

[54] **DYE TRANSFER APPARATUS WITH STAIN PREVENTING DEVICE**

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[58] Field of Search..... 118/50, 203, 224, 118/246, 259; 101/157, 167, 169, 181, 155, 327, 350, 366, 367, 425, 152; 68/202, 203; 355/10

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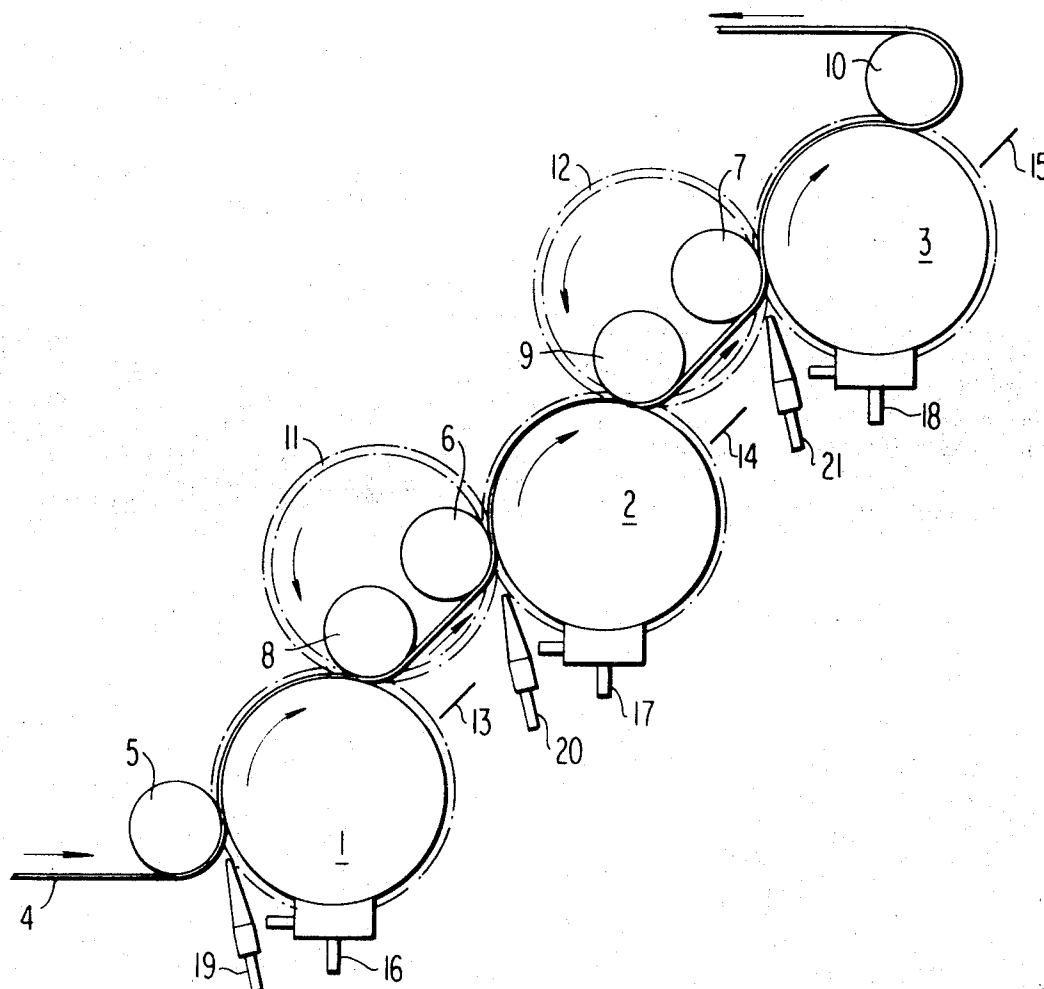
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[57]

ABSTRACT

A dye transfer apparatus having a stain preventing device. The apparatus comprises a rotatable plate cylinder on which a matrix is mounted, a dye solution applying device for applying a dye solution on the matrix, a washing liquid supplying device positioned downstream of the dye solution applying device, a squeeze roller positioned downstream of the washing liquid supplying device for urging a receiving material into contact with the matrix, and a washing liquid removing device having a head with a narrow tip end disposed closely adjacent the nip of the plate cylinder and the squeeze roller to remove washing liquid containing dye from the surface of the receiving material.

7 Claims, 4 Drawing Figures



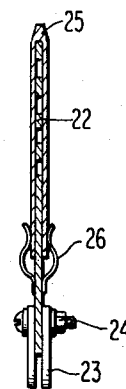
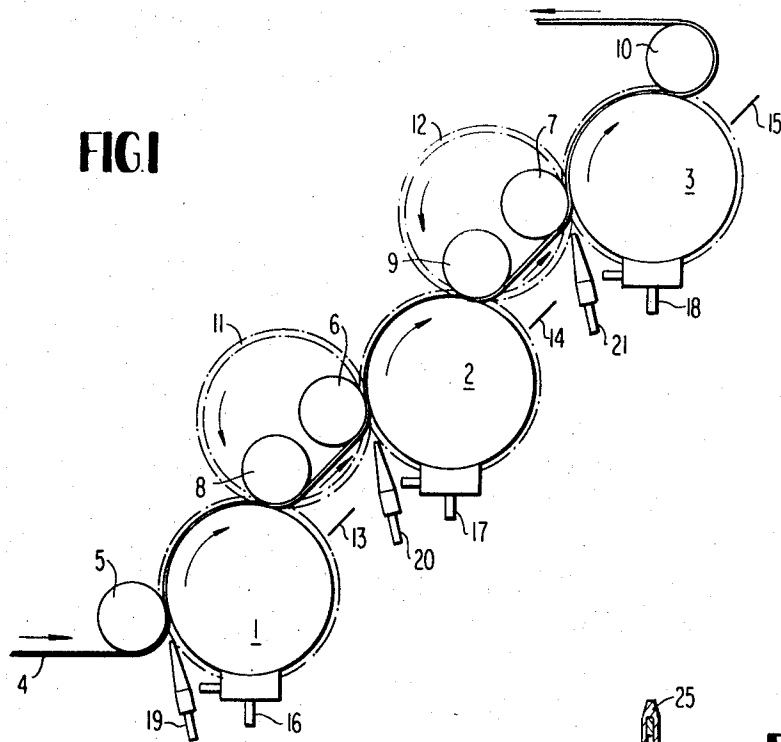


FIG3

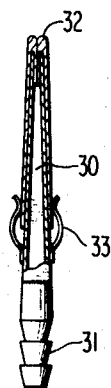


FIG4



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DYE TRANSFER APPARATUS WITH STAIN PREVENTING DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to a dye transfer apparatus for making a number of duplicates from an original by the use of a matrix mounted on a plate cylinder which is provided with a stain preventing device.

As has been known in the art for a long time, the dye transfer process is a process for duplicating a dye image on a material to be dye transferred by dyeing a plate, which is called a "matrix," absorbing dye or dye solution in an image pattern thereon, and then transferring the dye image on the matrix to a base (hereinafter referred to as "receiving material") having a dyeable layer thereon by bringing the receiving material into contact with the matrix.

The matrix is generally used as one set consisting of three matrices, each having a monocolored image corresponding to the element of the tricolor separation images. There are two kinds of processes for preparing the matrix, namely, a dichromatic acid photohardening process and a tanning development process. The former is a process in which the absorbability of the matrix is varied by photohardening in a gelatin layer thereon, and the latter is a process in which the unhardened part of the gelatin layer is washed away with warm water and the remaining gelatin relief is dyed with dye solution so that a dye image may be transferred to a receiving material. The former is a lithographic process and the latter is a relief printing-like process. Further, the former is suitable for obtaining a positive duplicate from a positive original since the amount of the light absorption by the dye is reduced in proportion to the magnitude of the light, and the latter is suitable for obtaining a positive duplicate from a negative original since the gelatin relief absorbing the dye is increased in its height in proportion to the magnitude of the light. The problem of whether the duplicate is negative or positive is, however, not a serious problem in the present invention, since the negative image can easily be changed to positive image and vice versa. One set of the matrices prepared as described above is used one by one to transfer the dye image to a receiving material to form a color image thereon. In this case, the monocolored dye images transferred to the material should all be in alignment with each other so that a sharp color image may be formed thereon when the material is transferred with the different monocolored images.

The dye transfer process which has been put into practice consists of four minor processes, namely, (1) a matrix preparing process in which monocolored matrices are made out of a color slide or color negative film; (2) a dye process in which the matrices are dyed; (3) a washing process in which excessive dye solution is removed from the matrices; and (4) a transferring process in which the matrices are brought into contact with the receiving material to transfer the dye image from the matrices to the material. By repeating three of the above four processes, excluding the first process, a number of duplicates can be obtained. In the case where a number of duplicates are made, the dye transfer process is economical compared with the color printing process in which a photographic paper is exposed and developed one by one for every duplicate, since in the dye transfer process the silver halide photosensitive material is only required to make the first

monocolored relief and the rest of the duplicates can be obtained only by the use of the receiving material having a mere gelatin layer. Further, the dye can be selected regardless of the harmful effect to the photosensitive material. Therefore, a bright and fast dye can be used. As a matter of fact, the brightness of the color obtained by the dye transfer process is superior to that obtained through the photographic color printing process.

As described above, the dye transfer process is advantageous in economy and brightness of color. However, as is well known, the dye transfer process is not as yet extensively used. The main reason for this is considered to be the great labor and time required thereby and unsuitability for mass production.

Heretofore, the dye transfer process has been conducted manually except in the case of using an apparatus embodying it. In this apparatus, an elongated strip of plastic matrix having accurately provided perforations in the longitudinal direction is fed together with an elongated strip of plastic material serving as a receiving material so that the dye image on the matrix may be transferred to the material while both are fed together in contact with each other. This type of automatic dye transfer apparatus is used in the field of motion pictures. In the dyeing apparatus, the matrix and the receiving material are easily regulated so as to be in accurate alignment with each other and fed together. Due to such ease, an automatic apparatus can be embodied for this type of matrix and receiving material.

In the dye transfer apparatus in accordance with the present invention, neither the matrix nor the receiving material is required to have perforations since the driving means for feeding the matrix is completely different from the conventional apparatus. The dye transfer apparatus in accordance with the present invention is provided with a means for preventing the receiving material from being stained. In the apparatus in accordance with the present invention, the material may be of any type, such as plastic, paper which absorbs water, and so forth.

On the other hand, in the conventional art where the dye transfer process is conducted manually, the process is carried out as follows. The matrix which is dipped in the washing liquid after dyeing is picked up with tweezers or fingers covered with a rubber glove and brought into contact with a receiving material placed on a plane base by means of a press roller in a manner in which the air and washing liquid remains between the surface of the matrix and the surface of the material.

The amount of the washing liquid has a very important relation to the quality of the transferred image obtained on the receiving material. The washing liquid serves not only to remove the excessive dye from the matrix but also insures that the matrix is in good contact with the material. That is, if the amount of the washing liquid is too small, the removal of the air cannot be conducted sufficiently and causes the image to be provided with spots where the dye image is not transferred. If the amount of the washing liquid is too large and the large amount of washing liquid is not removed well with the roller, a thin layer of the washing liquid remains between the matrix and the material, which results in a reduction in dye transferring speed and unevenness in dye transferring density or optical density shortage. Therefore, the washing liquid, which is required to exist between the matrix and the material to be dye transferred for insuring good contact between

them, is required to be well removed from the area between them when the dye image on the matrix is transferred to the material. In the process wherein the washing liquid is removed manually, it is removed from the surface of the material at an end thereof with a press of squeeze roller.

The removal of the washing liquid has another purpose other than to insure good contact between the matrix and the material. That is, the washing liquid is removed to prevent stain. The washing liquid, which is at first transparent and has no color, is colored with the dye when removing the dye. Therefore, the colored washing liquid causes the image to be stained. Accordingly, the colored washing liquid is required to be removed completely and quickly.

Further, in the above example of the apparatus, a matrix with perforations and a receiving material with perforations are dipped in the washing liquid in contact with each other to prevent air spots on the surface of the receiving material and, at the same time, to remove the colored washing liquid by diluting it with the environmental fresh washing liquid. Thus, the above stated two problems of colored washing liquid are solved.

SUMMARY OF THE INVENTION

The principal object of the present invention is to provide a dye transfer apparatus in which the above two problems are solved with respect to an apparatus for making a plurality of duplicates automatically.

Another object of the present invention is to provide a dye transfer apparatus for making a number of duplicates through a dye transfer process with a matrix mounted on a plate cylinder which is provided with a stain preventing device.

Still another object of the present invention is to provide a dye transfer apparatus in which the washing liquid is quickly and completely removed from the surface of the matrix.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages will be made apparent from the following description of the preferred embodiments thereof taken in conjunction with the accompanying drawings in which:

FIG. 1 is a schematic side view of one embodiment of the dye transfer apparatus in accordance with the present invention;

FIG. 2 is an enlarged sectional side view of the stain preventing head employed in the stain preventing device equipped in the dye transfer apparatus in accordance with the present invention;

FIG. 3 is an enlarged side view, partly in section, of another embodiment of the stain preventing head employed in conjunction with the present invention; and

FIG. 4 is an enlarged side view of a further embodiment of the stain preventing head employed in conjunction with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Now referring to the drawings, in FIG. 1 there is shown a schematic view of the whole apparatus in accordance with the present invention. In FIG. 1, reference numerals 1, 2 and 3 indicate plate cylinders for mounting three color separation matrices; numeral 4 indicates an elongated strip of material to be dye transferred receiving material; numerals 5, 6 and 7 indicate

squeeze rollers; and numerals 8, 9 and 10 indicate rollers for guiding the strip material 4 to the subsequent dye transferring or drying process. Reference numerals 11 and 12 indicate gears meshed with the gears provided on the end of plate cylinders 1, 2 and 3 for rotating the cylinders 1, 2 and 3 in synchronism with each other. Reference numerals 13, 14 and 15 indicate dye solution applicators for applying color dye solutions to the respective matrices; numerals 16, 17 and 18 indicate washing means for washing the excessive dye solution away; and numerals 19, 20 and 21 indicate washing liquid removing heads of the stain preventing device which are directed to the portion where the matrix is brought into contact with the strip material 4.

In the apparatus as shown in FIG. 1, one of the gears 11, 12 or one of the plate cylinders 1, 2 and 3 is driven so that all of the cylinders may be rotated in the direction indicated with arrows and strip material 4 may be fed upwardly to be dye transferred. The matrices are wound on the plate cylinders over a majority of the portion thereof, and the dye solution is applied as a flow onto the matrices of the dye solution applicators 13, 14 and 15. The dye solution is much less viscous than ordinary printing ink. The tip of the applicators 13, 14 and 15 is provided with a slot having a width wide enough to apply the dye solution to the strip material. The matrices absorb the dye solution in a pattern corresponding to the image while the plate cylinders are rotating by the time the dye solution applied portion thereof reaches the washing means 16, 17 or 18.

The excessive amount of the dye solution which was not absorbed by the matrices is washed away at the washing means. Strip material 4 is brought into good contact with the matrices by means of squeeze rollers 5, 6 and 7 and guide rollers 8, 9 and 10, and fed together with the matrices on plate cylinders 1, 2 and 3. By the pressure of the squeeze rollers 5, 6 and 7, the air therebetween is completely extruded and the matrices and the strip are contacted tightly, and the washing liquid therebetween has no other flow than the flow created by the washing liquid being sucked or blown away by the washing liquid removing heads 19, 20, 21. Thus, the colored and stained washing liquid is prevented from falling down along the surface of strip material 4. By the contact of the matrix with the strip material between the squeeze rollers and the guide rollers, the dye image on the matrices is transferred to the strip material.

Now, the stain preventing device will be described referring to FIGS. 2 through 4, wherein different embodiments of the washing liquid removing head are shown. Every embodiment has a sharp tip end which is inserted between the matrix and the strip material at the nip thereof, as shown in FIG. 1, so as to remove the washing liquid squeezed out therefrom.

In FIG. 2, the reference numeral 22 indicates a plate-like material having comparatively high rigidity, such as a suitable metal, plastic or the like. Reference numeral 23 indicates a supporter for supporting the plate-like material 22; numeral 24 indicates a bolt and nut for fixing the material 22 to the supporter 23; numeral 25 indicates an absorbent tip such as of hydrophilic paper, cloth, sponge or the like; and numeral 26 indicates a spring for mounting the absorbent tip 25 to the plate-like material 22. In this apparatus, the length of the supporter 23 is controlled to position the end of the absorbent tip 25 in the vicinity of the tip of the plate cylinder.

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der and the squeeze roller. The tip end of the absorbent material 25 is required to be in close relation to the strip material advancing along the surface of the squeeze roller. The colored or stained washing liquid is quickly and immediately absorbed by absorbent material 25 after it is squeezed out by the squeeze roller. Thus, the stained washing liquid is prevented from flowing down along the surface of the strip material. The absorbent material is gradually stained, and accordingly, it is required to be changed or washed with water after the matrix is used about 500 times for dye transferring the strip material.

FIG. 3 shows an embodiment of a vacuum suction head for removing the washing liquid. The reference numeral 30 indicates a nozzle member having a slit at the end thereof, numeral 31 indicates a pipe connection; numeral 32 indicates absorbent material covering the nozzle member 30; and numeral 33 indicates spring members for holding the absorbent material on the nozzle member 30. By connecting the pipe connection 31 with a vacuum system and locating the tip end of the nozzle 30 with the absorbent cover 32 at the same position as the washing liquid removing head shown in FIG. 2, the sustained washing liquid is sucked and picked up thereby and by the absorbent cover 32. Since the washing liquid absorbed by the absorbent cover 32 is also sucked through the nozzle 30, the washing or changing of the absorbent material can be omitted. Further, with the use of the head shown in FIG. 3, the suction is applied up to the region where strip material 4 is in contact with the matrix. Accordingly, the stained washing liquid can be removed completely. Any suitable material can be used for nozzle 30 which has water-resisting and weak acid-resisting properties.

In FIG. 4, another embodiment of the head which utilizes compressed air is shown in a side view. Reference numeral 40 indicates a nozzle having a slit opening 42 at the tip end thereof, and numeral 41 indicates a pipe connection for connecting the nozzle 40 to the compressor. The head constructed as described above is disposed at the same position as the heads described hereinabove, and compressed air is blown out of the slit opening 42 thereof to urge the squeezed out washed liquid toward the opposite side edges of the strip material 4 at the position where strip material 4 is in contact with the matrix. The removed or urged out washing liquid is stored in a waste receiver (not shown) and dumped.

Some specific examples of the dye transfer apparatus with a stain preventing device in accordance with the present invention will be described hereinbelow. In every example, a one percent water solution of acetic acid was used as the washing liquid.

EXAMPLE 1

As the head shown in FIG. 2, a brass plate of 0.5 mm thickness, 200 mm width and 120 mm height was used as the plate-like material covered with flannel of about 1 mm thickness on the opposite surfaces thereof. This head was located in a dye transfer apparatus of the type shown in FIG. 1 at a position where the tip end of the head was spaced 15 mm from the contact point of the plate cylinder and the squeeze roller and spaced 1 mm

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apart from the surface of the baryta paper coated with a gelatin layer used as a receiving material. The head was positioned vertically with the tip end thereof directed upwardly. By this disposition, the stain which had been seen on the strip material in an optical density of from 0.1 to 0.2 in the case where the head was not employed, was reduced to from 0.03 to 0.05. The dye was Tartrazine.

EXAMPLE 2

A nozzle as shown in FIG. 3 was made from a brass plate of 0.5 mm thickness and was covered with a piece of flannel of about 1 mm thickness on the opposite sides thereof. This head was located at the same position as that of Example 1 and connected to an electric vacuum cleaner made by Toshiba, Model VC-32S (100 V, 320 W). By suction, the stain was reduced to 0.01 to 0.03 in optical density.

EXAMPLE 3

A head as shown in FIG. 4 was connected to a compressor and located at the same position as in Example 1. The compressor was Super Babycon made by Hitachi Ltd. (100 V, 200 W) having a pressure of 2 Kg/cm². By this stain preventing device, the stain was reduced to 0.01 to 0.04 in optical density.

What is claimed is: device,

1. A dye transfer apparatus having a stain preventing device comprising a rotatable plate cylinder on which a matrix is mounted, a dye solution applying means for substantially uniformly applying dye solution on said matrix, a washing liquid supplying means disposed downstream of said dye solution applying means, a squeeze roller disposed downstream of said washing liquid supplying means for urging a receiving material into contact with said matrix, and a liquid removing means including a head having a thin tip end located in the vicinity of the nip of the plate cylinder and the squeeze roller, whereby the washing liquid containing dye solution is removed from the surface of the receiving material.

2. A dye transfer apparatus as defined in claim 1 wherein said head comprises an absorbing member for absorbing the liquid.

3. A dye transfer apparatus as defined in claim 2 wherein said head comprises a plate-like member and an absorbent cover mounted on the opposite surfaces of said member.

4. A dye transfer apparatus as defined in claim 3 further comprising a spring for retaining said absorbent cover on said plate-like member.

5. A dye transfer apparatus as defined in claim 1 wherein said head comprises a vacuum suction nozzle for sucking the liquid.

6. A dye transfer apparatus as defined in claim 5 wherein said head comprises a nozzle and an absorbent cover mounted on the opposite side surfaces of said nozzle.

7. A dye transfer apparatus as defined in claim 1 wherein said head comprises a nozzle for blowing compressed air therethrough.

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