

PATENT APPLICATION FORM  
COMMONWEALTH OF AUSTRALIA  
Patents Act 1952

Regulation 9

600918

We, HOECHST AKTIENGESELLSCHAFT  
of 6230 Frankfurt, Main 80, Germany

hereby apply for the grant of a Standard Patent for an invention  
entitled PROCESS FOR THE PRODUCTION OF A MULTI-COLORED IMAGE

which is described in the accompanying complete specification.

For a Convention application - details of basic application-

| <u>Number</u> | <u>Country</u> | <u>Date of Application</u> |
|---------------|----------------|----------------------------|
| P 38 01 345.2 | Germany        | 19th January, 1988         |

Our address for service is ARTHUR S. CAVE & CO., Patent and Trade  
Mark Attorneys, Level 10, 10 Barrack Street, Sydney, New South  
Wales, Australia 2000.

Dated this 20th day of December, 1988.

HOECHST AKTIENGESELLSCHAFT  
By Its Patent Attorneys,  
ARTHUR S. CAVE & CO.

*P.R. Taylor*  
P.R. TAYLOR F.I.P.A.A.

To:  
Commissioner of Patents

ARTHUR S. CAVE & CO.  
PATENT AND TRADE MARK ATTORNEYS  
SYDNEY

ASC 1

APPLICATION ACCEPTED AND AMENDMENTS  
ALLOWED.....20.2.91.....

PATENT DECLARATION FORM (CONVENTION)  
COMMONWEALTH OF AUSTRALIA

Patents Act 1952

DECLARATION IN SUPPORT OF A CONVENTION APPLICATION  
FOR A PATENT

In support of the Convention application made for a patent for an invention  
entitled: PROCESS FOR THE PRODUCTION OF A MULTI-COLORED IMAGE

I/We ..... PAUL ROBERT TAYLOR ..... (full name of declarant)  
of ... Level 10, 10 Barrack St, Sydney NSW 2000 ..... (full address)  
do solemnly and sincerely declare as follows:-

1. I am/~~We~~ are authorised by HOECHST AKTIENGESELLSCHAFT the applicant for  
the patent to make this declaration on its behalf.

2. The basic Application(s) as defined by Section 141 of the Act was/were  
made in the following country or countries on the following date namely:-  
in FEDERAL REPUBLIC OF GERMANY on 19 JANUARY 1988 by HOECHST AKTIENGESELLSCHAFT

3. INE GRAMM of Bingertstrasse 6, 6200 Wiesbaden, Federal Republic of  
Germany; DIETER MOHR of Eaubonner Strasse 8, 6510 Budenheim, Federal Republic  
of Germany; and DIETER HAAS of Stettiner Strasse 15, 6203 Hochheim, Federal  
Republic of Germany are the actual inventors of the invention and the facts  
upon which the applicant(s) are entitled to make the application are as  
follows:

The Applicant is the Assignee of the said invention from the actual inventors.

4. The basic application(s) referred to in paragraph 2 of this Declaration  
was the first application(s) made in a Convention country in respect of the  
invention the subject of the application.

Declared at Sydney this 14th day of February, 1991.

To: The Commissioner of Patents

ARTHUR S. CAVE & CO.

PATENT AND TRADE MARK ATTORNEYS  
SYDNEY

PR Taylor  
Signature of Declarant(s)

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**(12) PATENT ABRIDGMENT      (11) Document No. AU-B-27309/88**  
**(19) AUSTRALIAN PATENT OFFICE      (10) Acceptance No. 609918**

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(54) Title  
**PROCESS FOR THE PRODUCTION OF A MULTI-COLORED IMAGE**

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(51)<sup>5</sup> **G03F 009/00**

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(56) Prior Art Documents  
**EP 182031**  
**EP 179274**

(57) Claim

1. Process for the production of a multi-colored image, which comprises laminating a photosensitive element comprising a temporary support (A), a photosensitive layer (B) containing a dye or a pigment of a particular primary color, and an adhesive layer (C) on top of the photosensitive layer, with the application of heat and pressure, to an image receptor (D), exposing the layer under the corresponding color separation, peeling off the temporary support (A) before or after exposure, and developing the layer (B) into a first image of a primary color by washing out the non-image areas and producing, in the same manner, by transferring, exposing and developing on top of the first image, at least one additional image of another primary color in register with the first image, wherein at least one image of a primary color is produced from

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(10) 609918

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a negative-working photosensitive element and at least one image of a primary color is produced from a positive-working photosensitive element and all images of different primary colors are developed with the same developer.

2. A process as claimed in claim 1, wherein a positive-working photosensitive element comprising a 1,2-naphthoquinone diazide as the photosensitive compound and a negative-working photosensitive element comprising a diazonium salt polycondensation product as the photosensitive compound are used.

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COMPLETE SPECIFICATION

(ORIGINAL)

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Section 49 and is correct for  
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TO BE COMPLETED BY APPLICANT

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Complete Specification for the invention entitled PROCESS FOR  
THE PRODUCTION OF A MULTI-COLORED IMAGE.

The following statement is a full description of this invention  
including the best method of performing it known to me:-

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ASC 49

## Process for the production of a multi-colored image

In multicolor printing, color proofing is, in general, carried out to allow correction of the color separations used in the exposure of printing plates. The proof must be a correct duplication of the desired screen or line image and should neither increase or reduce the tonal values of the colors. Visual examination of a color proof should show defects in the original, allow the best color rendition to be expected from press printing of the material, reproduce the correct gradation of all colors and indicate the need, if any, for subduing one of the colors and/or give directions for altering the film original before making the printing plates.

Color proofing for multicolor printing has hitherto been made with the aid of proof prints. In this process, all the steps necessary for the actual multicolor printing must be taken. A color proofing process of this kind is costly and time-consuming and, therefore, other color proofing methods have been developed, which are intended to come up to the quality of a proof print. Two color proofing methods using photosensitive color proofing films are known in the art, namely the surprint type and the overlay type, in which images of different primary colors are produced and are either copied one on top of the other or superposed upon each other.

In the overlay method of color proofing, an independent transparent plastic film is used for producing an image of a primary color from each color separation. A plurality of such transparent films carrying images of corresponding colors are then superposed upon each other on a white sheet to produce a color proofing sheet. The overlay method has the disadvantage that the superposed plastic supports tend to darken the multi-colored image, which means that the impression given by the color proofing sheet thus prepared is widely different from the prints obtained with the aid of a proof press. The primary advantage of this method is that it is quick and corrections made can be checked by combining any two or more colors in register.

In the surprint method of color proofing, a color proof is prepared by successively producing images of different primary colors from different color separations on a single receptor sheet. For this purpose, an opaque support is used, which is coated successively with photosensitive layers of corresponding colors such as described, for example, in US-A 3,671,236. An advantage of the surprint method is that the color saturation is not influenced by superposed plastic supports. This method more closely resembles the actual printing process and eliminates the color distortion inherent in the overlay method.

In US-A 3,721,557 a method of transferring colored images is described, in which a stripping layer is

coated between the photosensitive layer and the support. When the photosensitive layer is exposed and developed, the more soluble portions of the layer are selectively removed to produce a visible image. The image-carrying support is pressed against a suitable adhesive-coated receptor member and subsequently, the support is stripped to accomplish the transfer of the image. A fresh layer of adhesive is applied to the receptor for each subsequent image transfer.

In Example 1 of US-A 4,093,464 a color proofing method is described, in which positive-working photosensitive layers, which are dyed in the desired primary colors and are, in each case, present on a temporary support film, are exposed and developed on this film. The images of different primary colors thus obtained are transferred to an image receptor, for example, a printing paper, by laminating in register.

These methods have the disadvantage that lamination in register requires very accurate work and is, consequently, extremely expensive. Moreover, laminating of developed images can only be performed by means of layers which are still sufficiently thermoplastic, i.e., in general, positive layers are required, which additionally contain certain plasticizing additives.

According to US-A 4,260,673 a multi-colored proof is prepared by laminating a multilayer material formed of a dyed and an undyed positive photosensitive layer, an adhesive layer, a release layer and a temporary support film to an image receptor comprising a white paper having a water-resistant finish; the multilayer material is exposed on this paper and then developed to give an image of a primary color. The following images of corresponding primary colors are produced in the same fashion on top of the first image. According to this procedure, the production of multi-colored images in register is facilitated, since it is only the exposure that has to be performed in register.

In EP-A 182 031 a similar surprint method of color proofing is described, which uses photosensitive layers on a basis of negative-working diazonium compounds. The image receptor employed is a polyester film which has been dyed white. The surface of the final image can be rendered matte to eliminate any undesirable gloss. A corresponding method using positive-working materials is described in EP-A 179,274.

Reversal plates which are now available - i.e. positive photosensitive printing plates that are subjected to a special sequence of treatment steps and can then also be processed into negative images - make it possible to copy positive and negative originals together on one and the same plate (photocomposing). Printing plates

of this type are, for example, described in EP-A 131 238 and EP-A 133 216. The reversal technique offers various possibilities of copying image elements which are present in the form of negative and positive film masks, side by side and in superimposed arrangement to produce a complete image on the printing plate. Since this method is advantageously employed, in particular, in the production of multicolor prints, it is increasingly desirable to be able to simulate the printed image to be expected by means of a color proofing system, even before the printing plate is exposed under the corresponding film originals. Any of the presently known color proofing methods, as employed in the graphic industry, are based on the construction of a multi-colored image from individual images of one primary color each, which are produced either exclusively of positive-working photosensitive elements or exclusively of negative-working photosensitive elements. It is thus impossible to simulate a printed multi-colored image which was produced with printing forms prepared by the photocomposing method, using the same film masks or film originals as employed for exposing the plate. In any of the hitherto described color proofing processes, the image elements that are present as positive color separations and the image elements that are present as negative color separations can only be produced separately from one another by means of a positive-working and a negative-working color proofing system. Consequently, an evaluation of the complete

image is out of the question. In the case of this specific application, it is thus impossible to achieve the object of any color proofing process, namely to produce a multi-colored image which closely resembles the intended multicolor print.

Combining an image of a primary color from negative and positive originals on a positive-working color proofing film, by photocomposing and reversal development, in analogy to the production of the printing forms, proves impracticable, because the support and intermediate layers or adhesive layers, as required in the surprint process, are damaged by the heating operation which must be carried out in the reversal development.

It is therefore an object of the present invention to propose a color proofing method, in which a multi-colored image - corresponding to the imaging of a plate according to the photocomposing method - is combined true to register from image elements carrying positive and negative images and in which all images of different primary colors can be produced using the same processing aids, in particular, the same developers.

The invention provides a process for the production of a multi-colored image, which comprises laminating a photosensitive element comprising a temporary support (A), a photosensitive layer (B) containing a dye or a pigment of a particular primary color, and an adhesive

layer (C) on top of the photosensitive layer, with the application of heat and pressure, to an image receptor (D), exposing the layer under the corresponding color separation, peeling off the temporary support (A) before or after exposure, and developing the layer (B) into a first image of a primary color by washing out the non-image areas and producing, in the same manner, by transferring, exposing and developing on top of the first image, at least one additional image of another primary color in register with the first image.

In the process of the present invention, at least one image of a primary color is produced from a negative-working photosensitive element and at least one image of a primary color is produced from a positive-working photosensitive element and all images of different primary colors are developed with the same developer.

According to the process of the present invention the final multi-colored image is built up on the image receptor D in any succession, by means of the images of different primary colors of the positively and negatively produced image elements.

For carrying out the process of the present invention a photosensitive element is used, which generally comprises a temporary support with a surface of low adhesiveness, a colored photosensitive layer on the surface of the support and an adhesive layer applied to the photo-

sensitive layer. Optionally additional layers can be employed, which contain anti-halation agents, adhesion promoters or release agents.

In a preferred embodiment the support comprises a dimensionally and chemically stable polyester film, in particular, of polyethylene terephthalate, which generally has a thickness ranging from about 25 to 250  $\mu\text{m}$ , preferably from about 50 to 130  $\mu\text{m}$  and particularly from about 50 to 75  $\mu\text{m}$ . The surface of the temporary support may be smooth or have a rough texture.

In general, the photosensitive layer of the photosensitive element comprises a photosensitive compound, a colorant, a binder and, if required, additional ingredients, for example, plasticizers, acid stabilizers, surfactants, antistatic agents, uv absorbers and residual solvents.

Suitable positive-working photosensitive compounds include, in particular, o-quinone diazides, for example, esters of 1,2-naphthoquinone-2-diazide-5-sulfonic acid and polyhydric phenols, such as 2,3,4-trihydroxybenzophenone or the reaction product of 2 mols of this compound with 1 mol of formaldehyde. Compounds of this kind are described, for example, in US-A 4,407,426; 4,266,001; 3,106,365; 3,148,983 and 3,201,239. Preference is given to compounds that are soluble in organic solvents.

Diazonium salt polycondensation products are preferably used as the photosensitive compounds for negative-working materials. The particularly preferred compounds comprise polycondensation products as described in US-A 3,849,392. Other suitable compounds are specified in US-A 4,436,804. The diazonium compounds of choice are preferably soluble in organic solvents.

Binding resins which can be used for positive and negative layers comprise polyvinyl acetals, e.g. polyvinyl butyral, and alkali-soluble polymers, such as copolymers of styrene and maleic acid half esters or mixtures thereof. Such resins include Butvar B 72, B 76 and B 90, and Scripset 540 or 550, all manufactured by Monsanto. An important resin selection criterion is that it must have good film forming properties.

The colorants useful for the present invention include various dyes and pigments. In the most preferred embodiment, the pigments used have an average particle size of about 1  $\mu$ m or less.

Plasticizers of the phthalate or phosphate type may optionally be incorporated into the photosensitive layer. Preferred plasticizers include dibutyl phthalate and dimethyl phthalate. Suitable acid stabilizers comprise, for example, phosphoric acid and p-toluene sulfonic acid.

These components may be dissolved in compatible solvents, such as ethanol, 2-methoxy ethanol, diacetone alcohol, butyrolactone, propylene glycol monomethyl ether or butanone and are then applied to the support surface and dried. The dried photosensitive layer preferably has a layer weight ranging from 0.1 to 5.0 g/m<sup>2</sup>, in particular, from 0.5 to 2.0 g/m<sup>2</sup>.

The positive-working layers preferably contain from 15 to 60 % by weight, particularly from 20 to 50 % by weight, of the photosensitive compound; from 10 to 40 % by weight, particularly from 13 to 34 % by weight, of the colorant; from 20 to 75 % by weight, particularly from 30 to 70 % by weight, of the binder; and up to about 20 % by weight, preferably up to 15 % by weight and, in particular, from 12 to 15 % by weight, of the plasticizer.

The coating solutions for the positive-working photosensitive layers typically have the following compositions in parts by weight:

|                                                                                                                                                  | Cyan<br>(P <sub>C</sub> ) | Yellow<br>(P <sub>Y</sub> ) | Magenta<br>(P <sub>M</sub> ) | Black<br>(P <sub>B</sub> ) |
|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------|------------------------------|----------------------------|
| diacetone alcohol                                                                                                                                | -                         | 11.7                        | -                            | -                          |
| butanone                                                                                                                                         | 35.52                     | 34.45                       | 24.23                        | 38.62                      |
| butyrolactone                                                                                                                                    | 22.60                     | 11.15                       | 24.04                        | 5.74                       |
| propylene glycol monomethyl ether                                                                                                                | 34.76                     | 35.21                       | 44.94                        | 48.34                      |
| copolymer of styrene and maleic<br>acid partial ester (M <sub>n</sub> 50 000;<br>acid number 185; Scripset 540)                                  | 1.60                      | 2.01                        | 2.15                         | 2.39                       |
| copolymer of styrene, maleic<br>anhydride and maleic acid partial<br>ester; MW 1900; acid No. 220 (SMA 2625)                                     | 1.74                      | 1.17                        | -                            | 0.60                       |
| polyvinyl butyral M <sub>w</sub> 40,000; 80 % of<br>vinyl butyral, 19 % of vinyl alcohol,<br>1 % of vinyl acetate units (Butvar B 90)            | 0.58                      | 0.59                        | 0.67                         | 0.30                       |
| ester obtained from 6 mols of<br>1,2-naphthoquinone-2-diazide-5-<br>sulfonic acid and 1 mol of bis-(5-<br>benzoyl-2,3,4-trihydroxyphenyl)methane | 2.09                      | 2.58                        | 2.81                         | 2.72                       |
| phthalocyanine blue                                                                                                                              | 1.11                      | -                           | -                            | -                          |
| yellow pigment                                                                                                                                   | -                         | 1.08                        | -                            | -                          |
| magenta pigment                                                                                                                                  | -                         | -                           | 1.15                         | -                          |
| black pigment                                                                                                                                    | -                         | -                           | -                            | 1.29                       |
| optical density                                                                                                                                  | 1.2                       | 1.0                         | 1.4                          | 1.6                        |

In the negative-working layers the components are preferably contained in the following amounts:

the photosensitive compound from about 5 to 40 % by weight, particularly from about 10 to 35 % by weight; the colorant from about 10 to 40 % by weight, particularly from about 13 to 34 % by weight; the binder from about 25 to 80 % by weight, particularly from about 32 to 75 % by weight; the plasticizer, if any, up to about 20 % by weight, preferably up to about 15 % by weight and, in particular, from about 12 to 15 % by weight; and the acid stabilizer, when one is used, up to about 10 % by weight.

Below, two typical compositions of the coating solutions for the negative-working photosensitive layers are given:

I.

|                                                                                            | Cyan<br>(NI <sub>C</sub> ) | Yellow<br>(NI <sub>Y</sub> ) | Black<br>(NI <sub>B</sub> ) |
|--------------------------------------------------------------------------------------------|----------------------------|------------------------------|-----------------------------|
| 2-methoxy ethanol                                                                          | 27.37                      | 62.16                        | 58.35                       |
| butanone                                                                                   | 40.30                      | 33.00                        | 35.65                       |
| ethanol                                                                                    | 27.20                      | -                            | -                           |
| conc. phosphoric acid                                                                      | 0.40                       | -                            | 0.50                        |
| p-toluene sulfonic acid                                                                    | -                          | 0.25                         | -                           |
| dibutyl phthalate                                                                          | -                          | -                            | 0.75                        |
| polyvinyl butyral, M <sub>w</sub> 225,000                                                  | 1.08                       | 1.62                         | 1.125                       |
| 80 % of vinyl butyral, 18 %<br>of vinyl alcohol, 2 % of vinyl<br>acetate units (Butvar 72) |                            |                              |                             |
| Butvar 90                                                                                  | 0.60                       | 0.80                         | 1.50                        |
| diazonium compound*)                                                                       | 1.70                       | 0.55                         | 1.00                        |
| phthalocyanine blue                                                                        | 1.35                       | -                            | -                           |
| yellow pigment                                                                             | -                          | 1.62                         | -                           |
| black pigment                                                                              | -                          | -                            | 1.125                       |
| optical density                                                                            | 1.2                        | 0.9                          | 1.3                         |

\*) polycondensation product of 3-methoxy-diphenylamine-4-diazonium salt and 4,4'-bis-methoxymethyl-diphenylether

II.

|                                                                                                                    | Cyan<br>(NII <sub>C</sub> ) | Yellow<br>(NII <sub>Y</sub> ) | Magenta<br>(NII <sub>M</sub> ) | Black<br>(NII <sub>B</sub> ) |
|--------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------------------|--------------------------------|------------------------------|
| 2-methoxy ethanol                                                                                                  | 41.00                       | 41.00                         | 46.50                          | 41.00                        |
| butanone                                                                                                           | 41.00                       | 40.99                         | 46.48                          | 41.00                        |
| butyrolactone                                                                                                      | 10.00                       | 10.00                         | -                              | 10.00                        |
| dimethyl phthalate                                                                                                 | 0.75                        | 0.75                          | 0.88                           | 0.75                         |
| dibutyl phthalate                                                                                                  | 0.25                        | 0.25                          | -                              | 0.25                         |
| p-toluene sulfonic<br>acid                                                                                         | -                           | -                             | 0.18                           | 0.35                         |
| Scripset 540                                                                                                       | 3.33                        | 2.60                          | 3.15                           | 3.71                         |
| copolymer of maleic<br>acid partial ester<br>and styrene;<br>M <sub>n</sub> 45,000; acid<br>No. 175 (Scripset 550) | 1.17                        | -                             | -                              | -                            |
| hydrolyzed Scripset 540                                                                                            | -                           | -                             | 0.67                           | -                            |
| SMA 2625                                                                                                           | -                           | 2.02                          | -                              | -                            |
| diazonium compound<br>as in I                                                                                      | 1.33                        | 1.35                          | 0.70                           | 2.00                         |
| phthalocyanine blue                                                                                                | 1.17                        | -                             | -                              | -                            |
| yellow pigment                                                                                                     | -                           | 1.04                          | -                              | -                            |
| magenta pigment                                                                                                    | -                           | -                             | 1.44                           | -                            |
| black pigment                                                                                                      | -                           | -                             | -                              | 0.94                         |
| optical density                                                                                                    | 1.1                         | 0.9                           | 1.2                            | 1.5                          |

The adhesive layer mainly comprises polyvinyl acetate. Examples of useful polyvinyl acetates are Mowilith 20, 25, 30, DM 6, DM 22 and mixtures thereof (manufacturer Hoechst AG). These polyvinyl acetates are usually dispersed in water, or dissolved in an organic solvent for coating on the photosensitive layer. The layer is then dried to a coating weight of from about 5 to about 30 g/m<sup>2</sup>, preferably from about 10 to about 20 g/m<sup>2</sup>.

The layer may optionally contain uv absorbers such as Uvinul D-50 (manufacturer GAF), plasticizers such as Resoflex R-296 (manufacturer Cambridge Industries), as well as antistatic agents, such as Gafac and Gafstat (manufacturer GAF), and other resins, such as Nitro-cellulose R 1/2 (manufacturer Hercules). The adhesive layer should not be tacky to the touch, during storage or during development of the photosensitive element.

The layer preferably should have a softening point in the range of from about 60 °C to about 120 °C, preferably 60 °C to 100 °C. In the preferred embodiment, the polyvinyl acetate is present in the adhesive layer in an amount of greater than about 50 percent by weight. The plasticizer may be present in an amount of up to about 30 percent by weight, the uv absorber up to about 20 percent by weight, and other resins up to about 50 percent by weight.

The adhesive layer may, for example, have one of the following compositions (in % by weight):

|                           |    |                      |
|---------------------------|----|----------------------|
| AI. Water                 | 50 |                      |
| Mowilith DM-22            | 50 | (terpolymer of vinyl |
| (50 % aqueous dispersion) |    | acetate, vinyl ester |
|                           |    | of a long chain      |
|                           |    | carboxylic acid and  |
|                           |    | acrylic acid ester)  |
| AII. n-butyl acetate      | 78 |                      |
| Resoflex R-296            | 1  |                      |
| Mowilith 25               | 21 | (polyvinyl acetate,  |
|                           |    | MW 100,000)          |
| AIII. isopropyl acetate   | 70 |                      |
| Mowilith 30               | 30 | (polyvinyl acetate,  |
|                           |    | MW 110,000)          |
| AIV. isopropyl acetate    | 49 |                      |
| cyclohexane               | 21 |                      |
| Mowilith 25               | 30 |                      |

In operation, the photosensitive element is laminated to a receiver sheet via the adhesive layer. The receiver sheet should be resistant to any adverse effect which may be caused by the developer of choice. For example, the receiver sheet should be water-resistant if aqueous developers are used. Plastic films or plastic-coated papers are useful for this purpose. Other white and non-white receiver sheets may also be used. Rough textured and/or adhesion promoted surfaces

are preferred for the receiver, which must be able to withstand the laminating and development processes.

Lamination may be conducted by putting the receiver sheet in contact with the adhesive side of the colored photosensitive element and then introducing the two materials into the nip of a pair of heated laminating rollers under suitable pressure. Suitable laminating temperatures usually range from about 60 to 120 °C, appropriately from 60 °C to 90 °C, preferably from 75 °C to 85 °C. After lamination, the support is peeled away, usually merely employing manual peeling forces. The adhesive and photosensitive layers thus remain on the receiver sheet.

The photosensitive layer is imagewise exposed by means well known in the art either before or after lamination. Such exposure may be conducted by exposure to a uv light source through a photomask under vacuum frame conditions. Exposures after laminating and peeling off the support film are preferred for emulsion-to-emulsion contact. Mercury vapor lamps are preferred over metal halide lamps. Filters may be used to reduce light scattering.

After laminating, peeling off the support film and exposing, the photosensitive layer is developed by dissolving the non-image areas in a suitable developer and dried. The adhesive layer is not removed by this development.

Suitable developers for positive-working and negative-working layers comprise aqueous solutions of the sodium, lithium and potassium salts of weak acids and the developers described in US-A 4,436,807. The adhesive layer is not substantially attacked by the developer. Suitable developers have, for example, the following compositions:

|                           | (%)    |
|---------------------------|--------|
| DI. water                 | 95.0   |
| sodium decyl sulfate      | 3.0    |
| disodium phosphate        | 1.5    |
| sodium metasilicate       | 0.5    |
| DII. water                | 89.264 |
| monosodium phosphate      | 0.269  |
| trisodium phosphate       | 2.230  |
| sodium tetradecyl sulfate | 8.237  |

Any developer solution may be used, which satisfactorily removes the non-image areas of the photosensitive layers of both types, while retaining the image areas.

The process can then be repeated whereby another photosensitive element having a different color is laminated to the same receiver sheet over the previously formed image. In the usual case, four colored layers are employed to produce a full color reproduction of a desired image. These colored layers comprise cyan (blue-green), magenta (purple), yellow and black.

The invention is explained in detail by the following examples, in which all percentages and quantitative proportions given are to be understood as relating to weight units, unless otherwise specified.

Example 1

This example describes the production of a color proof from a four-color screen image combined by photocomposing with a text insert.

- A) Four photosensitive color proofing films are prepared by coating 75  $\mu\text{m}$  thick biaxially stretched and heat-set transparent polyethylene terephthalate films with one of the solutions  $P_C$ ,  $P_Y$ ,  $P_M$  and  $P_B$  each, drying and coating the colored photosensitive layers so produced with a 15  $\mu\text{m}$  thick adhesive layer applied from the solution AII. A commercial laminator is then used for laminating the film carrying the layer  $P_C$ , under pressure and heat, to an image receiving film comprising a white, opaque, dimensionally stable plastic material. The photosensitive layer is then exposed under the corresponding color separation and, after peeling off the support film, developed with the solution DI. On top of the image of the color cyan thus obtained, the image of the color magenta is produced by laminating, exposing in register and developing. The images of the colors yellow and black are applied in the same manner.

A negative-working color proofing film of the color black is prepared by coating a temporary support film of the above-indicated kind with the solution  $NI_b$  and the adhesive coating solution AII. This film is then laminated to the four-color image previously obtained. By exposure under a negative text original, peeling off the support film and developing with the solution DI a four-color image with a text insert is obtained.

- B) Correspondingly, a four-color screen image can be obtained from negative-working color proofing films, with a text insert produced by means of a black positive-working color proofing film.

Four different negative-working color proofing films are prepared by coating the temporary supports indicated under A above with the solutions  $NIIC$ ,  $NIIm$ ,  $NIIf$ , and  $NIIf$  and coating each layer so produced with the adhesive coating solution AIII. The four-color screen image is produced by means of negative color separations, analogously to the positive image, and the solution DII is used as the developer.

For inserting the text, a black positive-working color proofing ( $P_b$ ) film is used and is processed with the same developer (DII).

#### Example 2

This example describes the production of a four-color proof, in which a text made up of transparent letters is inserted in the dark areas of a four-color screen image and a text made up of black letters is inserted in the light areas of the image or a text of a contrasting color is inserted in the dark and light areas.

- A) As described in Example 1A, four photosensitive positive-working color proofing films are prepared, using temporary support films. The cyan layer is coated with the adhesive layer AIV, while the other color layers are coated with the adhesive layer AIII. The cyan film is laminated as in Example 1A and exposed under the corresponding screen color separation. A second exposure is carried out under a negative text original. After development using the developer DII, the positive images of the colors magenta, yellow and black are produced in a correspondent manner and, in each case, a second exposure is carried out under the same text original as used for the cyan image. A four-color image with a transparent text insert is thus obtained. As in Example 1A, a negative color proofing film of

the color black, but which is coated with the color layer  $NII_b$  and the adhesive layer  $AIV$ , is laminated onto the screen image and exposed under the negative text original, the transparent text portions of which are covered in the area of the dark parts of the screen image. For developing the layer the developer  $DII$  is used, which was also employed for developing the screen image. In this way, a four-color image comprising light and dark text portions is obtained.

- B) As described under A above, a four-color screen image is produced from negative-working color proofing films comprising a text insert obtained with the aid of a black positive-working color proofing film.

Four different negative-working color proofing films are prepared by coating the temporary support described in Example 1A with the color layers  $NII_c$ ,  $NII_m$ ,  $NII_y$  and  $NII_b$  and then coating the color layers with the adhesive layer  $AII$ . The four-color screen image is produced, analogously to the positive image, by exposing under the corresponding negative color separations, in each case together with the same positive text original, and developing with the solution  $DI$ .

A black positive-working color proofing film coated with the photosensitive layer  $P_b$  and the adhesive layer AII is used for the text copy. The photosensitive layer is exposed under the above-indicated positive text original and, in a second exposure, the layer is covered in the light areas of the screen image, while the text inserts which are present in the dark areas are cleared out by exposure. After development using the developer EI a four-color image comprising transparent and black text inserts is obtained.

C) A negative-working color proofing film of the color cyan is laminated via its color layer  $NII_c$  and its adhesive layer AII to a four-color screen image obtained as described under A above and is exposed under the negative text original used in A and developed with the developer DII. The procedure is repeated using a color proofing film of the color yellow ( $NII_y + AII$ ). A four-color image comprising green text inserts in the empty spaces of the image is obtained.

D) A positive-working color proofing film of the color cyan is laminated via its color layer  $P_c$  and its adhesive layer AII to a four-color screen image obtained as described under B above and is exposed under the positive text original used above and developed with the developer DII. In the same

manner, a positive-working color proofing film of the color yellow ( $P_y + A_{III}$ ) is laminated to the screen image and is exposed and developed. A four-color screen image comprising green text inserts is obtained.

### Example 3

This example describes a process, in which a positive screen image and a negative screen image are combined by photocomposing on the same image receptor using, in each case, one or more color separations.

A positive-working color proofing film of the color cyan ( $P_c$  and  $A_I$ ) is laminated under heat and pressure to an image receiving film of a white, opaque, dimensionally stable plastic material, followed by exposure under a positive color separation of the color cyan. By means of a second exposure of the positive cyan layer through an appropriate negative mask, undesired image areas of the positive image can be cleared out to produce an image-free area for the subsequent insertion of an image produced by exposure under a negative original. After the second exposure, the image of the color cyan is developed with the developer  $D_{II}$ . If an image of a multi-colored original is to be reproduced, the multi-colored image is built up further as described in Example 2A. The multi-colored screen image obtained is laminated with a negative-working color proo-

ting film of the color cyan ( $NII_c + AI$ ). As described in Example 1B, a four-color image is then produced using this film and additional color proofing films of the colors magenta ( $NII_m + AI$ ), yellow ( $NII_y + AI$ ) and black ( $NII_b + AI$ ). In this manner, an image of a positive original consisting of one or more colors is combined by photocomposing with an image of a negative original consisting of one or more colors.

#### Example 4

This example describes a process, in which a positive and a negative screen image, each produced from one or more color separations, are combined by photocomposing with text inserts of one or more colors.

As described in Example 3, a positive multi-colored image and a negative multi-colored image are built up on an image receptor. A text can be inserted in the image by laminating a positive-working color proofing film of the color black ( $P_b + AIII$ ) to the final screen image, exposing under a positive text original and developing, as in Example 1B. Alternatively, it is also possible to insert a text of a secondary color, according to Example 2D. In this way, an image results which is combined by photocomposing from a positive and a negative screen original and which additionally contains a colored or black text insert.

The claims defining the invention are as follows:

1. Process for the production of a multi-colored image, which comprises laminating a photosensitive element comprising a temporary support (A), a photosensitive layer (B) containing a dye or a pigment of a particular primary color, and an adhesive layer (C) on top of the photosensitive layer, with the application of heat and pressure, to an image receptor (D), exposing the layer under the corresponding color separation, peeling off the temporary support (A) before or after exposure, and developing the layer (B) into a first image of a primary color by washing out the non-image areas and producing, in the same manner, by transferring, exposing and developing on top of the first image, at least one additional image of another primary color in register with the first image, wherein at least one image of a primary color is produced from a negative-working photosensitive element and at least one image of a primary color is produced from a positive-working photosensitive element and all images of different primary colors are developed with the same developer.
2. A process as claimed in claim 1, wherein a positive-working photosensitive element comprising a 1,2-naphthoquinone diazide as the photosensitive compound and a negative-working photosensitive

element comprising a diazonium salt polycondensation product as the photosensitive compound are used.

3. A process as claimed in claim 2, wherein the photosensitive layer of the positive-working photosensitive element additionally contains an alkali-soluble binder.
4. A process as claimed in claim 2, wherein the photosensitive layer of the negative-working photosensitive element additionally contains a polymeric binder of such a type and quantity that the layer can be developed with an aqueous solution.
5. A process as claimed in claim 1, wherein an aqueous-alkaline solution is used as the developer.
6. A process as claimed in claim 5, wherein the developer solution additionally contains a surface-active agent.
7. A process as claimed in claim 1, wherein at least one image of a primary color is produced on a positive-working element, in such a way that the photosensitive element is first exposed under a positive original and then under a negative original to produce further image elements and is subsequently developed.

8. A process substantially as herein described with reference to the foregoing examples thereof.

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