

HEAT-SENSITIVE MAGNETIC TRANSFER ELEMENT

The present invention relates to a heat-sensitive magnetic transfer element and more particularly to a heat-sensitive magnetic transfer element which
5 allows a thermal printer to prepare 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 the certain printed magnetic image, such as character, or mark, which
10 is 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 voltages 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 a certain shape, dimensions and allowable ranges of dimensions in addition to the certain magnetic signal
20 levels. Therefore, the allowable ranges as to E13B type face employed in American Bank Association are defined in JIS C 6251 (Japanese Industrial Standard).

E13B type face defined in JIS C 6251 consists of 10 numbers (0 to 9) and 4 special marks. According to
25 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 described. In addition to E13B type face, CMC7 type face is well known as type face for MICR. CMC7 type face is
30 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 numbers, 26 large alphabets and 5 special marks, and dimensions and magnetic property.
35 of CMC7 type face are determined by European Computer Manufactures 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 including a magnetic substance powder is coated and dried on a foundation such as plastic film 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 heat-sensitive magnetic transfer element which can 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 heat-sensitive magnetic transfer element which can 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 for showing an embodiment of a heat-sensitive magnetic transfer element of the invention; and

Fig. 2 is an explanatory view for showing a printing method using a heat-sensitive magnetic transfer element of the invention.

Fig. 1 shows a heat-sensitive magnetic transfer element according to the invention comprising a heat-

resisting foundation 1, and a heat-sensitive transferring layer 2 including a ferromagnetic substance powder and having a melting temperature of 50 to 120°C., which is measured at a heating-up velocity of 40°C./min. by 5 Meihosha-type melting point measuring device available from Meihosha Factory Ltd.

The heat-sensitive transferring layer 2 is one layer formed by uniformly admixing a binder material of wax and synthetic rubber including, if necessary, 10 additives such as fat and oil, extender pigment, or dispersant, with the magnetic substance powder. Such a transferring layer can be obtained by means of hot-melt coating or solvent coating.

The magnetic substance powder is preferably 15 included in the heat-sensitive transferring layer 2 at a range of 30 to 97 % by weight per total amount of the 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 20 reading of MICR becomes difficult. On the other hand, when the magnetic substance powder content is more than 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 25 lowered.

In the case that the heat-sensitive 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 30 material to prepare the heat-sensitive transferring layer. In that case, 30 to 97 % by weight of the ferromagnetic substance powder, 20 to 70 % by weight of wax, not more than 30% by weight of synthetic rubber, 0 to 30% by weight of fat and oil, 0 to 30% by weight of 35 extender pigment and 0 to 2 % by weight of dispersant are used per total amount of the heat-sensitive transferring layer 2.

In the case that the heat-sensitive

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transferring layer 2 is provided on the heat-resisting foundation 1 by means of solvent coating, 30 to 97 % by weight of the ferromagnetic substance powder, not more than 20% by weight of wax, 20 to 70% by weight of synthetic rubber, 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 are homogeneously dispersed in organic solvent such as toluene, methyl ethyl ketone, methyl isobutyl ketone, cyclohexane, butyl butyrate, dioxane, or ethyl-benzene.

An example of the ferromagnetic substance powder is γ - Fe_2O_3 , γ - Fe_2O_3 including Co, Fe_3O_4 , Fe_3O_4 including Co, CrO_2 , 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, or 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 same 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 .

An example of wax is one or more of carnauba wax, montan wax, paraffin wax, microcrystalline wax, bees wax, or the like. Due to wax contained in the heat-sensitive transferring layer 2 as a binder material, the melt-transfer property of the transferring layer 2 obtained can be effectively increased. Thus, the transferred magnetic image 5 prepared is free from the void and the break, and further has an excellent adhesion on the receiving paper 3. Accordingly, it is especially preferable that wax is contained in the heat-sensitive transferring layer 2.

Examples of the synthetic rubber are styrene-butadiene rubber, nitrile rubber, polyacrylate rubber, ethylene-propylene rubber, and the like. The synthetic

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rubber may be used in combination with a thermoplastic resin such as polyvinyl chloride, polyvinyl acetate, vinyl chloride-vinyl acetate copolymer, polyethylene, polypropylene, polyacetal, ethylene-vinyl acetate

5 copolymer, polystyrene, low molecular weight polystyrene, polyacrylic ester, polyamide, theyl cellulose, epoxy resin, xylene resin, ketone resin, petroleum resin, rosin or the derivatives thereof, cumarone-indene resin, terpene resin, polyurethane or polyvinyl butyral.

10 An example of the above fat and oil is animal oil, vegetable oil, mineral oil, dioctyl phthalate, tricresyl phosphate, dibutyl phthalate, or the like.

An example of the above extender pigment is calcium carbonate, magnesium carbonate, diatomaceous
15 earth, kaolin, white carbon, silicic acid powder, or the like. Furthermore, an example of the dispersant is nonionic surface active agent such as di(polyoxyethylene alkylether) phosphate, tri(polyoxyethylene alkylether) phosphate, polyoxyethylene stearylamine, polyoxyethylene
20 laurylether, polyoxyethylene oleylether, polyoxyethylene cetylether, polyoxyethylene stearylarylether, or the like.

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

An example of the heat-resisting foundation is a plastic film such as polyester, moisture-protected cellophane, polycarbonate, nylon, polypropylene, or a
30 paper such as condenser paper, glassine paper.

The heat-sensitive magnetic transfer element of the invention is overlapped with the receiving paper 3 such as cheque, and then is printed by a thermal head 4 of the thermal printer as shown in Fig. 2, whereby the
35 magnetic image 5 is melted and transferred on the 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 of the thermal head 4, because the heat-sensitive transferring layer 2 is 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 magnetic image prepared has a very sharp profile without causing the void, the break of the character and the smudge of the receiving paper 3.

10 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.

15 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 prepared by using the thermal printer.

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

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

Example 1

A composition of heat-sensitive transferring layer described below was uniformly admixed, and then was applied and dried on a condenser tissue to obtain a heat-sensitive transferring layer having a melting temperature of 90°C. and a thickness of 8 μ .

<u>Ingredients</u>	<u>Parts by Weight</u>
Fe ₃ O ₄ Coercive force: 1100 Oe Diameter: 0.2 μ Length: 0.5 μ	68
Solprene T (styrene-butadiene rubber available from Asahi Chemical Industry Co., Ltd.)	4.5
Arkon P-90 (saturated alicyclic hydrocarbon resin available from Arakawa Kagaku Kogyo Kabushiki Kaisha)	8.0
Hoechst wax V (Hoechst AG)	2.5

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Toluene	50
Solvent naphtha	25
(boiling point: 125°C.)	

The magnetic transfer element thus obtained was overlapped with a check paper, and then was printed by the same thermal printer as in Example 1 at a printing speed of 30 characters per second to melt and transfer the heat-sensitive transferring layer in the form of magnetic images on the paper.

As a result, Dimensions of each magnetic image prepared in Examples 1 and 2 (character height, character width and line width) were included 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 each magnetic image prepared in Examples 1 and 2 are also shown in the same Table.

In that case, the relative signal level is determined by measuring a signal level with a MICR tester (commercially-available from Kidder Press Company Inc. under "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.

Table

	Magnetic properties			
	Voids	Coercive force (Oe)	Residual magnetic flux density (G)	Relative Signal level (%)
Ex. 1	none	340	1700	110

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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.

5 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.

Other aspects of the matter described herein
10 form the subject of patent application 8504433.

The words Cellophane, Solprene and Arkon are Registered Trade Marks.



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CLAIMS:

1. A heat-sensitive magnetic transfer element used for printing a magnetic image by transferring imagewise the heat-sensitive transferring layer of the element onto a receiving medium by means of a thermal head, which
5 comprises 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 a synthetic rubber, and said transferring layer having a
10 melting temperature of 50° to 120°C.

2. The transfer element of Claim 1, wherein the synthetic rubber is at least one member selected from the group consisting of styrene-butadiene rubber, nitrile rubber, polyacrylate rubber and ethylene-propylene rubber.

15 3. The transfer element of Claim 1, wherein the content of the magnetic substance powder in the transferring layer is from 30 to 97 % by weight.

4. The transfer element of Claim 1, wherein the thickness of the foundation is within a range of 3 to
20 40 μ , and that of the transferring layer is within a range of 2 to 25 μ .

5. A heat-sensitive magnetic transfer element substantially as described with reference to ~~any~~ of the examples disclosed herein.
