Valid patch discrimination method for automatic density control apparatus

Verfahren zum Auswerten des Farbmessstreifens bei selbsttätiger densitometrischer Farbsteuerung

Procédé pour valoriser la barre de couleurs pour appareil de commande automatique de la densité des couleurs

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Description

Background of the Invention

The present invention relates to a valid patch discrimination method for an automatic density control apparatus. Normally, in density control of a print, a color patch in a color bar (control strip) printed on a margin portion of printed matter is measured by a densitometer, and a degree of opening of an ink key or an ink amount of a printing press is manually or automatically controlled based on the measured density. In recent years, an automatic density control apparatus has been proposed wherein a color bar is measured by a scanning type densitometer, the measured density is compared with a prestored reference density, and the degree of opening of an ink key of a printing press is automatically controlled.

However, a variety of sizes of paper are used in printing, and paper smaller than maximum paper for a printing press is frequently used for printing. For this reason, when a density is measured by the scanning type densitometer, a valid color patch is determined by the following methods, and density measurement and control are performed. In a first method, an operator inputs a paper size or nonused ink key, and a measurement/control range is determined based on the input data. In a second method, a measurement start patch is printed in a color bar, and the measurement/control range is determined according to the position of the patch.

However, the first method applies a load to the operator. In the second method, the measurement start patch must be printed for each paper size, and another patch corresponding to the printed patch must be deleted. A color may be corrected due to temporary contamination or omission (a color patch or its part is not printed due to a process error or contamination on a plate) although it need not be corrected.

EP 0-A-0283899 discloses a method for identifying and analysing printed target by a densitometer. A simple target is illuminated with annular illumination and a measuring head collects the reflected lights in a fibre optic bundle. The reflected light is transmitted to the densitometer body through the fibre optic bundle, where the bundle is divided into four separate bundles, i.e. quadrifurcated. Each bundle is associated with a dedicated optical fibre detector. The filters used a green, red, blue and visual optical filters. The filtered light is detected by the dedicated detectors and the analog signals from all four detectors are multiplexed, converted to digital signals and sent to a microprocessor for analysis. In such an identification method an erroneous detection and consequently erroneous discrimination - valid-, invalid color patches - is carried out if the density values of the color patches are totally smaller on starting printing operation.

Summary of the Invention

It is an object of the present invention to provide a valid color patch discrimination method for an automatic density control apparatus, which can prevent erroneous density control.

In order to achieve the above object, according to the present invention, there is provided a valid color patch discrimination method for an automatic density control apparatus, comprising detecting from the measurement of a color patch of a color bar printed on paper in units of color patches including patches of black, cyan, magenta and yellow with channels in a RGB-sensor. This method detects not only the output of one channel of the RGB-channels for detecting the density of the color patch but also at least another output channel of the R, G and B channels; calculates an output ratio for the color patch, wherein the output ratio is obtained by comparing the output from the channel for detecting the density at the color patch to the other detected output channel for the same color patch; compares the calculated output ratio of the color patch with a prestored value corresponding to said color patch; and discriminates a presence/absence of a valid color patch on said comparison of the calculated output ratio with the prestored value.

The subclaims refer to preferred embodiments of the invention.

With this method, an ink key corresponding to a color patch discriminated as an invalid color patch is protected.

Brief Description of the Drawings

Fig. 1 is a block diagram showing an embodiment of the present invention;
Fig. 2 is a view showing an arrangement of a scanning type densitometer;
Fig. 3 is a view showing a position of a color bar; and
Fig. 4 is a graph showing characteristics of colors.

Description of the Preferred Embodiment

An embodiment of the present invention will now be described with reference to the accompanying drawings. Figs. 1 and 2 show an embodiment of the present invention. In Fig. 2, when a motor 1 is rotated, a measurement head 4 movably supported on a guide 5 is moved in the right and-left direction in Fig. 2 through a pulley 2a and a wire 3. In this case, a rotary encoder 6 outputs a pulse signal according to a moving distance of the measurement head 4.
Note that reference numeral 2b denotes a pulley; 7a and 7b, columns; 8, printing paper; and 9, a color bar. The color bar 9 is printed on a margin portion of the printing paper 8, as shown in Fig. 3, and consists of a large number of color patches 9a. Each patch position of the color bar 9 is determined with reference to the center in the right-and-left direction of the paper.

In Fig. 1, a host computer section 20 processes data, and also serves as a man-machine interface (not shown) such as a keyboard, a CRT display, a printer, and the like. When the host computer section 20 receives a start signal from the keyboard, it transmits a start data block signal $S_4$ including a measurement condition and the like to a measurement timing controller 21. When the measurement timing controller 21 receives the signal $S_4$, it outputs a start signal $S_0$ to the motor 1 for driving the measurement head, and transmits timing generation data $S_2$ to a measurement timing generator 22 while monitoring a status signal $S_3$ output from the generator 22.

A head position signal generator 23 receives a signal $S_1$ synchronous with rotation of the motor 1, and sends a signal $S_6$ indicating a head position to the measurement timing generator 22. Based on the timing generation signal $S_2$ and the signal $S_6$ indicating the head position, the measurement timing generator 22 outputs a control (channel selection) signal $S_7$, and sends a density measurement head 24 and also outputs a fetch enable signal $S_9$ to the host computer section 20. The control (channel selection) signal $S_7$ is sequentially selected while determining the order of red, green, and blue, and the host computer section 20 fetches density signals $S_9$ from the density measurement head 24 in the order of red, green, and blue in response to the fetch enable signal $S_9$.

The measurement timing controller 21 receives a status signal $S_3$ from the measurement timing generator 22, and when the status signal $S_5$ indicates a stop state, it outputs a stop signal to the motor 1, and a measurement end signal $S_5$ to the host computer section 20. Upon reception of the signal $S_5$, the host computer section 20 ends measurement.

With the above processing, patch data of the color bar are stored in the host computer section 20 in units of red, green, and blue channels.

When printed colors (black, cyan, magenta, and yellow) are measured by the densitometer, they have characteristics as shown in Fig. 4. The absolute position of each patch to be used is fixed, and the host computer section 20 stores the absolute position. Therefore, the host computer section 20 checks whether or not the already stored data for each channel coincides with the characteristics shown in Fig. 4. If a noncoincidence is found, the host computer section 20 determines that the corresponding data is obtained by measuring a portion where no patch is printed, invalidates the data, and protects (does not control) an ink key corresponding to the patch. Thus, the presence/absence of a valid patch can be automatically discriminated, and erroneous control of an ink key corresponding to a patch discriminated as an invalid patch can be prevented.

Invalidation of data of each color is discriminated by the following inequalities based on Fig. 4.

a) Black Patch

$$Br < BL, Bg < BL, Bb < BL, Br/Bg > BsL1, \text{and } Bg/Br > BsL2$$

where

$Br, Bg, Bb$: measurement values of the black patch in red, green and blue channels, respectively

$BsL1$: threshold data of a ratio of $Br$ to $Bg$

$BsL2$: threshold data of a ratio of $Bg$ to $Br$

$BL$: minimum threshold data of the black patch

b) Cyan Patch

$$(Cr/Cb) < CsL$$

where

$Cr, Cb$: measurement values of the cyan patch in red and blue channels, respectively

$CsL$: threshold data of a ratio of $Cr$ to $Cb$

c) Magenta Patch

$$(Mg/Mr) < MsL$$

where

$Mg, Mr$: measurement values of the magenta patch in green and red channels, respectively
EP 0 370 126 B1

MsL: threshold data of a ratio of Mg to Mr

d) Yellow Patch

\[(Y_b/Y_r) < Y_{SL}\]

where

Yb, Yr: measurement values of the yellow patch in blue and red channels, respectively
YsL: threshold data of a ratio of Yb to Yr

Note that a base for fixing printing paper in position has characteristics other than those of the patches. An ink key is controlled such that the host computer section 20 calculates control data S_{10} based on measured data, a prestored reference density, and a signal S_{11} indicating the present opening data of the ink key, and transmits the control data S_{10} to an external apparatus (ink key control apparatus) through an interface. In this case, for an ink key corresponding to a patch discriminated as an invalid patch, the present value is used as control data as it is.

As described above, since the apparatus of the present invention discriminates validity of data of each patch, erroneous control for detecting a change in characteristics to invalidate the patch when a patch is temporarily contaminated can be prevented. Since no measurement start patch is required, various types of film can be printed by centering regardless of a paper size. If some colors are partially used, the apparatus of the present invention can cope with it. An ink key can be automatically controlled regardless of a paper size.

Claims

1. A valid color patch (9a) discrimination method for an automatic density control apparatus, comprising:

   - detecting from the measurement of a color patch (9a) of a color bar (9) printed on paper (8) in units of color patches (9a) including patches of black, cyan, magenta and yellow with channels in a RGB-sensor not only the output of one channel of the RGB-channels for detecting the density of the color patch but also at least another output channel of the R-channel, G-channel and B-channel;
   - calculating an output ratio for the color patch wherein the output ratio is obtained by comparing the output from the channel for detecting the density at the color patch to the other detected output channel for the same color patch;
   - comparing the calculated output ratio of the color patch with a prestored value corresponding to said color patch; and
   - discriminating a presence/absence of a valid color patch (9a) on said comparison of the calculated output ratio with the prestored value.

2. A method according to claim 1, wherein the presence/absence of each valid color patch is discriminated by repeating the steps of claim 1 for each color patch of the color bar.

3. A method according to claim 1 or 2, wherein the presence/absence of the valid color patch is discriminated by following inequalities for said black, cyan, magenta and yellow patches:

   a) Black Patch

   \[Br < BL, \ Bg < BL, \ Bb < BL, \ Br/Bg > BsL1, \text{ and } Bg/Br > BsL2\]

   where

   Br, Bg, Bb: detection values of the black patch in red, green and blue channels, respectively.
   BsL1: threshold data of a ratio of Br to Bg
   BsL2: threshold data of a ratio of Bg to Br
   BL: minimum threshold data of the black patch

   b) Cyan Patch

   \[(Cr/Cb) < CsL\]
where

Cr, Cb: detection values of the cyan patch in red and blue channels, respectively
Csl: threshold data of a ratio of Cr to Cb

c) Magenta Patch

(Mg/Mr) < MsL

where

Mg, Mr: detection values of the magenta patch in green and red channels, respectively.
MsL: threshold data of a ratio of Mg to Mr

d) Yellow Patch

(Yb/Yr) < YsL

where

Yb, Yr: detection values of the yellow patch in blue and red channels, respectively
YsL: threshold data of a ratio of Yb to Yr.

Patentansprüche

1. Verfahren zum Auswerten eines Farbmeßstreifens (9a) bei selbsttätiger densitometrischer Farbsteuerung, mit den Schritten:

- Erfassen aus der Messung eines Farbfleckes (9a), von einem Farbstreifen (9), welcher auf Papier (8) in Einheiten von Farbflecken (9a) gedruckt ist, wobei die Flecken Schwarz, Zyan, Magenta und Gelb aufweisen, mit Hilfe von Kanälen eines RGB-Sensors nicht nur den Ausgang eines Kanals der RGB-Kanäle zum Erfassen der Dichte des Farbfleckes, sondern mindestens noch eines weiteren Kanalausgangs des R-Kanals, G-Kanals und B-Kanals;
- Berechnen eines Ausgangsverhältnisses für den Farbfleck, wobei das Ausgangsverhältnis durch Vergleich des Kanalausgangs zum Erfassen der Dichte des Farbfleckes mit dem weiteren erfassten Ausgangskanal für den gleichen Farbfleck erhält wird;
- Vergleichen des berechneten Ausgangsverhältnisses des Farbfleckes mit einem vorher gespeicherten Wert, welcher mit dem Farbfleck korrespondiert; und
- Beurteilen einer Anwesenheit/Abwesenheit eines gültigen Farbfleckes (9a) nach bzw. durch den Vergleich des berechneten Ausgangsverhältnisses mit einem vorher gespeicherten Wert.

2. Verfahren nach Anspruch 1, bei welchem die Anwesenheit/Abwesenheit jedes gültigen Farbfleckes durch Wiederholen der Schritte von Anspruch 1 für jeden Farbfleck des Farbstreifens beurteilt wird.

3. Verfahren nach Anspruch 1 oder 2, bei welchem die Anwesenheit/Abwesenheit des gültigen Farbfleckes durch folgende Ungleichungen für die schwarzen, Zyan-, Magenta- und gelben Flecken beurteilt wird:

a) Schwarzer Fleck:

Br < BL, Bg < BL, Bb < BL, Br/BG > BsL1, and Bg/Br > BsL2

wobei:

Br, Bg, Bg: Meßwerte des schwarzen Fleckes in roten, grünen bzw. blauen Kanälen;
BsL1: Schwellenwerte eines Verhältnisses von Br zu Bg;
BsL2: Schwellenwertdellen eines Verhältnisses von Bg zu Br; und
BL: Minimum-Schwellenwertdaten des schwarzen Flecks darstellen.

b) Zyanfleck:
Revisions

1. Procédé de discrimination d’une tache (9a) valide de couleur pour un appareil de commande automatique de densité comprenant les étapes suivantes ;

- on détecte à partir de la mesure d’une tache de couleur (9a) d’une barre (9) de couleurs imprimée sur une feuille de papier (8) dans des unités de taches de couleur (9a) comprenant des taches de couleur noire, cyan, magenta et jaune avec des canaux dans un détecteur rouge, vert, bleu, non seulement le signal de l’un des canaux des canaux rouge, vert, bleu pour détecter la densité de la tache de couleur, mais également au moins un autre signal de canal du canal rouge, du canal vert et du canal bleu ;
- on calcule un rapport des signaux pour la tache de couleur dans lequel le rapport émis est obtenu en comparant le signal provenant du canal pour détecter la densité de la tache de couleur à l’autre signal détecté à l’autre canal pour la même tache de couleur ;
- on compare le rapport du signal calculé de la tache de couleur à une valeur préméorisée correspondant à ladite tache de couleur ; et
- on discrimine une présence/absence d’une tache de couleur valide (9a) à partir de ladite comparaison du rapport du signal calculé avec la valeur préméorisée.

2. Procédé selon la revendication 1 dans lequel la présence/absence de chaque tache de couleur valide est discriminate en répétant les étapes de la revendication 1 pour chaque tache de couleur de la barre de couleurs.

3. Procédé selon la revendication 1 ou la revendication 2, dans lequel la présence/absence de la tache de couleur valide est discriminée par les inégalités suivantes pour lesdites taches de couleur noire, cyan, magenta et jaune :

   a) tache noire

   \[ Br < BL, Bg < BL, Bb < BL, Br/Bg > Bsl1, \text{ et } Bg/Br > Bsl2 \]

dans lesquelles

   \[ Br, Bg, Bb : \] sont les valeurs des mesures de la tache noire dans les canaux respectifs rouge, vert et bleu,

   \[ Bsl1 : \] est la donnée de seuil du rapport de Br à Bg,

   \[ Bsl2 : \] est la donnée de seuil du rapport de Bg à Br,

   \[ BL : \] est la valeur de seuil minimale de la tache noire,
b) Tache cyan :

\[(Cr/Cb) < CsL\]

dans laquelle

Cr, Cb : sont les valeurs des mesures de la tache cyan respectivement dans les canaux rouge et bleu,
CsL : est la donnée de seuil du rapport de Cr à Cb,

c) Tache magenta :

\[(Mg/Mr) < MsL\]

dans laquelle

Mg, Mr : sont les valeurs des mesures de la tache magenta respectivement dans les canaux vert et rouge,
MsL : est la donnée de seuil du rapport de Mg à Mr,

d) Tache jaune :

\[(Yb/Yr) < YsL\]

dans laquelle :

Yb, Yr : sont les valeurs des mesures de la tache jaune respectivement dans les canaux bleu et rouge,
YsL : est la donnée de seuil du rapport de Yb à Yr.