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(54) **Pressure-fixable toner.**

(57) A pressure-fixable toner, suitable for use in developing electrostatic latent images in electrophotography, comprises a pigment and a binder medium comprising, based on the total weight of the binder medium, 20 to 50% by weight of a wax having a penetration of less than 5, 7 to 24% by weight of a styrene type resin or hydrogenated styrene resin and 37 to 73% by weight of a tough thermoplastic resin containing an amide or ester group at a concentration of 50 to 1200 milliequivalents per 100 g of the resin. The toner can take the form of a pressure-fixable one-component type magnetic developer comprising 40 to 300 parts by weight of a finely divided magnetic material as the pigment per 100 parts of binder medium.

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DESCRIPTION

TITLE: PRESSURE-FIXABLE TONER

The present invention relates to a pressure-fixing toner. More particularly, the present invention relates to a pressure-fixing toner which shows a good pressure-fixing property even to plain paper by a high anchoring effect and which provides a fixed image having a high resistance to friction or bending.

Conventional dry developers for use in electrophotography are roughly divided into two types, that is, heat-fixing developers and pressure-fixing developers. In case of the former type, a toner image is fixed by heat after the development, and in case of the latter type, a toner image is fixed by pressure after the development.

The former heat-fixing developer is advantageous in that a fixed image fast to friction or bending can be obtained. However, a considerable time is required for warming up the apparatus to elevate the temperature of a heating element to a level high enough to melt a binder resin, and the requirement for obtaining copies instantly is not sufficiently satisfied. Moreover, a large quantity of electric power is necessary for application of heat and a particular heating element should be arranged in the apparatus, resulting in increase of the copying cost.

In the fixing method using a developer of the latter type, that is, a pressure-fixing developer, since a toner image can be fixed by passing a copy sheet carrying the toner image thereon between a pair of pressure-fixing rollers, no time is necessary for warming up the copying

apparatus and the structure of the copying apparatus is relatively simple. However, a fixed image formed by using a known pressure-fixing toner is poor in the resistance to friction or bending and the adaptability to the developing or fixing operation is insufficient. Moreover, a copy sheet to which pressure fixation can be applied is limited to coated paper such as Fax paper or electrically insulating paper.

An oldest pressure-fixing toner comprises a binder medium having a relatively low melting point, such as a wax. A toner of this type, however, is poor in the fixing property and a fixed image is readily peeled if a copy is bent. Moreover, this toner has a tendency to agglomerate and is poor in the flowability. Accordingly, cohesion of toner particles readily occurs and such defects as blurring and blanking often appear in the formed image at the developing step.

As means for eliminating the foregoing disadvantages, Japanese Patent Application Laid-Open Specification No. 17739/74 proposes a pressure-fixing magnetic toner comprising encapsulated toner particles including a nucleus consisting of a finely divided magnetic material, a colorant and a soft binder polymer and a shell consisting of a hard polymer such as polystyrene. According to this proposal, by encapsulation of the soft binder medium with the hard polymer, the tendency of toner particles to agglomerate is controlled and the flowability is improved. Although these excellent effects can be attained, the resistance of the fixed image to friction or bending is still insufficient. Moreover, the developer having

the above-mentioned particle structure is defective in that the so-called offset phenomenon, that is, adhesion and transfer of the toner image to the roller surface, readily occurs at the pressure-fixing step.

Japanese Patent Application Laid-Open Specification No. 50042/75 proposes the use of a hot-melt composition comprising 50 to 100 parts by weight of a wax and 2 to 50 parts by weight of a thermoplastic resin as a binder medium of a magnetic toner. Since developer particles of this type contain a large amount of a wax component having a relatively low melting point, the tendency of the developer particles to agglomerate is prominent and the above-mentioned defects are caused at the developing step.

Recently, Japanese Patent Publication No. 15502/81 teaches that when a resin composition comprising (a) 25 to 60 % by weight, based on the total binder, of a hydrogenated styrene resin, (b) 15 to 45 % by weight of a wax having a melting point higher than 60°C, (c) 10 to 30 % by weight of a copolymer of an olefin with a carbonyl group-containing, ethylenically unsaturated monomer and (d) up to 20 % by weight of an epoxy resin as an optional component is used as the binder medium of a magnetic developer, there can be obtained a pressure-fixing magnetic developer for electrostatic photography, which is excellent in the adaptability to the developing and fixing operations and the properties of the formed image.

This pressure-fixing magnetic toner has relatively good fixing properties to paper coated with a photoconductive layer composed of a dispersion of zinc oxide in a resin, that is, so-called Fax paper, but when this toner

is applied to plain paper, the fixability is low and peeling of the fixed toner image is readily caused under friction or bending.

It is therefore a primary object of the present invention to provide a pressure-fixing toner which shows a good pressure-fixing property even to plain paper by a strong anchoring action and gives a fixed image having a high resistance to friction or bending.

Another object of the present invention is to provide a pressure-fixing, electrically insulating magnetic one-component type toner having good transferring and fixing properties to plain paper.

Still another object of the present invention is to provide a pressure-fixing one-component type magnetic toner having good powder flowability and high cohesion resistance in addition to the above properties.

More specifically, in accordance with one aspect of the present invention, there is provided a pressure-fixing toner comprising a composition containing a pigment and a binder having a pressure-fixing property, wherein the binder comprises 20 to 50 % by weight, based on the total binder, of a wax having a penetration of less than 5, 7 to 24 % by weight, based on the total binder, of a styrene type resin or hydrogenated styrene resin and 37 to 73 % by weight, based on the total binder, of a tough thermoplastic resin containing an amide or ester group at a concentration of 50 to 1200 milliequivalents per 100 g of the resin.

In accordance with another aspect of the present

invention, there is provided a pressure-fixing one-component type magnetic developer comprising 100 parts by weight of the above-mentioned binder composition and 40 to 300 parts by weight of a finely divided magnetic material.

The present invention will now be described in detail.

The most important feature of the present invention resides in the finding that a binder composition comprising a wax having a penetration of less than 5, a styrene resin or hydrogenated styrene resin and a tough thermoplastic resin containing an amide or ester group at a specific weight ratio shows a very strong fixing property to plain paper under application of pressure and the fixed image has a high fastness or resistance to friction or bending.

More specifically, it is indispensable that the binder medium that is used in the present invention should contain a wax having a penetration of less than 5, especially 2 to 4.5, in an amount of 20 to 50 % by weight, especially 25 to 40 % by weight. This wax is an indispensable component for imparting a good pressure-fixing property at normal temperatures to the toner and also for imparting a high abrasion resistance and smooth touch to the copied image. If the amount of the wax is too small and below the above range, the above-mentioned effects cannot be attained, and if the amount of the wax is too large and exceeds the above range, the anchoring effect to plain paper becomes insufficient and when the obtained copy is bent, the bent fixed toner image is peeled.

The binder medium should contain 7 to 24 % by weight, especially 10 to 20 % by weight, of a brittle thermoplastic

resin selected from the group consisting of styrene resins and hydrogenated styrene resins. The styrene resin or hydrogenated styrene resin intrudes into the fiber structure of plain paper at the pressure-fixing step to exert a good anchoring effect and show an excellent fixing property. If the amount of the styrene resin or hydrogenated styrene resin is too small and is below the above range, the anchoring effect becomes insufficient and no good fixation can be attained. If the amount of the styrene resin or hydrogenated styrene resin is too large and exceeds the above range, the fixed toner image becomes too brittle and when the obtained copy is bent, the fixed toner image is peeled in the bent portion.

Another characteristic feature of the present invention is that the binder medium comprises a tough thermoplastic resin containing amide or esters groups in or on the molecule chain in a relatively large amount of 37 to 73 % by weight, especially 45 to 65 % by weight.

We found that a pressure-fixing toner for plain paper is required to have a specific property quite different from the property required for a conventional pressure-fixing toner for Fax paper. More specifically, in a pressure-fixing toner for Fax paper or coated paper, the fixed image is held by a resin coating layer formed in advance on a paper substrate. Accordingly, in this case, even if the toner composition for forming an image is relatively brittle, peeling of the fixed image is prevented effectively to some extent because of the presence of the resin coating layer. However, in case of a pressure-fixing toner for plain paper, the fixed toner image is

readily peeled or broken by bending unless the toner image per se has a good adhesion to the fiber texture of the paper substrate and forms a mechanically tough layer.

In the present invention, in view of the foregoing, a tough thermoplastic resin containing amide or ester groups in or on themolecule chain at a concentration of 50 to 1200 milliequivalents, especially 80 to 1000 milliequivalents, per 100 g of the resin is incorporated into the toner binder, whereby the adhesion of the fixed toner image to paper is improved, various mechanical properties, especially the toughness, of the fixed toner image are improved, the cohesion tendency of toner particles is eliminated and the flowability of toner particles is prominently improved. If the amount of the tough thermoplastic resin in too small and is below the above range, the mechanical properties, especially the toughness, of the fixed image are reduced and the adhesion to paper is degraded, with the result that the fixed image is pelled by bending. If the amount of this resin is too large and exceeds the above range, the pressure-fixing property to paper is drastically reduced.

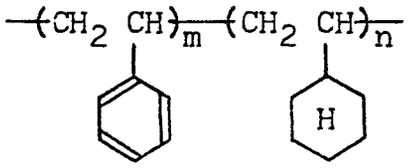
The wax that is used in the present invention is a relatively hard wax having a penetration of less than 5, as pointed out hereinbefore. Most of ordinary waxes, for example, natural waxes such as animal and vegetable waxes, fatty acid derivatives and mineral waxes have a penetration much larger than 5. If a wax having such a large penetration is incorporated into the binder, the fixed toner image readily migrates in the surface falling in contact therewith and the fastness is very poor.

Furthermore, the cohesion tendency of the toner particles is increased. If a wax having a penetration of less than 5 is used according to the present invention, these defects can be eliminated.

The wax that is used in the present invention is easily available as a polyolefin wax such as low-molecular-weight polyethylene or low-molecular-weight polypropylene. Furthermore, Fischer-Tropsch wax may be used for attaining the objects of the present invention.

The styrene resin that is used in the present invention may be a homopolymer or a copolymer of styrene with other vinyl monomer. It is preferred that the majority, especially at least 55 mole %, of the constituent monomer units of the styrene resin should consist of styrene. In order to improve not only the anchoring effect but also the adhesion, it is preferred that the comonomer of the styrene copolymer be an alkyl acrylate or alkyl methacrylate containing an alkyl group having 4 to 8 carbon atoms. This acrylate or methacrylate may be present in an amount of 5 to 45 mole %. It is preferred that the molecular weight of the styrene resin be 1000 to 100000, especially 5000 to 80000.

As the brittle resin component to be incorporated in the binder, a hydrogenated styrene resin disclosed in Japanese Patent Publication No. 15502/81 mentioned above may be used singly or in combination with a styrene resin. This hydrogenated resin is obtained by completely or partially hydrogenating polystyrene having a low degree of polymerization and consists ordinarily of recurring units represented by the following formula:



(1)

wherein ring H is a saturated 6-membered ring, n is an integer of at least 1 and m is zero or an integer of at least 1.

The degree of hydrogenation of this hydrogenated styrene resin, that is, the ratio 100n/(n+m) in the above formula (1), is preferably at least 30 %, especially at least 50 %. The molecular weight of the resin is not particularly critical, but from the viewpoint of the pressure-fixing property, it is preferred that the molecular weight be in the range of from 500 to 1000. From the viewpoint of the pressure-fixing property, it also is preferred that the melting point of the hydrogenated styrene resin be in the range of from 85 to 150°C. Hydrogenated resins are marketed by Arakawa Rinsan Kagaku Kogyo Kabushiki Kaisha, and a hydrogenated styrene resin having a hydrogenation degree of 100 % is available under the tradename of " Arkon P " and a hydrogenated styrene resin having a hydrogenation degree of 50 % is available under the tradename of " Arkon M ". Ordinarily, the former hydrogenated styrene resin is preferred.

In view of the pressure-fixing property, the tough thermoplastic resin to be incorporated in the binder should contain amide or ester groups in or on the molecule chain at the above-mentioned concentration. If the concentration of the amide or ester groups is too low and is below the above range, the adhesion to the paper substrate is degraded, and if the concentration is too high and

exceeds the above range, no good pressure-fixing property can be obtained.

Incidentally, by the term " tough " used in the instant specification is meant " having a high toughness ". Namely, by the term " tough resin " is meant a resin in which the quantity of deformation to fracture is large. The simplest test method for evaluating this property is the bending test.

As the resin satisfying this requirement, there can be mentioned a polyamide resin, a polyester resin and a copolymer of an olefin with a vinyl ester or acrylate (methacrylate). A polyamide resin having a high moisture resistance is preferred, and a polyamide resin obtained by condensation of a polymerized fatty acid (dimer acid) or a mixture of a polymerized fatty acid and an ordinary dibasic carboxylic acid with a damine or the like is especially advantageously used. A polyamide resin advantageously used for attaining the objects of the present invention is available under the tradename of " Versamid " (supplied by Henckel-Japan).

As the olefin copolymer, there is preferably used an ethylene-vinyl acetate copolymer having a vinyl acetate content of 5 to 30 % by weight, particularly 10 to 25 % by weight. Furthermore, a copolymer of ethylene with an acrylic or methacrylic acid ester may be used.

As the polyester resin, there can be used a copolyester having a relatively low melting point, which is derived from a mixture of a linear bicyclic diphenol such as bisphenol A and a diol component and a dicarboxylic acid component such as adipic acid, phthalic acid or terephthalic

acid.

According to an especially preferred embodiment of the present invention, a mixture of a polyamide resin and an ethylene-vinyl acetate copolymer is used as the tough thermoplastic resin. The polyamide resin is very effective for increasing the toughness and adhesion of the fixed image, and the ethylene-vinyl acetate copolymer has an effect of improving the mutual compatibility among the resin and wax components. In view of these effects, it is preferred that the polyamide resin be used in an amount of 25 to 50 % by weight based on the binder and the ethylene-vinyl acetate copolymer be used in an amount of 10 to 35 % by weight based on the binder.

A pigment for coloring the toner or rendering the toner magnetic or electrically conductive may be incorporated into the toner of the present invention.

Preferred pigments that can be used in the present invention are black pigments such as carbon black, acetylene black, lamp black and Aniline Black, yellow pigments such as chrome yellow, zinc yellow, cadmium yellow, yellow iron oxide, Mineral Fast Yellow, nickel-titanium yellow, naples yellow, Naphthol Yellow S, Hansa Yellow G, Hansa Yellow 10G, Benzidine Yellow G, Benzidine Yelllow GR, Quinoline Yellow Lake, Permanent Yellow NCG and Tatrazine Yellow Lake, orange pigments such as chrome orange, molybdenum orange, Permanent Orange GTR, Pyrazolone Orange, Vulcan Orange, Indanthrene Brilliant Orange RK, Benzidine Orange G and Indanthrene Brilliant Orange GK, red pigments such as red iron oxide, cadmium red, red lead, cadmium-mercury sulfide, Parmanent Red 4R, Lithol Red, Pyrazolone Red,

Watchung Red calcium salt, Lake Red D, Brilliant Carmine 6B, Eosine Lake, Rhodamine Lake B, Alizarine Lake and Brilliant Carmine 3B, violet pigments such as manganese violet, Fast violet B and Methyl Violet Lake, blue pigments such as prussian blue, cobalt blue, Alkali Blue Lake, Victoria Blue Lake, Phthalocyanine Blue, metal-free Phthalocyanine Blue, partially chlorinated Phthalocyanine Blue, Fast Sky Blue and Indanthrene Blue BC, green pigments such as chrome green, chromium oxide, Pigment Green B, Malachite Green Lake and Fanal Yellow Green G, white pigments such as zinc flower, titanium oxide, antimony white and zinc sulfide, extender pigments such as baryte powder, barium carbonate, clay, silica, white carbon, talc and alumina white, and dyes (basic dyes, acid dyes, disperse dyes, direct dyes and the like) such as Nigrosine, Methylene Blue, Rose Bengale, Quinoline Yellow and Ultramarine Blue.

It is preferred that the pigment or extender pigment be used in an amount of up to 30 % by weight, especially up to 25 % by weight, based on the binder medium.

The present invention is especially valuable for a one-component type magnetic toner which is used for the development without using any particular magnetic carrier. In this embodiment, 40 to 300 parts by weight, especially 70 to 150 parts by weight, of a magnetic pigment, that is, a finely divided magnetic material, is mixed with 100 parts by weight of the binder. As the finely divided magnetic material, there are preferably used triiron tetroxide (Fe_3O_4), diiron trioxide (γ-Fe_2O_3), zinc iron

oxide ($ZnFe_2O_4$), yttrium iron oxide ($Y_3Fe_5O_{12}$), cadmium iron oxide ($CdFe_2O_4$), gadolinium iron oxide ($Gd_3Fe_5O_{12}$), copper iron oxide ($CuFe_2O_4$), lead iron oxide ($PbFe_{12}O_{19}$), nickel iron oxide ($NiFe_2O_4$), neodium iron oxide ($NdFeO_3$), barium iron oxide ($BaFe_{12}O_{19}$), magnesium iron oxide ($MgFe_2O_4$), manganese iron oxide ($MnFe_2O_4$), lanthanum iron oxide ($LaFeO_3$), iron powder (Fe), cobalt powder (Co) and nickel powder (Ni). Triiron tetroxide (magnetite) is especially preferred.

As the conductive pigment, conductive carbon black and conductive metal powder may be used.

When the electroscopic property is required as in case of a one-component type magnetic developer or a toner of two-component type developer, a negative charge control agent such as a metal-containing dye or a positive charge control agent such as an oil-soluble dye may be incorporated into toner particles.

The toner of the present invention may be prepared by kneading the binder components and pigment under melting conditions, cooling and pulverizing the kneaded composition and adjusting the particle size by classification according to need. In order to improve the flowability of the obtained toner particles, they may be sprinkled with a flowability improving agent such as gas bhase method silica, and in case of a conductive toner, the toner particles may be sprinkled with conductive carbon black.

It is preferred that the toner of the present invention should have a particle size of 5 to 30 microns, especially 10 to 20 microns.

As will readily be understood from the results of

Examples given hereinafter, the present invention is especially valuable for an electrically insulating (electroscopic) one-component type magnetic pressure-fixing toner, and according to the present invention, a clear and sharp image excellent in the fixing property and fastness can be obtained by transferring a toner image onto plain paper and fixing the transferred image under application of pressure. However, it must be noted that the foregoing advantages can similarly be attained when the present invention is applied to a toner of an ordinary two-component type developer or an electrically conductive one-component type magnetic toner.

The present invention will now be described in detail with reference to the following Examples that by no means limit the scope of the present invention.

Example 1

Hi-Wax 200-P (low-molecular-weight polyethylene wax supplied by Mitsui Petrochemical Industries, Inc.)	14 parts
Arkon P-125 (hydrogenated styrene resin supplied by Arakawa Rinsan Kogyo K.K.)	7 parts
Versamid 940 (polyamide resin supplied by Henckel-Japan K.K.)	15 parts
AC-Polyethylene #400 (ethylene-vinyl acetate copolymer resin supplied by Allied Chemical Corporation)	7 parts
Evaflex 420 (ethylene-vinyl acetate copolymer resin supplied by Mitsui Polychemical Co.)	2 parts
Black Iron B6 (magnetite supplied by Toyo Shikiso K.K.)	55 parts

A mixture having the above composition was sufficiently molten and kneaded by a hot three-roll mill, and the kneaded mixture was cooled and roughly pulverized to about 2 mm by a rough pulverizer (Rotoplex cutting mill

supplied by Alpine Co.). The roughly pulverized product was then finely pulverized by an ultrasonic jet mill (supplied by Nippon Pneumatic Mfg. Co., Ltd.) to obtain a toner having a particle size of about 10 to about 20 μ. The bbtained toner was sprinkled with 0.5 % of silica (R-972 supplied by Nippon Aerosil K.K.). This toner was charged in a copying machine for the pressure fixation (Model MC-20 supplied by Mita Industrial Co., Ltd.), and the copying operation was carried out by using various kinds of plain papers. Clear copies having no fog were obtained. These copy samples were subjected to the following tests to evaluate the fixing property.

(1) Friction Test:

A friction cloth was bent at an angle of 90° and bonded, and the sample was reciprocatively moved at a constant speed under a constant tension while keeping the copied face in contact with the cloth face. The image density was measured by a reflection densitometer (supplied by Tokyo Denshoku K.K.) and the ratio of the measured density to the density measured in advance (the density of the copy before the test) was determined. The toner residual ratio was 99 to 100 %.

(2) Tape Peel Test:

An adhesive vinyl tape was bonded to the copied face under a certain pressure, and the tape was peeled at a certain speed and the residual density was measured. The ratio of the residual density to the density before the test was determined. The toner residual ratio was 60 to 70 %.

(3) Bending Test:

The sample was reciprocatively moved at a certain speed under a certain tension along the metal surface bent at an angle of 90° in the state where the copied face was kept in contact with the metal surface. The measurement was carried out in the same way as at the test (1). The toner residual ratio was 90 to 97 %.

Example 2

San Wax 161-P (low-molecular-weight polyethylene wax supplied by Sanyo Kasei Kogyo K.K.)	18 parts
Himer SBM-73 (styrene resin supplied by Sanyo Kasei Kogyo K.K.)	5 parts
DPX-580 (polyamide resin supplied by Henckel-Japan K.K.)	14 parts
AC-Polyethylene #400	8 parts
RB-BL (magnetite supplied by Titanium Kogyo K.K.)	55 parts

A toner having a particle size of 10 to 20 μ was prepared from a mixture having the above composition in the same manner as described in Example 1. The obtained toner was sprinkled with 0.5 % of silica (R-972). The toner was charged in the same copying machine (Model MC-20) as used in Example 1 and the copying operation was carried out by using various kinds of plain papers. Clear and sharp copies having no fog were obtained.

The three tests were conducted on the obtained copies in the same manner as described in Example 1. The toner residual ratios were 99 to 100 % at the test (1), 57 to 72 % at the test (2) and 90 to 95 % at the test (3).

Example 3

Hi-Wax 200-P	25 parts
Piccolastic D-125 (styrene resin supplied by Esso Standard Sekiyu K.K.)	20 parts

Versamid 940	37 parts
Evaflex 460 (ethylene-vinyl acetate copolymer resin supplied by Mitsui Polychemical Co.)	11 parts
Bontron S-31 (dye supplied by Orient Kagaku K.K.)	2 parts
Special Black 4 (carbon black supplied by Degussa Co.)	5 parts

A toner having a particle size of 10 to 20 μ was prepared from a mixture having the above composition in the same manner as described in Example 1. Then, 50 g of the toner was mixed with 950 g of an iron powder carrier (KMPF-402S supplied by Mitsubishi Kasei Kogyo K.K.) to obtain a developer. The developer was charged in a copying machine (Model DC-131 supplied by Mita Industrial Co., Ltd.) in which the fixing zone had been replaced by a pressure-fixing device, and the copying operation was carried to obtain a clear and sharp copy having no fog.

The three tests were conducted on the obtained copy in the same manner as described in Example 1. The toner residual ratios were 99 to 100 % at the test (1), 65 to 75 % at the test (2) and 85 to 89 % at the test (3).

Example 4

San Wax 165-P (low-molecular-weight polyethylene wax supplied by Sanyo Kasei Kogyo K.K.)	12 parts
Piccolastic D-125	5 parts
Versamid 940	9 parts
KN-320 (magnetite supplied by Toda Kogyo K.K.)	70 parts
Printex L (carbon black supplied by Degussa Co.)	4 parts

A toner having a particle size of 10 to 20 μ was prepared from a mixture having the above composition in

the same manner as described in Example 1. The toner was sprinkled with 0.5 % of carbon black (Printex L).

The toner was charged in a copying machine (Model 900D supplied by Mita Industrial Co., Ltd.) and the copying operation was carried out. A clear and sharp copy having no fog was obtained.

The three tests were conducted on the obtained copy in the same manner as described in Example 1. The toner residual ratios were 99 to 100 % at the test (1), 85 to 90 % at the test (2) and 99 to 100 % at the test (3).

Comparative Example 1

Hi-Wax 200-P	6 parts
Arkon P-125	2 parts
Versamid 940	22 parts
AC-Polyethylene #400	15 parts
Black Iron B6	55 parts

A toner having a particle size of 10 to 20 μ was prepared from a mixture having the above composition. The toner was sprinkled with 0.5 % of silica (R-972). The toner was charged in a copying machine (Model MC-20 supplied by Mita Industrial Co., Ltd.) and the copying operation was carried out by using various kinds of plain papers. Clear and sharp copies were obtained.

The three tests were conducted on the obtained copies in the same manner as described in Example 1. The toner residual ratios were 78 to 81 % at the test (1), 32 to 38 % at the test (2) and 96 to 99 % at the test (3). The resistance to friction and tape peeling was poor.

Comparative Example 2

Himer SBM-73	9 parts

Versamid 940	21 parts
AC-Polyethylene #400	13 parts
Black Iron B6	57 parts

A toner having a particle size of 10 to 20 μ was prepared from a mixture having the above composition. The toner was sprinkled with 0.5 % of silica (R-972). The toner was charged in a copying machine (Model MC-20 supplied by Mita Industrial Co.) and the copying operation was carried out by using various kinds of plain papers. The offset phenomenon was caused.

The three tests were conducted on the obtained copies in the same manner as described in Example 1. The toner residual ratios were 68 to 73 % at the test (1), 80 to 90 % at the test (2) and 93 to 98 % at the test (3). The resistance to friction was very poor.

Comparative Example 3

Hi-Wax 200-P	22 parts
DPX-580	12 parts
AC-Polyethylene #400	10 parts
Black Iron B6	56 parts

A toner having a particle size of 10 to 20 μ was prepared from a mixture having the above composition. The toner was sprinkled with 0.5 % of silica (R-972). The toner was charged in a copying machine (Model MC-20 supplied by Mita Industrial Co.) and the copying operation was carried out by using various kinds of transfer sheets. Clear and sharp copies having no fog were obtained.

The three tests were conducted on the obtained copies in the same manner as described in Example 1. The toner

residual ratios were 99 to 100 % at the test (1), 28 to 33 % at the test (2) and 91 to 97 % at the test (3). The resistance to tape peeling was very poor.

Comparative Example 4

San Wax 161-P	25 parts
Arkon P-125	22 parts
Black Iron B6	53 parts

A toner having a particle size of 10 to 20 μ was prepared from a mixture having the above composition. The toner was sprinkled with 0.5 % of silica (R-972). The toner was charged in a copying machine (Model MC-20 supplied by Mita Industrial Co., Ltd.) and the copying operation was carried out by using various kinds of transfer sheets. Clear and sharp copies having no fog were obtained.

The three tests were conducted on the obtained copies in the same manner as described in Example 1. The toner residual ratios were 90 to 95 % at the test (1), 55 to 60 % at the test (2) and 55 to 65 % at the test (3). The resistance to bending was very poor.

Comparative Example 5

Hi-Wax 200-P	10 parts
Arkon P-125	25 parts
Versamid 940	6 parts
AC-Polyethylene #400	4 parts
Black Iron B6	55 parts

A toner having a particle size of 10 to 20 μ was prepared from a mixture having the above composition. The toner was sprinkled with 0.5 % of silica (R-972). The toner was charged in a copying machine (Model MC-20

supplied by Mita Industrial Co., Ltd.) and the copying operation was carried out by using various kinds of plain papers. Clear and sharp copies were obtained.

The three tests were conducted on the obtained copies in the same manner as described in Example 1. The toner residual ratios were 80 to 85 % at the test (1), 60 to 65 % at the test (2) and 70 to 75 % at the test (3). The resistance to friction and bending was poor.

CLAIMS

1. A pressure-fixable toner comprising a pigment and a binder medium, said binder medium comprising, based on the total weight of the binder medium, 20 to 50% by weight of a wax having a penetration of less than 5, 7 to 24% by weight of a styrene type resin or hydrogenated styrene resin and 37 to 73% by weight of a tough thermoplastic resin containing an amide or ester group at a concentration of 50 to 1200 milli-equivalents per 100 g of the resin.

2. A toner according to claim 1, wherein the wax is a polyolefin wax.

3. A toner according to claim 1 or 2, wherein the tough thermoplastic resin comprises a polyamide resin.

4. A toner according to any one of the preceding claims, wherein the tough thermoplastic resin comprises an ethylene-vinyl acetate copolymer.

5. A toner according to any one of the preceding claims, wherein the tough thermoplastic resin is a mixture of a polyamide resin and an ethylene-vinyl acetate copolymer, and the polyamide resin is present in an amount of 25 to 50% by weight based on the total weight of the binder medium and the ethylene-vinyl acetate copolymer is present in an amount of 10 to 35% by weight based on the total weight of the binder medium.

6. A toner according to any one of the preceding claims which comprises 40 to 300 parts by weight of a finely divided magnetic material as the pigment per 100 parts by weight of the binder medium.

7. Use of a toner as claimed in any one of the preceding claims for the development of electrostatic latent images in electrophotography.

European Patent Office

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Application number

EP 82302991.3

EUROPEAN SEARCH REPORT

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
A	US - A - 3 965 022 (D.L. STRONG) * Column 3-4; examples 1-11 *	1-7
A	GB - B - 1 210 665 (ADDRESSOGRAPH) * Examples 10,12 *	1-7

CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)

G 03 G 9/14
G 03 G 9/08
G 03 G 13/09
G 03 G 13/08

TECHNICAL FIELDS SEARCHED (Int.Cl. 3)

G 03 G

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
T: theory or principle underlying the invention
E: earlier patent document, but published on, or after the filing date
D: document cited in the application
L: document cited for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	14-09-1982	SALTEN