs which are passed through a steamer after they have been soaked with dye.

In known devices of this type the dye is applied to the pile surface of the web which is then passed through a steamer with the pile surface facing upwardly. Thereby, on the one hand gravity improves penetration of the dye to the base of the web, and on the other hand the dye is fixed by the steam. High quality printing or dyeing is characterized by thorough colouring of the pile and eventually also the base; for printing it is also required that the pattern has sharp contours.

It has been usual up to now to use highly viscous liquids having a viscosity of about 1,000 cps to up to 1,2000 cps. This has been esteemed necessary because dyes with a low viscosity tended to blur the contours and additionally favor the so called frosting effect. This effect occurs when in the inlet region of the steamer the superheated or saturated steam condenses on the cold fibers of the web whereby the dye which is not yet fixed at that time flows down towards the base of the web. Due to the lack of dye on the tips of the fibers, the web looks as though it is covered by a veil. This effect occurs especially on high pile well made synthetic fiber which has a smooth surface without any scales on which surface the dye can flow without any considerable resistance.

SUMMARY OF THE INVENTION

The object of the invention is therefore to provide a device for printing and/or dyeing a high pile web whereby the frosting effect and/or blurring of the contours are avoided.

This object is accomplished in that the web is fed to the steamer upside down to the usual position, i.e., with the piled surface facing downwards, the web remaining in this position at least during the first fraction of its passage through the steamer.

This makes it possible to use low viscous dyes which are recommendable for good penetration of the dye into the web but have been estimated improper for the reasons set out above. The use of low viscous dyes in turn facilitates the use of a printing machine based on gravity, i.e., without the use of a high pressure squeegee.

It is therefore a further object of the invention to provide a device for applying dye to the web, this device providing an easily controllable supply of dye, whereby high quantities of dye are fed to the web.

BRIEF DESCRIPTION OF THE DRAWINGS

The device according to the invention will hereinafter be described in connection with the so-called tufted carpets without, however, being limited thereto.

FIG. 1 shows schematically a printing machine with a steamer. FIG. 2 shows a variation of the steamer. FIGS. 3, 4 and 5 show constructive details of the follower-belt, and FIG. 6 the principle of a gravity printing station.

DETAILED DESCRIPTION OF THE INVENTION

As shown in FIG. 1, the carpet 1 is passed through several gravity printing stations 2, the pile being on the

upper surface of the carpet. In these stations, a low viscous dye is brought by gravity onto the pile fibres through rotating screen cylinders. Penetration down to the base of the carpet is aided by moving the carpet essentially horizontally over a distance 3 in direction 4. At the end of this distance 3, the carpet is turned down over a guide roller 5 into the steamer 6 and is fixed upside down to a follower belt 7 moving in the direction of the arrow 8. When passing over the distance 3 the relatively low viscous dye has time to penetrate between the fibers of the pile to penetrate down to the base of the carpet, this movement being due to gravity.

In the steamer, when the carpet moves upside down while being fixed to the follower belt, the dye will flow in the opposite direction, i.e., towards the tips of the fibers. At the same time it will be fixed to the fibers by the influence of the superheated or saturated steam present in the steamer. It is true, that condensation occurs here as well as described above in connection with known devices. However, in the present invention the dye will not concentrate on the base of the carpet but rather on the tips of the fibers and will there be fixed in considerable quantities.

At the guide roller 9 the carpet is passed from the follower belt 7 on to the transport belt 10 and moves in the direction of the arrow 11 to the outlet 13 of the steamer and further on to the washer 14 and a squeezing roller not shown. It is possible with the steamer shown in FIG. 1 to pass the carpet therethrough in the normal manner, i.e., with the pile facing upwardly. For this purpose the carpet is passed through the steamer along the path indicated by the thin dotted lines 15. When the carpet follows path 15, both the follower belt 7 and the transport belt 10 are moved in the opposite directions indicated by arrows 8, resp. 11. The carpet enters the steamer at the opening 12, is fixed to the follower belt 7 and moves together with the upper part of the latter in the direction opposite to the arrow 8. At the guide roller 17 it is passed to the transport belt 10 and it leaves the steamer 6 through the opening 16. After having been deviated by the guide rollers 19 and 20 it passes through the washer 14 and on to the already mentioned squeeze rollers (not shown) and to a drier.

In FIG. 2, which shows a modified steamer wherein the same numbers denominate the same elements as in FIG. 1, after the carpet has passed the upper distance 3 above the steamer on a number of support rolls 21, it is fixed to the follower belt 7 after the guide roller 5.

This follower belt consists of a number of needle supporting beams 23 connected together like the links of a chain and provided with support needles which are distributed irregularly as described in detail in connection with FIGS. 3 and 4. The carpet 1 is laid onto the needle supporting beams with the pile fibers 22 directed downwardly and is then introduced into the steamer 6 in the direction of the arrow 8. At the guide roller 24 the carpet is laid down onto the lower transport belt 10, which, e.g., is a normal wide-meshed teflonized glassfiber or a wide-meshed polyester follower belt. By this transport belt the carpet 1 is transported in the direction of the arrow 11 to the guide roller 25 and further to the steamer outlet 26. Therefrom the carpet is passed on to the usual washing and drying devices (not shown).

In the modification according to FIG. 2 the follower belt 7 is passed through a washing device 27 outside the steamer. For this purpose, the follower belt is led downwards by the guide roller 28, enters the cleaning tank 29 and passes therein through a bath 30 the purpose of which is to rinse out or at least to soften dye particles adhering to the needles. After the belt has passed the guide roller 32 the particles are wiped off by the rotating brush roller 31 and/or are washed off by the sprinkling tubes 33. Then the follower belt returns over the guide roller 34 to the steamer inlet opening 35.

This steamer, too, can be run in the classical way. For that purpose, either the carpet is introduced into the steamer through the opening 36 and is passed only over the transport belt 10, or the movement of the follower belt 7 is reversed and the carpet is led only thereover, entering the steamer at 37 and leaving it at 38.

Steam is fed to the steamer by nozzles 39 and 40. The follower belt 7 is preheated before entering the steamer by superheated or saturated steam delivered by nozzles 71 which extend over the whole width of the belt. The preheating temperature is chosen such that condensation of superheated or saturated steam present in the steamer is prevented, the preheating temperature in general being higher than the temperature in the steamer. This is important because otherwise steam would condense readily on the needles since they leave the washing device at a low temperature. This condensed water on the needles would contact the fibers when the carpet is laid down on the belt and would dilute the dye on such fibers, which in turn would result in forming stains either by flow down of the dye or by intensified penetration of dye in to the capillary areas between the fibers of the web.

Instead of steam jets other suitable heaters may be used, e.g. infra red radiators, hot air jets, etc.

The FIGS. 3 and 4 show the guide roller 24 and the follower belt 7 more in detail. As the carpet lies on the follower belt upside down, i.e., with the fibers touching the belt, a special construction is required for the latter in order to prevent on one hand forming of visible areas of deformed carpet fibers and on the other hand sagging of the carpet as this would cause concentration of the dye at the lower part of each sagging carpet area.

Each needle supporting beam 23 consists of a crank-shaped streamlined sheet metal beam bearing the needles 42. As best shown in FIG. 4, the tips of the needles end in a plane 43 determined by the connection of the two lateral contact planes between the crank-shaped part 45 of the needle supporting beam 23 and the polygonal wheel 46 of the guide roller 24. Thereby it is achieved that the carpet, when being deviated by the guide roller 24, does not undergo any stretching as the tips of the needles move always at a constant speed.

As shown in FIG. 4, spacing of the needles is irregular. The distances between them vary in a statistical manner according to a Gaussian nomogram around an average value which might be 2 to 6 inches. It has been found that such a statistical fluctuation renders difficult the formation of areas of deformed carpet fibers which might otherwise have been formed at the places of contact.

FIG. 5 shows a needle 42. It comprises a relatively thin tip the length 49 of which is about $\frac{3}{4}$ inch and the diameter 50 of which is about $\frac{1}{32}$ inch. The upper end 51 is rounded. Below the tip part 48 the needle thick-

ens rapidly to a diameter 53 of about $\frac{3}{16}$ inch. The length of this part is about 2 inches. The needle is fixed in the sheet metal beam 41 by means such as a nut 55 and preferably is made of stainless steel.

This special shape of the needle results in that relatively looser or weaker carpet grounds or bases which cannot be supported by the the slim needle tips 48 may be penetrated thereby and are caught and supported by the thicker part of the needle. Therefore it is possible with a single type of needle to carry both tufting carpets and long pile web carpets, without the danger of forming areas of deformed fibers. Long pile webs generally have a looser base which can only be supported by thick needles. However, even thick needles do not produce visible areas of deformed fibers in such webs. On the contrary, in short looped tufted carpets such thick needles would cause very obvious areas of deformed fibers. However, this type of web has a firmly woven base which will not be penetrated even by the slim tips 48 of the needles.

FIG. 6 shows a gravity printing station 2 of the carpet printing machine shown in FIG. 1. This gravity printing station facilitates the application of dye through a screen, no considerable pressure being necessary between cylinder and web which, in known devices, causes compression of the pile which, in turn, hinders good penetration of the dye. Inside the rotary screen 56 a dye tank 57 is provided comprising two upper lateral walls 58 which are connected to the holders 59 for the rollers. These holders 59 embrace roller squeegees 61 contacting tightly the inner surface of the rotary screen 56. The carpet 1 situated below the screen is dyed in the region defined by the space between the two sealing points 62. Within the dye tank there is positioned, a dye feeding pipe 64 by which the dye is fed into the cavity 63. For reasons of mechanical stability the dye feeding pipe 64 is connected to an upper support tube 65 by means of a stem 66. The dye level 67 inside the dye tank 57 is maintained at a predetermined height, i.e., by three measuring tubes 68 and a control device (not shown in the drawings). One tube, according to the desired dye level, is fed by an air stream which is throttled by the liquid if the same approaches the opening of the tube. The resultant increase of pressure trips an impulse in the control device which stops the flow of dye to the dye tank.

The dye flows from the dye tube 64 into cavity 63 through openings 69 which are provided in the essentially uppermost part of the tube 64. Thereby the dye level 67, if necessary, can be lowered down to the height of the openings 69 without any further outflow of dye through these openings. If the openings 69 were provided at the lowermost point of the tube 64 and the dye were sucked from the dye tank 57 until the level reached the height of the openings, air would suddenly enter the dye tube making further sucking impossible, and at the same time all the dye contained in the tube would pour into the cavity 63.

A heater 70 is provided in the cavity 63 by which the dye may be heated and thereby made highly fluid such that the viscosity is lowered during the applying period.

It is possible to use sliding squeegees instead of rolling squeegees 61, such sliding squeegees also sealing the cavity 63 against the rotary screen.

Another improvement of the printing and/or dyeing quality can be obtained, especially with pile web made

of synthetic fiber, by treating the material by acid or other chemicals which increases the receptivity of the fiber surfaces for the dye.

What I claim is:

1. A device for printing and/or dyeing pile web, in particular high pile web, said device comprising means for applying dye to the pile side only of a carpet, a steamer positioned downstream of said dye applying means for treating said carpet after receipt of said dye, means for turning said carpet upside down at the inlet into said steamer, and means provided at least along a first zone of the passage of said carpet through said steamer for maintaining said carpet in a position with said pile side thereof facing downwardly.

2. A device in accordance with claim 1, further comprising means for horizontally guiding said carpet between said means for applying dye and said inlet of the steamer, the distance between said means for applying dye and said inlet being essentially equal to the length of the steamer.

3. A device in accordance with claim 1, further comprising a follower belt provided with vertical needles which support said carpet in its upside down position.

4. A device in accordance with claim 3, wherein said needles are arranged at irregular mutual distances which correspond to a Gaussian nomogram.

5. A device in accordance with claim 3, wherein said follower belt comprises support beams which extend horizontally and transverse to the direction of advance of said follower belt and which support said needles.

6. A device in accordance with claim 5, wherein said support beams are hinged to each other to form an endless chain which is supported between two pairs of guide rollers.

7. A device in accordance with claim 6, wherein the tips of said needles extend to a plane tangential to the outer diameter of said guide rollers.

8. A device in accordance with claim 5, wherein said support beams are bent upwardly at both ends thereof.

9. A device in accordance with claim 3, wherein each of said needles has a slim tip part of a first diameter and a base part of greater diameter.

10. A device in accordance with claim 3, further comprising a heater means for heating said follower belt before its entrance into said steamer to a tempera-

ture higher than the temperature within said steamer.

11. A device for printing and/or dyeing pile web, in particular high pile web, said device comprising means for applying dye to the pile side of a carpet, a steamer for treating said carpet after receipt of said dye, means for turning said carpet upside down at the inlet into said steamer, and means for horizontally guiding said carpet between said means for applying dye and said inlet of the steamer, the distance between said means for applying dye and said inlet being essentially equal to the length of the steamer.

12. A device for printing and/or dyeing pile web, in particular high pile web, said device comprising means for applying dye to the pile side of a carpet, a steamer for treating said carpet after receipt of said dye, means for turning said carpet upside down at the inlet into said steamer, and a follower belt provided with vertical needles which support said carpet in its upside down position.

13. A device in accordance with claim 12, wherein said needles are arranged at irregular mutual distances which correspond to a Gaussian nomogram.

14. A device in accordance with claim 12, wherein said follower belt comprises support beams which extend horizontally and transverse to the direction of advance of said follower belt and which support said needles.

15. A device in accordance with claim 14, wherein said support beams are hinged to each other to form an endless chain which is supported between two pairs of guide rollers.

16. A device in accordance with claim 15, wherein the tips of said needles extend to a plane tangential to the outer diameter of said guide rollers.

17. A device in accordance with claim 14, wherein said support beams are bent upwardly at both ends thereof.

18. A device in accordance with claim 12, wherein each of said needles has a slim tip part of a first diameter and a base part of greater diameter.

19. A device in accordance with claim 12, further comprising a heater means for heating said follower belt before its entrance into said steamer to a temperature higher than the temperature within said steamer.

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