# United States Patent [19]

**Lestina et al.**

[11] **3,715,208**

[45] **Feb. 6, 1973**


[54] **FILM CONTAINING BLEACH INHIBITOR AND PROCESS THEREFOR FOR PRODUCING COLOR FILM WITH SILVER SOUND RECORD**


[75] Inventors: **Gregory J. Lestina; Frank W. Kent; Carl F. Holtz,** all of Rochester, N.Y. 14650

[73] Assignee: **Eastman Kodak Company,** Rochester, N.Y.



[22] Filed: **Dec. 17, 1971**

[21] Appl. No.: **209,458**

**Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 100,613, Dec. 22, 1970, abandoned.

[52] **U.S. Cl.** ..... **96/4,** 96/60 R, 96/55

[51] **Int. Cl.** ..... **G03c 5/44,** G03c 5/24

[58] **Field of Search** ..... 96/4, 60 R, 11



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 3,083,097 | 3/1963 | Lassig et al. | 96/29 L |
| 3,210,189 | 10/1965 | Von Wartburg | 96/59 |



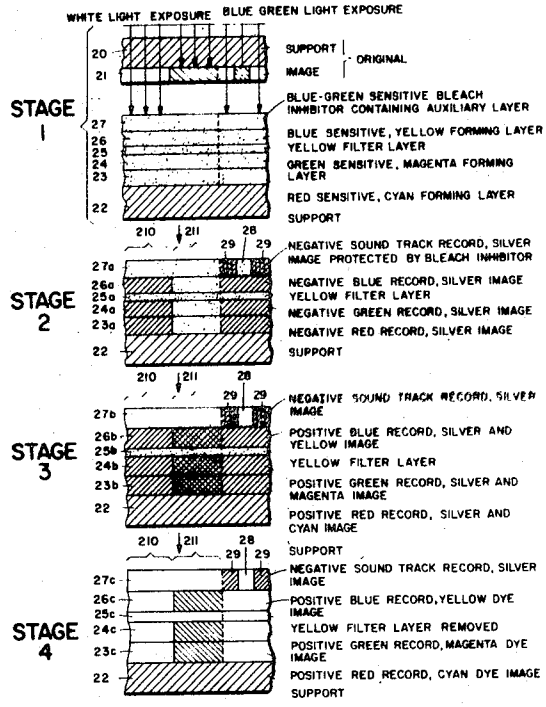
*Primary Examiner*—J. Travis Brown
*Assistant Examiner*—Alfonso T. SuroPico
*Attorney*—Robert W. Hampton et al.

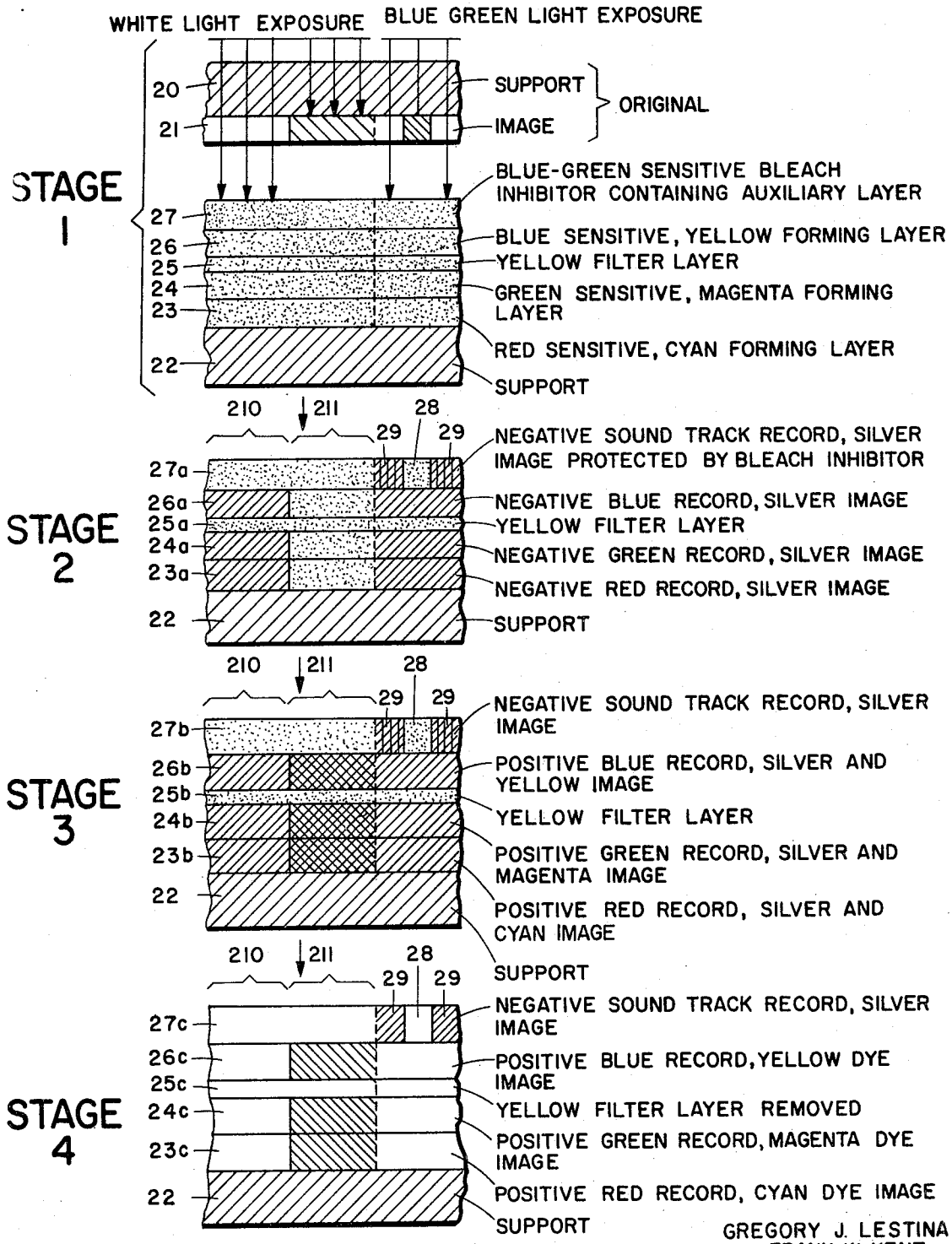


[57] **ABSTRACT**

A novel process of producing a picture record and a silver auxiliary image or sound track record in an imagewise exposed photographic element comprising a support having coated thereon, on one surface, at least one picture recording photographic image-forming unit comprising at least one silver halide emulsion layer and an auxiliary image radiation sensitive silver halide layer which does not form an image upon image-forming exposure of the picture recording unit or units, which auxiliary layer contains a nondiffusible ballasted silver bleach inhibitor, which process comprises (A) developing silver halide in said element with a black-and-white developing agent to form a silver picture record in said picture recording unit or units and a silver auxiliary image record or sound track record in said auxiliary layer, (B) fogging and developing silver halide in the element with aromatic primary amine color developing agent in the presence of a photographic color coupler to form a picture record comprising silver and a nondiffusible dye in the picture recording unit or units and thereafter (C) removing the residual silver halide and bleachable silver remaining after steps (A) and (B) by bleaching and fixing while retaining silver in the auxiliary layer to form the silver auxiliary image or silver sound track record. Also provided are novel photographic elements of the type described above.


**48 Claims, 1 Drawing Figure**






GREGORY J. LESTINA
FRANK W. KENT
CARL F. HOLTZ
*INVENTORS*

BY

ATTORNEY

# FILM CONTAINING BLEACH INHIBITOR AND PROCESS THEREFOR FOR PRODUCING COLOR FILM WITH SILVER SOUND RECORD

This application is a continuation-in-part of our copending U.S. Pat. application Ser. No. 100,613, filed Dec. 22, 1970 and now abandoned.

This invention relates to color photographic films having an auxiliary metallic silver image. In one aspect, this invention relates to color motion picture films having metallic silver sound tracks and more particularly to color photographic elements and processes useful in preparing such motion picture films.

Color photographic films having auxiliary metallic silver images are known. See, for example, French Patent No. 912,605. Color motion picture films having silver sound tracks are well known. Typically, the color images are prepared by the three-color system of photography. In this well known system color images are formed from three subtractive dyes: a yellow dye to control blue light, a magenta dye to control green light and a cyan dye to control red light. These dye images can be formed by various methods.

For example, color images can be produced by the dye-bleach process. This process uses a film which has incorporated therein, in three separate layers, each sensitive to a primary color region of the visible spectrum, a preformed subtractive dye which is capable of being destroyed in proportion to the silver formed upon development of a latent photographic image.

Another method of preparing a three-color record by the subtractive dye process is to photographically record an image in a photographic element having three photographic silver halide layers in a superposed relationship to each other, each layer being sensitive to essentially one primary color region of the visible spectrum. These photographic silver halide layers can contain photographic color couplers which form, upon coupling with oxidized aromatic primary amine color developing agent, subtractive dyes essentially complementary to the primary color regions of the visible spectrum. These photographic silver halide layers, can, alternatively, not contain photographic color formers; the color image then being produced by processing in a coupler-developer composition to form nondiffusible subtractive dyes. Subsequent to dye image formation the developed silver and the residual silver halide must be removed from the picture area. This is usually accomplished by bleaching and fixing or by bleach-fixing (single step bleaching and fixing).

Optical motion picture sound tracks are printed onto the same film on which the picture image was printed. Optical sound tracks can be of the variable density or variable area types. The sound track itself can be comprised of dyes, dyes plus silver, silver compounds, silver plus other metals or silver alone. The photocell used almost universally to detect light passing through an optical sound track is of such nature that it is most sensitive to electromagnetic radiation of a wavelength greater than 700 nanometers (nm) with a peak sensitivity at about 800 nm. The subtractive dyes which form the picture image have regions of maximum absorbtion from 400 to 700 nm. Consequently, these dyes are nearly transparent to infrared radiation and have very little modulating effect upon this radiation to which the photocell is most sensitive.



Silver produced as a result of the chemical reduction of a latent silver halide image is uniformly opaque to the full spectrum of radiation ranging from ultraviolet through visible into the infrared region and acts as an excellent modulator for infrared radiation to which currently used optical photocells are most sensitive. Silver compounds such as silver sulfide and silver toned with metals such as gold are also more opaque than image dyes to infrared radiation. It can thus be seen it is preferable that optical sound records in color motion picture films be comprised of substances other than subtractive image dyes. The presence of subtractive dyes in addition to the other substances, however, is not objectionable.

As noted above, the developed silver and the residual silver halide must be removed from the picture area of a color motion picture film subsequent to color image formation. At the same time, developed silver or a silver compound must be retained in the sound track area if the color motion picture film is to have the preferred sound track. A number of techniques have been devised to retain silver in the sound track area of color motion picture films during bleaching and fixing of the silver and residual silver halide in the picture area. For example, the sound track area can be covered with a varnish subsequent to formation of the picture and sound track images and prior to silver and silver halide removal. The varnish prevents diffusion of the bleaching solution into the sound track area. Subsequent to rehalogenation of the silver in the picture area, the varnish is removed from the entire film with a suitable solvent and silver halide is removed, reference being made to U.S. Pat. No. 1,973,463, issued Sept. 11, 1934 and U.S. Pat. No. 2,113,329, issued Apr. 5, 1938.

A currently used method of retaining metallic silver in the sound track area is to print the picture and sound track images in the photographic silver halide element and develop the latent image to metallic silver. In print films the residual silver halide is removed by fixing the entire film. In reversal films only the sound track area is fixed followed by color reversal development. At this point, both types of film have a sound track of metallic silver free from residual silver halide. The metallic silver is then converted to a fixable silver salt by bleaching both the sound track and picture areas. In the sound track area, the silver salt is reconverted to metallic silver by applying a viscous, highly active developer, for example, by known striping techniques. Subsequently, the silver salt in the picture area is removed by fixing.

Another method of preventing the removal of the silver sound track is to treat the silver metal with a solution which produces a gold tone. This gold-toned silver metal is not removed upon bleaching and fixing, reference being made to U.S. Pat. No. 2,263,019, issued Nov. 18, 1941.

Still another method is to stripe the sound track area of the film with a quaternary ammonium salt which renders the silver metal unbleachable, reference being made to U.S. Pat. No. 3,243,295, issued Mar. 29, 1966.

Still another method of retaining silver metal in the sound track area is to prepare a photographic multilayer element which forms a dye in the upper layer during chromogenic development which dye is reducible to a leuco dye which can reduced silver ions in solu-

tion to silver metal. The developed sound area is striped with water and passed through a sulfur dioxide gas atmosphere where the gas is absorbed only in the moistened sound track area. The absorbed gas reduces the dye to a leuco dye. The film is then passed through an ammonia-silver nitrate solution where the leuco dye reduces silver ions to silver metal which is deposited in the film, reference being made to U.S. Pat. No. 2,286,747, issued June 16, 1942.

Alternatively, the silver in the sound track area can be converted to compounds or complexes which resist the bleaching of the silver. For example, silver or silver halide can be converted to silver sulfide prior to bleaching. The sulfide is not converted to a fixable silver salt by bleaching and thus remains as silver sulfide following fixing, reference being made to U.S. Pat. No. 2,143,787, issued Jan. 10, 1939. The treatment solution can contain both sulfiding and iodizing compounds which also convert the silver to a compound, which is not removed upon bleaching and fixing, reference being made to U.S. Pat. No. 2,258,976, issued Oct. 14, 1941.

Still another method of preparing a sound track is to coat a separate layer on the back of the film support. Each of the two sides to the film is processed without contacting the other side with the processing solutions, for example, by floating the film on the surface of the solution, reference ebeing made to U.S. Pat. No. 2,235,033, issued being 18, 1941.

The above techniques refer to only a small number of the known methods or refinements for producing silver or silver complex sound tracks in color motion picture films.

The disadvantage of all methods known today is the requirement of separate treatment of a portion of the film at least once during processing. The method most commonly used today involves the use of a striping device which applies a narrow bead of reagent to the sound track area. In order to use a striping device the film must be taken out of the processing solutions and dried by passing between ringer-type rollers or between squeegees. The film is then passed through the striping device which, in one form, comprises a rotating wheel dipping into a viscous processing solution which is then applied by the wheel in the form of a bead on the edge of the film. The conditions under which this striping process is performed are critical. For example, the striping wheel is only 0.094 inches wide for 16 millimeter film. If the striping wheel picks up an insufficient amount of processing composition, too little will be applied to the film and an inferior sound track can result. If the striping wheel picks up too much processing solution, the bead applied to the film will be too wide and can cover part of the picture area. In this event silver will be retained in the picture area degrading the color image in those areas. Another problem with this type of striping technique is that if the film is vibrated in some manner, the viscous processing composition can flow into the picture area with the same result. Although the striping technique has been refined throughout the years, the conditions under which this process is performed are still so critical that a small amount of error inevitably occurs. Sometimes the error can be corrected by partially reprocessing the film. On other occasions the film is ruined and must be discarded. Whatever the result of error arising from the striping process and even though the amount of film affected by such error amounts to only a fraction of a percent of the film processed, these errors are economically costly.

It has been found that when a developed silver image is contacted with a silver bleach inhibitor subsequent to initial development and prior to bleaching, the silver is rendered unbleachable. Therefore, when only the sound track portion of a film having a silver sound record is contacted with a silver bleach inhibitor this silver sound record is rendered unbleachable. This method is the invention of Bevis, Bello and Holtz and is disclosed and claimed in a copending application entitled PROCESS FOR PREPARING COLOR FILM WITH SILVER SOUND RECORD USING BLEACH INHIBITOR, Ser. No. 100,608, filed Dec. 22, 1970, now abandoned, and the continuation-in-part thereof filed concurrently herewith. Although this method of producing sound tracks represents a significant advance over previously known methods since it involves a single application to the sound track area of a solution, the concentration, temperature and contact time of which are not critical, it still requires separate treatment of the sound track area of the film.

It has also been found that certain of the silver bleach inhibitors used in the invention of Bevis et al. can be used for the preparation of silver sound tracks in novel photographic elements by novel processes which are the invention of Bello and Holtz and which are disclosed and claimed in a copending application entitled FILM AND PROCESS USING BLEACH INHIBITOR FOR PRODUCING COLOR FILM WITH SILVER SOUND RECORD, Ser. No. 100,609, filed Dec. 22, 1970, now abandoned, and the continuation-in-part thereof filed concurrently herewith. The novel elements of this copending application are provided with an auxiliary layer coated outermost from the support and over the picture recording layers. This layer is of such photographic speed or spectral sensitivity or both that no image forms in the layer during picture image-forming exposure of the underlying picture recording layers. Sound record exposure of the novel element is by the necessary wavelengths of radiation and of sufficient intensity to form a latent sound record image in at least the auxiliary layer. The so exposed element is then processed according to the disclosed novel process which comprises initial development of the latent image (either to a silver image in reversal print films or a silver and dye image in negative-positive print films), contacting the surface of the entire film with a bleach inhibitor composition, reversal development if necessary and bleach-fixing or bleaching and fixing. The processed element is comprised of a picture record which includes dye and a sound record which includes silver. The use of the novel element and process offers the advantage that at no point in the processing of the element must the sound record or picture record areas of the element be given individual treatment. This is possible because of the auxiliary layer of the element. In the picture record area of the element, the auxiliary layer is not exposed. During initial development the silver halide in this area of this layer does not develop to metallic silver. However, in the sound record area a latent image is formed and is developed to metallic silver. When the element is contacted with bleach in-

hibitor composition the bleach inhibitor diffuses into and through the auxiliary layer in those areas where metallic silver was developed (the sound track area) much faster than in those areas where only silver halide is present (the picture area). As a result of this differential rate of diffusion of bleach inhibitor through the silver and silver halide of the auxiliary layer, only the silver of the sound record area is contacted with bleach inhibitor and is protected from the bleaching action of the bleach or bleach-fix solutions. Because the bleach inhibitor diffuses more slowly through silver halide, the picture record silver in the underlying layers is not contacted with bleach inhibitor and remains bleachable. It is, therefore, subsequently bleached and fixed out.

Although this second method represents a significant advance in producing silver sound tracks in color motion picture films, it requires one treatment step (the bleach inhibitor bath step) for the production of the sound track which is not required for the production of the picture record. This process, therefore, requires a processing machine with more processing tanks and is therefore more expensive. It also requires a longer processing time.

It has been found that certain of the ballasted silver bleach inhibitors used in the invention of Bello and Holtz can be substituted onto the reactive site of compounds capable of reacting with oxidized aromatic primary amine color developing agent. These bleach inhibitor substituted compounds can be incorporated into the auxiliary silver halide emulsion layer of a photographic element similar to that described above for the invention of Bello and Holtz. This photographic element is then exposed to a picture record and a sound track or auxiliary record and processed for the formation of the photographic images. One of the processing steps is development of silver halide with an aromatic primary amine color developing agent. This development of the sound track or auxiliary record in the auxiliary layer produces oxidized aromatic primary amine color developing agent which imagewise reacts with the incorporated bleach inhibitor substituted compound. During this reaction the bleach inhibitor moiety is coupled off to form a ballasted silver bleach inhibitor which becomes adsorbed to the developed silver thereby rendering it resistant to bleaching. Subsequent to this development step, the photographic element is bleached and fixed or bleach-fixed to yield a film containing a multicolor picture record and a silver auxiliary or sound record. The novel photographic elements and novel processes for use in preparing color motion picture films with silver auxiliary or sound track records as described above are the invention of Holtz and are disclosed and claimed in a copending application entitled FILM CONTAINING BLEACH-INHIBITOR-RELEASING COMPOUNDS AND PROCESS FOR PREPARING AUXILIARY SILVER IMAGE OR SILVER SOUND RECORDS THEREWITH, Ser. No.100,610, filed Dec. 22, 1970, now abandoned, and the continuation-in-part thereof filed concurrently herewith.

This method therefore eliminates the need for a processing step for the preparation of a sound track which is not required for the production of the picture record. It, however, does require the preparation of the bleach inhibitor substituted compounds. Generally, the bleach inhibitor substituted compounds are prepared by directly substituting the bleach inhibitor moiety onto the compound which is reactive with the oxidized aromatic primary amine color developing agent. It would be convenient to be able to avoid the preparation and use of the more sophisticated bleach inhibitor substituted compounds.

Accordingly, it is an object of my invention to provide a novel method of preparing silver auxiliary images and silver sound records in color photographic films.

It is also an object of my invention to provide novel photographic elements for the preparation of silver auxiliary images and silver sound records in color photographic films.

Other objects will become apparent from the following specification and the appended claims.

These and other objects can be by (A) the use of novel multilayer photographic elements, and (B) novel methods of processing such novel multilayer photographic elements.

Our novel photographic elements are comprised of a support having coated thereon (1) a picture recording photographic color-forming unit comprising one or more (generally one or two) silver halide emulsion layers and (2) an image recording auxiliary photographic silver halide emulsion layer which does not form an image upon image-forming exposure of the picture recording units. The auxiliary layer contains at least one nondiffusible ballasted silver bleach inhibitor. In a preferred embodiment, the picture recording unit contains a nondiffusing photographic color coupler which reacts with oxidized aromatic primary amine color developing agent to form a nondiffusible dye. The dye thus formed preferably is substantially complimentary in color to the primary sensitivity and color of light recorded in the emulsion in which it is incorporated.

Particularly useful photographic elements of the invention are those used for preparing multicolor motion picture films having a silver sound track and comprised of a transparent support having coated thereon a plurality (generally three) picture recording photographic units, each unit comprising one or more (generally one or two) silver halide emulsion layers which are so disposed and sensitized that each photographic unit is essentially sensitive to a different primary color region of the visible spectrum and an auxiliary silver image or silver sound recording photographic silver halide emulsion layer which does not form an image upon image-forming exposure of the picture recording layers. The auxiliary layer contains at least one nondiffusing ballasted silver bleach inhibitor. In a preferred embodiment, each picture recording layer contains a nondiffusing photographic color coupler which reacts with oxidized aromatic primary amine color developing agent to form a dye.

The novel photographic elements can have, in addition to the plurality of picture recording units and the auxiliary layer, a yellow filter layer. The picture recording units and the yellow filter layer are then so disposed and sensitized such that each picture recording unit is essentially sensitive to a different region of the visible spectrum.

The picture recording layers of my novel element are used to form subtractive dye images of the picture to be recorded. The layers can form colors substantially complementary to the color to which they are sensitive. For example, the blue sensitive layer can form a yellow dye image, the red sensitive layer can form a cyan dye image and the green layer can form a magenta dye image. Alternatively, these layers can be falsely sensitized, i.e., they can form colors not complementary to the color to which they are sensitive. If so desired, the layers can be used to form a dye or a mixture of dyes which appear to have a neutral density.

The novel elements of the invention are useful in the reversal system of photography.

In order to form subtractive dyes, the photographic elements are processed in the presence of photographic color formers. Preferred photographic color formers are referred to as couplers. In the well known three color system of subtractive color photography, 5-pyrazolone couplers are typically used to form magenta dyes, phenolic couplers including naphtholic couplers are typically used to form cyan dyes and open-chain ketomethylene couplers are typically used to form yellow dyes.

The photographic element can have layers which do not contain incorporated couplers. In this case, the exposed element is sequentially processed in the presence of developing compositions containing couplers. Such coupler-developer compositions contain both diffusible photographic developing agents such as the aromatic primary amines and diffusible photographic color couplers. The oxidized photographic developing agent couples with the diffusible color coupler to form a non-diffusible dye at the site of photographic silver halide development. Suitable color couplers which can be used in coupler-developer compositions are shown in U.S. Pat. Nos. 2,252,718; 2,252,243 and 2,950,970.

Preferably, the couplers are nondiffusible and are incorporated into the picture recording silver halide layers. Exposed elements are then processed in the presence of an aromatic primary amine color developing agent, such as the well known p-phenylenediamines. The oxidized color developing agent resulting from the reduction of the latent silver halide images couples with the incorporated coupler to form a nondiffusible dye. Examples of nondiffusible photographic couplers which can be incorporated into the picture recording silver halide emulsion layers of my novel photographic element are the pyrazolone couplers shown in U.S. Pat. Nos. 2,343,702; 2,369,489; 2,436,130; 2,600,788; 3,006,759; 3,062,653; 3,311,476 and 3,419,391 and Belgian Patent No. 698,354, the phenolic couplers shown in U.S. Pat. Nos. 2,367,531; 2,423,730; 2,474,293; 3,311,476; 3,419,390; 3,458,315 and 3,476,563 and the open-chain ketomethylene couplers shown in U.S. Pat. Nos. 2,206,142; 2,436,130; 2,728,658 and 3,408,149. The layers can also contain other couplers such as development-inhibitor-releasing couplers such as are shown in U.S. Pat. No. 3,227,554 and competing couplers as disclosed in U.S. Pat. Nos. 2,808,329; 2,689,793 and 2,742,832.

The auxiliary layer of the photographic element is used only to record the auxiliary image or sound track image. This layer can be coated anywhere in the element. For example, it can be coated as the light sensitive layer closest to the support or alternatively it can be coated as a light sensitive layer outermost from the support. In addition, it can be coated between two of the picture recording units or it can be coated between a picture recording unit and a filter layer if the element contains filter layers. Latent images of the picture record should not be formed in the auxiliary layer. Depending upon the arrangement of the picture recording units and auxiliary layers and filter layers, if any, various methods of exposure can be utilized to achieve picture exposure while at the same time not exposing the auxiliary layer to the picture images. For example, with the auxiliary layer as the light sensitive layer closest to the support and with a removable, e.g., bleachable, filter layer between the auxiliary layer and the picture recording units, the picture recording layers can be exposed from the emulsion side of the support and the auxiliary layer exposed through the support. Alternatively, with the auxiliary layer as the light sensitive layer outermost from the support and with a removable filter layer between the auxiliary layer and the underlying picture recording layers, picture exposure can be through the support and auxiliary image exposure can be from the emulsion side. Generally however, it is desirable to expose all layers from the emulsion side. Selective exposure of the auxiliary and picture recording layers is attained in this case because of the photographic speed or spectral sensitivity or both of this layer. For example, the auxiliary layer can be sensitized to radiation to which the picture recording layers are at least partially insensitive such as infrared radiation and exposure is then made through the appropriate filters. Sensitization to the region of relatively equal minimum sensitivity between two of the picture recording layers is still another alternative. Examples are those regions between the blue and green sensitive layers or the green and red sensitive layers of a color film having three color-forming units, each primarily sensitive to a different primary region of the visible spectrum. In addition to or instead of the spectral sensitization, the auxiliary layer can be of a different photographic speed. For example, the auxiliary layer can be unsensitized, i.e., it has only the native silver halide sensitivity to ultra-violet and near blue radiation. In this case, the auxiliary layer should be slower than the blue sensitive layer such that it is not exposed upon exposure of the blue sensitive picture recording layer. Alternatively, the auxiliary layer can be sensitized to one of the primary color regions of the visible spectrum. Again, the auxiliary layer should be slower than the picture recording layer of corresponding spectral sensitivity. Photographic elements having certain of these spectral sensitivity and photographic speed relationships are the invention of Baptista and Smith and are disclosed and claimed in a copending application entitled NOVEL PHOTOGRAPHIC ELEMENT AND PROCESS, Ser. No. 100,614, filed Dec. 22, 1970.

The silver halide content of the auxiliary layer can vary widely, typical coverages being from about 50 milligrams of silver as silver halide per square foot or less to 150 milligrams per square foot or more. The quantity of silver halide in this auxiliary layer will have an effect upon the turbidity of the element and the sharpness of the image when viewed. It is, therefore,

preferred that the auxiliary layer contain from about 70 milligrams per square foot to 120 milligrams per square foot silver as silver halide.

The grain size of the silver halide of the auxiliary layer can vary widely. For example, the average silver halide grain size typically ranges from about 0.05 micron or less to about 0.5 micron or greater. Particularly, when the auxiliary layer is used only to record the sound image in a motion picture film, the grain size desirably is as small as possible without requiring such high intensity exposure in the sound record area that the picture recording layers in the sound area are overexposed causing loss of definition in the sound record. An average grain size of from about 0.05 micron to about 0.2 micron is preferred.

The silver halide emulsions used in the auxiliary layer can be negative developing out emulsions or they can be fogged direct positive emulsions. They can comprise silver chloride, silver bromide, silver chlorobromide, silver bromoiodide, silver chlorobromoiodide or mixtures thereof.

As described above, the auxiliary photographic silver halide emulsion layer contains at least one nondiffusing ballasted silver bleach inhibitor. This bleach inhibitor should be present in an amount which is necessary to fully protect from bleaching all that silver desired to be retained in the auxiliary layer. Since certain of the bleach inhibitors if present in a quantity much in excess of that necessary to fully protect the developed silver from bleaching can cause certain adverse effects such as inhibition of development and interference with fixing, it is important that the quantity of ballasted nondiffusible silver bleach inhibitor present in the auxiliary layer be kept at a minimum. As an example a satisfactory silver density can be retained through the bleaching and fixing steps if the auxiliary layer contains between 70 and 130 milligrams per square foot silver as silver halide of about 0.1 micron average grain size and between about 0.005 and 0.03 millimoles per square foot of nondiffusible ballasted silver bleach inhibitor. The quantity of silver bleach inhibitor which must be incorporated in the auxiliary layer to retain a satisfactory silver density in auxiliary layers containing silver halide of other grain sizes and other coverages can readily be determined by one skilled in the art.

The addition of the nondiffusible ballasted silver bleach inhibitor to the auxiliary layer can be accomplished by a variety of known techniques. One of these techniques involves the use of organic solvents known as coupler solvents. These coupler solvents can be of the low boiling or water soluble type which are removed from the emulsion by evaporation or washing following dispersion of the coupler and solvent in the emulsion. Alternatively, they can be of the high boiling, organic, crystalloidal type which remain incorporated in the emulsion. A description of the low boiling coupler solvents and the methods by which they can be used to disperse photographic couplers is found in Vittum et al., U.S. Pat. No. 2,801,170, particularly at column 2, lines 3 to 32. Also, refer to U.S. Pat. No. 2,861,170; Fierke et al. U.S. Pat. No. 2,801,171, particularly at column 10, lines 33 to 51. High boiling, organic, crystalloidal coupler solvents are those which are substantially water-insoluble, having a low molecular weight and a high boiling point (above about 175°C. at atmospheric pressure). Examples of this type of solvent include those shown in Fierke, U.S. Pat. No. 2,801,171 at column 10, lines 22 to 32; Julian, U.S. Pat. No. 2,949,360 at column 2, lines 3 to 18 and Jelley et al., U.S. Pat. No. 2,322,027, page 2, column 2, line 45 through page 3, column 2, line 6.

An alternative method of incorporating the ballasted nondiffusible silver bleach inhibitors involves the conversion of these bleach inhibitors to an aqueous soluble salt such as alkali metal salts of a bleach inhibitor. This aqueous solution is dispersed in the hydrophilic colloid silver halide emulsion which is then acidified. Upon acidification the bleach inhibitor becomes nondiffusible and remains dispersed within these hydrophilic colloid silver halide emulsions which is then coated on the element.

The selection of other addenda such as sensitizing dyes and the method of their incorporation in the silver halide emulsion of the auxiliary layer can be made by one skilled in the art who wishes to tailor the auxiliary emulsion for particular purposes and needs.

Gelatin or any other conventional photographic hydrophilic colloid can be used as the vehicle for the silver halide in the auxiliary layer or in the silver halide emulsion layer comprising the picture recording layers.

Our novel method of processing multilayer photographic elements having at least one picture recording unit comprising one or more silver halide emulsion layers and an image recording auxiliary photographic silver halide emulsion layer which does not form an image upon image-forming exposure of the picture recording units and which contains a nondiffusible ballasted silver bleach inhibitor comprises (A) black-and-white developing the element to form a picture negative of silver in the picture recording unit or units and an auxiliary image record or sound track record of silver in the auxiliary layer, nondiffusible ballasted silver bleach inhibitor becoming adsorbed to the silver developed in the auxiliary layer, (B) fogging unexposed and undeveloped silver halide in the picture record area and color developing such silver halide with an aromatic primary amine color developing agent in the presence of a photographic color coupler to produce a picture record positive comprising silver and a nondiffusible dye in the picture recording unit or units and (C) removing the bleachable silver images remaining after steps (A) and (B) by bleaching and fixing while retaining silver in the auxiliary layer to form the silver auxiliary image or sound record and a color picture record.

The processing of these elements can be carried out using available processing equipment such as the presently used continuous processing apparatus. Processing temperatures can vary widely. Suitable processing temperatures include those which are now used for processing other conventional types of film. These temperatures typically range from about 20°C. or less to 60°C. or higher. Temperatures of about 25°C., 40°C. and 50°C. are suitable in high speed processing procedures.

As was stated above, the auxiliary layer is of such photographic speed or spectral sensitivity or both that an image is not formed in the auxiliary layer upon image-forming exposure of the picture recording units. The auxiliary image exposure can be made prior to,

concurrent with, or subsequent to, picture image exposure. The auxiliary image exposure is such that the auxiliary or sound image is recorded in at least the auxiliary layer. Subsequent to exposure, the element is processed as generally described above.

Although the present photographic elements are particularly suited for the preparation of color motion picture films having a silver sound record, the elements are also well adapted to the preparation of any color photographic film having an auxiliary silver image. Since the element is particularly adapted for the preparation of silver sound records, the general processing sequence and the method by which the auxiliary silver images are retained in color photographic films will be described as it pertains to the preparation of color motion pictures having silver sound records.

Subsequent to exposure to a picture image and a sound track image, the photographic element is developed with a black-and-white developer to form silver images in areas of exposure. During black-and-white development, the nondiffusible ballasted silver bleach inhibitor contained in the auxiliary layer becomes adsorbed to the silver which developed in this layer. Typical suitable black-and-white developers include hydroquinones, 3-pyrazolidones, aminophenols and the like.

Thereafter the remaining undeveloped silver halide in the picture recording units is fogged and color developed with aromatic primary amine color developing agent, p-phenylene-diamines being particularly useful. Fogging can be accomplished by any means which does not also fog the undeveloped silver halide in the auxiliary layer. For example, fogging can be accomplished with light of the proper wavelengths and intensity. Alternatively, fogging can be accomplished with certain known chemical fogging agents such as the amine boranes disclosed in U.S. Pat. No. 3,246,987. Although not understood, it has been determined that the residual silver halide in the auxiliary layer is not reversal color developed when the silver halide is fogged with one of these amine boranes. It, however, does reversal color develop if the silver halide is fogged with light.

To prevent fogging and color development of silver halide in the sound track area of the picture recording units not exposed by sound track exposure, the sound track can be flashed with light of sufficient intensity to fully expose the picture recording units, but of insufficient intensity to expose the auxiliary layer. The silver halide of the picture recording units of the sound track area will then be completely developed during the black-and-white development step.

Since the photographic element was fogged in such a manner that silver developed in the auxiliary layer only during the black-and-white development step, only this silver is present and only this silver has nondiffusible ballasted silver bleach inhibitor adsorbed to it. When the element is contacted with a bleach-fix composition or a bleach composition, all the developed silver which is not protected by the bleach inhibitor is converted to a fixable salt and removed from the element. In the auxiliary layer, wherever silver is developed the bleach inhibitor becomes adsorbed to it and this silver is rendered substantially unbleachable and is not removed from the element. Subsequent to bleaching and fixing or bleach-fixing, the photographic element is comprised of nondiffusible dyes in picture recording units and silver in the auxiliary layer.

The photographic elements of the invention instead of having an auxiliary layer as described above containing both light sensitive silver halide and a nondiffusible ballasted silver bleach inhibitor can have a first auxiliary layer containing a moderately diffusible ballasted silver bleach inhibitor and a second auxiliary layer containing light sensitive photographic silver halide coated between the picture recording unit or units and the first auxiliary layer. During processing of the imagewise exposed element as described above, the moderately diffusible ballasted silver bleach inhibitor diffuses from the first auxiliary layer into the second auxiliary layer and becomes adsorbed to the developed silver present there. This silver is thus protected from bleaching and is present in the processed element to comprise the auxiliary silver image or silver sound track.

As used herein and in the appended claims, the term "nondiffusible ballasted silver bleach inhibitor" refers to a nondiffusible organic compound which when incorporated in a fogged photographic element having coated on a transparent support a gelatino silver halide emulsion layer containing silver chlorobromide (having 80 percent molar chloride and 20 percent molar bromide) of about 0.1 micron average grain size, coated at 200 mg. gelatin and 100 mg. silver per square foot and about 0.005 to 0.1 millimole of bleach inhibitor per square foot and which element is developed for 60 seconds at 52°C. in a developer of the following composition:

| | |
|---|---|
| Sodium sulfite (anhydrous) | 44 g. |
| Sodium tetraborate (borax) | 12 g. |
| Hydroquinone | 8 g. |
| Phenidone | 0.55 g. |
| Sodium bromide | 1.3 g. |
| Sodium hydroxide | 0.75 g. |
| Water to make | 1 liter |

will prevent the bleaching of a sufficient amount of the developed silver to result in an infrared density of at least 0.80 measured at 900 nm. when the element is treated for 90 seconds at a temperature of 25°C. with a photographic bleach-fix solution of the following composition:

| | |
|---|---|
| NaFeEDTA* (13% Fe) | 60 g. |
| $Na_2SO_3$ | 12 g. |
| $NH_4SCN$ | 12 g. |
| $Na_4EDTA$* | 7 g. |
| Ammonium thiosulfate (60% solution) | 200 ml. |
| water to | 1 liter |
| pH 6.68 | |

*EDTA - Ethylenediamine tetraacetic acid

In conducting the above test, the concentration of nondiffusible ballasted bleach inhibitor is selected to give optimum bleach inhibition.

We have found that organic compounds which exhibit particular utility as nondiffusible ballasted silver bleach inhibitors as defined above are thiol- and selenol-containing compounds which are substituted with or contain a hydrophobic moiety such as a medium to long alkyl chain. One function of this moiety is to act as a ballast to render relatively nondiffusible the nondiffusible ballasted bleach inhibitor within the

hydrophilic colloid silver halide emulsion layer. Examples of such compounds are mercapto- and selenol-substituted alkanoic acids, especially 2-mercapto alkonoic acids, thiol- and selenol-substituted aryls such as thiophenols, thionaphthols alkyl- and alkylamidothiophenols and thionaphthols, ballasted thiol- and selenol-substituted heterocyclic compounds containing at least one nitrogen atom such as alkylamidomercaptobenzoxazoles, alkylamidomercaptobenzothiazoles, alkylamidomercaptobenzimidazoles, alkylamidomercaptothiadiazoles, alkylthiomercaptothiadiazoles, alkylamidomercaptotriazoles, 1-alkylamidophenyl-5-mercaptotetrazoles and mercaptoquinolines, alkylamido- and alkylmercaptoquinolines, ballasted thiocarboxylic acids and esters thereof such as alkyl- and alkylamidothiobenzoic acid.

Particularly useful nondiffusible ballasted silver bleach inhibitors that can be used in the invention have the following general formulas:

I. $R_a^1-(-A^1-)_a-XR^5$

II. $R_a^2-(-A^2-)_a-X-X-(-A^3-)_a-R_a^3$

III. $R_a^4-(-A^4-)_a-X^{\ominus}\ Y^{\oplus}$

wherein:

a represents 0, 1, 2, 3, 4, 5 or 6;

X represents sulfur or selenium;

$R^1$, $R^2$, $R^3$ and $R^4$ each represents nitro; halo (e.g., chloro, bromo, fluoro, iodo); an alkyl group including substituted alkyl having from one to 22 carbon atoms and preferably having five to 18 carbon atoms, such as alkyl (e.g., methyl, ethyl, propyl, cyclopropyl, isopropyl, butyl, isobutyl, secbutyl, tert-butyl, cyclobutyl, pentyl, iso-amyl, tertamyl, cyclopentyl, hexyl, cyclohexyl, cyclohexadienyl, heptyl, octyl, nonyl, decyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, octadecyl and the like), haloalkyl (e.g., fluoroalkyl, chloroalkyl, bromoalkyl, as for example, chlorooctyl, bromododecyl, fluorotetradecyl and the like), sulfoalkyl (e.g., sulfohexyl, sulfooctyl, sulfododecyl and the like), sulfatoalkyl (e.g., sulfatodecyl, sulfatotetradecyl and the like) alkylsulfonylalkyl (e.g., ethylsulfonylbutyl and the like), cyanoalkyl (e.g., cyanohexyl, cyanooctyl, cyanodecyl and the like), carboxyalkyl (e.g., carboxyhexyl, carboxydecyl, carboxyhexadecyl and the like), aralkyl (e.g., benzyl, phendodecyl, tolyldodecyl and the like), alkoxyalkyl (e.g., octoxyhexyl, butoxyhexyl, ethoxydecyl and the like), aryloxyalkyl (e.g., phenoxymethyl, phenoxyethyl and the like), alkoxyaralkyl (e.g., methoxyphenylethyl, butoxyphenylhexyl and the like), acyloxyalkyl (e.g., benzoyloxyhexyl, acetoxybutyl and the like), alkoxycarbonylalkyl (e.g., butoxycarbonylhexyl and the like), aryloxycarbonylalkyl (e.g., phenoxycarbonylethyl, chlorophenoxycarbonylbutyl and the like), alkylamidoalkyl (e.g., hexanamidobutyl, octanamidopropyl and the like), arylamidoalkyl (e.g., phenylamidoethyl, methylphenylamidobutyl and the like) and the like; an aryl group including naphthyl and other fused ring aromatics and substituted aryl such as aryl (e.g., phenyl, naphthyl, anthracenyl, phenanthrenyl and the like), haloaryl (e.g., chlorophenyl, trichlorophenyl, dibromophenyl, fluorophenyl, chlorotolyl and the like), sulfoaryl (e.g., sulfophenyl and the like), sulfatoaryl (e.g., sulfatophenyl and the like), nitroaryl (e.g., nitrophenyl, dinitrophenyl and the like), cyanoaryl (e.g., cyanophenyl, cyanonaphthyl and the like), carboxyaryl (e.g., carboxyphenyl, dicarboxyphenyl and the like), alkaryl (e.g., tolyl, butylphenyl, decylphenyl, diethylphenyl, trifluoromethylphenyl and the like), aralkaryl (e.g., benzylphenyl, naphthyl methylphenyl and the like), alkoxyaryl (e.g., octoxyphenyl, methoxyphenyl and the like), aryloxyaryl (e.g., phenoxyphenyl, phenoxynaphthyl and the like), acyloxyaryl (e.g., benzoyloxyphenyl, acetyloxyphenyl and the like), alkoxycarbonylaryl (e.g., ethoxycarbonylphenyl and the like), aryloxycarbonylaryl (e.g., phenoxycarbonylphenyl, methylphenoxycarbonylnaphthyl and the like), alkylamidoaryl (e.g., acetamidophenyl, amylamidophenyl, di-t-amylamidophenyl, hexanamidophenyl, heptanamidophenyl, octanamidophenyl, nonanamidophenyl, decanamidophenyl, undecanamidophenyl, dodecanamidophenyl, tridecanamidophenyl, tetradecanamidoaryl, pentadecanamidophenyl, heptafluorobutanamidophenyl, carboxycyclopentanacetamidophenyl and the like), cycloalkyliminosulfonylaryl (e.g., piperidinylsulfonylphenyl, azetidinylsulfonylphenyl, pyrrolidinylsulfonylphenyl, indolinylsulfonylphenyl and the like) and the like; a thio group containing three to 22 carbon atoms such as alkylthio (e.g., propylthio, hexylthio, octylthio, dodecylthio and the like), carboxyalkylthio (e.g., carboxybutylthio, carboxyhexylthio and the like), arylthio (e.g., phenylthio, naphthylthio, methylphenylthio and the like), alkylcarbonylalkylthio (e.g., methylcarbonylethylthio, butylcarbonylpropylthio and the like), alkylcarbonylarylthio (e.g., methylcarbonylphenylthio, hexylcarbonyltolylthio, benzylcarbonylphenylthio and the like), arylcarbonylarylthio (e.g., phenylcarbonylphenylthio and the like), arylcarbonylalkylthio (e.g., phenylcarbonylmethylthio and the like) and the like; an amido group containing from four to 22 carbon atoms such as alkylamido (e.g., hexanamido, heptanamido, octanamido, decanamido, heptafluorobutanamido and the like), arylamido (e.g., benzylamido and the like), alkarylamido (e.g., methylbenzylamido, butylbenzylamido, hexylbenzylamido, decylbenzylamido and the like), aralkylamido (e.g., phenacetamido, phenbutanamido, tolylhexanamido and the like), aryloxyalkylamido e.g., phenoxyacetamido, naphthoxyacetamido, di-t-amylphenoxyacetamiodo and the like) and the like; a carbonyl group such as alkylcarbonyl (e.g., butylcarbonyl, heptylcarbonyl and the like), arylcarbonyl (e.g., phenylcarbonyl, naphthylcarbonyl and the like, alkoxycarbonyl (e.g., ethoxycarbonyl butoxycarbonyl and the like), aryloxycarbonyl (e.g., phenoxycarbonyl, naphthoxycarbonyl and the like) and the like; a carbamoyl group such as alkylcarbamoyl (e.g., butylcarbamoyl, hexylcarbamoyl and the like), arylcarbamoyl (e.g., phenylcarbamoyl, naphthylcarbamoyl and the like) and the like; alkoxy (e.g.,

ethoxy, butoxy, octoxy, benzoxy and the like); or aryloxy (e.g., phenoxy, toluoxy and the like);

$R^5$ represents hydrogen or an acyl group having from one to 22 carbon atoms including aryloyl and alkanoyl groups (e.g., benzoyl acetyl, propanoyl, benzothioyl, acetothioyl and the like);

$Y^{\oplus}$ represents a basic cation such as an alkali metal ion like sodium and potassium, ammonium and the like;

$A^1$, $A^2$, $A^3$ and $A^4$ each represents a carbonyl group ( C=O); a thiocarbonyl group ( C=S); a carboxymethylene group ( CH—COOH); a carbocyclic ring containing three to six carbon atoms which can be part of a fused ring structure such as cycloalkylene (e.g., cyclopropylene, cyclobutylene, cyclopentylene and cyclohexylene), cycloalkenylene (e.g., cyclopropenylene, cyclobutenylene, cyclopentenylene, cyclopentadienylene, cyclohexenylene and cyclohexadienylene) or arylene (e.g., phenylene, naphthylene, anthrylene and the like); or a 3 to 6 membered heterocyclic ring containing at least one carbon atom and from one to five atoms selected from nitrogen, oxygen, sulfur or selenium which ring can have other carbocyclic and heterocyclic rings fused to it such as oxirenyl, furanyl, benzofuranyl, isobenzofuranyl, dibenzofuranyl, oxazolyl, benzoxazolyl, isoxazolyl, benzisoxazolyl, oxadiazolyl, benzoxadiazolyl, 1,2-pyranyl, 1,4-pyranyl, 2(H)benzopyranyl, 4(H)benzopyranyl, dioxolyl, methylenedioxybenzene, 1,2-oxazinyl, 1,3-oxazinyl, 1,4-oxazinyl, morpholinyl, 1,3-dioxolanyl, 1,3-oxathianyl, 1,4-oxathianyl, 1,2-dioxanyl, 1,3-dioxanyl, 1,4-dioxanyl, dioxanenyl, dioxadienyl, diazetyl, pyrrolyl, indolyl, isoindolyl, carbazolyl, pyrrocolinyl, acridinyl, phenanthridinyl, 2-imidazolinyl, 3-imidazolinyl, 4-imidazolinyl, pyridyl, pyridazinyl, cinnolinyl, phthalazinyl, quinoxalinyl, pyrimidinyl, pyrazolo[3,4dpyrimidinyl, hypoxanthinyl, benzopyrimidinyl, pyraxinyl, quinoxalinyl, phthalazinyl, quinolinyl, isoquinolinyl, phenazinyl, phenoxazinyl, phenothiazinyl, pyrazinyl, pteridinyl, 1,3,5-triazinyl, 1,2,4-triazinyl, 1,2,3-triazinyl, triazolyl, benzotriazolyl, tetrazolyl, triazinthionyl, 1(H)azepinyl, piperidinyl, imidazolidinyl, quinolizidinyl, thienyl, benzothienyl, isobenzothienyl, dibenzothienyl, thiazolyl, benzothiazolyl, isothiazolyl, benzisothiazolyl, thiadiazolyl, benzothiadiazolyl, 1,2-dithiolyl, 1,3-dithiolyl, 1,3-oxathiolyl, thianthrinyl, thiamorpholinyl, 1,4-thianinyl, 1,4-dithanyl, 1,4-dithiadienyl, selenazolyl, benzoselenazolyl, isoselenazolyl, benzisoselenazolyl, selenadiazolyl, benzoselenadiazolyl and the like; such that $R^1$, $R^2$, $R^3$ and $R^4$ do not represent a carbonyl group, a carbamoyl group or an amido group when $A^1$, $A^2$, $A^3$ and $A^4$ represent carbonyl or thiocarbonyl and such that the grouping $R_a^1$—$(A^1)$—, the grouping $R_a^2$ $(A^2)$, the grouping $R_a^3$ $(A^3)$ and the grouping $R_a^4$—$(A^4)$— each represents a moiety having a molecular weight of from 125 to 1,000 and preferably from 175 to 400 and preferably containing not more than one solubilizing group such as carboxy, unless the grouping contains a hydrophobic moiety which renders the bleach inhibitor relatively nondiffusible in the hydrophilic colloid such as a long alkyl chain or an aryl group and such that when $A^1$, $A^2$, $A^3$ and $A^4$ represent a carbocyclic or a heterocyclic ring said ring has attached to it a hydrophobic moiety such as the atoms necessary to complete a five to six membered carbocyclic or heterocyclic ring fused to said ring; an alkyl group having from six to 18 carbon atoms; an alkylamido group having from six to 18 carbon atoms and an aryl group such as phenyl, naphthyl and an alkylamidoaryl group having six to 18 carbon atoms in the alkyl moiety and the like or has attached to it a plurality of such hydrophobic moieties, the total effect of which is to impart similar hydrophobic character such as two alkylamido groups having three to 12 carbon atoms and two alkylamidoaryl groups having three to 12 carbon atoms in the alkyl moiety.

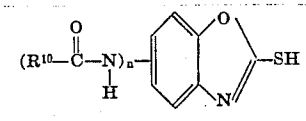
Many heterocyclic compounds having a molecular weight of less than 100 (exclusive of the mercapto group) such as those compounds shown in British Patent No. 1,138,842 have been found not be to bleach inhibitors but rather bleach accelerators. Compounds of this type do not fall within the meaning of the term bleach inhibitor as defined herein.

In a more preferred embodiment of our invention, the bleach inhibitor is an organic compound or the salt of an organic compound as defined in Formulas I, II and III above having an acidic thiol or selenol, or having a group capable of forming such a compound prior to or subsequent to being brought into contact with a photographic element. For example, such thiol and selenol precursors can form the thiol or selenol group upon hydrolysis. Examples of precursors which form acidic thiol bleach inhibitors are bleach inhibitors XLVII and XLVIII. An examples of a compound which can be treated to increase the number of acidic thiol groups is bleach inhibitor VI. Another example of thiol-forming compounds are disulfides (i.e., compounds of Formula II above) which cleave at the sulfur atoms to yield at least one thiol compound.

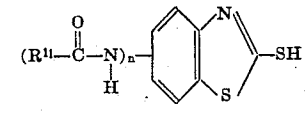
The acidity of the thiol and selenol groups can be imparted by the group to which these groups are attached (e.g., a heterocyclic or carbocyclic ring). Alternatively, other groups attached to the group having the thiol and selenol groups can impart acidity. For example, a carboxylic acid group on a carbon atom adjacent to the atom to which these groups are attached (e.g., 2-mercapto-lauric acid) imparts the desired acidity. Other electron withdrawing groups (e.g., nitro and halo) can also impart acidity to the thiol and selenol groups.

Compounds having the following general formulas exhibit particular utility as bleach inhibitors in the present invention:

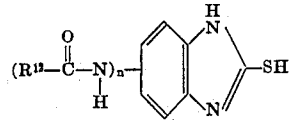
IV. 2-mercaptobenzoxazoles



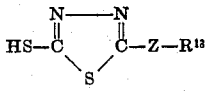
V. 2-mercaptobenzothiazoles



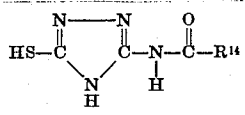
VI. 2-mercaptobenzimidazoles



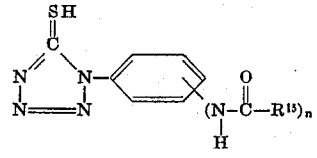
VII. 2-mercaptothiadiazoles



VIII. 2-mercaptotriazoles



IX. 1-phenyl-5-mercaptotetrazoles



wherein:

$R^{10}$, $R^{11}$, $R^{12}$ and $R^{15}$ each represents an alkyl group having from one to 17 carbon atoms and preferably five to 12 carbon atoms;

$R^{13}$ and $R^{14}$ each represents an alkyl group having from five to 17 and preferably eight to 12 carbon atoms;

Z represents sulfur or the group —NHCO—; and

*n* represents 1 to 5 and preferably 1.

The following list of compounds are typical sulfur and selenium compounds which function as bleach inhibitors in the present invention:

I. 2-mercaptolauric acid
II. 4-octylthiobenzoic acid
III. 4-butyl-2-naphthalenethiol
IV. 4-hexyl-2-quinolinethiol
V. 5-pentyl-4-benzopyrimidinethiol
VI. 1-(5-mercapto-1,2,4-triazol-3-ylthio)butan-3-one
VII. 3-mercapto-4-phenyl-5-n-undecyl-1,2,4-triazole
VIII. 1-(3-heptafluorobutramidophenyl)-5-mercaptotetrazole
IX. 1-{3-[2-(2,4-di-t-amylphenoxy)-acetamido ]phenyl}-5-mercaptotetrazole
X. 1-[4-(1piperidinylsulfonyl)-phenyl]-5-mercaptotetrazole
XI. 1-(3-heptanamidophenyl)-5-mercaptotetrazole
XII. 1-(3-octanamidophenyl)-5-mercaptotetrazole
XIII. 1-(3-nonanamidophenyl)-5-mercaptotetrazole
XIV. 1-(3-decanamidophenyl)-5-mercaptotetrazole
XV. 1-(3-undecanamidophenyl)-5-mercaptotetrazole
XVI. 1-(3-dodecanamidophenyl)-5-mercaptotetrazole
XVII. 1-(3-tridecanamidophenyl)-5-mercaptotetrazole
XVIII. 1-(3-tetradecanamidophenyl)-5-mercaptotetrazole
XIX. 1-(2,4-di-butanamidophenyl)-5-mercaptotetrazole
XX. 1-(2,4-di-propanamidophenyl)-5-mercaptotetrazole
XXI. 1-(2,4,6-tri-acetamidophenyl)-5-mercaptotetrazole
XXII. 2-mercapto-6-heptanamido-1,3-benzothiazole
XXIII. 2-mercapto-6-octanamido-1,3-benzothiazole
XXIV. 2-mercapto-6-nonanamido-1,3-benzothiazole
XXV. 2-mercapto-6-decanamido-1,3-benzothiazole
XXVI. 2-mercapto-6-undecanamido-1,3-benzothiazole
XXVII. 2-mercapto-6-dodecanamido-1,3-benzothiazole
XXVIII. 2-mercapto-6-tridecanamido-1,3-benzothiazole
XXIX. 2-mercapto-6-tetradecanamido-1,3-benzothiazole
XXX. 2-mercapto-4,7-di-butanamido-1,3-benzothiazole
XXXI. 2-mercapto-4,6,7-tri-acetanamido-1,3-benzothiazole
XXXII. 2-mercapto-5-heptanamido-1,3,4-thiadiazole
XXXIII. 2-mercapto-5-octanamido-1,3,4-thiadiazole
XXXIV. 2-mercapto-5-nonanamido-1,3,4-thiadiazole
XXXV. 2-mercapto-5-decanamido-1,3,4-thiadiazole
XXXVI. 2-mercapto-5-undecanamido-1,3,4-thiadiazole
XXXVII. 2-mercapto-5-dodecanamido-1,3,4-thiadiazole
XXXVIII. 2-mercapto-5-tridecanamido-1,3,4-thiadiazole
XXXIX. 2-mercapto-5-tetradecanamido-1,3,4-thiadiazole
XL. 2-heptylthio-5-mercapto-1,3,4-thiadiazole
XLI. 2-octylthio-5-mercapto-1,3,4-thiadiazole
XLII. 2-nonylthio-5-mercapto-1,3,4-thiadiazole
XLIII. 2-decylthio-5-mercapto-1,3,4-thiadiazole
XLIV. 2 -undecyl-5-mercapto-1,3,4-thiadiazole
XLV. 2-dodecyl-5mercapto-1,3,4-thiadiazole
XLVI. 2,4-dihexanamido-6-mercaptopyrimidine
XLVII. 1-(1-phenyltetrazol-5-ylthio)-butan-3-one
XLVIII. 2-(1-phenyltetrazol-5-ylthio)-ethyl-phenyl-ketone
XLIX. 3-decanamido-2-oxirenthiol
L. 5-(5-trichloropentanamido)-2-puranthiol
LI. 6-(10-sulfodecyl)-2-benzofuranthiol
LII. 6-(8-sulfatooctyl)-3-isobenzofuranthiol
LIII. 4-butylsulfonylhexyl-1-dibenzofuranthiol
LIV. 4-(7-cyanoheptyl)-2-oxazolthiol
LV. 6-heptanamido-1,3-benzoxazol-2thiol
LVI. 6-octanamido-1,3-benzoxazol-2thiol
LVII. 6-nonanamido-1,3-benzoxazol-2-thiol
LVIII. 6-decanamido-1,3-benzoxazol-2-thiol
LIX. 6-undecanamido-1,3-benzoxazol-2-thiol
LX. 6-dodecanamido-1,3-benzoxazol-2-thiol
LXI. 5-octanamido-1,3-benzoxazol-2-thiol
LXII. 5-decanamido-1,3-benzoxazol-2-thiol
LXIII. 4,7-di-butanamido-1,3-benzoxazol-2-thiol
LXIV. 7-(4-butanamidobenzyl)-3-benzisoxazolthiol
LXV. 4-propoxypentyl-2,1,3-oxadiazol-5-thiol
LXVI. 4-phenoxybutyl-1,2,3-oxadiazol-5-thiol

LXVII. 7-(7-hexylenebenzoate)-2,1,3-benzoxadiazol-4-thiol
LXVIII. 4-(3-phenylhexanoate)-1,4-pyran-2-ylthiol
LXIX. 8-butanamidoethyl-2(H)-benzopyran-4-ylthiol
LXX. 8-phenamidobutyl-4(H)-benzopyran-2-ylthiol
LXXI. 4-(2-ethyl-4-hexanamidophenyl)-dioxazol-2-ylthiol
LXXII. 4-(2-hexanamido-4-sulfatophenyl)-benzodioxazol-2-ylthiol
LXXIII. 2-butyl-5-(2,4-dinitrophenyl)-1,2-oxazin-3-ylthiol
LXXIV. 3-(4-benzylphenyl)-1,4-oxazin-5-ylthiol
LXXV. 4-(4-butoxyphenyl)-morpholin-3-ylthiol
LXXVI. 4-(4-phenoxyphenyl)-1,3-dioxolan-2-ythiol
LXXVII. 5-octanamido-6-(4-ethylbenzoate)-1,4-oxathian-2-ylthiol
LXXVIII. 8-(2-mercapto-1,3-dioxanol-5-ylthio)-octanamido, n-butyl
LXXIX. 2-(3-hexanamidophenylthio)-1,4-dioxin-3-ylthiol
XC 4'-(5-mercapto-1,2,4-triazol-3-ylthiol)-4-butanamidoacetophenone
XCI. 4dodecanamido-1,2-diazet-3-ylthiol
XCII. 1-(3-octanamidophenyl)-pyrrol-2-ylthiol
XCIII. 1-ethyl-3-n-octylthio-indol-2-ylthiol
XCIV. 2-ethyl-3-octanamido-isoindol-1-ylthiol
XCV. 7-nonanamidopyrrocolin-3-ylthiol
XCIV. 5-butanamido-2-phenanthridinylthiol
XCVII. 3-ethyl-4-heptanamido-2-imidazolin-2-ylthiol
XCVIII. 6-heptanamido-1,3-benzimidazol-2-thiol
XCIX. 6-octanamido-1,3-benzimidazol-2-thiol
C. 6-nonanamido-1,3-benzimidazol-2-thiol
CI. 6-decanamido-1,3-benzimidazol-2-thiol
CII. 6-undecanamido-1,3-benzimidazol-2-thiol
CIII. 6-dodecanamido-1,3-benzimidazol-2-thiol
CIV. 4,7-di-n-butanamido-1,3-benzimidazol-2-thiol
CV. 4,5,7-tri-acetamido-1,3-benzimidazol-2-thiol
CVI. 5-octanamido-1,3-benzimidazol-2-thiol
CVII. 5-decanamido-1,3-benzimidazol-2-thiol
CVIII. 4-octanamido-2-pyridinylthiol
CIX. 1-octylphthalazin-4-ylthiol
CX. 5-benzylamidophenylquinolin-2-ylthiol
CXI. 5-n-decylthio-1,2,4-triazin-3-ylthio
CXII. 5-(3-octanamidophenyl)-6-benzotriazolylthiol
CXIII. 1,3-dihexyl-2-imidazolidinylthiol
CXIV. 2-octylthio-5-thienylthiol
CXV. 5-octylthio-2-thiazolylthiol
CXVI. 4-(3-decanamidophenyl)-1,3-dithiol-2-ylthiol
CXVII. 4-(3-octanamidophenyl)-1,3-oxathiol-2-ylthiol
CXVIII. 6-hexanamido-4-hexyl-3-thiamorpholinylthiol
CXIX. 5-butanamido-4-(4-phenylbutyl)-1,4-thianin-3-ylthiol
CXX. 4-(3-octanamidophenyl)-2selenazolylthiol
CXXI. 5-benzamido-2-benzoselenazolylthiol
CXXII. 5-decanamido-3-benzoisoselenazolythiol
CXXIII. 4-decanamido-2,1,3-selenadiazol-5ylthiol
CXXIV. 1-(2,4-di-n-butanamidophenyl)-tetrazol-5-ylselenol
CXXV. 1-(2,4,6-tri-acetamidophenyl)-tetrazolyl-5-ylselenol
CXXVI. 1-(3-heptanamidophenyl)-tetrazol-5-ylselenol
CXXVII. 1-(3-octanamidophenyl)-tetrazol-5-ylselenol
CXXVIII. 1-(3-nonanamidophenyl)-tetrazol-5-ylselenol
CXXIX. 1-(3-decanamidophenyl)-tetrazol-5-ylselenol
CXXX. 1-(3-undecanamidophenyl)-tetrazol-5-ylselenol
CXXXI. 1-(3-dodecanamidophenyl)-tetrazol-5-ylselenol
CXXXII. 4,7-di-tert-amylamido-1,3-benzoselenazol-2-ylselenol
CXXXIII. 4,5,7-tri-acetamido-1,3-benzoselenazol-2-ylselenol
CXXXIV. 6-octanamido-1,3-benzoselenazol-2-ylselenol
CXXXV. 6-nonanamido-1,3-benzoselenazol-2-ylselenol
CXXXVI. 6-decanamido-1,3-benzoselenazol-2-ylselenol
CXXXVII. 6-undecanamido-1,3-benzoselenazol-2-ylselenol
CXXXVIII. 6-dodecanamido-1,3-benzoselenazol-2-ylselenol
CXXXIX. 5-octanamido-1,3,4-selenadiazol-2-ylselenol
CXL. 5-decanamido-1,3,4-selenadiazol-2-ylselenol
CXLI. 5-octanamido-1,3,4-thiadiazol-2ylsenenol
CXLII. 5-decanamido-1,3,4-thiadiazol-2-ylselenol
CXLIII. 2-octylthio-1,3,4-thiadiazol-2ylselenol
CXLIV. 2-nonylthio-1,3,4-thiadiazol-2-ylselenol
CXLV. 2-decylthio-1,3,4-thiadiazol-2-ylselenol
CXLVI. 2-octylthio-1,3,4-selenadiazol-2-ylselenol
CXLVII. 2-decylthio-1,3,4-selenadiazol-2-ylsenenol
CXLVIII. oxalic-bis-N-[3-(5-mercaptotetrazol-1-yl)-anilide]
CXLIX. suberic-bis-N-[3-(5-mercaptotetrazol-1-yl)-anilide]
CL. terephthalic-bis-N-[3-(5-mercaptotetrazol-1-yl)-anilide]
CLI. disulfide,bis-1-(3-nonanamidophenyl)-tetrazol-1-yl
CLII. disulfide,bis-6-octanamido-1,3-benzo-thiazol-2-yl
CLIII. disulfide,bis-5-nonanamido-1,3,4-thia-diazol-2-yl
CLIV. disulfide,bis-2-octylthio-1,3,4-thia-diazol-5-yl
CLV. 1-(3-octanamidophenyl)-5-mercaptotetrazole, sodium salt
CLVI. 1-(3-nonanamidophenyl)-5mercaptotetrazole, potassium salt
CLVII. 2-octylthio-5-mercapto-1,3,4-thiadiazol, ammonium salt

The bleach inhibitors used in the invention are known compounds and can be prepared by known methods. For example, the alkylamido substituted benzoxazoles, benzothiazoles and benzoselenazoles can be prepared by reacting the corresponding commercially available amino substituted compounds with an acid chloride. The 1-(3-alkylamidophenyl)-5-mercaptotetrazoles are prepared by similar methods as shown in U.S. Pat. No. 3,376,310. Other bleach inhibitors can be prepared by methods available in well known organic chemistry reference works.

The method of our invention is useful to prevent the bleaching of sound records by both bleach-fix compositions and bleach compositions. Bleach compositions contain an oxidizing agent. Bleach-fix compositions are those which contain both an oxidizing agent such as an iron salt of EDTA and a silver halide solvent. In a bleach-fix composition, the silver is oxidized to a silver salt which is then removed from the film all in a single solution. Bleach compositions, however, contain only an oxidizing agent such as sodium iron EDTA to oxidize the silver to a silver salt. This silver salt and residual silver halide are subsequently removed by treatment with a separate fixing bath.

The method of the invention is also applicable to the production of silver sound records and films in which dye images are of a neutral density. Neutral density images can be formed from one or a mixture of couplers which react to form a neutral density dye or a combination of dyes which appear to be of neutral density. As with color image formation, subsequent to neutral density image formation, the silver of the picture record is removed by bleaching and fixing. The silver sound record can be retained in this type of film by the use of an auxiliary layer containing a nondiffusible ballasted silver bleach-inhibitor to yield a neutral density film having a picture record comprised of a dye or a mixture of dyes and a sound record comprised of silver.

The term "nondiffusible" used herein as applied to couples, products derived from couplers and bleach inhibitors 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 photographic hydrophilic colloid layers such as gelatin, particularly during processing in aqueous alkaline solutions. The same meaning is attached to the term "immobile." The terms "diffusible" and "mobile" have a converse meaning. The terms "moderately diffusible" and "moderately mobile" are used to indicate compounds which do migrate or wander through photographic hydrophilic colloid layers, but the rate of diffusion of which is markedly slower than those compounds which can be labeled as diffusible or mobile, but whose rate of diffusion is significantly greater than those compounds which can be labeled nondiffusible or immobile.

A further understanding of the invention can be gained by reference to the drawing. The FIGURE depicts diagrammatically and sequentially the processing of one embodiment of my novel photographic element shown in cross-sectional view to produce a color picture record and a silver sound record. The processing is according to my novel method of processing. With reference to the embodiment shown in the FIGURE transparent film support **22** has coated thereon gelatino silver halide, red sensitive, cyan-forming layer **23**, gelation silver halide, green sensitive, magenta-forming layer **24**, yellow filter layer **25**, gelatino silver halide, blue sensitive, yellow-forming layer **26** and gelatino silver halide, blue-green sensitive, nondiffusible ballasted silver bleach inhibitor containing auxiliary layer **27**. The sensitivity of layer **27** is such that the sensitivity peak falls at about 480 nm. The photographic speed of layer **27** is such that it is about 2 to 15 times slower than the blue (**26**) and green (**24**) sensitive layers when exposed to 480 nm. For simplicity in illustrating the invention, conventional subbing layers, interlayers and the overcoat have been omitted from the drawing. In stage **1** the element is exposed through the original depicted for simplification of the figure as a single layer **21** coated on transparent support **20**. Exposure for the picture record is made with white light and for the sound record with blue-green light having a maximum intensity at about 480 nm. and a bandspread of 20 nm. at half height. In practice, this original can be a multilayer, multicolor element or a scene as viewed through a camera lens. Also, in practice, the picture record and the sound track record would generally be on separate originals and separate exposures made from each of these originals a short interval of time apart. In this embodiment prior to the imagewise exposure through the original depicted in state 1, the sound track area (that area to the right of the dotted line in the photographic element) is flashed with white light of sufficient intensity to fully expose layers **23**, **24** and **26** but of insufficient intensity to expose layer **27**.

In carrying out the process of the invention as illustrated in the drawing, subsequent to exposure, the latent image is developed with a black-and-white developer. The element then appears as in state 2. Layers **23***a*, **24***a* and **26***a* in picture area **210** are comprised of silver. In picture area **211**, these layers did not receive exposure and a latent image was not former. Area **211** of these layers is thus comprised of silver halide. Auxiliary layer **27***a*, because of its photographic speed and spectral sensitivity, does not become exposed and is thus comprised of silver halide in both picture areas **210** and **211**. Layers **23***a*, **24***a* and **26***a* are comprised of silver in sound track areas **28** and **29** because they were fully exposed with white light prior to exposure through the original. Auxiliary layer **27***a* in sound track areas **29** received sound track exposure and is comprised of silver to which the nondiffusible ballasted silver bleach inhibitor has become adsorbed. Sound track area **28** of auxiliary layer **27***a* did not receive sound track exposure and is comprised of silver halide. Subsequent to black-and-white development, the element is developed in a color developer containing an aromatic primary amine color developing agent and an amine borane chemical fogging agent. The element then appears as in state **3**. Layers **23***b*, **24***b* and **26***b* in picture record area **211** are comprised of silver and nondiffusible dye images. These silver and dye images represent positive images and form wherever silver halide remains after the black-and-white development step. Areas **28**, **210** and **211** of auxiliary layer **27***a* are comprised of silver halide. These areas do not color develop during the color development step because the element was reversal fogged with a chemical fogging agent. Subsequent to color development, the element is contacted with a bleach-fix composition and is then washed. State **4** depicts the element subsequent to bleach-fixing and washing. Layers **23***c*, **24***c* and **26***c* of areas **28**, **29** and **210** are clear, the silver which was developed during the black-and-white development step having been bleached and fixed out. Picture area **211** of these areas is comprised of dyes, the silver developed during color development having been bleached and fixed out. Auxiliary layer **27***c* in areas **28**, **210** and **211** are clear, the residual silver ha-

lide having been fixed out. Areas **29** of auxiliary layer **27***c* are comprised of silver, since the silver developed in these areas was protected by the nondiffusible ballasted bleach inhibitor present in the auxiliary layer. The processed element is thus comprised of a dye picture record and a silver sound record.

The following example is included for a further understanding of the invention.

## EXAMPLE

Strips of a conventional incorporated coupler reversal print film, for example, Eastman Ektachrome Reversal Print Film, having coated on a transparent cellulose acetate film support, in order from the support, a gelatino silver halide color-forming unit primarily sensitive to the red region of the visible spectrum and containing a phenolic cyan-forming photographic coupler, a gelatino silver halide color-forming unit primarily sensitive to the green region of the visible spectrum and containing a 5-pyrazolone magenta-forming photographic coupler, a yellow dye filter layer and a gelatino silver halide color-forming unit primarily sensitive to the blue region of the visible spectrum and containing an open-chain ketomethylene yellow-forming photographic coupler is overcoated with an auxiliary gelation silver chlorobromide (80/20) (0.1 micron average grain size) emulsion layer primarily sensitive to the blue-green region of the visible spectrum having a peak sensitivity at about 480 nm. and having a photographic speed at this peak sensitivity of at least 2 times slower than the photographic speed of the slower of the blue and green sensitive layers. This auxiliary layer contains about 150 mg/ft.$^2$ gelatin and a nondiffusible ballasted silver bleach inhibitor and other addenda as shown in the table below. Unless otherwise specified, the coupler solvent is used to disperse both the coupler, if used, and the bleach inhibitor. The element is given a white light flash exposure in the sound track area of sufficient intensity to fully expose the red, green and blue sensitive color-forming units but of insufficient intensity to expose the auxiliary layer. Subsequently the element is given a white light exposure in the picture record area and a blue-green exposure in the sound track area with a narrow band of light having a maximum intensity at about 480 nm. with a bandwidth at half height of about 20 nm. through a step exposure object and is processed as shown below:

| | |
|---|---|
| 1. Prehardener | 40 sec. |
| 2. Neutralizer | 30 sec. |
| 3. Black-and-White Developer | 60 sec. |
| 4. Stop Bath | 30 sec. |
| 5. Wash | 60 sec. |
| 6. Color Developer | 180 sec. |
| 7. Stop Bath | 30 sec. |
| 8. Wash | 60 sec. |
| 9. Bleach-fix | 180 sec. |
| 10. Wash | 60 sec. |
| 11. Stabilizer | 30 sec. |
| Processing temperature | 52°C. |

The chemical composition of the above processing baths in shown below.

| | |
|---|---|
| 1. Prehardener | |
| Water | 800 ml. |
| p-Toluenesulfinic acid, Na salt | .5 g. |
| Sulfuric acid (18N) | 5.41 ml. |
| Dimethoxytetrahydrofuran | 4.3 ml. |
| Sodium sulfate | 154 g. |
| Sodium bromide | 2 g. |
| Sodium acetate | 20 g. |
| Formaldehyde (37.5%) | 27 ml. |
| N-Methyl-benzothiazolium-p-toluenesulfonate (antifoggant) (1.0%) | 3 ml. |
| Water to | 1 liter |
| 2. Neutralizer | |
| Water | 800 ml. |
| Hydroxylamine sulfate | 22 g. |
| Sodium bromide (anhydrous) | 17 g. |
| Sodium sulfate (anhydrous) | 50 g. |
| Glacial acetic acid | 10 ml. |
| Sodium hydroxide | 5.7 g. |
| Water to | 1 liter |
| 3. **Black-and-White Developer** | |
| Water | 800 ml. |
| Sodium sulfite (anhydrous) | 44 g. |
| Sodium tetraborate (borax) | 12 g. |
| Hydroquinone | 8 g. |
| Phenidone | .55 g. |
| Sodium bromide | 1.3 g. |
| Sodium hydroxide | .75 g. |
| Water to | 1 liter |
| 4. + 7. **Stop Bath** | |
| Water | 800 ml. |
| Glacial acetic acid | 30 ml. |
| Sodium hydroxide | 5.35 g. |
| Water to | 1 liter |
| 6. Color Developer | |
| Water | 800 ml. |
| Benzyl alcohol | 5.25 ml. |
| Potassium bromide | 1.68 g. |
| Potassium iodide | 5.3 g. |
| Sodium metaborate (Kodalk) | 85 g. |
| Sodium sulfite | 2 g. |
| 4-Amino-3-methyl-N-ethyl-N-β-(methanesulfonamido)ethylaniline (color developer) | 5.25 g. |
| Tetramethylammonium hydrotriborate | .1 g. |
| Sodium hydroxide to pH | 10.7 |
| Water to | 1 liter |
| 9. Bleach-fix | |
| Water | 600 ml. |
| Ammonium iron (III) ethylenediamine tetraacetic acid | 60 g. |
| Sodium sulfite | 12 g. |
| Ammonium thiocyanate | 12 g. |
| Ammonium thiosulfate 60% | 200 ml. |
| Sodium EDTA | 6.7 g. |
| Water to | 1 liter |
| 11. Stabilizer | |
| Renex 30 (a polyethylene ether alcohol sold by Atlas Chemical) | 0.14 ml. |
| Formaldehyde (37.5%) | 7 ml. |
| Water to | 1 liter |

## CONTENTS OF AUXILIARY LAYER

| El. No. | Silver Mg/ft.$^2$ | Coupler Solvent Compound | Coupler mg/ft.$^2$ | Coupler[a] mg/ft.$^2$ | Bleach Inhibitor Compound | Bleach Inhibitor mg/ft.$^2$ | Retained silver density (Dmax) in sound track |
|---|---|---|---|---|---|---|---|
| 1 | 73 | A | 50 | 100 | — | — | 0.04 |
| 2 | 74 | A | 50 | 100 | C | 3.0 | 1.46 |
| 3 | 110 | A | 50 | 100 | C | 5.0 | 1.94 |
| 4 | 73 | A | 50 | 100 | C | 8.0 | 1.16 |
| 5 | 131 | A | 100 | — | C | 5.0 | 2.54 |
| 6 | 131 | A | 150 | — | C | 5.0 | 2.54 |
| 7 | 136 | B | —[b] | 100 | C | 5.0 | 2.37 |
| 8 | 136 | B | —[b] | — | C | 5.0 | 1.47 |
| 9 | 123 | —[c] | — | — | C | 10.0 | 1.90 |
| 10 | 126 | — | — | — | C | 5.0 | 1.47 |
| 11 | 72 | A | 50 | 100 | D | 5.6 | 1.10 |
| 12 | 110 | A | 50 | — | D | 5.6 | 1.56 |
| 13 | 115 | A | 50 | 100 | E | 5.6 | 2.16 |
| 14 | 106 | A | 50 | 100 | F | 4.6 | 1.66 |
| 15 | 118 | A | 50 | — | F | 4.6 | 1.33 |
| 16 | 73 | A | 50[d] | 100 | G | 5.4 | 1.14 |

Coupler Solvents:
A. Di-n-butylphthalate
B. Ethyl acetate
Bleach Inhibitors:
C. 1-(3-nonanamidophenyl)-5-mercaptotetrazole
D. 1-(3-dodecanamidophenyl)-5-mercaptotetrazole
E. 1-(3-nonanamidophenyl)tetrazol-5-ylthio acetate
F. 1-(3-heptanamidophenyl)-5-mercaptotetrazole
G. 1-(3-undecanamidophenyl)-5-mercaptotetrazole
a. 1-hydroxy-2-[Δ-2,4-di-tert-amylphenoxy)-n-butyl]naphthamide,

b. coupler solvent removed from emulsion after dispersion and before coating,

c. bleach inhibitor dispersed in the emulsion by first dissolving in 0.1N sodium hydroxide,

d. coupler solvent used to disperse coupler only, bleach inhibitor dispersed as in element 10.

The processed elements contain positive nondiffusible dye image records substantially free of silver in the picture record area and silver images in the sound track area. The density of the silver images retained through the bleach-fix step is shown in the table. The above elements when exposed to multicolor picture records and sound track records, processed as above and projected with an optical sound projector are subjectively evaluated by observers as yielding an excellent picture record and sound record.

Similar results are obtained when the auxiliary layer contains the following nondiffusible ballasted silver bleach inhibitors which are incorporated in a manner and quantity similar to those shown in the table.

H. 1-(3-decanamidophenyl)-5-mercaptotetrazole

I. 6-nonanamido-2-mercaptobenzothiazole

J. 6-nonanamido-2-mercaptobenzimidazole

K. 5-nonanamido-2-mercaptothiadiazole

L. 1-(3-nonanamidophenyl)tetrazol-5-yl disulfide

The invention has been described in detail with particular reference to 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 multilayer color photographic element comprising a support having coated thereon (1) a picture recording photographic unit comprising at least one silver halide emulsion layer and (2) an image recording auxiliary photographic silver halide emulsion layer which does not form an image upon image-forming exposure of said picture recording unit, said auxiliary layer containing a nondiffusible ballasted silver bleach inhibitor.

2. A multilayer color photographic element comprising a transparent support having coated thereon (1) a picture recording photographic unit comprising at least one silver halide emulsion layer containing a nondiffusing photographic color coupler which reacts with oxidized aromatic primary amine color developing agent to form a nondiffusible dye and (2) an auxiliary sound recording photographic silver halide emulsion layer which does not form an image upon image-forming exposure of said picture recording unit, said auxiliary layer containing a nondiffusible ballasted silver bleach inhibitor.

3. A multilayer color photographic element of claim 2 wherein said nondiffusible ballasted silver bleach inhibitor in said auxiliary layer has the formulas:

I. $R_a^1-(A^1)_a-XR^5$

II. $R_a^2-(A^2)_a-X-X-(A^3)_a-R_a^3$ or

III. $R_a^4-(A^4)_a-X^{\ominus}Y^{\oplus}$

wherein:

a represents 0, 1, 2, 3, 4, 5 or 6;

X represents sulfur or selenium;

$R^1$, $R^2$, $R^3$ and $R^4$ each represents nitro, halo, an alkyl group, an aryl group, a thio group containing from three to 22 carbon atoms, an amido group containing from four to 22 carbon atoms, a carbonyl group, a carbamoyl group, an alkoxy group or an aryloxy group;

$R^5$ represents hydrogen or an acyl group;

$Y^{\oplus}$ represents a basic cation;

$A^1$, $A^2$, $A^3$ and $A^4$ each represents a carbonyl group, a thiocarbonyl group, a carboxymethylene group, a three to six membered carbocyclic ring or a three to six membered heterocyclic ring containing at least one carbon atom and at least one heteroatom selected from nitrogen, oxygen, sulfur or selenium such that $R^1$, $R^2$, $R^3$ and $R^4$ do not represent a carbonyl group, a carbamoyl group or an amido group when $A^1$, $A^2$, $A^3$ and $A^4$ represent a carbonyl group or a thiocarbonyl group and such that the grouping $R_a^1-(A^1)_a-$, the grouping $R_a^2-(A^2)_a-$, the grouping $R_a^3-(A^3)_a-$ and the grouping $R_a^4-(A^4)_a-$ each represents a moiety having a molecular weight of from 125 to 1,000 and such that when $A^1$, $A^2$, $A^3$ and $A^4$ represent a carbocyclic or a heterocyclic ring, said ring has attached to it at least one hydrophobic moiety which renders said bleach inhibitor non-diffusible.

4. A multilayer color photographic element of claim 3 wherein $A^1$, $A^2$, $A^3$ and $A^4$ each represents a radical containing a five to six membered heterocyclic ring containing at least one nitrogen atom.

5. A multilayer color photographic element of claim 4 wherein $R_a^1-(A^1)_a-$, $R_a^2-(A^2)_a-$, $R_a^3-(A^3)_a-$ and $R_a^4-(A^4)_a-$ each represents a benzoxazole radical, a benzothiazole radical, a benzimidazole radical, a thiadiazole radical, a triazole radical or a 1-phenyltetrazole radical.

6. A multilayer color photographic element comprising a transparent support having coated thereon, on one surface in order from the support, (1) a picture recording color-forming unit comprising at least one photographic silver halide emulsion layer primarily sensitive to the red region of the visible spectrum and containing a nondiffusing photographic coupler which reacts with oxidized aromatic primary amine color developing agent to form a nondiffusing cyan dye, (2) a picture recording photographic color-forming unit comprising at least one silver halide emulsion layer primarily sensitive to the green region of the visible spectrum and containing a nondiffusing photographic coupler which reacts with oxidized aromatic primary amine color developing agent to form a nondiffusing magenta dye, (3) a yellow filter layer, (4) a picture recording photographic color-forming unit comprising at least one silver halide emulsion layer primarily sensitive to the blue region of the visible spectrum and containing a non-diffusing photographic coupler which reacts with oxidized aromatic primary amine color developing agent to form a non-diffusing yellow dye and (5) a sound recording auxiliary photographic silver halide emulsion layer which does not form an image upon image-forming exposure of the picture recording units, said auxiliary layer containing a nondiffusible ballasted silver bleach inhibitor.

7. A multilayer color photographic element comprising a transparent support having coated thereon, on one surface, (1) three picture recording photographic color-forming units and a yellow filter layer, each unit comprising at least one silver halide emulsion layer, which units and filter layer are so disposed and sensitized that each color-forming unit is essentially sensitive to a different primary color region of the visible spectrum and contains a nondiffusing color coupler

which reacts with oxidized aromatic primary amine color developing agent to form a nondiffusing dye essentially complimentary in color to the sensitivity of the unit in which it is incorporated and (2) an auxiliary sound recording silver halide emulsion layer which does not form an image upon image-forming exposure of the picture recording units, said auxiliary layer containing a nondiffusible ballasted silver bleach inhibitor, said bleach inhibitor having the following formula:

I. $R_a^1$–(A¹)–XR⁵

II. $R_2^2$–(A²)–X–X–(A³)–$R_a^3$ or

III. $R_2^4$–(A⁴)–X⊖Y⊕

wherein:

a represents 0, 1, 2, 3, 4, 5 or 6;

X represents sulfur or selenium;

$R^1$, $R^2$, $R^3$ and $R^4$ each represents nitro, halo, an alkyl group, an aryl group, a thio group containing from three to 22 carbon atoms, an amido group containing from four to 22 carbon atoms, a carbonyl group, a carbamoyl group, an alkoxy group or an aryloxy group;

$R^5$ represents hydrogen or an acyl group;

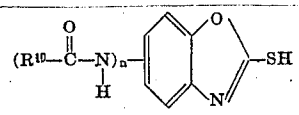
$Y^{\oplus}$ represents a basic cation;

$A^1$, $A^2$, $A^3$ and $A^4$ each represents a carbonyl group, a thiocarbonyl group, a carboxymethylene group, a 3 to 6 membered carbocyclic ring or a 3 to 6 membered heterocyclic ring containing at least one carbon atom and at least one heteroatom selected from nitrogen, oxygen, sulfur or selenium such that $R^1$, $R^2$, $R^3$ and $R^4$ do not represent a carbonyl group, a carbamoyl group or an amido group when $A^1$, $A^2$, $A^3$ and $A^4$ represent a carbonyl group or a thiocarbonyl group and such that the grouping $R_2^1$–(A¹)–, the grouping $R_a^2$–(A²)– , the grouping $R_a^3$–(A³)– and the grouping $R_a^4$–(A⁴)– each represents a moiety having a molecular weight of from 125 to 1,000 and such that when $A^1$, $A^2$, $A^3$ and $A^4$ represent a carbocyclic or a heterocyclic ring, said ring has attached to it at least one hydrophobic moiety which renders said bleach inhibitor nondiffusible.

8. A multilayer color photographic element of claim 7 wherein $A^1$, $A^2$, $A^3$ and $A^4$ each represents a radical containing a five to six membered heterocyclic ring containing at least one nitrogen atom.

9. A multilayer color photographic element of claim 8 wherein $R_a^1$–(A¹)–, $R_a^2$–(A²)–, $R_a^3$–(A³)– and $R_a^4$–(A⁴)– each represents a benzoxazole radical, a benzothiazole radical, a benzimidazole radical, a thiadiazole radical, a triazole radical or a 1-phenyltetrazole radical.

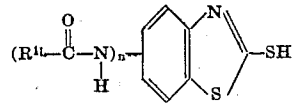
10. A multilayer color photographic element of claim 7 wherein said nondiffusible ballasted silver bleach inhibitor has the following formula:



wherein *n* represents a positive integer of from 1 to 5 and $R^{10}$ represents an alkyl group having from one to 17 carbon atoms.

11. A multilayer color photographic element of claim 10 wherein *n* represents 1 and $R^{10}$ represents an alkyl group having from five to 12 carbon atoms.

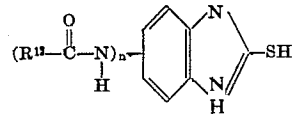
12. A multilayer color photographic element of claim 7 wherein said nondiffusible ballasted silver bleach inhibitor has the following formula:



wherein *n* represents a positive integer of from 1 to 5 and $R^{11}$ represents an alkyl group having from one to 17 carbon atoms.

13. A multilayer color photographic element of claim 12 wherein *n* represents 1 and $R^{11}$ represents an alkyl group having from five to 12 carbon atoms.

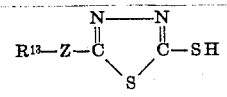
14. A multilayer color photographic element of claim 7 wherein said nondiffusible ballasted silver bleach inhibitor has the following formula:



wherein *n* represents a positive integer of from 1 to 5 and $R^{12}$ represents an alkyl group having from one to 17 carbon atoms.

15. A multilayer color photographic element of claim 14 wherein *n* represents 1 and $R^{12}$ represents an alkyl group having from five to 12 carbon atoms.

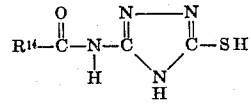
16. A multilayer color photographic element of claim 7 wherein said nondiffusible ballasted silver bleach inhibitor has the following formula:



wherein Z represents a member selected from the group consisting of sulfur and the group —NHCO— and $R^{13}$ represents an alkyl group having from five to 17 carbon atoms.

17. A multilayer color photographic element of claim 16 wherein $R^{13}$ represents an alkyl group having from eight to 12 carbon atoms.

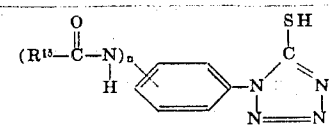
18. A multilayer color photographic element of claim 7 wherein said nondiffusible ballasted silver bleach inhibitor has the following formula:



wherein $R^{14}$ represents an alkyl group having from five to 17 carbon atoms.

19. A multilayer color photographic element of claim 18 wherein $R^{14}$ is an alkyl group having from eight to 12 carbon atoms.

20. A multilayer color photographic element of claim 7 wherein said nondiffusible ballasted silver bleach inhibitor has the following formula:



wherein *n* represents a positive integer of from 1 to 5 and $R^{15}$ represents an alkyl group having from one to 17 carbon atoms.

21. A multilayer color photographic element of claim 20 wherein *n* represents 1 and $R^{15}$ represents an alkyl group having from five to 12 carbon atoms.

22. A multilayer color photographic element comprising a transparent support having coated thereon, on one surface in order from the support, (1) a picture recording photographic color-forming unit comprising at least one silver halide emulsion layer primarily sensitive to the red region of the visible spectrum containing a nondiffusing cyan dye forming photographic color coupler, (2) a picture recording photographic color-forming unit comprising at least one silver halide emulsion layer primarily sensitive to the green region of the visible spectrum and containing a nondiffusing magenta dye forming photographic color coupler, (3) a yellow filter layer (4) a picture recording photographic color-forming unit comprising at least one silver halide emulsion layer primarily sensitive to the blue region of the visible spectrum and containing a nondiffusing yellow forming photographic color coupler and (5) an auxiliary sound recording photographic silver halide emulsion layer which does not form an image upon image-forming exposure of the picture recording color-forming units and containing as a nondiffusible ballasted silver bleach inhibitor 1-(3-nonanamidophenyl)-mercaptotetrazole.

23. A multilayer color photographic element comprising a transparent support having coated thereon, on one surface in order from the support, (1) a picture recording photographic color-forming unit comprising at least one silver halide emulsion layer primarily sensitive to the red region of the visible spectrum and containing a nondiffusing cyan dye forming photographic color coupler, (2) a picture recording photographic silver halide emulsion layer primarily sensitive to the green region of the visible spectrum and containing a nondiffusing magenta dye forming photographic color coupler, (3) a yellow filter layer, (4) a picture recording photographic color-forming unit comprising at least one silver halide emulsion layer primarily sensitive to the blue region of the visible spectrum and containing a nondiffusing yellow dye forming photographic color coupler, and (5) an auxiliary sound recording photographic silver halide emulsion layer which does not form an image upon image-forming exposure of the picture recording color-forming units and containing as a nondiffusible ballasted silver bleach inhibitor 6-nonanamido-2-mercapto-1,3-benzimidazole.

24. The process of producing a picture record and an auxiliary silver image record in an imagewise exposed photographic element comprising a support having coated thereon (1) a picture recording photographic color-forming unit comprising at least one silver halide emulsion layer and (2) an image recording auxiliary photographic silver halide emulsion layer which does not form an image upon image-forming exposure of said picture recording unit, said auxiliary layer containing a nondiffusible ballasted silver bleach inhibitor, which process comprises (A) developing silver halide in said element with a black-and-white developing agent to form a silver picture record in said picture recording unit and a silver auxiliary image record in said auxiliary layer, (B) fogging silver halide in the picture recording layers but not fogging undeveloped silver halide in the auxiliary layer of said element and developing said element with aromatic primary amine color developing agent in the presence of a photographic color coupler to form a picture record comprising silver and a nondiffusible dye in said picture recording unit and thereafter (C) removing the residual silver halide and bleachable silver remaining after steps (A) and (B) by bleaching and fixing while retaining silver in said auxiliary layer to form said auxiliary silver image.

25. The process of producing a picture record and a silver sound track record in a photographic element imagewise exposed to a picture image and a sound track image comprising a support having coated thereon (1) a picture recording photographic color-forming unit comprising at least one silver halide emulsion layer containing a nondiffusing color coupler which reacts with oxidized aromatic primary amine color developing agent to form a nondiffusing dye and (2) an auxiliary sound recording photographic silver halide emulsion layer which does not form an image upon image-forming exposure of said picture recording unit, said auxiliary layer containing a nondiffusible ballasted silver bleach inhibitor which comprises (A) developing silver halide in said element with black-and-white developing agent to form a picture record of silver in said picture recording unit and a sound record of silver in said auxiliary layer, (B) fogging silver halide in the picture recording layers but not fogging undeveloped silver halide in the auxiliary layer of said element and developing said element with aromatic primary amine color developing agent to form a picture record comprising silver and a nondiffusible dye in said picture recording unit and thereafter (C) removing the residual silver halide and bleachable silver remaining after steps (A) and (B) by bleaching and fixing while retaining silver in said auxiliary layer to form said silver sound record.

26. The process of claim 25 wherein said nondiffusible ballasted bleach inhibitor in said auxiliary layer has the formula:

I. $R_a^1-(A^1)-XR^5$

II. $R_a^2-(A^2)-X-X-(A^3)-R_a^3$ or

III. $R_a^4-(A^4)-X^{\ominus}Y^{\oplus}$

wherein:

*a* represents 0, 1, 2, 3, 4, 5 or 6;

X represents sulfur or selenium;

$R^1$, $R^2$, $R^3$, and $R^4$ each represents nitro, halo, an alkyl group, an aryl group, a thio group containing from three to 22 carbon atoms, an amido group containing from four to 22 carbon atoms, a carbonyl group, a carbamoyl group, an alkoxy group or an aryloxy group;

$R^5$ represents hydrogen or an acyl group;

$Y^{\oplus}$ represents a basic cation;

$A^1$, $A^2$, $A^3$ and $A^4$ each represents a carbonyl group, a thiocarbonyl group, a carboxymethylene group, a three to six membered carbocyclic ring or a three to six membered heterocyclic ring containing at least one carbon atom and at least one heteroatom selected from nitrogen, oxygen, sulfur or selenium such that $R^1$, $R^2$, $R^3$ and $R^4$ do not represent a carbonyl group, a carbamoyl group or an amido group

when $A^1$, $A^2$, $A^3$ and $A^4$ represent a carbonyl group or a thiocarbonyl group and such that the grouping $R_a^1-(A^1)-$, the grouping $R_a^2-(A^2)-$, the grouping $R_a^3-(A^3)-$and the grouping $R_a^4-(A^4)-$ each represents a moiety having a molecular weight of from 125 to 1,000 and such that when $A^1$, $A^2$, $A^3$ and $A^4$ represent a carbocyclic or a heterocyclic ring, said ring has attached to it at least one hydrophobic moiety which renders said bleach inhibitor nondiffusible.

**27**. The process of claim **26** wherein $A^1$, $A^2$, $A^3$ and $A^4$ each represents a radical containing a five to six membered heterocyclic ring, said ring containing at least one nitrogen atom.

**28**. The process of claim **27** wherein $R_a^1-(A^1)-$, $R_a^2-(A^2)-$, $R_a^3-(A^3)-$ and $R_a^4-(A^4)-$ each represents a benzoxazole radical, a benzothiazole radical, a benzimidazole radical, a thiadiazole radical, a triazole radical or a 1-phenyltetrazole radical.

**29**. The process of producing a picture record and a silver sound track record in a photographic element imagewise exposed to a color picture image and a sound track image comprising a transparent support having coated thereon, on one surface, in order from the support, (1) a picture recording photographic color-forming unit comprising at least one silver halide emulsion layer primarily sensitive to the red region of the visible spectrum and containing a nondiffusing photographic coupler which reacts with oxidized aromatic primary amine color developing agent to form a nondiffusing cyan dye, (2) a picture recording photographic color-forming unit comprising at least one silver halide emulsion layer primarily sensitive to the green region of the visible spectrum and containing a nondiffusing photographic coupler which reacts with oxidized aromatic primary amine color developing agent to form a nondiffusing magenta dye, (3) a yellow filter layer, (4) a picture recording photographic color-forming unit comprising at least one silver halide emulsion layer primarily sensitive to the blue region of the visible spectrum and containing a nondiffusing photographic color coupler which reacts with oxidized aromatic primary amine color developing agent to form a nondiffusing yellow dye and (5) a sound recording auxiliary photographic silver halide emulsion layer which does not form an image upon image-forming exposure of the picture recording units, said auxiliary layer containing a nondiffusible ballasted silver bleach inhibitor, which process comprises (A) developing silver halide in said element with black-and-white developing agent to form a silver picture record in said picture recording units and a silver sound record in said auxiliary layer, (B) fogging silver halide in the picture recording layers but not fogging undeveloped silver halide in the auxiliary layer of said element and developing said element with aromatic primary amine color developing agent to form a picture record comprising silver and a nondiffusible dye in said picture recording unit and (C) removing residual silver halide and bleachable silver remaining after steps (A) and (B) by bleaching and fixing while retaining silver in said auxiliary layer to form a silver sound track record and a color picture record.

**30**. The process of producing a picture record and a silver sound track record in a photographic element imagewise exposed to a color picture image and a sound track image comprising a transparent support having coated thereon, on one surface in order from the support, (1) three picture recording photographic color-forming units and a yellow filter layer, each unit comprising at least one silver halide emulsion layer, which units and filter layer are so disposed and sensitized that each said unit is essentially sensitive to a different primary color region of the visible spectrum and contains photographic color coupler which reacts with oxidized aromatic primary amine color developing agent to form a nondiffusing dye essentially complimentary in color to the sensitivity of the unit in which it is incorporated and (2) an auxiliary sound recording photographic silver halide emulsion layer which does not form an image upon image-forming exposure of the picture recording units, said auxiliary layer containing a nondiffusible ballasted silver bleach inhibitor, said bleach inhibitor having the following formula:

I. $R_a^1-(A^1)-XR^5$

II. $R_a^2-(A^2)-X-X-(A^3)-R_a^3$ or

III. $R_a^4-(A^4)-X^{\ominus}Y^{\oplus}$

wherein:

*a* represents 0, 1, 2, 3, 4, 5, or 6;

X represents sulfur or selenium;

$R^1$, $R^2$, $R^3$ and $R^4$ each represents nitro, halo, an alkyl group, an aryl group, a thio group containing from three to 22 carbon atoms, an amido group containing from four to 22 carbon atoms, a carbonyl group, a carbamoyl group, an alkoxy group or an aryloxy group;

$R^5$ represents hydrogen or an acyl group;

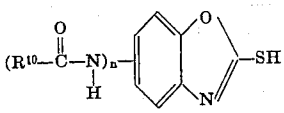
$Y^{\oplus}$ represents a basic cation;

$A^1$, $A^2$, $A^3$ and $A^4$ each represents a member selected from a carbonyl group, a thiocarbonyl group, a carboxymethylene group, a three to six membered carbocyclic ring or a three to six membered heterocyclic ring containing at least one carbon atom and at least one heteroatom selected from nitrogen, oxygen, sulfur or selenium such that $R^1$, $R^2$, $R^3$ and $R^4$ do not represent a carbonyl group, a carbamoyl group or an amido group when $A^1$, $A^2$, $A^3$ and $A^4$ represent a carbonyl group or a thiocarbonyl group and such that the grouping $R_a^1-(A^1)-$, the grouping $R_a^2-(A^2)-$, the grouping $R_a^3-(A^3)-$ and the grouping $R_a^4-(A^4)-$ each represents a moiety having a molecular weight of from 125 to 1,000 and such that when $A^1$, $A^2$, $A^3$ and $A^4$ represent a carbocyclic or a heterocyclic ring, said ring has attached to it at least one hydrophobic moiety which renders said bleach inhibitor nondiffusible, which process comprises (A) developing silver halide in said element with black-and-white developing agent to form a silver picture record in said picture recording unit and a silver sound record in said auxiliary layer, (B) fogging silver halide in the picture recording layers but not fogging undeveloped silver halide in the auxiliary layer of said element and developing said element with aromatic primary amine color developing agent to form a picture record comprising silver and a nondiffusible dye and (C) removing the residual silver halide and the bleachable silver remaining after steps (A) to (B) by bleaching and fixing while retaining silver in said auxiliary layer to form a silver sound track record and a color picture record.

31. The process of claim 30 wherein $A^1$, $A^2$, $A^3$ and $A^4$ each represents a radical containing a five to six membered heterocyclic ring, said ring containing at least one nitrogen atom.

32. The process of claim 31 wherein $R_a^1$—($A^1$)—, $R_a^2$—($A^2$)—, $R_a^3$—($A^3$)—, and $R_a^4$—($A^4$)— each represents a benzoxazole radical, a benzothiazole radical, a benzimidazole radical, a thiadiazole radical, a triazole radical or a 1-phenyltetrazole radical.

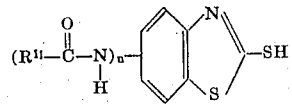
33. The process of claim 30 wherein said nondiffusible ballasted silver bleach inhibitor has the following formula:



wherein $n$ represents a positive integer of from 1 to 4 and $R^{10}$ represents an alkyl group having from one to 17 carbon atoms.

34. The process of claim 33 wherein n represents 1 and $R^{10}$ represents an alkyl group having from five to 12 carbon atoms.

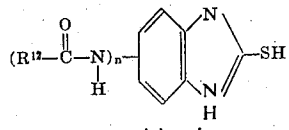
35. The process of claim 30 wherein said nondiffusible ballasted silver bleach inhibitor has the following formula:



wherein $n$ represents a positive integer of from 1 to 4 and $R^{11}$ represents an alkyl group having from one to 17 carbon atoms.

36. The process of claim 35 wherein $n$ represents 1 and $R^{11}$ represents an alkyl group having from five to 12 carbon atoms.

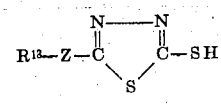
37. The process of claim 30 wherein said nondiffusible ballasted silver bleach inhibitor has the following formula:



wherein $n$ represents a positive integer of from 1 to 4 and $R^{12}$ represents an alkyl group having from one to 17 carbon atoms.

38. The process of claim 37 wherein $n$ represents 1 and $R^{12}$ represents an alkyl group having from five to 12 carbon atoms.

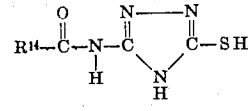
39. The process of claim 30 wherein said nondiffusible ballasted silver bleach inhibitor has the following formula:



wherein Z represents a member selected from the group consisting of sulfur and the group —NHCO— and $R^{13}$ represents an alkyl group having from five to 17 carbon atoms.

40. The process of claim 39 wherein $R^{13}$ represents an alkyl group having from eight to 12 carbon atoms.

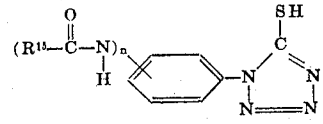
41. The process of claim 30 wherein said nondiffusible ballasted silver bleach inhibitor has the following formula:



wherein $R^{14}$ represents an alkyl group having from five to 17 carbon atoms.

42. The process of claim 41 wherein $R^{14}$ is an alkyl group having from eight to 12 carbon atoms.

43. The process of claim 30 wherein said nondiffusible ballasted silver bleach inhibitor has the following formula:



wherein $n$ represents a positive integer of from 1 to 5 and $R^{15}$ represents an alkyl group having from one to 17 carbon atoms.

44. The process of claim 43 wherein $n$ represents 1 and $R^{15}$ represents an alkyl group having from five to 12 carbon atoms.

45. The process of producing a picture record and a silver sound track record in a photographic element imagewise exposed to a color picture image and a sound track image comprising a transparent support having coated thereon, on one surface in order from the support, (1) a picture recording photographic color-forming unit comprising at least one silver halide emulsion layer primarily sensitive to the red region of the visible spectrum containing a nondiffusing cyan dye forming photographic color coupler, (2) a picture recording photographic color-forming unit comprising at least one silver halide emulsion layer primarily sensitive to the green region of the visible spectrum and containing a nondiffusing magenta dye forming photographic color coupler, (3) a yellow filter layer, (4) a picture recording photographic color-forming unit comprising at least one silver halide emulsion layer primarily sensitive to the blue region of the visible spectrum and containing a nondiffusing yellow dye forming photographic color coupler and (5) an auxiliary sound recording photographic silver halide emulsion layer which does not form an image upon image-forming exposure of the picture recording color-forming units and containing as a nondiffusible ballasted silver bleach inhibitor 1-(3-nonanamidophenyl)-5-mercaptotetrazole, which process comprises (A) developing said exposed element with black-and-white developing agent to form a silver picture record in said picture recording units and a silver sound record in said auxiliary layer, (B) fogging silver halide in the picture recording layers but not fogging undeveloped silver halide in the auxiliary layer of said element and developing said element with aromatic primary amine color developing agent to form a picture record comprising silver and a nondiffusible dye in said picture recording units and (C) removing the residual silver halide and the bleachable silver ha-

lide remaining after steps (A) and (B) by bleaching and fixing while retaining silver in said auxiliary layer to form a silver sound record and a color picture record.

**46.** The process of producing a picture record and a silver sound track record in a photographic element imagewise exposed to a color picture image and a sound track image comprising a transparent support having coated thereon, on one surface in order from the support, (1) a picture recording photographic color-forming unit comprising at least one silver halide emulsion layer primarily sensitive to the red region of the visible spectrum and containing a non-diffusing cyan dye forming photographic color coupler, (2) a picture recording photographic color-forming unit comprising at least one silver halide emulsion layer primarily sensitive to the green region of the visible spectrum and containing a nondiffusing magenta dye forming photographic color coupler, (3) a yellow filter layer, (4) a picture recording photographic color-forming unit comprising at least one silver halide emulsion layer primarily sensitive to the blue region of the visible spectrum and containing a nondiffusible yellow dye-forming photographic coupler and (5) an auxiliary sound recording photographic silver halide emulsion layer which does not form an image upon image-forming exposure of the picture recording unit and containing as a nondiffusible ballasted silver bleach inhibitor 6-nonanamido-2-mercapto-1,3-benzimidazole, which process comprises (A) developing said exposed element with black-and-white developing agent to form a silver picture record in said picture recording units and a silver sound record in said auxiliary layer, (B) fogging silver halide in the picture recording layers but not fogging undeveloped silver halide in the auxiliary layer of said element and developing said element with aromatic primary amine color developing agent to form a picture record comprising silver and a nondiffusing dye in said picture recording layers and (C) removing the residual silver halide and the bleachable silver remaining after steps (A) and (B) by bleaching and fixing while retaining silver in said auxiliary layer to form a silver sound record and a color picture record.

**47.** In a multilayer color photographic element comprising a support having coated thereon:

1. a picture-recording photographic color-forming unit comprising at least one silver halide emulsion layer; and,
2. an auxiliary image-recording unit comprising a photographic silver halide emulsion layer;

said photographic element being capable of recording:

1. an auxiliary record comprising silver, at least a portion of said silver record being in said auxiliary layer; and,
2. a picture record comprising silver, essentially all of said picture record silver being in said picture-recording color-forming unit:

the improvement wherein said photographic silver halide emulsion of said auxiliary image-recording unit contains a nondiffusible ballasted silver bleach inhibitor.

**48.** In a multilayer color photographic element comprising a support having coated thereon:

1. three picture-recording photographic color-forming units, each unit comprising at least one silver halide emulsion layer, each color-forming unit having an effective sensitivity to a different primary color region of the visible spectrum and containing a nondiffusing color coupler to react with oxidized aromatic primary amine color developing agent to form a nondiffusing dye essentially complementary in color to the sensitivity of the unit in which it is incorporated; and,
2. an auxiliary image-recording unit comprising a photographic silver halide emulsion layer;

said photographic element being capable of recording:

1. an auxiliary record comprising silver, at least a portion of said silver record being in said auxiliary unit; and,
2. a picture record comprising silver and dye, essentially all of said picture record silver being in said picture color-forming units;

the improvement wherein said photographic silver halide emulsion layer of said auxiliary image-recording unit contains a nondiffusible ballasted silver bleach inhibitor.

* * * * *