A SYSTEM AND METHOD FOR COMPUTER TO PRESS PRINTING

This invention is a computer to press printing system and method for operating same. The system includes a plate cylinder (102) capable of carrying at least one printing member (112), a multi-beam imaging system (110) for recording at least two color separations on the at least one printing material (112), at least one inking assembly (116) for applying at least two printing inks on corresponding ones of the at least two color separations, an impression cylinder (216), and a control system for activating a correction to the mis-registration between said at least two color separations.
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A SYSTEM AND METHOD FOR COMPUTER TO PRESS PRINTING

FIELD OF THE INVENTION

The present invention relates to printing systems generally and more particularly to computer to press printing systems.

BACKGROUND OF THE INVENTION

Printing press systems, such as the ones manufactured and sold by Heidelberg Druckmaschinen of Germany are well known in the art. One drawback of conventional printing press systems is that the time required to prepare the printing system before the onset of actual printing, also termed the "make ready time", is relatively long and therefore, it is widely accepted that these systems are suitable only for printing large number of copies of the artwork to be printed. Typically, conventional printing press systems operate to print more than five thousand copies per printing job.

In the conventional printing process, printing is preceded by a "pre-press" process which generally includes the production of films of the color separations of the artwork to be printed, the preparation of plates therefrom, and their subsequent mounting on the periphery of the printing press. The films are recorded by a laser plotter according to the digital representation of the artwork stored in a computer used to control the process. Alternatively, plates may be recorded directly so as to eliminate the stage of producing them from films.

In the last decade, printing press systems designed for short run printing has been developed. Typically, short run printing press systems are computer to
press printing systems in which the pre-press process and the actual printing are carried out by a single system. In these systems, the color separations are recorded directly on the printing plates.

Examples of computer to press printing systems are described in U.S. Patent 4,395,946 to Price and in published European Patent Application 0,512,549 to Naniwa.

One type of computer to press printing systems is digital offset press (DOP) printing systems. A typical prior art DOP printing system is illustrated in Fig. 1 to which reference is now made. The DOP printing system of Fig. 1, generally referenced 1, includes a plate cylinder 10, a blanket cylinder 12 and an impression cylinder 14. A single beam imaging unit 18 records the color separations of the artwork to be printed, typically four color separations of the four process colors cyan, magenta, yellow and black (CMYK), on four corresponding printing plates 20, 22, 24 and 26.

After the color separations CMYK are recorded on the printing plates 20, 22, 24 and 26, respectively, each one of the four inking assemblies 30, 32, 34 and 36 apply a corresponding ink on one of the CMYK printing plates. As shown by the arrow 37, the inking assemblies may move towards the plate cylinder and away therefrom to position one inking assembly in a working position according to the color separation to which ink is applied.

The illustrated DOP printing system is a rotary DOP printing system, i.e. the plate cylinder 10, the blanket cylinder 12 and the impression cylinder 14 rotate during their operation in the direction indicated by the arrows 40, 42 and 44, respectively.
The operation of the DOP printing system 1 is controlled by a control system 50, typically a commercially available computer equipped with dedicated applications and cards for driving, in coordination, the elements of the system 1.
SUMMARY OF THE INVENTION

It is an object of the present invention to provide an improved computer to press printing system.

According to one aspect of the present invention, there is provided a printing system capable of printing on substrates of different formats (i.e. different sizes of the printing substrate) while employing the entire area of the printing plates mounted on the plate cylinders.

According to a preferred embodiment of the present invention, there is provided a printing system capable of printing on printing substrates which are both in the B2 format and in the B3 format.

In accordance with a preferred embodiment of the present invention, the computer to press printing system is a digital offset press (DOP) printing system.

According to a preferred embodiment of the present invention, the DOP printing system includes a multibeam imaging system for recording color separations of the artwork to be printed on at least one printing member mounted on the plate cylinder of the DOP printing system.

A particular feature of the DOP printing system of the present invention is that it overcomes the misregistration between color separations of different color separations associated with rotary DOP printing systems employing multibeam imaging.

In accordance with a preferred embodiment of the present invention, the digital information of each color separation to be recorded by the multibeam imaging system is stored in an offset with respect to other color separations so as to
compensate for the shift inherent to the movement of the imaging system with respect to the plate cylinder.

According to an alternative embodiment of the present invention, the multibeam imaging head is capable of multi directional movement so as to compensate for the shift of the imaging system with respect to the plate cylinder.

According to a preferred embodiment of the present invention, the printing members are driographic, waterless, infra red (IR) laser ablateable printing plates and accordingly, the imaging system includes IR lasers for emitting radiation capable of ablating the printing members.

According to another aspect of the present invention, the printing system includes more than four inking assemblies for applying ink on the color separations produced on the printing members by the multibeam imaging system.

According to yet another aspect of the present invention, the DOP printing system is a duplex printing system.

According to a further aspect of the present invention, the DOP printing system includes an ink-jet printing system which operates to print customized information on the artwork to be printed by the DOP printing system.

The present invention provides a system which is particular advantageous for short run printing since it is characterized by a short make ready time, its imaging rate is relatively high since it employs a multibeam imaging system, it allows duplex printing and enables to record customized information on the printed outwork.

There is thus provided, in accordance with a preferred embodiment of the present invention, a computer to press printing system which includes a plate
cylinder capable of carrying at least one printing member, an imaging system for recording at least one color separation on the at least one printing member, at least one inking assembly for applying at least one printing ink on a corresponding one of the at least one color separation, at least two impression cylinders each of which for impressing a printing substrate of a different size and a control system for selectively activating one of the at least two impression cylinders in accordance with the size of the printing substrate to be printed.

Further, according to a preferred embodiment of the present invention, the imaging system is a multibeam imaging system.

According to one preferred embodiment of the present invention, the multibeam imaging system operates to record at least two color separations on the at least one printing plate.

Still further, according to a preferred embodiment of the present invention, the control system activates a correction to the misregistration between the at least two color separations.

There is also provided, in accordance with a preferred embodiment of the present invention, a computer to press printing system which includes a plate cylinder capable of carrying at least one printing member, a multibeam imaging system for recording at least two color separations on the at least one printing member, at least one inking assembly for applying at least two printing inks on corresponding ones of the at least two color separations, an impression cylinder, and a control system for activating a correction to the misregistration between the at least two color separations.
Further, according to a preferred embodiment of the present invention, the correction includes shifting the data files representing the at least two color separations therebetween, whereby similar locations on the at least two color separations are disposed on similar imaginary lines circumfering the plate cylinder, the imaginary lines being generally perpendicular to the axis of rotation of the plate cylinder.

According to an alternative preferred embodiment, the correction includes translating the multibeam imaging system in a counter direction to the axial direction of an imaginary spiral formed by the recording lines thereof, thereby similar locations on the at least two color separations are disposed on similar lines of the plate cylinder, the lines being generally perpendicular to the axis of rotation of the plate cylinder.

Further, in accordance with a preferred embodiment of the present invention, the system may also include at least one additional impression cylinder for impressing a printing substrate of a different size and wherein the control system operates to selectively activate a selected impression cylinder in accordance with the size of the printing substrate to be printed.

Additionally, according to a preferred embodiment of the present invention, the system may also include a blanket cylinder disposed and acting between the plate cylinder and the selected one of the at least two impression cylinders whereby the system operates as an offset press.

Further, according to a preferred embodiment of the present invention, the system may also include a conveying system for conveying to one of the at least two impression cylinders the printing substrate having the size corresponding thereto.
According to a preferred embodiment of the present invention, the conveying system operates to flip the printed substrate and to convey it again for printing the second side thereof.

Additionally, in accordance with a preferred embodiment of the present invention, the system may also include an additional printing unit for printing customized information on the printing substrate printed by the computer to press printing system.

According to a preferred embodiment of the present invention, the printing unit is an ink-jet printing unit which operates to print the customized information while the printing substrate is disposed on the conveying system.

There is also provided, in accordance with a preferred embodiment of the present invention, a method for operating a computer to press printing system which includes a plate cylinder capable of carrying at least one printing member, an imaging system for recording at least one color separation on the at least one printing member, at least one inking assembly for applying at least one printing ink on a corresponding one of the at least one color separation and at least two impression cylinders each of which for impressing a printing substrate of a different size, the method includes the step of activating one of the at least two impression cylinders in accordance with the size of the printing substrate to be printed.

Further, according to a preferred method of the present invention, the imaging system which includes a multibeam imaging system and wherein the method also includes recording at least two color separations on the at least one printing plate.
Additionally, according to a preferred embodiment of the present invention, the method may also include the step of providing a correction to the misregistration between the at least two color separations.

There is also provided, according to a preferred embodiment of the present invention, a method for operating a computer to press printing system which includes a plate cylinder capable of carrying at least one printing member, a multibeam imaging system for recording at least two color separations on the at least one printing member, at least one inking assembly for applying at least two printing inks on corresponding ones of the at least two color separations and an impression cylinder, the method includes the step of activating a correction to the misregistration between the at least two color separations.

According to a preferred embodiment of the present invention, the method may also include the step of providing at least one additional impression cylinder for impressing a printing substrate of a different size and selectively activating a selected impression cylinder in accordance with the size of the printing substrate to be printed.

According to a preferred embodiment of the present invention, the correction may be provided by shifting the data files representing the at least two color separations therebetween whereby similar locations on the at least two color separations are disposed on similar imaginary lines circumfering the plate cylinder, the imaginary lines being generally perpendicular to the axis of rotation of the plate cylinder.

Alternatively, according to a preferred embodiment of the present invention, the correction may be provided by translating the multibeam imaging
system in a counter direction to the axial direction of an imaginary spiral formed by the recording lines thereof, thereby similar locations on the at least two color separations are disposed on similar lines of the plate cylinder, the lines being generally perpendicular to the axis of rotation of the plate cylinder.

Additionally, according to a preferred embodiment of the present invention, the method may also include the step of providing a blanket cylinder disposed and acting between the plate cylinder and the selected one of the at least two impression cylinders.

Further, according to a preferred embodiment of the present invention, the method may include the step of conveying to one of the at least two impression cylinders the printing substrate having the size corresponding thereto and may also include the step of flipping the printed substrate and conveying it again for printing the second side thereof.

Finally, in accordance with a preferred embodiment of the present invention, the method may also include the step of employing an additional printing unit for printing customized information on the printing substrate.
BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from the following detailed description taken in conjunction with the appended drawings in which:

Fig. 1 is a schematic cross section illustration of a prior art computer to press printing system.

Figs. 2A and 2B are schematic cross section illustrations of a computer to press printing system, constructed and operative in accordance with a preferred embodiment of the present invention in first and second operation modes;

Figs. 3A - 3B and 4A - 4B are schematic cross section illustrations of the printing system of Figs. 2A - 2B with a printing substrate feeding system, in the first and second operation modes, respectively.

Figs. 5A and 5B are schematic illustrations of a configuration of the four color separations on the plate cylinder and of the corresponding alignment of the data representing them in the memory of the control system of the printing system of Figs. 2A - 4B according to one preferred embodiment of the present invention;

Figs. 6A and 6B are schematic illustrations of the configuration of the four color separations on the plate cylinder and of the corresponding alignment of the data representing them in the memory of the control system of the printing system of Figs. 2A - 4B according to another preferred embodiment of the present invention; and

Figs. 7A and 7B are a schematic partial top view illustration of the imaging system and the plate cylinder of the printing system of Figs. 2A - 4B and of
the configuration of the four color separations on the plate cylinder resulting from employing the imaging system of Fig. 6A.

**DETAILED DESCRIPTION OF THE PRESENT INVENTION**

Reference is now made to Figs. 2A and 2B which are schematic cross sections of a computer to press printing system, constructed and operative in accordance with a preferred embodiment of the present invention.

In the illustrated embodiment, the computer to press printing system is a rotary digital offset press (DOP) printing system, generally referenced 100. It will be appreciated that while the present invention is described with reference to a DOP printing system, it is applicable to any computer to press printing system, such as a computer to press gravure printing system, mutatis mutandis.

One particular feature of the DOP printing system 100 is that unlike prior art computer to press printing systems, it is capable to print on printing substrates of more than one size, such as on B3 size paper and B2 size paper by switching between two modes of operation, a first one for printing B3 size paper and a second one for printing B2 size paper.

It will be appreciated that while the present invention is described with respect to paper as the printing substrate, the printing substrate may be any suitable printing substrate, such as plastic.

The DOP printing system 100 preferably comprises a plate cylinder 102, capable of carrying on its outer periphery two printing members 112 and 114, a blanket cylinder 104 and at least two impression cylinders. In the illustrated embodiment, two impression cylinders referenced 106 and 108 are shown for printing on B3 size paper and on B2 size paper, respectively.
The DOP printing system 100 preferably also comprises an imaging system 110 for recording color separations of the artwork to be printed by the DOP printing system 100 on the printing plates 112 and 114.

The printing plates may be any suitable printing members. Preferably, but not necessarily, the printing plates 112 and 114 are waterless driographic IR ablateable printing members, such as the one described in U.S. Patent 3,535,705 to Lewis et al.

It is a particular feature of the present invention that the imaging system 110 is a multibeam imaging system as described in detail hereinbelow.

It is another particular feature of the present invention that the number of the color separations recorded on each of the printing plates varies in accordance with the size format of the printed substrate.

The DOP printing system 100 preferably also includes more than four inking assemblies of which five inking assemblies, 116, 118, 120, 122 and 124 are shown. Each of the inking assemblies apply ink of a different color on a corresponding color separation.

Preferably, each one of the four inking assemblies 116, 118, 120 and 122 applies ink of one of the four process colors Cyan, Magenta, Yellow and Black (CMYB or CMYK) on a corresponding color separation, the general position of which is denoted by the letters C, M, Y and K, and the additional inking assembly 124 applies ink of one or more special colors, such as gold, on a corresponding color separation.

The inking stations move towards the plate cylinder 112 and away therefrom as indicated by arrow 126 according to the current color separation on
which ink is applied. It will be appreciated that the number of inking assemblies is not limited to five inking assemblies and that the DOP printing system 100 may include any desired number of inking assemblies.

The DOP system 100 preferably also includes a control system, indicated schematically by reference numeral 109. The control system 109 may be any suitable computer, such as an International Business Machine (IBM) personal having a CPU, such as the Intel 40486, a storage system, such as a hard disk and any suitable control application and control cards for driving and coordinating the operation of the elements of the DOP system 100.

As is known to the ordinary person skilled in the art, in prior art computer to press printing systems, each color separation of the artwork to be printed is recorded on a separate printing member. In the present invention, in each operation mode, the number of color separations recorded on each printing member is different.

In the illustrated embodiment, the DOP printing system 100 includes two modes of operation in accordance with the paper size on which the artwork is to be printed.

In its first mode of operation (Fig. 2A), the DOP printing system 100 is operative to print a desired artwork on an B3 size paper 107. For the B3 paper which is smaller than B2 paper, the corresponding impression cylinder is impression cylinder 106 which is illustrated in a working position, impressing the B3 size paper 107 against the blanket cylinder 104.

In the DOP printing system 100, an artwork to be printed on B3 size paper 107 is preferably printed in a single pass. The term pass refers herein to a cycle of imaging, application of ink, color transfer and impression on the paper.
For an B3 size paper 107, provided that no special colors, i.e. colors other than the four color separations are printed, the imaging system 110 records each two of the four color separations of the four process colors on the two printing members 112 and 114, the four inking assemblies 116, 118, 120 and 122 apply a corresponding ink on each one of the color separations and the blanket cylinder operates to transfer each one of the colors to the paper 107 impressed by the impression cylinder 102.

It will be appreciated that each color separation is recorded on a different half of one of the printing members 112 and 114 so as to provide the four process color separations CMYK.

It will be appreciated that if a special color is to be used, such as gold, the printing members 112 and 114 are replaced by new printing members 112 and 114 and a second pass of imaging, ink application and color transfer and impression takes place.

In its second mode of operation (Fig. 2B) the DOP printing system 100 operates to print on the larger size B2 paper 109 and accordingly the impression cylinder 108 is in a working position.

For printing on the B2 size paper, two passes are required if the artwork to be printed includes the four process colors and more if special colors are required.

In the first pass, two color separations, for example that of cyan and magenta which are schematically indicated by the letters C and M, are recorded on the printing members 112 and 114. Then, two inking assemblies 116 and 120 apply corresponding ink on the printing members 112 and 114, respectively, and the inks are subsequently being transferred to the B2 size paper.
The printing members 112 and 114 are replaced with new ones and in a second pass the yellow and black color separations are recorded on the members 112 and 114, respectively. Then, the inking assemblies 118 and 120 apply yellow and black inks on the members 112 and 114, respectively, and the ink is transferred to the B2 size paper 109 to complete the printing of the artwork.

It will be appreciated that the size of the printing members 112 and 114 is selected to correspond to the size of the color separation of the largest paper to be printed. In the illustrated embodiment, B2 paper is the largest paper to be printed and therefore, the plate cylinder 102 includes on its outer periphery two printing members 112 and 114. However, if one desires that the DOP printing system 100 will print on a larger size paper than B2, it may include only one printing member around its periphery on which one color separation is recorded.

Reference is now made to Figs. 3A - 3B and 4A - 4B which are schematic cross sections of the printing system of Figs. 2A - 2B with a printing substrate feeding system, generally referenced 130, in the first and second operation modes, respectively.

Figs. 3A - 3B correspond to the B3 operation mode illustrated in Fig. 2A and Figs. 4A and 4B correspond to the B2 operation mode illustrated in Fig. 2B.

The feeding system 130 feeds the paper to the DOP printing system 100 and may flip it after the first side thereof has been printed so as to enable duplex printing.

The feeding system 130 preferably comprises three movable paper trays referenced 132, 134 and 136 and three movable conveyers, each of which includes a conveying belt turned in a capstan fashion by two wheels. The belt of the three
conveyers are referenced 140, 141 and 142 and their wheels 240, 240', 241, 241' and 242 and 242', respectively.

The trays 132, 134 and 136 preferably move along a generally vertical direction by any suitable means such as motor means (not shown) so they can be used for duplex printing as described in detail hereinbelow. The trays 132, 134 and 136 store any paper size to be printed by the DOP system 100.

In addition to the capstan fashion turnaround movement of the conveyers belts 140, 141 and 142, the conveyer belts 140 and 141 are preferably capable of pivotal movement wherein the wheels 240 and 241 are fixed and the wheels 240' and 241' are movable so as to direct the conveyer belts to either of the conveying systems 144 and 146 as described hereinbelow.

Fig. 3A illustrates the working position of the trays and conveyers for the first side of printing of the B3 size paper 107. In this working position paper is conveyed from the tray 136 on the upper side of conveyer belt 140 and the bottom side of conveying system 144 of the DOP system 100 to its position between the blanket cylinder 104 and the impression cylinder 106 and after printing thereof, it is conveyed on the upper side of the conveying system 144 via the upper side of the conveying belt 141 to the upper side of the conveying belt 142. When the printed sheet reaches the edge of the conveying belt 142 it falls upside down into the tray 134.

Fig. 3B illustrates the working position of the trays and conveyers for the second side of printing of the B3 size paper 107. In this working position paper is conveyed from the tray 134 via belt 140 and conveying system 144 to its position...
between the blanket cylinder 104 and the impression cylinder 106, and after printing via conveyor belt 141 and 142 to the tray 132.

Similarly, Figs. 4A and 4B illustrate the working positions of the feeding system 130 for printing the first and second sides of B2 size paper 109, respectively. In this embodiment the conveyor belts 140 and 141 operate to direct the paper to the conveying system 146 of the impression cylinder 108.

Additionally, according to a preferred embodiment of the present invention, a suitable printing system, such as an ink jet printing system illustrated schematically be reference 150 and having an ink drying mechanism 149 may be disposed along the paper path between the DOP printing system 100 and the paper trays for printing customized information, such as the address of the recipient of the printed artwork.

It will be appreciated that the term customized information applies herein to any information which has to be printed on part of the printed artwork of a single printing job. Examples are the home address of an individual, the business address of a number of individuals and the serial number or the series number of an artwork.

Reference is now made to Figs. 5A - 7B which illustrate three different embodiments of multibeam imaging of the printing members 112 and 114, i.e. recording simultaneously more than a single line per one rotation of the plate cylinder 102. Figs. 5A - 7B are described by way of example only with respect to B3 size paper printing. It will be appreciated that they are applicable to printing with any other paper size, such as with the B2 size paper 109.

Figs. 5A, 6B and 7A are simplified schematic illustrations which illustrate three embodiments of multibeam imaging of the DOP system 100. For illustration
purposes only, Figs. 5A, 6A and 7B illustrate the two plates 112 and 114, carrying the
four color separations 117, 119, 121 and 123, on the part of the plate cylinder 102
visible in these figures. It will be appreciated that, as illustrated in any of Figs. 2A -
4B, the plate cylinders 112 and 114 preferably occupy a larger portion of the
circumference of the plate cylinder 102 and similarly, the four color separations 117,
119, 121 and 123 occupy generally a large portion of the plate cylinders 112 and 114.

Typically, as best seen in Fig. 7A, in the course of recording the color
separations on the printing plates 112 and 114, the cylinder 102 rotates as indicated
by the arrow 152 about its longitudinal axis 156 while the imaging head 110 translates
as indicated by arrow 154 so as to record the color separations on the printing plates
112 and 114.

Since the imaging head translates during the rotation of the plate
cylinder 102, the recording lines of the imaging system form an imaginary spiral
having an axial translation along its axis 156.

This spiral effect causes misregistration between the four color plates,
this is to say that similar points on the four color separations are not lying on lines
perpendicular to the plate cylinder 102 and therefore, when the ink applied thereto will
be impressed to the paper, the colors of a similar point which form together the final
color of that point on the paper 107 will not superimpose but will have different
locations, i.e. will be misregistered.

The spiral effect is neglected in prior art DOP printing systems employing
a single beam imaging source since the resulting shift between the color separations
are within the limits required for registration therebetween. However, since this effect
is multiplied when multibeam imaging is used to record the color separations, the
present invention provides two different solutions for the spiral effect as described in
detail with respect to Figs. 6A - 7B.

According to a preferred embodiment of the present invention (Figs. 6A -
6B), the color separations are recorded in a spiral like fashion but are shifted
therebetween as described in detail hereinbelow so as to provide adequate
registration therebetween.

According to an alternative preferred embodiment of the present
invention (Figs. 7A - 7B), the registration between the images is provided by recording
all the color separations of the image on the plate cylinder generally perpendicular to
its rotation axis 156 so as to avoid spiral like recording which result in misregistration
between the color separations of the artwork to be printed by the DOP printing system
100.

It will be appreciated that according to a preferred embodiment of the
present invention, the operator selects whether the DOP system 100 will operate
without a correction to the spiral effect (Figs. 5A - 5B) or with either of the corrections
of Figs. 6A - 6B or Figs. 7A - 7B or in a desired combination therebetween.

Fig. 5A illustrates the result of using multibeam imaging without providing
a correction to the spiral recording effect. In the three illustrated embodiments, the
imaging system 110 images four beams 170A, 170B, 170C and 170D (Fig. 7A) on the
printing plate 112. It will be appreciated that this is by way of example only and that
the imaging system 100 may include any desired number of light beams imaged on
the printing plates of the DOP system 100.

As seen in Fig. 5A, the edges of each of the color separations 117, 119,
121 and 123, referenced respectively 317, 319, 321 and 323 are along the imaging
line 252 and so will be any other corresponding points of the color separations 117, 119, 121 and 123. The imaging line 252 as well as any other imaging line, such as the line 262, are diagonal to a line 250 perpendicular to the axis 156 of the plates cylinder 112 and 114. Therefore, the color separations are recorded in a misregistration therebetween.

Fig. 5B illustrates the corresponding alignment of the four data files corresponding to the four color separations 117, 119, 121 and 123 and referenced respectively, 217, 219, 221 and 223, in the memory of the control system 109. Since in the embodiment of Figs. 5A and 5B no correction to the spiral effect is required by the operator of the DOP system 100, the data files 217, 219, 221 and 223 are aligned and are not shifted therebetween.

Figs. 6A and 6B illustrate the result of using multibeam imaging when a correction to the spiral effect is provided by shifting the data files 217, 219, 221 and 223 with respect to each other in the memory of the control system 109 (Fig. 6B).

The resulting imaging lines from a single rotation of the drum cylinder are referenced 252, 254, 256, 258. It will be appreciated that while the recording lines are diagonal with respect to the line 250 which is perpendicular to the axis 156, the edge of each of the color separations 117, 119, 121 and 123, referenced 317, 319, 321 and 323, respectively, are along an imaginary line which is also perpendicular to the axis 156. Therefore, the points 317, 319, 321 and 323 are registered and the color applied thereto will superimpose on the paper 107.

However, since color separations 117, 119, 121 and 123 are diagonal with respect to line 250, i.e. are rotated with respect to the edges of cylinder 102, the resulting printed image will not be parallel to the edges of paper 107 if, as is usually
the case, paper 107 is fed in parallel to the cylinders 102 and 104 edges. Therefore, if the printed image is to be parallel to the edges of paper 107, the paper is fed with a corresponding rotation to that of color separations 117, 119, 121 and 123.

It will be appreciated that, similarly, any other point on the color separations are lying as a result of the correction on the same imaginary line perpendicular to the axis 156 and therefore the separations are in registration therebetween.

It will be appreciated that the distance between the recording lines 252, 254, 256 and 258 is equal to the spacing between the beams 170A, 170B, 170C and 170D of the imaging system 110. Similarly, the lines resulting from a subsequent rotation of the plate cylinder 112 of which only one, line 262 is shown, are evenly spaced and correspond to the spacing between the beams 170A - 170D generated by the imaging system 110.

It is a particular feature of the present invention that the shift between the data files 217, 219, 221 and 223 in the memory of the control system 109 also corresponds to the spacing between the beams 170A - 170D generated by imaging system 110.

The embodiment illustrated in Figs. 7A and 7B illustrates the recording of the color separations of the image generally perpendicular to the rotation axis 156. This is achieved by compensating for the movement of the imaging system with respect to the plate cylinder with a counter movement thereof as described in detail herein below.

As shown in Fig. 7A, the imaging system 110 comprises a guiding support 160 and an imaging optical assembly 162.
The optical imaging assembly 162 preferably comprises a plurality of IR laser diodes, collectively referenced 164, and of which four laser diodes 164A, 164B, 164C and 164D are illustrated for exemplary purposes in the illustrated embodiment, and four light guides which are preferably, but not necessarily fiber optics collectively referenced 166 and of which four, 166A, 166B, 166C and 166D collect the light from each of the IR laser diodes 164, respectively.

The ends of the fiber optics 166 are bundled to provide a linear array multi beam light source 168, the four light beams 168A, 168B, 168C and 168D are imaged by lens 170 on the printing plate 112 as light beams 170A, 170B, 170C and 170D.

A particular feature of the imaging system 110 is that it is capable of two simultaneous movements, one is the movement of the optical assembly 162 along the support 160 as indicated by arrow 154, and the other being the movement of the multibeam light source 168 along a second support 172 as indicated by arrows 174.

The resulting imaging lines of which only one, referenced 252, is shown in Fig. 7B for simplicity, are all parallel to the line 250 and perpendicular to the axis 156 and provide registration therebetween and therefore misregistration between similar points on the four color separations is avoided.

It will be appreciated that the control system 109 activates one of the corrections described above either in response to an input from the operator or in accordance with predetermined definitions which associate different printing applications with different corrections. For example, the system may be defined as providing the correction of the embodiment of Figs. 7A - 7B when high quality brochures are to be printed by the system 100 whereas no correction is required
when law quality publication is printed. In the second mode, the operator selects the
type of printing application and the desired paper size and the control system
activates the corresponding impression cylinder and if required, the appropriate
correction.

It will be appreciated that the preferred embodiments described
hereinabove are described by way of example only and that numerous modifications
thereto, all of which fall within the scope of the present invention, exist. For example,
four color separations may be recorded on each of the printing members 112 and 114
so as to enable use of smaller size paper.

Another example is that while the present invention has been described
hereinabove with respect to paper as the printing substrate, the DOP printing system
100 may operate to print on any suitable printing substrate, such as plastic.

It will be appreciated by persons skilled in the art that the present
invention is not limited to what has been particularly shown and described
hereinabove. Rather, the scope of the present invention is defined only by the claims
that follow:
CLAIMS

1. A computer to press printing system comprising:
   a plate cylinder capable of carrying at least one printing member;
   a multibeam imaging system for recording at least two color
   separations on said at least one printing member;
   at least one inking assembly for applying at least two printing inks
   on corresponding ones of said at least two color separations;
   an impression cylinder; and
   a control system for activating a correction to the misregistration
   between said at least two color separations.

2. A system according to claim 1 wherein said correction comprises
   shifting the data files representing said at least two color separations therebetween,
   whereby similar locations on said at least two color separations are disposed on
   similar imaginary lines circumfering said plate cylinder, said imaginary lines being
   generally perpendicular to the axis of rotation of said plate cylinder.

3. A system according to claim 1 wherein said correction comprises
   translating said multibeam imaging system in a counter direction to the axial direction
   of an imaginary spiral formed by the recording lines thereof, thereby similar locations
   on said at least two color separations are disposed on similar lines of said plate
   cylinder, said lines being generally perpendicular to the axis of rotation of said plate
   cylinder.
4. A system according to any of the previous claims and also comprising at least one additional impression cylinder for impressing a printing substrate of a different size and wherein said control system operates to selectively activate a selected impression cylinder in accordance with the size of the printing substrate to be printed.

5. A system according to any of the previous claims and also comprising a blanket cylinder disposed and acting between said plate cylinder and the selected one of said at least two impression cylinders whereby said system operates as an offset press.

6. A system according to any of the previous claims and also comprising a conveying system for conveying to one of said at least two impression cylinders the printing substrate having the size corresponding thereto.

7. A system according to claim 6 wherein said system for conveying is operative to convey said printed substrate with a rotation corresponding to the rotation of said at least two color separations after shifting.

8. A system according to claim 6 or 7 wherein said conveying system is operative to flip the printed substrate and to convey it again for printing the second side thereof.
9. A system according to any of the previous claims and also comprising an additional printing unit for printing customized information on the printing substrate printed by said computer to press printing system.

10. A system according to claim 9 wherein said printing unit is an ink-jet printing unit which operates to print said customized information while said printing substrate is disposed on said conveying system.

11. A computer to press printing system comprising:
   a plate cylinder capable of carrying at least one printing member;
   an imaging system for recording at least one color separation on said at least one printing member;
   at least one inking assembly for applying at least one printing ink on a corresponding one of said at least one color separation;
   at least two impression cylinders each of which for impressing a printing substrate of a different size; and
   a control system for selectively activating one of said at least two impression cylinders in accordance with the size of the printing substrate to be printed.

12. A system according to claim 11 wherein said imaging system comprises a multibeam imaging system.
13. A system according to claim 12 wherein said multibeam imaging system operates to record at least two color separations on said at least one printing plate.

14. A system according to any of claims 11 - 13 wherein said control system activates a correction to the misregistration between said at least two color separations.

15. A system according to claim 14 wherein said correction comprises shifting the data files representing said at least two color separations therebetween, whereby similar locations on said at least two color separations are disposed on similar imaginary lines circumfering said plate cylinder, said imaginary lines being generally perpendicular to the axis of rotation of said plate cylinder.

16. A system according to claim 14 wherein said correction comprises translating said multibeam imaging system in a counter direction to the axial direction of an imaginary spiral formed by the recording lines thereof, thereby similar locations on said at least two color separations are disposed on similar lines of said plate cylinder, said lines being generally perpendicular to the axis of rotation of said plate cylinder.

17. A system according to any of claims 11 - 16 and also comprising a blanket cylinder disposed and acting between said plate cylinder and the selected
one of said at least two impression cylinders whereby said system operates as an offset press.

18. A system according to any of claims 11 - 17 and also comprising a conveying system for conveying to one of said at least two impression cylinders the printing substrate having the size corresponding thereto.

19. A system according to claim 18 wherein said system for conveying is operative to convey said printed substrate with a rotation corresponding to the rotation of said at least two color separations after said shift.

20. A system according to claim 18 wherein said conveying system is operative to flip the printed substrate and to convey it again for printing the second side thereof.

21. A system according to any of claims 11 - 20 and also comprising an additional printing unit for printing customized information on the printing substrate printed by said computer to press printing system.

22. A system according to claim 21 wherein said printing unit is an ink-jet printing unit which operates to print said customized information while said printing substrate is disposed on said conveying system.
23. A method for operating a computer to press printing system comprising a plate cylinder capable of carrying at least one printing member, a multibeam imaging system for recording at least two color separations on said at least one printing member, at least one inking assembly for applying at least two printing inks on corresponding ones of said at least two color separations and an impression cylinder, the method comprising:

activating a correction to the misregistration between said at least two color separations.

24. A method according to claim 23 comprising, providing said correction by shifting the data files representing said at least two color separations whereby similar locations on said at least two color separations are disposed on similar imaginary lines circumfering said plate cylinder, said imaginary lines being generally perpendicular to the axis of rotation of said plate cylinder.

25. A method according to claim 23 comprising, providing said correction by translating said multibeam imaging system in a counter direction to the axial direction of an imaginary spiral formed by the recording lines thereof, thereby similar locations on said at least two color separations are disposed on similar lines of said plate cylinder, said lines being generally perpendicular to the axis of rotation of said plate cylinder.

26. A method according to any of claims 23 - 25 comprising, providing at least one additional impression cylinder for impressing a printing substrate of a
different size and selectively activating a selected impression cylinder in accordance with the size of the printing substrate to be printed.

27. A method according to any of claims 23 - 26 comprising, providing a blanket cylinder disposed and acting between said plate cylinder and the selected one of said at least two impression cylinders.

28. A method according to any of claims 23 - 27 comprising, conveying to one of said at least two impression cylinders the printing substrate having the size corresponding thereto.

29. A method according to any of claims 23 and 26 - 28 comprising, rotating said printing substrate with a rotation corresponding to the rotation of said at least two color separations after said shifting.

30. A method according to claim 28 or 29 comprising, flipping the printed substrate and conveying it again for printing the second side thereof.

31. A method according to any of claims 23 - 30 comprising, providing an additional printing unit for printing customized information on the printing substrate.

32. A method for operating a computer to press printing system comprising a plate cylinder capable of carrying at least one printing member, an imaging system for recording at least one color separation on said at least one
printing member, at least one inking assembly for applying at least one printing ink on a corresponding one of said at least one color separation and at least two impression cylinders each of which for impressing a printing substrate of a different size, the method comprising:

activating one of said at least two impression cylinders in accordance with the size of the printing substrate to be printed.

33. A method according to claim 32 wherein said imaging system comprises a multibeam imaging system and wherein said method comprising, recording at least two color separations on said at least one printing plate.

34. A method according to claim 32 or 33 comprising, providing a correction to the misregistration between said at least two color separations.

35. A method according to claim 34 comprising, providing said correction by shifting the data files representing said at least two color separations therebetween whereby similar locations on said at least two color separations are disposed on similar imaginary lines circumfering said plate cylinder, said imaginary lines being generally perpendicular to the axis of rotation of said plate cylinder.

36. A method according to claim 34 comprising, providing said correction by translating said multibeam imaging system in a counter direction to the axial direction of an imaginary spiral formed by the recording lines thereof, thereby similar locations on said at least two color separations are disposed on similar lines
of said plate cylinder, said lines being generally perpendicular to the axis of rotation of said plate cylinder.

37. A method according to any of claims 32 - 36 comprising, providing a blanket cylinder disposed and acting between said plate cylinder and the selected one of said at least two impression cylinders.

38. A method according to any of claims 32 - 37 comprising, conveying to one of said at least two impression cylinders the printing substrate having the size corresponding thereto.

39. A method according to any of claims 34 and 36 - 38 comprising rotating said printing substrate with a rotation corresponding to the rotation of said at least two color separations after said shifting.

40. A method according to claim 38 or 39 comprising, flipping the printed substrate and conveying it again for printing the second side thereof.

41. A method according to any of claims 32 - 40 comprising, employing an additional printing unit for printing customized information on the printing substrate.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC(6) : B41C 1/10
US CL : 101/463.1
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
U.S. : 101/130, 141, 142, 216, 218, 450.1, 451, 452, 463.1, 465, 467, 478; 346/74.2, 74.6; 347/115-117

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>EP, A, 0 512 549 (NANLWA) 11 November 1992, see column 8 line 17 to column 9 line 10.</td>
<td>1-41</td>
</tr>
<tr>
<td>Y</td>
<td>US, A, 4,305,332 (PFAHL ET AL.) 15 December 1981, see column 4 lines 22-29.</td>
<td>2-7, 9-19, 23-29, 32-39</td>
</tr>
<tr>
<td>Y</td>
<td>US, A, 4,989,850 (WELLER) 05 February 1991, see column 2 lines 54-67.</td>
<td>21, 22, 31, 41</td>
</tr>
<tr>
<td>Y</td>
<td>US, A, 4,327,641 (GOODWIN ET AL.) 04 May 1982, see column 6 line 63 to column 7 line 7.</td>
<td>8, 20, 30, 40</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:
  "A" document defining the general state of the art which is not considered to be part of particular relevance
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  "O" document referring to an oral disclosure, use, exhibition or other means
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Date of the actual completion of the international search
07 JULY 1996

Date of mailing of the international search report
19 AUG 1996

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Form PCT/ISA/210 (second sheet)(July 1992)