March 6, 1956 C. CHILDRESS 2,737,457

PHOTOGRAPHIC METHOD OF TONAL SCALE COMPENSATION

Filed Nov. 22, 1952 2 Sheets-Sheet 1

FIG. 1

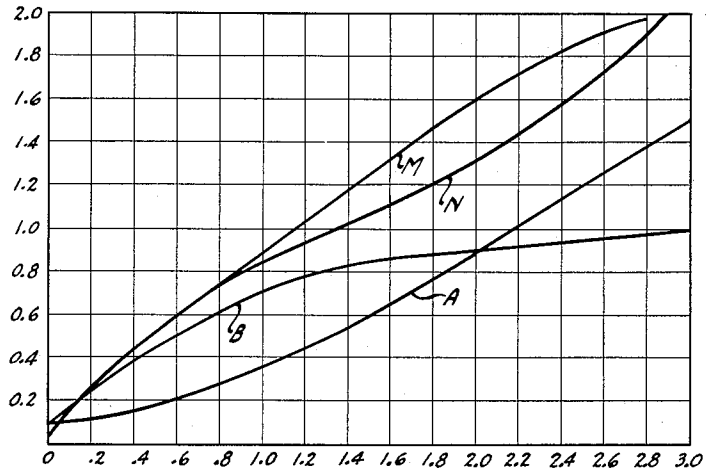
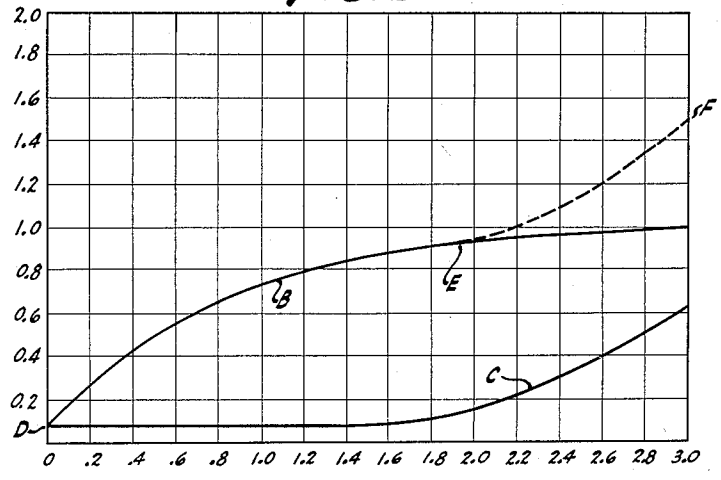


FIG. 2



INVENTOR.
CLYDE CHILDRESS

BY Henry Gipson Hardy.

ATTORNEY

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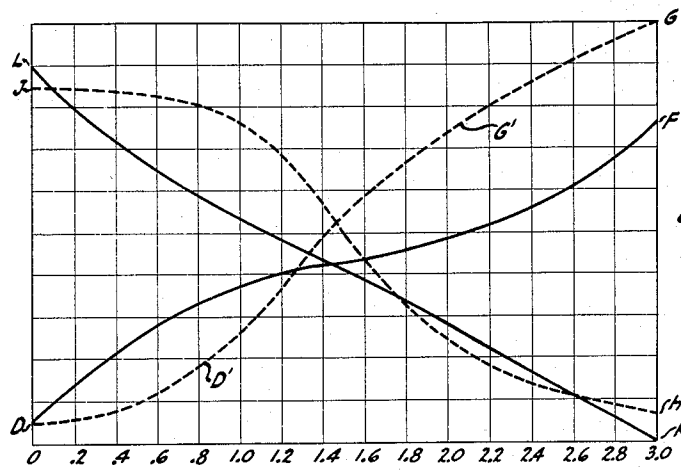


FIG. 3

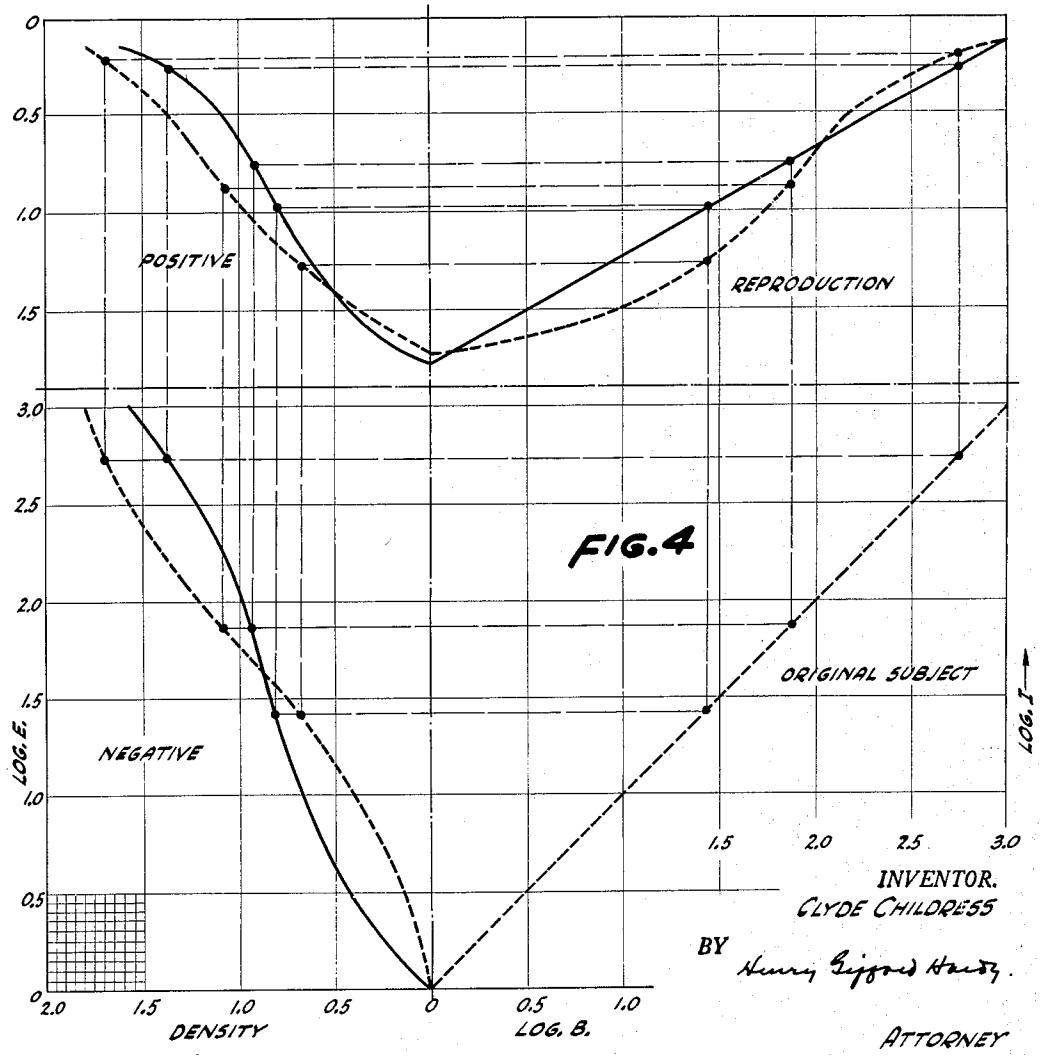


FIG. 4

INVENTOR.
CLYDE CHILDRESS
BY Henry Gifford Hardy.
ATTORNEY

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PHOTOGRAPHIC METHOD OF TONAL SCALE COMPENSATION

Clyde Childress, Marin City, Calif., assignor of one-half to Jerome Flax, San Francisco, Calif.

Application November 22, 1952, Serial No. 322,121

11 Claims. (Cl. 95—88)

This invention relates to photography and particularly to a method for effective and improved tone reproduction control. The present method produces a photographic negative which when printed on the standard positive materials, will, in a large measure, compensate for the transitive distortions of such negative and positive materials and produce prints with substantially equal gradient tonal separations through the full range of the print values.

It is well-known that in photographing an original scene or an existing continuous tone photographic record in black and white or in color, certain tonal distortions occur. These distortions occur as a relative loss of contrast in the shadow and highlight regions and as an increase in the middle values. Shadow value contrasts are lowered by camera flare, the toe of the negative characteristic curve, and the shoulder of the positive material curve. Highlight contrasts are lowered by the shoulder of the negative material (in long scale subjects), the toe of positive material, and in projection printing, by the flare light of the projection printer.

For exact objective tone reproduction, the reproduction curve must be a straight line at an angle of 45 degrees, to the horizontal axis. However, in practice most subjects exceed the maximum reflectance range of a paper print and often of a projected transparency. Such values must be compacted to the range of the positive material. The most correct reproduction curve in such cases would be a straight line at a lower gradient. To achieve such a reproduction requires a negative giving sufficient increase in contrast in shadow and highlight regions to compensate for the toe and shoulder of the negative material, and of the positive material as well, and should supply some general compensation for flare.

Previous methods of correcting these tonal defects have consisted of separate masks, to be printed in conjunction with the film, special films which only compensated for one end of the curve, and a double development technique. The separate masks are too involved for ordinary use in photography. The special film has generally been unstable and the double development technique applies to a slow speed, high contrast film, limiting its usefulness to copying or other applications were high emulsion speed or long range of values are not required.

The present invention provides a method of producing a negative with compensated printing characteristics capable of giving greatly improved tonal reproduction and is further capable of producing such a negative from subject matter having an extremely long range of values. This method further makes possible relatively independent manipulation of contrast in shadow and highlight regions of the tonal reproduction curve.

One object of the present invention is to provide a method of producing an original negative with compensated printing characteristics capable of giving improved tonal reproduction.

Another object of the present invention is to provide

a method of giving relatively increased or decreased contrast independently to the high or low regions of the negative.

A further object of the present invention is to provide a method of producing a negative with such characteristics, that by printing manipulations relative to the color sensitivity of the positive material, can be printed with relatively increased or decreased contrast independently in the high or low regions of the tonal reproduction curve.

Another object of the present invention is to provide a method of producing a print, from an ordinary uncompensated negative, that has increased contrast in the high and low regions of the tonal reproduction curve.

The objects of the present invention may be accomplished by the following disclosure.

In the accompanying drawings:

Figure 1 is a graph showing the characteristic negative silver image curve and the characteristic dye image curve showing shouldering off. Also shown is a characteristic dye image curve where the procedures of this invention are used without bleaching.

Figure 2 is a graph showing the same dye image curve as Figure 1, but combined with the silver image curve after reducing, which is the compensated negative curve of this invention, and the reduced silver image curve.

Figure 3 is a graph showing the normal negative characteristic curve, the compensated negative characteristic curve, the normal positive material curve, and the compensated print curve from the compensated negative.

Figure 4 is a graph of the complete subject-reproduction cycle divided into four quadrants, the lower right quadrant being the tonal scale of the original, the lower left (which is read by rotating 90° clockwise) showing the characteristic curves for both the normal and compensated negatives, the upper left quadrant being the positive material curves, and the upper quadrant being the reproduction curves for both the normal and compensated prints, each contact printed to eliminate camera flare, showing a substantially straight line reproduction but on a less steep gradient.

It is well-known that film density is a logarithmic expression in photography so far as the exposure of the negative is concerned and that exposure, therefore, may by transposed into logarithmic terms. This is known as the log E or the logarithm of the two factors, illumination (I) times the time (t). The plotting of the log E with respect to density, therefore produces a curve for any particular form of film and is generally known as the characteristic curve. The ideal curve for film would be a straight line wherein the density increases in direct proportion to the log E. This would mean that the film would record the densities from the light tones to the deep tones and shadows with substantial equal photographic effect.

However, photographic film does not act or respond in this manner. There is a threshold below which there is not sufficient light to be of any photographic consequence and hence, there will be no exposure of the film. As the exposure is increased, the reaction of the film increases until a constant rate is reached, during which, for a time, the density increases at precisely the same rate as the log E increases. Beyond that is another point where the rate drops off until subsequent increase of exposure results in no more density as the film has reached maximum density. The characteristic curve for different types of film negatives vary as to location when charted but in general the curves are similar in shape and for purposes of illustration are represented by the curve D—G of Figure 3.

The portion of the curve from D to D' where the curve

begins to be a straight line, is known as the "toe." For exposures less than at D, no density results on the film. From D to D' the density difference is compressed and this portion of the curve is widely used in the preparation of negatives. The straight line portion of the curve from D' to G' defines the range wherein the density increases proportionally with the log of exposure. The portion of the curve above G', the gradient of the curve decreases and eventually becomes horizontal and then no longer records exposure differences corresponding to density differences. This portion is called the "shoulder."

The picture will locate along some section of the characteristic curve. If there is too much light or the shutter is left open too long, the scene is located to the right on the curve or in the shoulder area. The negative, therefore, will show a falling off in the highlight contrasts which is characteristic of extreme overexposure. On the other hand, if there is very little light and inadequate time, the picture locates to the left on the curve where the darker tones begin to lose their separation one from the other.

Although films differ in the position of their curves along the log E axis, the present invention is applicable to all of them, and is particularly effective for subjects with a long tonal range.

Since both the negative and the positive print material have substantially similar curves (see Figure 3) with toe and shoulder areas, it will be observed that the lack of differentiation of the gradient in these areas is multiplied in the printing so that the black areas or shadows in the finished print tend to merge with consequent lack of definition and detail, while the highlight areas wash out. The middle tones alone are recorded with full separations and simulate the differences seen by the human eye. However, in context with the high and low values the tonal separations of the middle tones appear overemphasized and are factually exaggerated.

It is the inferior tonal separations in the high and low values of the current negative materials and the developing out papers which are responsible for the tremendous amount of extra work required by the photographers in the producing of satisfactory prints. Probably the principal portion of the manual light control, such as holding back shadow areas and burning in highlight areas, is utilized to overcome the deficiencies of the negative and paper scale to bring a result which is closer to the observed visual reality. The photographer as an artist thinks of these controls and their use primarily as creative manipulations rather than corrections. This is due to the fact that the art has been conditioned to the shortcomings and the mechanical deficiencies of present tone reproduction methods.

In the complete handling in the normal manner, photographic reproduction in black and white has a tonal scale contraction in the lower values resulting in a three or four fold compounded loss. In the camera the flare from the lamps and internal camera reflections further compact the lower values. Thus, these values are flattened even at the moment of exposure without considering the effect of the normal negative curve.

Since it is the practice in the art and a criterion of a good print that it must be printed to full black in the shadows, these twice flattened values are printed on the shoulder of the paper curve. In so doing some of the lowest values are inevitably lost.

If photographic prints are to be used for halftone reproduction or if negatives are to be made for halftone reproduction, the breaking up of the continuous tone image into halftone dots further decreases the separation in the light tone areas and in the black or shadow areas.

Positives for projections such as movie release prints have many of these same shortcomings as they have the same general characteristic curve. Although the positive stock will carry a much longer range of tone than a paper print, the flare curve in the original shooting compresses the low values and both high and low values are on the flattened or compressed portions of the original film curve and are both carried to the film print. In addition, the house lights of the theatre degrade the low separation areas to a point where the tonal range of values is often no greater on the screen than on a normal paper print. The need for better value separation in both the very light tones and in the very dark tones is particularly evident in low key scenes. These same observations apply with equal force to color motion pictures.

The present method provides a simple and reliable means for producing compensated negatives and prints not only having truer tonal relationships to the original subject, but greatly extending the subject luminance which can be reproduced. A range of 1:8000 can be reproduced with relatively even compaction of value as compared with approximately 1:1000 which is the most that available methods satisfactorily attain.

The method of the present invention may be succinctly stated by reference to the following steps. A monochromatic film is exposed and then developed with a dye coupled developer which gives both a silver image and a dye image. The developer required gives a complete silver image which is shown as the line A in Figure 1. It will be observed that this is the characteristic curve for the usual silver image of negatives having a moderately long range of tonal values. The dye image resulting is a shouldered image giving the characteristic curve represented by the line B in Figure 1. The dye image is evaluated actinically with respect to the color sensitivity of the positive material. The negative is then fixed and rinsed. The negative thereafter is reduced sufficiently in a cutting or subtractive reducer to remove the silver from the low values, and leave the silver image in the high values. The characteristic reduced silver image is shown by the curve C in Figure 2. The remaining silver image combined with the dye image B, also shown in Figure 2, gives the compensated negative curve D—E—F shown on Figure 2.

In Figure 3 the normal monochromatic negative curve is shown by the line D—G. The compensated negative produced by the present invention results in the curve D—F which, it will be observed, is the same as that shown in Figure 2. A normal print made from a normal negative will result in a curve represented by the line H—J in Figure 3 and shows the usual flattening in the toe regions and shouldering off at the opposite end. However, prints made from compensated negatives and following the methods herein described, result in a compensated print represented by the substantially straight line K—L in Figure 3, and demonstrates that a print having a substantially even gradient over the entire range is produced thereby reproducing the original subject more exactly and faithfully than by any method which has been available for general photographic use.

A specific method for obtaining a compensated negative having the characteristic curve D—F of Figure 3 is as follows:

A film having the normal emulsion, such as Eastman Panchro Press type B, is exposed to an original subject. For illustrative purposes, a substantially accurate subject such as a film step wedge having opacities from 0 to 3.0 may be assumed. Such is the subject illustrated by the graph of Figure 4. The exposure should be of such duration as to produce a density of .2 on a negative through an opacity of 3.0 when developed for 18 minutes in Eastman developer D-76 at 20° C.

The exposed emulsion is then developed in a developer compounded to produce a silver and a dye image of the characteristics referred to above and represented by the curve D—F in Figure 3. A developer suitable for such purposes is as follows:

EXAMPLE A

2-amino-5-diethylaminotoluene (monohydrochloride)	grams	1
p-Phenylene-diamine (base)	do	1
Sodium sulfite (anhydrous)	do	1
Sodium carbonate (monohydrated)	do	95
Potassium bromide	do	2.5
Water to 1 liter.		
to which is added:		
p-Nitrophenylacetonitrile	do	.03
Acetoacet-2-chloroanilide	do	.1
Methyl alcohol	cc	26

The negative is developed 10 to 15 minutes at 24° C.

This developer gives a yellow-orange dye image suitable for blue sensitive printing emulsions.

Another developer suitable for the present invention is as follows:

EXAMPLE B

2-amino-5-diethylaminotoluene (monohydrochloride)	grams	1
p-Phenylene-diamine (base)	do	1
Sodium sulfite (anhydrous)	do	2
Sodium carbonate (monohydrated)	do	95
Potassium bromide	do	2.5
Water to 1 liter.		
to which is added:		
p-Nitrophenylacetonitrile	do	.06
Acetoacet-2-chloroanilide	do	.03
Methyl alcohol	cc	18

The negative is developed 10 to 15 minutes at 24° C.

This formula gives a red dye image which has greater opacity to green light than to blue. This type of dye image is suitable for the contrast manipulation as hereinafter described.

Still another developer may be used and this is secured from the commercial F. R. developchrome as compounded January 1952. It is to be understood that frequently the manufacturer changes a formulation as to ingredients and proportions without notice to the consuming public which might make reproduction of the results here disclosed difficult if not impossible. This product is a three-part packaged powder sold as a paper toner and not as a film developer.

EXAMPLE C

From the packaged F. R. developchrome, mix 1 part yellow developer (mix according to directions); 1 part red developer.

In Example C the film is developed from 6 to 12 minutes at 24° C.

Any color dye may be used which is relatively not transmissive within the sensitivity range of the print material. Yellow, orange, red and green images have been found satisfactory for use on various printing materials, orange showing the most universal application. The couplers must be present in such proportion as to shoulder the dye image in the proper development time for the silver image.

The negative is then fixed and rinsed in the usual manner for such dye images.

Next, the negative is reduced in a subtractive reducer for the time necessary to remove the silver from the lower values leaving the silver curve of the characteristics shown by curve C in Figure 2. A suitable reducer is:

Stock solution A

Water	cc	500
Sodium Thiosulfate	grams	50
Sodium carbonate	do	17.3
Water to make 1.0 liter.		

Stock solution B

Water	liters	1.0
Potassium ferricyanide	grams	5.0

For the reduction solution one part of solution A, one part of solution B, and one part of water should be used. This reduction can be by time and temperature and is dependent upon the density of the silver image in its relation to the dye image. For example, for a development time of 15 minutes, a reduction time of 10 minutes is generally satisfactory with the reducer given above.

Before bleaching the negative curves generally show marked improvement over the normal negative. The dye image is already compensating for the toe of the curve, giving practically a straight line curve. Accordingly, it could be used at this point for printing with greatly improved results although it has not yet been compensated with respect to the distortions of the positive material. A typical curve for this result is shown at line M in Figure 1.

It is possible to secure a reverse compensated negative curve without reducing. Such a curve is represented by the line N on Figure 1, and may be attained using the developer of the following example.

EXAMPLE D

2-amino-5-diethylaminotoluene (monohydrochloride)	grams	1
p-Phenylene-diamine (base)	do	1
Sodium sulfite (anhydrous)	do	1
Sodium carbonate (monohydrated)	do	85
Potassium bromide	do	2.5
Water to 1 liter.		
to which is added:		
p-Nitrophenylacetonitrile	do	.03
Acetoacet-2-chloroanilide	do	.06
Methyl alcohol	cc	18

The negative is developed 10 to 15 minutes at 24° C.

This formula gives a reverse curve or compensated curve without the silver reduction step (bleaching) although the compensation is somewhat less than where bleaching is used. However, if bleaching is to be performed this formula should not be used, and the above is merely a modification of the presently preferred procedure.

Where the control of the reduction is to be secured by inspection, the silver image is visible and distinct from the dye image when seen through the back of the film by reflected light from an angle a few degrees above the plane of the film against a dark tray, preferably of the same or similar color as that of the dye image. The dried negative may be seen in its approximate printing values by viewing the same by transmitted light filtered by a color substantially complementary to the dye color. For the examples given above a Wratten B58 filter is suitable. The negative is thoroughly washed before drying.

A negative so developed and processed will print on a blue sensitive material, such as Kodabromide paper with approximately straight line tonal reproduction, curve K—L of Figure 3, although the log E for its characteristic curve is curve H—J of Figure 3.

The dye image of a negative processed in accordance with this invention using Example B, transmits more blue light than green. When printed on a material with green as well as blue sensitivity, the contrast of the dye image portion of the negative may be increased relative to the silver image portion by printing through a green filter. Printing on such a material through a blue filter will lower the contrast of the dye image portion relative to the silver image portion. A paper suitable for such manipulations is Eastman Ektacolor black and white proof used with Wratten filters B58 for increasing the contrast of the lower portion and C47 for decreasing the contrast of the dye image portion.

To increase the contrast of the middle and upper values an additional development after rinsing the film may be given in a non-coupling developer. Increased reduction will be required to remove the proper amount of silver from the low values.

An increase of reduction time beyond that required for usual compensation will lower the contrast of the middle values, while a decrease of reduction time will raise the contrast of the middle values.

To lower the contrast of the middle and upper values independently of the lower values, reduction of the silver image is accomplished by bathing the negative alternately in stock solution A and stock solution B, rather than mixing the solutions, giving a proportional rather than a cutting or subtractive action.

To increase the contrast of the upper and middle values of a negative that has been previously developed and reduced, the silver image may be rehalogenated in a ferricyanide bromide bath of the following composition:

	Grams
Potassium bromide	30
Potassium ferricyanide	30
Water to make 1 liter.	

The negatives so treated may then be redeveloped in the developer of the formulas set forth above in Examples A, B, and C, and the development carried to completion. Fixing and further reduction are unnecessary.

Any normally processed silver image negative may be rehalogenated and reprocessed in accordance with the procedures of this invention.

It is likewise practical to incorporate the monochrome dye coupler in a single layer with the silver emulsion of a film. The dye coupler may be incorporated either by the Eastman method used for color photography where the molecules are surrounded with a protective coating which prevents their "wandering" in the emulsion, or by the Ansco method for color photography where the molecules are free in the emulsion. As before indicated, the dye coupler must be present in sufficient amount to shoulder the dye image within the time required for the proper development of the silver image and without excessive fogging. This particular form of the invention has the obvious advantages of simplicity of development and extending the life of the developer.

A further form for practicing the method of this invention is split-development. The dye coupler and/or the developing agent may be used as a pre-bath. For example, the exposed negative is soaked in the dye coupler solution. Full soaking to saturation will permit the emulsion to absorb the proper amount of coupler. The film is then placed in a developing solution for the proper development of the silver image and the dye image at the same time, as explained above.

The production of a compensated negative having a shouldered dye image and a reduced silver image increasing the contrast in the shoulder region of the negative characteristic curve, and utilizing the differential color sensitivity of the projection paper from that of the dye image to increase the contrast of the toe region of the negative characteristic curve, effectively accomplishes a final reproduction maintaining equal value separations throughout the longest scale subject, as is possible with present materials. It is to be understood that by means of variations in the procedure disclosed herein, the areas of maximum tonal separation may be controlled and placed for creative uses.

By the use of neutral couplers or neutral combinations of couplers, prints for viewing may be made by following the procedures given above.

As used herein, the phrase "original subject" includes a print, a transparency or the original object.

I claim:

1. The method of making photographic negatives having tonal compensated printing characteristics comprising

exposing a monochromatic negative film to produce a latent image, developing said negative in a dye coupled developer having a formula as follows:

2-amino-5-diethylaminotoluene (monohydrochloride)	grams	1
p-Phenylene-diamine (base)	do	1
Sodium sulfite (anhydrous)	do	2
Sodium carbonate (monohydrated)	do	95
Potassium bromide	do	2.5
Water to 1 liter.		
to which is added:		
p-Nitrophenylacetonitrile	do	.03
Acetoacet-2-chloroanilide	do	.1
Methyl alcohol	cc	26

to produce a shouldered dye image and a silver image on said negative, fixing said negative, rinsing said negative, and reducing the silver image on said negative with a selective reducer to reduce the silver from the image in the low values to produce a combined image on said negative having increased contrast in the shadow and highlight regions.

2. The method of making photographic negatives having tonal compensated printing characteristics comprising exposing a monochromatic negative film to produce a latent image, developing said negative in a dye coupled developer having a formula as follows:

2-amino-5-diethylaminotoluene (monohydrochloride)	grams	1
p-Phenylene-diamine (base)	do	1
Sodium sulfite (anhydrous)	do	1
Sodium carbonate (monohydrated)	do	95
Potassium bromide	do	2.5
Water to 1 liter.		
to which is added:		
p-Nitrophenylacetonitrile	do	.03
Acetoacet-2-chloroanilide	do	.1
Methyl alcohol	cc	26

to produce a shouldered dye image for increased contrast in the shadow areas and a silver image on said negative, fixing said negative, rinsing said negative, and reducing the silver image on said negative with a subtractive reducer having a formula as follows:

1 part of Solution A—		
Water	cc	500
Sodium thiosulfate	grams	50
Sodium carbonate	do	17.3
Water to make 1 liter.		
Plus 1 part of Solution B—		
Water	liters	1.0
Potassium ferricyanide	grams	5.0

to reduce the silver in the low values or shadow areas of said negative.

3. The method of making photographic negatives having tonal compensated printing characteristics comprising exposing a monochromatic negative film to produce a latent image, developing said negative for 10 to 15 minutes at 24° C. in a dye coupled developer having a formula as follows:

2-amino-5-diethylaminotoluene (monohydrochloride)	grams	1
p-Phenylene-diamine (base)	do	1
Sodium sulfite (anhydrous)	do	2
Sodium carbonate (monohydrated)	do	95
Potassium bromide	do	2.5
Water to 1 liter.		
to which is added:		
p-Nitrophenylacetonitrile	do	.03
Acetoacet-2-chloroanilide	do	.1
Methyl alcohol	cc	26

to produce a shouldered dye image for increased contrast

in the low values and a silver image on said negative, fixing said negative, rinsing said negative, and reducing the silver image on said negative for 10 to 15 minutes at 24° C. with a subtractive reducer having a formula as follows:

1 part of Solution A—

Water	cc	500
Sodium thiosulfate	grams	50
Sodium carbonate	do	17.3
Water to make 1 liter.		

Plus 1 part of Solution B—

Water	liters	1.0
Potassium ferricyanide	grams	5.0

to reduce the silver in the areas of the low values.

4. The method of making photographic negatives with substantially equal gradient tonal separations within the limits of the negative material comprising, exposing a monochromatic negative film to produce a latent image, developing said negative in a dye coupled developer having a formula as follows:

2-amino-5-diethylaminotoluene (monohydrochloride)

	grams	1
p-Phenylene-diamine (base)	do	1
Sodium sulfite (anhydrous)	do	2
Sodium carbonate (monohydrated)	do	95
Potassium bromide	do	2.5
Water to 1 liter.		

to which is added:

p-Nitrophenylacetonitrile	do	.06
Acetoacet-2-chloroanilide	do	.03
Methyl alcohol	cc	18

to produce a shouldered dye image to increase the contrast in the low value areas and a silver image on said negative, fixing said negative in the usual manner, rinsing said negative, and treating the silver image on said negative with a subtractive reducer to reduce the silver image in the low value areas.

5. The method of making photographic negatives with substantially equal gradient tonal separations within the limits of the negative material comprising, exposing a monochromatic negative film to produce a latent image, developing said negative in a dye coupled developer having a formula as follows:

2-amino-5-diethylaminotoluene (monohydrochloride)

	grams	1
p-Phenylene-diamine (base)	do	1
Sodium sulfite (anhydrous)	do	2
Sodium carbonate (monohydrated)	do	95
Potassium bromide	do	2.5
Water to 1 liter.		

to which is added:

p-Nitrophenylacetonitrile	do	.06
Acetoacet-2-chloroanilide	do	.03
Methyl alcohol	cc	18

to produce a shouldered dye image and a silver image on said negative, fixing said negative in the usual manner, rinsing said negative, and treating the silver image on said negative with a subtractive reducer having a formula as follows:

1 part of Solution A—

Water	cc	500
Sodium thiosulfate	grams	50
Sodium carbonate	do	17.3
Water to make 1 liter.		

Plus 1 part of Solution B—

Water	liters	1.0
Potassium ferricyanide	grams	5.0

to reduce the silver image in the low value areas on said negative.

6. The method of making photographic negatives with substantially equal gradient tonal separations within the limits of the negative material comprising, exposing a monochromatic negative film to produce a latent image, developing said negative 10 to 15 minutes at 24° C. in a dye coupled developer having a formula as follows:

2-amino-5-diethylaminotoluene (monohydrochloride)

	grams	1
p-Phenylene-diamine (base)	do	1
Sodium sulfite (anhydrous)	do	2
Sodium carbonate (monohydrated)	do	95
Potassium bromide	do	2.5
Water to 1 liter.		

to which is added:

p-Nitrophenylacetonitrile	do	.06
Acetoacet-2-chloroanilide	do	.03
Methyl alcohol	cc	18

to produce a shouldered dye image and a silver image on said negative, fixing said negative in the usual manner, rinsing said negative, and treating the silver image on said negative 10 to 15 minutes at 24° C. with a subtractive reducer having a formula as follows:

1 part of Solution A—

Water	cc	500
Sodium thiosulfate	grams	50
Sodium carbonate	do	17.3
Water to make 1.0 liter.		

Plus 1 part of Solution B—

Water	liters	1.0
Potassium ferricyanide	grams	5.0

to reduce the silver from the image in the low value areas on said negative.

7. The method of producing a photographic negative having tonal compensated printing characteristics from a previously normally developed and processed monochromatic negative, comprising rehalogenating said developed negative, developing said negative for 10 to 15 minutes at 24° C. in a dye coupled developer having a formula as follows:

2-amino-5-diethylaminotoluene (monohydrochloride)

	grams	1
p-Phenylene-diamine (base)	do	1
Sodium sulfite (anhydrous)	do	1
Sodium carbonate (monohydrated)	do	95
Potassium bromide	do	2.5
Water to 1 liter.		

to which is added:

p-Nitrophenylacetonitrile	do	.03
Acetoacet-2-chloroanilide	do	.1
Methyl alcohol	cc	26

to produce a shoulder dye image and a silver image on said negative, fixing said negative, rinsing said negative, and reducing the silver image on said negative for 10 to 15 minutes at 24° C. with a subtractive reducer having a formula as follows:

1 part of Solution A—

Water	cc	500
Sodium thiosulfate	grams	50
Sodium carbonate	do	17.3
Water to make 1.0 liter.		

Plus 1 part of Solution B—

Water	liters	1.0
Potassium ferricyanide	grams	5.0

to reduce the silver in the low value areas on said negative.

8. The method of producing a photographic negative having tonal compensated printing characteristics from a previously normally developed and processed monochromatic negative, comprising rehalogenating said developed negative, developing said negative for 10 to 15

minutes at 24° C. in a dye coupled developer having a formula as follows:

2-amino-5-diethylaminotoluene (monohydrochloride)	grams	1
p-Phenylene-diamine (base)	do	1
Sodium sulfite (anhydrous)	do	2
Sodium carbonate (monohydrated)	do	95
Potassium bromide	do	2.5
Water to 1 liter.		

to which is added:

p-Nitrophenylacetonitrile	do	.06
Acetoacet-2-chloroanilide	do	.03
Methyl alcohol	cc	18

to produce a shouldered dye image and a silver image on said negative, fixing said negative in the usual manner, rinsing said negative, and treating the silver image on said negative 10 to 15 minutes at 24° C. with a subtractive reducer having a formula as follows:

1 part of Solution A—

Water	cc	500
Sodium thiosulfate	grams	50
Sodium carbonate	do	17.3
Water to make 1.0 liter.		

Plus 1 part of Solution B—

Water	liters	1.0
Potassium ferricyanide	grams	5.0

to reduce the silver in the low value areas on said negative.

9. The method of producing a photographic negative having substantially equal value separations throughout the longest scale subject, comprising exposing a monochromatic negative in the presence of a subject to produce a latent image of said subject on said negative, developing said image in dye coupled developed having a formula as follows:

2 - amino - 5 - diethylaminotoluene monohydrochloride	grams	1
p-Phenylene-diamine (base)	do	1
Sodium sulfite (anhydrous)	do	1
Sodium carbonate (monohydrated)	do	85
Potassium bromide	do	2.5
Water to 1 liter.		

to which is added:

p-Nitrophenylacetonitrile	do	.03
Acetoacet-2-chloroanilide	do	.06
Methyl alcohol	cc	18

to produce a silver image and a shouldered dye image of said subject on said negative, said dye image being free of any silver in the lower values, fixing said development image, washing and drying the same.

10. The method of making photographic negatives having tonal compensated printing characteristics with increased contrast in the areas of maximum and minimum exposure comprising exposing a monochromatic negative film to produce a latent image, developing said negative in a dye coupled developer to produce a complete silver image and a dye image, said developer containing only suffiicent dye coupler to produce a dye image which has its maximum contrast in the area corresponding to the toe of the curve of the developed silver image and thereafter progressively loses contrast, said development being continued to develop substantially all of the silver image, fixing and rinsing said negative and then reducing the silver image in the low density areas of said negative with a selective reducer to remove the silver in the area corresponding to the toe area of the curve of the developed dye image and to leave a silver image of increased printing contrast in the high density areas of the original silver image, said combined developed dye and reduced silver images having a density curve with increased printing contrast in the shadow and high light areas of the curve.

11. The method of producing a photographic negative having tonal compensated printing characteristics with increased contrast in the areas of maximum and minimum exposure from a previously normally exposed, developed and processed monochromatic negative which comprises rehalogenating said normally developed negative, then developing it in a dye coupled developer to produce a complete silver image and a dye image, said developer containing only sufficient dye coupler to produce an image which has its maximum contrast in the area corresponding to the toe of the curve of the developed silver image and thereafter progressively loses contrast, said development being continued to develop substantially all of the silver image, fixing and rinsing the resulting negative and then reducing the silver image in the low density areas with a selective reducer to remove the silver in the area corresponding to the toe area of the curve of the developed dye image and to lease a silver image of increased printing contrast in the high density areas of the original silver image, said combined developed dye and reduced silver images having a density curve with increased printing contrast in the shadow and high light areas of the curve.

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