A printing means for depositing ink or dye onto a web of cloth, paper, or plastic material. The web is moved under an ink reservoir and a quantity of ink is deposited on the web. A scraper limit blade removes most of the ink but permits small quantities of ink to remain on the web forming design patterns. Double limit blades and means for mixing colored inks on the web create a large variety of designs.

8 Claims, 10 Drawing Figures
PLATELESS PRINTING DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to an inexpensive method of applying a colored design to a web of material which is moved through the printing device at a constant speed. Several prior devices have been made to accomplish the same result but these machines have been limited to simple designs and limited color variations. The present invention employs novel limit blades having two scraping surfaces, collecting notches in the blades for redistributing the excess ink, and a vacuum system for recovering excess ink at the last scraping area.

One of the features of the present invention is a new type of scraper blade wherein the blade is at 90° with respect to the plane of the web and has cut out portions in the scraping surface. The blade is angularly disposed along the web surface to distribute the ink along the length of the blade. Another feature of the invention is the provision of collector flaps formed in the limit blade wherein some of the ink is diverted and passed through one section of the limit blade to a second section.

Still another feature of the invention is the novel manner of mixing different colored inks to form unique patterns after the inks have been applied to the web. This is made possible by depositing ink portions at selected positions along a blade, by the use of collector flaps and multiple blade construction, and by the use of small reservoir cups which function as mixing areas.

For a better understanding of the present invention, together with other details and features thereof, reference is made to the following description taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 is a side view of the printing device showing the bed, the moving web, and the limit blade with ink supply.

FIG. 2 is a schematic diagram showing components in the ink supply system. Also, a vacuum ink removal system is shown.

FIG. 3 is a side view of a limit blade showing some of the notches which create a printing pattern.

FIG. 4 is a top view of one of the limit blades.

FIGS. 5, 7, 8, 9 and 10 are cross sectional views of various limit blades taken along a horizontal plane close to the lower edge of the blade.

FIG. 6 is a side view of one of the limit blades showing how a collector flap is formed in the blade.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIGS. 1 and 2, the web 15 is supported on a flat bed 16 and is moved along the bed in the direction of the arrow by exterior roll take-up means (not shown). The printing device is supported by a vertical cylinder 17 and the upper plate 18. In order to rotate the printing device, its elements are secured to a vertical shaft 20 held in a bushing 21 and turned by a large gear 22. Gear 22 is turned by a pinion 23 run by an electrical motor 24, secured to plate 18. The motor 24 is controlled by external switching means (not shown) to gear 22 through a restricted arc.

The flow of ink from a storage tank 25 to the web 15 is controlled by a vertical limit blade 26 (sometimes called a doctor blade) having small nicks or notches cut in its lower edge. These components are supported by a plate 27, secured to shaft 20, and are partially rotated about the shaft through a limited arc over the surface of the web by the gear. When this device is in operation, ink from reservoir 25 is applied to the web through a nozzle 28 and the excess ink is removed by blade 26. Ink which moves through the nicks 30 (FIG. 3) forms the pattern while the rotational movement of the blade varies the pattern in accordance with a predetermined schedule. The blade 26 shown in FIG. 1 is a simple, circular design. A vacuum system shown in this figure includes a pick-up pipe 56, a reservoir 53, and a vacuum pipe 55.

FIG. 2 shows the complete system with many of the details not indicated in FIG. 1. Pressure for moving and mixing the ink is generated by a compressor 31 run by motor 32. Pressure control valves 33 and 34, which may be of the diaphragm type, regulate the pressure of the air supplied to a high pressure tank 35 and a low pressure tank 36. The high pressure tank 35 is connected to one or more ink reservoirs 37, 38, supplying pressure above an ink supply 40. The ink moves from the reservoirs by means of pipes 41 and 42 which are immersed in the ink. Pipes 41 and 42 may be connected directly to the supply tank 25 but it is preferred to run them to a mixing valve 43 where they may be mixed in controlled proportions. The mixed ink leaves the valve 43 by way of conduit 44 and is then delivered to supply tank 25 through valve 45 controlled to open and shut by a float 46 positioned inside the tank.

The high pressure is necessary for the mixing of the inks since some inks are viscous and are moved with difficulty. After arrival in the storage tank 25, gravity flow helps to send the ink to the web through nozzle 28 but it has been found that low pressure air helps this flow and increases the speed of delivery. The low pressure air is sent from storage tank 36 through conduit 47 to the space above the ink 48, this flow being under control by valve 50.

Storage tank 25 is supported by plate 27 which also supports an adjustable screw 51. Screw 51 is meshed with a nut 52, secured to one side of a double limit blade 26, 26-A. Ink, deposited through nozzle 28, is spread by the blade 26, some of it passing through the nicks in the blade and some being collected by notches 57. All the excess ink accumulates in front of the second portion 26-A of the limit blade. A vacuum system picks up this excess and deposits it in a container 53. The complete vacuum system includes a vacuum pump 54, a conduit 55, the container 53, and a pick up nozzle 56. A second screw 51-A, similar to screw 51, meshes with nut 52-A, secured to another portion of the blade 26-A.

FIG. 4 shows one form of single limit blade wherein the ink is deposited by nozzle 28 at a leading bend in the blade. When the web is moved under the blade, the ink is moved away from the nozzle 28 toward the blade ends in the direction shown by the arrows. During this time small portions of the ink flow through the notches or nicks in the lower edge of the blade and form a pattern on the web. Two vacuum nozzles 56 are provided in this design for removing the excess ink. The ends of the blade 26 are bent to form a hook 26C where the ink is collected prior to being removed by the vacuum nozzle.
FIGS. 5 and 6 show a double bladed arrangement using collecting flaps 57 cut from the lower portion of the blade to alter the direction of the ink flow and to produce a distinctive printing pattern. The ink is deposited by nozzle 28 at the leading convex portion of the blade. The ink flows along the blade until it reaches one of the flaps 57 which is bent outward to catch the ink and move it to the inside of the blade. The ink is distributed over the interior area by the partial rotation of shaft 29 and finally the ink is divided by blade 26-A and then collected by the two vacuum nozzles 56.

FIG. 7 shows another type of blade where a first color ink is deposited through nozzle 28. This ink is distributed by blade 26 in the usual manner. The excess is caught by flaps 57 and moved toward the inside of the blade. A second color ink is deposited through a second nozzle 28A and this ink is distributed by the blade portion 26A. The two colors mix as they are moved into the two channels and finally the excess ink is removed by nozzles 56.

FIG. 8 is a cross sectional view of a limit blade having three nozzles 28, 28B and 28C delivering inks of three different colors. The first color ink from nozzle 28 spreads along the outer blade 26 and then moves into one of the two cut-out portions 57. At this area the first color ink mixes with the ink from nozzle 28B or 28C. The mixed ink then moves along blade 26A or 26B until the two streams are joined at the vacuum nozzle 55 where the excess ink is removed.

FIG. 9 shows a blade for depositing three colors. A first colored ink is introduced by nozzle 28 and is spread over a broad band by the leading portion of blade 26. Some of the ink is moved into a pocket formed by a curved plate 58, welded to the main plate 26. A second nozzle 28D deposits a second color in the same pocket where the two colors mix. The overflow from this pocket passes along the blade 26 until it reaches the nozzle 56 where the excess is removed. A similar action occurs on the bottom half of the blade where a third colored ink is deposited into the pocket produced by curved plate 60. Then the mixed ink overflows the pocket and moves to the final vacuum nozzle 56.

The blade shown in FIG. 10 is still another means for mixing three colors for printing lines on a web. The three ink nozzles 28, 28G, and 28F deposit ink at the positions shown. Excess ink is removed from the concave portions by vacuum nozzles 56. The arrow 61 indicates the direction of movement of the web under the limit blade in this figure. In the other figures on this sheet the web moves to the right.

This invention is related to Torongo and Heston U.S. Pat. No. 3,507,674, granted Apr. 21, 1970 on which this invention is, in part, an improvement, and which patent is incorporated herein by reference.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A machine for plateless printing of designs on a web comprising: a base plate for supporting the web as it is moved along in a direction parallel to its length; an ink dispensing unit mounted above the base plate and including an ink reservoir and a nozzle for delivering a flow of ink to a selected portion of the web; a notched limit blade with its lower edge resting on the web for distributing ink over the web surface and for creating tones or line patterns by the ink which passes under and through the blade notches, said limit blade mounted at right angles to the plane of the web but convexly curved so as to direct the ink along the blade toward the web edges, and wherein the limit blade is bent to form ink collection points, and wherein a vacuum system is also positioned above the base plate and includes a nozzle extending to the web at a collection point, an ink storage container connected to the nozzle, and a conduit connected between the storage container and a vacuum pump.

2. A machine for plateless printing of designs on a web comprising: a base plate for supporting the web as it is moved along in a direction parallel to its length; an ink dispensing unit mounted above the base plate and including an ink reservoir and a nozzle for delivering a flow of ink to a selected portion of the web; a notched limit blade with its lower edge resting on the web for distributing ink over the web surface and for creating tones or line patterns by the ink which passes under and through the blade notches, said limit blade mounted at right angles to the plane of the web but convexly curved so as to direct the ink along the blade toward the web edges, and wherein said limit blade is made of a continuous metal band defining an outer and an inner area, means for depositing ink adjacent to an outer surface of the band, and a plurality of outwardly extending flaps cut from the band material for gathering ink from the outside area and directing it to the inside area.

3. A machine as claimed in claim 2 wherein a first ink nozzle deposits ink adjacent to an outer surface of the limit blade and two other ink nozzles deposit ink on the inside surface of the limit blade.

4. A machine for plateless printing of designs on a web comprising: a base plate for supporting the web as it is moved along in a direction parallel to its length; an ink dispensing unit mounted above the base plate and including an ink reservoir and a nozzle for delivering a flow of ink to a selected portion of the web; a notched limit blade with its lower edge resting on the web for distributing ink over the web surface and for creating tones or line patterns by the ink which passes under and through the blade notches, said limit blade mounted at right angles to the plane of the web but convexly curved so as to direct the ink along the blade toward the web edges, and wherein said limit blade includes a curved extension on the outside of the blade for forming a collection area, and a second ink nozzle for depositing ink in said area.

5. A machine for plateless printing of designs on a web comprising: a base plate for supporting the web as it is moved along in a direction parallel to its length; an ink dispensing unit mounted above the base plate and including an ink reservoir and a nozzle for delivering a flow of ink to a selected portion of the web; a notched limit blade with its lower edge resting on the web for distributing ink over the web surface and for creating tones or line patterns by the ink which passes under and through the blade notches, said limit blade mounted at right angles to the plane of the web but convexly curved so as to direct the ink along the blade toward the web edges; and a vacuum system positioned above the base plate and including a nozzle extending to the web at a collection point, an ink storage container connected to the nozzle and a conduit connected between the storage container and a vacuum pump.

6. A machine as claimed in claim 5 wherein said limit blade is made of a continuous metal band defining an
outer and an inner area, means for depositing ink adjacent to an outer surface of the band, and a plurality of outwardly extending flaps cut from the band material for gathering ink from the outside area and directing it to the inside area.

7. A machine as claimed in claim 6 wherein a first ink nozzle deposits ink adjacent to an outer surface of the limit blade and two other ink nozzles deposit ink on the inside surface of the limit blade.

8. A machine for plateless printing of designs on a web comprising: a base plate for supporting the web as it is moved along in a direction parallel to its length; an ink dispensing unit mounted above the base plate and including an ink reservoir and a nozzle for delivering a flow of ink to a selected portion of the web; a notched limit blade with its lower edge resting on the web for distributing ink over the web surface and for creating tones or line patterns by the ink which passes under and through the blade notches, said limit blade mounted at right angles to the plane of the web but convexly curved so as to direct the ink along the blade toward the web edges, and wherein said limit blade includes a curved extension on the outside of the blade for forming a collection area, and a second ink nozzle for depositing ink in said area.

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