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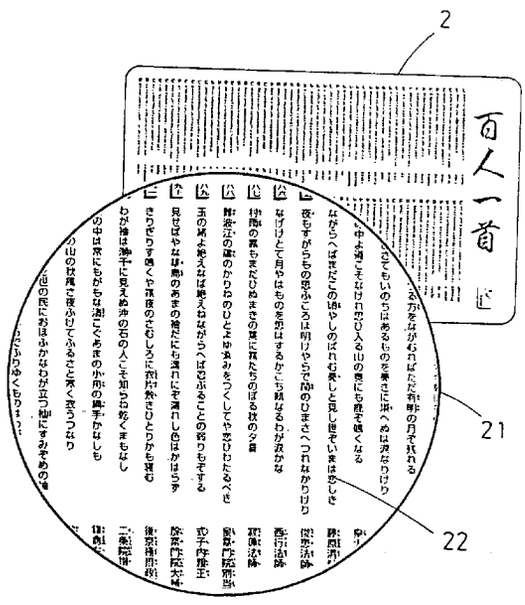
(54) Offset printing method and high-density mini-prints produced by the method.

(57) An offset printing method, comprises a film preparing step of generating four color components of cyan, magenta, yellow, and black by separation of an original with an electronic camera processor and subjecting the components to dot process of a dot generator to form their respective dot positive films ; a plate making step of transferring dot patterns of the dot positive films to four PS plates respectively ; and a printing step of printing the dot patterns of the PS plates onto a given sheet of paper. The dot positive films produced at the film preparing step are arranged to have a more than 300-line resolution. A dampening liquid used at the printing step has a pH of 4 to 7 and a surface tension of 40 to 45 dyne/cm.

Fig.2



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BACKGROUND OF THE INVENTION

The present invention relates to an offset printing method and high-density mini-prints produced by the method.

A consumption of a considerable amount of paper material involves destruction of environment and an incineration of the disposal involves air pollution which causes temperature rise of the earth or Production of ozone holes.

In order to overcome the problem, for example, it is proposed to minimize the size of printed products to minimize the amount of consumption of paper material and to decrease the amount of disposal.

A conventional offset printing method for printing a great number of prints at a time comprises the steps of preparing photographic films, transferring data from the films to press plates, and printing the data onto receptive materials.

1. Preparing of film

An original (on a color film) is subjected to color separation with an electronic camera processor (scanner) into four components: cyan, magenta, yellow, and black. Each color version of the original is then converted by a dot generator to a positive screen film consisting of dots of different sizes.

2. Making of plate

The positive screen film produced by the above step is placed directly on the photosensitive surface of a PS plate (presensitized offset plate) produced by coating a fine abrasive surface of an aluminum plate with a light curable layer and exposed to light to transfer a dot pattern of the original from the film to the aluminum surface.

3. Printing

The PS plate is loaded to a printer machine and used to print the dot pattern on a sheet of paper.

The offset printing method is recognized one of the most popular color print techniques employing for making esthetic calendars, catalogs, and art prints. However, it disappointedly produces as low as a 200 to 300-line resolution in combination with high quality papers.

Any print of the dot pattern with the 200 to 300-line resolution offers only a moderate intelligibility allowing small full-color characters to be read with difficulty even through a glass magnifier. Also, any adjacent dots in the print of an elaborate pattern create a blur deteriorating the quality as a commercial product.

As the print characters used in the print are limited in reduction of the size, they permit a sheet of the print to carry a limited number of data. The more the data are increased, the greater the number of printed sheets are needed. It is not easy to handle or transfer such a bulk of printed sheets.

As a variety of computers and OA machines have been advanced, a bulk of data are neatly stored in flexible disks and optical disks whereby a given size of information can be processed in a minimum of space.

While such computers and OA machines have different formats for operations, it may be true that data on the flexible and optical disks are hardly retrieved for reproduction when having been received from other sources.

On the other hand, photographic films such as microfilms have much reduced sizes of characters reproduced intelligible thereon but are costly when reproducing a great number of products.

It is an object of the present invention, in view of the foregoing aspect, to provide an improved offset printing method of printing a dot pattern with more than a 300-line resolution which is thus increased in market quality and also, high-density mini-prints capable of carrying in a given space a full color pattern of such as small characters and pictures (including dupes of photographs) which remains intelligible when enlarged optically.

SUMMARY OF THE INVENTION

We, the inventors, have successfully developed a concept of the present invention through a series of studies that a clean, blur-free print with a more than 300-line resolution is feasible by using a dot positive film of high precision and having a dampening liquid adjusted to desired levels of pH and surface tension.

The offset printing method according to the present invention comprises a film preparing step of generating four color components of cyan, magenta, yellow, and black by separation of an original with an electronic camera processor and subjecting the components to dot process of a dot generator to form their respective dot

positive films, a plate making step of transferring dot patterns of the dot positive films to four PS plates respectively, and a printing step of printing the dot patterns of the PS plates onto a given sheet of paper. In particular, the dot positive films produced at the film preparing step are arranged to have a more than 300-line resolution and a dampening liquid used at the printing step has a pH of 4 to 7 and a surface tension of 40 to 45 dyne/cm.

The dampening liquid with a desired pH scale may be prepared in any known manner, for example, by using nitrate, e.g. nitric acid or ammonia nitrate, phosphoric acid, phosphate, and their combination. The surface tension may be determined by any appropriate manner. For example, the addition of nonionic surface activator or water causes an increase of the surface tension. The surface tension is decreased when a reagent for pH control is applied.

At the printing step, it is preferable to use an ink material which is higher in hardness and viscosity than conventional ink materials.

Although varying with a class of hue, the ink material may preferably be increased the tackiness by 2 % to 10 % and the hardness by 35 % to 80 %, as compared with conventional ink materials which are commonly used for printing a less than 300-line resolution.

The dot positive film may be prepared directly or produced from a reversal of a negative film. In general, the positive film with a 1000-line or lower resolution is shifted from its negative form.

Also in the film preparation step of the offset printing method of the present invention, a standard highlight setup area is preferably formed with Y1 (%) of dots denoted by the following statement (1) and a standard shadow setup area is with Y2 (%) denoted by the statement (2).

$$Y1 = 0.01X + 2 \quad (1)$$

$$Y2 = -0.0125X + 93.75 + 2.5 \quad (2)$$

(where X is a number of lines on a screen).

A high-density mini-print according to the present invention is produced by the offset printing method which comprises a film preparing step of generating four color components of cyan, magenta, yellow, and black by separation of an original with an electronic camera processor and subjecting the components to dot process of a dot generator to form their respective dot positive films, a plate making step of transferring dot patterns of the dot positive films to four PS plates respectively, and a printing step of printing the dot patterns of the PS plates onto a given sheet of paper. Similarly, a dampening liquid used in the printing step has a pH of 4 to 7 and a surface tension of 40 to 45 dyne/cm.

The high-density mini-print is as small as ranging from telephone cards to name cards in which a full-color pattern of characters and pictures are designed. A plurality of high-density mini-print may form a series which is a larger size in total.

The print may be in the form of a plain card or a booklet.

The print is not limited to a sheet of paper but may be a sheet of polycarbonate, polyvinyl chloride, polyester, or the like.

The size of characters to be printed is not limited but preferably to be under 0.6mm square and more preferably in the range of 0.2 to 0.4mm.

The number of dots to be printed is not limited only if it is over 90,000 (with 300 lines) but preferably 250,000 per square inch (with 500 lines) or more preferably, 490,000 per square inch (with 700 lines).

As the result, the printing of dot pattern can be executed without creating blurs or doublings.

When the pH of the dampening liquid is lower than 4, the ink material will be dried slowly producing doublings. When the pH is high than 7, print blurs appear.

If the surface tension is smaller than 40 dyne/cm, a layer of the dampening liquid becomes thinner than that of the ink material which thus flows over the dampening liquid causing blurs. If it is greater than 45 dyne/cm, the ink layer becomes thinner than the dampening liquid layer thus lowering adhesion to the rubber surface of a cylinder drum and producing breaks of the pattern.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a catalog booklet of a stamp size showing one embodiment of a high-density mini-print of the present invention;

Fig. 2 is a partially enlarged plan view of a poem printed card showing another embodiment of the high-density mini-print of the present invention;

Fig. 3 is a perspective view of a foldable tag showing a further embodiment of the high-density mini-print of the present invention; and

Fig. 4 is a partially enlarged plan view of a sacred writing print showing a still further embodiment of the high-density mini-print of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Some examples of the above embodiments of the present invention will be described.

Example 1

A color original was separated into a cyan, a magenta, a yellow, and a black components, using an electronic camera processor (scanner). Each color component was then dot processed with a dot generator to produce a dot pattern positive film with a 500-line resolution. The positive film was composed of a shadow area having a 85% setup and a highlight area having a 5% setup. The positive films were placed over PS plates respectively produced by a plate making step and exposed to light until the third grade density of a step tablet made by Fiji Film turned to clear.

The PS plates were loaded to a printer machine which was then actuated to start printing. The printing was followed by bookbinding, thus producing a 20-page catalog booklet 1 having a size equal to that of a postal stamp. The catalog booklet 1 is identical to a conventional A4 size booklet in the amount of printed information.

More specifically, characters printed on the catalog booklet 1 have a size of 0.2 square millimeter at minimum and can definitely be read through a glass magnifier. Any dot pattern on the catalog booklet 1 was clear showing no blurs.

As the 20-page catalog booklet 1 is compact in the overall size, a 100-piece name card box can accommodate 270 sets of the catalog booklets 1 for ease of shipment.

The ink materials used for printing were arranged to have a tackiness of 12.9 and a hardness of 576 in cyan color, 12.0 and 291 in magenta, 11.3 and 291 in yellow, and 11.8 and 351 in black. The dampening liquid was also set to a pH of 5 and a surface tension of 44.5 dyne/cm.

Example 2

A color original was separated into a cyan, a magenta, a yellow, and a black components, using an electronic camera processor (scanner). Each color component was then dot processed with a dot generator to produce a dot pattern positive film with a 1000-line resolution. The positive film was composed of a shadow area having a 83% setup and a highlight area having a 7% setup. The positive films were placed over PS plates respectively produced by a plate making step and exposed to light until the first grade density of a step tablet made by Fiji Film turned to clear.

After the PS plates were loaded to a printer machine and driven, a printed card 2 carrying a list of poems was produced as shown in Fig. 2, where characters of 0.2 square millimeter in size are denoted by 22.

The characters 22 on the card 2 had a gradation of colors and were clearly read through a glass magnifier 21 without discrepancy. A picture pattern printed together with the characters 22 was also distinct showing no blurs.

The ink materials used for printing were arranged to have a tackiness of 12.9 and a hardness of 576 in cyan color, 12.0 and 291 in magenta, 11.3 and 291 in yellow, and 11.8 and 351 in black under the standard conditions including a temperature of about 20oC and a humidity of 60 % to 65 %. The dampening liquid was set to a pH of 6 and a surface tension of 42 dyne/cm.

Example 3

A color original was separated into a cyan, a magenta, a yellow, and a black components, using an electronic camera processor (scanner). Each color component was then dot processed with a dot generator to produce a dot pattern positive film with a 1500-line resolution. The positive film was composed of a shadow area having a 77% setup and a highlight area having a 14% setup. The positive films were placed over PS plates respectively produced by a plate making step and exposed to light until the first grade density of a step tablet made by Fiji Film turned to clear.

After the PS plates were loaded to a printer machine and driven, a printed tag 3 of 3 cm by 4 cm in size was produced as shown in Fig. 3. The printed tag 3 comprises a zigzag-folded catalog sheet 33 bonded between a front sheet 31 and a back sheet 32.

The ink materials used for printing were arranged to have a tackiness of 12.9 and a hardness of 576 in cyan color, 12.0 and 291 in magenta, 11.3 and 291 in yellow, and 11.8 and 351 in black. The dampening liquid was set to a pH of 6 and a surface tension of 42.4 dyne/cm.

The tag 3 is useful when attached to a corresponding commercial product as carrying detailed information of the product or other products of a company.

Example 4

The same procedure as of Example 1 was conducted except that the setup was 84 % in the shadow area and 6 % in the highlight area. A resultant print 4 was similar in the size to a postal stamp, as shown in Fig. 4, carrying 262 characters of a sacred writing accompanied with kana letters or subscripts.

The characters on the print 4 were printed in colors having a size of 0.2 square millimeter and read clearly through a glass magnifier 41 without discrepancy. Non of the 42 characters within a scope of the magnifier 41 was indistinct. A picture pattern printed together with the characters was also distinct showing no blurs.

Example 5

The same procedure as of Example 1 was executed except that the setup was 75 % in the shadow area and 15 % in the highlight area. A resultant print was similar to the catalog booklet 1 of a postal stamp size shown in Fig. 1.

The size of characters printed on the print was 0.2 square millimeter and read clearly through a glass magnifier without discrepancy. Also, a picture pattern printed together with the characters was also distinct showing no blurs.

Example 6

The same procedure as of Example 1 was carried out except that the tackiness and the hardness of the ink material were set to 12.6 and 320 respectively in cyan, 11.8 and 350 in magenta, 10.2 and 214 in yellow, and 11.8 and 224 in black. A resultant print was similar to the catalog booklet 1 of a postal stamp size shown in Fig. 1.

The size of characters printed on the print was 0.2 square millimeter and read clearly through a glass magnifier without discrepancy. Also, a picture pattern printed together with the characters was also distinct showing no blurs.

Comparative Example 1

The same procedure as of Example 1 was executed except that the pH of the dampening liquid was set to 7.5, producing a print similar to the catalog booklet 1 of Example 1. Characters printed on the print were blurred and hardly intelligible with a glass magnifier when their size was less than 1.0 square millimeter.

Comparative Example 2

The same procedure as of Example 1 was conducted except that the pH of the dampening liquid was set to 3.5, producing a print similar to the catalog booklet 1 shown in Fig. 1. Characters printed on the print exhibited blurs and doublings.

Comparative Example 3

The same procedure as of Example 2 was conducted except that the surface tension of the dampening liquid was set to 39 dyne/cm, producing a print similar to the printed card 2 of Example 2. Characters printed on the print exhibited blurs and doublings.

Comparative Example 4

The same procedure as of Example 2 was conducted except that the surface tension of the dampening liquid was set to 47 dyne/cm, producing a print similar to the printed card 2. Characters printed on the print exhibited blurs and doublings.

Table 1 shows the results of experiments regarding blur, doubling and intelligibility of prints obtained in the above examples 1-6 and the comparative examples 1-4.

Table 1 shows the degrees of blur, doubling, and intelligibility as expressed by the grade symbols ⓞ , ○ , and ×.

Blur

ⓞ indicates that no blur is visible when magnified 3 times, ○ is that no visible blur is found but some when magnified 3 times, and × denotes the appearance of visible blurs.

Doubling

ⓞ represents no doubling, ○ indicates some doublings but not critical, and × denotes the appearance of critical doublings.

Intelligibility

The intelligibility was examined with reference to characters of a 0.2 square millimeter size. ⓞ represents excellent intelligibility, ○ is good intelligibility, and × is poor intelligibility.

The mini-prints produced by the offset printing method of the present invention are illustrative and not limited to those of Examples 1 to 6. For example, the printed card 2 of Example 2 may carry any other information of e.g. business activities than the list of poems. Such business cards are useful to give instance responses to questions of customers. As the cards are compact in the size, they are taken about in a pocket without difficulty.

It is a good idea to provide the prints with size decreased but finely visible patterns of fine arts, illustrations, photographs, maps, time-tables, telephone books, and so on which require higher precision. Especially, a hand-sized telephone book is useful for carrying about with a pocket telephone. It is also possible to carry about an emergency manual in a compact size. Also, the print of the present invention may be implemented on an A4 sheet or larger size of paper which is then folded down into a smaller size for ease of carrying.

The prints of digital information such as two-dimensional matrix codes can be made with equal success. Cards or tickets with such two-dimensional matrix codes printed thereon may be discriminated from others, thus preventing the sneaking of fakes.

TABLE 1

	BLUR	DOUBLING	INTELLIGIBILITY
EXAMPLE 1	◎	◎	◎
EXAMPLE 2	◎	◎	◎
EXAMPLE 3	◎	◎	◎
EXAMPLE 4	◎	◎	◎
EXAMPLE 5	◎	◎	◎
EXAMPLE 6	○	○	○
COMPARATIVE EXAMPLE 1	×	×	×
COMPARATIVE EXAMPLE 2	×	×	×
COMPARATIVE EXAMPLE 3	×	×	×
COMPARATIVE EXAMPLE 4	×	×	×

Claims

1. An offset printing method, comprising:
a film preparing step of generating four color components of cyan, magenta, yellow, and black by

separation of an original with an electronic camera processor and subjecting the components to dot process of a dot generator to form their respective dot positive films;

a plate making step of transferring dot patterns of the dot positive films to four PS plates respectively; and

a printing step of printing the dot patterns of the PS plates onto a given sheet of paper, characterized in that:

the dot positive films produced at the film preparing step are arranged to have a more than 300-line resolution; and

a dampening liquid used at the printing step has a pH of 4 to 7 and a surface tension of 40 to 45 dyne/cm.

2. An offset printing method as claimed in claim 1, wherein

an ink material used in the printing step is higher in hardness and viscosity as compared with an ink material used for printing a less than 300-line resolution.

3. An offset printing method as claimed in claims 1 and 2, wherein

in the film preparation step, a standard highlight setup area is formed with Y1 (%) of dots denoted by the following statement (1) and a standard shadow setup area is with Y2 (%) denoted by the statement (2).

$$Y1 = 0.01X + 2 \quad (1)$$

$$Y2 = -0.0125X + 93.75 + 2.5 \quad (2)$$

(where X is a number of lines on a screen).

4. A high-density mini-print printed by an offset printing method as claimed in claims 1, 2 and 3.

5. A high-density mini-print as claimed in claim 4, wherein

the number of dots is more than 300-line.

6. A high-density mini-print as claimed in claims 4 and 5, wherein

The size of characters is under 0.6mm square.

Fig.1

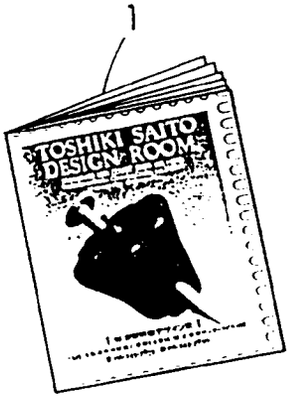


Fig.2

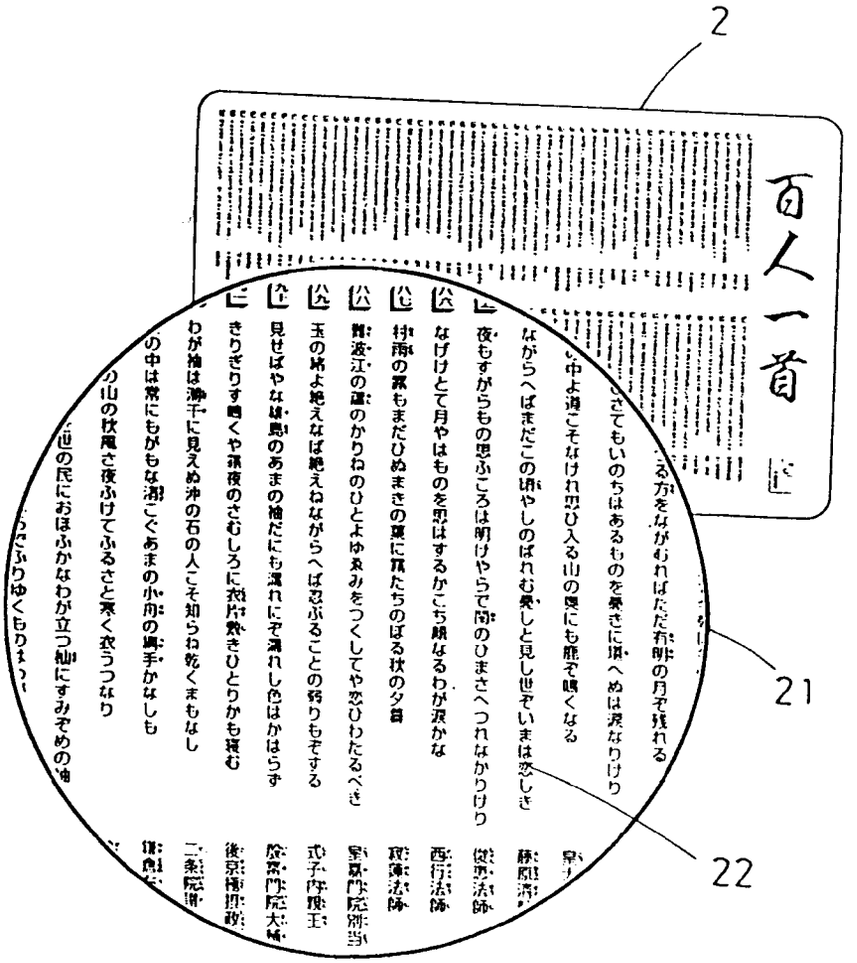


Fig.3

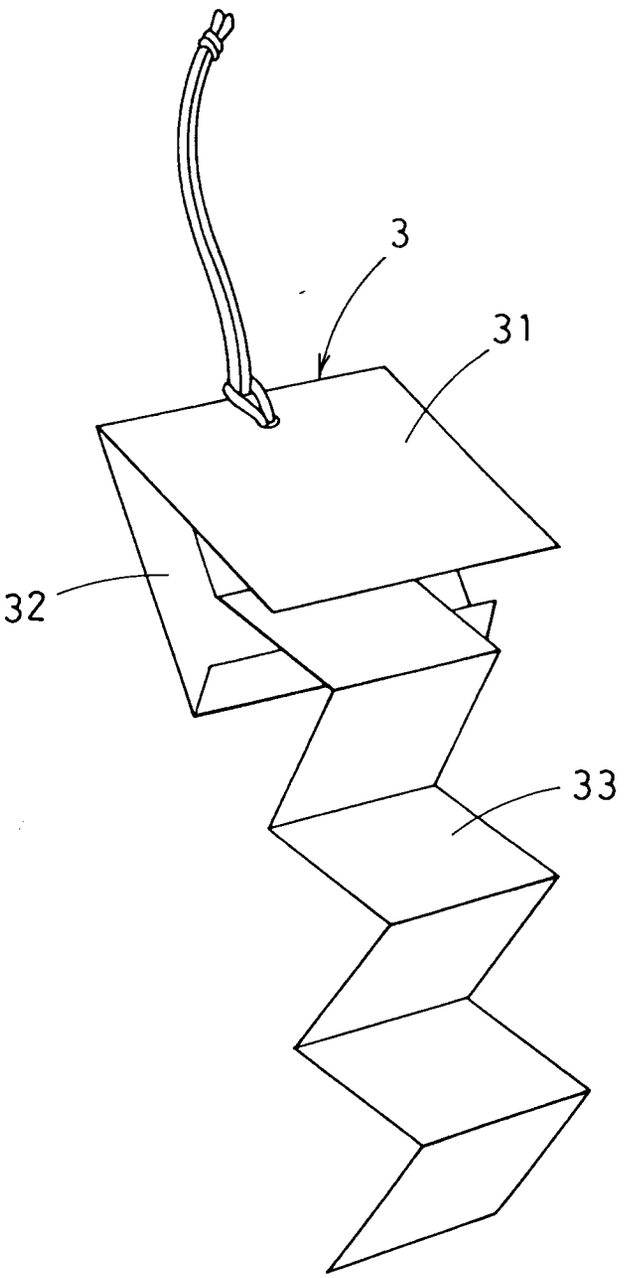
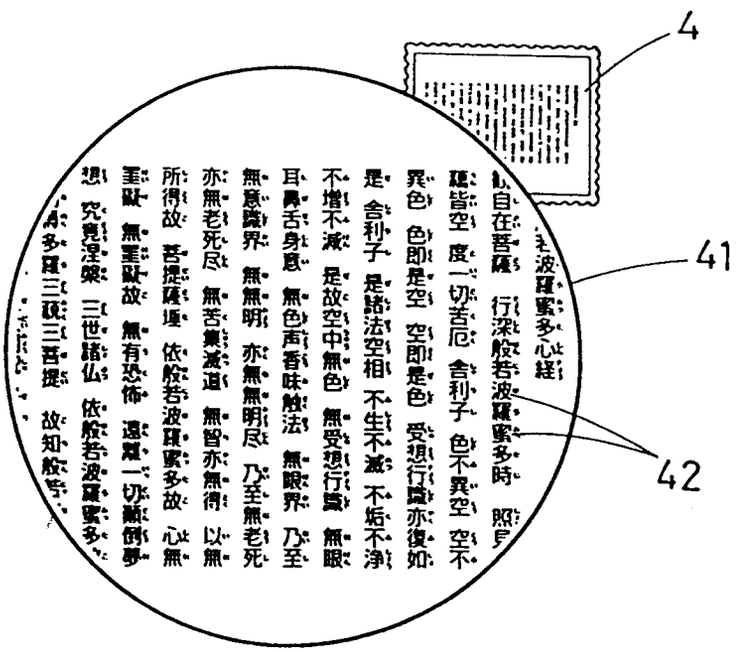


Fig.4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摩訶般若波羅蜜多心經
觀自在菩薩 行深般若波羅蜜多時 照見
五蘊皆空 度一切苦厄 舍利子 色不異空 空不
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不增不減 是故空中無色 無受想行識 無眼
耳鼻舌身意 無色聲香味觸法 無眼界 乃至
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想 究竟涅槃 三世諸佛 依般若波羅蜜多
故 得阿耨多羅三藐三菩提 故知般若

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EUROPEAN SEARCH REPORT

Application Number
EP 95 30 0900

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	ELECTRONIC IMAGING '88. INTERNATIONAL ELECTRONIC IMAGING EXPOSITION AND CONFERENCE., 28 March 1988 - 31 March 1988 ANAHEIM, CA, USA, pages 916-917, J.F.DUNN 'A new device for digitizing color slides into computer based desktop publishing systems' * abstract *	1-6	B41M1/18 B41M1/06
Y	KWALITEITSBEHEERSING MEERKLEUREN OFFSETDRUKKEN. VOORWARDEN VOOR KOPIE EN DRUK., AMSTERDAM 1982, G.WERNER * page 13 * * page 53 * * page 56 - page 57 *	1-6	
Y	EP-A-0 412 455 (KAO CORP. & TOYO INK MANUFACTURING CO. LTD. & TOPPAN PRINTING CO. LTD.) * table 1 *	1-6	TECHNICAL FIELDS SEARCHED (Int.Cl.6) B41M B41N
Y	WO-A-84 02142 (INMONT CORPORATION) * page 1, line 8 - page 2, line 25; claim 1; example 2 *	1-6	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	29 May 1995	Balsters, E

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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