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(71) Applicant: **HONSHU PAPER CO., LTD.**
12-8, Ginza 5-chome
Chuo-ku Tokyo(JP)

(72) Inventor: **ISHIBASHI, Yoshimi**
3-1-204, Higashishinozaki 2-chome
Edogawa-ku
Tokyo 132(JP)
Inventor: **MORONUKI, Katsumi**
10-24, Naka-machi 4-chome Koganei-shi
Tokyo 184(JP)

(74) Representative: **Vossius & Partner**
Siebertstrasse 4 P.O. Box 86 07 67
W-8000 München 86(DE)

(54) HEAT-SENSITIVE RECORDING PAPER.

(57) This invention relates to heat-sensitive recording paper. More particularly, in heat-sensitive recording paper including a heat-sensitive recording layer containing a basic colorless dye and an acidic material causing coloration of the basic colorless dye upon heating on a substrate, the present invention relates to heat-sensitive recording paper wherein the support contains used paper and the content of the residual surfactant contained in the support is below 1,000 ppm. According to the present invention, heat-sensitive paper which is economical and has high storage stability and high reliability with respect to a thermal head can be obtained.

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TECHNICAL FIELD

The present invention relates to heat-sensitive recording paper and more specifically to heat-sensitive recording paper which is cheap and excellent in storage stability and which has high reliability to the thermal head. Background Art

The heat-sensitive recording system which makes use of a basic colorless dye and an acidic substance capable of causing the color-development of the basic colorless dye upon heating shows various characteristic properties. For instance, the system does not require the use of any developing process and the maintenance of the hard thereof is very easy. For this reason, such a heat-sensitive recording system has widely been used in a variety of fields such as facsimiles, printers and recorders for measuring machinery and tools.

As substrates for the heat-sensitive recording paper, there have presently been used wood-free paper which does not contain any waste paper, but it is assumed that the waste paper will be more frequently used in the substrates for the heat-sensitive recording paper because of the increasing demand for the reduction in the cost of the heat-sensitive recording paper and reuse or recycling of paper-making pulp.

Incidentally, when waste paper is incorporated into the substrates for the heat-sensitive recording paper, the resulting recording paper suffers from a variety of problems. For instance, the color-printing density thereof is reduced (discoloration) during storage under a high humidity condition, fogging of the white ground thereof is caused during storage under a high temperature condition and further when a long term running test is performed, there is observed the dot-missing of a thermal head (partial breakage of the thermal head).

Accordingly, the object of the present invention is to provide heat-sensitive recording paper which is cheap, makes it possible to save resources, is excellent in storage stability and exhibits high reliability to the thermal head.

The inventors of this invention have conducted various studies to achieve the foregoing object and as a result have found out that the aforementioned object of the present invention can effectively be achieved if the amount of the surfactants remaining in a substrate for heat-sensitive recording paper can be reduced to a level of not more than 1,000 ppm in the case where the substrates for the heat-sensitive recording paper comprise waste paper. Moreover, the inventors have also found out that a more excellent effect can be attained by disposing a barrier layer between the foregoing substrate and a heat-sensitive recording layer.

In general, waste paper is prepared according to any combination of the following three processes:

(1) Defibration Process • • • • waste paper is treated mechanically and with a chemical to loosen into fibrous state and to thus peel off printing ink from the fibers.

(2) Process for Removing Dusts • • • • foreign substances (such as plastics) and dusts are removed.

(3) Process for Deinking • • • • the printing ink peeled off from the fibers is removed outside the system according to a floatation method or a washing method.

If the waste paper thus obtained is simply incorporated into a substrate for the heat-sensitive recording paper, the resulting recording paper is greatly affected by surfactants as deinking agents which are used in the foregoing deinking process (3). Thus, the recording paper causes discoloration during storage under a high humidity condition, fogging of the white ground thereof during storage under a high temperature condition and the dot-missing of the thermal head. The inventors of this invention have investigated the influence of these surfactants on the properties of the substrate containing the waste paper and have found out that if the deinking agent comprises, for instance, nonionic surfactants such as polyoxyethylene alkyl phenyl ethers, polyoxyethylene alkyl ethers or polyoxyethylene polyoxypropylene block polymers; or cationic surfactants such as quaternary ammonium salts, alkyltrimethylammonium chloride, cetyltrimethylammonium chloride and alkylbenzylmethylammonium chloride, the substrate containing the waste paper causes discoloration during storage under a high humidity condition and fogging of the white ground thereof during storage under a high temperature condition, while if the deinking agent comprises, for instance, anionic surfactants such as fatty acid soaps, alkylbenzenesulfonic acid salts, salts of higher alcohol sulfuric acid ester, α-olefinsulfonates and dialkylsulfosuccinates, the reliability of the substrate to the thermal head is greatly impaired. The present invention has been completed on the basis of the foregoing findings.

Consequently, the present invention relates to heat-sensitive recording paper which comprises a substrate provided thereon with a heat-sensitive recording layer, which comprises a basic colorless dye and an acidic substance capable of color-developing the basic colorless dye upon heating, wherein the substrate comprises waste paper and the amount of surfactants remaining in the substrate is controlled to not more than 1,000 ppm.

The present invention will hereinafter be explained in more detail.

In the heat-sensitive recording paper, there is used a substrate comprising waste paper.

The term "waste papers" is a generic name which enbraces used paper, paper board or cutting scraps thereof.

The substrate used in the present invention may be completely composed of waste paper, but it preferably comprises waste paper in an amount of not more than 60%. If the waste paper is incorporated into the substrate in an amount of greater than 60%, the strength of the substrate is liable to be impaired and it is apt to cause a decrease in whiteness.

In addition, the content of the surfactants remaining in the substrate must be in general controlled to not more than 1,000 ppm and preferably not more than 800 ppm. The storage stability of the substrate is impaired and the dot-missing of the thermal head is apt to cause as the content of the remaining surfactants increases.

As the basic colorless dyes which may be used in the heat-sensitive recording paper of the present invention, there may be mentioned, for instance, triarylmethane type dyes such as 3,3-bis(p-dimethylaminophenyl)- 6-dimethylaminophthalide, 3,3-bis(p-dimethylaminophenyl)phthalide, 3-(p-dimethylaminophenyl)-3-(1,2-dimethylindol-3-yl)phthalide, 3-(p-dimethylaminophenyl)-3-(2-methylindol-3-yl)-phthalide, 3,3-bis(1,2-dimethylindol-3-yl)-5-dimethylaminophthalide, 3,3-bis(1,2-dimethylindol-3-yl)-6-dimethylaminophthalide, 3,3-bis(9-ethylcarbazol-3-yl)-6-dimethylaminophthalide, 3,3-bis (2-phenylindol-3-yl)-6-dimethylaminophthalide and 3-p-dimethylaminophenyl-3-(1-methylpyrrol-3-yl)-6-dimethylaminophthalide; diphenylmethane type dyes such as 4,4' -bis-dimethylaminobenzhydryl benzyl ether, N-halophenyl-leucoauramine and N-2,4,5-trichlorophenyl leucoauramine; thiazine type dyes such as benzoyl leucomethylene blue and p-nitrobenzoyl leucomethylene blue; spiro type dyes such as 3-methyl-spiro-dinaphthopyran, 3-ethyl-spiro-dinaphthopyran, 3-phenyl-spiro-dinaphthopyran, 3-benzyl-spiro-dinaphthopyran, 3-methyl-naphtho(6'-methoxybenzo)spiropyran and 3-propyl-spiro-dibenzopyran; lactam type dyes such as rhodamine-B-anilinolactam, rhodamine(p-nitroanilino)lactam and rhodamine(o-chloroanilino)lactam; and fluoran type dyes such as 3-dimethylamino-7-methoxyfluoran, 3-diethylamino-6-methoxyfluoran, 3-diethylamino-7-methoxyfluoran, 3-diethylamino-7-chlorofluoran, 3-diethylamino-6-methyl-7-chlorofluoran, 3-diethylamino-6,7-dimethylfluoran, 3-(N-ethyl-p-toluidino)-7-methylfluoran, 3-diethylamino-7-N-acetyl-N-methylaminofluoran, 3-diethylamino-7-N-methylaminofluoran, 3-diethylamino-7-dibenzylaminofluoran, 3-diethylamino-7-N-methyl-N-benzylaminofluoran, 3-diethylamino-7-N-chloroethyl-N-methylaminofluora n, 3-diethylamino-7-N-diethylaminofluoran, 3-(N-ethyl-p-toluidino)-6-methyl-7-phenylaminofluoran, 3-(N-ethyl-p-toluidino)-6-methyl-7-(p-toluidino)fluoran, 3-diethylamino-6-methyl-7-phenylaminofluoran, 3-diethylamino-7-(2-carbomethoxy-phenylamino)fluoran, 3-(N-ethyl-N-isoamylamino)-6-methyl-7-phenylaminofluoran, 3-(N-cyclohexyl-N-methylamino)-6-methyl-7-phenylaminofluoran, 3-pyrrolidino-6-methyl-7-phenylaminofluoran, 3-piperidino-6-methyl-7-phenylaminofluoran, 3-diethylamino-6-methyl-7-xylidinofluoran, 3-diethylamino-7-(o-chlorophenylamino)fluoran, 3-dibutylamino-7-(o-chlorophenylamino) fluoran, 3-pyrrolidino-6-methyl-7-p-butylphenylaminofluoran, 3-diethylamino-6-methyl-7-anilinofluoran, 3-butylamino-6-methyl-7-anilinofluoran and 3-(N-ethyl-N-isoamyl)amino-6-methyl-7-anilinofluoran.

As the inorganic or organic acidic substance capable of color-developing the basic colorless dyes by heating, a variety of compounds have been known and examples thereof include inorganic acidic substances such as active china clay, acidic china clay, attapulgite, bentonite, colloidal silica and aluminum silicate; and organic acidic compounds, for instance, phenolic compounds such as 4-tert-butylphenol, 4-hydroxydiphenoxide, α-naphthol, β-naphthol, 4-hydroxyacetophenol, 4-tert-octylcatechol, 2,2'-dihydroxydiphenol, 2, 2'-methylenebis (4-methyl-6-tert-isobutylphenol), 4,4'-isopropylidenebis(2-tert-butylphenol), 4,4'-sec-butylidenephenol, 4-phenylphenol, 4,4'-isopropylidenediphenol (bisphenol A), 2,2'-methylenebis(4-chlorophenol), hydroquinone, 4,4'-cyclohexylidenediphe nol, benzyl 4-hydroxybenzoate, dimethyl 4-hydroxyphthalate, hydroquinone monobenzyl ether, novolak type phenol resin and phenolic polymer; aromatic carboxylic acids such as benzoic acid, p-tert-butylbenzoic acid, trichlorobenzoic acid, terephthalic acid, 3-sec-butyl-4-hydroxybenzoic acid, 3-cyclohexyl-4-hydroxybenzoic acid, 3,5-dimethyl-4-hydroxybenzoic acid, salicylic acid, 3-isopropylsalicylic acid, 3-tert-butylsalicylic acid, 3-benzylsalicylic acid, 3-(α-methylbenzyl)-salicylic acid, 3-chloro-5-(α-methylbenzyl)salicylic acid, 3,5-di-tert-butylsalicylic acid, 3-phenyl-5-(α, α-dimethylbenzyl)salicylic acid and 3,5-di-α-methylbenzylsalicylic acid; and salts of these phenolic compounds or aromatic carboxylic acids with multivalent metals such as zinc, magnesium, aluminum, calcium, titanium, manganese, tin and nickel.

The ratio of the amount of the basic colorless dye to that of the acidic substance in the heat-sensitive recording layer is appropriately selected depending on the kinds of these basic colorless dyes and the acidic substances employed, but in general the acidic substance is used in an amount ranging from 1 to 50 parts by weight and preferably in the order of 1 to 10 parts by weight per 1 part by weight of the basic

colorless dye.

A coating solution containing these substances is prepared by simultaneously or separately dispersing the basic colorless dye and the acidic substance in a dispersion medium which is usually water utilizing an apparatus for agitation • pulverization such as a ball mill, an attritor and a sand grinder to thus give a coating solution. In this case, the particle size of the dispersed particles are desirably as small as possible and more specifically this dispersion process is desirably continued till the size of the dispersed particles reaches not more than 2μm.

Such a coating solution may comprise, as an adhesive, starches, hydroxyethyl cellulose, methyl cellulose, carboxymethyl cellulose, gelatin, casein, gum arabic, polyvinyl alcohol, salts of diisobutylene • maleic anhydride copolymers, salts of styrene • maleic anhydride copolymers, salts of ethylene• acrylic acid copolymers, salts of styrene • acrylic acid copolymers and styrene • butadiene copolymer emulsion in an amount ranging from 10 to 40% by weight and preferably 15 to 30% by weight on the basis of the total weight of the solid content of the solution.

In addition, the coating solution may further comprise a variety of auxiliary agents, for instance, dispersants such as sodium dioctylsulfosuccinate, sodium dodecylbenzenesulfonate, lauryl alcohol sulfuric acid ester• Lsodium salts, alginic acid salts and metal salts of fatty acids; and ultraviolet light absorbers such as benzophenol type and triazole type ultraviolet light absorbers; as well as other additives such as antifoaming agents, fluorescent dyes and coloring dyes.

Moreover, it is also possible to optionally add, to the coating solution, for instance, lubricants such as zinc stearate, calcium stearate, polyethylene wax, carnauba wax, paraffin wax and ester wax; inorganic pigments such as kaolin, clay, talc, cacium carbonate, calcined clay, titanium oxide, diatomaceous earth, finely pulverized anhydrous silica and active china clay; sensitizing agents such as stearic acid amide, stearic acid methylenebisamide, oleic acid amide, palmitic acid amide, sperm oil oleic acid amide, coconut oil fatty acid amide, meta-terphenyl, p-benzylbiphenyl, ester derivatives of hydroxynaphthoic acid, dibenzyl terephthalate and tribenzylamine.

In the present invention, it is preferred to dispose a barrier layer between the substrate and the heat-sensitive recording layer. The presence of such a barrier layer makes it possible to reduce the influence of the surfactants included in the substrate and to provide an improved heat-sensitive recording paper which does not show any discoloration and fogging of the white ground during storage and whose reliability to the thermal head is further enhanced.

The barrier layer can be formed from, for instance, film-forming polymeric compounds and examples thereof include casein, polyvinyl alcohol, ammonium alginate, methyl cellulose, hydroxyethyl cellulose, carboxymethyl cellulose, maleic anhydride copolymers, styrene • maleic anhydride copolymers and styrene • butadiene copolymers. These polymeric compounds are in general used in the form of an emulsion. In addition, the amount thereof to be coated in general ranges from 0.3 g/m^2 to 5.0 g/m^2 and preferably 0.5 g/m^2 to 2.0 g/m^2. This is because, if the coated amount of the polymer is less than 0.3 g/m^2, the effect of lowering the influence of the surfactants is impaired, while if it exceeds5.0 g/m^2, the resulting images are apt to have insufficient quality.

Moreover, a protective layer may optionally be applied onto the heat-sensitive recording layer.

Furthermore, an intermediate layer containing a pigment may also be applied onto the foregoing barrier layer. (Examples)

The present invention will hereinafter be explained in more detail with reference to the following Examples.

Preparation of Coating Solution for Heat-sensitive Recording Layer

Solution A:

·Black color-developing basic dye: 3-(N-ethyl-N-isoamyl)-amino-6-methyl-7-anilino-fluoran (S-205: available from Yamada Chemical Co., Ltd.)	9 parts by weight
·polyvinyl alcohol: a 12% aqueous solution	15 parts by weight
·ammonium polystyrene acrylate: a 20% aqueous solution	0.7 part by weight
·water	30 parts by weight

Solution B:

·2,2-bis(4-oxyphenyl)propane	20 parts by weight
·meta-terphenyl	20 parts by weight
·polyvinyl alcohol: a 12% aqueous solution	50 parts by weight
·ammonium polystyrene acrylate: a 20% aqueous solution	3 part by weight
·water	62.3 parts by weight

Each of the solutions A and B was dispersed using a sand grinder so that the average particle size of the dispersed particles therein reached not more than 2 μm.

Solution C:

·light calcium carbonate	25 parts by weight
·sodium polyacrylate: a 40% aqueous solution	1 part by weight
·water	24 parts by weight

The solution C was dispersed with a homomixer for 10 minutes.

A coating solution for heat-sensitive recording layer was prepared by mixing 54.7 parts by weight of the solution A, 155.3 parts by weight of the solution B and 50 parts by weight of the solution C and then adding, to the resulting mixture, 33.3 parts by weight of a 30% dispersion of zinc stearate, 100 parts by weight of a 12% aqueous solution of polyvinyl alcohol and 130 parts by weight of water.

Example 1

The foregoing coating solution for heat-sensitive recording layer was applied onto base paper having a waste paper content of 40%, an amount of a remaining surfactant (sodium alkylbenzenesulfonate) of 240

ppm and a basis weight of 50 g/m^2 so that the coated amount thereof (weighed after drying) was equal to 5 g/m^2, dried and further subjected to calendering to thus give heat-sensitive recording paper whose recording surface has a Bekk smoothness of 600 seconds.

Example 2

Heat-sensitive recording paper was prepared in the same manner used in Example 1 except that base paper having a waste paper content of 50%, an amount of a remaining nonionic surfactant (polyoxyethylene-alkylphenyl ether) of 430 ppm and a basis weight of 50 g/m^2 was used as a substrate.

Example 3

Heat-sensitive recording paper was prepared in the same manner used in Example 1 except that base paper having a waste paper content of 60%, an amount of a remaining nonionic surfactant (polyoxyethylene-alkylphenyl ether) of 510 ppm and a basis weight of 50 g/m^2 was used as a substrate.

Example 4

Heat-sensitive recording paper was prepared in the same manner used in Example 1 except that base paper having a waste paper content of 50%, an amount of a remaining cationic surfactant (alkyltrimethyl ammonium chloride) of 700 ppm and a basis weight of 50 g/m^2 was used as a substrate.

Example 5

Heat-sensitive recording paper was prepared in the same manner used in Example 1 except that base paper having a waste paper content of 50%, an amount of a remaining anionic surfactant (sodium alkylbenzenesulfonate) of 950 ppm and a basis weight of 50 g/m^2 was used as a substrate.

Comparative Example 1

Heat-sensitive recording paper was prepared in the same manner used in Example 1 except that base paper having a waste paper content of 50%, an amount of a remaining anionic surfactant (sodium alkylbenzenesulfonate) of 1200 ppm and a basis weight of 50 g/m^2 was used as a substrate.

Comparative Example 2

Heat-sensitive recording paper was prepared in the same manner used in Example 1 except that base paper having a waste paper content of 50%, an amount of a remaining nonionic surfactant (polyoxyethylene-alkylphenyl ether) of 1400 ppm and a basis weight of 50 g/m^2 was used as a substrate.

Comparative Example 3

Heat-sensitive recording paper was prepared in the same manner used in Example 1 except that base paper having a waste paper content of 50%, an amount of a remaining cationic surfactant (alkyltrimethyl ammonium chloride) of 1500 ppm and a basis weight of 50 g/m^2 was used as a substrate.

Comparative Example 4

Heat-sensitive recording paper was prepared in the same manner used in Example 1 except that base paper having a waste paper content of 40%, an amount of a remaining nonionic surfactant (polyoxyethylene-alkylphenyl ether) of 1500 ppm and a basis weight of 50 g/m^2 was used as a substrate.

Example 6

Heat-sensitive recording paper was prepared in the same manner used in Example 4 except that polyvinyl alcohol was applied onto the base paper in an amount of 1 g/m^2.

Example 7

Heat-sensitive recording paper was prepared in the same manner used in Example 5 except that polyvinyl alcohol was applied onto the base paper in an amount of 1 g/m^2.

Example 8

Heat-sensitive recording paper was prepared in the same manner used in Example 7 except that the amount of polyvinyl alcohol coated was changed to 2 g/m^2.

Then the heat-sensitive recording paper obtained in Examples 1 to 8 and Comparative Examples 1 to 4 were subjected to the following tests and the results thus obtained were summarized in the following Table 1.

(1) Storability

A test pattern was printed and recorded on each heat-sensitive recording paper with a heat-sensitive facsimile FF 621C (available from Fujitsu Limited) and the density of the white ground and the printed portion thereof were determined by a Mcbeth densitometer RD-514. Further, the samples which had been printed with the facsimile FF 621C were used in the following storability test.

a) Resistance to Humidity

Each sample was stored under a high humidity condition of 40 °C-90% RH for 24 hours and after the storage, the density of the white ground and the printed portion of the sample were determined by a Macbeth densitometer RD-514.

b) Heat Resistance

Each sample was stored under a high temperature and dry condition of 60 °C for 24 hours and after the storage, the density of the white ground and the printed portion thereof were likewise determined by a Macbeth densitometer RD-514.

(2) Thermal Head Breakage Test

Each heat-sensitive recording paper was wound around a platen roll, the platen roll and a thermal head (KJT-216-8MGF1) commercially available from Kyocera Corp. were fixed (0.15 kgf/cm), stored in an environment of 80 °C-85% RH for 20 hours while applying a voltage to the thermal head and then subjected to a solid printing operation to determine the rate of the dot-missing of the thermal head.

Evaluation

- ○: the rate of the dot-missing is not more than 5%.
- △: the rate of the dot-missing is more than 5% and not more than 10%.
- ×: the rate of the dot-missing is more than 10%.

Table 1

Ex. No.	Content of Waste Pulp (%)	Surfactant		Storage Test						Head Break-age Test
		Kind	Remain-ing Amount	Prior to Storage		Resistance to Humidity		Heat Resistance		
				White Gound	Printed Portion	White Ground	Printed Portion	White Ground	Printed Portion	
1	40	anionic	240	0.06	1.25	0.08	1.20	0.13	1.26	○
2	50	nonionic	430	0.06	1.25	0.08	1.21	0.14	1.27	○
3	60	nonionic	510	0.06	1.26	0.08	1.22	0.13	1.25	○
4	50	cationic	700	0.06	1.25	0.12	1.23	0.14	1.22	○
5	50	anionic	950	0.06	1.26	0.06	1.15	0.12	1.23	○
1(*)	50	anionic	1200	0.06	1.26	0.06	1.04	0.12	1.24	×
2(*)	50	nonionic	1400	0.06	1.25	0.06	0.81	0.23	0.92	△
3(*)	50	cationic	1500	0.06	1.25	0.15	1.19	0.24	1.21	×
4(*)	40	nonionic	1500	0.06	1.25	0.06	0.79	0.21	0.89	△
6	50	cationic	700	0.06	1.25	0.08	1.22	0.13	1.21	○
7	50	anionic	950	0.06	1.23	0.06	1.19	0.11	1.20	○
8	50	anionic	950	0.06	1.22	0.06	1.20	0.12	1.23	○

(*): Comparative Example

Anionic surfactant: sodium alkylbenzenesulfonate

Nonionic surfactant: polyoxyethylene alkylphenyl ether

Cationic surfactant: alkyltrimethylammonium chloride

As seen from the results listed in Table 1, improved heat-sensitive recording paper can be obtained by controlling the amount of the remaining surfactants to not more than 1,000 ppm, the resulting recording paper being cheap, making it possible to save resources, being excellent in storage stability and exhibiting high reliability to the thermal head, though waste paper is incorporated into the substrate of the recording paper. In addition, it is also found that the quality of the recording paper can further be improved by

disposing a barrier layer between the substrate and the heat-sensitive recording layer.

Claims

1. Heat-sensitive recording paper which comprises a substrate and a heat-sensitive recording layer which is applied onto the substrate and which comprises a basic colorless dye and an acidic substance capable of color-developing the basic colorless dye upon heating, wherein the substrate comprises waste paper and the amount of surfactants remaining in the substrate is controlled to not more than 1,000 ppm.

2. The heat-sensitive recording paper of claim 1 wherein the content of the waste paper is not more than 60%.

3. The heat-sensitive recording paper of claim 1 wherein the content of the surfactants is not more than 800 ppm.

4. The heat-sensitive recording paper of claim 1 wherein it comprises a barrier layer between the substrate and the heat-sensitive recording layer.

5. The heat-sensitive recording paper of claim 4 wherein the barrier layer comprises a polymeric compound selected from the group consisting of casein, polyvinyl alcohol, ammonium alginate, methyl cellulose, hydroxyethyl cellulose, carboxymethyl cellulose, maleic anhydride copolymers, styrene • maleic anhydride copolymers and styrene • butadiene copolymers.

6. The heat-sensitive recording paper of claim 5 wherein the coated amount of the barrier layer ranges from 0.3 g/m^2 to 5.0 g/m^2.

7. The heat-sensitive recording paper of claim 6 wherein the coated amount of the barrier layer ranges from 0.5 g/m^2 to 2.0 g/m^2.

INTERNATIONAL SEARCH REPORT

International Application No PCT/JP89/01121

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl[4] B41M5/18

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	B41M5/18

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

Jitsuyo Shinan Koho 1926 - 1989
Kokai Jitsuyo Shinan Koho 1971 - 1989

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	JP, A, 58-40556 (Ricoh Co., Ltd.), 9 March 1983 (09. 03. 83), (Family : none)	1 - 7
A	JP, A, 57-128346 (Honshu Paper Co., Ltd.), 9 August 1982 (09. 08. 82), (Family : none)	1 - 7

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
December 13, 1989 (13. 12. 89)	December 25, 1989 (25. 12. 89)
International Searching Authority	**Signature of Authorized Officer**
Japanese Patent Office	