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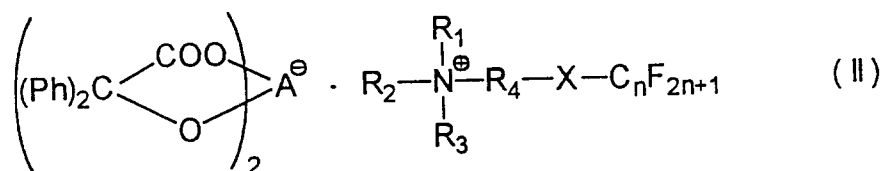
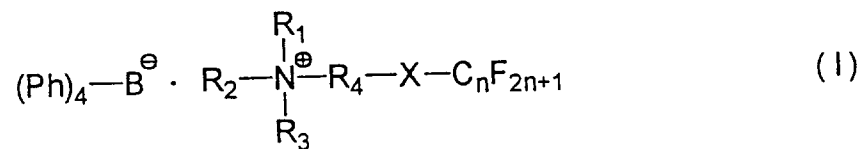
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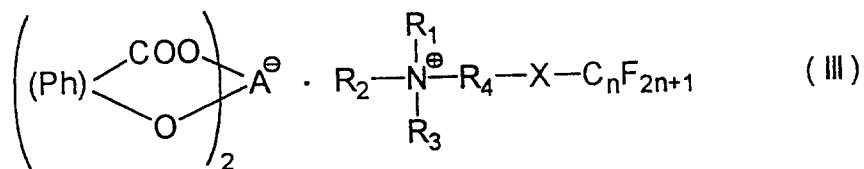
54 **Toner.**

57 A toner containing a colorless charge controller having charge control power effective for a polymer toner. The toner comprises a charge controller expressed by the following formula:

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or



(where, Ph represents a substituent or non-substituent phenyl group; A represents aluminum, zinc or boron; R₁, R₂, and R₃ represent an alkyl group having a carbon number of 1 to 18; R₄ represents an alkylene group having a carbon number of 1 to 18; and X represents a sulfonic amide group or carboxylic amide group.)

BACKGROUND OF THE INVENTION

1. Field of the Invention

5 The present invention relates to a toner for developing a latent image for use in electrophotography.

2. Description of the Prior Art

10 In electrophotography, it is general practice to develop a latent image formed on a photoconductive medium by using a powder developer (toner) and fix the developed image on a base material (such as paper) by heat or pressure or otherwise. For such development purposes in electrophotography there has been used a two-component developer composed of a mixture of a toner comprising a colorant dispersed in natural resin or synthetic resin, and a carrier of iron or ferrite powder. A one-component developer has also been used which comprises a natural or synthetic resin material containing a colorant and a magnetic
15 material.

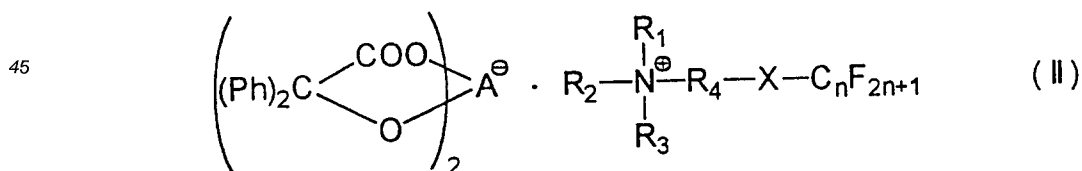
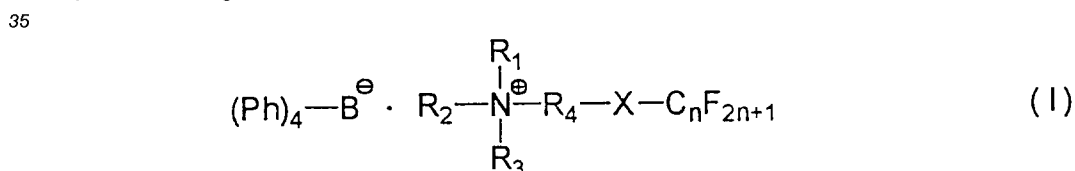
The two-component developer is such that a toner charged electrically by its friction with carrier is deposited on a latent image so that development is achieved, whereas the one-component developer is such that toner is charged electrically by its friction with a brush-like or plate-like member having a function similar to that of carrier, whereby a latent image is developed. It is required that toner be kept in a desired
20 polarity according to the development system, positive or negative, for the photoconductive medium used. For this purpose, a so-called charge controller is usually added.

In order to obtain improved image quality, development of toners of reduced particle size is currently in progress. In this connection, a so-called polymer toner is receiving attention which is produced by reacting monomers dispersed in an aqueous solution of protective colloid. However, charge controllers compatible
25 with polymer toners are extremely limited and, in addition, many of them are colored substances, such as alloy dyes. Therefore, use of them in color toners is limited. This is found particularly noticeable with negatively charging charge controllers.

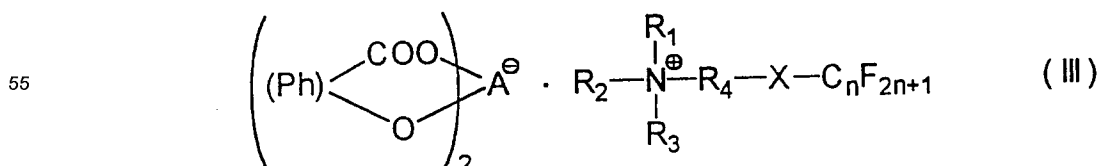
SUMMARY OF THE INVENTION

30 Accordingly, the object of the present invention is to provide a toner including a colorless charge controller applicable for use in a polymer toner.

According to the invention there is provided a toner comprising at least one charge controller expressed by the following formula:



50 or



(where, Ph represents a substituted or non-substituted phenyl group; A represents aluminum, zinc or boron; R₁, R₂, and R₃, same or different, represent an alkyl group having a carbon number of 1 to 18; R₄ represents an alkylene group having a carbon number of 1 to 18; and X represents a sulfonic amide group or carboxylic amide group.)

5 Generally, toner is a resin powder comprised of a colorant and a binder resin. There are two kinds of toners, i. e., ground type toner produced by grinding molded resin material of binder resin and other necessary components, and polymerized toner produced by suspension polymerization or emulsion polymerization of resin-forming monomers and other necessary components. The charge controller of the invention can be used for either type of toner.

10 In either type of toner, the binder resin is generally of the known type, which may be, for example, styrene resin, styrene-acrylate resin, styrene-butadiene resin, acrylate resin, polyester resin, polyamide resin, polyamine resin, ammonium resin, ethylene resin, phenolic resin, or epoxy resin, or any combination of such resins.

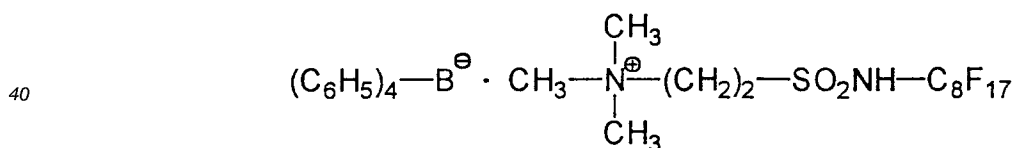
15 The colorant used in the toner may be any type of colorant which has conventionally been used for toner production, which may be, for example, phthalocyanine blue, quinacridone, azoic pigment, lake type pigment (such as carmine 6B), carbon black, or rhodamine G. An amount of the colorant may be, for example, 0.2 to 2.0 wt %, especially 2.0 to 12 wt % in the toner, though it may substantially vary according to the purpose and/or type of the toner.

20 The charge controller of the invention is very advantageously used in polymer toners in which binder monomers are dispersed in an aqueous solution of protective colloid for polymerization, such as suspension polymerization, emulsion polymerization, or interfacial polymerization. Monomers for production of binder resins above described are also known, including, for example, vinyl aromatic compounds (such as, styrene and α -methyl styrene), vinyl esters (such as, methyl (meth)acrylate, butyl (meth)acrylate, poly-functional isocyanate, and acid chloride, or any mixture of them.

25 For the charge controller of the invention may be used any of the compounds (I) to (III) or a mixture thereof. In the formulae for the foregoing compounds, Ph represents a substituted or non-substituted phenyl group. Examples of a substituent group which may be present on a phenyl group are an alkyl group having a carbon number of 1 to 18, an alkoxy group having a carbon number of 1 to 18, halogen, and a halogenated alkyl group (with a carbon number of 1 to 18). Specific examples of the Ph groups are methylphenyl, t-butylphenyl, stearylphenyl, methoxyphenyl, chlorophenyl, and trifluoromethylphenyl.

30 In the formula, A represents a metallic element selected from the group consisting of aluminum, zinc and boron. R₁ to R₃ may be identical or different, each representing an alkyl group having a carbon number of 1 to 18. R₄ each represent an alkylene group having a carbon number of 1 to 18, which is preferably ethylene group, propylene group, or butylene group.

35 As a specific example of the foregoing compound (I) is given the following:



45 An amount of the charge controller is 0.01 to 10 wt%, preferably 0.1 to 5 wt% in the toner. If the amount is less than 0.01 wt%, sufficient charge controlling power is not obtained. If the amount is more than 10 wt%, the volume resistance is reduced, resulting in such an inconvenience as a decrease in charge with time.

50 The toner of the invention may contain, in addition to the colorant and charge controller, various other additives. Examples of the additives include a lubricant (such as polypropylene wax and silicon oil) and a fluorescent material (such as pyrene, perylene).

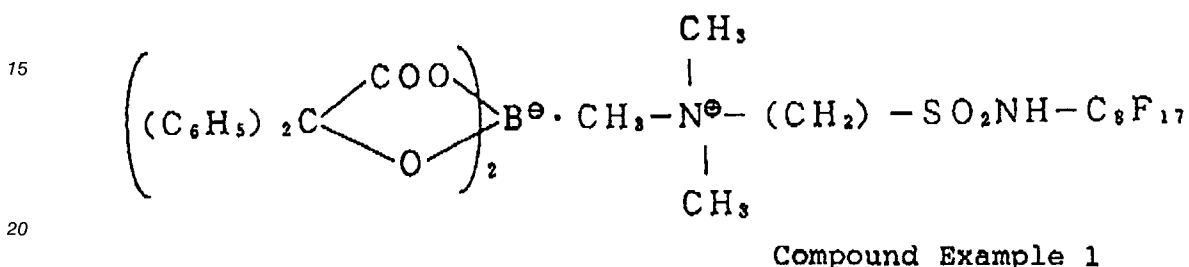
The charge controller of the invention is a colorless charge controller which can very effectively act on a polymer toner, and a toner containing the charge controller has high charging characteristics.

EXAMPLES

55 The invention will be described in further detail with respect to Examples given below. It is understood, however, that the examples should be taken as exemplary and should not be taken as limiting the invention.

EXAMPLE 1

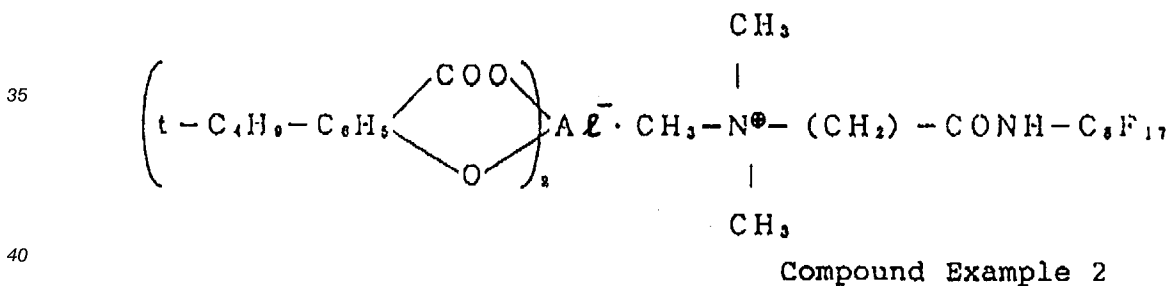
Ingredients	Wt Part
Polyurethane composed principally of isophorone diisocyanate (Tg:28°C.)	45
Butyl acetate	15
Carmine 6B	10
Charge controller according to the following Compound Example 1	2.5
m-Tetramethylxylene diisocyanate	40



A pigment dispersion paste composed of the above ingredients was emulsified in an aqueous solution of polyvinyl alcohol and cellulosic protective colloid, to which were added diamine and then monoamine to complete an interface polymerization. The resulting product was centrifuged and dried to give a toner.

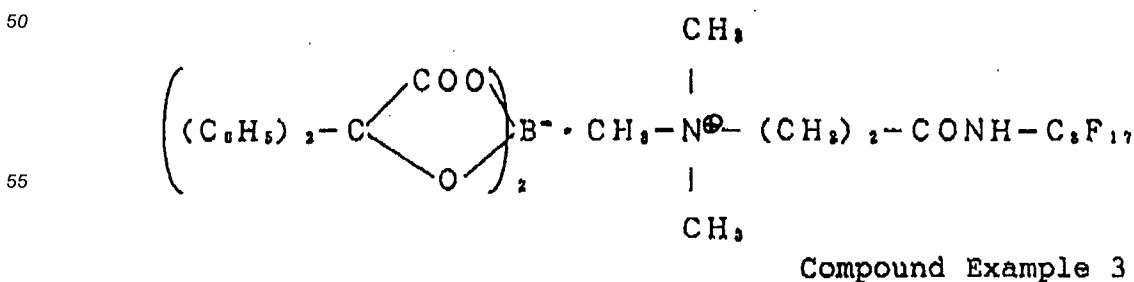
EXAMPLE 2

A toner was prepared in the same way as in EXAMPLE 1, except that a charge controller of the following compound example (2) was used instead of the charge controller of compound example (1).



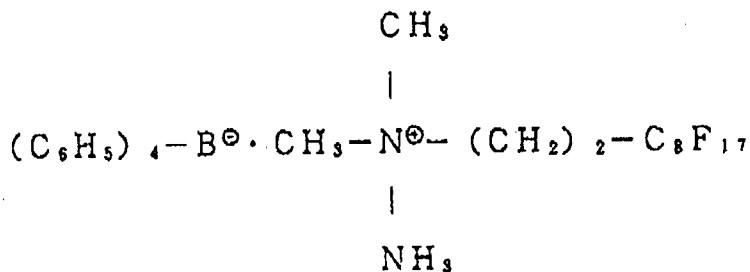
EXAMPLE 3

A toner was prepared in the same way as in EXAMPLE 1, except that a charge controller of the following compound example (3) was used instead of the charge controller of compound example (1).



COMPARATIVE EXAMPLE 1

A toner was prepared in the same way as in EXAMPLE 1, except that a charge controller of the following compound example (4) was used instead of the charge controller of compound example (1).



Compound Example 4

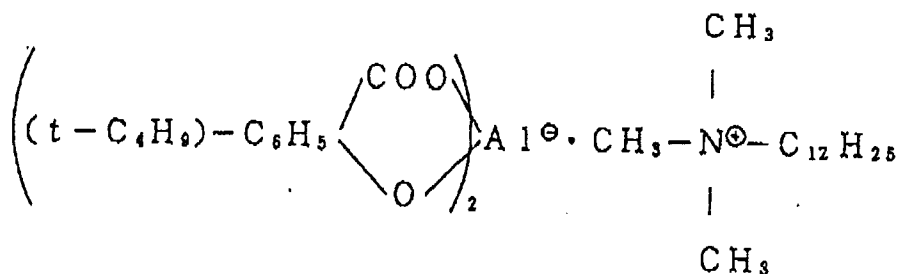
EXAMPLE 4

Ingredients	Wt Part
Polyurethane composed principally of toluene diisocyanate (Tg:34 ° C.)	40
Styrene	50
2-Ethylhexyl acrylate	10
Regal 330 R (carbon black)	10
Charge controller of Compound Example (2)	2.5
V-59 (Azoic polymerization initiator)	1.8

A pigment dispersion paste composed of the foregoing ingredients were emulsified in an aqueous solution of polyvinyl alcohol and cellulosic protective colloid, and polymerization was completed at 75 ° C./ 6 hours. The resulting product was centrifuged and dried, whereby a toner was obtained.

COMPARATIVE EXAMPLE 2

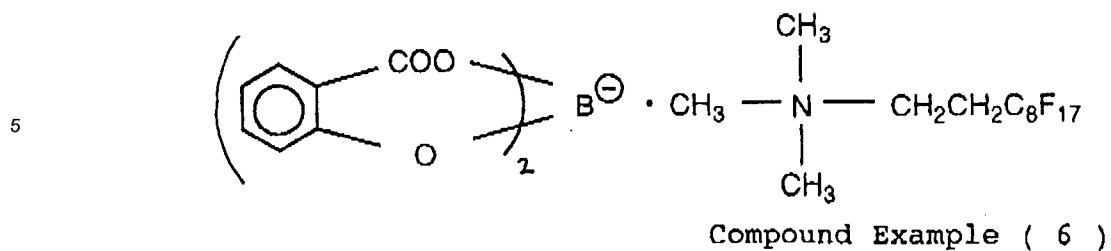
A toner was prepared using a charge controller of the following compound example (5) instead of the charge controller of Compound Example (2).



Compound Example (5)

COMPARATIVE EXAMPLE 3

A toner was prepared in the same way as in EXAMPLE 4, except that a charge controller of the following compound example (6) was used instead of the charge controller of compound example (2).



EXPERIMENTAL EXAMPLE 1

15 Environmental dependency of toner charging rate, and toner quantity of reversed polarity according to charge distribution measurement were measured with respect the foregoing toners.

Measurement methods used:

20 (1) Toners and ferrite carriers which had been allowed to stand for two hours in environments of 15° C./8 % RH and 35° C./80 % RH respectively were mixed in a weight ratio of 3 / 97, which mixtures was measured according to the blow-off method.

(2) For measurement of toner quantity of reversed polarity, charge distribution with respect to toner/carrier mixtures prepared at 15° C./8% RH in (1) above was measured by a q / d meter, on the basis of which measurements were calculated reversed polarity toner quantities.

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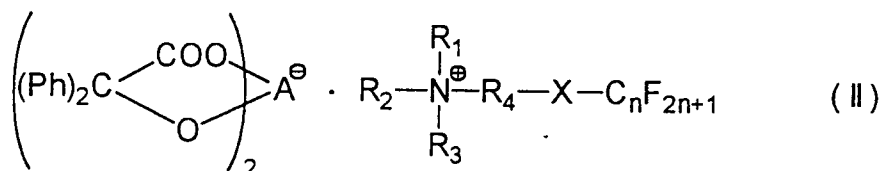
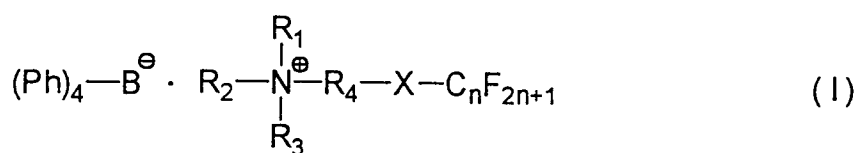
Table 1:

#	Toner size (μ)	Toner size distribution (%)	Charged quantity ($\mu\text{C}/\text{gr}$)		Reversed polarity toner (%)
			15°C/8% temp.	35°C/80% temp.	
Example 1	7.2	15	-25	-22.5	0.4
Example 2	6.4	13	-29	-26	0.3
Example 3	7.2	15	-25	-23	0.4
Comp. Example 1	5.7	16	+25	+9.5	4.3
Example 4	7.6	13	-22	-20	0.5
Comp. Example 2	8.5	19	-18	-7.5	4.6
Comp. Example 3	7.6	13	-15	+0.5	3.4
coaler counter		blow-off tripo (ferrite carrier, toner concentration: 3%)			q/d meter 15°C/8%

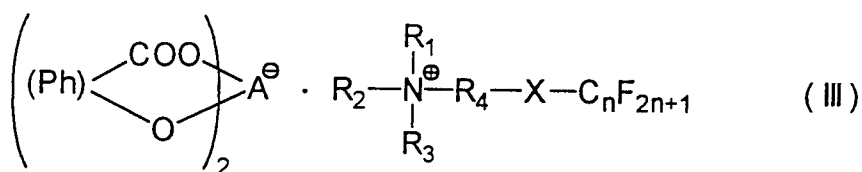
From the above results, it can be seen that toners using the charge controller of the invention exhibit good environmental stability and good charge distribution.

Claims

1. A toner comprising at least one charge controller expressed by the following formula:

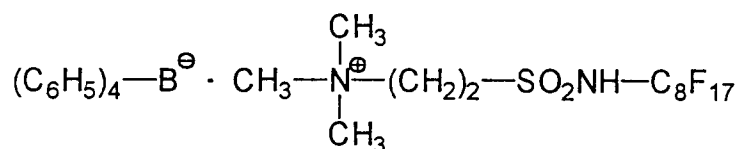


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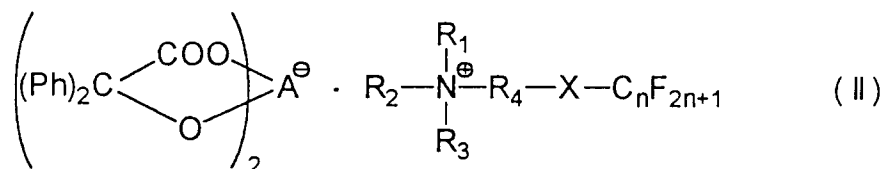
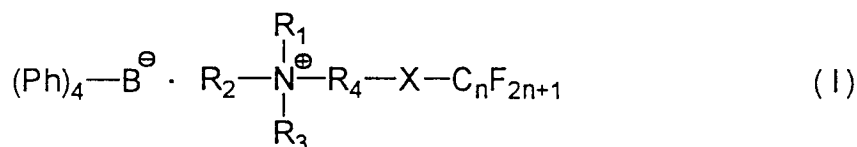


(where, Ph represents a substituted or non-substituted phenyl group; A represents aluminum, zinc or boron; R₁, R₂, and R₃ represent an alkyl group having a carbon number of 1 to 18; R₄ represents an alkylene group having a carbon number of 1 to 18; and X represents a sulfonic amide group or carboxylic amide group.)

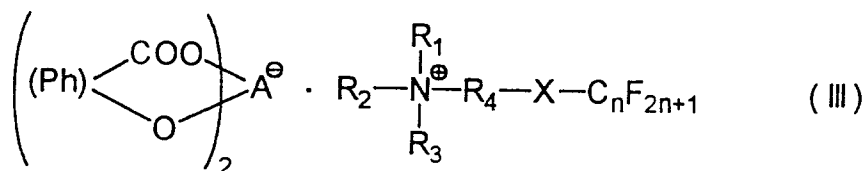
2. A toner according to claim 1 wherein Ph in the formula is selected from the group consisting of methylphenyl, t-butylphenyl, stearylphenyl, methoxyphenyl, chlorophenyl and trifluoromethylphenyl.
3. A toner according to claim 1 wherein R₁ to R₄, same or different, is selected from the group consisting of ethylene, propylene and butylene.
4. A toner according to claim 1 wherein said charge controller is represented by:



5. A toner comprising:
 - (a) a colorant
 - (b) a binder resin and
 - (c) at least one charge controller expressed by the following formula:

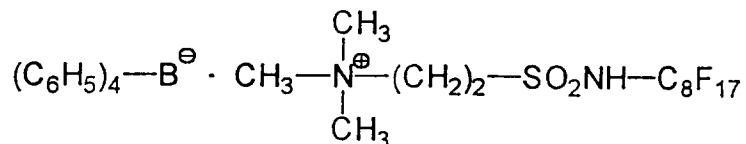


or



(where, Ph represents a substituted or non-substituted phenyl group; A represents aluminum, zinc or boron; R₁, R₂, and R₃, same or different, represent an alkyl group having a carbon number of 1 to 18; R₄ represents an alkylene group having a carbon number of 1 to 18; and X represents a sulfonic amide group or carboxylic amide group.)

6. A toner according to claim 5 wherein Ph in the formula is selected from the group consisting of methylphenyl, t-butylphenyl, stearylphenyl, methoxyphenyl, chlorophenyl and trifluoromethylphenyl.
7. A toner according to claim 5 wherein R₁ to R₄, same or different, is selected from the group consisting of ethylene, propylene and butylene.
8. A toner according to claim 5 wherein said charge controller is represented by:



9. A toner according to claim 5 wherein said colorant is selected from the group consisting of phthalocyanine blue, quinacridone, azoic pigment, lake type pigment, carbon black, rhodamine G and mixtures thereof,
10. A toner according to claim 5 wherein said colorant is present in the toner in an amount of 0.2 to 2.0 wt%.
11. A toner according to claim 5 wherein said binder resin is selected from the group consisting of styrene resin, styrene-acrylate resin, styrene-butadiene resin, acrylate resin, polyester resin, polyamide resin, polyamine resin, ammonium resin, ethylene resin, phenolic resin, or epoxy resin, or any combination of

such resins.

12. A toner according to claim 5 wherein said charge controller is present in said toner in an amount of 0.01 to 10 wt%.

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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)
Y	DE-A-29 40 907 (KONISHIROKU PHOTO INDUSTRY CO., LTD.) * page 8, line 12 - line 15 * * page 23, line 14 - line 25 * * page 19, compound (V-3) * * page 20, compound (V-9) * * claim 1 *	1-3,5-7, 9-12	G03G9/097
Y	EP-A-0 050 987 (MINNESOTA MINING AND MANUFACTURING COMPANY) * claims 6,7 *	1-3,5-7, 9-12	TECHNICAL FIELDS SEARCHED (Int.Cl.5) G03G
Y	DE-A-37 07 303 (FUJI XEROX CO., LTD.) * page 6, line 60 - page 8, line 45 * * page 9, line 45 - page 10, line 32; claims 1-6 *	1-3,5-7, 9-12	
Y	EP-A-0 367 162 (HOECHST AKTIENGESELLSCHAFT) * page 9, line 50 - page 10, line 7; claim 1 * * page 7, compound (1) * * page 8, compound (2) *	1,3,5,7, 9,11,12	
Y	PATENT ABSTRACTS OF JAPAN vol. 15, no. 180 (P-1199)9 May 1991 & JP-A-03 039 973 (RICOH CO., LTD.) 20 February 1991 * abstract *	1-3,5-7, 9,11,12	
Y	PATENT ABSTRACTS OF JAPAN vol. 15, no. 347 (P-1246)3 September 1991 & JP-A-03 131 869 (HITACHI CHEM., CO., LTD.) 5 June 1991 * abstract *	1-3,5,7, 9,11,12	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 2 June 1994	Examiner Hindia, E
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	