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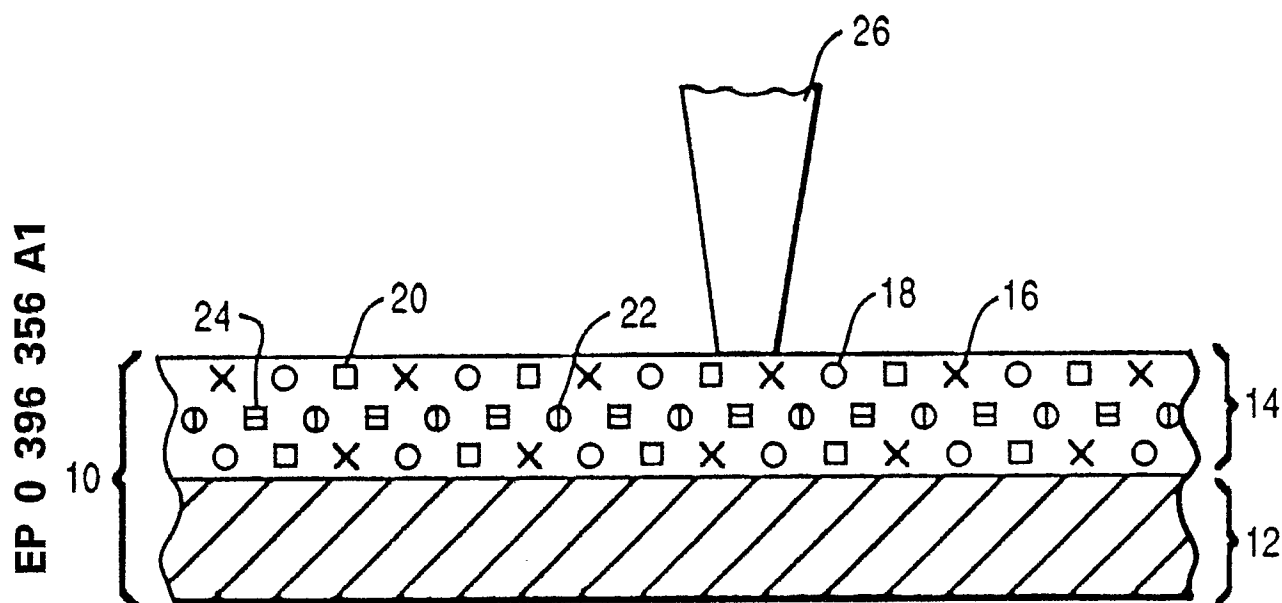
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54 **Thermo sensitive record medium.**

57 A record medium (10) includes a substrate (12) having a coating (14) which is responsive to thermal elements in thermal printing operations. The coating (14) includes a chromogenic dye material (18), a phenolic resin (16), a water soluble polymeric binder (24), and a temperature modifier (20) selected from the group including methyl-p-nitro benzoate. The temperature modifier (20) permits lower energy and temperature values in thermal printing and provides enhanced smear and background whiteness characteristics.



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THERMO SENSITIVE RECORD MEDIUM

The present invention relates to a thermosensitive record medium.

In the field of thermal printing, it is well known that thermal paper is used in direct printing operations. The thermal printing systems use a thermal print element or a plurality of elements which are energized to heat specific and precise areas of a heat-sensitive coating on paper or like record material. The heating of such specific and precise areas of the coating produces readable characters on the sheet of thermal paper. In this regard, the single sheet of paper contains the coating which reacts to the applied heat and is described as a self-contained system.

The direct thermal paper systems have been used in producing bar code images, graphic images, instrument recording displays, and communication imaging as in facsimile equipment. The use of certain ingredients in the thermally sensitive coating on the paper is desired to provide clear and well-defined characters and/or images. It is also desired to obtain such characters and/or images with lower energy levels, as in the case of facsimile operation. Prior art materials used in thermal coating compositions included P-Benzyl Bisphenol, Ethylene Glycol M-Tolyl Ether, and 2-Naphthyl Benzyl Ether.

An object of the present invention is to provide a thermosensitive record medium having a composition including a temperature modifier to permit lower temperature operating conditions.

A further object of the present invention is to provide a coating formulation for thermal paper providing enhanced smear characteristics and improved background whiteness.

Accordingly, the present invention provides a thermosensitive record medium including a substrate and a thermally reactive coating thereon which includes a reactive material of the phenol group, a thermochromic dye and a temperature modifier material in a polyvinyl alcohol binder, characterized in that said temperature modifier material is selected from the group comprising methyl-p-nitro benzoate, ethyl p-nitro benzoate and isobutyl-p-nitro benzoate.

The present invention also provides a thermosensitive record medium including a substrate and a thermally reactive coating thereon which includes a reactive material of the phenol group, a thermochromic dye and a temperature modifier material in a polyvinyl alcohol binder characterized in that said coating includes 14 to 27% by weight phenolic resin, 6 to 12% by weight thermochromic dye, 1 to 5% by weight paraffin wax emulsion, 14 to 27% by weight temperature modifier, and 9 to 27% by weight polyvinyl alcohol binder, said temperature modifier being selected from the nitro benzoate group.

The invention will be described further by way of a single drawing illustrating a diagrammatical view of a thermal paper according to one embodiment of the present invention.

The thermal paper 10 includes a substrate 12 on which is coated a heat-sensitive coating 14. The coating 14 includes essential ingredients as a phenolic resin 16, an opaque dye 18, a temperature modifier 20, a filler 22, and a binder 24. Certain of the ingredients, of lesser percentage amounts, are not shown so as to provide clarity in the drawing. A thermal print head 26 of appropriate design is used in the printing operation.

The substrate 12 is preferably paper, however, substitutes may include polyester film, polypropylene, polyethylene or other synthetic materials.

Example I

Example I is a composition of ingredients which are included in the coating of the present invention.

Material	% Dry	Range
Polyvinyl Alcohol at 12% Solids	9	3-15%
Modified Polyvinyl Alcohol at 18% Solids	6	6-12%
Nopco NDW	Trace	0-0.5%
Dispex N-40 at 40% Solids	Trace	0-0.2%
Niaproof 08 at 40% Solids	Trace	0-0.3%
Bisphenol A	18	14-27%
Methyl p-Nitro-Benzoate	18	14-27%
Paraffin Wax Emulsion at 30% Solids	3	1-5%
Calcium Carbonate	28	5-50%
Sylox 2	8	4-16%
Zinc Stearate	2	1-4%
Dye	8	6-12%
Tinopal SFP	Trace	0-1%

The polyvinyl alcohol (PVA) is a water-soluble polymer used as a binder for the various essential ingredients in the coating 14. The PVA at 12% provides an initial binder for the various ingredients in the coating 14, and the PVA at 18% provides a supplemental binder and dispersant for these various ingredients in the coating. The Nopco NDW is a defoamer of the glycol group. Dispex N-40 is a neutral sodium salt of a polycarboxylic acid and is used as a dispersing agent. Niaproof 08 is a sodium 2-ethylhexyl sulfate used as a wetting agent. Bisphenol A (4, 4-isopropylidenedi-phenol) is a reactive material of the phenol group. Methyl-p-nitro benzoate acts as a solubilizer and is used as a preferred temperature modifier in the coating to allow lower energy levels and lower temperature operation of the thermal elements in the thermal printing operation. Other temperature modifiers such as ethyl-p-nitro benzoate and isobutyl-p-nitro benzoate can be substituted in similar percentage amounts in the coating 14 as are the amounts of the preferred temperature modifier.

The paraffin wax emulsion is a substantially permanent mixture of two liquids which do not normally dissolve in each other but which are held in suspension, one in the other. The paraffin wax is remaining after the emulsifying process. The wax is used as a lubricant and as a calender aid. Calcium carbonate is a filler. Sylox 2 is a silica, identified as silicon dioxide in white tasteless powder form, is insoluble in water and certain acids, and is soluble in molten alkali when finely divided and amorphous. Silica is used as a filler and a smear suppressant. Zinc stearate is used as a filler, a water repellent, and a lubricant or anti-stick agent. The opaque dye is thermochromic in nature and may be any one of the fluoran family. These opaque dyes may be identified as Pergascript, PSD-150, ODB-2, TH-107, N-102, or S-205 black dye. Tinopal is a fluorescent brightener. The methyl-p-nitro benzoate in conjunction with the bisphenol A, the opaque dye, and the PVA binder provide an acceptable image on low energy Group 3 facsimile machines.

The coating is aqueous based and can be applied in an amount from 2.0 to 6.0 pounds dry weight per 3300 square feet and then dried in a typical coater oven at a temperature and for a period of time to drive off the moisture but not at a sufficient temperature and time so as to develop the coating. Typical speeds of the coater can be from 500 to 1500 feet per minute. The paper or other substrate may have a weight in the range of 13 to 137 pounds per 3300 square feet. The first grind in the preparation of the coating 14 includes the dye, the 12% polyvinyl alcohol and the 18% polyvinyl alcohol, the NOPCO NDW, and the Niaproof 08. The second grind includes the PVA's, the NOPCO NDW, the Niaproof 08, and the remaining ingredients. The two grinds are then mixed in proper proportions to produce the coating 14.

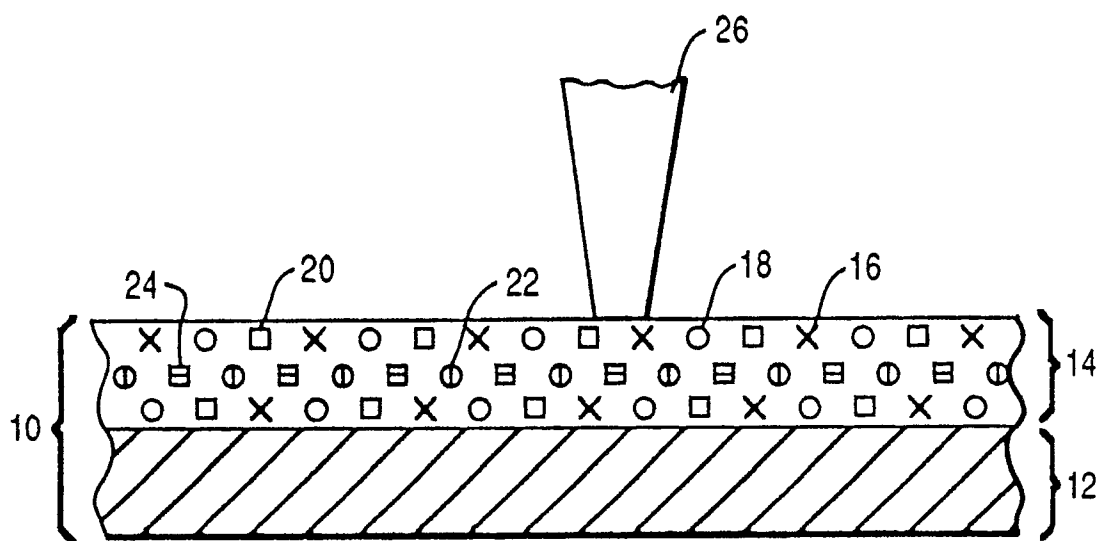
The availability of the various ingredients used in the present invention is provided by the following list of companies.

	Material	Supplier
5	Polyvinyl Alcohol @ 12%	Air Products Corp.
	Modified Polyvinyl Alcohol @ 18%	Hodogaya Chemical
	Nopco NDW	Diamond Shamrock
	Dispex N-40	Allied Colloids Ltd.
	Niaproof 08	Niacet Corp.
	Bisphenol A	Dow Chemical Co.
10	Methyl-p-Nitro Benzoate	Nipa Labs
	Paraffin Wax Emulsion	Chukyo Yushi Co.
	Calcium Carbonate	Mississippi Lime
	Sylox 2	W.R. Grace
	Zinc Stearate	Witco Chemical
15	S-205 Dye	Yamada
	Tinopal	Ciba-Geigy

It is thus seen that herein shown and described is an improved temperature-sensitive coating on one surface of a substrate for use in direct thermal paper printing. The coating includes ingredients which provide enhanced smear and background whiteness characteristics and also which provide a superior reaction for image density and stability.

Claims

1. A thermosensitive record medium including a substrate (2) and a thermally reactive coating (14) thereon which includes a reactive material of the phenol group (16), a thermochromic dye (18) and a temperature modifier material (20) in a polyvinyl alcohol binder (24), characterized in that said temperature modifier material (20), is selected from the group comprising methyl-p-nitro benzoate, ethyl p-nitro benzoate and isobutyl-p-nitro benzoate.
2. A thermosensitive record medium as claimed in claim 1, characterized in that said coating (14) includes 14 to 27% by weight of said temperature modifier (20).
3. A thermosensitive record medium as claimed in claim 2, characterized in that said coating (14) includes 14 to 27% by weight of phenolic resin (16).
4. A thermosensitive record medium as claimed in claim 3, characterized in that said coating (14) includes 6 to 12% by weight of said thermochromic dye (18), 1 to 5% by weight paraffin wax emulsion and 9 to 27% by weight polyvinyl alcohol binder (24).
5. A thermosensitive record medium as claimed in any one of claims 1 to 4, characterized in that said binder (24) includes 3 to 15% polyvinyl alcohol at 12% and 6 to 12% modified polyvinyl alcohol at 18%.
6. A thermosensitive record medium as claimed in any one of claims 1 to 5, characterized in that said coating (14) includes 5 to 50% by weight filler (22), 4 to 16% by weight filler and smear depressant, and 1 to 4% by weight anti-stick agent.
7. A thermosensitive record medium as claimed in claim 4, characterized in that said paraffin wax comprises an emulsion at 30%.
8. A thermosensitive record medium as claimed in any one of claims 1 to 7, characterized in that said coating (14) includes traces of a defoamer, traces of a dispersing agent, and traces of a wetting agent.
9. A thermosensitive record medium as claimed in any one of claims 1 to 8, characterized in that the coating weight is in the range of 2 to 6 pounds dry weight per 3300 square feet.
10. A thermosensitive record medium including a substrate (2) and a thermally reactive coating (14) thereon which includes a reactive material of the phenol group (16), a thermochromic dye (18) and a temperature modifier material (20) in a polyvinyl alcohol binder (24), characterized in that said coating (14) includes 14 to 27% by weight phenolic resin (16), 6 to 12% by weight thermochromic dye (18), 1 to 5% by weight paraffin wax emulsion, 14 to 27% by weight temperature modifier (20), and 9 to 27% by weight polyvinyl alcohol binder (24), said temperature modifier (20) being selected from the nitro benzoate group.





European Patent
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EUROPEAN SEARCH REPORT

Application Number

EP 90 30 4630

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.5)
X	PATENT ABSTRACTS OF JAPAN vol. 13, no. 229 (M-831)(3577) 26 May 1989, & JP-A-01 42277 (RICOH COMPANY LIMITED) 14 February 1989, * the whole document *	1-10	B41M5/30
X	PATENT ABSTRACTS OF JAPAN vol. 13, no. 22 (M-786)(3370) 19 January 1989, & JP-A-63 231983 (SHOWA DENKO K.K.) 28 September 1988, * the whole document *	1-10	
X	PATENT ABSTRACTS OF JAPAN vol. 12, no. 376 (M-750)(3223) 07 October 1988, & JP-A-63 126784 (TOMOE GAWA PAPER COMPANY LIMITED) 30 May 1988, * the whole document *	1-10	
A	EP-A-306344 (APPLETON PAPERS INCORPORATED) * page 2, lines 37 - 47; claim 2 *	1-10	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B41M
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 26 JULY 1990	Examiner BACON A.J.
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			
f : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application I : document cited for other reasons & : member of the same patent family, corresponding document			