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(54) A heat sensitive imaging element and a method for producing lithographic plates therewith

(57) According to the present invention there is provided a heat sensitive imaging element comprising on a hydrophilic surface of a lithographic base an image forming layer comprising at least hydrophobic thermoplastic polymer particles and a compound capable of converting light into heat, said compound being present in said image forming layer or a layer adjacent thereto, characterized in that onto said image forming layer is coated a covering layer having a thickness between 0.1 and 3 µm.

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Description

1. Field of the invention.

The present invention relates to a heat sensitive material for making a lithographic printing plate. The present invention further relates to a method for preparing a printing plate from said heat sensitive material.

2. Background of the invention.

Lithography is the process of printing from specially prepared surfaces, some areas of which are capable of accepting lithographic ink, whereas other areas, when moistened with water, will not accept the ink. The areas which accept ink form the printing image areas and the ink-rejecting areas form the background areas.

In the art of photolithography, a photographic material is made imagewise receptive to oily or greasy ink in the photo-exposed (negative working) or in the non-exposed areas (positive working) on a hydrophilic background.

In the production of common lithographic plates, also called surface litho plates or planographic printing plates, a support that has affinity to water or obtains such affinity by chemical treatment is coated with a thin layer of a photosensitive composition. Coatings for that purpose include light-sensitive polymer layers containing diazo compounds, dichromate-sensitized hydrophilic colloids and a large variety of synthetic photopolymers. Particularly diazo-sensitized systems are widely used.

Upon imagewise exposure of the light-sensitive layer the exposed image areas become insoluble and the unexposed areas remain soluble. The plate is then developed with a suitable liquid to remove the diazonium salt or diazo resin in the unexposed areas.

On the other hand, methods are known for making printing plates involving the use of imaging elements that are heat sensitive rather than photosensitive. A particular disadvantage of photosensitive imaging elements such as described above for making a printing plate is that they have to be shielded from the light. Furthermore they have a problem of stability of the sensitivity on storage and they show a lower resolution. The trend towards heat sensitive printing plate precursors is clearly seen on the market.

WO 94/18005 discloses a heat mode recording material comprising on a support having an ink receptive surface a substance capable of convertibg light into heat and a hardened hydrophilic surface layer having a thickness not more than 3 µm.

EP-A 703,499 discloses a no-process printing plate having a protective top coat layer. Said protective top coat layer may provide the no-processing plate with protection from contamination during handling.

For example, EP-A 770,494, 770,495, 770,496 and 770,497 disclose a method for making a lithographic printing plate comprising the steps of (1) image-wise exposing to light a heat sensitive imaging element comprising (i) on a hydrophilic surface of a lithographic base an image forming layer comprising hydrophobic thermoplastic polymer particles dispersed in a hydrophilic binder and (ii) a compound capable of converting light to heat, said compound being comprised in said image forming layer or a layer adjacent thereto; (2) and developing a thus obtained image-wise exposed element by rinsing it with plain water.

FR 1,561,957 discloses an analogous material as mentioned above with the option that said material carries a surface layer. Neither the nature or the thickness of said surface layer is disclosed.

Research Disclosure no. 333, 1 January 1992, page 2 XP 000281114 disclose an imaging element as described in EP-A 770,494 et al with a specified hydrophilic binder.

However during the exposure of such an imaging element the imaging element shows partially ablation resulting in a deterioration of the lithographic properties of a so obtained lithographic plate e.g. a decreased ink acceptance on said ablated areas. So, a solution for said ablation phenomenon would be greatly appreciated

3. Summary of the invention.

It is an object of the present invention to provide a heat sensitive imaging element showing no ablation on exposure to light.

It is a further object of the present invention to provide a heat sensitive imaging element for making in a convenient way a lithographic printing plate having improved lithographic properties e.g. an increased ink acceptance.

It is another object of the present invention to provide a method for obtaining in a convenient way a negative working lithographic printing plate of a high quality using said imaging element.

Further objects of the present invention will become clear from the description hereinafter.

According to the present invention there is provided a heat sensitive imaging element comprising on a hydrophilic surface of a lithographic base an image forming layer comprising hydrophobic thermoplastic polymer particles and a compound capable of converting light into heat, said compound being present in said image forming layer or a layer adjacent thereto, characterized in that on said image forming layer a covering layer is, present having a thickness between 0.1 and 5 µm.

According to the present invention there is also provided a method for obtaining a lithographic printing plate comprising the steps of:

(a) image-wise or information-wise exposing to light or heat an imaging element as described above

(b) developing said exposed imaging element with an aqueous developing solution in order to remove the unexposed areas and thereby form a lithographic printing plate.

4. Detailed description of the invention.

It has been found that lithographic printing plates of high quality, especially with a high ink acceptance in the printing areas can be obtained according to the method of the present invention using an imaging element as described above. More precisely it has been found that said printing plates are of high quality and are provided in a convenient way, thereby offering economical and ecological advantages.

An imaging element for use in accordance with the present invention comprises on a hydrophilic surface of a lithographic base an image forming layer comprising at least hydrophobic thermoplastic polymer particles which is overcoated with a covering layer having a thickness between 0.1 and 5 µm.

Said covering layer can be a hydrophobic layer containing a hydrophobic polymer or copolymer such as polystyrene, polyolefinic compounds, poly(meth)acrylates, polyesters, copolymers of said polymers, etc..

Said covering layer can be a water insoluble, alkali soluble or swellable layer containing a resin having phenolic hydroxy groups and/or carboxyl groups such as novolacs or polyvinyl phenols.

Preferably the covering layer used in connection with the present invention is a water soluble or swellable layer comprising hydrophilic polymers. Suitable water soluble or swellable polymers for use in said covering layer in connection with this invention are for example synthetic homo or copolymers such as a polyvinyl alcohol, a poly(meth)acrylic acid, a poly(meth)acrylamide, a polyhydroxyethyl(meth)acrylate, a polyvinylmethylether, a polyvinyl pyrrolidone or natural binders such as gelatin, a polysaccharide such as e.g. dextran, pullulan, cellulose, arabic gum, alginic acid.

The thickness of said layer is preferably between 0.15 and 3 µm, more preferably between 0.2 and 2 µm.

According to one embodiment of the present invention, the lithographic base can be an anodised aluminum support. A particularly preferred lithographic base is an electrochemically grained and anodised aluminum support. According to the present invention, an anodised aluminum support may be treated to improve the hydrophilic properties of its surface. For example, the aluminum support may be silicated by treating its surface with sodium silicate solution at elevated temperature, e.g. 95°C. Alternatively, a phosphate treatment may be applied which involves treating the aluminum oxide surface with a phosphate solution that may further contain an inorganic fluoride. Further, the aluminum oxide surface may be rinsed with a citric acid or citrate solution. This treatment may be carried out at room temperature or can be carried out at a slightly elevated temperature of about 30 to 50°C. A further interesting treatment involves rinsing the aluminum oxide surface with a bicarbonate solution. It is further evident that one or more of these post treatments may be carried out alone or in combination.

According to another embodiment in connection with the present invention, the lithographic base comprises a flexible support, such as e.g. paper or plastic film, provided with a cross-linked hydrophilic layer. A particularly suitable cross-linked hydrophilic layer may be obtained from a hydrophilic binder cross-linked with a cross-linking agent such as formaldehyde, glyoxal, polyisocyanate or a hydrolysed tetra-alkylorthosilicate. The latter is particularly preferred.

As hydrophilic binder there may be used hydrophilic (co)polymers such as for example, homopolymers and copolymers of vinyl alcohol, acrylamide, methylol acrylamide, methylol methacrylamide, acrylic acid, methacrylic acid, hydroxyethyl acrylate, hydroxyethyl methacrylate or maleic anhydride/vinylmethylether copolymers The hydrophilicity of the (co)polymer or (co)polymer mixture used is preferably the same as or higher than the hydrophilicity of polyvinyl acetate hydrolyzed to at least an extent of 60 percent by weight, preferably 80 percent by weight.

The amount of crosslinking agent, in particular of tetraalkyl orthosilicate, is preferably at least 0.2 parts by weight per part by weight of hydrophilic binder, preferably between 0.5 and 5 parts by weight, more preferably between 1.0 parts by weight and 3 parts by weight.

A cross-linked hydrophilic layer in a lithographic base used in accordance with the present embodiment preferably also contains substances that increase the mechanical strength and the porosity of the layer. For this purpose colloidal silica may be used. The colloidal silica employed may be in the form of any commercially available water-dispersion of colloidal silica for example having an average particle size up to 40 nm, e.g. 20 nm. In addition inert particles of larger size than the colloidal silica can be added e.g. silica prepared according to Stöber as described in J. Colloid and Interface Sci., Vol. 26, 1968, pages 62 to 69 or alumina particles or particles having an average diameter of at least 100 nm which are particles of titanium dioxide or other heavy metal oxides. By incorporating these particles the surface of the cross-linked hydrophilic layer is given a uniform rough texture consisting of microscopic hills and valleys, which serve as storage places for water in background areas.

The thickness of a cross-linked hydrophilic layer in a lithographic base in accordance with this embodiment may vary in the range of 0.2 to 25 µm and is preferably 1 to 10 µm.

Particular examples of suitable cross-linked hydrophilic layers for use in accordance with the present invention are disclosed in EP-A 601240, GB-P-1419512, FR-P-2300354, US-P-3971660, US-P-4284705 and EP-A 514490.

As flexible support of a lithographic base in connection with the present embodiment it is particularly preferred to use a plastic film e.g. substrated polyethylene terephthalate film, cellulose acetate film, polystyrene film, polycarbonate film etc... The plastic film support may be opaque or transparent.

It is particularly preferred to use a polyester film support to which an adhesion improving layer has been provided. Particularly suitable adhesion improving layers for use in accordance with the present invention comprise a hydrophilic binder and colloidal silica as disclosed in EP-A 619524, EP-A 620502 and EP-A 619525. Preferably, the amount of silica in the adhesion improving layer is between 200 mg per m^2 and 750 mg per m^2. Further, the ratio of silica to hydrophilic binder is preferably more than 1 and the surface area of the colloidal silica is preferably at least 300 m^2 per gram, more preferably at least 500 m^2 per gram.

In accordance with the present invention, on top of a hydrophilic surface there is provided an image forming layer. Optionally, there may be provided one or more intermediate layers between the lithographic base and the image forming layer. An image forming layer in connection with the present invention comprises at least thermoplastic polymer particles. Preferably said thermoplastic polymer particles are dispersed in a hydrophylic binder.

The hydrophilic binder can be a water insoluble, alkali soluble or swellable resin having phenolic hydroxy groups and/or carboxyl groups.

Preferably she water insoluble, alkali soluble or swellable resin used in connection with the present invention comprises phenolic hydroxy groups. Suitable water insoluble, alkali soluble or swellable resins for use in an image forming layer in connection with this invention are for example synthetic novolac resins such as ALNOVOL, a registered trade mark of Reichold Hoechst and DUREZ, a registered trade mark of OxyChem and synthetic polyvinylfenols such as MARUKA LYNCUR M, a registered trade mark of Dyna Cyanamid.

The hydrophilic binder is preferably a water soluble or swellable hydrophilic polymer. Suitable water soluble or swellable polymers for use in an image forming layer in connection with this invention are for example synthetic homo or copolymers such as a polyvinyl alcohol, a poly(meth)acrylic acid, a poly(meth)acrylamide, a polyhydroxyethyl(meth)acrylate, a polyvinylmethylether, a polyvinyl pyrrolidone or natural binders such as gelatin, a polysaccharide such as e.g. dextran, pullulan, cellulose, arabic gum, alginic acid.

The hydrophilic binder used in connection with the present invention is preferably not cross-linked or only slightly cross-linked.

Hydrophobic thermoplastic polymer particles used in connection with the present invention preferably have a coagulation temperature above 35°C and more preferably above 50°C. Coagulation may result from softening or melting of the thermoplastic polymer particles under the influence of heat. There is no specific upper limit to the coagulation temperature of the thermoplastic hydrophobic polymer particles, however the temperature should be sufficiently below the decomposition of the polymer particles. Preferably the coagulation temperature is at least 10°C below the temperature at which the decomposition of the polymer particles occurs. When said polymer particles are subjected to a temperature above coagulation temperature they coagulate to form a hydrophobic agglomerate in the hydrophilic layer so that at these parts the hydrophilic layer becomes insoluble in plain water or an aqueous liquid.

Specific examples of hydrophobic polymer particles for use in connection with the present invention are e.g. polyethylene, polyvinyl chloride, polymethyl (meth)acrylate, polyethyl (meth)acrylate, polyvinylidene chloride, polyacrylonitrile, polyvinyl carbazole etc. or copolymers thereof. Most preferably used is polyethylene, or polymethyl methacrylate.

The weight average molecular weight of the polymers may range from 5,000 to 1,000,000g/mol.

The hydrophobic particles may have a particle size from 0.01 µm to 50 µm, more preferably between 0.05 µm and 10 µm and most preferably between 0.05 µm and 2 µm.

The polymer particles are present as a dispersion in the aqueous coating liquid of the image forming layer and may be prepared by the methods disclosed in US-P-3,476,937. Another method especially suitable for preparing an aqueous dispersion of the thermoplastic polymer particles comprises:

- dissolving the hydrophobic thermoplastic polymer in an organic water immiscible solvent,
- dispersing the thus obtained solution in water or in an aqueous medium and
- removing the organic solvent by evaporation.

The amount of hydrophobic thermoplastic polymer particles contained in the image forming layer is preferably between 20% by weight and 65% by weight and more preferably between 25% by weight and 55% by weight and most preferably between 30% by weight and 45% by weight.

The image forming layer can also comprise crosslinking agents although this is not necessary. Preferred crosslinking agents are low molecular weight substances comprising a methylol group such as for example melamine-formaldehyde resins, glycoluril-formaldehyde resins, thiourea-formaldehyde resins, guanamine-formaldehyde resins, benzoguanamine-formaldehyde resins. A number of said melamine-formaldehyde resins and glycoluril-formaldehyde resins are commercially available under the trade names of CYMEL (Dyno Cyanamid Co., Ltd.) and NIKALAC (Sanwa Chemical Co., Ltd.).

The image forming layer has preferably a thickness between 0.1 and 3 µm, more preferably between 0.15

and 2 µm, most preferably between 0.2 and 1 µm.

Suitable compounds capable of converting light into heat are preferably infrared absorbing components although the wavelength of absorption is not of particular importance as long as the absorption of the compound used is in the wavelength range of the light source used for image-wise exposure. Particularly useful compounds are for example dyes and in particular infrared dyes, carbon black, metal carbides, borides, nitrides, carbonitrides, bronze-structured oxides and oxides structurally related to the bronze family but lacking the A component e.g. $WO_{2.9}$. It is also possible to use conductive polymer dispersion such as polypyrrole or polyaniline-based conductive polymer dispersions. The lithographic performance and in particular the print endurance obtained depends on the heat-sensitivity of the imaging element. In this respect it has been found that carbon black yields very good and favorable results.

A light to heat converting compound in connection with the present invention is most preferably added to the image forming layer but at least part of the light to heat converting compound may also be comprised in a neighbouring layer. Such layer can be for example the cross-linked hydrophilic layer of the lithographic base according to the second embodiment of lithographic bases explained above.

In accordance with a method of the present invention for obtaining a printing plate, the imaging element is image-wise exposed and subsequently developed with an aqueous solution.

Image-wise exposure in connection with the present invention is preferably an image-wise scanning exposure involving the use of a laser or L.E.D.. It is highly preferred in connection with the present invention to use a laser emitting in the infrared (IR) and/or near-infrared, i.e. emitting in the wavelength range 700-1500nm. Particularly preferred for use in connection with the present invention are laser diodes emitting in the near-infrared.

In case that the hydrophilic binder in the image forming layer of the imaging element is a water insoluble, alkali soluble or swellable resin having phenolic hydroxy groups and/or carboxyl groups the developing liquid is an alkaline solution, preferably with a pH between 9 and 14, more preferably with a pH between 10 and 13.

In case that the hydrophilic binder in the image forming layer of the imaging element is a water soluble or swellable hydrophilic polymer the developing solution may be plain water.

For a good development the exposed imaging element is rubbed with e.g. an absorbent means or a brush during the application of the developing liquid or while still being wet with the developing solution or is sprayed with the developing solution.

After the development of an image-wise exposed imaging element with an aqueous solution and drying the obtained plate can be used as a printing plate as such. However, it is still possible to bake said plate at a temperature between 100°C and 230°C for a period of 40 minutes to 5 minutes. For example the exposed and developed plates can be baked at a temperature of 230°C for 5 minutes, at a temperature of 150°C for 10 minutes or at a temperature of 120°C for 30 minutes.

The printing plate can be used in the printing process as a seamless sleeve printing plate. In this option the printing plate is soldered in a cylindrical form by means of a laser. This cylindrical printing plate which has as diameter the diameter of the print cylinder is slided on the print cylinder instead of applying in a classical way a classically formed printing plate. More details on sleeves is given in "Grafisch Niews", 15, 1995, page 4 to 6.

In accordance with the present invention there are different particular embodiments for obtaining a printing plate when the hydrophylic binder in the image forming layer is a water soluble or swellable polymer. In a first particular embodiment the imaging element is image-wise exposed and subsequently mounted on a print cylinder of a printing press. According to a preferred embodiment, the printing press is then started and while the print cylinder with the imaging element mounted thereon rotates, the dampener rollers that supply dampening liquid are dropped on the imaging element and subsequently thereto the ink rollers are dropped. Generally after about 10 revolutions of the print cylinder the first clear and useful prints are obtained.

According to an alternative embodiment, the ink rollers and dampener rollers may be dropped simultaneously or the ink droppers may be dropped first.

In these particular embodiments the exposed imaging element may be converted to a seamless sleeve imaging element before mounting the exposed imaging element on the print cylinder.

Suitable dampening solutions that can be used in connection with the present invention are aqueous liquids generally having an acidic pH and comprising an alcohol such as isopropanol. With regard to dampening liquids useful in the present invention, there is no particular limitation and commercially available dampening liquids, also known as fountain solutions, ban be used.

It may be advantageous to wipe the image forming layer of an image-wise exposed element according to the above mentioned particular embodiment with e.g. a cotton pad or sponge soaked with water before mounting the imaging element on the press or at least before the press Starts running. This will remove some non-image areas but will not actually develop the imaging element. However, it has the advantage that possible substantial contamination of the dampening system of the press and ink used is avoided.

According to a further particular embodiment, the imaging element is first mounted on the print cylinder of the printing press and then image-wise exposed directly on the press. Subsequent to exposure, the imaging element can be developed as described above.

In these particular embodiment the unexposed imaging element may be converted to a seamless sleeve imaging element before mounting the unexposed imaging element on the print cylinder.

The following example illustrates the present invention without limiting it thereto. All parts are by weight unless otherwise specified.

EXAMPLE 1

Preparation of the lithographic base

A 0.15 mm thick aluminum foil was degreased by immersing the foil in an aqueous solution containing 5 g/l of sodium hydroxide at 50°C and rinsed with demineralized water. The foil was then electrochemically grained using an alternating current in an aqueous solution containing 4 g/l of hydrochloric acid, 4 g/l of hydroboric acid and 5 g/l of aluminum ions at a temperature of 35°C and a current density of 1200 A/m^2 to form a surface topography with an average center-line roughness Ra of 0.5 µm.

After rinsing with demineralized water the aluminum foil was then etched with an aqueous solution containing 300 g/l of sulfuric acid at 60°C for 180 seconds and rinsed with demineralized water at 25°C for 30 seconds.

The foil was subsequently subjected to anodic oxidation in an aqueous solution containing 200 g/l of sulfuric acid at a temperature of 45°C, a voltage of about 10 V and a current density of 150 A/m^2 for about 300 seconds to form an anodic oxidation film of 3.00 g/m^2 of Al_2O_3, then washed with demineralized water, posttreated with a solution containing 20 g/l of sodium bicarbonate at 40°C for 30 seconds, subsequently rinsed with demineralized water at 20°C during 120 seconds and dried.

The grained and anodized lithographic base was then submersed in an aqueous solution containing 5 % w/w of citric acid for 60 seconds, brought at pH 7 with an aqueous solution of sodium hydroxyde 2N for 60 seconds, rinsed with demineralized water and dried at 25°C.

Preparation of the coating composition for the recording layer

To 130 g of a 20 % w/w dispersion of polymethyl methacrylate (particle diameter of 90 nanometer) stabilized with the polyethyleneoxide surfactant Hostapal B (1% w/w vs. polymer) in deionized water was subsequently added, while stirring, 50 g of a 15 % w/w dispersion of carbon black containing a wetting agent in water, 500 g of water, 320 g of a 2 % w/w solution of a 98 % hydrolyzed polyvinylacetate, having a weight average molecular weight of 200,000 g/mol (MOWIOL 56-98 available from Hoechst) in water.

Preparation of the coating composition I for a covering layer

To 99 g of methanol was added 1 g of polyvinyl pyrrolidone.

Preparation of the coating composition II for a covering layer

To 99 g of methanol was added 1 g of polyacrylic acid.

Preparation of the imaging element I

An imaging element according to the invention was produced by preparing the above described coating composition for the infrared recording layer, coating it onto the above described lithographic base in an amount of 30 g/m^2 (wet coating amount) and drying it at 36°C.

Preparation of the imaging element II

Imaging element II was prepared in an identical way as imaging element I with the exception that on top of the recording layer a covering layer from the above described coating solution I was coated in an amount of 30 g/m^2 (wet coating amount) and dried at room temperature.

Preparation of the imaging element III

Imaging element III was prepared in an identical way as imaging element I with the exception that on top of the recording layer a covering layer from the above described coating solution II was coated in an amount of 30 g/m^2 (wet coating amount) and dried at room temperature.

Preparation of a printing plate and making copies thereof.

The imaging elements I, II and III were subjected to a scanning infra-red laser diode emitting at 830 nm (scanspeed 1 m/s, spot size 10 µm and the power on the plate surface was 120 mW). After imaging the plates were processed with plain water.

The ablation on said plates is the ratio on an exposed non-processed imaging element of the optical reflection density of an unexposed area (maximum density) versus the optical reflection density of an exposed area (image density). The results are given in table 1.

After imaging the plates were processed with plain water. The obtained lithographic printing plates were used to print in an identical way on a conventional offset press using a commonly employed ink and fountain. The results are given in table 1.

Table 1

Imaging Element	I	II	III
Ablation	48 %	15 %	18 %
Ink Acceptance	poor	good	good

It is clear from the results in table 1 that the presence of a covering layer on an imaging element comprising on a hydrophilic surface of a lithographic base an image forming layer comprising hydrophobic thermoplastic polymer particles dispersed in a hydrophilic binder and a compound capable of converting light into heat, said compound being present in said image forming layer (imaging elements II and III according to the invention) decreases markedly the ablation and increases greatly the ink acceptance when compared with an identical imaging element without a covering layer (imaging element I, being a comparison element)

Claims

1. A heat sensitive imaging element comprising on a hydrophilic surface of a lithographic base an image forming layer including at least hydrophobic thermoplastic polymer particles and a compound capable of converting light into heat, said compound being present in said image forming layer or a layer adjacent thereto, characterized in that on said image forming layer a covering layer is present having a thickness between 0.1 and 3 µm.

2. A heat sensitive imaging element according to claim 1 wherein said covering layer is a water soluble or swellable layer comprising a hydrophilic polymer.

3. A heat sensitive imaging element according to claim 1 or 2 wherein said hydrophobic thermoplastic polymer particles are dispersed in a hydrophilic binder.

4. A heat sensitive imaging element according to claim 3 wherein said hydrophilic binder of the image forming layer is a water soluble or swellable polymer.

5. A heat sensitive imaging element according to any of claims 1 to 4 wherein said lithographic base is anodized aluminum or comprises a flexible support having thereon a cross-linked hydrophilic layer.

6. A heat sensitive imaging element according to any of claims 1 to 5 wherein said compound capable of converting light into heat is a member from the group consisting of an infrared absorbing dye, carbon black, a metal boride, a metal carbide, a metal nitride, a metal carbonitride and a conductive polymer dispersion.

7. A heat sensitive imaging element according to any of claims 1 to 6 wherein said heat sensitive imaging element is a seamless sleeve heat sensitive imaging element.

8. A method for obtaining a lithographic printing plate comprising the steps of:

   (a) image-wise or information-wise exposing to light or heat an imaging element according to any of claims 1 to 7,
   (b) developing said exposed imaging element with an aqueous developing solution in order to remove the unexposed areas and thereby form a lithographic printing plate.

9. A method for obtaining a lithographic plate according to claim 8 wherein said hydrophilic binder of the image forming layer is a water soluble or swellable polymer and wherein said image-wise exposed imaging element is developed by mounting it on a print cylinder of a printing press and supplying an aqueous dampening solution and/or ink to said image forming layer while rotating said print cylinder.

10. A method for obtaining a lithographic plate according to claim 8 or 9 wherein said lithographic printing plate is a seamless sleeve printing plate.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 20 1636

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)
X Y	FR 1 561 957 A (GEVAERT-AGFA N.V.) 4 April 1969 * page 2, right-hand column, line 18 * * page 3, right-hand column, line 24 - line 50 *	1-10 1-10	B41C1/10 B41M5/36
Y	WO 94 18005 A (AGFA GEVAERT NV ;VERBURGH YVES (BE); DEN BERGH RUDOLF VAN (BE); ME) 18 August 1994 * the whole document *	1-10	
Y	EP 0 703 499 A (MINNESOTA MINING & MFG) 27 March 1996 * the whole document *	1	
X	J.VERMEERSCH ET AL.: "A LITHOGRAPHIC PRINTING PLATE" RESEARCH DISCLOSURE, no. 333, 1 January 1992, page 2 XP000281114 * the whole document *	1	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	PATENT ABSTRACTS OF JAPAN vol. 006, no. 196 (M-161), 5 October 1982 & JP 57 102394 A (KONISHIROKU PHOTO IND CO LTD), 25 June 1982, * abstract *	1	B41C B41M
A	FR 1 552 000 A (GEVAERT-AGFA N.V.) 3 January 1969 * the whole document *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	30 September 1997	Rasschaert, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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D : document cited in the application
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