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FINE GRAIN PHOTOGRAPHIC DEVELOPER CONTAINING MORPHOLINE

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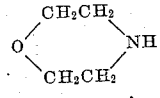
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1 Claim. (Cl. 95—88)

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My invention relates generally to the art of photography, and in particular it relates to "developers," that is, solutions for developing latent images on photographic film having a silver halide emulsion thereon, after exposure of the film to the action of light.

Most developers, or developing solutions, comprise a developing agent as "metol" (paramethylaminophenol sulphate), a preservative as sodium sulfite, an accelerator as sodium carbonate, and a restrainer as potassium bromide. Silver halide solvents, as sodium thiocyanate, are also added in certain instances, for decreasing the size of the silver grains. While these developers are relatively satisfactory for larger film sizes where the enlargement factor is relatively small, I have discovered that they can be very much improved not only for use with films of smaller size, as 35 mm., but also for the larger film sizes, by the substitution in the solution for the alkalies now used of an alkaline compound containing a secondary amine and an ether group, the compound being known as morpholine of the following formula:



Among the objects of my invention, therefore, are the formation of an extremely fine grain developer for silver halide emulsion films which has longer keeping qualities than previously known developers and which maintains its alkalinity over a longer period of time than heretofore possible, by means of the addition to the solution of morpholine. Other objects of my invention will be obvious from the following description of an illustrative embodiment, and still others will be specifically pointed out in the following description.

Developers including those containing metol-hydroquinone are already known in the art which use derivatives of morpholine, or which use reaction products of morpholine and sulphur dioxide, and which use sulfites of morpholine, but none of these have the properties of my new and improved developer, and none of these prior disclosures evidence any appreciation of the benefits attendant the use of morpholine in the developing solution.

This particular compound, morpholine, has some developing properties of its own, and when used as an alkaline agent in connection with metol-containing developing compounds, containing preservatives, silver halide solvents and restrainers, my compound has a final pH of between 8.2 and 9. I have found that this pH range and the resultant very fine grain obtained with my developer to be due largely to the presence of the morpholine in the solution, and that the grain size is measurably increased when other alkaline compounds are used instead.

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An illustrative example of a very fine grain developer compounded in accordance with my invention is as follows:

Metol (paramethylaminophenol sulphate)	grams	6
Sodium sulfite	do	80
Sodium thiocyanate	do	1
Potassium bromide	do	.7
Morpholine	cc.	1

Water to make one liter of solution.

I believe that the foregoing example is the very first disclosure of a practical and highly beneficial metol-containing developing compound using morpholine itself. The morpholine aids in maintaining the alkalinity of the solution, and has a very noticeable effect on the keeping properties thereof when used in concentrations described, for it permits the use and re-use of the developer over a much longer period of time than heretofore possible with standard or ordinary developers which do not contain morpholine.

I have found, further, that morpholine may advantageously be added to the metol-containing developing solution as above described in concentrations of between .15 cc. to 3 cc. per liter, which corresponds to .015% to .3% by volume, the resultant solution achieving and retaining all the benefits above described. As used herein, and in the claim appended hereto, the term "metol" refers to the product commercially and commonly known as paramethylaminophenol sulphate.

Having described my invention, what I claim and desire to secure by Letters Patent is:

A photographic developer essentially consisting of an aqueous solution of the following ingredients in approximately the amounts indicated per liter of solution:

Paramethylaminophenol sulphate	grams	6
Sodium sulfite	do	80
Sodium thiocyanate	do	1
Potassium bromide	do	.7
Morpholine	cc.	1

GEORGE L. STEANS.

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