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PHOTOGRAPHIC DEVELOPER

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5 Claims. (Cl. 95—88)

This invention relates to an improved photographic developer and, more particularly, to a developer which will produce surface development and relatively low contrast. For some purposes, particularly where high definition is required, it is desirable that the image in the photographic emulsion shall be developed inwardly from the surface rather than through the entire depth of the emulsion at the same time. When this is done, diffusion of the image in the emulsion has a minimum effect, since the degree of development can be chosen to give the best balance between density and diffusion. If a developer is used which develops the image uniformly through the thickness of the emulsion, the diffused image is developed along with the rest of the image and such control can not be secured. While there are a few developing agents which tend in an ordinary developing solution to give development which is predominantly from the surface, this does not apply to the ordinary developing agents as used in the usual developing formulas.

I have discovered, however, that if the ordinary developing agents are used with an extremely high concentration of alkali, the development can be caused to occur predominantly from the surface, with the relative amount of surface development depending on the alkali concentration. With ordinary developer formulas, it is impossible to use an alkali greater than about 50 grams of sodium hydroxide per liter, or the equivalent, due to the extreme softening effect of the alkali on the gelatine. I have avoided this result, however, by balancing the alkali content with alum, as described and claimed in my application Serial No. 205,363, filed April 20, 1939, now Patent No. 2,199,904, issued May 7, 1940. As described in the said patent (page 3, lines 55, et seq.) if the sodium hydroxide or other alkali is added to the solution first it may be balanced with alum by adding alum to the solution until no more will dissolve thereby saturating the solution with alum. Conversely, if the amount of alum to be used is known, the alum may be dissolved first and the alkaline hydroxide added later until the initial precipitate of alum hydroxide is just redissolved. If the proper proportions of both materials are once determined in this manner, they may both be added at the same time.

The hardening effect of the alum prevents excessive softening of the gelatine by the alkali and thereby permits the use of alkali concentrations much higher than could be used in other developer formulas. At the same time, the balancing of the alkali by alum serves to maintain the alkalinity constant, since aluminum hydroxide is precipitated and alkali is released as the alkali in the solution is used up or neutralized.

The main object of the invention is to provide an improved photographic developer.

Another object of the invention is to provide a photographic developer which will give a predominantly surface development.

Another object of the invention is to provide a photographic developer which will have a high alkalinity but give an image of low contrast.

In my aforesaid Patent No. 2,199,904, issued May 7, 1940, I have described and claimed a developer of substantially the following formula:

Hydroquinone	grams	15
NaOH	do	30
Sodium sulfite	do	25
Alum	do	40
KBr	do	9
Water	cubic centimeters	1000

This developer will give for a certain film, such, for example, as duPont 100, a gamma of 1.2 for a two-minute development at approximately 70° F. If, however, the alkali content of the developer is increased and is kept balanced with alum by maintaining the ratio of approximately 3 parts of sodium hydroxide to 4 parts of alum, I find that there is a point at about 100 grams per liter of sodium hydroxide where the image noticeably changes its character. Instead of the image developing substantially uniformly through the thickness of the emulsion, it develops predominantly from the surface, and the amount of this surface effect increases with the alkalinity up to approximately 240 grams of sodium hydroxide per liter of water. If the alkali content increases, not only does the surface effect increase but the contrast decreases. For example, with a developer having the following formula:

Hydroquinone	15
Sulfite	30
NaOH	240
KBr	9
Alum	320
Water	1000

the gamma for a two-minute development with duPont No. 100 film, the same type referred to above, falls to .62.

The high alkali concentration seems to alter the penetrating effect of the developing agent. This result may be due to polymerization of the

developing agent, it may be that the hardening effect of the alum on the gelatine plus the water affinity of the alkali decreases the tendency for the solution to penetrate the gelatine, or it may be a combination of both effects. Whatever the cause, the developing agent acts first on the portion of the image at the surface and then gradually affects the deeper portions of the image.

The same effect applies in other developing agents which operate in alkaline solution.

I claim as my invention:

1. A photographic developer containing a developing agent, more than 100 grams of caustic alkali per liter of solution and alum to saturation.

2. A photographic developer containing hydroquinone, more than 100 grams of caustic alkali per liter of solution and alum to saturation.

3. A photographic developer having substantially the following composition:

Hydroquinone	15
Sulfite	30
NaOH	240
KBr	9
Alum	320
Water	1000

4. A photographic developer containing a developing agent, a quantity of caustic alkali of the order of 240 grams per liter of solution and alum to saturation.

5. A photographic developer containing hydroquinone, caustic alkali of the order of 240 grams per liter of solution and alum to saturation.

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