(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 709 221 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
01.05.1996 Bulletin 1996/18

(51) Int. Cl.[6]: **B41M 1/36**, B41M 5/00

(21) Application number: **95202783.7**

(22) Date of filing: **16.10.1995**

(84) Designated Contracting States:
DE FR GB

(30) Priority: **28.10.1994 US 330591**
17.11.1994 US 343858

(71) Applicant: **ARKWRIGHT INC.**
Fiskeville, Rhode Island 02823 (US)

(72) Inventors:
- **Yang, Sen**
  Warwick, RI 02886 (US)
- **Atherton, David**
  Saunderstown, RI 02874 (US)
- **Sargeant, Steven J.**
  West Warwick, RI 02893 (US)
- **Miaoling, Huang**
  Danielson, CT 06239 (US)
- **Sun, Kang**
  North Attleboro, MA 02163 (US)

(74) Representative: **Hanneman, Henri W.A.M. et al**
Océ-Nederland B.V.
Patents and Information
St. Urbanusweg 43
P.O. Box 101
NL-5900 MA Venlo (NL)

(54) A glossy ink jet receiving paper

(57) A glossy ink jet receiving paper comprising (1) a paper substrate having a gloss greater than about 20 as measured at a 60 degree angle, a Sheffield smoothness of less than about 80 Sheffield units, an opacity of greater than about 70%, and a brightness of greater than about 70%; and (2) an ink receptive coating containing one or more water-soluble components in a total amount of about 4 to about 100 wt%, based on the total weight of solids in the coating; wherein the prepared glossy ink jet receiving paper should possess a gloss of greater than about 50 as measured at a 60 degree angle, a Sheffield smoothness of less than about 300 Sheffield units as measured on a surface of the paper coated with the ink receptive coating, an opacity of greater than about 70% as measured on a surface of the paper coated with the ink receptive coating, and a brightness of greater than about 70% as measured on a surface of the paper coated with the ink receptive coating.

EP 0 709 221 A1

Description

Field of the Invention

This invention relates to a glossy ink jet receiving paper that can be used for high resolution color ink jet printing applications.

Background of the Invention

Recently, ink jet printing technology has been used for presentation, graphic art, engineering drawing and home office applications. The performance requirements for ink jet media that are used for these applications are quite stringent. These include fast ink drying, low ink migration, large color gamut, good color fidelity, minimal ink offset, high image resolution and good performance under varied environmental conditions. Another important requirement for ink jet media in commercial applications is high surface gloss. This is particularly important for graphic art applications. Current commercial ink jet media cannot meet these performance requirements. For example, plastic substrate based ink jet media cannot offer high image resolution and fast drying, and most commercial ink jet papers cannot overcome low gloss and poor color fidelity.

Although many ink jet receiving paper designs have been proposed in the field, none of them provides a satisfactory solution to the problem of providing a glossy ink jet receiving sheet. For example, U.S. Patent 5,141,599 discloses a glossy ink jet receiving material based on a polyolefin coated paper, but the coated paper performs more like a plastic film than a paper. Similarly, U.S. Patent 4,092,457 disclosed an ink receiving material based on synthetic fibers that do not offer desired paper properties. Further, U.S. Patents 5,141,797, 5,279,885, 5,213,873, 5,207,824, 5,180,624, 4,542,059, 5,281,467, 5,302,437, 5,126,010, 5,013,603, 4,952,943, 4,900,620 all discuss ink jet receiving papers, but all of these designs ignored two important performance parameters, namely, gloss and ink migration. The provision of an ink jet receiving paper which can satisfy both of these performance requirements would be an important achievement in the art.

Summary of the Invention

An objective of the present invention is to provide an ink jet receiving sheet which overcomes the above-mentioned drawbacks and problems which previously existed in the art.

The present invention provides an ink jet receiving paper for use in applications wherein high gloss, good image resolution and color fidelity are required. More specifically, the present invention provides an ink jet receiving paper with improved gloss, image resolution, color fidelity, ink migration, dry time and environmental tolerance. The present invention offers an ink jet receiving paper giving optimal performance in this respect, through the provision of unique combinations of ink receptive coatings and paper substrates having specified properties, wherein the resulting ink jet receiving paper fully meets the physical and performance requirements of commercial ink jet recording media.

More specifically, the present invention provides for a glossy ink jet receiving paper which comprises:

(1) a paper substrate having:
- a gloss greater than about 20 and preferably greater than about 30 as measured at a 60 degree angle,
- a Sheffield smoothness of less than about 80 and preferably less than about 60,
- an opacity of greater than about 70% and preferably greater than about 80%, and
- a brightness of greater than about 70% and preferably greater than about 80%; and

(2) an ink receptive coating containing one or more water-soluble components in a total amount of about 4 to about 100 weight %, based on the total weight of solids in the coating.

Additionally, the prepared glossy ink jet receiving paper media encompassed by the present invention should possess the following characteristics:

a gloss of greater than about 50, as measured at a 60 degree angle on a surface of the paper coated with the ink receptive coating,

a Sheffield smoothness of less than about 300 as measured on a surface of the paper coated with the ink receptive coating,

an opacity of greater than about 70% as measured on a surface of the paper coated with the ink receptive coating, and

a brightness of greater than about 70% as measured on a surface of the paper coated with the ink receptive coating.

In the glossy ink jet receiving papers provided herein, the ink receptive coating provides an image forming layer, and the paper substrate provides a base for handling as well as a reservoir for an ink vehicle.

Detailed Description of the Invention

In the present invention, any kind of paper can be used as the paper substrate, so long as it meets the above described parameters for gloss, Sheffield smoothness, opacity and brightness. However, a clay-coated paper meeting such parameters is thought to be preferred.

Exemplary of suitable paper substrates which may be used in the present invention are clay-coated papers, such as Reflections II grade paper (Consolidated Paper Inc.), MultiArt Gloss grade paper (Stora Papyrus Newton Falls, Inc.), Tahoe Gloss grade paper (Simpson Paper Company), Evergreen Gloss paper (Simpson Paper Company) and the like. The base weight of the paper is not particularly restricted, but should generally be in the range of about 30 g/m^2 to about 250 g/m^2, preferably about 50 g/m^2 to about 150 g/m^2. The paper substrate may be pretreated to enhance adhesion of the ink receptive coating thereto or increase the gloss level of the finished glossy ink jet receiving paper product.

The paper substrate used in the present invention preferably also contains at least one element selected from the group consisting of silicon, aluminum, titanium, potassium, iron, magnesium, sodium and calcium. These elements are important to paper appearance and physical properties. They also sometimes reduce ink migration and dye fading.

The gloss of the paper used in the present invention is important. This is because high gloss is required in many ink jet imaging applications, particularly in the areas of graphic art, pre-press proof reading, display and presentation. Further, gloss is also a key factor that affects color gamut.

The gloss is the characteristic of the paper surface that causes it to reflect light at a given angle of reflection in excess of the diffuse reflection at that angle. The paper used in the present invention should have gloss greater than about 20, and preferably greater than about 30 as measured at a 60 degree angle. The gloss values are obtained from a Micro Tri-Gloss Meter (BYK-Gardner), according to the procedure described in the product manual. The test procedure for determining gloss more specifically entails the following steps: cut paper sample into an 8.5 inch by 11 inch size sheet; calibrate the Micro Tri-Gloss meter at 60 degrees using the standard supplied with the unit; place sample on a flat surface and measure the gloss at 60 degrees; repeat the measurement on five samples; and report the average value.

The ink receptive coatings utilized to prepare the glossy ink jet receiving papers should not reduce the gloss of the paper substrates utilized. Preferably the ink receptive coating utilized should be capable of increasing the gloss of the paper substrate at least 10%.

The opacity of the paper substrate used in the invention should be greater than about 70%, and preferably greater than about 80%. The opacity is measured on a BNL-3 Opacimeter (Technidyne Corp.), according to the procedure described in the product manual. The test procedure for determining opacity more specifically entails the following steps: cut paper sample into a 10 cm by 10 cm square; calibrate the opacimeter according to the standard procedure; and measure 5 samples and report the average value.

The smoothness of the paper substrate is a property that affects the paper's appearance and surface property. The smoothness is also associated with gloss. For the applications described herein, the Sheffield smoothness of the paper should be below about 80 Sheffield Units and preferably below about 60 Sheffield Units. The Sheffield smoothness is measured on a Hagerty Smoothness Tester (Model 538, Hagerty Technologies, Inc.), according to the procedure described in the product manual. The test procedure for determining smoothness more specifically entails the following steps: cut sample into an 8.5 inch by 11 inch size sheet and select Sheffield Units (SU) from the Hagerty Smoothness Tester console; set test zones at 3 centimeters apart; start measurements and report average smoothness values in SU units.

The brightness refers to the lightness or overall spectral reflectance of the paper substrate. The brightness of the paper used in this invention should be greater than about 70% and preferably greater than about 80%. The brightness is measured on a Photovolt Model 575 Reflection and Gloss Meter (Seragen Inc.), according to the procedure described in the product manual. The test procedure for determining brightness more specifically entails the following steps: cut paper sample into a 10 cm by 10 cm square; calibrate the meter by placing a standard white enamel plaque over the search unit and adjust the sensitivity knobs to set the meter to standard value; place the sample to be measured over the search unit and back it with the white standard enamel plaque; read the brightness values; and repeat with five samples and report average value.

The ink receptive coating layers present in the glossy ink jet receiving paper of the present invention are coated on a surface of the paper substrate and can exist as either a single layer, or alternatively they may be a multi-layer coating structure. However, it is required that at least one ink receptive coating containing one or more water-soluble components in a total amount of about 4 to about 100 weight %, based on the total weight of solids in the coating, must be present in the provided ink jet recording receiving papers encompassed hereby. The water soluble components are preferably present in the ink-receptive coating in a total amount of about 20 to about 100 weight %, and most preferably in a total amount of about 30 to about 100 weight %, based on the total weight of solids in the coating.

The ink receptive coatings used in the glossy ink jet receiving papers of the present invention contain at least one water-soluble component and may contain more than one if so desired.

The chosen water-soluble components are preferably soluble in an amount of about at least 1 wt%, and more preferably about at least 3 wt%, in water at a temperature in the range of about 5°C to about 100°C.

The coating materials used to prepare the ink receptive coatings have to be carefully selected so that the resulting ink jet receiving sheet has a gloss of about 50 or above as measured at a 60 degree angle, a Sheffield smoothness of less than about 300 Sheffield units as measured on a surface of the paper coated with the ink receptive coating, an opacity of greater than about 70% as measured on a surface of the paper coated with the ink receptive coating, and a brightness of greater than about 70% as measured on a surface of the paper coated with the ink receptive coating.

Exemplary of suitable water-soluble components which may be used in such coatings are poly(vinyl alcohol), poly(vinyl pyrrolidone), poly(2-ethyl-2-oxazoline), polyacrylamide, gelatins, poly(vinyl acetate), poly(ethylene glycol), poly(ethylene oxide), cellulose esters, proteins, alginates, poly(acrylic acid), water-soluble gums, and mixtures thereof. The water-soluble component may be a component of a homopolymer, a copolymer or a polymer blend.

In addition, the ink receptive coating should be soluble or swellable in the ink to be used for the intended application. The term "soluble" when used in this context means that the coating is soluble in the ink in an amount of about at least 1% on a wt/wt basis. The term "swellable" when used in this context means the coating increases in volume in the ink as a function of time before reaching a saturated state. These properties are important to achieving good image quality, since coating materials that do not possess these properties cannot receive ink satisfactorily.

If desired, inorganic and/or organic particulates may be incorporated in the coating layer to provide proper handling properties, increase brightness, provide high surface gloss to the ink receiving paper, as well as mixtures of these properties. Another function of the particulates is to prevent sheet to sheet ink transfer when imaged sheets are stacked for long term storage and in such instances the particulates can be incorporated in either the ink receiving side or backing side of the prepared glossy ink jet receiving media.

Examples of inorganic particulates which may be used in the glossy ink jet receiving media are silica, titanium oxide, alumina, glass beads, barium sulfate, diatomaceous earth and zinc oxide. Examples of organic particulates which may be used include poly(methyl methacrylate), polyethylene, polypropylene, starch, polytetrafluoroethylene and polystyrene.

To achieve optimal performance, the coat weight of the coating should be well controlled. The coat weight of the ink receiving coating should be within the range of about 1g/m^2 to about 30 g/m^2, and preferably from about 2 g/m^2 to about 20 g/m^2.

The side of the substrate which does not bear the ink receptive coating may need a backing material in order to reduce electrostatic charge and to reduce sheet-to-sheet friction and sticking. The backing may either be a polymeric coating or polymeric film.

Any of a number of coating methods may be employed to coat the coating composition onto the paper base, such as roller coating, wire-bar coating, dip coating, extrusion coating, air knife coating, curtain coating, slide coating, blade coating, doctor coating, or gravure coating. Such techniques are well know in the art.

In practice, various additives may be employed in the coatings of both sides of the paper. These additives include surface active agents which control wetting or spreading action of the coatings, antistatic agents, suspending agents, and compounds with acidic groups to control the pH, among other properties, of the coated paper.

It is noted that the same apparatuses used for measuring the gloss, Sheffield smoothness, opacity and brightness of the paper substrate can also be used to measure such properties of the finished ink jet receiving papers disclosed herein.

The following general procedures were used for the preparation of the ink jet recording sheets according to the examples. All the examples are given merely as illustrative of the invention in order to aid those desiring to practice the present invention, and are not to be considered as limiting.

Example 1

Substrate:	
MultiArt Gloss 80#[1]	
Coating Composition:	
PVP K90[2]	6.8 parts
Acrylic Copolymer[3]	1.2 parts
PMMA Particulate (20 um)[4]	0.04 parts
DOWANOL PM[5]	20 parts
MEK[6]	30 parts

1. Stora Papyrus Newton Falls, Inc.
2. Poly(vinyl pyrrolidone) K90, ISP, Inc.
3. Copolymer of methyl methacrylate and 2-hydroxyethyl methacrylate.
4. Poly(methyl methacrylate) particulate.
5. Propylene glycol monomethyl ether, Dow Chemical Corporation.
6. Methyl ethyl ketone.

The coating was coated on the following paper substrates using a No. 24 Meyer rod. The coating is dried in a circulating hot air oven at 110°C for 2 minutes. The dry coat weight of the finished coating is about 7 g/m^2. The same procedure was used for Examples 2-6 and Comparative Examples 1-3. A No. 36 Meyer rod was used for Example 7.

Example 2

Substrate:
Reflections II 90#[1]
Coating Composition:
Same as in Example 1

1. Consolidated Papers, Inc.

Example 3

Substrate:
Excellence 100#[1]
Coating Composition:
Same as in Example 1

1. Repap Sales Corporation

Example 4

Substrate:
Warren Flo 80# Text[1]
Coating Composition:
Same as in Example 1

1. S. D. Warren Company

Example 5

Substrate:
Tahoe Gloss 80#[1]
Coating Composition:
Same as in Example 1

1. Simpson Paper Company

Example 6

Substrate:
CHROMOLUX 60#[1]
Coating Composition:
Same as in Example 1

1. Zanders Feinpapiere, A. G.

Example 7

Substrate:	
MultiArt 100# Gloss[1]	
Coating Composition:	
PVP K90	4.62 parts
AIRVOL 603[2]	4.62 parts
Methocel A4M[3]	0.25 parts
Isopropyl Alcohol	2.00 parts
Water	88.51 parts

1. Stora Papurus Newton Falls, Inc.
2. Polyvinyl Alcohol, Air Products and Chemicals, Inc.
3. Dow Chemical Company

Comparative Example 1

Substrate:
Ardor Offset 50#[1]
Coating Composition:
Same as in Example 1

1. Georgia Pacific

Comparative Example 2

Substrate:
Gilbert 20# Bond (25%Cotton)[1]
Coating Composition:
Same as in Example 1

1. Gilbert Paper Company

Comparative Example 3

Substrate:
XEROX 4200DP 20# Bond[1]
Coating Composition:
Same as in Example 1

1. Xerox Corporation

The gloss values are presented in Table I. The paper substrate disclosed in Examples 1-7 are superior to those shown in Comparative Examples 1-3.

TABLE I

GLOSS VALUES			
Example	**Substrate Gloss (60 deg)**	**Sample Gloss (60 deg)**	**Image Quality**
1	38	73	Good
2	57	83	Good
3	45	76	Good
4	24	62	Good
5	32	67	Good
6	62	84	Good
7	38	72	Good
C1	4.0	7.0	Poor
C2	3.7	6.5	Poor
C3	5.0	9.0	Poor

*Image quality was visually inspected on samples printed on a HP DESKJET 1200C with a full page color graphic pattern. Good: High color brightness and imagery gloss. Poor: Poor imagery brightness and gloss.

In Examples 8-10, a multilayered coating structure consisting of an underlayer and a surface layer is applied to a paper substrate, to produce the desired glossy ink-jet receiving paper.

Example 8

Substrate:	
MultiArt Gloss 100# Paper[1]	
Underlayer:	
PVP-K90[2]	6.8 parts
Copolymer A[3]	1.2 parts
Quaternary polymer[4]	3.2 parts
Starch particulate[5]	0.2 parts
DOWANOL PM[6]	120 parts
Surface layer:	
Methocel F-50[7]	1.5 parts
Methanol	5.0 parts
Water	93.5 parts

1. Stora Papyrus Newton Falls, Inc.
2. Poly(vinyl pyrrolidone) K90, ISP, Inc.
3. Copolymer of methyl methacrylate and 2-hydroxyethyl methacrylate.
4. Quaternized copolymer of methylmethacrylate and dimethylaminoethyl methacrylate.
5. Corn starch.
6. Propylene glycol monomethyl ether, Dow Chemical Corporation.
7. Hydroxypropyl methylcellulose, Dow Chemical Corporation.

The coating was coated on the paper base using a No. 42 Meyer rod. After drying the underlayer coating at 110°C for about 2 minutes, the surface layer coating was coated using a No. 10 Meyer rod at the same condition. The dry coat weight of the finished coating is about 7 g/m^2. The same procedure was used for Examples 9-10 and Comparative Examples 4-7.

Example 9

Substrate:	
MultiArt Gloss 100# Paper[1]	
Underlayer:	
Same composition as that in Example 8	
Surface layer:	
Hydroxyethyl Cellulose blend[2]	1.75 parts
Citric acid[3]	0.25 parts
Water	98.00 parts

1. Stora Papyrus Newton Falls, Inc.
2. Union Carbide Corporation
3. Pfizer Inc.

Example 10

Substrate:	
MultiArt Gloss 100# Paper[1]	
Underlayer:	
Same composition as that in Example 8	
Surface layer:	
AIRVOL 523[2]	3.87 parts
ACRYLIDON ACP1005[3]	1.00 parts
Isopropyl alcohol	4.00 parts
Water	91.13 parts

1. Stora Papyrus Newton Falls, Inc.
2. Polyvinyl Alcohol, Air Products and Chemicals, Inc.
3. Copolymer of vinyl pyrrolidone and acrylic acid, ISP, Inc.

Comparative Example 4

Substrate:
MELINEX 339 White Polyester Film[1]
Underlayer:
Same as that in Example 8
Surface layer:
Same as that in Example 8

1. ICI Films

Comparative Example 5

Substrate:
Schoeller VRH polyolefin coated paper[1]
Underlayer:
Same as that in Example 8
Surface layer:
Same as that in Example 8

1. Schoeller Technical Papers, Inc.

Comparative Example 6

Substrate:
MELINEX 339 White Polyester Film[1]
Underlayer:
Same as that in Example 8
Surface layer:
Same as that in Example 9

1. ICI Films

Comparative Example 7

Substrate:
Schoeller VRH polyolefin coated paper[1]
Underlayer:
Same as that in Example 8
Surface layer:
Same as that in Example 9

1. Schoeller Technical Papers, Inc.

The ink migration results are present in Table II. The glossy ink jet receiving papers disclosed in Examples 8-10 are clearly superior to the other ink jet receiving papers shown in Comparative Examples 4-7.

TABLE II

INK MIGRATION PERFORMANCE COMPARISON		
	Migration (Blue/Red)	**Migration % (Blue/Red)**
Example 8	2.17 mil	5.4%
Example 9	1.50 mil	3.8%
Example 10	2.17 mil	5.4%
Comparative Example 4	8.83 mil	22.1%
Comparative Example 5	7.67 mil	19.2%
Comparative Example 6	14.17 mil	35.4%
Comparative Example 7	12.33 mil	30.8%

Ink migration (sometimes called color to color bleed) measurements were performed as follows: color prints with a 40 mil solid blue line in a red background were printed with a HP DESKJET 1200C printer. The prints were conditioned for 30 minutes at 73°F/50% RH (RH=relative humidity). Then the samples were stored in an controlled environment chamber at 86°F/80% RH for 48 hrs. The blue line width was measured with an ACU-RITE travelling microscope (Automation Components, Inc). The differential line width of the initial and final line was reported in the above table. Ink migration (%) was calculated as follows.

$$\text{Ink Migration (\%)} = (Lw_f - Lw_i) / Lw_i \times 100\%$$

wherein:

LW_i is the initial blue line width (40 mil), and

LW_f is the blue line width after 48 hours at 86°F/80% RH.

The above detailed disclosure, including the Examples set forth herein, has been provided as an aid to those desiring to practice the present invention. Accordingly, the same is not to be construed as unduly limiting to the present invention, since those skilled in the art will readily recognize that various changes may be made in the procedures and materials referred to herein without departing from the spirit or scope of the present inventive discovery.

Each of the publications, product manuals and patent documents referred to herein is incorporated by reference in its entirety.

Claims

1. A glossy ink jet receiving paper having improved image quality for ink jet applications, which comprises a paper substrate and an ink receiving coating;
wherein:

(a) the paper substrate has a gloss of greater than about 20 as measured at a 60 degree angle, a Sheffield smoothness of less than about 80 Sheffield units, an opacity of greater than about 70%, and a brightness of greater than about 70%;
(b) the ink receiving coating contains one or more water-soluble components in a total amount of about 4 to about 100 weight %, based on the total weight of solids in the ink receiving coating; and
(c) the glossy ink jet receiving paper has a gloss of greater than about 50 as measured at a 60 degree angle, a Sheffield smoothness of less than about 300 Sheffield units as measured on a surface of the paper coated with the ink receiving coating, an opacity of greater than about 70% as measured on a surface of the paper coated with the ink receiving coating, and a brightness of greater than about 70% as measured on a surface of the paper coated with the ink receiving coating.

2. The glossy ink jet receiving paper according to Claim 1, wherein said one or more water-soluble components in the ink receiving coating are selected from the group consisting of:
poly(vinyl alcohol), gelatins, cellulose esters, poly(vinyl pyrrolidone), poly(ethylene glycol), poly(2-ethyl-2-oxazoline), poly(vinyl acetate), polyacrylamide, poly(acrylic acid), alginates, proteins and water-soluble gums.

3. The glossy ink jet receiving paper according to claim 1, wherein said one or more water-soluble components in the ink receiving coating are components of a homopolymer, a copolymer or a polymer blend.

4. The glossy ink jet receiving paper according to claim 1, wherein said ink receiving coating is soluble in an ink jet printing ink.

5. The glossy ink jet receiving paper according to claim 1, wherein said ink receiving coating is swellable in an ink jet printing ink.

6. The glossy ink jet receiving paper according to claim 1, wherein said ink receiving coating does not reduce the gloss of the paper substrate.

7. The glossy ink jet receiving paper according to claim 1, wherein said ink receiving coating increases the gloss of the paper substrate.

8. The glossy ink jet receiving paper according to claim 1, wherein said paper substrate contains at least one element selected from the group consisting of calcium, silicon, titanium, sodium, aluminum, iron, potassium and magnesium.

9. The glossy ink jet receiving paper according to claim 1, wherein said ink receiving coating has a coat weight of from about 1 g/m^2 to about 30 g/m^2.

10. The glossy ink jet receiving paper according to claim 1, wherein said ink receiving coating contains an inorganic particulate selected from the group consisting of silica, aluminum, titanium oxide, calcium carbonate, barium sulfate, glass beads, and zinc oxide.

11. The glossy ink jet receiving paper according to claim 1, wherein said ink receiving coating contains an inorganic particulate selected from the group consisting of poly(methyl methacrylate), polystyrene, polyethylene, polypropylene, starch and polytetrafluoroethylene.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 20 2783

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,D	US-A-5 141 599 (R.JAHN ET AL.) * column 2, line 19 - column 3, line 8 * * claims 1-28; examples 1-4 *	1-11	B41M1/36 B41M5/00
X,D	US-A-5 141 797 (J.W.WHEELER) * column 2, line 17 - column 3, line 51 * * claims 1-13; examples 1-10 *	1-11	
X,D	US-A-5 126 010 (A.KOBAYASHI ET AL.) * column 2, line 35 - line 64 * * column 3, line 6 - line 62 * * claims 1-4; examples 1-12 *	1-11	
X,D	US-A-5 213 873 (K.YASUDA ET AL.) * column 3, line 65 - column 4, line 23 * * column 5, line 3 - line 48 * * claims 1-3; examples 1-3 *	1-11	
X,D	US-A-5 281 467 (T.SHIMADA ET AL.) * column 2, line 33 - line 54 * * column 3, line 32 - column 4, line 48 * * claims 1-14; examples 1-12 *	1-11	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6) B41M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	6 February 1996	Bacon, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)