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SUPERINTENDENCIA Y COMERCIO

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SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

E.

S.

D.

COD:01

REF: SOLICITUD Nº 01001608 ✓

FECHA SOLICITUD: enero 11 de 2.001

PATENTE: TINTAS CURABLES POR ACCIÓN DE LA ENERGÍA Y
MÉTODOS DE PREPARACIÓN DE LAS MISMAS.

SOLICITANTE: SUN CHEMICAL CORPORATION

ASUNTO: PRESENTACIÓN DE PRIORIDAD

DILIA RODRIGUEZ D'ALEMAN, en mi condición de apoderada de la sociedad
solicitante, en esta oportunidad por el presente escrito me permito presentar:

- Copia certificada de la prioridad de Estados Unidos reivindicada Nº
09/481.070 de Enero 11 de 2.000.
- Traducción al Español de la mencionada prioridad

Esta prioridad está siendo presentada dentro del término de 3 meses que
exige el Convenio de París, toda vez que la solicitud fue radicada el 11 de
Noviembre de 2.001

Ruego a usted continuar con el presente trámite.

Señor Jefe,

DILIA RODRIGUEZ D'ALEMAN

LCD/srr

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THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

January 16, 2001

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE UNDER 35 USC 111.

APPLICATION NUMBER: 09/481,070 ✓

FILING DATE: January 11, 2000



By Authority of the
COMMISSIONER OF PATENTS AND TRADEMARKS

P. R. Grant

P. R. GRANT

Certifying Officer

01-12-00

AD

**UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)**

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
C-416

Total Pages in this Submission

TO THE ASSISTANT COMMISSIONER FOR PATENTSBox Patent Application
Washington, D.C. 20231

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

ENERGY CURABLE INKS AND METHODS OF PREPARING THE SAME

and invented by:

Edward Stone, Gordon Kotora, Neil Young

JCS30 U.S. PTO
09/1481070
01/11/00If a **CONTINUATION APPLICATION**, check appropriate box and supply the requisite information:Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: _____

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Enclosed are:

Application Elements

1. ☒ Filing fee as calculated and transmitted as described below
2. ☒ Specification having 19 pages and including the following:
- a. ☒ Descriptive Title of the Invention
 - b. ☒ Cross References to Related Applications (if applicable)
 - c. ☐ Statement Regarding Federally-sponsored Research/Development (if applicable)
 - d. ☐ Reference to Microfiche Appendix (if applicable)
 - e. ☒ Background of the Invention
 - f. ☒ Brief Summary of the Invention
 - g. ☒ Brief Description of the Drawings (if drawings filed)
 - h. ☒ Detailed Description
 - i. ☒ Claim(s) as Classified Below
 - j. ☒ Abstract of the Disclosure

UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
C-416

Total Pages in this Submission

Application Elements (Continued)

3. ☒ Drawing(s) (when necessary as prescribed by 35 USC 113)
- a. ☒ Formal Number of Sheets 2
- b. ☐ Informal Number of Sheets _____
4. ☒ Oath or Declaration
- a. ☐ Newly executed (original or copy) ☐ Unexecuted
- b. ☐ Copy from a prior application (37 CFR 1.63(d)) (for continuation/divisional application only)
- c. ☒ With Power of Attorney ☐ Without Power of Attorney
- d. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. 1.63(d)(2) and 1.33(b).
5. ☐ Incorporation By Reference (usable if Box 4b is checked)
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. ☐ Computer Program in Microfiche (Appendix)
7. ☐ Nucleotide and/or Amino Acid Sequence Submission (if applicable, all must be included)
- a. ☐ Paper Copy
- b. ☐ Computer Readable Copy (identical to computer copy)
- c. ☐ Statement Verifying Identical Paper and Computer Readable Copy

Accompanying Application Parts

8. ☒ Assignment Papers (cover sheet & document(s))
9. ☐ 37 CFR 3.73(B) Statement (when there is an assignee)
10. ☐ English Translation Document (if applicable)
11. ☐ Information Disclosure Statement/PTO-1449 ☐ Copies of IDS Citations
12. ☐ Preliminary Amendment
13. ☒ Acknowledgment postcard
14. ☒ Certificate of Mailing
- ☐ First Class ☒ Express Mail (Specify Label No.): EM067803548US

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UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.

C-416

Total Pages in this Submission

Accompanying Application Parts (Continued)

15. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed)

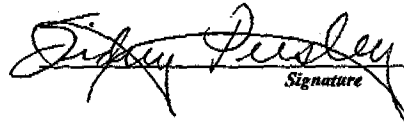
16. ☐ Additional Enclosures (please identify below):

Fee Calculation and Transmittal

CLAIMS AS FILED

For	#Filed	#Allowed	#Extra	Rate	Fee
Total Claims	17	- 20 =	0	x \$18.00	\$0.00
Indep. Claims	3	- 3 =	0	x \$78.00	\$0.00
Multiple Dependent Claims (check if applicable) ☐					\$0.00
BASIC FEE					\$760.00
OTHER FEE (specify purpose)					\$0.00
TOTAL FILING FEE					\$760.00

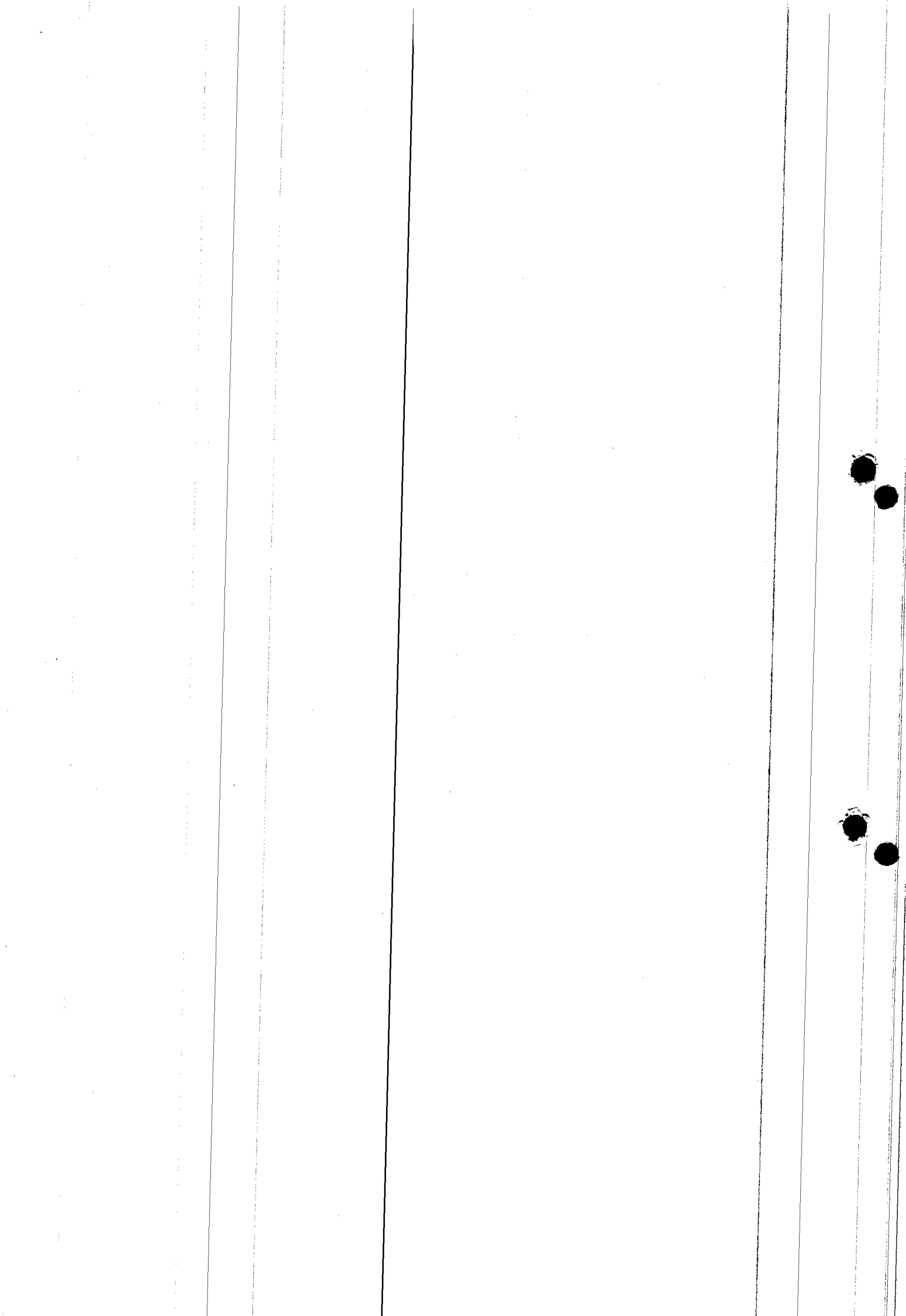
- ☐ A check in the amount of _____ to cover the filing fee is enclosed.
- ☒ The Commissioner is hereby authorized to charge and credit Deposit Account No. 19-4968 as described below. A duplicate copy of this sheet is enclosed.
- ☒ Charge the amount of \$760.00 as filing fee.
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- ☒ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
- ☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).


Signature

Dated: January 11, 2000

Sidney Persley, Esquire
Attorney for Applicant
Registration Number 34,898

cc:



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PATENT APPLICATION

C-416

ENERGY CURABLE INKS AND METHODS OF PREPARING SAME

FIELD OF THE INVENTION

This invention relates to novel energy curable inks in which non-reactive branched polyesters are used to reduce misting. The invention also relates to methods of reducing misting and/or dot gain in ink compositions by using non-reactive branched polyester resins.

BACKGROUND OF THE INVENTION

The use of gelled or structured varnishes is very important in controlling a number of printing problems. Two important functions of the gel varnish are controlling misting and dot gain.

Misting occurs when small droplets of ink are expelled from printing nips due to high printing speeds and low ink structure. They are a health and clean-up problem. These droplets form an aerosol which stays in the air and coats equipment, and also may be inhaled by plant employees. A gelled or structured varnish controls this by giving the ink enough elasticity so that the ink is pulled back into the press, and small droplets are less likely to be formed and expelled.

Dot gain is the spreading of dots of ink on paper to produce poor image quality. Again, the gelled or structured varnish prevents this by adding enough structure to the ink

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to prevent easy spreading.

Conventional UV curable paste inks, customarily use gelled resins to impart higher structure and viscosity, and improve properties such as misting and dot gain. The gelled vehicles are produced from resins that are reacted with chelating agents such as aluminum alkoxides. These materials, known as gellants, form coordinate covalent and hydrogen bonds. The amount of each type of bonding varies with the gellant being used. However, there is a significant drawback to this method of imparting structure. Most of the diluents used in UV inks are reactive acrylate monomers, which are fairly polar. These polar solvents cause a breakdown in the hydrogen bonding structure when added to the gelled varnish. To compensate for this, the varnishes are typically gelled with a very high level of gellant, which results in inks with poor flow and transfer. These are relatively hard to handle due to their high structure. They also make the inks print poorly owing to poor water emulsification properties.

It has now been found that resins that are designed to provide structure through crosslinking and entanglements are much more robust and do not suffer a loss of structure when mixed with polar solvents. According to the present invention, branched polyesters are such polymers since they provide structure through a combination of branching and chain entanglements to mimic the rheological properties of a "gelled varnish." While branched polyesters are known in the prior art, this invention provides for the first time their use in energy curable printing inks and coatings. This invention is also provides formulations containing branched

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polyesters which are incorporated in a UV curable printing ink by design to control ink properties.

SUMMARY OF THE INVENTION

The present invention relates to an energy curable printing ink composition having low misting and dot gain properties. Specifically, the printing ink composition of the invention includes non-reactive highly branched polyester resins that are designed to provide structure through crosslinking and entanglements and thereby increase rheology and reduce misting.

DESCRIPTION OF THE DRAWINGS

Figures 1A and 1B show the effect of gellant level on elasticity (G') in varnish (1A) formulations and UV curable ink (1B). The level of gellant (OAO) in the UV let down varnish was varied from 0 to 0.9% in five steps. The inks formulated were then tested for misting using a Thwing Albert electronic inkometer, and for rheology using a Carri-Med CSL 500 rheometer. The gellant levels of the varnishes were 0.0%, 0.25%, 0.5%, 0.75%, and 0.9%. Contrary to what was expected, inks produced using higher gellant levels had lower elasticity (G') and had greater misting than inks using little or no gellant. In fact, the inks with the least gellant (0 and 0.25%) yielded the least misting and highest elasticity (see Table 2, for formulas and misting results). To simplify the investigation, Cyan inks were used as the standard, since all pigment color (such as Magenta and Yellow) showed the same results. To determine if the loss in elasticity with higher gellant level was due to varnish structure, or due to some other factor in the ink, various varnishes (containing 52.5% Branched Polyester #1 as

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described in Table 1) containing different amounts of gellants (OAO) were investigated. When these were analyzed on the Carri-Med CSL-500, it was found that increasing gellant level increased the G' of the varnish.

Figure 2 shows the effect of increased branching (expressed in excess functionality) of the polyester resin on elasticity (G') in UV curable ink formulations.

DETAILED DESCRIPTION OF THE INVENTION

It has now been found that the objectives of this invention are realized by employing novel energy curable inks in which non-reactive branched polyesters are used to reduce misting by increasing the elasticity of the printing ink. Highly branched polyesters provide the proper viscosity and other rheological properties required of a good lithographic ink without gelling or adding clay or talc. Energy curable inks are normally cured by radiation sources, preferably ultra violet (UV) or electron beam (EB) radiation.

In order to better understand the phenomenon of misting, and the rheological factors involved in its control, studies were undertaken to see how various resin properties and bodying additives affected the rheology and misting of UV curable paste inks.

The resin structure in the varnish of the UV Curable Inks was altered by changing the degree of branching and molecular weight. The degree of gellation was also varied from no gellant to a high level of gellant. Increases in degree of gellation resulted in inks that misted more,

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contrary to the findings with heatset inks. The molecular weight of the resin in the let down varnish also had minimal impact. The most dramatic effect was caused by altering the amount of covalent branching in the polymer. An increase in branching resulted in an increase in elasticity of the inks and a reduction in misting. At high levels of branching, no mist control agent, i.e. clay, was needed to control the misting of the printing ink.

The energy curable printing ink composition of the present invention comprises a branched polyester which has monofunctional components, and components with two or more functional groups and wherein the excess functionality (xsf) is from about 0.140 to 0.180, preferably from about 0.147 to 0.16. The excess functionality of the branched polyesters of the present invention (xsf) is defined as follows: $xsf = \sum m_i (f_i - 2)$, where m is the number of moles of the monofunctional or multifunctional component i , and f is the functionality of component i .

The functional groups of the multifunctional component may be any suitable carboxylic acid or hydroxyl groups. For example, the components with at least three functional groups may be multifunctional hydroxyl or carboxylic acids. Typical hydroxyl compounds include but are not limited to: Abitol; Butylene glycol; Cyclohexanedimethanol; Diethylene glycol; Dipentaerythritol; Dipropylene glycol; Ethylene glycol; Glycerine; Hexylene glycol; Hydrogenated Bisphenol A; Methyl 1,2 propanediol; Neopentylglycol; Pentaerythritol; Propylene glycol; Sorbitol; Triethylene glycol; Trimethylolethane;

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Trimethylolpropane; and Tripentaerythritol.

Typical carboxylic acid compounds include but are not limited to: Abietic acid; Acetic acid; Adipic acid; Azelaic acid; Benzoic acid; Capric acid; Caproic acid; Caprylic acid; Citric acid; Crotonic acid; Dimer acid; Dimetholpropionic acid; Dimethyl terephthale; Dimethylolpropionic acid; Ethylhexanoic acid; Fatty acids; Fumaric acid; Hexahydrophthalic anhydride; Isophthalic acid; Lauric acid; Maleic acid; Maleic anhydride; Methyl hexahydrophthalic anhydride; Palmitic acid; Pelargonic acid; Phthalic acid; Phthalic anhydride; Propionic acid; p-tert-Butylbenzoic acid; Sebacic acid; Succinic anhydride; Terephthalic acid; Tetrahydrophthalic anhydride; and Trimellitic anhydride.

The functional groups of the monofunctional component (typically having acidic functional groups) of the branched polyesters of the present invention may comprise benzoic acid, palmitic acid, aliphatic, cycloaliphatic and aromatic carboxyl acids. Monofunctional hydroxyl-containing compounds may also be used. These include benzyl, aliphatic, cycloaliphatic and aromatic alcohols.

Optionally, the branched polyesters may further include difunctional components such as phthalic anhydride, neopentyl glycol, saturated, unsaturated, aliphatic, cycloaliphatic and aromatic diols or dicarboxylic acids. These branched polyesters may further contain multifunctional components such as pentaerythritol trimethylolethane, trimethylolpropane or trimellitic anhydride, etc.

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The average molecular weight of the branched polyester is about 1,000 to 10,000, and preferably about 2,000 to 4,000, and more preferably about 3,000 to 3,500.

The branched polyesters of the present invention provide the proper viscosity and other rheological properties required of a good lithographic ink without gelling or the need to add clays or other rheology control additives. In addition, the new polyester resins of the present invention are easier to manufacture and less costly than the gelled varnishes. The new resins are also covalently bonded so that their rheological properties are not affected by H-bonding with the solvent. In addition, the inks made from these polyester resins are easier to manufacture, less expensive and offer improved lithographic properties (e.g. reduced misting) than their gelled counterparts.

A trial on a Miehle press demonstrated that inks formulated with covalently branched resins required no gellant or clay to control misting and rheology. These inks performed well on press, demonstrating better flow, superior transfer, less dot gain, and overall better press performance.

Rheological measurements were carried out using a Carri-Med CSL-500 Rheometer from TA Instruments. A 2°, 4 cm cone was used to perform the measurements. Ink measurements were made at 30°C using a Peltier plate to keep a constant temperature. Oscillation measurements were first carried out manually at 1 Hertz at variable torque to determine the

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linear viscoelastic region for each ink sample. After determination, a frequency sweep was done at 1-10 Hertz to determine rheological parameters such as G' and G'' . Viscosity measurements were carried out in the flow mode from 0 - 25,000 dyne/cm².

These measurements allowed the determination of the specific ink structures that control rheology. From oscillation measurements, values for G' (elastic modulus), G'' (loss modulus), $\tan(\delta)$ (G''/G') and η^* (complex viscosity) were obtained by non-destructive measurements. These values were then compared against "real-life" measurements such as tack and misting to provide a correlation between rheological parameters and press performance. Using this information, specific resins and varnishes were chosen to give the desired properties.

Ink tack and misting were measured on a Thwing Albert Model 101 electronic inkometer. Tack and misting were recorded for 1 minute at 1200 rpm and 90°F. Misting was measured visually on an empirical scale of 1-5 with 1 representing no misting and 5 being severe misting.

Based on the results of the misting studies, and also on the results of the Carri-Med data, the use of gellant produced opposite results to what was expected. The varnishes with the highest level of gellant produced inks that misted more than inks with less gellant. This may be due to a disruption of hydrogen bonding of the gelled structure by the polar acrylates used in this ink. The

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molecular weight of the resin did not seem to have a dramatic effect on misting, but the changes were very small due to physical constraints needed for the varnish. The most dramatic effect was found when the degree of branching was altered in the resin. With a high degree of branching, the misting was controlled without the use of clay. The manufacture of varnishes using this increased branched concept for UV curable inks produced inks with much better flow characteristics than standard inks.

Example 1

Preparation of Branched Polyesters

Branched Polyester A

Phthalic anhydride (554.3 g), neopentyl glycol (309.7 g), pentaerythritol (102.7 g), palmitic acid (20.4 g), benzoic acid (11 g) and Fascat 41000 (2 g) were charged. The mixture was then subsequently heated under a nitrogen blanket to 220°C-230°C, with the water distillate being removed. This condition was held until an acid number of 21-23 was reached. About 67g of distillate resulted. This gave a material with an acid number of 21.5 and a softening point of 106°C.

Branched Polyester B

Polyethylene terephthalate (PET, 532.6 g), 1,2-propanediol (60.2g), glycerine (98.3g) and 4.2g of tetra-n-butyl titanate (4.2 g) were charged. The mixture was subsequently heated under reflux and nitrogen blanket to 215-220°C. This was held for formation of a solution (about 3 hours). The flask was then set for distillate removal.

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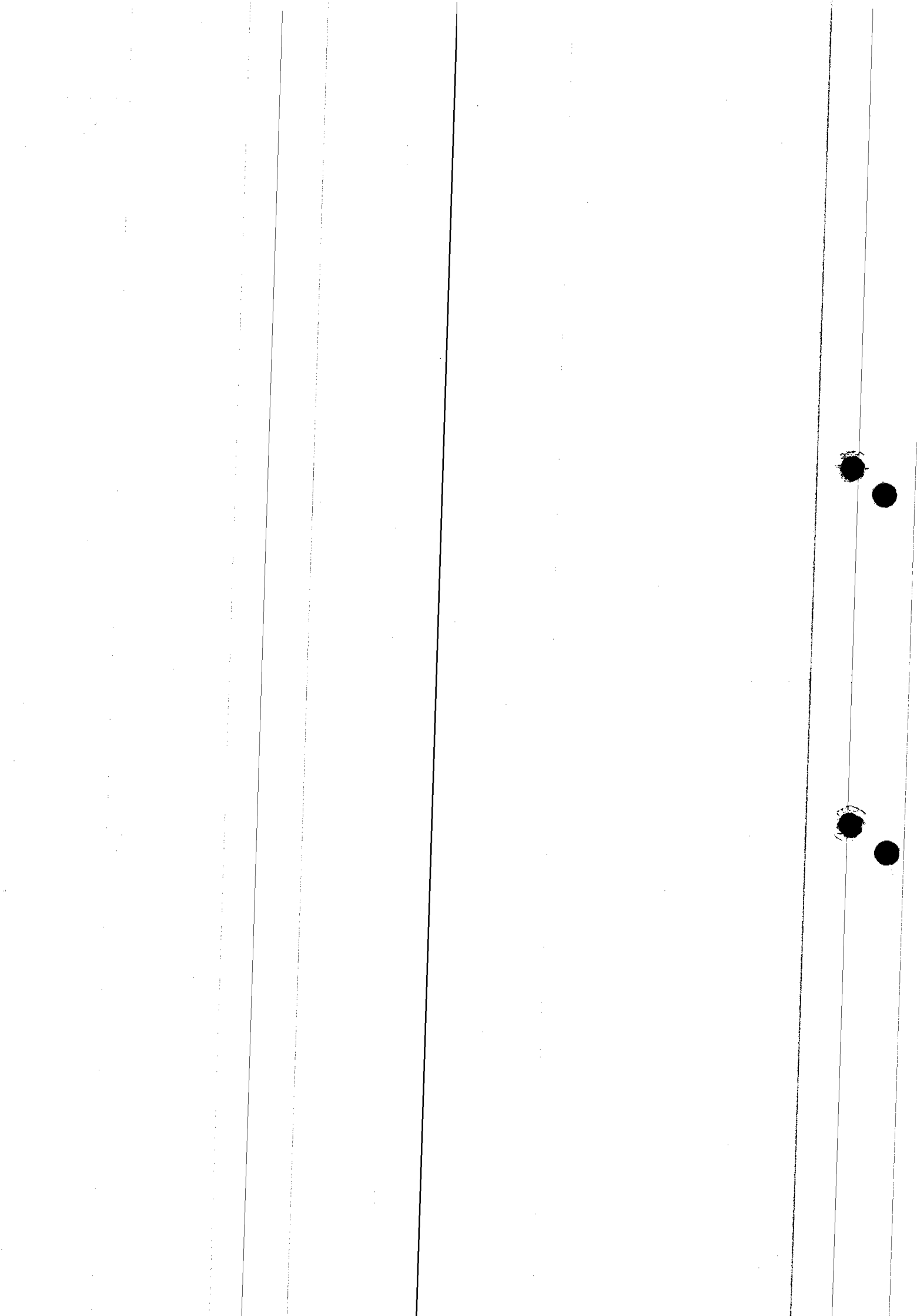
Trimellitic anhydride (115.2 g), maleic anhydride (47.6 g) and benzoic acid (193.4) were then added. The batch was heated to 240°C and held for an acid number 26-28. About 51.5g of distillate resulted. This gave a resin with an acid number of 27.8 and a softening point of 101°C.

Putting Branched Polyesters into solution

Branched polyester B (575.2 g), 57.5 grams of Benzoflex 400 (organic solvent) and 0.9 grams of 4-methoxyphenol were charged. The mixture was subsequently heated under nitrogen blanket, to 140-150°C and held for formation of solution. The solution was then cooled to 115°C, switched to an air sparge, and tripropylene glycol diacrylate (364.4 g) was charged to it. The solution was held at 90-95°C for a Haake viscometer at 60°C, resulting in Eta #4 (D=170 [1/s]) of 11 and an Ostwald B value of 0.84.

Branched polyesters 1-6 (BP#1-6) were synthesized in a similar fashion to branched polyesters A and B. Table 1 shows the composition of these polyesters:

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Table 1
Composition in equivalents of
Branched Polyesters 1-6

BRANCHED POLYESTERS						
MATERIALS	BP#1*	BP#2	BP#3	BP#4	BP#5	BP#6
Palmitic Acid	.020	0.025	0.016	0.012	0.008	0
Benzoic Acid	.020	0.025	0.016	0.013	0.009	0
Phthalic Anhydride	0.714	0.700	0.724	0.735	0.751	0.782
Pentaerythritol	0.269	0.264	0.275	0.280	0.290	0.290
Neopentyl Glycol	0.569	0.558	0.579	0.590	0.595	0.611
Excess Functionality	0.117	0.134	0.147	0.160	0.173	0.193
Softening Point EC		94	100	97	106	120
Acid Number		22.5	22	21	21.5	22.5

*Standard branched polyester used in the industry.

Example 2

Effect of Gellant Level on Misting and G' in Ink Formulations (Comparative)

The level of gellant in the UV varnish was varied from 0 to 0.9% in five steps. The inks formulated were then tested for misting using a Thwing Albert electronic inkometer, and for rheology using a Carri-Med CSL 500 rheometer. The gellant levels of the varnishes were 0.0%, 0.25%, 0.5%, 0.75%, and 0.9%. Contrary to what was expected, inks produced using higher gellant levels had lower elasticity

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(G') and had greater misting than inks using little or no gellant (see Figure 1A). In fact, the inks with the least gellant (0 and 0.25%) yielded the least misting and highest elasticity (see Table 2, for formulas and misting results). To simplify the investigation, Cyan inks (containing BP#1) were used as the standard since all pigment colors (such as Magenta and Yellow) showed the same results.

Table 2
Misting of Inks vs. Degree of Gelation of Varnishes

Ingredient	Ink #1	Ink #2	Ink #3	Ink #4	Ink #5
Grind Veh.	46	46	46	46	
Blue	14.7	14.7	14.7	14.7	46
Additives	18.4	18.4	18.4	18.4	14.7
TMPTA	25.9	5.9	5.9	5.9	18.4
Photoinitiator	3.8	3.8	3.8	3.8	5.9
Varnish #1 (0% Gellant)	11.2				3.8
Varnish #2 (0.25% Gellant)		11.2			
Varnish #3 (0.50% Gellant)			11.2		
Varnish #4 (0.75% Gellant)				11.2	
Varnish #5 (0.9% Gellant)					11.2
G= @ 10 Hz	179,000	180,000	170,000	121,000	93,000
Misting 1-5 (Best)	5	4	3	2	1
TMPTA = Trimethylol propane triacrylate					

Example 3

Effect of Highly Branched Polyester Resins on Misting and Rheology

A varnish was made up of a polyester resin cut into Benzoflex 400, a commercial plasticizer. The resin is made up of five components. Benzoic acid and Palmitic acid are both monofunctional, chain terminating acidic components. Phthalic Anhydride is a difunctional acidic component. The

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alcohol components are Neopentyl Glycol, which is difunctional, and Pentaerythritol, which has four functional hydroxyl groups and imparts branching. Using a computer program, the ratio of the components can be changed to give a predicted MW or degree of branching.

The molecular weight can be altered by changing the ratio of acid to alcohol. By making this ratio close to one, the molecular weight will increase. The MW of the inks in this Example was relatively constant at about 3,000. The amount of branching can be changed by varying the ratio of multifunctional (3 functional groups or more) to monofunctional components. In this case, the multifunctional component was pentaerythritol. The amount of branching in the polyester resin that forms the basis of the let down varnish was altered by changing the ratios of the components that make up the polymer. The amount of excess functionality was altered, and the reaction conditions changed in order to produce polymers that had varying amounts of branching, but similar molecular weights. In order to maintain these similar weights, polymers with more branching have a shorter overall chain length, but more branch points and side chains.

These additional side chains were tested to see if they would give the ink more structure through controlled covalent crosslinking, which would mimic a gellant, without the unwanted effects of H-bonding.

An ungelled standard varnish was used with different types of branched polyesters. The varnish in ink#1 contains Branched Polyester#1 which is the standard commercial resin.

A number of resins were synthesized as described in Example 1 and Table 1. After initial screening, six were chosen for further investigation. There was one resin with less

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branching than the standard, and four resins with more branching than the standard. At the highest level, no monofunctional reagents (chain terminators) were used resulting in a very highly branched resin. These resins were cut into Benzoflex 400 and in turn formulated into an ink in exact percentages. The results as shown in Table 3 indicate that as the level of branching is increased, the misting of the inks formulated from these resins decreased. This is true up to almost the highest levels of branching. At the very highest levels (BP#6, not shown in Table 3), i.e. no chain terminators, the varnish was very heavy, and the misting became worse. This was probably due to the extremely high viscosity of the varnish, and this resin was not used in the study. All other samples followed the theory that increased branching resulted in more structure, and reduced misting (see Table 3 for formulas and misting results).

Table 3
Misting Control of Inks by Covalent Bonding

Ingredient	Ink #6	Ink #1*	Ink #7	Ink #8	Ink #9
Grind Veh.	45.4	45.4	45.4	45.4	45.4
Blue Pigment	14.5	14.5	14.5	14.5	14.5
TMPTA	5.8	5.8	5.8	5.8	5.8
Photoinitiator	4	4	4	4	4
Additives	18.7	18.7	18.7	18.7	18.7
Varnish containing BP #2	11.6				
Varnish containing BP #1		11.6			
Varnish containing BP #3			11.6		
Varnish containing BP #4				11.6	
Varnish containing BP #5					11.6
G= @ 10 Hz	180,000	178,00	192,500	190,000	215,600
Misting 1-5 (Best)	1	2	3	4	5
TMPTA = Trimethylol propane triacrylate					

This result was confirmed in the Carri-Med analysis of

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the inks. A reduction in branching results in inks with less elasticity (G'), which has already been shown to correlate to more misting (Figure 2). Increasing the branching (i.e. increasing the excess functionality) resulted in higher G' values (Figure 2). This reached a maximum value after which the varnish became too elastic and did not mix well into the ink and the misting increased.

The present invention has been described in detail, including the preferred embodiments thereof. However, it will be apparent to those of skill in the art, upon consideration of the present disclosure, that the invention is capable of numerous modifications, substitutions, rearrangements of parts and/or improvements without departing from the spirit and scope of the invention.

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What is claimed is:

1. An energy curable printing ink composition comprising a branched polyester containing monofunctional and multifunctional components, wherein said branched polyester has an excess functionality of about 0.1 to 0.20, which results in an ink composition having increased rheological properties and reduced misting.
2. The printing ink composition of claim 1, wherein the excess functionality is about 0.14 to 0.16.
3. The printing ink composition of claim 1, wherein the multifunctional components comprise hydroxyl and carboxylic acid groups.
4. The printing ink composition of claim 1, wherein the monofunctional components comprise saturated, unsaturated, aliphatic, cycloaliphatic or aromatic acid or alcohol.
5. The printing ink composition of claim 4, wherein the monofunctional components comprise benzoic acid and/or palmitic acid.
6. The printing ink composition of claim 1, wherein the branched polyester further includes difunctional components and multifunctional components.
7. The printing ink composition of claim 6, wherein the difunctional components comprise phthalic anhydride

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and/or neopentyl glycol.

8. The printing ink composition of claim 6, wherein the multifunctional components are selected from the group consisting of trimethylpropane, pentaerythritol and trimellitic anhydride.

9. The printing ink composition of claim 1, wherein the average molecular weight of the branched polyester is about 1,000 to 10,000.

10. The printing ink composition of claim 1, wherein the average molecular weight of the branched polyester is about 2,000 to 4,000.

11. An energy curable varnish comprising a branched polyester containing monofunctional and multifunctional components, wherein said branched polyester has an excess functionality of about 0.1 to 0.20, which reduces misting when the varnish is employed in an energy curable printing ink composition.

12. The varnish of claim 11 wherein the multifunctional components comprise hydroxyl and carboxylic acid groups.

13. The varnish of claim 11 wherein the monofunctional components comprise saturated, unsaturated, aliphatic, cycloaliphatic or aromatic acid or alcohol.

14. The varnish of claim 13, wherein the monofunctional components comprise benzoic acid and/or palmitic acid.



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15. The varnish of claim 11, wherein the multifunctional components are selected from the group consisting of trimethylpropane, pentaerythritol and trimellitic anhydride.

16. The varnish of claim 11, wherein the average molecular weight of the branched polyester is about 1,000 to 10,000.

17. A method of reducing misting and/or dot gain in an energy curable printing ink composition comprising adding to such composition a branched polyester containing monofunctional and multifunctional components wherein the excess functionality of the components is about 0.1 to 0.20

OFFICE OF THE ATTORNEY GENERAL



Docket No.
C-416

Declaration and Power of Attorney For Patent Application

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

ENERGY CURABLE INKS AND METHODS FOR PREPARING THE SAME

the specification of which

(check one)

☒ is attached hereto.

☐ was filed on _____ as United States Application No. or PCT International Application Number _____ and was amended on _____

(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

Priority Not Claimed

_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	☐
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	☐
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	☐

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I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

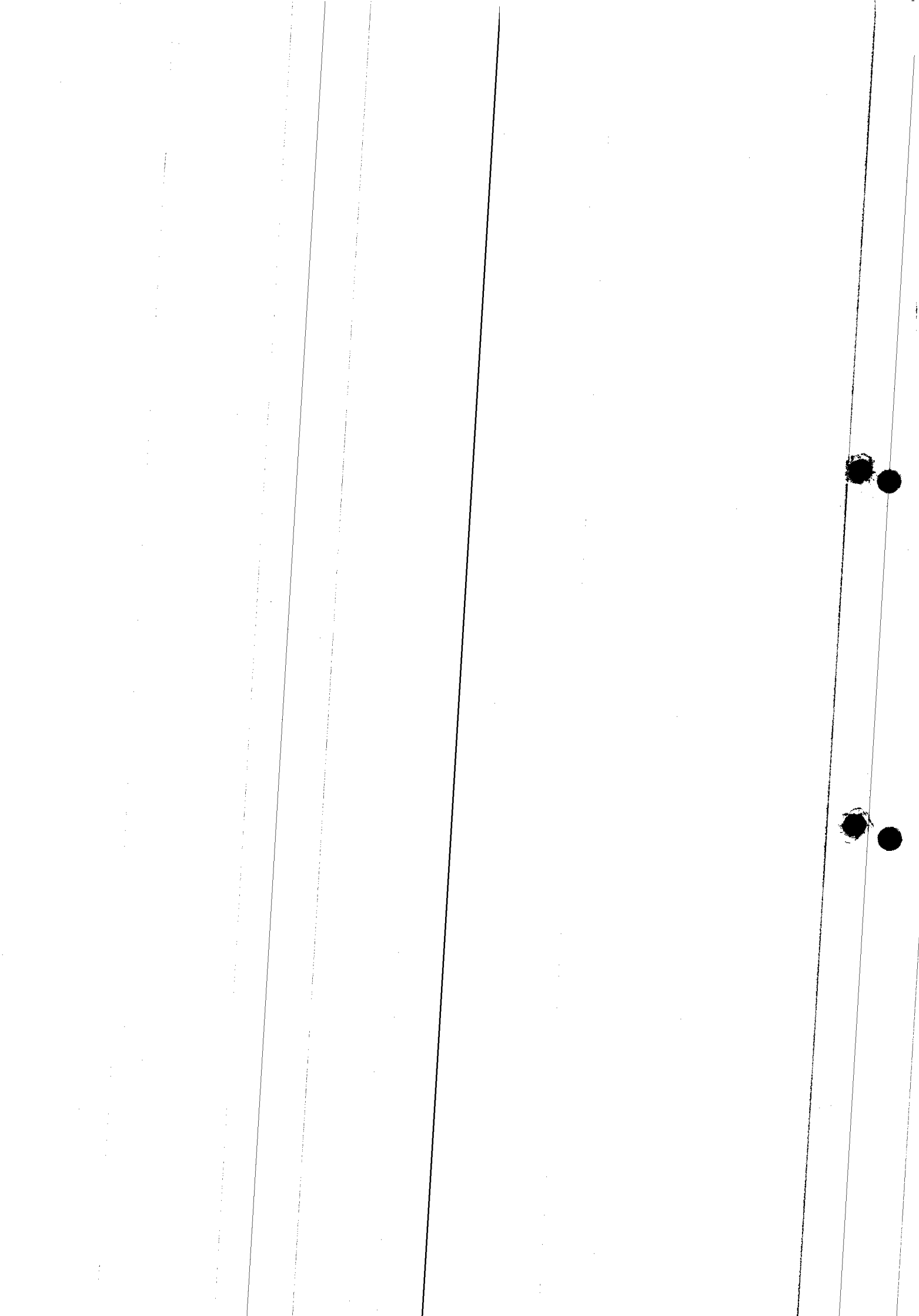
_____	_____
(Application Serial No.)	(Filing Date)
_____	_____
(Application Serial No.)	(Filing Date)
_____	_____
(Application Serial No.)	(Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

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_____	_____	_____
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
_____	_____	_____
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
_____	_____	_____
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.



POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

Sidney Persley, Esquire

Registration Number 34,898

William H. Saltzman, Esquire

Registration Number 20,303

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Full name of sole or first inventor

Edward Stone

Sole or first inventor's signature

Edward Stone

Date

1/3/02

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Citizenship

United States of America

Post Office Address

4 Inwood Place, Morris Plains, New Jersey 07950

Full name of second inventor, if any

Gordon Kotora

Second inventor's signature

Gordon Kotora

Date

12-28-99

Residence

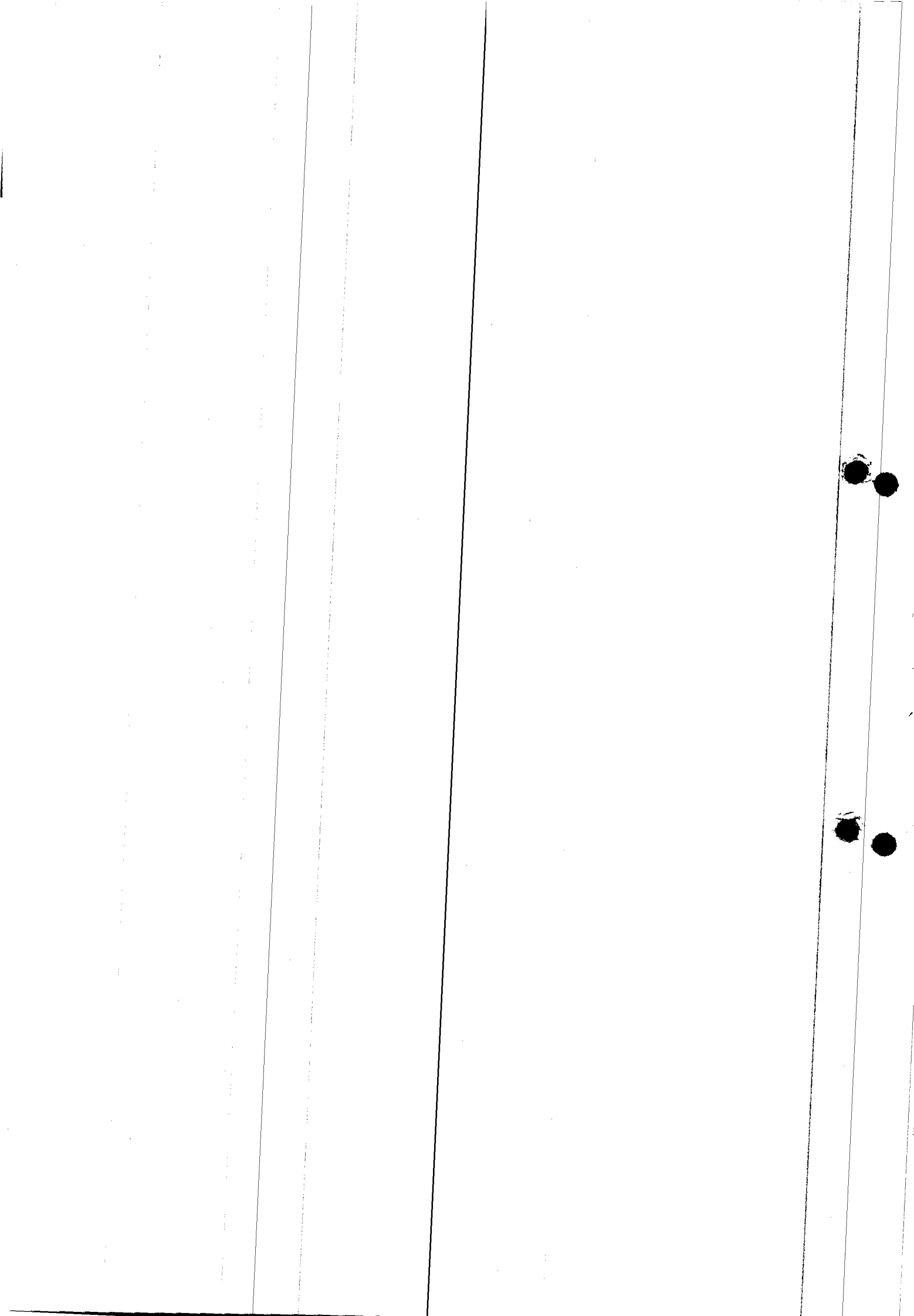
29 Belgrade Avenue, Clifton, New Jersey 07013

Citizenship

United States of America

Post Office Address

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Full name of third inventor, if any Neil Young	
Third inventor's signature <i>Neil Young</i>	Date 12-28-97
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Citizenship United States of America	
Post Office Address 140 Skyline Drive, Oakland, New Jersey 07436	

Full name of fourth inventor, if any	
Fourth inventor's signature	Date
Residence	
Citizenship	
Post Office Address	

Full name of fifth inventor, if any	
Fifth inventor's signature	Date
Residence	
Citizenship	
Post Office Address	

Full name of sixth inventor, if any	
Sixth inventor's signature	Date
Residence	
Citizenship	
Post Office Address	

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Varnish

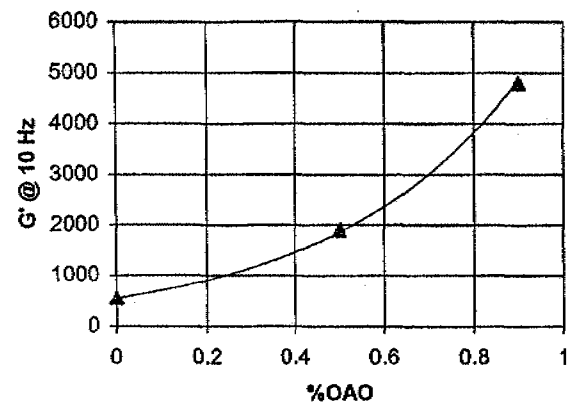


Figure 1A

Ink

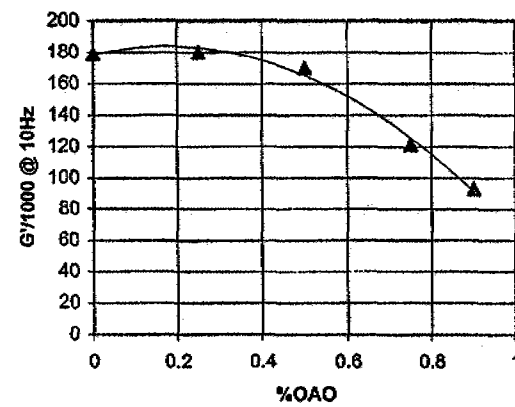


Figure 1B

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Handwritten signatures and marks at the bottom right corner.

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Ink

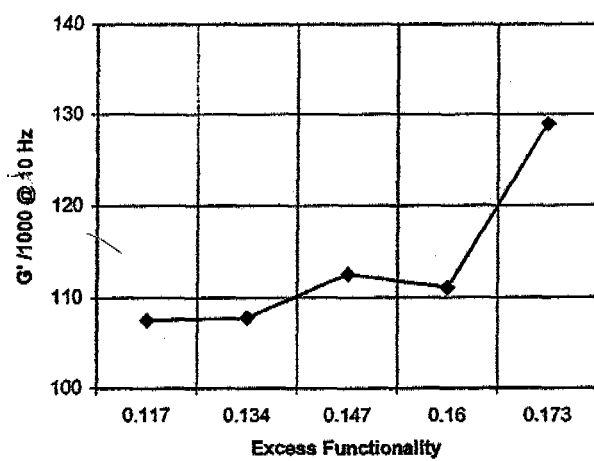


Figure 2

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ESTADOS UNIDOS DE AMÉRICA

A QUIEN INTERESE

DEPARTAMENTO DE COMERCIO DE ESTADOS UNIDOS

Oficina de Patentes y Marcas de Estados Unidos

16 de enero de 2001

EL PRESENTE TIENE COMO OBJETO CERTIFICAR QUE LOS ANEXOS AL PRESENTE INSTRUMENTO SON UNA FIEL COPIA DE LOS REGISTROS QUE REPOSAN EN LA OFICINA DE PATENTES Y MARCAS DE ESTADOS UNIDOS CORRESPONDIENTES A LOS DOCUMENTOS DE SOLICITUD DE PATENTE IDENTIFICADA A CONTINUACIÓN Y QUE CUMPLEN CON LOS REQUERIMIENTOS EXIGIDOS PARA QUE SE LES OTORQUE UNA FECHA DE RADICACIÓN SEGÚN EL CÓDIGO 35 USC 111.

SOLICITUD NÚMERO: 09/481,070

FECHA DE RADICACION: 11 de enero de 2000

AUTORIZADO POR EL COMISIONADO DE PATENTES Y MARCAS

(FIRMADO) P.R. GRANT, FUNCIONARIO DE CERTIFICACIONES

Marbete de correo expreso No. EM067803548US

(Sello de correo con código de barras: 09/481070 01/11/00)

TRÁMITE DE LA SOLICITUD DE PATENTE UTILITARIA

(Para entidad de gran tamaño) (Únicamente para nuevas solicitudes no provisionales según el 37 C.F.R. 1.53(b))

Expediente No. C-416

AL COMISIONADO AUXILIAR DE PATENTES

Transmitido para registro según el 35 C.F.R. 1.53(b) es una nueva solicitud de patente utilitaria por una invención denominada:

TINTAS DE SECADO POR ENERGIA Y METODOS DE PREPARARLAS

e inventada por:

Edward Stone, Gordon Kotoru y Neil Young

Se anexan:

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Elementos de la solicitud

1. Tarifa de registro calculada y transmitida tal como se describe a continuación
2. Especificación con 19 páginas que comprenden lo siguiente:
 - a. Título descriptivo de la invención
 - b. Referencias cruzadas con solicitudes relacionadas (*si es del caso*)
 - e. Antecedentes de la invención
 - f. Breve resumen de la invención
 - g. Breve descripción de los dibujos (*si se registraron junto con la solicitud*)
 - h. Descripción detallada
 - i. Reivindicación(es) tal como se clasifican más adelante
 - j. Extracto de la revelación
3. Dibujo(s) (*cuando se requieran según lo provisto en el 35 USC 113*)
 - a. Formales Número de hojas: 2
4. Juramento o declaración
 - c. Con Poder

Partes acompañantes de la solicitud

8. Documentos de asignación (*portada y documento(s)*)
13. Tarjeta postal de acuse de recibo
14. Certificado de correo

Correo Expreso Especificar No. de rótulo): EM067803548US

Cálculo de la tarifa y trámite

ST 6
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REIVINDICACIONES RADICADAS					
Concepto	# expe- dientes	# permi- tido	# de extras	Tasa	Tarifa
Total de reivindicaciones	17	-20 =	0	x\$18,00	\$0,00
Reivindicaciones independientes	3	-3 =	0	x\$78,00	\$0,00
Reivindicaciones dependientes múltiples (si es del caso)					\$0,00
TARIFA BASICA					\$760,00
OTRAS TARIFAS (especificar el propósito correspondiente)					\$0,00
TARIFA TOTAL DE REGISTRO					\$760,00

Por el presente el Comisionado queda autorizado para cobrar y acreditar a la cuenta corriente No. 19-4968 tal como se describe enseguida.

- Cobrar la cantidad de \$760,00 como tarifa de registro.
- Acreditar cualquier sobrepago.
- Cobrar cualquier tarifa de registro adicional que se requiera según lo previsto en el 37 C.F.R. 1.16 y 1.17.

(Firmado) Sidney Presley, Abogado

Representante apoderado del solicitante

Registro Número 34,898

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Se reivindica lo siguiente:

1. Una composición de una tinta de impresión de secado por energía, el cual comprende un poliéster ramificado que contiene componentes monofuncionales y multifuncionales, en la cual el mencionado poliéster ramificado tiene un exceso de funcionalidad de alrededor de 0,1 a 0,20, lo cual produce una composición de tinta con un aumento en las propiedades reológicas y una reducida flotación de la tinta en el aire.
2. La composición de la tinta de impresión de la reivindicación 1, en la cual el exceso de funcionalidad es de aproximadamente de 0,14 a 0,16.
3. La composición de la tinta de impresión de la reivindicación 1, en la cual los componentes multifuncionales comprenden hidroxilo y grupos ácidos carboxílicos.
4. La composición de la tinta de impresión de la reivindicación 1, en la cual los componentes monofuncionales comprenden ácido saturado, no saturado, alifático, cicloalifático o aromático, o alcoholes.
5. La composición de la tinta de impresión de la reivindicación 4, en la cual los componentes monofuncionales comprenden ácido benzoico y/o ácido palmítico.
6. La composición de la tinta de impresión de la reivindicación 1, en la cual el poliéster ramificado comprende además componentes bifuncionales y componentes multifuncionales.
7. La composición de la tinta de impresión de la reivindicación 6, en la cual los componentes bifuncionales comprenden anhídrido ftálico y/o neopentil glicol.
8. La composición de la tinta de impresión de la reivindicación 6, en la cual los componentes multifuncionales se seleccionan

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de entre el grupo compuesto por trimetilpropano, pentaeritritol y anhídrido trimelítico.

9. La composición de la tinta de impresión de la reivindicación 1, en la cual el peso molecular del poliéster ramificado es de alrededor de 1.000 a 10.000.
10. La composición de la tinta de impresión de la reivindicación 1, en la cual el peso molecular promedio del poliéster ramificado es de alrededor de 2.000 a 4.000.
11. Un barniz de secado por energía, el cual comprende un poliéster ramificado que contiene componentes monofuncionales y multifuncionales, en el cual el mencionado poliéster ramificado tiene un exceso de funcionalidad de alrededor de 0,1 a 0,20, que reduce la flotación de la tinta en el aire cuando el barniz se emplea en una composición de tinta de impresión de secado por energía.
12. El barniz de la reivindicación 11, en el cual los componentes multifuncionales comprenden hidroxilo y grupos ácidos carboxílicos.
13. El barniz de la reivindicación 11, en el cual los componentes monofuncionales comprenden ácidos saturados, insaturados, alifáticos, cicloalifáticos o aromáticos o alcoholes.
14. El barniz de la reivindicación 13, en el cual los componentes monofuncionales comprenden ácido benzoico y/o ácido palmítico.
15. El barniz de la reivindicación 11, en el cual los componentes monofuncionales se seleccionan de entre el grupo compuesto por trimetilpropano, pentaeritritol y anhídrido trimelítico.
16. El barniz de la reivindicación 11, en el cual el peso molecular promedio del poliéster ramificado es de aproximadamente 1.000 a 10.000.

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17. Un método para reducir la flotación de la tinta en el aire y/o la ganancia de punto en una composición de tinta de impresión de secado por energía, el cual comprende la adición a dicha composición de un poliéster ramificado que contiene componentes tanto monofuncionales como multifuncionales, en donde el exceso de funcionalidad de los componentes es de aproximadamente 0,1 a 0,20.

EXTRACTO

Una composición de tinta de impresión de secado por energía que contiene un poliéster ramificado, el cual comprende componentes tanto monofuncionales como bifuncionales, que tienen un exceso de funcionalidad de aproximadamente 0,1 a 0,20. Asimismo, se describe un método para reducir la flotación de la tinta en el aire y/o la ganancia de punto en una composición de tinta de impresión de secado por energía agregando dichos poliésteres ramificados a la composición.

