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PHOTOSENSITIVE ELEMENTS HAVING IMPROVED PROCESSING TEMPERATURE LATITUDE

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U.S. Cl. 96—3 **43 Claims**

ABSTRACT OF THE DISCLOSURE

The processing temperature latitude of a photographic element containing an image-recording silver halide emulsion layer is improved by employing in the photosensitive element an opposite-working silver halide emulsion layer which as a function of development produces a diffusible development inhibitor to inhibit further development in the image-recording layer when both layers are developed simultaneously. The invention is particularly applicable to color diffusion transfer systems. Development inhibitor-releasing compounds such as couplers which release mercaptans or azoles are also described.

This application is a continuation-in-part of our copending application Ser. No. 204,340 filed Dec. 2, 1971, now abandoned.

This invention relates to the art of photography, and more particularly to photosensitive elements, color diffusion transfer film systems and methods for obtaining diffusion transfer dye images with increased processing temperature latitude.

U.S. Pats. 3,227,550 of Whitmore et al. and 3,227,552 of Whitmore, both issued Jan. 4, 1966, describe a color diffusion transfer system using direct-positive, silver halide emulsions and nondiffusible couplers which react with an oxidized color developing agent to form diffusible dyes which are transferred by diffusion to a receiving layer to form a color image. It is desirable to obtain a high quality image according to this system both at room temperature and temperatures in excess of room temperature such as 90–100° F. (32–38° C.) or even higher.

In Belgian Pat. 757,960, there is described a developer scavenger layer for use in an integral film unit which may employ direct-positive, silver halide emulsions and non-diffusible couplers that react with oxidized color developing agent to form diffusible dyes. The described developer scavenger layer may comprise a silver halide emulsion and a non-diffusible coupler capable of reacting with oxidized color developing agent to form an immobile product. The developer scavenger layer is described as being located adjacent the light-reflective layer or image-receiving layer to prevent excess color developing agent from staining the image-receiving layer. This is distinguishable from the instant invention wherein an opposite-working silver halide emulsion layer is located in the photosensitive element itself and produces a diffusible development inhibitor as a function of development to inhibit further development in the image-recording layer when both layers are developed simultaneously, the opposite-working emulsion layer and at least one of the image-recording layers having substantially the same sensitivity to actinic radiation within a particular spectral region.

U.S. Pats. 2,179,786; 2,336,380; and 2,653,872 and British Patents 581,772 and 595,419 describe various photographic elements wherein a different silver halide emulsion layer is employed in addition to the image-recording silver halide emulsion layer. Again, however, our invention is not taught.

It is an object of this invention to provide a means for increasing the processing temperature latitude of a color diffusion transfer system utilizing compounds which react with oxidized developing agent to produce diffusible dyes.

It is another object of this invention to provide photosensitive elements, film units and methods for obtaining an image wherein a particular temperature-responsive layer is utilized in the photosensitive element.

Still another object of this invention is to provide color transfer film units and methods for processing same wherein the dye image-receiving layer is integral with the photosensitive element itself or is provided on a separate support to be superposed on the photosensitive element after exposure thereof.

These and other objects are achieved by a photosensitive element according to our invention comprising a support having thereon at least one, and preferably three, photosensitive, image-recording, silver halide emulsion layers, and an opposite-working silver halide emulsion layer which as a function of development produces a diffusible development inhibitor to inhibit further development in the image-recording layer when both layers are developed simultaneously, the opposite-working silver halide emulsion layer and at least one of the image-recording emulsion layers having substantially the same sensitivity to actinic radiation within a particular spectral region.

When the image-recording silver halide emulsion layer is negative-working, then the opposite-working silver halide emulsion layer is a direct-positive emulsion layer. When the image-recording silver halide emulsion layer is a direct-positive one, then the opposite-working silver halide emulsion layer is a negative-working emulsion layer.

It is known that the developing rate of a photographic element increases with increasing temperature. This necessitates extraordinary procedures in processing to maintain the temperature of processing baths within a very narrow range to prevent over- or underdevelopment. By use of our invention the processing temperature latitude of a photographic element is significantly extended, thus eliminating or at least minimizing the criticality of temperature-control during processing.

The need for processing temperature latitude of a photographic element is especially evident in the diffusion transfer field. When diffusion transfer processes are adapted for in-camera processing, the temperature of the processing will depend upon the prevalent ambient temperature. Temperatures as high as 100° F. (38° C.) or higher are frequently encountered in desert or tropical regions. In the absence of a temperature-compensating mechanism in the system, an increase in temperature increases the rate at which silver halide is developed. At a standard development time, therefore, overdevelopment occurs. This overdevelopment results in images of inferior quality as evidenced by undesirable high densities in the highlight or D min areas or by undesirable low dye densities in the shadow or $D_{max.}$ areas, depending upon the particular imaging chemistry employed. Our invention provides a solution to this problem. By employing an opposite-working silver halide emulsion layer in the photographic element which produces a diffusible development inhibitor as a function of development, an inhibiting effect on the image-recording layer is obtained which appears to be directly proportional to the thermally sensitive rate of development in the opposite-working emulsion layer. At elevated temperatures, therefore, overdevelopment of the image-recording emulsion layer is minimized.

There are many ways to provide an opposite-working emulsion layer having the property of producing a diffusible development inhibitor as a function of development. For example, it is known that certain halide ions, i.e., bromide, iodide or combinations thereof, if released upon development are development inhibitors. Reference is made to Becker, U.S. Pat. 3,404,002, issued Oct. 1, 1968, wherein it is taught that iodide ions provide useful interimage effects. Bromide ions also have a similar development inhibiting effect. Generally speaking, for halide ions development repression, the opposite-working silver halide emulsion layer should release a halide ion which forms a silver salt that is more insoluble than the halide comprising the greatest mole percent of the emulsion in the image-recording layer. For example, if the image-recording layer is a silver chlorobromide or silver chloride emulsion, then the opposite-working silver halide layer can be a silver bromide or silver bromoiodide emulsion. If the image-recording layer is a silver bromide emulsion, then the opposite-working silver halide layer can be a silver bromoiodide emulsion. If the image-recording layer is a silver bromoiodide emulsion, then the opposite-working silver halide layer can be a silver bromoiodide emulsion having a higher iodide mole percent than the emulsion in the image-recording layer. If the image-recording emulsion layers in the embodiments described above contain dye image-providing materials such as nondiffusible couplers capable of reacting with oxidized color developing agent to produce diffusible dyes, then the opposite-working emulsion layer should contain a nondiffusible coupler capable of reacting with oxidized color developing agent to produce a nondiffusible product.

Another way to provide an opposite-working emulsion layer having the property of producing a diffusible development inhibitor as a function of development is to employ in the system an inhibitor-releasing developer such as those described in U.S. Pat. 3,379,529 of Porter et al. issued Apr. 23, 1968. An additional method according to our invention which is highly preferred is to employ in or contiguous to the opposite-working silver halide emulsion layer a development inhibitor-releasing compound or a precursor thereof. Such compounds include ring-closing compounds of the type disclosed in U.S. Pat. 3,443,940 of Bloom et al, issued May 13, 1969 except that the diffusible moiety released is a development inhibitor instead of a dye; the compounds disclosed in U.S. Pat. 3,674,478; the compounds disclosed in U.S. Pat. 3,364,022 of Barr issued Jan. 16, 1968; couplers which release bromide or iodide ions as described in British Patent 1,201,110 of Fuji issued Aug. 5, 1970; compounds disclosed in U.S. Pat. 3,227,554 of Barr et al. issued Jan. 4, 1966; U.S. Pat. 3,148,062 of Whitmore et al. issued Sept. 8, 1964; Canadian Patent 846,172 of Sawdey issued July 7, 1970; British Patent 1,224,555 of Agfa-Gevaert issued Mar. 10, 1971; and "Development-Inhibitor-Releasing (DIR) Couplers in Color Photography," Barr et al., *Photographic Science and Engineering*, Volume 13, Number 4, July-August, 1969, pages 214–220; etc., the disclosures of which are hereby incorporated by reference. Preferably, the development inhibitor-releasing compound is a coupler and the development inhibitor which is released is either a mercaptan such as a heterocyclic mercaptan e.g., phenylmercaptotetrazole, ethylmercaptotetrazole, 2-benzothiazolylthiol, etc., or an azole, e.g., those containing a $>$NH moiety which will form a benzotriazole, benzimidazole, 5 - methylbenzotriazole, indazoles, etc.

A photographic film unit according to our invention, which is adapted to be processed by passing the unit between a pair of juxtaposed pressure-applying members, such as would be found in a camera designed for in-camera processing, comprises:

(a) a photosensitive element comprising a support having thereon at least one, and preferably three, photosensitive, image-recording, silver halide emulsion layers, each silver halide emulsion layer having associated therewith a dye image-providing material comprising a compound capable of reacting with oxidized developing agent to produce a diffusible dye, the photosensitive element containing an opposite-working silver halide emulsion layer which as a function of development produces a diffusible development inhibitor to inhibit further development in the image-recording layer when both layers are developed simultaneously, the opposite-working emulsion layer and at least one of the image-recording emulsion layers having substantially the same sensitivity to actinic radiation within a particular spectral region.

(b) a dye image-receiving layer; and

(c) a means for discharging an alkaline processing composition within the film unit such as a rupturable container which is adapted to be positioned during processing of the film unit so that a compressive force applied to the container by the pressure-applying members will effect a discharge of the container's contents within the film unit;

the above film unit containing a developing agent, preferably in the alkaline processing composition.

Our invention can be used not only in diffusion transfer systems wherein the image-receiving element is located on a separate support from the photosensitive element, but also in diffusion transfer systems wherein the image-receiving element is integral with the photosensitive element.

The general configuration of an image-receiving layer located on a separate support adapted to be superposed on the photosensitive element after exposure thereof is disclosed, for example, in U.S. Pat. 3,362,819. In such an embodiment, a rupturable container is usually positioned during processing of the film unit so that a compressive force applied to the container by pressure-applying members will effect a discharge of the container's contents between the image-receiving element and the layer most remote from the support of the photosensitive element. During the development phase of a color diffusion transfer process according to our invention, the image dyes formed in the respective blue-, green- and red-sensitive silver halide emulsion layers diffuse out of the photosensitive element through the viscous developer composition and into the dye image-receiving layer, e.g., into the dye image-receiving element described above, where the dyes are mordanted to form the transferred image.

In another embodiment of our invention, the dye image-receiving layer is located integral with the photosensitive element between the support and the lowermost photosensitive silver halide emulsion layer. One useful format for integral receiver-negative photosensitive elements is described in Barr, Bush and Thomas, Belgian Patent No. 757,960, granted Apr. 23, 1971. In such an embodiment, the support for the photosensitive element is transparent and is coated with the dye image-receiving layer, a substantially opaque, light-reflective layer, e.g., TiO_2, and the various layers forming the color-forming units containing the temperature-responsive layer as described above. After exposure of the photosensitive element, a rupturable container containing an alkaline processing composition and an opaque process sheet are brought into superposed position. Pressure-applying members in a camera rupture the container and spread processing composition over the photosensitive element as the film unit is withdrawn from the camera. The processing composition develops the exposed silver halide layers and dye images are formed as a function of development which diffuse to the image-receiving layer to provide a positive, right-reading image which is viewed through the transparent support on the opaque reflecting layer background.

For further details concerning the format of this particular integral film unit, its preparation and use, reference is made to the above-mentioned Belgian Pat. 757,960.

Another format for integral receiver-negative photosensitive systems in which our invention can be employed is described in Belgian Pat. No. 757,959 of Cole granted Apr. 23, 1971. In such an embodiment, the support for the color diffusion transfer system is transparent and is coated with the image-receiving layer, a substantially opaque, light-reflective layer, e.g., TiO_2, and then the various layers forming the color-forming units containing the temperature-responsive layer described above. A rupturable container containing an alkaline processing composition and an opacifier is positioned adjacent to the top layer and a transparent top sheet. The film unit is placed in a camera, exposed through the top transparent sheet and then passed between a pair of pressure-applying members in the camera as it is being removed therefrom. The pressure-applying members rupture the container and spread processing composition and opacifier over the negative portion of the film unit to render it light-insensitive. The processing composition develops the exposed silver halide layers and dye images are formed as a result of development which diffuse the image-receiving layer to provide a positive, right-reading image which is viewed through the transparent support on the opaque reflecting layer background. For further details concerning the format of this particular integral film unit, its preparation and use, reference is made to the above-mentioned Belgian Pat. No. 757,959.

Still other useful integral formats in which our invention can be employed are described in U.S. Pats. 3,415,644, 3,415,645, 3,415,646, 3,647,437, and 3,635,707.

Our invention may be employed to extend the processing latitude of various types of photographic elements. It may be used in, for example, color negative materials of the type described in Example 6 of U.S. Pat. 3,547,640 of Beckett et al., issued Dec. 15, 1970; color print materials of the type described in U.S. Pat. 2,956,879 of Van Campen issued Oct. 18, 1960; Ektachrome (trademark) color materials designed for reversal processing as described in U.S. Pat. 3,168,400 of Blackmer et al. issued Feb. 2, 1965; Kodachrome (trademark) color materials designed for reversal processing as described in U.S. Pat. 2,950,970 of Schwan et al., issued Aug. 30, 1960, etc. As previously mentioned, a highly preferred use of our invention is in the field of color diffusion transfer. Such systems in which our invention may be employed include those described in U.S. Pats. 3,227,550 of Whitmore et al. and 3,227,552 of Whitmore, both issued Jan. 4, 1966, wherein direct-positive, image-recording emulsions are employed, U.S. 2,983,606 of Rogers issued May 9, 1961, wherein negative-working image-recording emulsion layers are employed, etc.

In a highly-preferred photographic film unit embodiment of our invention, the image-recording layers are direct-positive, silver halide emulsion layers having associated therewith a dye image-providing material comprising a nondiffusible coupler which produces a diffusible dye on reaction with oxidized aromatic primary amino color developing agent in an alkaline processing composition. The nondiffusible couplers employed in this preferred embodiment include those having formulas:

$$\text{DYE-LINK-(COUP-BALL)}_n$$

and

$$\text{BALL-LINK-(COUP-SOL)}_n$$

wherein:

(1) DYE is a dye precursor, e.g., a leuco dye, a "shifted" dye which shifts hypsochromically or bathochromically when subjected to a different environment such as a change in pH, reaction with a material to form a complex, etc.; or a dye radical (including metallized dye radicals) exhibiting selective absorption in the visible spectrum, the dye precursor or dye radical containing an acidic solubilizing radical;

(2) LINK is a connecting radical such as an azo radical, a mercuri radical, an oxy radical, an alkylidene radical, a thio radical, a dithio radical or an azoxy radical;

(3) COUP is a coupler radical such as a 5-pyrazolone coupler radical, a pyrazolotriazole coupler radical, a phenolic coupler radical or an open-chain ketomethylene coupler radical, COUP being substituted in the coupling position with LINK;

(4) BALL is a photographically inert organic ballasting radical of such molecular size and configuration as to render such coupler nondiffusible during development in an alkaline processing composition;

(5) SOL is a hydrogen atom or an acidic solubilizing group when the color developing agent contains an acidic solubilizing group, and SOL is an acidic solubilizing group when the color developing agent is free of an acidic solubilizing group; and

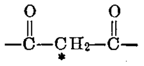
(6) *n* is an integer of 1 to 2 when LINK is an alkylidene radical, and *n* is 1 when said LINK is a radical selected from the group consisting of an azo radical, a mercuri radical, an oxy radical, a thio radical, a dithio radical or an azoxy radical.

The acidic solubilizing radicals attached to the diffusible dye-producing couplers described above can be solubilizing radicals which, when attached to the coupler or developer moieties of the dyes, render the dyes diffusible in alkaline processing compositions. Typical of such radicals are carboxylic, sulfonic, ionizable sulfonamide, and hydroxy-substituted groups that lend to dyes negative charges.

The nature of the ballast groups in the diffusible dye-producing coupler compounds described above (BALL-) is not critical as long as they confer nondiffusibility to the coupler compounds. Typical ballast groups include long-chain alkyl radicals linked directly to or indirectly to the coupler molecules, as well as aromatic radicals of the benzene and naphthalene series, etc., linked directly or indirectly to the coupler molecules by a splittable linkage, or by a removable or irremovable but otherwise nonfunctional linkage depending upon the nature of the coupler compound. Useful ballast groups have at least 8 carbon atoms.

Typical dye radical substituents (DYE-) include azo, azomethane, indoaniline, indophenol, anthraquinone and related dye radicals well-known in the art that exhibit selective absorption in the visible spectrum. The dye radicals contain acidic solubilizing moieties.

With regard to the above-described coupler radicals (COUP-), the "coupling position" is well-known to those skilled in the photographic art. The 5-pyrazolone coupler radicals couple at the carbon atom in the 4-position, the phenolic coupler radicals, including α-naphthols, couple at the carbon atom in the 4-position and the open-chain ketomethylene coupler radicals couple at the carbon atom forming the methylene moiety (e.g.,



$$-\overset{\overset{\displaystyle O}{\|}}{C}-\underset{*}{C}H_2-\overset{\overset{\displaystyle O}{\|}}{C}-$$

*denoting the coupling position). Pyrazolotriazole couplers and their coupling position are described, for example, in U.S. Pat. 3,061,432 and U.S. application Ser. No. 106,892 of Bailey et al., filed Jan. 15, 1971.

The term "nondiffusing" used above as applied to the couplers has the meaning commonly applied to the term in color photography and denotes materials which for all practical purposes do not migrate or wander through organic colloid layers, such as gelatin, comprising the sensitive elements of the invention. The same meaning is to be attached to the term "immobile."

The term "diffusible" as applied to the dyes formed from the "nondiffusing" couplers described above has the converse meaning and denotes materials having the property of diffusing effectively through the colloid layers of the sensitive elements in the presence of the "nondiffusing" materials from which they are derived. "Mobile" has the same meaning.

When the couplers having the formula DYE-LINK-(COUP-BALL)$_n$ as described above are reacted with oxidized color developing agent, the connecting radical (LINK) is split and a diffusible preformed dye or dye precursor (DYE) is released which diffuses imagewise to a reception layer. An acidic solubilizing group on the preformed dye lends diffusibility to the dye molecule. The coupling portion of the coupler (COUP) couples with the color developing agent oxidation product to form a dye that is nondiffusible because of the attached ballasting group (BALL) in a noncoupling position. In this type of coupler, the color of the diffusible dye is determined by the color of the dye or dye precursor moiety (DYE), the color of the reaction product of color developer oxidation product and the coupler moiety (COUP) being unimportant to the color of the diffusible image.

When couplers having the formula BALL-LINK-(COUP-SOL)$_n$ as described above are reacted with oxidized color developing agent, the connecting radical (LINK) is split and a diffusible dye is formed with the color developing agent oxidation product and the coupling portion (COUP) of the coupler which diffuses imagewise to a reception layer. Diffusibility is imparated to the dye by an acidic solubilizing group attached to a noncoupling position of the coupling portion (COUP) of the coupler or to the color developing agent. The ballasting portion of the coupler remains immobile. In this type of coupler, the color of the diffusible dye is determined by the color of the reaction product of color developer oxidation product and the coupler moiety (COUP). Specific examples of the above-described nondiffusible couplers and other details concerning this type of photographic chemistry are found in U.S. Pats. 3,227,550 and 3,227,552.

As mentioned above, both conventional negative-working silver halide emulsions and direct positive silver halide emulsions may be employed in the invention. Direct-positive silver halide emulsions, such as an internal-image emulsion or a solarizing emulsion, are developable in unexposed areas to obtain a positive image on the dye image-receiving layer. Internal-image silver halide emulsions which may be used are direct-positive emulsions that form latent images predominantly inside the silver halide grains, as distinguished from silver halide grains that form latent images predominantly on the surface thereof. Such internal-image emulsions were described by Davey et al. in U.S. Pat. 2,592,250 issued Apr. 8, 1952, and elsewhere in the literature.

The solarizing direct-positive silver halide emulsions useful in the above-described embodiment are well-known siver halide emulsions which have been effectively fogged either chemically or by radiation to a point which corresponds approximately to the maximum density of the reversal curve as shown by Mees, *The Theory of the Photographic Process*, published by the Macmillan Co., New York, N.Y., 1942, pages 261–297. Typical methods for the preparation of solarizing emulsions are shown by Groves British Patent 443,245, Feb. 25, 1936, who subjected emulsions to Roentgen rays "until an emulsion layer formed therefrom, when developed without preliminary exposure, is blackened up to the apex of its graduation curve"; Szaz, British Patent 462,730, Mar. 15, 1937, the use of either light or chemicals such as silver nitrate, organic sulfur compounds and dyes to convert ordinary silver halide emulsions to solarizing direct-positive emulsions; and Arens U.S. Pat. 2,005,837, June 25, 1935, the use of silver nitrate and other compounds in conjunction with heat to effect solarization. Kendall and Hill, U.S. Pat. 2,541,472, Feb. 13, 1951, shows useful solarized emulsions particularly susceptible to exposure with long wavelength light and initial development to produce the Herschel effect described by Mees above, produced by adding benzothiazoles and other compounds to the emulsions which are fogged either chemically or with white light. In using the emulsions a sufficient reversal image exposure is employed using minus blue light of from about 500–700 mμ wavelength preferably 520–554 mμ, to substantially destroy the latent image in the silver halide grains in the region of the image exposure. Particularly useful are the fogged direct-positive emulsions of Berriman, U.S. Pat. 3,367,778; Illingsworth, U.S. Pat. 3,501,305, 3,501,306 and 3,501,307; and combinations thereof.

Internal-image silver halide emulsions which contain or which are processed in the presence of fogging or nucleating agents are particularly useful in the above-described embodiment since the use of fogging agents is a convenient way to inject electrons into the silver halide grains. Suitable fogging agents include the hydrazines disclosed in Ives. U.S. Pats. 2,588,982 issued Mar. 11, 1952 and 2,563,785 issued Aug. 7, 1951; the hydrazides and hydrazones disclosed in Whitmore, U.S. Pat. 3,227,552 issued Jan. 4, 1966; hydrazone quaternary salts described in Lincoln and Heseltine, application Ser. No. 828,064 filed Apr. 28, 1969; or mixtures thereof. The quantity of fogging agent employed can be widely varied depending upon the results desired. Generally, the concentration of fogging agent is from about 1 to about 20 mg. per square foot of photosensitive layer in the photosensitive element or from about 0.1 to about 2 grams per liter of developer if it is located in the developer.

As mentioned previously, the opposite-working silver halide emulsion is located in the photosensitive element itself on either side of or between any image-recording silver halide emulsion layers. One or more such layers can be used, if desired, in various locations in the photosensitive element. Good results are obtained when this processing temperature-responsive layer is located between the red-sensitive silver-halide emulsion layer and the blue-sensitive silver halide emulsion layer.

As previously described, the opposite-working silver halide emulsion layer and at least one of the image-recording silver halide emulsion layers have substantially the same sensitivity to actinic radiation within a particular spectral region. Having the opposite-working emulsion layer spectrally sensitized to a particular region of the spectrum enables one to selectively control unwanted dye production in one or more image-recording layers, as desired. If the opposite-working silver halide emulsion layer is pan-sensitized, then it will control unwanted dye production in all image-recording layers. The image-recording emulsion layer and the opposite-working emulsion layer also have approximately the same sensitivity to radiation, i.e., photographic speed, so that the inhibiting effect on the image-recording layer is substantially proportional to exposure and under- or over-inhibiting does not result.

The negative-working silver halide emulsion employed in our invention can be any conventional silver halide emulsion so long as it is negative-working. These emulsions are well known to those skilled in the art.

In a preferred color diffusion transfer system employing the development inhibitor-releasing compounds described above and nondiffusible couplers, the image-forming layers are direct-positive emulsions sensitive to blue, green and red light and are capable of forming imagewise distributions of diffusible yellow, magenta and cyan dyes. After exposure of the film unit, the alkaline processing composition permeates the various layers to initiate development in the unexposed areas of each direct-positive photosensitive silver halide emulsion layer and in the exposed areas of the negative-working silver halide emulsion layer. The aromatic primary amino color developing agent present in the film unit, preferably in the alkaline processing composition itself, develops each of the silver halide emulsion layers, thus causing said aromatic primary amino color developing agent to become oxidized imagewise. In the direct-positive, silver halide emulsion layers, the oxidized developing agent then reacts with the nondiffusible coupler present in each silver halide emulsion layer to form imagewise distributions, respectively, of diffusible cyan, magenta and yellow dye as a function of the imagewise exposure of each of the silver halide emulsion layers. At least a portion of the imagewise distributions of diffusible cyan, magenta and yellow dye diffuse to the image-receiving layer to provide a positive dye image. In the negative-working silver halide emulsion layer, the oxidized developing agent reacts with the nondiffusible development inhibitor-releasing compound to release a diffusible development inhibitor. The development inhibitor thereafter diffuses imagewise to the various image-forming layers to inhibit development therein in proportion to exposure and development of the negative-working silver halide emulsion layer. Any concentration of the development inhibitor-releasing compound can be used which is effective for the intended purpose.

The various silver halide emulsion layers of a color film assembly of the invention can be disposed in the usual order, i.e., the blue-sensitive silver halide emulsion layer first with respect to the exposure side, followed by the green-sensitive and red-sensitive silver halide emulsion layers. If desired, a yellow dye layer or a Carey Lea silver layer can be present between the blue-sensitive and green-sensitive silver halide emulsion layer for absorbing or filtering blue radiation that may be transmitted through the blue-sensitive layer. If desired, the selectively sensitized silver halide emulsion layers can be disposed in a different order, e.g., the blue-sensitive layer first with respect to the exposure side, followed by the red-sensitive and green-sensitive layers.

Unless otherwise specified, the silver halide emulsions used in this invention can comprise, for example, silver chloride, silver bromide, silver chlorobromide, silver bromoiodide, silver chlorobromoiodide or mixtures thereof. The emulsions can be coarse- or fine-grain and can be prepared by any of the well-known procedures, e.g., single-jet emulsions such as those described in Trivelli and Smith, *The Photographic Journal,* Vol. LXXIX, May 1939 (pp. 330–338), double-jet emulsions, such as Lippmann emulsions, ammoniacal emulsions, thiocyanate or thioether ripened emulsions such as those described in Nietz et al., U.S. Pat. 2,222,264 issued Nov. 19, 1940 and Illingsworth, U.S. Pat. 3,320,069 issued May 16, 1967.

In the above-described embodiments employing nondiffusible couplers, interlayers are generally employed between the various photosensitive color-forming units to scavenge oxidized developing agent and prevent it from forming an unwanted dye in another color-forming unit. Such interlayers would generally comprise a hydrophilic polymer such as gelatin and an immobilizing coupler, which is capable of reacting with oxidized aromatic primary amino color developing agent to form an immobile product.

As previously mentioned, the aromatic primary amino color developing agent employed in certain above-described embodiments is preferably present in the alkaline processing composition which is preferably located in the rupturable pod. The color developing agent can also be incorporated into the negative portion of the film unit as a separate layer, e.g., by employing a Schiff base derivative of an aromatic primary amino color developing agent such as that formed by reacting *o*-sulfobenzaldehyde and N,N-diethyl-3-methyl-4-aminoaniline. Such incorporated developing agent will be activated by the alkaline processing composition. While the incorporated developing agent can be positioned in any layer of the photosensitive element from which it can be readily made available for development upon activation with alkaline processing composition, it is generally either incorporated in the light-sensitive silver halide emulsion layers or in layers contiguous thereto. Aromatic primary amino color developing agents which may be employed in this invention are preferably *p*-phenylenediamine developing agents. These developing agents are well-known to those skilled in the art and include the following compounds and salts thereof: 4-amino-N,N-diethyl-3-methyl aniline, N,N-diethyl-p-phenylenediamine, N-ethyl-β-methanesulfonamidoethyl-3-methyl-4-aminoaniline, 4-amino-N-ethyl-3-methyl-N-(β-sulfoethyl)aniline, 4-amino-N-ethyl-3-methoxy-N-(β-sulfoethyl)aniline, 4-amino-N-ethyl-N-(β-hydroxyethyl)aniline, 4-amino-N,N-diethyl-3-hydroxymethyl aniline, 4-amino-N-methyl-N-(β-carboxyethyl) aniline, 4-amino-N,N-bis(β-hydroxyethyl)aniline, 4-amino-N,N-bis(β-hydroxyethyl)-3-methyl aniline, 3-acetamido-4-amino-N,N-bis(β-hydroxyethyl)aniline, 4-amino-N-ethyl-N-(2,3-dihydroxypropyl)-3-methyl aniline, 4-amino-N,N-diethyl-3-(3-hydroxypropoxy)aniline, and the like.

The rupturable container employed in certain embodiments of this invention can be of the type disclosed in U.S. Pat. Nos. 2,543,181; 2,643,886; 2,653,732; 2,723,051; 3,056,492; 3,056,491 and 3,152,515. In general, such containers comprise a rectangular sheet of fluid and air-impervious material folded longitudinally upon itself to form two walls which are sealed to one another along their longitudinal and end margins to form a cavity in which processing solution is contained.

In a color film unit according to this invention, each silver halide emulsion layer containing a dye image-providing material or having the dye image-providing material present in a contiguous layer may be separated from the other silver halide emulsion layers in the negative portion of the film unit by materials including gelatin, calcium alginate, or any of those disclosed in U.S. Pat. No. 3,384,483, polymeric materials such as polyvinylamides as disclosed in U.S. Pat. 3,421,892, or any of those disclosed in French Patent 2,028,236 or U.S. Pat. Nos. 2,992,104; 3,043,692; 3,044,873; 3,061,428; 3,069,263; 3,069,264; 3,121,011; and, 427,158.

Generally speaking, except where noted otherwise, the silver halide emulsion layers in the invention comprise photosensitive silver halide dispersed in gelatin and are about 0.6 to 6 microns in thickness; the dye image-providing materials are dispersed in an aqueous alkaline solution-permeable polymeric binder, such as gelatin, as a separate layer about 0.5 to 7 microns in thickness or may be contained in the silver halide emulsion layer; and the alkaline solution-permeable polymeric interlayers, e.g., gelatin, are about 0.5 to 5 microns in thickness. Of course, these thicknesses are approximate only and can be modified according to the product desired.

Any material can be employed as the image-receiving layer in this invention as long as the desired function of mordanting or otherwise fixing the dye images will be obtained. The particular material chosen will, of course, depend upon the dye to be mordanted. If acid dyes are to be mordanted, the image-receiving layer can contain basic polymeric mordants such as polymers of amino guanidine derivatives of vinyl methyl ketone such as described in Minsk U.S. Pat. 2,882,156 issued Apr. 14, 1959, and basic polymeric mordants such as described in copending U.S. Application Serial No. 100,491 of Cohen et al. filed Dec. 21, 1970. Other mordants useful in the invention include poly-4-vinylpyridine, the 2-vinyl pyridine polymer metho-p-toluene sulfonate and similar compounds described in Sprague et al. U.S. Pat. 2,484,430 issued Oct. 11, 1949, and cetyl trimethylammonium bromide, etc. Effective mordanting compositions are also described in Whitmore U.S. Pat. 3,271,148 and Bush U.S. Pat. 3,271,147, both issued Sept. 6, 1966.

Furthermore, the image-receiving layer can be sufficient by itself to mordant the dye as in the case of use of an alkaline solution-permeable polymeric layer such as N-methoxymethyl polyhexylmethylene adipamide; partially hydrolyzed polyvinyl acetate; polyvinyl alcohol with or without plasticizers; cellulose acetate; gelatin; and other materials of a similar nature. Generally, good results are obtained when the image-receiving layer, preferably alkaline solution-permeable, is transparent and about 0.25 to about 0.40 mil in thickness. This thickness, of course, can be modified depending upon the result desired. The image-receiving layer can also contain ultraviolet absorbing materials to protect the mordanted dye images from fading due to ultraviolet light, brightening agents such as the stilbenes, coumarins, triazines, oxazoles, dye stabilizers such as the chromanols, alkylphenols, etc.

Use of a pH-lowering material in the dye image-receiving element of a film unit according to the invention will usually increase the stability of the transferred image. Generally, the pH-lowering material will effect a reduction in the pH of the image layer from about 13 or 14 to at least 11 and preferably 5–8 within a short time after imbibition. For example, polymeric acids as disclosed in U.S. Pat. 3,362,819 or solid acids or metallic salts, e.g., zinc acetate, zinc sulfate, magnesium acetate, etc., as disclosed in U.S. Pat. 2,584,030 may be employed with good results. Such pH-lowering materials reduce the pH of the film unit after development to terminate development and substantially reduce further dye transfer and thus stabilize the dye image.

An inert timing or spacer layer can be employed in our invention when a pH-lowering material is used and is located between the pH-lowering layer and the dye image-receiving layer which "times" or controls the pH-reduction as a function of the rate at which alkali diffuses through the inert spacer layer. Examples of such timing layers include gelatin, polyvinyl alcohol or any of those disclosed in U.S. Pat. 3,455,686. Especially goods results are obtained when the timing layer comprises a hydrolyzable polymer which is slowly hydrolyzed by the processing composition such as polyvinyl acetate, polyamides, cellulose esters, etc. The timing layer can also contain a light-reflecting material such as TiO_2, if desired.

The alkaline processing composition employed in certain embodiments of this invention is the conventional aqueous solution of an alkaline material, e.g., sodium hydroxide, sodium carbonate or an amine such as diethylamine, preferably possessing a pH in excess of 12, and preferably containing a developing agent as described previously. The solution also preferably contains a viscosity-increasing compound such as a high-molecular-weight polymer, e.g., a water-soluble ether inert to alkaline solutions such as hydroxyethyl cellulose or alkali metal salts of carboxymethyl cellulose such as sodium carboxymethyl cellulose. A concentration of viscosity-increasing compound of about 1 to about 5% by weight of the processing composition is preferred which will impart thereto a viscosity of about 100 cps. to about 200,000 cps. In certain embodiments of our invention, an opacifying agent, e.g., TiO_2, carbon black, etc., may be added to the processing composition.

While the alkaline processing composition used in certain embodiments of this invention can be employed in a rupturable container, as described previously, to conveniently facilitate the introduction of processing composition into the film unit, other methods of inserting processing composition into the film unit could also be employed, e.g., interjecting processing solution with communicating members similar to hypodermic syringes which are attached either to a camera or camera cartridge.

The supports for the photographic elements of this invention can be any material as long as it does not deleteriously affect the photographic properties of the film unit and is dimensionally stable. Typical flexible sheet materials include cellulose nitrate film, cellulose acetate film, poly(vinyl acetal) film, polystyrene film, poly(ethyleneterephthalate) film, polycarbonate film, poly-α-olefins such as polyethylene and polypropylene film, and related films or resinous materials as well as glass, paper, metal, etc. The support is usually about 2 to 6 mils in thickness.

While the invention has been described with reference to layers of silver halide emulsions and dye image-providing materials, dotwise coating, such as would be obtained using a gravure printing technique, could also be employed. In this technique, small dots of blue-, green- and red-sensitive emulsions have associated therewith, respectively, dots of yellow, magenta and cyan color-providing substances. After development, the transferred dyes would tend to fuse together into a continuous tone.

The silver halide emulsions useful in our invention are well-known to those skilled in the art and are described in *Product Licensing Index*, Vol. 92, Dec., 1971, publication 9232, p. 107, paragraph I, "Emulsion types"; they may be chemically and spectrally sensitized as described on p. 107, paragraph III, "Chemical sensitization", and pp. 108–109, paragraph XV, "Spectral sensitization," of the above article; they can be protected against the production of fog and can be stabilized against loss of sensitivity during keeping by employing the materials described on p. 107, paragraph V, "Antifoggants and stabilizers," of the above article; they can contain development modifiers, hardeners, and coating aids as described on pp. 107–108, paragraph IV, "Development modifiers"; paragraph VII, "Hardeners"; and paragraph XII, "Coating aids," of the above article; they and other layers in the photographic elements used in this invention can contain plasticizers, vehicles and filter dyes described on p. 108, paragraph XI, "Plasticizers and lubricants," and paragraph VIII, "Vehicles," and p. 109, paragraph XVI, "Absorbing and filter dyes," of the above article; they and other layers in the photographic elements used in this invention may contain addenda which are incorporated by using the procedures described on p. 109, paragraph XVII, "Methods of addition," of the above article; and they can be coated by using the various techniques described on p. 109, paragraph XVIII, "Coating procedures," of the above article, the disclosures of which are hereby incorporated by reference.

The following examples further illustrate the invention.

Example 1—Halide Ion Release

A photosensitive element is prepared by coating the following layers in the order recited on an opaque cellulose acetate film support:

(1) red-sensitive internal-image gelatin-silver chlorobromide emulsion (123 mg. gelatin/ft.^{2} and 100 mg. silver/ft.^{2}), cyan image transfer coupler 1-hydroxy-4-{4-[α-(3-pentadecylphenoxy)butyramido]-phenoxy}-N-ethyl-3′,5′-dicarboxy-2-naphthanilide (115 mg./ft.^{2}) and nucleating agent formyl-4-methylphenylhydrazine (0.75 g./mole of silver);

(2) a scavenger interlayer comprising 1-hydroxy-N-[α-(2,4-di-*tert*-amylphenoxy)butyl]-2-naphthamide (35 mg./ft.^{2}), gelatin (50 mg./ft.^{2}) and tricresyl phosphate (17 mg./ft.^{2});

(3) blue- and green-sensitized, negative-working, gelatin-silver bromide emulsion (25 mg. silver/ft.^{2} and 84 mg. gelatin/ft.^{2}) and 1-hydroxy-N-[α-(2,4-di-*tert*-amylphenoxy)butyl]-2-naphthamide (50 mg./ft.^{2});

(4) a scavenger interlayer comprising 1-hydroxy-N-[α-(2,4-di-*tert*-amylphenoxy)butyl]-2-naphthamide (35 mg./ft.^{2}), gelatin (50 mg./ft.^{2}) and tricresyl phosphate (17 mg./ft.^{2});

(5) green-sensitive internal-image gelatin-silver chlorobromide emulsion (127 mg. gelatin/ft.^{2} and 100 mg. silver/ft.^{2}), magenta image transfer coupler 1-phenyl-3-(3,5-dicarboxyanilino)-4-(*m*-octadecylcarbamylphenylthio)-5-pyrazolone (90 mg./ft.^{2}), nucleating agent formyl-4-methylphenylhydrazine (0.75 g./mole of silver) and N-n-butylacetanilide (45 mg./ft.^{2});

(6) a scavenger and a yellow filter layer comprising 1-hydroxy-N-[α-(2,4-di-*tert*-amylphenoxy)butyl]-2-naphthamide (35 mg./ft.^{2}), yellow Carey Lea silver (15 mg./ft.^{2}), gelatin (50 mg./ft.^{2}) and tricresyl phosphate (17 mg./ft.^{2});

(7) blue-sensitive internal-image gelatin-silver chlorobromoiodide emulsion (74 mg. gelatin/ft.^{2} and 100 mg. silver/ft.^{2}), yellow image transfer coupler α-pivalyl-α-[14 - (N - methyl)-N-n-octadecylsulfamylphenoxy]-4-sulfoacetanilide (100 mg./ft.^{2}) and nucleating agent formyl-4-methylphenylhydrazine (0.75 g./mole of silver); and

(8) overcoat of gelatin (50 mg./ft.^{2}), 1-hydroxy-N-[α-(2,4-di - *tert* - amylphenoxy)butyl]-2-naphthamide (20 mg./ft.^{2}) and tricresyl phosphate (10 mg./ft.^{2}).

The above silver halide emulsions, except for the one in layer (3), are direct-positive emulsions having high internal sensitivity and low surface sensitivity.

A control photosensitive element similar to the one described above is prepared except that layer (2) and the negative-working silver halide emulsion of layer (3) are omitted.

Dye image-receiving elements are prepared by coating the following layers in the order recited on a polyethylene-coated paper support:

(1) polymeric acid layer of poly(methyl vinyl ether/maleic anhydride) (825 mg./ft.^{2});

(2) light-reflecting layer of copoly[styrene-N-benzyl-N,N-dimethyl - N - (3-maleimidopropyl)ammonium chloride] (400 mg./ft.^{2}) and titanium dioxide (1000 mg./ft.^{2});

(3) mordant layer of copoly[styrene-N-benzyl-N,N-dimethyl - N - (3-maleimidopropyl)ammonium chloride] (350 mg./ft.^{2}); and

(4) overcoat layer of gelatin (30 mg./ft.^{2}).

Samples of the above-described photosensitive elements are exposed to a graduated-density multicolor test object. The following processing composition is employed in a pod and is spread between the exposed surface of each photosensitive element and each superposed dye image-receiving element by passing the transfer "sandwich" between a pair of juxtaposed pressure rollers:

	G.
potassium hydroxide	40
4 - amino-N-ethyl-N-β-hydroxyethylaniline	50
piperidinohexose reductone	0.20
5 - methylbenzimidazole	0.05
hydroxyethyl cellulose	30
phenylmercaptotetrazole	0.02
distilled water to 1000 ml.	

This process is repeated at both 75° F. (24° C.) and at 100° F. (38° C.) with a 60-second transfer time. After separation of the dye image-receiving element from the photosensitive element, the minimum red, green and blue densities are measured for each transferred image at each processing temperature to give the following results:

Photosensitive element	$D_{min.}$								
	60″ at 75° F. (24° C.)			60″ at 100° F. (38° C.)			Increase		
	Red	Green	Blue	Red	Green	Blue	Red	Green	Blue
With negative emulsion layer	0.30	0.29	0.31	0.37	0.50	0.70	0.07	0.21	0.39
With no negative emulsion layer (control)	0.23	0.26	0.32	0.50	0.92	1.13	0.27	0.66	0.81

The smaller increase in D_{min} for the photosensitive element according to the invention demonstrates its greater latitude of processing temperatures.

Example 2—DIR Coupler in Negative-working Emulsion

A photosensitive element is prepared by coating the following layers in the order recited on an opaque cellulose acetate film support:

(1) red-sensitive internal-image gelatin-silver chlorobromide emulsion (123 mg. gelatin/ft.^{2} and 100 mg. silver/ft.^{2}), cyan image transfer coupler 1-hydroxy-4-{4 - [α - (3-pentadecylphenoxy)butyramido]-phenoxy}-N-ethyl - 3′,5′ - dicarboxy-2-naphthanilide (115 mg./ft.^{2}) and nucleating agent formyl-4-methylphenylhydrazine (0.75 g./mole of silver);

(2) a scavenger interlayer comprising 1-hydroxy-N-[α-(2,4-di - *tert* - amylphenoxy)butyl]-2-naphthamide (35 mg./ft.^{2}), gelatin (50 mg./ft.^{2}), and tricresyl phosphate (17 mg./ft.^{2});

(3) green-sensitive internal-image gelatin-silver chlorobromide emulsion (127 mg. gelatin/ft.^{2} and 100 mg. silver/ft.^{2}), magenta image transfer coupler 1-phenyl-3-(3,5-dicarboxyanilino) - 4 - (*m* - octadecylcarbamylphenylthio)-5-pyrazolone (90 mg./ft.^{2}), nucleating agent formyl - 4 - methylphenylhydrazine (0.75 g./mole of silver) and N-n-butylacetanilide (45 mg./ft.^{2});

(4) a scavenger interlayer comprising 1-hydroxy-N-[α-(2,4-di - *tert* - amylphenoxy)butyl]-2-naphthamide (35 mg./ft.^{2}), tricresyl phosphate (17 mg./ft.^{2}) and gelatin (50 mg./ft.^{2});

(5) green-sensitive, negative-working, gelatin-silver bromide emulsion (20 mg. silver/ft.^{2} and 84 mg. gelatin/ft.^{2}), 2,4-di - *tert* - amylphenol (30 mg./ft.^{2}), and developer inhibitor-releasing (DIR) coupler 1-hydroxy-4-(5-methyl - 2 - benzotriazolyl) - 2 - (2′-n-tetradecyloxy)naphthamide (30 mg./ft.^{2});

(6) a scavenger and a yellow filter layer comprising 1-hydroxy-N-[α-(2,4-di - *tert* - amylphenoxy)butyl] - 2 - naphthamide (35 mg./ft.^{2}), yellow Carey Lea silver (15 mg./ft.^{2}), tricresyl phosphate (17 mg./ft.^{2}) and gelatin (50 mg./ft.^{2});

(7) blue-sensitive internal-image gelatin-silver chlorobromoiodide emulsion (74 mg. gelatin/ft.^{2} and 100 mg. silver/ft.^{2}), yellow image transfer coupler α-pivalyl-α-[4 - (N - methyl-N-n-octadecylsulfamylphenoxy] - 4 - sulfoacetanilide (100 mg./ft.^{2}) and nucleating agent formyl - 4 - methylphenylhydrazine (0.75 g./mole of silver); and

(8) overcoat of gelatin (50 mg./ft.^{2}), 1-hydroxy-N-[α-(2,4 - di - *tert* - amylphenoxy)butyl]-2-naphthamide (20 mg./ft.^{2}) and tricresyl phosphate (10 mg./ft.^{2}).

The above silver halide emulsions, except for the one in layer (5), are direct-positive emulsions having high internal sensitivity and low surface sensitivity.

A control photosensitive element similar to the one described above is prepared except that the negative-working, silver halide emulsion of layer (5) is replaced by a layer similar to that of layer (2). An additional control is prepared similar to the element described above except for minor variations in the amounts employed for the individual materials and the omission of layers (4) and (5)—(6-layer control).

Dye image-receiving elements are prepared as in Example 1.

Samples of the above-described photosensitive elements are exposed and processed as in Example 1. This process is repeated at both 75° F. (24° C.) and at 100° F. (38° C.) with a 60-second transfer time. After separation of the dye image-receiving element from the photosensitive element, the minimum red, green and blue densities are measured for each transferred image at each processing temperature to give the following results:

Photosensitive element	$D_{min.}$								
	60″ at 75° F. (24° C.)			60″ at 100° F. (38° C.)			Increase		
	Red	Green	Blue	Red	Green	Blue	Red	Green	Blue
With negative emulsion layer	0.20	0.28	0.36	0.26	0.36	0.46	0.06	0.08	0.10
Control (8-layer)	0.23	0.26	0.32	0.50	0.92	1.13	0.27	0.66	0.81
Control (6-layer)	0.18	0.22	0.36	0.56	1.16	1.40	0.38	0.94	1.04

The smaller increase in D_{min} for the photosensitive element according to our invention demonstrates its greater latitude of processing temperatures.

Example 3

A photosensitive element similar to that of Example 2 is prepared by coating the following layers in the order recited on an opaque cellulose acetate film support:

(1) red-sensitive internal-image gelatin-silver chlorobromide emulsion (120 mg. gelatin/ft.^{2} and 80 mg. silver/ft.^{2}), cyan image transfer coupler 1-hydroxy-4-{4-[α-(3-pentadecylphenoxy)butyramido]phenoxy}-N-ethyl-3′,5′-dicarboxy-2-naphthanilide (100 mg./ft.^{2}) and nucleating agent formyl-4-methylphenylhydrazine (0.75 g./mole of silver);

(2) a scavenger interlayer comprising 1-hydroxy-N-[α-(2,4-di-*tert*-amylphenoxy)butyl]-2-naphthamide (45 mg./ft.^{2}), gelatin (65 mg./ft.^{2}) and tricresyl phosphate (23 mg./ft.^{2});

(3) green-sensitive internal-image gelatin-silver chlorobromide emulsion (116 mg. gelatin/ft.^{2} and 100 mg. silver/ft.^{2}), magenta image transfer coupler 1-phenyl-3-(3,5-dicarboxyanilino)-4-(*m*-octadecylcarbamylphenylthio)-5-pyrazolone (80 mg./ft.^{2}), nucleating agent formyl-4-methylphenylhydrazine (0.75 g./mole of silver) and N-n-butylacetanilide (40 mg./ft.^{2});

(4) a scavenger and a yellow filter layer comprising 1-hydroxy-N-[α-(2,4-di-*tert*-amylphenoxy)butyl]-2-naphthamide (50 mg./ft.^{2}), yellow Carey Lea silver (15 mg./ft.^{2}), tricresyl phosphate (25 mg./ft.^{2}) and gelatin (65 mg./ft.^{2});

(5) blue-sensitive internal-image gelatin-silver chlorobromoiodide emulsion (126 mg. gelatin/ft.^{2} and 100 mg. silver/ft.^{2}), yellow image transfer coupler α-pivalyl-α-[4-(N-methyl)-N-n-octadecylsulfamylphenoxy]-4-sulfoacetanilide (70 mg./ft.^{2}) and nucleating agent formyl-4-methylphenylhydrazine (0.75 g./mole of silver);

(6) a scavenger interlayer comprising 1-hydroxy-N-[α-(2,4-di-*tert*-amylphenoxy)butyl]-2-naphthamide (50 mg./ft.^{2}), tricresyl phosphate (25 mg./ft.^{2}) and gelatin (50 mg./ft.^{2}); and

(7) green-sensitive, negative-working, gelatin-silver bromide emulsion (25 mg. silver/ft.^{2} and 59 mg. gelatin/ft.^{2}), tricresyl phosphate (50 mg./ft.^{2}) and developer inhibitor-releasing (DIR) coupler 1-hydroxy-4-(1-phenyl-5-tetrazolylthio)-2-(2′-n-tetradecyloxy)naphthanilide (50 mg./ft.^{2}).

Control elements are prepared in the same manner as in Example 2. After processing all of the photosensitive elements in the same manner as in Example 1, similar results are obtained.

Example 4

A photosensitive element similar to that of Example 2 is prepared by coating the following layers in the order recited on an opaque cellulose acetate film support:

(1) red-sensitive internal-image gelatin-silver chlorobromide emulsion (123 mg. gelatin/ft.^{2} and 80 mg. silver/ft.^{2}), cyan image transfer coupler 1-hydroxy-4-{4-[α-(3-pentadecylphenoxy)butyramido]phenoxy}-N-ethyl-3′,5′-dicarboxy-2-naphthanilide (100 mg./ft.^{2}) and nucleating agent formyl-4-methylphenylhydrazine (0.75 g./mole of silver);

(2) a scavenger interlayer comprising 1-hydroxy-N-[α-(2,4-di-*tert*-amylphenoxy)butyl]-2-naphthamide (45 mg./ft.^{2}), gelatin (65 mg./ft.^{2}) and tricresyl phosphate (23 mg./ft.^{2});

(3) green-sensitive internal-image gelatin-silver chlorobromide emulsion (116 mg. gelatin/ft.^{2} and 100 mg. silver/ft.^{2}), magenta image transfer coupler 1-phenyl-3-(3,5-dicarboxyanilino)-4-(*m*-octadecylcarbamylphenylthio)-5-pyrazolone (80 mg./ft.^{2}), nucleating agent formyl-4-methylphenylhydrazine (0.75 g./mole of silver) and diethyl lauramide (40 mg./ft.^{2});

(4) a scavenger and a yellow filter layer comprising 1-hydroxy-N-[α-(2,4-di-*tert*-amylphenoxy)butyl]-2-naphthamide (50 mg./ft.^{2}), yellow Carey Lea silver (15 mg./ft.^{2}), tricresyl phosphate (25 mg./ft.^{2}) and gelatin (65 mg./ft.^{2});

(5) red-sensitive, negative-working, gelatin-silver bromide emulsion (25 mg. silver/ft.^{2} and 100 mg. gelatin/ft.^{2}), tricresyl phosphate (100 mg./ft.^{2}) and DIR coupler 1-hydroxy-4-(1-phenyl-5-tetrazolylthio)-2-(2′-n-tetradecyloxy)naphthanilide (100 mg./ft.^{2});

(6) a scavenger interlayer comprising 1-hydroxy-N-[α-(2,4-di-*tert*-amylphenoxy)butyl]-2-naphthamide (50 mg./ft.^{2}), tricresyl phosphate (25 mg./ft.^{2}) and gelatin (80 mg./ft.^{2});

(7) blue-sensitive internal-image gelatin-silver chlorobromoiodide emulsion (126 mg. gelatin/ft.^{2} and 100 mg. silver/ft.^{2}), yellow image transfer coupler α-pivalyl-α-[4-(N-methyl)-N-n-octadecylsulfamylphenoxy]-sulfoacetanilide (70 mg./ft.^{2}) and nucleating agent formyl-4-methylphenylhydrazine (0.75 g./mole of silver); and

(8) overcoat of gelatin (100 mg./ft.^{2}), 1-hydroxy-N-[α-(2,4-di-*tert*-amylphenoxy)butyl]-2-naphthamide (20 mg./ft.^{2}) and tricresyl phosphate (10 mg./ft.^{2}).

Control elements are prepared in the same manner as in Example 2. After processing all of the photosensitive elements in the same manner as in Example 1, similar results are obtained.

Example 5

Example 4 is repeated except that the negative-working, silver halide emulsion of layer (5) is green- and native blue-sensitive instead of red-sensitive. Similar results are obtained.

Example 6

Example 5 is repeated except that DIR coupler 1-hydroxy-4-(2-benzothiazolylthio)-2-(2′-n-tetradecyloxy)naphthanilide is employed in layer (5) at the same concentration instead of the DIR coupler there listed. Similar results are obtained.

Example 7

Example 4 is repeated except that the negative-working, silver halide emulsion of layer (5) is green-sensitive instead of red-sensitive and DIR coupler 1-hydroxy-4-(1-ethyl-5-tetrazolylthio)-2-(2′-n-tetradecyloxy)naphthanilide is employed in layer (5) at a concentration of 50 mg./ft.^{2} instead of the DIR coupler there listed. Similar results are obtained.

Example 8

A photosensitive element similar to that of Example 2 is prepared by coating the following layers in the order recited on an opaque cellulose acetate film support:

(1) red-sensitive internal-image gelatin-silver chlorobromide emulsion (123 mg. gelatin/ft.^{2} and 100 mg. silver/ft.^{2}), cyan image transfer coupler 1-hydroxy-4-{4-[α-(3-pentadecylphenoxy)butyramido]phenoxy}-N-ethyl-3′,5′-dicarboxy-2-naphthanilide (115 mg./ft.^{2})

and nucleating agent formyl-4-methylphenylhydrazine (0.75 g./mole of silver);

(2) a scavenger interlayer comprising 1-hydroxy-N-[α-(2,4-di-*tert*-amylphenoxy)butyl]-2-naphthamide (35 mg./ft.^{2}), gelatin (50 mg./ft.^{2}) and tricresyl phosphate (17 mg./ft.^{2});

(3) green-sensitive, negative-working, gelatin-silver bromide emulsion (20 mg. silver/ft.^{2} and 66 mg. gelatin/ft.^{2}), 2,4-di-*tert*-amylphenol (40 mg./ft.^{2}), and developer inhibitor-releasing (DIR) coupler 1-hydroxy-4-(5-methyl-2-benzotriazolyl)-2-(2′-n-tetradecycloxy) naphthamide (40 mg./ft.^{2});

(4) a scavenger interlayer comprising 1-hydroxy-N-[α-(2,4-di-*tert*-amylphenoxy)butyl]-2-naphthamide (35 mg./ft.^{2}), tricresyl phosphate (17 mg./ft.^{2}) and gelatin (50 mg./ft.^{2});

(5) green-sensitive internal-image gelatin-silver chlorobromide emulsion (127 mg. gelatin/ft.^{2} and 100 mg. silver/ft.^{2}), magenta image transfer coupler 1-phenyl-3-(3,5-dicarboxyanilino)-4-(*m*-octadecylcarbamylphenylthio)-5-pyrazolone (90 mg./ft.^{2}), nucleating agent formyl-4-methylphenylhydrazine (0.75 g./mole of silver) and N-n-butylacetanilide (45 mg./ft.^{2});

(6) a scavenger and a yellow filter layer comprising 1-hydroxy-N-[α-(2,4-di-*tert*-amylphenoxy)butyl]-2-naphthamide (35 mg./ft.^{2}), yellow Carey Lea silver (15 mg./ft.^{2}), tricresyl phosphate (17 mg./ft.^{2}) and gelatin (50 mg./ft.^{2});

(7) blue-sensitive internal-image gelatin-silver chlorobromoiodide emulsion (74 mg. gelatin/ft.^{2} and 100 mg. silver/ft.^{2}), yellow image transfer coupler α-pivalyl-α-[4-(N-methyl-N-n-octadecylsulfamylphenoxy]-4-sulfoacetanilide (100 mg./ft.^{2}) and nucleating agent formyl-4-methylphenylhydrazine (0.75 g./mole of silver); and

(8) overcoat of gelatin (50 mg./ft.^{2}), 1-hydroxy-N-[α(2,4-di-*tert*-amylphenoxy)butyl]-2-naphthamide (20 mg./ft.^{2}) and tricresyl phosphate (10 mg./ft.^{2}).

Control elements are prepared in the same manner as in Example 2. After processing all the photosensitive elements in the same manner as in Example 1, similar results are obtained.

Example 9—Mixture of DIR Couplers

A photosensitive element similar to that of Example 2 is prepared by coating the following layers in the order recited on an opaque cellulose acetate film support:

(1) red-sensitive internal-image gelatin-silver chlorobromide emulsion (123 mg. gelatin/ft.^{2} and 100 mg. silver/ft.^{2}), cyan image transfer coupler 1-hydroxy-4-{4-[α-(3-pentadecylphenoxy)butyramido]phenoxy}-N-ethyl-3′,5′-dicarboxy-2-naphthanilide (115 mg./ft.^{2}) and nucleating agent formyl-4-methylphenylhydrazine (0.75 g./mole of silver);

(2) a scavenger interlayer comprising 1-hydroxy-N-[α-(2,4-di-*tert*-amylphenoxy)butyl]-2-naphthamide (35 mg./ft.^{2}), gelatin (50 mg./ft.^{2}) and tricresyl phosphate (17 mg./ft.^{2});

(3) green-sensitive, negative-working, gelatin-silver bromide emulsion (20 mg. silver/ft.^{2} and 100 mg. gelatin/ft.^{2}), tricresyl phosphate (40 mg./ft.^{2}), 2,4-di-n-amylphenol (20 mg./ft.^{2}), DIR coupler 1-hydroxy-4-(2-benzothiazolylthio)-2-(2′-n-tetradecyloxy)naphthamide (40 mg./ft.^{2}) and DIR coupler 1-hydroxy-4-(5-methyl-2-benzotriazolyl)-2-(2′-n-tetradecyloxy) naphthanilide (20 mg./ft.^{2});

(4) a scavenger interlayer comprising 1-hydroxy-N-[α-(2,4-di-*tert*-amylphenoxy)butyl]-2-naphthamide (35 mg./ft.^{2}), tricresyl phosphate (17 mg./ft.^{2}) and gelatin (50 mg./ft.^{2});

(5) green-sensitive internal-image gelatin-silver chlorobromide emulsion (100 mg. gelatin/ft.^{2} and 75 mg. silver/ft.^{2}), magenta image transfer coupler 1-phenyl-3-(3,5-dicarboxyanilino)-4-(*m*-octadecylcarbamylphenylthio)-5-pyrazolone (80 mg./ft.^{2}), nucleating agent formyl-4-methylphenylhydrazine (0.75 g./mole of silver) and N-n-butylacetanilide (40 mg./ft.^{2});

(6) a scavenger and a yellow filter layer comprising 1-hydroxy-N-[α-(2,4-di-*tert*-amylphenoxy)butyl]-2-naphthamide (35 mg./ft.^{2}), yellow Carey Lea silver (15 mg./ft.^{2}), tricresyl phosphate (17 mg./ft.^{2}) and gelatin (50 mg./ft.^{2});

(7) blue-sensitive internal-image gelatin-silver chlorobromoiodide emulsion (86 mg. gelatin/ft.^{2} and 60 mg. silver/ft.^{2}), yellow image transfer coupler α-pivalyl-α-[4-(N-methyl-N-n-octadecylsulfamylphenoxy]-4-sulfoacetanilide (70 mg./ft.^{2}) and nucleating agent formyl-4-methylphenylhydrazine (0.75 g./mole of silver); and

(8) overcoat of gelatin (50 mg./ft.^{2}).

Dye image-receiving elements are prepared in the same manner as in Example 1.

Samples of the above-described photosensitive element are exposed to a graduated-density multicolor test object. The following processing composition is employed in a pod and is spread between the exposed surface of the photosensitive element and the dye image-receiving element by passing the transfer "sandwich" between a pair of juxtaposed pressure rollers:

	G.
potassium hydroxide	40
4-amino-N-ethyl-N-β-hydroxyethylaniline	40
5-methylbenzimidazole	0.05
hydroxyethyl cellulose	22
distilled water to 1 liter	

This process is repeated at both 75° F. (24° C.) and at 100° F. (38° C.) with a 60-second transfer time. After separation of the dye image-receiving element from the photosensitive element, the minimum red, green and blue densities are measured for each transferred image at each processing temperature to give the following results:

	$D_{min.}$		
Development conditions	Red	Green	Blue
60 sec. at 75° F. (24° C.)	0.20	0.20	0.28
60 sec. at 100° F. (38° C.)	0.19	0.23	0.31

The results indicate the relative stability of the $D_{min.}$ which is obtained in accordance with our invention over the range of processing temperatures listed.

Example 10—DIR Coupler In Positive-Working Emulsion

(A) A control photosensitive element is prepared by coating the following layers in the order recited on a gelatin-subbed (450 mg./ft.^{2}) cellulose acetate film support:

  (1) blue-sensitive, negative-working, gelatin-silver bromoiodide emulsion (50 mg. silver/ft.^{2} and 250 mg. gelatin/ft.^{2}), and magenta coupler 1-(2,4,6-trichlorophenyl)-3-[3-{α-(2,4-di-*tert*.-amylphenoxy)-acetamido]benzamido]-5-pyrazolone (75 mg./ft.^{2}); and

  (2) Overcoat layer of gelatin (90 mg./ft.^{2}).

(B) A second control element is prepared similar to (A) except that an additional layer (1.5) is present between layers (1) and (2) containing a green-sensitive, reduction plus gold-fogged, gelatin-silver bromoiodide emulsion (200 mg. silver/ft.^{2} and 650 mg. gelatin/ft.^{2}). This emulsion is a direct positive emulsion of the type disclosed in U.S. Pat. 3,501,307.

(C) A photosensitive element according to our invention is prepared similar to (B) except that layer (1.5) contains DIR coupler α-(1-phenyl-5-tetrazolylthio)-α-pivaloyl-2-chloro-5-[4-2,4-di-*tert*-pentylphenoxy) butyramido]-acetanilide (400 mg./ft.^{2}).

(D) A photosensitive element according to our invention is prepared similar to (C) except that layer (1.5) contains the green-sensitive, internal-image, gelatin-silver bromoiodide emulsion at a concentration of only

100 mg. silver/ft.^{2} and 400 mg. gelatin/ft.^{2}, the DIR coupler is present at a concentration of only 200 mg./ft.^{2} and layer (1.5) also contains a yellow image-forming coupler α-pivaloyl-α-(4-carboxyphenoxy)-2-chloro-5 - [3 - (2,4-di-*tert*-pentylphenoxy)butyramido]-acetanilide (90 mg./ft.^{2}).

The above-described photosensitive elements are exposed through a Wratten (Trademark) No. 9 filter and processed by a color negative process similar to that described in Bild Und Ton, Heft 8, 1971, 24th Jahrgang, p. 248, except that processing takes place at 38° C. These steps are, briefly, color develop, rinse, fix, wash, ferricyanide bleach, wash, fix, wash, stabilize, and wash. The following sensitometric results are obtained:

	Magenta densities							
	2 min dev.		4 min. dev.		6 min. dev.		8 min. dev.	
Element	$D_{min.}$	$D_{max.}$	$D_{min.}$	$D_{max.}$	$D_{min.}$	$D_{max.}$	$D_{min.}$	$D_{max.}$
A (control)	.20				.36		.44	
B (control)	.20	2.16	.31	2.38	.42	2.42	.54	2.48
C (w/DIR coupler)	.17	1.86	.23	2.24	.25	2.44	.27	2.40
D (w/DIR coupler)	.16	2.01	.21	2.38	.23	2.39	.25	2.42

The above results indicate lower minimum densities in the photosensitive elements according to our invention with the maximum densities being essentially unaffected, thus providing an improvement in image discrimination and better fog control on high temperature processing.

The invention has been described with particular reference to certain preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

We claim:

1. A photosensitive element comprising a support having thereon at least one photosensitive, image-recording, silver halide emulsion layer, said element containing an opposite-working silver halide emulsion layer for producing in direct proportion to its development, a diffusible development inhibitor to inhibit further development in said image-recording layer when both layers are developed simultaneously, said opposite-working silver halide emulsion layer and at least one of said image-recording silver halide emulsion layers having substantially the same sensitivity to actinic radiation within a particular spectral region.

2. The photosensitive element of Claim **1** wherein said image-recording silver halide emulsion layer is a negative-working silver halide emulsion layer and said opposite-working silver halide emulsion layer is a direct-positive silver halide emulsion layer.

3. The photosensitive element of Claim **1** wherein said image-recording silver halide emulsion layer is a direct-positive silver halide emulsion layer and said opposite-working silver halide emulsion layer is a negative-working silver halide emulsion layer.

4. The photosensitive element of Claim **1** wherein said diffusible development inhibitor comprises halide ions released upon development of said opposite-working silver halide emulsion layer, said halide ions being bromide ions, iodide ions, or a combination thereof.

5. The photosensitive element of Claim **1** wherein said opposite-working silver halide emulsion layer has associated therewith a development inhibitor-releasing compound capable of reacting with oxidized developing agent to release a diffusible development inhibitor.

6. The photosensitive element of Claim **5** wherein said development inhibitor-releasing compound is a coupler and said development inhibitor which is released is a mercaptan or an azole.

7. The photosensitive element of Claim **1** wherein each said silver halide emulsion layer contains an incorporated coupler.

8. The photosensitive element of Claim **1** wherein said image-recording, silver halide emulsion layer has a dye image-providing material associated therewith capable of reacting with oxidized developing agent to produce a dye.

9. The photosensitive element of Claim **8** wherein said image-recording, silver halide emulsion layer is a direct-positive silver halide emulsion layer having associated therewith a nondiffusible coupler capable of reacting with oxidized aromatic primary amino color developing agent to produce a diffusible dye, said opposite-working silver halide emulsion layer being a negative-working silver halide emulsion layer.

10. The photosensitive element of Claim **9** wherein said diffusible development inhibitor comprises halide ions released upon development of said negative-working silver halide emulsion layer, said halide ions being bromide ions, iodide ions, or a combination thereof.

11. The photosensitive element of Claim **9** wherein said negative-working silver halide emulsion layer has associated therewith a development inhibitor-releasing compound capable of reacting with oxidized aromatic primary amino color developing agent to release a diffusible development inhibitor.

12. The photosensitive element of Claim **11** wherein said development inhibitor-releasing compound is a coupler and said development inhibitor which is released is a mercaptan or an azole.

13. The photosensitive element of Claim **9** wherein the image-recording portion of said photosensitive element comprises a direct-positive, red-sensitive silver halide emulsion layer having associated therewith a cyan dye image-providing material comprising a nondiffusible coupler capable of reacting with oxidized aromatic primary amino color developing agent to produce a diffusible cyan dye, a direct-positive, green-sensitive silver halide emulsion layer having associated therewith a magenta dye image-providing material comprising a nondiffusible coupler capable of reacting with oxidized aromatic primary amino color developing agent to produce a diffusible magenta dye, and a direct-positive, blue-sensitive silver halide emulsion layer having associated therewith a yellow dye image-providing material comprising a nondiffusible coupler capable of reacting with oxidized aromatic primary amino color developing agent to produce a diffusible yellow dye.

14. The photosensitive element of Claim **13** wherein each said direct-positive silver halide emulsion is an internal-image emulsion wherein the silver halide forms latent images predominantly inside the silver halide grains.

15. In a photosensitive element comprising a support having thereon the following layers in sequence:

(a) a direct-positive, red-sensitive silver halide emulsion layer containing a nondiffusible coupler capable of reacting with oxidized aromatic primary amino color developing agent to produce a diffusible cyan dye;

(b) an alkaline solution-permeable interlayer containing a compound capable of scavenging oxidized aromatic primary amino color developing agent;

(c) a direct-positive, green-sensitive silver halide emulsion layer containing a nondiffusible coupler capable of reacting with oxidized aromatic primary amino color developing agent to produce a diffusible magenta dye;

(d) an alkaline solution-permeable interlayer containing a compound capable of scavenging oxidized aromatic primary amino color developing, agent; and

(e) a direct-positive, blue-sensitive silver halide emulsion layer containing a nondiffusible coupler capable of reacting with oxidized aromatic primary amino color developing agent to product a diffusible yellow dye;

each said nondiffusible coupler having the formula:

$$\text{DYE-LINK-(COUP-BALL)}_n \text{ or}$$
$$\text{BALL-LINK-(COUP-SOL)}_n$$

wherein:

(1) DYE is a dye precursor or a dye radical exhibiting selective absorption in the visible spectrum and containing an acidic solubilizing group;

(2) LINK is a connecting radical selected from the group consisting of an azo radical, a mercuri radical, an oxy radical, an alkylidene radical, a thio radical, a dithio radical and an azoxy radical;

(3) COUP is a coupler radical selected from the group consisting of a 5-pyrazolone coupler radical, a pyrazolotriazole coupler radical, a phenolic coupler radical and an open-chain ketomethylene coupler radical, said COUP being substituted in the coupling position with said LINK;

(4) BALL is a photographically inert organic ballasting radical of such molecular size and configuration as to render said coupler nondiffusible during development in an alkaline processing composition;

(5) SOL is selected from the group consisting of a hydrogen atom and an acidic solubilizing group when said color developing agent contains an acidic solubilizing group, and SOL is an acidic solubilizing group when said color developing agent is free of an acidic solubilizing group; and

(6) *n* is an integer of 1 to 2 when said LINK is an alkylidene radical, and *n* is 1 when said LINK is a radical selected from the group consisting of an azo radical, a mercuri radical, an oxy radical, a thio radical, a dithio radical and an azoxy radical;

the improvement comprising employing in said photosensitive element between said red-sensitive and blue-sensitive silver halide emulsion layers a negative-working silver halide emulsion layer having associated therewith a development inhibitor-releasing compound capable of reacting with oxidized aromatic primary amino color developing agent to release a diffusible development inhibitor.

16. The photosensitive element of Claim **15** wherein each said direct-positive silver halide emulsion is an internal-image emulsion wherein the silver halide forms latent images predominantly inside the silver halide grains.

17. The photosensitive element of Claim **15** wherein said development inhibitor-releasing compound is a coupler and said development inhibitor which is released is a mercaptan or an azole.

18. In a photographic film unit comprising:

(a) a photosensitive element comprising a support having thereon at least one photosensitive, image-recording, silver halide emulsion layer, each said silver halide emulsion layer having associated therewith a compound capable of reacting with oxidized developing agent to produce a diffusible dye;

(b) a dye image-receiving layer; and

(c) means for discharging an alkaline processing composition within said film unit;

said film unit containing a developing agent; the improvement comprising employing in said photosensitive element an opposite-working silver halide emulsion layer for producing, *in direct proportion to its* development, a diffusible development inhibitor to inhibit further development in said image-recording layer when both layers are developed simultaneously, said opposite-working silver halide emulsion layer and at least one of said image-recording silver halide emulsion layers having substantially the same sensitivity to actinic radiation within a particular spectral region.

19. The photographic film unit of Claim **18** wherein said image-recording silver halide emulsion layer is a negative-working silver halide emulsion layer and said opposite-working silver halide emulsion layer is a direct-positive silver halide emulsion layer.

20. The photographic film unit of Claim **18** wherein said image-recording silver halide emulsion layer is a direct-positive silver halide emulsion layer and said opposite-working silver halide emulsion layer is a negative-working silver halide emulsion layer.

21. The photographic film unit of Claim **18** wherein said diffusible development inhibitor comprises halide ions released upon development of said opposite-working silver halide emulsion layer, said halide ions being bromide ions, iodide ions, or a combination thereof.

22. The photographic film unit of Claim **18** wherein said opposite-working silver halide emulsion layer has associated therewith a development inhibitor-releasing compound capable of reacting with oxidized developing agent to release a diffusible development inhibitor.

23. The photographic film unit of Claim **22** wherein said development inhibitor-releasing compound is a coupler and said development inhibitor which is released is a mercaptan or an azole.

24. The photographic film unit of Claim **18** wherein said image-recording, silver halide emulsion layer is a direct-positive silver halide emulsion layer having associated therewith a nondiffusible coupler capable of reacting with oxidized aromatic primary amino color developing agent to produce a diffusible dye, said opposite-working silver halide emulsion layer being a negative-working silver halide emulsion layer.

25. The photographic film unit of Claim **24** wherein said diffusible development inhibitor comprises halide ions released upon development of said negative-working silver halide emulsion layer, said halide ions being bromide ions, iodide ions, or a combination thereof.

26. The photographic film unit of Claim **24** wherein said negative-working silver halide emulsion layer has associated therewith a development inhibitor-releasing compound capable of reacting with oxidized aromatic primary amino color developing agent to release a diffusible development inhibitor.

27. The photographic film unit of Claim **26** wherein said development inhibitor-releasing compound is a coupler and said development inhibitor which is released is a mercaptan or an azole.

28. The photographic film unit of Claim **24** wherein the image-recording portion of said photosensitive element comprises a direct-positive, red-sensitive silver halide emulsion layer having associated therewith a cyan dye image-providing material comprising a nondiffusible coupler capable of reacting with oxidized aromatic primary amino color developing agent to produce a diffusible cyan dye, a direct-positive, green-sensitive silver halide emulsion layer having associated therewith a magenta dye image-providing material comprising a nondiffusible coupler capable of reacting with oxidized aromatic primary amino color developing agent to produce a diffusible magenta dye, and a direct-positive, blue-sensitive silver halide emulsion layer having associated therewith a yellow dye image-providing material comprising a nondiffusible coupler capable of reacting with oxidized aromatic primary amino color developing agent to produce a diffusible yellow dye.

29. The photographic film unit of Claim **28** wherein each said direct-positive silver halide emulsion is in internal-image emulsion wherein the silver halide forms latent images predominantly inside the silver halide grains.

30. The photographic film unit of Claim **18** wherein said dye image-receiving layer is located in said photosensitive element between said support and the lowermost photosensitive silver halide emulsion layer.

31. The photographic film unit of Claim **18** wherein said dye image-receiving layer is coated on a separate support and is adapted to be superposed on said photosensitive element after exposure thereof.

32. The photographic film unit of Claim **31** wherein said discharging means comprises a rupturable container and is so positioned during processing of said film unit that a compressive force applied to said container by pressure-applying members will effect a discharge of the container's contents between said dye image-receiving layer and the layer most remote from the support of said photosensitive element.

33. In a photographic film unit comprising:

(I) a photosensitive element comprising a support having thereon the following layers in sequence:

(a) a direct-positive, red-sensitive silver halide emulsion layer containing a nondiffusible coupler capable of reacting with oxidized aromatic primary amino color developing agent to produce a diffusible cyan dye;

(b) an alkaline solution-permeable interlayer containing a compound capable of scavenging oxidized aromatic primary amino color developing agent;

(c) a direct-positive, green-sensitive silver halide emulsion layer containing a nondiffusible coupler capable of reacting with oxidized aromatic primary amino color developing agent to produce a diffusible magenta dye;

(d) an alkaline solution-permeable interlayer containing a compound capable of scavenging oxidized aromatic primary amino color developing agent; and

(e) a direct-positive, blue-sensitive silver halide emulsion layer containing a nondiffusible coupler capable of reacting with oxidized aromatic primary amino color developing agent to produce a diffusible yellow dye;

each said nondiffusible coupler having the formula:

$$\text{DYE-LINK-(COUP-BALL)}_n \text{ or}$$
$$\text{BALL-LINK-(COUP-SOL)}_n$$

wherein:

(1) DYE is a dye precursor or a dye radical exhibiting selective absorption in the visible spectrum and containing an acidic solubilizing group;

(2) LINK is a connecting radical selected from the group consisting of an azo radical, a mercuri radical, an oxy radical, an alkylidene radical, a thio radical, a dithio radical and an azoxy radical;

(3) COUP is a coupler radical selected from the group consisting of a 5-pyrazolone coupler radical, a pyrazolotriazole coupler radical, a phenolic coupler radical and an open-chain ketomethylene coupler radical, said COUP being substituted in the coupling position with said LINK;

(4) BALL is a photographically inert organic ballasting radical of such molecular size and configuration as to render said coupler nondiffusible during development in an alkaline processing composition;

(5) SOL is selected from the group consisting of a hydrogen atom and an acidic solubilizing group when said color developing agent contains an acidic solubilizing group, and SOL is an acidic solubilizing group when said color developing agent is free of an acidic solubilizing group; and

(6) *n* is an integer of 1 to 2 when said LINK is an alkylidene radical, and *n* is 1 when said LINK is a radical selected from the group consisting of an azo radical, a mercuri radical, an oxy radical, a thio radical, a dithio radical and an azoxy radical;

(II) a dye image-receiving element comprising a support having thereon a dye image-receiving layer, said element being adapted to be superposed over said blue-sensitive silver halide emulsion layer after exposure of said photosensitive element; and

(III) a rupturable container containing an alkaline processing composition and which is adapted to be positioned during processing of said film unit so that a compressive force applied to said container by pressure-applying members will effect a discharge of the container's contents between said dye image-receiving layer and said blue-sensitive silver halide emulsion layer of said photosensitive element;

said film unit containing an aromatic primary amino color developing agent; the improvement comprising employing in said photosensitive element between said red-sensitive and blue-sensitive silver halide emulsion layers a negative-working silver halide emulsion layer having associated therewith a development inhibitor-releasing compound capable of reacting with oxidized aromatic primary amino color developing agent to release a diffusible development inhibitor.

34. The photographic film unit of Claim **33** wherein each said direct-positive silver halide emulsion is an internal-image emulsion wherein the silver halide forms latent images predominantly inside the silver halide grains.

35. The photograph film unit of Claim **33** wherein said development inhibitor-releasing compound is a coupler and said development inhibitor which is released is a mercaptan or an azole.

36. In a process of forming a transfer image comprising:

(A) imagewise-exposing a photosensitive element comprising a support having thereon at least one photosensitive, image-recording, silver halide emulsion layer, each said silver halide emulsion layer having associated therewith a compound capable of reacting with oxidized developing agent to produce a diffusible dye;

(B) treating the layer most remote from the support of said photosensitive element with an alkaline processing composition to effect development of each of said exposed silver halide emulsion layers with a developing agent;

(C) forming an imagewise distribution of diffusible dye image-providing material as a function of said imagewise exposure of each said silver halide emulsion layer; and

(D) at least a portion of each said imagewise distributions of diffusible dye image-providing material diffusing to a dye image-receiving layer;

the improvement comprising employing in said photosensitive element an opposite-working silver halide emulsion layer for producing, in direct proportion to its development, a diffusible development inhibitor to inhibit further development in said image-recording layer when both layers are developed simultaneously, said opposite-working silver halide emulsion layer and at least one of said image-recording silver halide emulsion layers having substantially the same sensitivity to actinic radiation within a particular spectral region.

37. The process of Claim **36** wherein said treatment step (B) is effected by:

(a) superposing over the layer most remote from the support of said photosensitive element said dye image-receiving layer coated on a support;

(b) positioning a rupturable container containing said alkaline processing composition between said exposed photosensitive element and said dye image-receiving layer; and

(c) applying a compressive force to said container to effect a discharge of the container's contents between said most remote layer of said exposed photosensitive element and said dye image-receiving layer.

38. The process of Claim **36** wherein said image-recording, silver halide emulsion layer is a direct-positive silver halide emulsion layer having associated therewith a nondiffusible coupler capable of reacting with oxidized aromatic primary amino color developing agent to produce a diffusible dye, said opposite-working silver halide emulsion layer being a negative-working silver halide emulsion layer.

39. The process of Claim **38** wherein said diffusible development inhibitor comprises halide ions released upon development of said opposite-working silver halide emulsion layer, said halide ions being bromide ions, iodide ions, or a combination thereof.

40. The process of Claim **38** wherein said negative-working silver halide emulsion layer has associated therewith a development inhibitor-releasing compound capable of reacting with oxidized aromatic primary amino color developing agent to release a diffusible development inhibitor.

41. The process of Claim **40** wherein said development inhibitor-releasing compound is a coupler and said development inhibitor which is released is a mercaptan or an azole.

42. The process of Claim **38** wherein the image-recording portion of said photosensitive element comprises a direct-positive, red-sensitive silver halide emulsion layer having associated therewith a cyan dye image-providing material comprising a nondiffusible coupler capable of reacting with oxidized aromatic primary amino color developing agent to produce a diffusible cyan dye, a direct-positive, green-sensitive silver halide emulsion layer having associated therewith a magenta dye image-providing material comprising a nondiffusible coupler capable of reacting with oxidized aromatic primary amino color developing agent to produce a diffusible magenta dye, and a direct-positive, blue-sensitive silver halide emulsion layer having associated therewith a yellow dye image-providing material comprising a nondiffusible coupler capable of reacting with oxidized aromatic primary amino color developing agent to produce a diffusible yellow dye.

43. The process of Claim **42** wherein each said direct-positive silver halide emulsion is an internal-image emulsion wherein the silver halide forms latent images predominantly inside the silver halide grains.

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