



PROCESS FOR PRINTING MAGNETIC IMAGE

The present invention relates to a process for printing a magnetic image using a heat-sensitive magnetic transfer element, particularly a heat-sensitive magnetic transfer element which allows a thermal printer to
5 produce a printed magnetic image recognized by a magnetic ink character reader.

The magnetic ink character reader (hereinafter referred to as MICR) can read and recognize a printed magnetic image, such as character or mark, which is
10 printed to bill, check, credit card, pass, traffic census card, or the like. A magnetic head in the MICR converts the variations of magnetic portions corresponding to various characters and marks into predetermined signals, and the voltages thereof are detected to recognize the
15 characters and marks.

In that case, it is necessary that each of the characters and marks to be read by the magnetic head has predetermined shape, dimensions and allowable ranges of dimensions in addition to predetermined magnetic signal
20 levels. Therefore, as to El3B type face employed in American Bank Association, the allowable ranges are defined in JIS C 6251 (Japanese Industrial Standard).

El3B type face defined in JIS C 6251 consists of 10 numerals (0 to 9) and 4 special marks. According
25 to JIS C 6251, a character height, a character width, a corner radius, allowable ranges of those and an allowable range of a void with respect to each character are prescribed. In addition to El3B type face, CMC7 type face is well known as type face for MICR. CMC7 type face
30 is formed by arranging 7 longitudinal bars with 2 kinds of intervals, and each of CMC7 type faces can be magnetically recognized by combinations of 2 kinds of intervals. Thus, CMC7 type faces consist of 10 numerals, 26 large alphabets and 5 special marks, and dimensions and
35 magnetic property of CMC7 type face are determined by European Computer Manufacturers Association.

The printed image of the above type face for MICR is formed by transferring a magnetic ink onto a receiving paper by an impact printer such as typewriter. The magnetic ink containing a magnetic substance powder is coated on a foundation such as plastic film and dried to form a pressure-sensitive magnetic transfer element. Such a pressure-sensitive magnetic transfer element is disclosed in, for example, Japanese Patent Publication No. 21449/1970.

However, the use of the pressure-sensitive magnetic transfer element results in generating noise due to impact system, and further cannot perform high printing speed. In addition, the above transfer element tends to generate voids in the printed magnetic image.

A main object of the invention is to provide a process for printing a magnetic image using a heat-sensitive magnetic transfer element which allows to easily produce a printed magnetic image by a thermal printer with high printing speed without generating noise.

Another object of the invention is to provide a process for printing a magnetic image using a heat-sensitive magnetic transfer element which allows to produce a printed magnetic image having high accuracy of dimensions and high magnetic properties.

Other objects and advantages of the invention will become apparent from the following descriptions with reference to the accompanying drawings.

Fig. 1 is a schematically sectional view showing an embodiment of a heat-sensitive magnetic transfer element used in the invention.

Fig. 2 is an explanatory view showing a printing method in accordance with the invention.

Fig. 1 shows a heat-sensitive magnetic transfer element according to the invention which comprises a heat-resisting foundation 1, and a heat-sensitive transferring layer 2 containing a ferromagnetic substance powder and having a melting temperature of 50° to 120°C.,

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which is measured at a heating-up velocity of 40°C./min. by Meihosha-type melting point measuring device available from Meihosha Factory Ltd.

5 The heat-sensitive transferring layer 2 is a layer which is formed by uniformly admixing a binder material composed of a wax and a thermoplastic resin and, if necessary, an additive such as fat or oil, extender pigment, or dispersant, with the magnetic substance powder, and applying the mixture onto the foundation 1.
10 Such a transferring layer can be prepared by means of hot-melt coating or solvent coating.

The magnetic substance powder is preferably contained in the heat-sensitive transferring layer 2 in a range of 30 to 97 % by weight per total amount of the
15 transferring layer 2. When the magnetic substance powder content is less than the above range, the magnetic properties of the printed image are lowered, whereby reading of MICR becomes difficult. On the other hand, when the magnetic substance powder content is more than
20 the above range, the melt-transfer property of the transferring layer 2 and the adhesion strength of the printed image against the image receiving paper are lowered.

In the case that the heat-sensitive
25 transferring layer 2 is provided on the heat-resisting foundation 1 by means of hot-melt coating, wax is preferably employed as a main ingredient of the binder material to prepare the heat-sensitive transferring layer. In that case, 30 to 97 % by weight of the
30 ferromagnetic substance powder, 20 to 70 % by weight of wax, not more than 30 % by weight of thermoplastic resin, 0 to 30 % by weight of fat and oil, 0 to 30 % by weight of extender pigment and 0 to 2 % by weight of dispersant are used per total amount of the heat-sensitive trans-
35 ferring layer 2.

In the case that the heat-sensitive transferring layer 2 is provided on the heat-resisting foundation 1 by means of solvent coating, 30 to 97 % by

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weight of the ferromagnetic substance powder, not more than 20 % by weight of wax, 20 to 70 % by weight of thermoplastic resin, 0 to 30 % by weight of fat and oil, 0 to 30 % by weight of extender pigment and 0 to 2 % by weight of dispersant are used per total amount of the heat-sensitive transferring layer, and those ingredients are homogeneously dispersed in an organic solvent such as toluene, methyl ethyl ketone, methyl isobutyl ketone, cyclohexane, butyl butyrate, dioxane, or ethylbenzene.

Examples of the ferromagnetic substance powder are γ -Fe₂O₃, γ -Fe₂O₃ containing Co, Fe₃O₄, Fe₃O₄ containing Co, CrO₂, Co-Cr alloy, Co-Fe alloy, Co-Ni-P alloy, Co-Ni-Fe alloy, Co-Ni-Fe-B alloy, Co-Ni-Zn alloy, Fe-Mn-Zn alloy, Fe-Co-Ni-Cr alloy, Fe-Co-Ni-P alloy, Ni-Co alloy, and the like. The aspect ratio (L/D) of the ferromagnetic substance powder mentioned above is 5 : 1 to 20 : 1, more preferably 5 : 1 to 10 : 1, and the diameter of the ferromagnetic substance powder is 0.01 to 1 μ , more preferably 0.02 to 0.5 μ . Furthermore, the length of the ferromagnetic substance powder is preferably 0.05 to 20 μ , more preferably 0.1 to 5 μ .

Examples of the wax are one or more of carnauba wax, montan wax, paraffin wax, microcrystalline wax, bees wax, and the like. Due to incorporation of wax and thermoplastic resin in the heat-sensitive transferring layer 2 as a binder material, the melt-transfer property of the transferring layer 2 can be effectively increased. Thus, the transferred magnetic image 5 is free from voids and breaks, and further has an excellent adhesion to a receiving paper 3.

Examples of the thermoplastic resin are polyvinyl chloride, polyvinyl acetate, vinyl chloride-vinyl acetate copolymer, polyethylene, polypropylene, polyacetal, ethylene-vinyl acetate copolymer, polystyrene, low molecular weight polystyrene, polyacrylic ester, polyamide, ethyl cellulose, and the like. Furthermore, epoxy resin, xylene resin, ketone resin, petroleum resin, rosin or the derivatives thereof, cumarone-indene resin,

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terpene resin, polyurethane, polyvinyl butyral, and the like can also be preferably employed.

5 Examples of the above fat and oil are animal oils, vegetable oils, mineral oils, dioctyl phthalate, tricresyl phosphate, dibutyl phthalate, and the like.

10 Examples of the above extender pigment are calcium carbonate, magnesium carbonate, diatomaceous earth, kaolin, white carbon, silicic acid powder, and the like. Furthermore, examples of the dispersant are nonionic surface active agents such as di(polyoxyethylene
15 alkyl ether) phosphate, tri(polyoxyethylene alkyl ether) phosphate, polyoxyethylene stearylamine, polyoxyethylene lauryl ether, polyoxyethylene oleyl ether, polyoxyethylene cetyl ether, polyoxyethylene stearyl aryl ether, and the like.

The heat-sensitive transferring layer 2 thus obtained has preferably a thickness of 2 to 25 μ , and the heat-resisting foundation 1 has preferably a thickness of 3 to 40 μ .

20 Examples of the heat-resisting foundation are plastic films such as polyester, moisture-protected cellophane, polycarbonate, nylon and polypropylene, and papers such as condenser paper and glassine paper.

25 In accordance with the process of the present invention, the above-mentioned heat-sensitive magnetic transfer element is overlapped with a receiving paper 3 such as cheque, and then heated selectively by the thermal head 4 of a thermal printer as shown in Fig. 2, whereby the magnetic image 5 is melted and transferred on the
30 receiving paper 3.

In that case, the heat-sensitive transferring layer 2 according to the invention can be correctly transferred only in the portion of the transferring layer 2 corresponding to the heating and printing portion
35 of the thermal head 4, because the heat-sensitive transferring layer 2 has a melting temperature of 50° to 120°C., and therefore is superior in the heat-transfer property and the adhesion property. As a result, the

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magnetic image produced has a very sharp profile without any void and any break of the character and causes no smudge of the receiving paper 3.

5 In particular, the magnetic image 5 thus obtained has a high accuracy in dimension to ensure the reading operation of MICR so that a high reliability can be offered.

10 In addition, the invention has also significant advantages that a high-speed printing can be performed without generating noise, and the preparation of bill, check, credit card, pass, traffic census card, or the like can be readily and rapidly carried out, since the magnetic image 5 is produced by using the thermal printer.

15 Further, the magnetic image obtained in the invention is not limited to only the type face mentioned above, such as El3B or CMC7, and other characters are also readily produced from the heat-sensitive magnetic transfer element by means of the thermal printer.

20 The invention is more particularly described and explained by means of the following Example.

Example

25 The ingredients described below were uniformly admixed and the resulting mixture was applied on a polyester film having a thickness of 6 μ by means of hot-melt coating to form a heat-sensitive transferring layer having a melting temperature of 68°C. and a thickness of 6 μ .

	<u>Ingredients</u>	<u>Parts by Weight</u>
30	γ -Fe ₂ O ₃ Coercive force: 1200 Oe Diameter: 0.4 μ Length: 1 μ	200
	Carnauba wax	15
35	Paraffin wax (melting point: 68°C)	32
	Ethylene-vinyl acetate copolymer	3
	Vaseline	5

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The magnetic transfer element thus obtained was overlapped with a fine paper, and then printing was carried out using a thermal printer commercially available from Oki Electric Industry Co., Ltd. under the commercial name "Thermal Printer 200" at a printing speed of 30 characters per second so that the heat-sensitive transferring layer was selectively melted and transferred on the fine paper to form magnetic images.

The dimensions of the magnetic image obtained above (character height, character width and line width) fell within the allowable ranges defined in JIS C 6251.

Also, voids existing in the magnetic images were determined by observing whether single void is included within a square gauge of 0.203 mm. X 0.203 mm. In that case, the void existing in a line having a width of 0.660 mm. or more was determined by employing a square gauge of 0.254 mm. X 0.254 mm. according to the definition of JIS C 6251. The results are shown in the following Table.

Furthermore, magnetic properties (coercive force, residual magnetic flux density and relative signal level) of the magnetic image obtained above are also shown in the same Table.

In that case, the relative signal level was determined by measuring a signal level with a MICR tester (commercially available from Kidder Press Company Inc. under the commercial name "Kidder Magnetic Character Tester") defined in JIS C 6251, and then calculating a percentage of the measured signal level against the standard signal level with reference to the same character. The relative signal level must be within a range of 50 to 200 % against the standard signal level of the examined character.

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Magnetic properties			
Voids	Coercive force	Residual magnetic	Relative
	(Oe)	flux density	signal
		(G)	level (%)
5 none	340	1700	110

10 In addition to the elements or ingredients used in Example, other elements or ingredients can be used in Example as set forth in the specification to obtain substantially the same results.

15 Variations and modifications will be apparent to a person skilled in the art in the light of the present disclosure and within the scope of the present claims.

The words "Cellophane" and "Vaseline" are registered Trade Marks.

Certain aspects of the processes disclosed herein form the subject of copending application No. 8207591.



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CLAIMS:

1. A process for printing a magnetic image which comprises printing a magnetic image on a receiving medium by a thermal printer from a heat-sensitive magnetic transfer element comprising a heat-resisting foundation and a heat-sensitive transferring layer provided on the foundation, said transferring layer comprising a ferromagnetic substance powder and a binder material comprising a wax and at least one thermoplastic resin selected from the group consisting of polyvinyl chloride, polyvinyl acetate, vinyl chloride-vinyl acetate copolymer, polyacetal, ethylene-vinyl acetate copolymer, low molecular weight polystyrene, polyacrylic ester, polyamide, ethyl cellulose, ketone resin, petroleum resin, rosin, rosin derivative, cumarone-indene resin, terpene resin and polyvinyl butyral, the contents of the ferromagnetic substance powder, the wax and the thermoplastic resin in the transferring layer being from 30 to 97 % by weight, from 20 to 70 % by weight and not more than 30 % by weight, respectively, and said transferring layer having a melting temperature of 50° to 120°C.

2. The process of Claim 1, wherein the thickness of the foundation is within a range of 3 to 40 μ , and that of the transferring layer is within a range of 2 to 25 μ .

3. A process for printing a magnetic image as claimed in Claim 1 and substantially as described in the example disclosed herein.