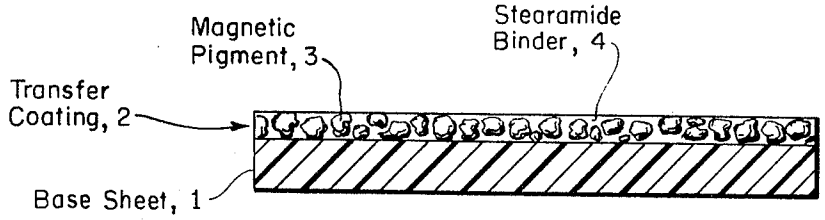
Nov. 8, 1966 J. V. PESHIN 3,284,360

MAGNETIC TRANSFER SHEET

Filed Feb. 24, 1964



INVENTOR
JOHN V. PESHIN

BY
Keneway, Jenney & Hildreth

ATTORNEYS

United States Patent Office 3,284,360 Patented Nov. 8, 1966

3,284,360

MAGNETIC TRANSFER SHEET

John V. Peshin, Islington, Mass., assignor to The Carters Ink Company, Cambridge, Mass., a corporation of Massachusetts

Filed Feb. 24, 1964, Ser. No. 346,631
7 Claims. (Cl. 252—62.5)

My invention relates to transfer sheets, and particularly to an improved magnetic transfer sheet of the type suitable for use in high speed printers for producing optically visible images capable of interpretation by electronic data processing equipment.

The advantages of a machine record comprising a series of visually intelligible characters printed on a record sheet in magnetic ink have long been recognized. The characters used to form such a record are desirably selected from the numerals and alphabet familiar to persons who will use the record, or, in standardized records of simple form, from a limited number of arbitrary symbols having an assigned significance that can readily be memorized. In addition, the characters must be capable of unambiguous interpretation by electrical circuits responsive to their form and magnetic properties. Various magnetic character sets meeting these requirements have been proposed. For example, the banking industry has devised a set of 14 characters, known as Type E–13B; the set comprises the Arabic numerals from 0–9 and four arbitrary symbols having assigned significance. These characters are readily interpreted visually, and may be electrically interpreted in terms of a train of pulses induced in a recording head scanning the characters by transitions across their vertical edges. Since the requirement that the characters be visually interpretable limits the number and length of the vertical edges that a character may have, it is necessary to use the magnitude as well as the polarity sequences of the induced pulses for character identification. Thus, every property of each character which will influence the magnitude of the induced pulses must be rigorously controlled.

Basically, the magnitude of a pulse induced by the transit of the edge of a magnetic character across a recording head at constant speed is determined by the length of the edge, the definition, or sharpness, of the edge, the magnetic level of the character, as determined by the thickness of the character image and the concentration of magnetic material in the image, and the evenness of the image. Accordingly, all of these properties must be carefully controlled to avoid errors, which, particularly in the handling of checks, must be avoided at all costs. To ensure compliance with this requirement, exacting standards for Type E–13B characters have been established which must be met by character recording systems for use in check handling. These standards are set forth in Bank Management Publications 147 and 149, both published in 1959 by the Bank Management Commission of The American Bankers Association. As an indication of the strictness of these standards, typical requirements are that the average edge of a character must be within 0.0015 inch of the specified distance from a reference centerline, and deviations from the average edge must be no more than 0.0035 inch in either direction.

Magnetic ink records are frequently made by striking a transfer sheet having a magnetic ink coating against a record sheet with a hammer or anvil in the shape of the desired character. In order to produce an image of the quality demanded by the considerations discussed above, the transfer sheet must be capable of cleanly releasing a sharp magnetic image of controlled magnetic level in response to the action of the printing mechanism that will be employed, without the need for such striking force as would emboss the record sheet. The image itself must be visually sharp, adherent to the record sheet, and highly resistant to smudging. To complicate these requirements, high speed printers have been developed in which the dwell time of the print hammers on the transfer sheet, in striking off an image, is in the order of microseconds. One such printer comprises a print cylinder, bearing characters, which rotates at angular velocities in the range of 300–1,000 r.p.m., and electrically driven hammers which strike the ribbon against the record sheet when selected characters are in position for printing. Another printer employs a print wheel, which is stationary during printing, and across which the paper and transfer sheet are moved at speeds up to 1,000 inches per minute. In this device, the hammers are mechanically driven. Both types of printer operate while there is relative movement between the paper and the type. In order to avoid smudging under these conditions, the release of the image must take place within an extremely short period of time, and the magnetic ink must have no tendency to smudge.

So far as I am aware, prior magnetic transfer sheets have fallen far short of meeting the requirements outlined above. To a large extent, previous efforts have been based, for the most part, on technology drawn from the diverse arts of typewriting and sound recording. In typewriting, it is conventional to form a visible image on a recording medium by striking a transfer sheet, in the form of a sheet of paper or a ribbon coated with an ink of contrasting color, against a recording sheet, with a hammer shaped in the form of the desired character. The inks have been prepared by mixing a pigment with a waxy base, which holds the admixture to the ribbon or paper until forcibly detached by the hammer. In sound recording, it is conventional to coat a recording medium with particles of iron, or various oxides of iron or the like, which can be selectively magnetized to provide a pattern of coded intelligence. To provide an image having both visible and magnetic properties, it has been proposed to mix particles of iron or iron oxide with the pigment in an ink for use in saturating or coating a transfer sheet. However, this apparently simple approach poses difficult problems that, so far as I am aware, have not been satisfactorily resolved.

Usually, a transfer coating for carbon paper or the like is formed by a hot melt process, using a rod coater, and involves the melting of relatively hard waxes such as candelilla, carnauba, ouricury, and others known to the art, to form an intimate dispersion with the desired pigment. These relatively hard waxes are desired for their smudge resistant properties. However, admixtures of these waxes with effective quantities of magnetic material are found to exhibit undesirable coating properties. Thus, when coated on a base sheet in a rod coater, these admixtures give uneven, wavy coatings, and the resulting images exhibit erratic signal levels. In an attempt to improve the flow qualities of magnetic ink mixtures, it has been proposed to use a softer base, incorporating a high percentage of soft, low melting components such as petrolatum. Inks formed in this manner are adequately magnetic, but are readily smudged after application. The objects of my invention are to improve the magnetic properties and the smudge resistant qualities of transfer sheets for both visual and electrical interpretation, so that visually sharp images having good edge definition, controlled magnetic level, and freedom from voids, may be produced under the difficult conditions imposed by modern high speed printers.

My invention is based on the discovery that a transfer sheet of excellent characteristics, meeting all the requirements for the high-speed printing of magnetic characters for electronic recognition, can be made by depositing on a flexible base sheet a transfer coating from a dispersion

of magnetic pigment in a solution of a binder consisting principally of stearamide, or mixtures of stearamide and oleamide and a suitable volatile solvent for the binder. When dried, the transfer coating of my invention comprises a major proportion by weight of magnetic pigment and a minor proportion of a binder consisting primarily of stearamide or mixtures of stearamide and oleamide. The efficiency of stearamide, and mixtures of stearamide and oleamide, in this composition is surprising, because other chemically related compositions which might be thought to be suitable, such as oleamide, palmitamide, arachidamide, behenamide, and similar amides of other fatty acids have been proven to be unsatisfactory when used alone or as the major constituent of the binder. For example, oleamide alone forms a coating which is too soft. Palmitamide and arachidamide are both too soft, whereas behenamide has very poor solubility in alcohol, in other respects a desirable solvent. The derivatives of lower molecular fatty acids tend to effect soft transfer coatings, which are not suitable for use with high-speed printers where very high quality images are required. Various attempts to modify the properties of other fatty acids and derivatives by adding plasticizers, resins, waxes and so forth have proved unsuccessful. Transfer coatings which I have formed in this way fractured irregularly upon impact from a print mechanism, producing transfer images with poor edge definition. On the other hand, transfer sheets made with stearamide, or a mixture of stearamide and oleamide, as the binder proved to have surprisingly good transfer characteristics, and were found to be capable of producing transfer images with excellent edge definition and freedom from voids. Moreover, a transfer coating in accordance with my invention has a desirable balance of adhesive and coating qualities; it will adhere uniformly to a base sheet of conventional film, such as polyester, polypropylene, polyethylene, polystyrene, polyvinyl chloride, polyvinylidene chloride, rubber hydrochloride, and polyurethane films, and the like, without dissolving or reacting with these materials, and is capable of release to form an image having good adhesion on conventional sheets of paper, plastic or the like.

My invention will best be understood with reference to the following detailed description, together with the accompanying drawing, of a preferred embodiment thereof.

In the drawing, the sole figure comprises a fragmentary cross-sectional schematic view of a transfer sheet in accordance with my invention.

Referring now to the drawing, I have illustrated a transfer sheet in accordance with my invention comprising a base sheet **1**, and a transfer coating **2** on the base sheet.

The base sheet **1** may be of any suitable material, and need not be flexible in the broader aspects of my invention, but is preferably a flexible plastic film such as those listed above; a polyester film such as Mylar polyethylene terephthalate of about one-half mil in thickness is especially suitable. The thickness and flexibility of such films is highly desirable in securing the close correspondence between the type face of a printer and the transferred image produced by the type face required for electronic interpretation.

The transfer coating **2** consists of particles **3** of magnetic pigment, such as cubic iron oxide particles or the like, dispersed in a binder **4** which is predominantly of stearamide, or a mixture of stearamide and oleamide. Minor amounts of other ingredients may be combined with the stearamide if so desired, to modify its properties slightly to best suit them to the particular base sheet or recording sheet to be used. However, the essential characteristics of the transfer coating are determined primarily by the stearamide, and its presence as a major constituent of the binder is an essential and characteristic feature of my invention.

The amount of magnetic pigment used may vary somewhat depending on the desired thickness of coating and on the magnetic qualities desired, but in practice I have found it preferable to use magnetic pigment in amounts equal to from one to one and one-half times the weight of binder. I prefer to coat the transfer coating composition by means of any suitable conventional coating apparatus, such as a conventional reverse roll coater, to a finished dry thickness of from 0.00010 to 0.00025 inch.

The coating composition of my invention is made simply by dissolving the binder in a suitable solvent, such as ethanol or the like, and dispersing the pigment in the solution by means of a ball mill.

The following examples illustrate the manner in which my invention may be carried out, and show preferred proportions of the ingredients, although it will be apparent to those skilled in the art that variations in the proportions may be made without departing from the scope of my invention. In each of the examples, the binder was dissolved in the solvent, and the magnetic pigment ground into the solvent in a ball mill to provide a coatable dispersion. In the examples in which plasticizers and suspending agents were used, these constituents were added with the pigment and dispersed in the solution. The components of the coating composition of each of the examples are listed in the following table, in which amounts are given in percent by weight.

Components		Examples						
Function	Name	1	2	3	4	5	6	7
Binder	Stearamide	12.75					11.0	9.1
	KEMSTRENE Amide SU-25		12.0	12.0	6.6	8.0		
	Bleached Shellac		3.0					
	Zein			3.0			5.3	
	Ethyl Cellulose K500				2.1	2.0		
	Carbowax 1500				2.1			
	Versamid 950				1.3			
	Versamid 900					0.7		
	PE Tetrastearate					2.0		
	Vinac ASB 20						0.7	
	Amberol 750 Resin							4.6
Plasticizer	Santicizer 8						5.3	
	Paricin 15							2.3
Suspending Agent	Diphenyl Phthalate				2.1	3.0		
	Cab-O-Sil M6		2.0	2.0		0.8		
	Bentone 27							1.3
Solvent	Ethanol	59.75				42.0	41.0	
	Cellosolve	7.50			6.3	5.0	6.7	
	Shellacol				31.5			60.0
	Isopropanol		61.0	60.0				
	Ethyl Acetate				10.8	5.0		
	Thinner #70				19.0	10.0		
	Water			3.0				
Magnetic Pigment	Cubic Iron Oxide	20.00	22.0	20.0	18.2	21.5	30.0	22.7

In the above table, KEMSTRENE Amide SU-25 is a mixture comprising approximately 75 percent stearamide

and 25 percent oleamide. Ethyl cellulose K500 is the ethyl ether of cellulose as made by the Hercules Powder Company, having a viscosity greater than 5000 c.p.s. and an ethoxyl content ranging from 45.5 to 46.8 percent. Carbowax 1500 is a polyethylene gylcol with a molecular weight of 500 to 600, as made by Union Carbide Chemical Company; "Carbowax" is a trademark of that company. Versamid 900 and Versamid 950 are hard thermoplastic polyamide resins produced by General Mills Inc., which have an amine number of 3–8 and a specific gravity of 0.98. Versamid 900 and Versamid 950 have molecular weights of 6000 to 9000. PE Tetrastearate is the pentaerythritol ester of stearic acid as produced by Hercules Powder Company. Cab-O-Sil M6 is a pyrogenic silica, produced by the Godfrey Cabot Co. Cellosolve is ethylene glycol monoethyl ether produced by Union Carbide Chemical Co. Thinner No. 70 is a solvent blend of 15 percent butyl acetate, 60 percent toluene, 10 percent ethyl acetate and 15 percent isopropanol, as made by Raffi & Swanson Co. Shellacol is an alcohol-type solvent produced by Shell Chemical Co. Santicizer 8, ortho and para N-ethyl toluene sulfonamide, is made by Monsanto Chemical Company. Vinac ASB 20 is polyvinyl acetate in pellet form, a product of the Air-Reduction Chemical Company. Amberol 750 is a fortified rosin type resin produced by Rohm & Haas Company. Bentone 27 is an organic compound of a special montmorillonite (hydrous silicate material having an expanded lattice) and is sold by National Lead Company. Paricin 15 is an alkyl hydroxy stearate sold by The Baker Castor Oil Company.

In Examples 2, 3, 4 and 5, the amount of oleamide used was one third of the amount of stearamide. Somewhat more, or any amount less, may be included, the deciding factor being the hardness of the resultant coating.

The above formulations may be coated on any smooth substrate, such as preferably one of the plastic films listed above. For optical effectiveness as transfer sheets, the finished dry thickness of the coating should be from 0.00010 to 0.00025 inch.

While I have described my invention with reference to the details of specfic examples, many changes and variations will be suggested to those skilled in the art by my description, and such can obviously be made without departing from the scope of my invention.

Having thus described my invention, what I claim is:

1. A coating composition, consisting of stearamide, an amount of magnetic pigment equal to from 1 to 1.5 times the weight of stearamide, and sufficient volatile solvent for the stearamide to dissolve it and form a coatable dispersion with the pigment.

2. A coating composition, consisting of stearamide and a minor amount of oleamide, an amount of magnetic pigment equal to from 1 to 1.5 times the combined weight of stearamide and oleamide, and sufficient volatile solvent for the stearamide and oleamide to dissolve them and form a coatable dispersion with the pigment.

3. A transfer coating composition, consisting of a binder comprising a major proportion of stearamide and particles of magnetic pigment dispersed in said binder, said pigment being present in an amount equal to from 1 to 1.5 times the weight of the binder.

4. A transfer coating composition, consisting of a binder comprising stearamide and an amount of oleamide which is a minor proportion of the stearamide, the major portion of the binder consisting of stearamide and oleamide, and particles of magnetic pigment dispersed in said binder, said pigment being present in an amount equal to from 1 to 1.5 times the weight of the binder.

5. A transfer sheet, comprising a base sheet and a transfer coating on said sheet, said transfer coating consisting of a binder, said binder comprising a major proportion of a member of the class consisting of stearamide and mixtures if stearamide and oleamide in which stearamide predominates, and particles of finely divided magnetic pigment in an amount equal to from 1 to 1.5 times the weight of binder dispersed in the binder.

6. A transfer sheet comprising a sheet of plastic of the order of one-half mil in thickness, and a coating on said sheet of approximately one tenth to one quarter mil in thickness, said coating comprising a major proportion by weight of a magnetic pigment and a minor proportion by weight of a binder consisting essentially of a member of the class consisting of stearamide and mixtures of stearamide and oleamide in which stearamide predominates.

7. A magnetic transfer sheet, comprising a base sheet of thin smooth material, and a coating on said sheet consisting predominantly of from 1 to 1.5 parts by weight of cubic iron oxide particles and 1 part by weight of a member of the class consisting of stearamide and mixtures of stearamide and oleamide in which stearamide predominates.

References Cited by the Examiner

UNITED STATES PATENTS

2,584,318	2/1952	Allyn	106—19
2,800,077	7/1957	Marron	117—36.1

TOBIAS S. LEVOW, *Primary Examiner.*

R. D. EDMONDS, *Assistant Examiner.*