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PHOTOGRAPHIC FILM HAVING ENHANCED HERSCHEL EFFECT SUSCEPTIBILITY AND THE PROCESS USING THE SAME

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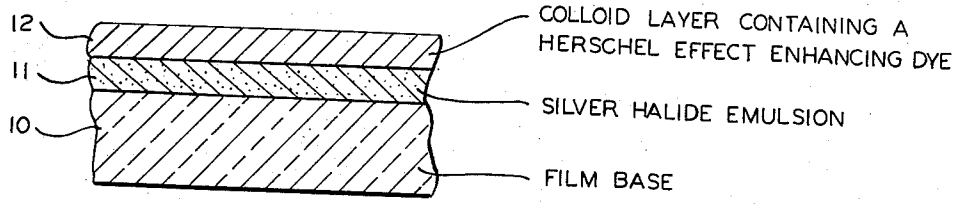


FIG. 1

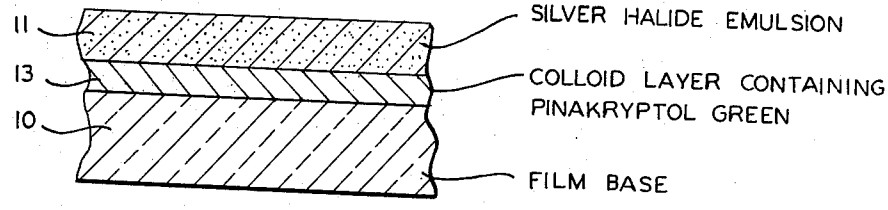


FIG. 2

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PHOTOGRAPHIC FILM HAVING ENHANCED HERSCHEL EFFECT SUSCEPTIBILITY AND THE PROCESS USING THE SAME

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This invention relates to photographic film and particularly to film having enhanced Herschel effect susceptibility for use in the Hersol process and to a method of preparing the same.

The Hersol process, briefly stated, is a photographic system of reproduction of an original in which the lines have been printed in various colors. The separation of the colors by ordinary methods cannot be accomplished without interference by black lettering or lines because the black cannot be dropped out. By "dropping out" the graphic art photographer means fading out a color so that it blends with or disappears into the background. For instance, if it is desired to drop out a green line on white paper by the usual method, using an orthochromatic green sensitive film plus a sharp green filter in the path of the light will make the green line disappear in the resulting negative. A red line can be dropped out by using a sharp cutting red filter and a red sensitive film. However, it is impossible to drop out a black line in this manner by conventional methods. Consequently, ordinary separations require considerable detailed retouching in order to remove the black image from the negative, a process which requires skilled artisans and much time.

This expensive and laborious step is avoided by making use of two rarely used photographic phenomena, solarization and the Herschel effect. The name Hersol is derived from these phenomena—the Herschel effect and solarization effect—therefore, "Her" and "sol"—Hersol. Of these two, the Herschel effect is more important. The solarization phenomena is less often used.

The "solarization" effect is the reversal obtained by using a powerful overexposure on an emulsion and then developing partially to obtain the maximum contrast. An illustration of this effect is often seen in night photographs of street scenes where the illuminated street lights appear black on the finished print. The high intensity of the street lights has caused this reversal.

The "Herschel" effect is shown when a latent image is progressively destroyed by exposure to an intense red light. The usable light is of a wavelength of about 500 A. longer than the peak sensitivity of the emulsion. This light can be obtained from an ordinary filament projection bulb, for example, one operating at 115 v. and consuming 500 w. This light source yields a continuous spectrum of which the region of 6000 A. and higher is segregated by the employment of a sharp cutting red filter of appropriate characteristics to illuminate the orthochromatic emulsion at an appropriate distance, for example 20 cm. The latent image previously formed is slowly reduced and under sufficient exposure time will ultimately disappear.

In the Hersol process, the blacks can be "dropped out" but to do so, it is necessary to reverse the order of procedures. Instead of using an ordinary film, it is necessary to use an emulsion which has an enhanced susceptibility to the Herschel effect. Instead of a clean and fog-free film, it is necessary to use an emulsion which has been given an initial overall exposure to light, and instead

of developing fully, it is necessary to develop partially. This procedure eliminates the necessity for a great deal of retouching and spotting-out, since in the usual system of separations, black appears open on all separation negatives. A photographic film is, therefore, required which is strongly susceptible to latent image destruction by red light (Herschel effect) and this sensitivity is conferred by a number of Herschel effect enhancing substances of which Pinakryptol Green is one of the most important.

The procedure for preparing separations according to the Hersol process was heretofore as follows.

A bath was prepared using about 5 mls. of $\frac{1}{1000}$ solution of Pinakryptol Green per liter of distilled water. A wetting agent was added and the emulsion soaked in this bath for about one minute. It was then drained and hung up to dry after which it is ready for use. These operations, which make use of orthochromatic films of high contrast (commercially available as "Reprolith Ortho" films) were carried out under a red safelight and drying of the film is carried out in darkness.

Before it is possible to have any reverse action, such as Herschel or solarization, it is necessary first to have a latent image to work on. This basic image is obtained by deliberately fogging the emulsion by exposure to white light and then making the additional exposures through the copy.

The orthochromatic film of medium or high contrast which has been pre-treated by immersion in a bath containing the Pinakryptol Green and overall exposure to light is then used for the initial separations, some of which are positives and some are negatives. These separations are prepared as follows.

The black separation is made by giving the pre-treated film a high initial, overall exposure. A subsequent contact exposure with high intensity tungsten light made through the copy erases the initially produced latent image everywhere but where the print is printed in black. The destruction of the latent fog image under the white background areas and under the blue, green and yellow lines is caused by solarization; the destruction of the initially produced latent image under the red lines is caused by the Herschel effect. A positive image of the black line is obtained after development.

The blue separation is made on pre-treated film which has been given a low overall initial exposure to overcome the initial exposure inertia and to adjust the latent background density. Two contact exposures are then made through the copy. The first, through a blue filter, builds up the image in the blue areas and the background. The images under the green, yellow and red areas remain unaffected because the latter do not transmit blue light. The latent image of the background area is then destroyed by a subsequent exposure through the original with red light which causes a repression due to the Herschel effect. A positive image of the blue areas is obtained after development.

The green separation is prepared in a similar manner as the blue separation except that the first contact exposure is made with yellow light through the original and causes an increase in latent density under the white, green and yellow areas and a lesser increase in latent density under the blue areas. A subsequent contact exposure with red light leaves the blue and green densities intact and destroys the latent densities under the yellow, red and background areas as a consequence of the Herschel effect. After development, a composite positive image of the blue and green areas is obtained. The blue images are cancelled out by combining the composite blue and green separation with a mask of opposite character prepared from the blue record.

The red separation is made on the film which has been given high initial overall exposure after the pretreatment

with Pinakryptol Green. A first contact exposure through a yellow filter increases the latent fog densities under the background, yellow and green portions. A second contact exposure with red light which is passed by the yellow, red and background areas causes a reversal in these areas due to the Herschel effect. This reversal effect is greatest under the red areas because the latent image produced by the first contact exposure under the background and yellow areas is greater than under the red areas. A negative is obtained after development.

The yellow separation is prepared in a similar manner as the red separation with the exception that the first contact exposure is given with blue light which builds up the latent image densities under the blue and background areas. A second exposure with red light results in a Herschel effect reversal under the red and yellow areas. A negative image of the red and yellow portions is obtained after development. A record of the yellow portions alone is obtained by masking the composite record with a positive of the red portions.

Inasmuch as some of the separations obtained are negatives while the others are positives, intermediate prints of one group must be made.

The bathing process for imparting Herschel effect susceptibility heretofore recommended has many inherent disadvantages. It is messy, time consuming, ties up a dark room and requires careful control of the Pinakryptol Green concentration, duration of immersion, temperature of the bath and agitation. Only small quantities of film can be treated in one bath. The photographic characteristics are changed to an undesirable extent because soluble bromides and other soluble ingredients of the treated film are removed from the emulsion. Even under carefully controlled conditions, the dried films are nonuniform in their characteristics and are marred by air bells, blotches and drying streaks.

In order to obviate some of the foregoing shortcomings, it has also been proposed to employ in the process, a light sensitive emulsion having the property of reversing upon exposure. The emulsion is prepared by producing the desired silver halide in a sufficiently small amount of gelatin to prevent the immediate formation of a stable emulsion or suspension. The silver halide is settled from the solution, subjected to solarization, emulsified in a sufficient quantity of gelatin solution to form a pourable emulsion and the emulsion coated upon a subbed film base. Instead of solarizing the silver halide desensitizing compounds such as, for example, thiazine or quinoxaline and similar dyestuffs are added to the emulsion prior to coating upon a film base.

Although emulsions prepared by the above procedure are of value in the preparation of film which, after exposure and development, yields direct positive pictures, they show little Herschel effect susceptibility. When used in the Hersol process, they yield pictures of low contrast and low maximum density. Moreover, the addition of the desensitizing compound to the emulsion is wasteful and requires large quantities of dye.

It is an object of the present invention to provide an orthochromatic film having enhanced Herschel effect susceptibility and being particularly suited to the Hersol process.

Another object is to provide a process of preparing said film.

Other objects and advantages will become apparent from the following description.

I have found that the aforementioned shortcomings can be very readily overcome by providing a special film which has a greatly enhanced susceptibility to the Herschel effect and completely eliminates the many variables involved in the pre-bathing treatment or in the addition of a Herschel effect enhancing compound to the emulsion. Such a film is obtained by contacting at least one surface of a high contrast emulsion with a separate layer containing a colloidal carrier and a compound which enhances the susceptibility of the emulsion to the Herschel effect. The colloidal layer is coated either above or below the high contrast emulsion and in contact therewith from an aqueous colloidal solution or dispersion containing from 0.5 percent to 10 percent of a water permeable colloid and the Herschel effect enhancing compound. If gelatin is used as a colloid, its optimum concentration lies between 1.0 percent and 3.5 percent. The proportions of the Herschel effect enhancer employed may range from 20 to 200 milligrams per liter of the colloidal carrier solution or dispersion used in the preparation of the surface coating, or from 0.15 to 2.0 milligrams per gram of silver nitrate used in the preparation of the overcoated silver halide emulsion. In terms of overcoated areas, the amounts may range from 0.1 (one tenth) to 1 milligram of Herschel effect enhancer per square foot of overcoated emulsion which, in turn, has a silver halide content corresponding to from 200 to 1000 milligrams of metallic silver per square foot. For any unit of area, the ratio of enhancer to the amount of silver present in the emulsion lies between 400 to 4000 parts of silver contained in the adjacent and contiguous emulsion for one part of enhancer. Vice versa, from 250 to 2500 parts per million of enhancer based on the amount of silver present in the overcoated or undercoated emulsion are required.

The aqueous dispersion is coated or spread over the subbed film base, prior to coating with a light sensitive emulsion or over the emulsion, and the coating allowed to dry in the usual manner. The coated film in which either the non-sensitive colloid layer, emulsion layer or both may contain a hardening agent, is then aged so as to allow it to reach its stabilized photographic and physical characteristics. The usual coating agents, such as those required to adjust the flexibility, such as glycerol, the hardness, such as formaldehyde, glyoxal or potassium chrome alum and photographically inert wetting agents, such as saponin, an isopropylnaphthalenesulfonate or sodium dioctyl sulfosuccinate may be added to the water permeable colloid Herschel effect enhancer solution or dispersion.

The degree of activity can be regulated by varying the thickness of the water permeable colloid coating containing the Herschel effect enhancer. A ratio of 1 unit thickness of the coating layer to 5 units thickness of the gelatino silver halide emulsion layer is of best practical value. The thickness of the coating layer may range from 0.3 to 4.5 microns and the thickness of the emulsion layer may range from 1.5 to 20 microns. For best practical results, the emulsion layer should be between 4 and 9 microns thick.

For still greater effect or for the treatment of emulsion layers of considerable thickness ranging from 8 to 20 microns, the water permeable colloid enhancer layer may be alternately coated over two or three alternate emulsion layers. When more than one colloid enhancer layer is coated adjacent to an emulsion, the total enhancer concentration is divided about equally between the layers. For example, where both an undercoat and overcoat are utilized adjacent to the emulsion layer, the quantity of enhancer in the coating layer is preferably the same in each coat. This quantity many range from 10 to 100 milligrams of Herschel effect enhancer per liter of water permeable colloid dispersion in each of the two layers which is the equivalent of 20 to 200 milligrams applied in a single layer.

The film prepared as above is most suitable for both contact and reflex methods of reproduction. In the latter case, the film has a clear backing. Best results are obtained with reflex printing exposures when the quantity of enhancer in the undercoat or overcoat is in the range of 10 to 55 cc. of a 0.1 percent solution of enhancer per liter of 2 percent aqueous dispersion of water permeable colloid.

The film may also have the customary antihalation backings. Although some of the Herschel effect enhanc-

ing compounds used are colored, they are employed in such low concentrations that the auxiliary layers are essentially colorless and do not give any protection against halation. Dyes for antihalation purposes are well known to those skilled in the art and need not be listed herein.

The films as above prepared are sufficiently stable under all ordinary conditions, are essentially free from fog and will retain their Herschel effect enhancing properties for a considerable period of time. The reason for the efficiency of this film and method of preparation is not fully known but is attributed to a gradual migration of the enhancer to the silver halide grain. This adsorption mechanism is apparently different from the one induced by bathing or by adding the enhancer directly to the molten emulsion and results in a greatly increased Herschel effect susceptibility.

The gelatino silver halide emulsion, constituting part of the foregoing film is an unsensitized or an orthochromatic emulsion of high contrast and has a gamma of at least 3.5. Silver chloride, bromide, or chloro-bromide emulsions may be employed, which must be free of iodide or have an iodide content which does not exceed 1.5 percent of iodine based on the amount of silver nitrate used in the preparation of the silver halide emulsion. The emulsions used are practically insensitive to radiation of wavelengths longer than 600 mμ, i. e., they do not yield a latent image when exposed with orange or red light.

As for the Herschel effect enhancing compounds which may be either dissolved or suspended in the aqueous water permeable dispersion, it is to be understood that any compound may be employed which enhances the Herschel effect when used for the bathing of silver halide emulsions. Compounds of this nature are disclosed in the photographic literature, cf., Walter Clark's "Photography by Infrared," second edition, 1946, pages 108 et seq.

As examples of such compounds, the following azine and triphenylmethane dyes may be mentioned:

Auramine	Colour Index No. 655
Malachite Green	Colour Index No. 657
Brilliant Green	Colour Index No. 662
Fuchsine	Colour Index No. 677
Iodine Green	Colour Index No. 686
Neutral Red	Colour Index No. 825
Phenosafranine	Colour Index No. 840
Safranine	Colour Index No. 841
Rosolane B	Colour Index No. 845
Aniline Violet	Colour Index No. 846
Diphene Blue B	Colour Index No. 851
Methylene Violet	Colour Index No. 922
Pinakryptol Green	Schultz, 7th ed., No. 944
Pinakryptol Yellow	Schultz, 7th ed., No. 929

The enhancer may be used singly or in suitably mixed proportions. It is to be noted that the nature or constitution of the compound is immaterial; so long as it imparts Herschel effect enhancing properties, it may be used in the present invention.

The water permeable colloids which can be used in the preparation of the Herschel effect enhancing layer are gelatin, water soluble cellulose derivatives, e. g., hydroxyethyl cellulose; polyvinyl alcohol and gelling compounds, e. g., o-hydroxybenzanilide or o-hydroxybenznaphthalide as described in U. S. Patent 2,249,537; the aldehyde reaction products of partially saponified mixed polymerization products of vinyl acetate and vinyl esters of higher fatty acids as disclosed in U. S. Patent 1,939,422; the acetals of partially hydrolyzed polyvinyl ester as disclosed in U. S. Patent 2,036,092. The polyvinyl acetaldehyde acetal resins having a polyvinyl acetaldehyde acetal content of at least 50 percent and an uncombined hydroxy content corresponding to at least 15 percent polyvinyl alcohol, and the partially hydrolyzed polyvinyl acetate resins having a polyvinyl acetate content of from about 20 percent to 50 percent and a hydroxyl content corresponding from 50 percent to 80 percent polyvinyl alcohol are preferred.

The film bases used in accordance with this invention include the cellulose derivatives, e. g., cellulose nitrate, cellulose acetate, and other lower fatty acid esters of cellulose including simple and mixed esters, such as cellulose propionate, cellulose butyrate, cellulose acetate-propionate, cellulose acetate butyrate, and the like, ethers of cellulose, such as the ethyl ether, benzyl ether, and the like, and fusible, water insoluble synthetic linear superpolymers used for film elements as described in U. S. Patents 2,071,250; 2,071,252; 2,071,253 and 2,130,948.

Instead of the foregoing film bases, polyvinyl resin film bases such as polyvinyl chloride, polyvinyl bromide, polyvinyl acetate, copolymers of vinyl chloride and vinyl acetate, copolymers of vinyl chloride and vinyl bromide, and a mixture of such polymers and copolymers may be employed.

For a fuller understanding of the nature and objects of the invention, reference is made to the following examples which are given to further illustrate the invention and they should be regarded as exemplary and not limitative. All parts are by weight.

Example I

Ten kilograms of an orthochromatic ammonia type emulsion of high contrast, and suitable for half tone reproductions having a gamma of 4 and a sensitivity which did not extend beyond 590 mμ were prepared for the following tests.

The emulsion contained 90 grams of gelatin and 40 grams of silver halide (predominantly silver bromide with small traces of silver iodide) per kilogram of liquid emulsion.

One liter of this melted emulsion was coated onto a cellulose acetate butyrate film base, allowed to set and chilled. An area of about 100 square feet was then overcoated with 800 milliliters of a 2 percent solution of gelatin containing, in addition to coating finals, such as saponin, glycerin and potassium chrome alum hardener, 50 milliliters of a 0.1 aqueous solution of Pinakryptol Green per liter of gelatin solution as a Herschel effect enhancer. After drying, the silver halide emulsion had a thickness of 6.5 microns and the overcoated layer had a thickness of 1.5 microns. In terms of overcoated area, the film contained 40 milligrams of Pinakryptol Green per square foot. The silver bromide content of the overcoated film was 400 milligrams per square foot.

A sheet of the resultant film was flash exposed with white light to produce a latent image which, on subsequent development, gave an image density of about 2.0.

Another sheet of the same film was given a flash exposure of the same intensity and duration and then exposed for 8 seconds from a distance of 30 inches with a 500 w. incandescent lamp through a red filter which did not transmit any light below 600 millimicrons. This exposure destroyed the latent image as a result of the Herschel effect and the film was completely clear after development.

This overcoated film was compared with a film which had been prepared by adding 250 milliliters of a 0.1 percent solution Pinakryptol Green to a kilogram of the same high contrast emulsion before coating and without providing the emulsion with an overcoat. This film was also susceptible to the Herschel effect but required 20 seconds exposure with red light to erase the latent image. It displayed thus, only 40 percent of the Herschel effect susceptibility of the overcoated film in spite of the fact that a much larger amount of Pinakryptol Green had been used in its preparation.

A comparison sample of the same emulsion without a Pinakryptol Green addition, overcoating, or bathing, did

not give a Herchel effect and showed no latent image regression when exposed with red light.

The overcoated film was also compared with an 8 x 10" sheet of film prepared from the same emulsion which was bathed for 2 minutes at 68° F. in 1 liter of a 0.001 percent solution of Pinakryptol Green. After drying, flashing, exposure to red light and developing, the treated sheet showed approximately the same degree of Herschel effect susceptibility as the film which had been prepared from the emulsion which contained 250 milliliters of a 0.1 percent solution of green per liter of emulsion.

Example II

A gelatin solution having the following composition:

Gelatin	gms	30
Water	mls	1000
Phenosafranine, 0.2 percent solution	cc	20
Potassium chrome alum, 10 percent	cc	5
Saponin, 5 percent solution	cc	20

was prepared by soaking the gelatin in cold water. After the gelatin had swelled, it was dissolved by placing the container in hot water and the volume made up to 1000 cc. by the addition of warm water. The other ingredients are then added and the resulting solution applied to the base in a manner which assured a uniform coating, such as by contacting the base with the surface of the melted solution.

The coated base was then chilled and overcoated with the orthochromatic emulsion described in Example I. The finished film had a Herschel effect susceptibility three times as great as that of a film which contained the phenosafranine in the emulsion.

Example III

A photographic emulsion prepared as described in Example I was coated on a suitable base material, allowed to set and overcoated with a gelatin solution having the following formula:

Gelatin	gms	15
Water	mls	1000
Pinakryptol Green, 0.1 percent solution	mls	60
Formaldehyde, 0.2 percent solution	mls	20
Saponin, 0.5 percent solution	mls	10

The coating was dried and overcoated with an additional coating of the orthochromatic emulsion described in Example I. The drying operation can be omitted, provided the coated layers are given sufficient time to chill and set before being covered by the additional emulsion layer.

The finished product in which the layer containing the Pinakryptol Green was sandwiched between two emulsion coatings was flash-fogged to a latent image density of 2.5. The latent image was destroyed by exposing it for 4 seconds with the light source described in Example I.

Example IV

A film was prepared in which two emulsion layers as described in Example I were separated by a layer prepared from a 1.5 percent gelatin solution containing, in addition to saponin and formaldehyde, 50 milliliters of a 0.1 percent aqueous Pinakryptol Yellow solution per liter. One additional layer was coated between the support and the lower emulsion layer and one additional layer was coated as a top layer over the upper emulsion. The resulting sandwich type film showed a strong Herschel effect susceptibility and required only less than one second exposure to red light to extinguish a latent image under the conditions described in Example I.

Example V

Example I was repeated with the exception that a high contrast "boiled" type emulsion having a gamma of 6 was used in place of the ammonia type emulsion. The overcoated emulsion showed a greatly enhanced Herschel effect susceptibility.

The invention is further illustrated by the accompanying drawing which shows, in cross section, films embodying my invention. Figure 1 shows a film base 10 carrying a silver halide emulsion 11 which is overcoated with a surface layer 12 containing a colloidal carrier and a dye which enhances the Herschel effect. Figure 2 shows a film carrying between the film base 10 and the emulsion layer 11 an intermediate layer 13 which contains a colloidal carrier material and Pinakryptol Green as a Herschel effect enhancing dye.

From the foregoing description and working examples, it is clearly apparent that the present invention provides a film having enhanced Herschel effect susceptibility which will save up to one third of the labor involved in using the Hersol process and since it is quite uniform, will save considerable time by reducing the number of incorrectly exposed separations. Its uniformity from one sheet to the next makes it possible to adjust the exposures carefully and with certainty of achieving the desired results.

In particular, it should be noted that the results obtained according to the present invention are highly unexpected in the light of the prior art. Thus, the average time required to extinguish a latent image in bathed films or samples containing the Herschel effect enhancing compounds in the emulsion exceeds by a factor of from 2.5 to more than 20 the time or light intensity required when using a film prepared in accordance with the present invention.

This application is a continuation-in-part of my copending application Serial No. 156,728, filed April 18, 1950, now abandoned.

I claim:

1. A photographic film comprising a base and a light sensitive silver halide emulsion of the type suitable for half-tone reproduction, said emulsion being essentially free from fog, insensitive to light of a wavelength exceeding 600 mμ, and having a gamma higher than 3.5, said silver halide being selected from the group consisting of silver chloride, silver bromide and silver chlorobromide but substantially free of silver iodide, and containing less than 1.5 percent of iodine based on the amount of silver nitrate used in the preparation of the emulsion, said film having coated in direct contact with said emulsion layer, a separate water permeable colloidal layer having uniformly dispersed therein, a dye which is known to enhance the Herschel effect in a concentration ranging from 0.15 to 2.0 milligrams per gram of silver nitrate used in the preparation of the contacted emulsion, and from 10 to 200 milligrams per liter of 0.5 percent to 10.0 percent aqueous dispersion of the water soluble colloid, said dye being selected from the group consisting of Auramine, Malachite Green, Brilliant Green, Fuchsine, Iodine Green, Neutral Red, Phenosafranine, Safranine, Rosolane B, Aniline Violet, Diphene Blue, Methylene Violet, Pinakryptol Green and Pinakryptol Yellow.

2. A photographic film comprising a base and a light sensitive silver halide emulsion of the type suitable for half-tone reproduction, said emulsion being essentially free from fog and insensitive to light of a wavelength exceeding 600 mμ, having a gamma higher than 3.5, and a silver halide content corresponding to from 200 to 1000 milligrams of metallic silver per square foot, said silver halide being selected from the group consisting of silver chloride, silver bromide and silver chlorobromide, but being substantially free of silver iodide and containing less than 1.5 percent of iodine based on the amount of silver nitrate used in the preparation of the emulsion, said film having coated in direct contact with said emulsion layer, a separate water permeable colloidal layer having uniformly dispersed therein, a dye which is known to enhance the Herschel effect in a concentration ranging from 0.1 to 1 milligram per square foot of overcoated

emulsion, said dye being selected from the group consisting of Auramine, Malachite Green, Brilliant Green, Fuchsine, Iodine Green, Neutral Red, Phenosafranine, Safranine, Rosolane B, Aniline Violet, Diphene Blue, Methylene Violet, Pinakryptol Green and Pinakryptol Yellow.

3. A photographic film comprising a base and a light sensitive silver halide emulsion of the type suitable for half-tone reproduction, said emulsion being essentially free from fog, insensitive to light of a wavelength exceeding 600 mμ and having a gamma higher than 3.5, said silver halide being selected from the group consisting of silver chloride, silver bromide and silver chlorobromide but substantially free of silver iodide with a silver iodide content corresponding to less than 1.5 percent of iodine based on the amount of silver nitrate used in the preparation of the emulsion, said film having in direct contact with said emulsion layer, a separate water permeable colloidal layer having uniformly dispersed therein a dye which is known to enhance the Herschel effect, said compound being in a concentration ranging from 250 to 2500 parts per million based on the amount of silver present in a unit of contacted emulsion, and from 0.1 to 1.0 milligram per square foot of contacted emulsion, said dye being selected from the group consisting of Auramine, Malachite Green, Brilliant Green, Fuchsine, Iodine Green, Neutral Red, Phenosafranine, Safranine, Rosolane B, Aniline Violet, Diphene Blue Methylene Violet, Pinakryptol Green and Pinakryptol Yellow.

4. A photographic film according to claim 1 wherein said dye is Pinakryptol Green.

5. A photographic film according to claim 2 wherein said dye is Pinakryptol Green.

6. A photographic film according to claim 3 wherein said dye is Pinakryptol Green.

7. A photographic film according to claim 1 wherein said dye is Pinakryptol Yellow.

8. A photographic film according to claim 2 wherein said dye is Pinakryptol Yellow.

9. A photographic film according to claim 3 wherein said dye is Pinakryptol Yellow.

10. In a process of progressively destroying a latent image in a photographic silver halide emulsion by exposure with intense red light which includes coating an emulsion on a suitable carrier, fogging the emulsion by exposure to light, having a wavelength shorter than 6000A. thereby forming a latent image, exposing the fogged emulsion through a transparency with red light having a continuous spectrum and a wavelength longer than 6000 A. thereby progressively destroying the latent image in the areas illuminated by red light as a result of the Herschel effect, developing and fixing the emulsion; the improvement which comprises enhancing the Herschel effect susceptibility of the emulsion by selecting a silver halide emulsion of the type suitable for half-tone reproduction having a gamma higher than 3.5, and insensitive to a wavelength exceeding 6000 A. said silver halide being selected from the class consisting of silver chloride, silver bromide and silver chlorobromide but substantially free of silver iodide and containing less than 1.5 percent of iodine based on the amount of silver nitrate used in the preparation of the emulsion; coating in direct contact with said emulsion a separate water permeable colloid layer having uniformly dispersed therein a dye which is known to enhance the Herschel effect and selected from the group consisting of Pinakryptol Green, Pinakryptol Yellow and Phenosafranine, said dye being in a concentration ranging from 0.15 to 2.0 milligrams per gram of silver nitrate used in the preparation of the silver halide emulsion and ranging from 10 to 200 milligrams per liter of 1.0 percent to 3.5 percent aqueous dispersion of the colloid used in the preparation of the said water permeable layer.

11. A process according to claim 10, wherein said dye is Pinakryptol Green.

12. A process according to claim 10 wherein said dye is Pinakryptol Yellow.

References Cited in the file of this patent

UNITED STATES PATENTS

1,946,640	Seymour	Feb. 13, 1934
2,126,516	Szasz	Aug. 8, 1938
2,358,590	Powers	Sept. 19, 1944
2,373,289	Brown	Apr. 10, 1945

FOREIGN PATENTS

5,932 of 1893	Great Britain	Jan. 20, 1894
324,330	Great Britain	Jan. 13, 1930
482,633	Great Britain	Apr. 1, 1938
532,895	Great Britain	Feb. 3, 1941

OTHER REFERENCES

British Journal of Photography, vol. 71, Sept. 5, 1924, page 537. (Copy in Scientific Library.)

Ilford Manual of Process Work, 4th ed. 1946 (page 76–81), Clerc; publ. by Percy Lund, Humphries & Co., Ltd., London, England.