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SCAVENGERS FOR OXIDIZED DEVELOPING AGENT

Stanley M. Bloom, Waban, and Paul S. Huyffer, Lynnfield, Mass., assignors to Polaroid Corporation, Cambridge, Mass., a corporation of Delaware

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U.S. Cl. 96—3 12 Claims

ABSTRACT OF THE DISCLOSURE

This invention relates to novel immobile reducing agents which, upon oxidation, auto-react intramolecularly in such a way as to form a new heterocyclic ring.

BACKGROUND OF THE INVENTION

The copending application of Stanley M. Bloom and Howard G. Rogers, Ser. No. 655,440, filed concurrently, describes and claims certain photographic procedures for forming positive color transfer images wherein a photosensitive element containing at least one light-sensitive silver halide emulsion and an associated layer of color-providing material is exposed and then developed with an aqueous alkaline processing composition including a silver halide solvent and a silver halide developing agent. As a function of development, an imagewise distribution of soluble silver complex is formed, and this imagewise distribution migrates to the associated color-providing material where it is reduced and the color-providing material is in turn liberated for transfer to a superposed stratum to impart thereto a positive color transfer image.

In the practice of this photographic procedure, care must be taken to avoid a redox reaction between oxidized developing agent formed as a function of development and the color-providing material, since this redox reaction interferes with the system upon which selective transfer of color-providing material to the superposed stratum to form the desired image is predicated.

One system for obviating this redox reaction is to incorporate in the photosensitive element a reducing agent or "scavenger" for the oxidized developer which will reduce the latter before it has had opportunity to react with the color-providing material. The "scavenger" should ideally provide an immobile reaction product so that it will be unable to migrate to the superposed stratum where it might adversely affect the color and/or stability of the desired color image.

SUMMARY

The present invention is directed to a novel class of reducing agents which are of particular use in the aforementioned photographic processes and in procedures generally where it is desired that the reducing agent be immobile or non-migratory. The reducing agents of this invention are also silver halide developing agents.

The novel reducing agents of this invention contain an immobilizing or "anchoring" substituent which effectively precludes their migration and subsequent competition with the color-providing material in the aforementioned photographic systems and further, upon oxidation, undergo a ring-closing reaction to form a new heterocyclic ring which also contributes to the immobility of the resulting compound. Moreover, this ring-closure precludes any possibility of subsequent reduction which may be undesirable in the photographic system described above.

As was mentioned previosuly, the present invention is directed to novel reducing agents.

A primary object of this invention, therefore, is to provide a novel class of reducing agents.

Another object is to provide a novel class of reducing agents or "scavengers" of the foregoing description.

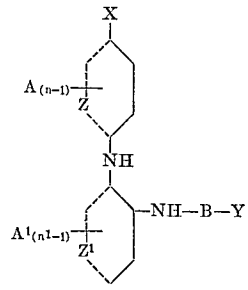
Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the product possessing the features, properties and the relation of components which are exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description.

The novel reducing agents of this invention may be represented by the following formula:

(A)



wherein:

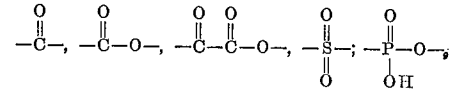
Z and Z^1 each represent the atoms necessary to complete a benzene or naphthalene ring;

X is hydroxy or amino, e.g., a primary, secondary or tertiary amino substituent of the formula:

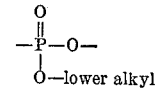


wherein each R may be hydrogen, a hydrocarbon radical, e.g., alkyl such as methyl, ethyl, butyl, dodecyl, etc., aryl such as phenyl or naphthyl attached through a carbon atom thereof to the nitrogen atom, a cyclic alkyl such as cyclopentyl or cyclohexyl, i.e., where both R's are alkylene comprising together with a nitrogen atom a heterocyclic ring, a substituted alkyl, such as hydroxyethyl, methoxyethoxyethyl, polyglycoloxyethyl, carboxymethyl, ethylcarboxymethyl, benzyl, phenylethyl, sulfo-phenylethyl, acetylamino-phenylethyl, succinylamino-phenylethyl, furanemethyl, etc.; or a substituted aryl such as methylphenyl, ethylphenyl, etc.;

B is



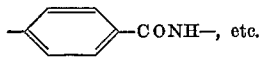
or



Y is a substantially colorless substitutent, e.g., an aryl radical such as phenyl, naphthyl, or substituted derivatives thereof, e.g., a nitro, alkyl or alkoxy-substituted phenyl or naphthyl, alkyl, alkoxy, hydroxyalkyl, haloalkyl, e.g., trifluoromethyl etc. wherein the alkyl moiety of the aforementioned substituents contains from 1–18 carbon atoms;

A and A^1 each represent an "anchoring" or immobilizing substituent rendering the compound non-diffusible, e.g., higher alkyl such as decyl, dodecyl, stearyl, oleyl, etc., linked directly to the aromatic nucleus or linked in-

directly thereto through an appropriate linking group, e.g., —CONH—; —alkylene—CONH—;

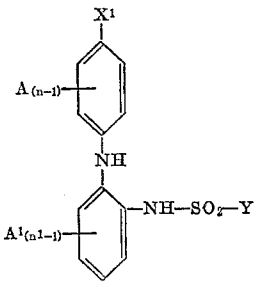


an aromatic ring, e.g., of the benzene or naphthalene series which rings may be either bonded to a single carbon atom of the aromatic nucleus or fused thereto, i.e., bonded to a pair of adjacent carbon atoms, or A and A^1 each may be a plurality of short chain radicals which together provide the anchoring moiety, each of the short chain radicals being linked directly or indirectly to a different carbon atom on the designated aromatic nuclei; and

n and *n* are 1 or 2, provided that when X is a secondary or tertiary amino comprising an anchoring moiety rendering said compound non-diffusible, Y is a substituent providing an anchoring moiety, or X and Y together provide an anchoring moiety, *n* and n^1 may be 1, but when X and Y alone or together do not provide such a substituent, at least one of *n* and n^1 must be 2; and nuclear substituted derivatives of these compounds, e.g., where any of the nuclear carbon atoms not containing one of the specifically designated substituents may contain an alkyl such as methyl, ethyl, etc., alkoxy such as methoxy, ethoxy, etc., carboxy, chloro or amide substituent.

The preferred class of compounds within formula A may be represented by the following formula:

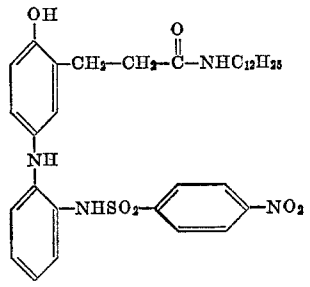
(B)



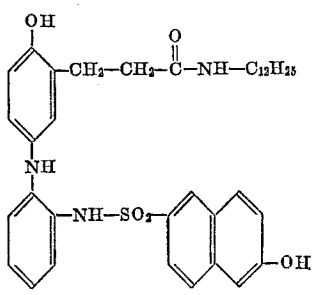
wherein X^1 is hydroxy or primary amino and the other moieties have the meanings heretofore noted; and nuclear substituted derivatives thereof, e.g., derivatives such as mentioned previously in the description of the compounds of Formula A.

As examples of novel reducing agents contemplated by this invention, mention may be made of the following:

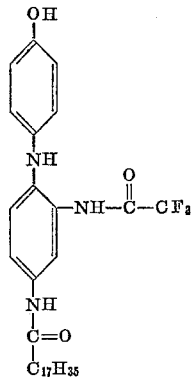
(1)



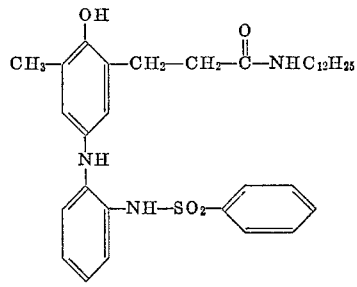
(2)



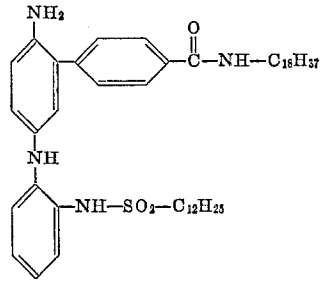
(3)



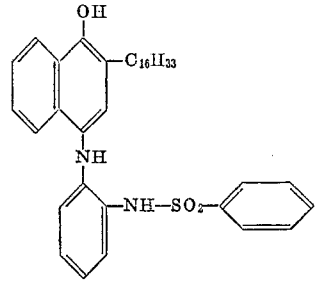
(4)



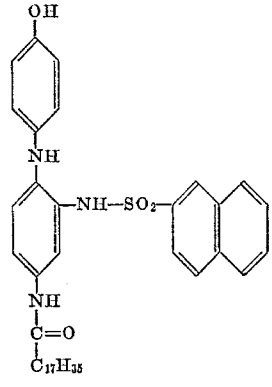
(5)



(6)

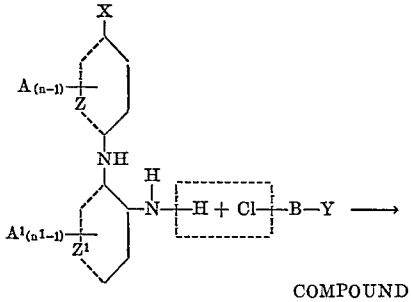


(7)



In general, the compounds of this invention may be readily synthesized by appropriate reaction between an

acid salt: Cl—B—Y and the 3-amino substituent of the aromatic ring, as follows:



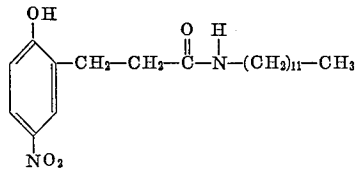
COMPOUND OF FORMULA A

It may be desired for the X moiety to be in some other form during the above coupling reaction. For example, where X is hydroxy, it may be necessary or advisable for it to be present as a protected derivative, e.g., an alkoxy substituent, during coupling, in which event the desired hydroxy analogue may subsequently be obtained by hydrolysis. Where X is primary amino, it may be necessary or advisable to employ the corresponding 1-nitro analogue in the coupling reaction, followed by reduction, e.g., with hydrogen in the presence of a Raney nickel catalyst, to form the desired amino compound.

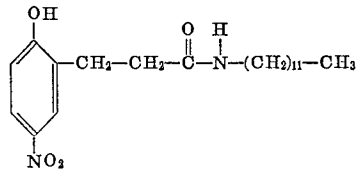
The following examples show by way of illustration and not by way of limitation the preparation of the novel compounds of this invention and their usefulness in the photographic processes described and claimed in the aforementioned copending application, Ser. No. 655,440.

EXAMPLE 1

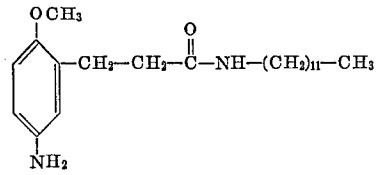
11.0 g. (0.05 mole) of 6-nitrodehydrocoumarin was dissolved in 100.0 cc. of methyl Cellosolve. 12.0 g. (0.064 mole) of n-dodecylamine was then added. The reaction was exothermic and a yellow solid separated out. The mixture was heated until a clear solution was obtained and then cooled to give 14.0 g. of light yellow crystals, M.P. 168–170, an amide of the formula:



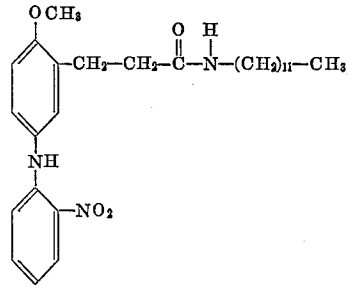
A mixture of 16.5 g. (0.0437 mole) of this amide, prepared in the manner described above, 7.0 g. (0.056 mole) of dimethylsulfate, 9.2 g. (0.066 mole) of potassium carbonate and 250 ml. of xylene was refluxed overnight. The xylene was then removed by steam distillation and an oily product crystallized on standing. Recrystallization of this product from hexane-chloroform yielded 13.3 g. of light tan needles, M.P. 106–108° C. of the formula:



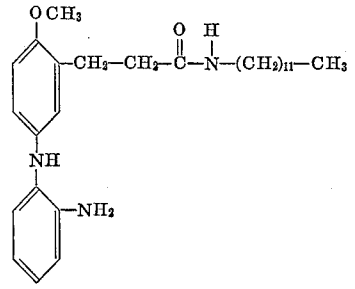
13.3 g. of this latter amide was hydrogenated in 95% ethanol in the presence of Raney-nickel catalyst. The reaction mixture was filtered and the filtrate evaporated. The resulting solid was recrystalized from hexane-ether to obtain 9 g. of a pure white amine, M.P. 80–82° C. of the formula:



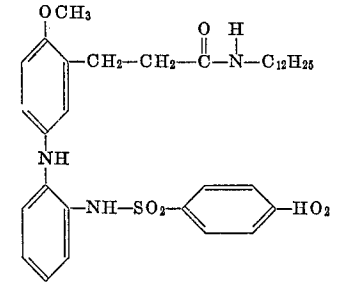
52 g. (0.145 mole) of the amine prepared in the above manner, 21.0 g. (0.145 mole) of 2-fluoronitrobenzene, 7.85 g. (0.195 mole) of magnesium oxide and 100.0 ml. of water were heated in a sealed bomb at 180° C. for 18 hours. The contents of the bomb were then filtered and the solid obtained by filtering was stirred in boiling ethyl acetate and filtered. Cooling of the filtrate yielded 40 g. of a light yellow solid, M.P. 125–126° C., of the formula:



10.0 g. of the last-named product was hydrogenated with 5% $Pd/BaSO_4$ in ethyl acetate to reduce the nitro group to the corresponding amine. The reaction mixture was filtered and the filtrate was then cooled in Dry Ice. Filtration yielded 9 g. of an off-white solid, M.P. 81–93° C. an amine of the formula:



7.0 g. of the above amine and 3.5 g. of p-nitrobenzenesulfonyl chloride were allowed to stand overnight in 50.0 ml. of dry pyridine. The mixture was then poured into a mixture of 250.0 ml. of 10% HCl and about 50.0 g. of ice. The resulting solid was filtered and recrystallized from ethanol-water (80–20) to yield 7.0 g. of a sulfonamide, M.P. 120–121° C. of the formula:

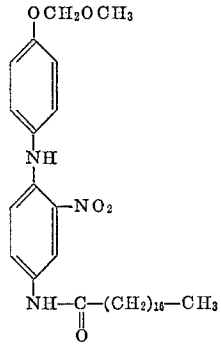


7 g. of the above sulfonamide in 50.0 cc. of dry dichloromethane was treated with excess boron tribromide and allowed to stand overnight. Water was added to destroy the excess boron tribromide and the resulting solid was filtered, stirred in boiling water and filtered again. Recrystallization from hexane-chloroform yielded 5.0 g. of the compound of Formula 1, a light tan solid, M.P. 139–141° C.

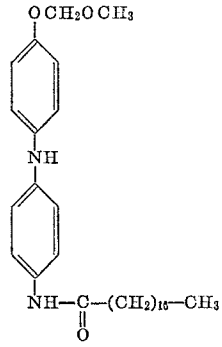
EXAMPLE 2

14.5 g. of p-methoxymethoxyaniline, 8.0 g. of 2-fluoro-4-stearamido-nitrobenzene, 4.0 g. of magnesium oxide and 100.0 ml. of water were heated with shaking at 180° C. for two days. After cooling, the mixture was filtered to recover a solid which was crystallized from ethyl

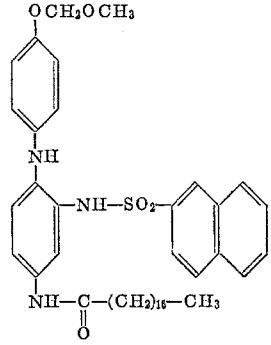
acetate to yield 6.0 g. of an orange crystalline solid, M.P. 118–119° C. of the formula:



6.0 g. of this nitro compound was hydrogenated in ethyl acetate using 5% palladium on barium sulfate as catalyst. After theoretical hydrogen uptake was completed, the reaction mixture was heated to boiling and then filtered through celite. After cooling, the filtrate was filtered to yield 4.0 g. of a white solid amine, M.P. 113–114° C. of the formula:



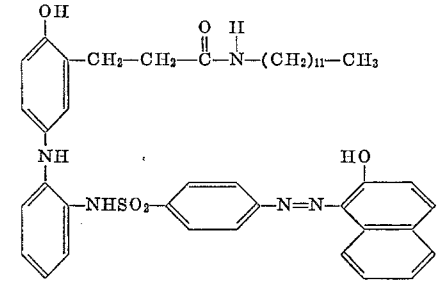
15.8 g. of the above amine (prepared in the foregoing manner) and 6.8 g. of 2-naphthalene-sulfonyl chloride were heated in 75.0 ml. of pyridine under nitrogen on a steam bath for two hours. The mixture was then poured into a mixture of 250.0 ml. of 10% sodium bicarbonate solution and about 50.0 g. of ice. The resulting solid was filtered and recrystallized from ethanol to yield 14.0 g. of an off white solid, M.P. 123–124° C., of the formula:



A mixture of 14.0 g. of the above compound, 50.0 ml. of ethanol and 2.0 ml. of concentrated HCl was heated under nitrogen on a steam bath for two hours. The mixture was then stirred into ice water and the resulting solid was collected by filtration. After several dissolutions in ethanol and precipitations from water, the resulting solid was dried to yield 11.0 g. of the compound of Formula 7, M.P. 87–89° C.

EXAMPLE 3

A photosensitive element of the type disclosed in the aforementioned copending application Ser. No. 655,440, was prepared by coating on a cellulose acetate support a gelatin layer containing a colloidal silver, silver-precipitating agent and non-diffusible color-providing compound of the formula:



to provide a calculated coverage of 136 mgm. per square foot of each of the color-providing compound and the silver precipitating agent; applying over this a layer containing a calculated coverage of 136 mgm. per square foot of gelatin and the same amount of a compound of Formula 1; and finally coating on a light-sensitive gelatino silver iodobromide emulsion. This element was then exposed and developed by spreading between the thus exposed element and a superposed dyeable sheet material at a gap of .0026 a processing composition containing the following proportions of ingredients:

Water	cc..	100.0
Hydroxyethyl cellulose	g..	3.9
Sodium hydroxide	g..	4.0
Sodium thiosulfate	g..	2.0
Sodium sulfite	g..	2.0
Metol	g..	1.6

After an imbibition time of about two minutes, the elements were separated to reveal a positive dye transfer image.

EXAMPLE 4

A similar photosensitive element containing no scavenger was exposed and developed in the manner described in Example 3. When the elements were separated following imbibition, dye had transferred in both exposed and unexposed areas so that no image formation was observable.

EXAMPLE 5

A photosensitive element may be prepared as in Example 3, except that the compound of Formula 1 may be included in the silver halide emulsion layer at a calculated coverage of, for example, 68 mgm. per square foot. Such a photosensitive element may be exposed and developed in the manner described in Example 3 with a developing composition containing no silver halide developing agent, e.g., a composition containing the following proportions of ingredients:

Water	cc..	100.0
Hydroxyethyl cellulose	g..	3.9
Sodium hydroxide	g..	5.0
Sodium thiosulfate	g..	1.0

Employing a gap of .0016", after two minutes the elements may be separated to provide a positive dye image.

From the procedure illustrated in Example 5, it will be observed that the compounds of this invention may be employed as silver halide developing agents. While they are primarily intended for use in the processes described above, it will be apparent that they may find use as silver halide developing agents in other pohtographic processes, e.g., processes wherein the use of an immobile or relatively immobile developer is desirable. Accordingly, it is to be expressly understood that the photographic

utilization of the compounds of this invention is not restricted to products and processes such as were described in Examples 3–5.

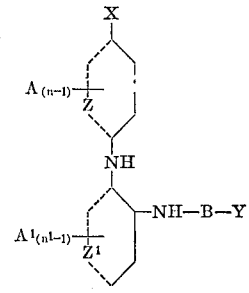
By way of recapitulation the compounds of this invention are particularly useful in the photographic systems described and claimed in the aforementioned Ser. No. 655,440 wherein a photosensitive element including at least one light-sensitive silver halide emulsion having associated therewith a non-diffusible color-providing material which is capable of providing an oxidation product which can auto-react intramolecularly to effect ring-closure and to eliminate the color-providing moiety of said material for transfer is exposed and then developed with an aqueous alkaline processing composition including a silver halide solvent and a silver halide developing agent the oxidation product of which is reducible by a redox reaction with the color-providing material; an imagewise distribution of soluble silver complex is formed in terms of unexposed areas of the emulsion; the non-diffusible color-providing material is contacted with the imagewise distribution of soluble silver complex where, in the presence of silver-precipitating nuclei, the complex is reduced and as a function thereof an imagewise distribution of oxidized color-providing material is formed; the oxidized material is allowed to auto-react intramolecularly to eliminate the color-providing moiety to provide an imagewise distribution of diffusible color-providing moiety in terms of unexposed areas of the emulsion; and this imagewise distribution of color-providing moiety is transferred, at least in part, by imbibition, to a superposed stratum to impart thereto a positive color transfer image. In one procedure described in this copending application, a scavenger for oxidized developer is positioned in a layer in the photosensitive element between the emulsion layer and the layer of color-providing material, so that oxidized developer formed as a function of development is reduced before it can migrate to the layer of color-providing material and there undergo an undesired redox reaction with the color-providing material.

Since the novel compounds of this invention are effectively immobile in their reduced form, they cannot migrate to the layer of color-providing material where they would compete with the color-providing material as reducing agents for the soluble silver complex, which competing would be detrimental to proper image formation. Since these compounds are even more non-migratory in their oxidized form, owing to ring-closure as a function of oxidation, the oxidized form also cannot leave the layer in the photosensitive element where they are employed and thereby adversely affect the quality and/or stability of the color transfer image.

Since certain changes may be made in the above product and process without departing from the scope of the invention herein involved it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In a process for forming positive color transfer images wherein a photosensitive element containing at least one light-sensitive silver halide emulsion and an associated layer of a non-diffusible compound containing a color-providing moiety is exposed and then developed with an aqueous alkaline processing composition including a silver halide solvent and a silver halide developing agent, the oxidation product of said developing agent being reducible by a redox reaction with said compound; and an imagewise distribution of soluble silver complex formed as a function of development migrates to said compound where said complex is reduced and the color-providing moiety of said compound is in turn liberated for transfer to a superposed stratum to impart thereto a positive color transfer image, said process being performed in the presence of a scavenger for reducing oxidized developing agent formed as a function of development to prevent said redox reaction with said compound; the improvement which comprises employing as said scavenger a compound of the formula:

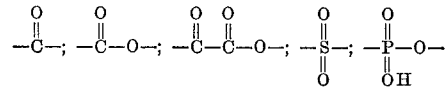


wherein:

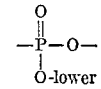
Z and Z^1 each represent the atoms necessary to complete a benzene or naphthalene ring;

X is hydroxy or amino;

B is



or



Y is a colorless substituent selected from the group consisting of phenyl, naphthyl, nitro-, alkyl-, or alkoxy-substituted phenyl or naphthyl, alkyl, alkoxy, hydroxyalkyl and halo alkyl radicals wherein the alkyl moiety contains from 1 to 18 carbon atoms;

A and A^1 each represents an anchoring substituent rendering the compound non-diffusible, said substituent containing a higher alkyl, aromatic or heterocyclic ring bonded to a single carbon atom of said aromatic nucleus formed by said Z and Z^1 moieties, respectively, or fused thereto by being bonded to a pair of adjacent carbon atoms of said nucleus, or a plurality of short chain alkyl radicals which together provide said anchoring moiety, each of said short chain radicals being linked directly or indirectly to a different nuclear carbon atom; and

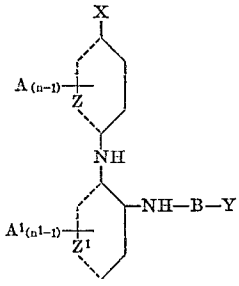
radicals being linked directly or indirectly to a different nuclear carbon atom; and

n and n^1 are 1 or 2 provided that when X is a secondary or tertiary amino comprising an anchoring moiety rendering said compound non-diffusible, Y is a substituent providing an anchoring moiety, n and n^1 must be 2; and

alkyl, alkoxy, carboxy, chloro or amide substituted derivatives of said compounds.

2. In a process of forming positive color transfer images comprising the steps of (1) exposing a photosensitive element including at least one light-sensitive silver halide emulsion having associated therewith a non-diffusible color-providing material which is capable of providing an oxidation product which can auto-react intramolecularly to effect ring-closure and to eliminate the color-providing moiety of said material for transfer; (2) developing said exposed silver halide emulsion with an aqueous alkaline processing composition including a silver halide solvent and a silver halide developing agent; (3) forming as a function of development an imagewise distribution of soluble silver complex in terms of unexposed areas of said emulsion; (4) contacting said nondiffusible color-providing material with said imagewise distribution of soluble silver complex to reduce said silver complex and as a function thereof forming an imagewise distribution of oxidized color-providing material; (5) allowing said oxidized material to auto-react intramolecularly to eliminate said color-providing moiety, thereby forming an imagewise distribution of diffusible color-providing moiety in terms of unexposed areas of said emulsion; and (6) transferring

said imagewise distribution of said color-providing moiety to a superposed stratum to impart thereto a positive color transfer image, said process being performed in the presence of a scavenger for oxidized silver halide developing agent, said scavenger comprising a material for reducing oxidized developing agent formed as a function of development of said silver halide emulsion; the improvement which comprises employing as said scavenger a compound of the formula:

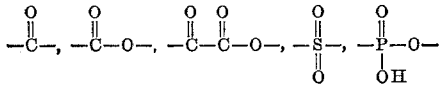


wherein:

Z and Z^1 each represent the atoms necessary to complete a benzene or naphthalene ring;

X is hydroxy or amino;

B is



or



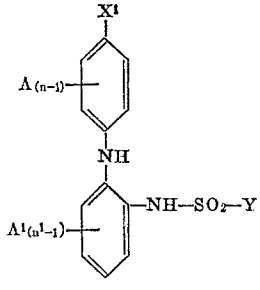
Y is a colorless substituent selected from the group consisting of phenyl, naphthyl, nitro-, alkyl-, or alkoxy-substituted phenyl or naphthyl, alkyl, alkoxy, hydroxyalkyl and halo alkyl radicals wherein the alkyl moiety contains from 1 to 18 carbon atoms;

A and A^1 each represents an anchoring substituent rendering the compound non-diffusible, said substituent containing a higher alkyl, aromatic or heterocyclic ring bonded to a single carbon atom of said aromatic nucleus formed by said Z and Z^1 moieties, respectively, or fused thereto by being bonded to a pair of adjacent carbon atoms of said nucleus, or a plurality of short chain alkyl radicals which together provide said anchoring moiety, each of said short chain radicals being linked directly or indirectly to a different nuclear carbon atom; and

n and n^1 are 1 or 2, provided that when X is a secondary or tertiary amino comprising an anchoring moiety rendering said compound non-diffusible, Y is a substituent providing an anchoring moiety, n and n^1 must be 2; and

alkyl, alkoxy, carboxy, chloro or amide substituted derivatives of said compounds.

3. A process as defined in claim **1** wherein said compound is a compound of the formula:



wherein:

X^1 is hydroxy or primary amino;

Y is a colorless substituent selected from the group consisting of phenyl, naphthyl, nitro-, alkyl-, or alkoxy-substituted phenyl or naphthyl, alkyl, alkoxy, hydroxyalkyl and haloalkyl radicals wherein the alkyl moiety contains from 1 to 18 carbon atoms;

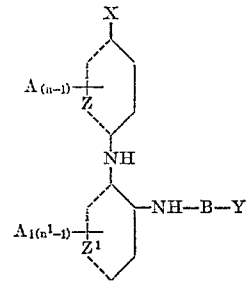
A and A^1 each represents an anchoring substituent rendering the compound non-diffusible, said substituent containing a higher alkyl, aromatic or heterocyclic ring bonded to a single carbon atom of said aromatic nucleus formed by said Z and Z^1 moieties, respectively, or fused thereto by being bonded to a pair of adjacent carbon atoms of said nucleus, or a plurality of short chain alkyl radicals which together provide said anchoring moiety, each of said short chain radicals being linked directly or indirectly to a different nuclear carbon atom; and

n and n^1 are 1 or 2, provided that at least one of n and n^1 must be 2 to provide at least one anchoring moiety; and

alkyl, alkoxy, carboxy, chloro and amide substituted derivatives of said compounds.

4. A process as defined in claim **1** wherein said compound is selected from those identified in the specification as Formulae 1–7.

5. In a photographic product comprising a support, a light-sensitive silver halide emulsion in a layer on said support, said emulsion having associated therewith a non-diffusible compound containing a color-providing moiety, said compound being capable upon development of said emulsion of providing a reaction product which can auto-react intramolecularly to effect ring closure and to eliminate said color-providing moiety, said eliminated moiety being diffusible in an aqueous alkaline processing composition, said compound being in a layer on the same side of said support as said emulsion, and a layer containing a scavenger for oxidized silver halide developing agent, said scavenger comprising a material for reducing oxidized developing agent formed as a function of development of said silver halide emulsion, said non-diffusible compound containing said color-providing moiety being in a layer between said support and said layer containing said scavenger; the improvement which comprises employing as said scavenger a compound as defined in claim **1** of the formula:

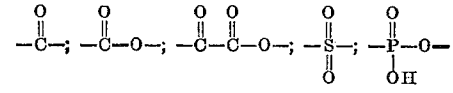


wherein:

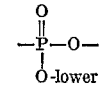
Z and Z^1 each represent the atoms necessary to complete a benzene or naphthalene ring;

X is hydroxy or amino;

B is



or



Y is a colorless substituent selected from the group consisting of phenyl, naphthyl, nitro-, alkyl-, or alkoxy-substituted phenyl or naphthyl, alkyl, alkoxy, hydroxyalkyl and halo alkyl radicals wherein the alkyl moiety contains from 1 to 18 carbon atoms;

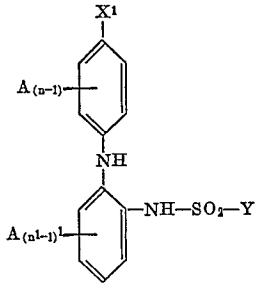
A and A^1 each represent an anchoring substituent ren-

dering the compound non-diffusible, said substituent containing a higher alkyl, aromatic or heterocyclic ring bonded to a single carbon atom of said aromatic nucleus formed by said Z and Z^1 moieties, respectively, or fused thereto by being bonded to a pair or adjacent carbon atoms of said nucleus, or a plurality of short chain alkyl radicals which together provide said anchoring moiety, each of said short chain radicals being linked directly or indirectly to a different nuclear carbon atom; and

n and n^1 are 1 and 2, provided that when X is a secondary or tertiary amino comprising an anchoring moiety rendering said compound non-diffusible, Y is a substituent providing an anchoring moiety, n and n^1 must be 2; and

alkyl, alkoxy, carboxy, chloro or amide substituted derivatives of said compounds.

6. A photographic product as defined in claim **5** wherein said compound is a compound of the formula:



wherein:

X^1 is hydroxy or primary amino;

Y is a colorless substituent selected from the group consisting of phenyl, naphthyl, nitro-, alkyl-, or alkoxy-substituted phenyl or naphthyl, alkyl, alkoxy, hydroxyalkyl and haloalkyl radicals wherein the alkyl moiety contains from 1 to 18 carbon atoms;

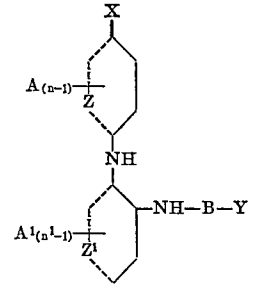
A and A^1 each represents an anchoring substituent rendering the compound non-diffusable, said substituent containing a higher alkyl, aromatic or heterocyclic ring bonded to a single carbon atom of said aromatic nucleus formed by said Z and Z^1 moieties, respectively, or fused thereto by being bonded to a pair of adjacent carbon atoms of said nucleus, or a plurality of short chain radicals which together provide said anchoring moiety, each of said short chain radicals being linked directly or indirectly to a different nuclear carbon atom; and

n and n^1 are 1 or 2, provided that at least one of n and n^1 must be 2 to provide at least one anchoring moiety; and

alkyl, alkoxy, carboxy, chloro or amide substituted derivatives of said compounds.

7. A product as defined in claim **5** wherein said compound is selected from those identified in the specification as Formulae 1–7.

8. A photographic product including a photosensitive element having a layer containing a light-sensitive silver halide emulsion and a compound of the formula:

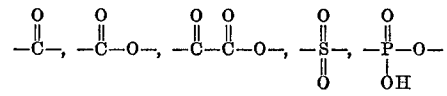


wherein:

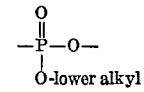
Z and Z^1 each represent the atoms necessary to complete a benzene or naphthalene ring;

X is hydroxy or amino;

B is



or



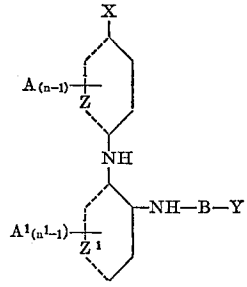
Y is a colorless substituent selected from the group consisting of phenyl, naphthyl, nitro-, alkyl-, or alkoxy-substituted phenyl or naphthyl, alkyl, alkoxy, hydroxyalkyl and halo alkyl radicals wherein the alkyl moiety contains from 1 to 18 carbon atoms;

A and A^1 each represents an anchoring substituent rendering the compound non-diffusible, said substituent containing a higher alkyl, aromatic or heterocyclic ring bonded to a single carbon atom of said aromatic nucleus formed by said Z and Z^1 moieties, respectively, or fused thereto by being bonded to a pair of adjacent carbon atoms of said nucleus, or a plurality of short chain alkyl radicals which together provide said anchoring moiety, each of said short chain radicals being linked directly or indirectly to a different nuclear carbon atom; and

n and n^1 are 1 or 2, provided that when X is a secondary or teritary amino comprising an anchoring moiety rendering said compound non-diffusible, Y is a substituent providing an anchoring moiety, n and n^1 must be 2; and

alkyl, alkoxy, carboxy, chloro or amide substituted derivatives of said compounds.

9. A process which comprises developing an exposed light-sensitive silver halide emulsion containing a developable image with a compound of the formula:

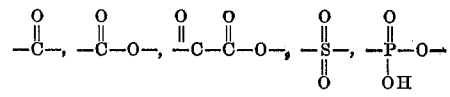


wherein:

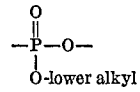
Z and Z^1 each represent the atoms necessary to complete a benzene or naphthalene ring;

X is hydroxy or amino;

B is



or



Y is a colorless substituent selected from the group consisting of phenyl, naphthyl, nitro-, alkyl-, or alkoxy-substituted phenyl or naphthyl, alkyl, alkoxy, hydroxyalkyl and halo alkyl radicals wherein the alkyl moiety contains from 1 to 18 carbon atoms;

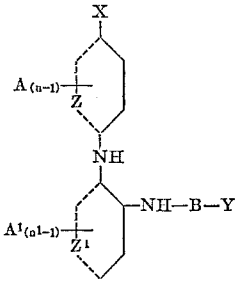
A and A^1 each represents an anchoring substituent rendering the compound non-diffusible, said substituent containing a higher alkyl, aromatic or heterocyclic ring bonded to a single carbon atom of said aromatic nucleus formed by said Z and Z^1 moieties, respectively, or fused thereto by being bonded to a pair of adjacent

carbon atoms of said nucleus, or a plurality of short chain alkyl radicals which together provide said anchoring moiety, each of said short chain radicals being linked directly or indirectly to a different nuclear carbon atom; and

n and n^1 are 1 or 2, provided that when X is a secondary or tertiary amino comprising an anchoring moiety rendering said compound non-diffusible, Y is a substituent providing an anchoring moiety, n and n^1 must be 2; and

alkyl, alkoxy, carboxy, chloro or amide substituted derivatives of said compounds.

10. In a process for forming images by diffusion transfer wherein a photosensitive element including a layer comprising an exposed light-sensitive silver halide emulsion containing a developable image is developed with a silver halide developing agent, an imagewise distribution of a soluble silver complex is formed in terms of unexposed and undeveloped areas of said emulsion, and the imagewise distribution of soluble silver complex is transferred, at least in part, by imbibition to a superposed silver-receptive stratum to impart thereto a silver transfer image; the improvement which comprises employing as said silver halide developing agent a compound of the formula:

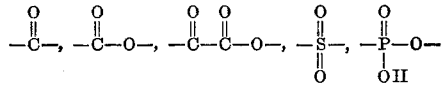


wherein:

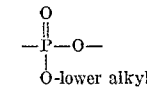
Z and Z^1 each represent the atoms necessary to complete a benzene or naphthalene ring;

X is hydroxy or amino;

B is



or



Y is a colorless substituent selected from the group consisting of phenyl, naphthyl, nitro-, alkyl-, or alkoxy-substituted phenyl or naphthyl, alkyl, alkoxy, hydroxyalkyl and halo alkyl radicals wherein the alkyl moiety contains from 1 to 18 carbon atoms;

A and A^1 each represents an anchoring substituent rendering the compound non-diffusible, said substituent containing a higher alkyl, aromatic or heterocyclic ring bonded to a single carbon atom of said aromatic nucleus formed by said Z and Z^1 moieties, respectively, or fused thereto by being bonded to a pair of adjacent carbon atoms of said nucleus, or a plurality of short chain alkyl radicals which together provide said anchoring moiety, each of said short chain radicals being linked directly or indirectly to a different nuclear carbon atom; and

n and n^1 are 1 or 2, provided that when X is a secondary or tertiary amino comprising an anchoring moiety rendering said compound non-diffusible, Y is a substituent providing an anchoring moiety, n and n^1 must be 2; and

alkyl, alkoxy, carboxy, chloro or amide substituted derivatives of said compounds.

11. A process as defined in claim **9** wherein said compound is contained initially in the layer in said photosensitive element containing said silver halide emulsion.

12. A process as defined in claim **9** wherein said compound is selected from those identified in the specification as Formulae 1–7.

References Cited

UNITED STATES PATENTS

2,735,765	2/1956	Loria et al.	96—56
3,022,166	2/1962	Green et al.	96—61
3,304,182	2/1967	Froehlich	96—100
3,383,214	5/1968	Anderson	96—74

NORMAN G. TORCHIN, Primary Examiner

A. T. SURO PICO, Assistant Examiner

U.S. Cl. X.R.

96—29, 56, 100

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

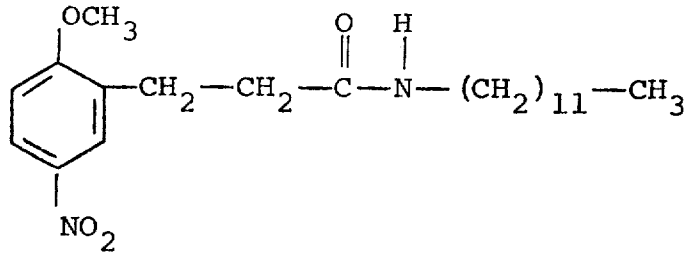
Patent No. 3,482,971 Dated December 9, 1969

Inventor(s) Stanley M. Bloom et al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

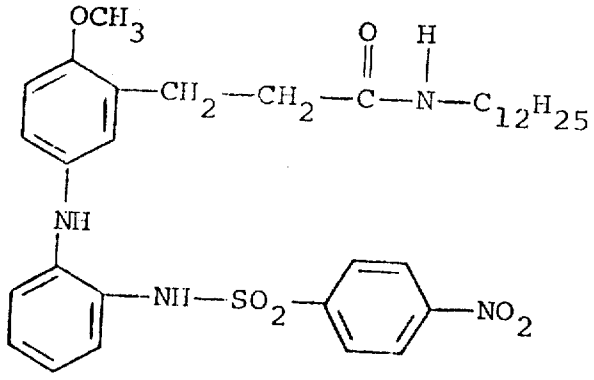
Column 5, Example 1, Formula 2, should appear as shown below:

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Column 6, Formula 3, should appear as shown below:



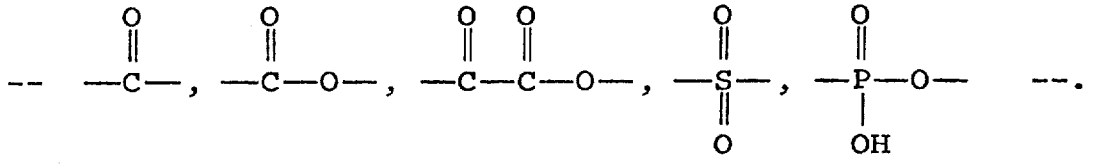
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,482,971 Dated December 9, 1969

Inventor(s) Stanley M. Bloom and Paul S. Huyffer

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 26 (appl. page 10, line 15), "93" should be --83--.
Column 8, line 72 (appl. page 15, line 24), "pohtographic" should be --photographic--.
Column 10, lines 46 and 47 (appl. Amendment A, page 3), delete "radicals being linked directly or indirectly to a different nuclear carbon atom; and".
Column 12, line 42 (appl. Amendment A, page 7), delete "as defined in claim 1".
Column 13, line 11 (appl. Amendment A, page 8), "and" should be --or--.
Column 14, line 29 (appl. Amendment A, page 10), "teritary" should be --tertiary--.
Column 14, line 55 (appl. Amendment A, page 11), should be



Signed and sealed this 28th day of March 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents