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(54) **Optical writing printer head, printer, and print system**

Optischer Druckerschreibkopf, Drucker, und Druckanordnung

Tête d'écriture optique, imprimante, et système d'impression

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Description

[0001] The present invention relates to an optical writing printer head for use in a printer capable of selecting a colour to be printed by an optical writing wavelength and controlling the density of the developed colour by optical writing power. The present invention provides an optical writing printer head capable of optimising the sizes of apertures for restricting exposure dot sizes to effectively utilise light emitting power, so that miniaturisation and lower cost can be attained.

[0002] Fig. 4 shows a sectional view of a conventional optical writing printer head. An LED 2 for emitting blue light, an LED 3 for emitting green light, and an LED 4 for emitting red light are mounted on a substrate 1, and a cover 5 covers the whole upper surface of the substrate 1. An aperture 25 corresponding to the LED 2, an aperture 26 corresponding to the LED 3, and an aperture 27 corresponding to the LED 4 are provided in the cover 5 to restrict the beam sizes of the blue light, green light, and red light going upward. The sizes of the apertures 25, 26, and 27 are substantially equal to one another. Separators 9 are provided between the LED 2 and the LED 3 and between the LED 3 and the LED 4 to avoid leakage in the lateral direction of light emitted by the respective LEDs, and to separate the light.

[0003] Print media is disposed above this optical writing printer head, and, with regard to every print pixel, the LED 2, the LED 3, and the LED 4 are made to emit light correspondingly to the colour/density of the pixel to carry out exposure. The print media is moved in the right and left directions in Fig. 4. The head is moved in a direction perpendicular to the section in Fig. 4, which is so-called serial writing. By these two movements, the whole plane is exposed.

[0004] As an example of the media used for this printer, a system in which pigment is encapsulated in microcapsules is put to practical use. In this system, pigments of cyan, magenta, and yellow are encapsulated in microcapsules which react to red light, green light, and blue light, respectively. When the capsules are illuminated by the corresponding light, they are cured, while, when the capsules are not illuminated by the corresponding light, they keep their soft state and are easy to break. The media is exposed to red light, green light, and blue light conforming to the colour and density to be printed. After that, pressure is applied to the media to collapse the microcapsules which have not cured to fix the pigment to develop the colour.

[0005] A printer according to this system has been commercially produced as a handy printer that is capable of colour printing with a simple structure.

[0006] In the above conventional example, since photosensitive media is used, it is designed such that the media is not exposed to the external light in the print process. However, since there is some light leakage, in view of the easiness of handling, it is preferable that the sensitivity to light is low. On the other hand, in view of the writing speed, the size of the light source, and the cost, it is preferable that the sensitivity to light is high.

[0007] Practically, since it is necessary to cure the microcapsules to a certain extent of strength, a relatively high level of light power is required to accomplish it. Therefore, for example, one pixel is exposed to light not by one blue LED 2 but by a plurality of blue LEDs to enhance the power.

[0008] In order to miniaturise the printer head, it is preferable that the number of LEDs is decreased, which leads to lower cost. Further, increased light emitting power is accompanied by increased loss requiring a heat radiating mechanism, which is also a disadvantage to the miniaturisation and lower cost.

[0009] EP 0634863 (Xerox Corporation) discloses a selective optical element having four zones of transmission, each zone transmitting a desired wavelength band. The zones for each wavelength are individually calculated to give an effective aperture for each wavelength such that a spot size for all wavelengths meet user specification.

[0010] Accordingly, it is desired to effectively utilise the light generated by the LEDs. One thing which is thought of is to increase the light power by enlarging the apertures for restricting the exposure dot sizes. However, enlarging these apertures leads to decrease in the resolution of print pixels to blur an image.

[0011] According to one aspect of the present invention, there is provided an optical writing printer head comprising a plurality of light sources for respectively emitting light of different wavelengths; and a plurality of apertures each for restricting the exposure dot size of a respective light source, characterised in that the sizes of said apertures for light sources of the same wavelength differ from each other.

[0012] According to another aspect of the present invention, there is provided an optical writing printer head comprising a plurality of light sources for emitting light of different wavelengths for exposing print paper developing colours according to the exposure wavelengths by being exposed to light of different wavelengths, wherein said print paper develops colours of a red region, a green region, and a blue region respectively by being exposed to light emitted from said respective plurality of light emitting sources; and a plurality of apertures each for restricting the exposure dot size of a respective light source, characterised in that the sizes of said apertures have the relationship of the size of the blue apertures being greater than the size of the red apertures which in turn are greater than the size of the green apertures where the apertures correspond to the colours of said light emitting sources for developing the colours of said respective regions.

[0013] By making larger the aperture with respect to a colour that is not important for space recognition to decrease the number of the LEDs for the same colour or to use low-cost LEDs the light emitting power of which is low, the miniaturisation and lower cost is realised.

[0014] Further, when one pixel is exposed to light by a plurality of LEDs of the same colour, since the time for the exposure, pressure application, and development varies, the extent of the influence of light emitted from the respective LEDs on the colour development varies. Therefore, an aperture corresponding to an LED which emits light first and has a great influence is made larger to more effectively utilise the light emitting power. This makes it easy to dispose of the radiated heat, and, by utilising LEDs the light emitting power of which is low, the miniaturisation and lower cost is made possible.

[0015] Preferably, the optical writing printer head carries out writing during its mechanical movement in one direction with respect to the print plane. Preferably, the optical writing printer head comprises a plurality of optical shutters each corresponding to a respective light emitting source.

[0016] Further, according to the present invention, by structuring a printer provided with the above optical writing printer head and connecting the printer with an information processing apparatus, a print system is structured such that the printer prints information transmitted from the information processing apparatus.

[0017] Embodiments of the present invention will now be described by way of further example only and with reference to the accompanying drawings, in which:

Fig. 1 is a sectional view illustrating an embodiment of an optical writing printer head according to the present invention;
Fig. 2 is a plan view illustrating an upper surface of the cover in Fig. 1;
Fig. 3 is a plan view illustrating another embodiment of an optical writing printer head according to the present invention; and
Fig. 4 is a sectional view illustrating a conventional optical writing printer head.

[0018] An embodiment of an optical writing printer head according to the present invention will be described using the sectional view of Fig. 1 and the plan view of Fig. 2. An LED 2 for emitting blue light, an LED 3 for emitting green light, and an LED 4 for emitting red light are mounted on a substrate 1, and a cover 5 covers the whole upper surface of the substrate 1. An aperture 6 corresponding to the LED 2, an aperture 7 corresponding to the LED 3, and an aperture 8 corresponding to the LED 4 are provided in the cover 5 to restrict the beam sizes of the blue light, green light and red light going upward. Separators 9 are provided between the LED 2 and the LED 3 and between the LED 3 and the LED 4 to avoid leakage in the lateral direction of light emitted by the respective LEDs, and to separate the light.

[0019] Exposure to light by only the LED 2 for emitting blue light leads to colour development in blue, light emission by only the LED 3 for emitting green light leads to colour development in green, light emission by only the LED 4 for emitting red light leads to colour development in red, and light emission by all the LEDs leads to white. In the human sense of sight, sensitivity to green is high, and, with regard to red, a gap in the colour is relatively remarkably recognised. Accordingly, enlarging the aperture 7 corresponding to the green LED 3 leads to a blurred image. On the other hand, enlarging the aperture 6 corresponding to the blue LED 2 has only small influence on an image. Therefore, in the sectional view of Fig. 1, the aperture 7 is small, and the apertures 8 and 6 are made larger in this order.

[0020] Next, the upper surface of the cover 5 of Fig. 1 is shown in the plan view of Fig. 2. There are nine apertures in total in the cover 5. The aperture 6 and apertures 10 and 13 correspond to the blue LED. These pore sizes are substantially equal to one another. The aperture 7 and apertures 11 and 14 correspond to the green LED. These pore sizes are also substantially equal to one another. The aperture 8 and aperture 12 and 15 correspond to the red LED. These pore sizes are also substantially equal to one another. For example, when a certain pixel is exposed to red light, the pixel is illuminated by light through the aperture 8. Then, the media moves upward in Fig. 2. When the pixel comes to the position of the aperture 12, the pixel is illuminated by light through the aperture 12. Finally, when the pixel comes to the position of the aperture 15, the pixel is illuminated by light through the aperture 15, and thus the exposure is completed. In order to carry out exposure with regard to the whole plane, the media is moved upward in Fig. 2 as described in the above, and further, the printer head is moved in the right and left directions in Fig. 2 as the exposure is carried out. By this, with regard to one pixel, three times of blue exposure, three times of green exposure, and three times of red exposure are carried out, and thus, nine times of exposure is carried out in total.

[0021] Since the blue apertures are made larger in this way, the efficiency of the light use is high, and, depending on the situation, the number of the blue LEDs can be decreased, or, low-cost LEDs the light emitting power of which is low can be used. Further, in case the same LEDs are used, the input power can be lowered, and thus, the heat loss of the LEDs is decreased to make the heat radiation easier. Especially, with regard to a serial exposure type head in which the printer head moves, the miniaturisation of the head affects the miniaturisation of the whole apparatus, and, since the head moves and it is difficult to form a heat radiating structure, there is a strong demand for effective utilisation of the light power. Further, decreases in the input power of the LEDs leads to decrease in the power source capacity, which is effective in the miniaturisation and lower cost of the printer as a whole.

[0022] Another embodiment of an optical writing printer head according to the present invention will be described using a plan view of Fig. 3. Similarly to Fig. 2, Fig. 3 illustrates the upper surface of the cover 5, which has nine apertures in total. Apertures 16, 19, and 22 cor-

respond to the blue LED, apertures 17, 20, and 23 correspond to the green LED, and apertures 18, 21, and 24 correspond to the red LED. The apertures 16, 17, and 18 are large, and the apertures 22, 33, and 24 are small. On the other hand, the sizes of the apertures 16, 17, and 18 are substantially equal to one another. Similarly, the sizes of the apertures 19, 20 and 21 are substantially equal to one another, and the sizes of the apertures 22, 23, and 24 are also substantially equal to one another. The light emitting operation of the LED light sources is similar to the case of Fig. 2. When a certain pixel is exposed to red light, the pixel is illuminated by light through the aperture 18, then illuminated by light through the aperture 21, and finally illuminated by light through the aperture 24, and thus the exposure is completed.

[0023] In the media used here, microcapsules are cured by light. Since this is chemical reaction, the obtained pigment density varies depending on the time for the exposure, pressure application, and collapse of the capsules. In other words, the effect of the exposure through the aperture 18 which is the first exposure is great while the effect of the exposure through the aperture 24 which is the last exposure is small. Therefore, by making larger the aperture of the first exposure, the light emitting power is effectively used to greatly control the colour development. The last aperture realises fine control of the colour development and assurance of the resolution. Thus, the exposure power as a whole can be decreased.

[0024] Similarly to the case of Fig. 1 and Fig. 2, this makes the miniaturisation and lower cost of the printer head possible.

[0025] Though the description in the above is only with regard to the serial writing system in which the head moves, also in the case of the system in which writing for one line is conducted at a time, similarly, by optimising the sizes of the apertures, it is possible to improve the cost performance.

[0026] Further, by varying the sizes of the apertures depending on the colour of the LEDs and by varying the sizes of the apertures used in writing a plurality of times among those for the same colour, the multiplier effect of the both may be sought.

[0027] Further, the light source is not limited to LEDs, and the present invention can be applied also to systems in which discharge light emitting lamps or filament lamps using wavelength filters and/or optical shutters are used. These also fall within the scope of the present invention.

[0028] It is obvious that the optical writing printer head structured as above is adopted to structure a printer. Further, it is also possible to structure a print system by connecting the printer structured in this way with an information processing apparatus such that the printer prints information transmitted from the information processing apparatus.

[0029] By using an optical writing printer head according to the present invention, the efficiency of utilising the light emitting power is improved, the number, the power, and the sizes of light emitting sources can be reduced, and heat generation is decreased. Thus, the size and the cost of a heat radiating mechanism can be decreased. These effects make it possible to miniaturise and to lower cost of a printer head, and further, a great contribution is made to the miniaturisation and lower cost of a printer set as a whole, and thus, the effects of using the present invention are great.

[0030] It will, of course, be appreciated that the expression "wavelength" as used herein refers to a range of actual values corresponding for example to "red" light rather than one specific numeric wavelength value.

Claims

1. An optical writing printer head comprising:

a plurality of light sources (2, 3, 4) for respectively emitting light of different wavelengths; and
a plurality of apertures (16, 19, 22) each for restricting the exposure dot size of a respective light source (2), **characterised in that** the sizes of said apertures (16, 19, 22) for the respective light source of the same wavelength differ from each other.

2. An optical writing printer head comprising:

a plurality of light emitting sources (2, 3, 4) for emitting light of different wavelengths for exposing print paper developing colours according to the exposure wavelengths by being exposed to light of different wavelengths, wherein said print paper develops colours of a red region, a green region, and a blue region respectively by being exposed to light emitted from said respective plurality of light emitting sources (2, 3, 4); and
a plurality of apertures (6, 7, 8) each for restricting the exposure dot size of a respective light source (2, 3, 4), **characterised in that** the sizes of said apertures (6, 7, 8) have the relationship of the size of the blue apertures (6) being greater than the size of the red apertures (8) which in turn are greater than the size of the green apertures (7) where the apertures (6, 7, 8) correspond to the colours of said light emitting sources (2, 3, 4) for developing the colours of said respective regions.

3. An optical writing printer head as claimed in claim 2, comprising:

a plurality of the light emitting sources (2, 3, 4)

for each of said different wavelengths and a respective aperture (16, 19, 22) for each light emitting source (2) wherein the size of the apertures (16, 19, 22) for the respective light emitting source (2) of the same wavelength differ from each other.

4. An optical writing printer head as claimed in claim 1, carrying out writing during its mechanical movement in one direction with respect to the print plane.

5. An optical writing printer head as claimed in any preceding claim, further comprising a plurality of optical shutters each corresponding to a respective light emitting source (2, 3 4).

6. A printer comprising an optical writing printer head as claimed in any one of claims 1 to 5.

7. A print system comprising a printer as claimed in claim 6 and an information processing apparatus connected thereto.

Patentansprüche

1. Optischer Druckerschreibkopf mit

- mehreren Lichtquellen (2, 3, 4), welche jeweils Licht unterschiedlicher Wellenlängen emittieren; und
- mehreren Öffnungen (16, 19, 22), die jeweils die Belichtungspunktgröße der entsprechenden Lichtquelle (2) einschränken, **dadurch gekennzeichnet, dass** sich die Abmessungen der Öffnungen (16, 19, 22) für die entsprechende Lichtquelle der gleichen Wellenlänge voneinander unterscheiden.

2. Optischer Druckerschreibkopf mit

- mehreren lichtemittierenden Quellen (2, 3, 4), die Licht unterschiedlicher Wellenlängen aussenden, um das Druckpapier zu belichten, welches die Farben entsprechend der Wellenlängen der Belichtung dadurch entwickelt, dass es mit Licht unterschiedlicher Wellenlängen belichtet wird, wobei das Druckpapier Farben eines roten Bereichs, eines grünen Bereichs bzw. eines blauen Bereichs dadurch entwickelt, dass es mit Licht belichtet wird, welches von den jeweiligen lichtemittierenden Quellen (2, 3, 4) ausgesendet wird; und
- mehreren Öffnungen (6, 7, 8), die jeweils die Belichtungspunktgröße der entsprechenden Lichtquelle (2, 3, 4) einschränken, **dadurch gekennzeichnet, dass** die Abmessungen der Öffnungen (6, 7, 8) so gewählt sind, dass die Größe der blauen Öffnungen (6) größer ist als die Größe der roten Öffnungen (8), die wiederum größer als die Größe der grünen Öffnungen (7) ist, wobei die Öffnungen (6, 7, 8) den Farben der lichtemittierenden Quellen (2, 3, 4) entsprechen, welche die Farben der jeweiligen Bereiche entwickeln.

3. Optischer Druckerschreibkopf nach Anspruch 2, **gekennzeichnet durch** mehrere lichtemittierende Quellen (2, 3, 4) für die jeweiligen unterschiedlichen Wellenlängen und eine entsprechende Öffnung (16, 19, 22) für jede lichtemittierende Quelle (2), wobei die Abmessungen der Öffnungen (16, 19, 22) für die entsprechende lichtemittierende Quelle (2) der gleichen Wellenlänge sich voneinander unterscheiden.

4. Optischer Druckerschreibkopf nach Anspruch 1, welcher den Schreibvorgang während seiner mechanischen Bewegung in einer Richtung relativ zur Druckebene durchführt.

5. Optischer Druckerschreibkopf nach einem der vorhergehenden Ansprüche, **gekennzeichnet durch** mehrere optische Verschlüsse, die jeweils einer lichtemittierenden Quelle (2, 3, 4) entsprechen.

6. Drucker mit einem optischen Druckerschreibkopf nach einem der Ansprüche 1 - 5.

7. Drucksystem mit einem Drucker nach Anspruch 6 und einer angeschlossenen Informationsverarbeitungsanlage.

Revendications

1. Tête d'imprimante d'écriture optique comprenant :

une pluralité de sources de lumière (2, 3, 4) destinées à émettre respectivement de la lumière de différentes longueurs d'onde, et
une pluralité d'ouvertures (16, 19, 22) destinées à chacune à limiter la taille de point d'exposition d'une source de lumière respective (2) **caractérisée en ce que** les tailles desdites ouvertures (16, 19, 22) pour la source de lumière respective de la même longueur d'onde diffèrent les unes des autres.

2. Tête d'imprimante d'écriture optique comprenant :

une pluralité de sources d'émission de lumière (2, 3, 4) destinées à émettre de la lumière de différentes longueurs d'onde afin d'exposer un papier d'épreuve développant les couleurs conformément aux longueurs d'onde d'exposi-

tion en étant exposé à de la lumière de différentes longueurs d'onde, où ledit papier d'épreuve développe les couleurs d'une région rouge, d'une région verte et d'une région bleue respectivement en étant exposé à de la lumière émise à partir de ladite pluralité respective de sources d'émission de lumière (2, 3, 4), et
une pluralité d'ouvertures (6, 7, 8) destinées chacune à limiter la taille de point d'exposition d'une source de lumière respective (2, 3, 4), **caractérisée en ce que** les tailles desdites ouvertures (6, 7, 8) présentent la relation consistant **en ce que** la taille des ouvertures du bleu (6) est supérieure à la taille des ouvertures du rouge (8) qui à son tour est supérieure à la taille des ouvertures du vert (7), où les ouvertures (6, 7, 8) correspondent aux couleurs desdites sources d'émission de lumière (2, 3, 4) destinées à développer les couleurs desdites régions respectives.

3. Tête d'imprimante d'écriture optique selon la revendication 2, comprenant :

une pluralité de sources d'émission de lumière (2, 3, 4) pour chacune desdites longueurs d'onde différentes et une ouverture respective (16, 19, 22) pour chaque source d'émission de lumière (2) où les tailles des ouvertures (16, 19, 22) pour la source d'émission de lumière respective (2) de la même longueur d'onde diffèrent les unes des autres.

4. Tête d'imprimante d'écriture optique selon la revendication 1, exécutant une écriture durant son déplacement mécanique dans une direction par rapport au plan d'impression.

5. Tête d'imprimante d'écriture optique selon l'une quelconque des revendications précédentes, comprenant en outre une pluralité d'obturateurs optiques correspondant chacun à une source d'émission de lumière respective (2, 3, 4).

6. Imprimante comprenant une tête d'imprimante d'écriture optique selon l'une quelconque des revendications 1 à 5.

7. Système d'impression comprenant une imprimante selon la revendication 6 et un dispositif de traitement d'informations relié à celle-ci.

FIG.1

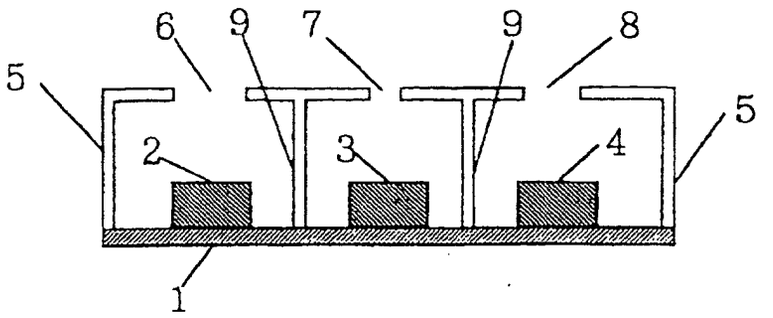


FIG.2

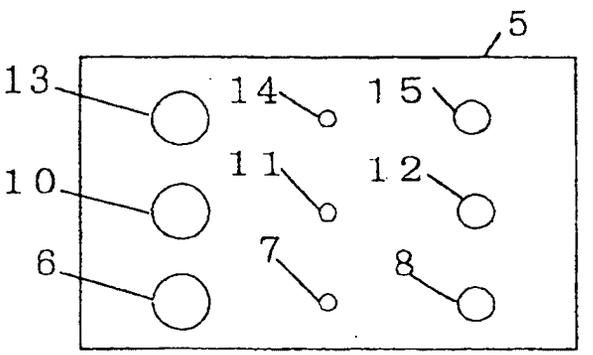


FIG.3

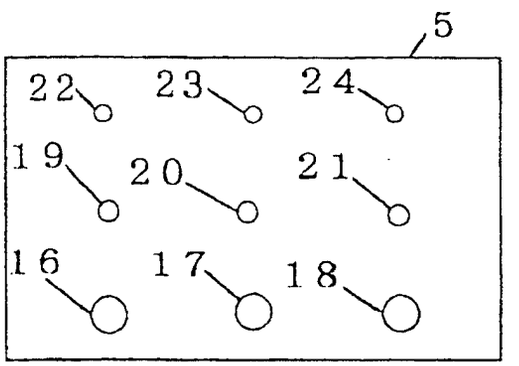


FIG.4 PRIOR ART

