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**HIGH SPEED PHOTOGRAPHIC DEVELOPER**

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8 Claims. (Cl. 95—88)

This invention relates to improvements in photographic developers, and particularly to an improved high speed developer adapted for developing black and white moving picture films.

This application is a continuation in part of my co-pending application Serial No. 310,350, filed September 18, 1952 for High Speed Photographic Developer, now abandoned.

It is a principal object of the present invention to provide a novel and improved high speed developer for use in developing black and white negative motion picture film at normal room temperatures, and without the use of a prehardener.

In carrying out the present invention a developing solution is employed in which the developing agents may be metol or a similar well known compound in combination with hydroquinone. An element of the invention consists in the fact that I use a concentration approximately 9 times greater than the concentration of these developing agents which would normally be employed for the development of commercial black and white moving picture films at ordinary room temperature. The formula set forth in Example 1 develops motion picture negative film under normal room temperatures in approximately 20 seconds without the use of a pre-hardener. This solution when mixed has excellent keeping qualities and can be stored in stoppered bottles or covered containers for long periods of time without noticeable deterioration. A gallon solution of the formula set forth in Example 1 will process 1500 ft. of 16 mm. negative film without loss of strength. If replenishment during processing is required fresh developer of the same formula can be added. The negative image of film processed in the solution of Example 1 shows excellent tonal gradation and can be printed by contact or optically onto a positive film. On normal speed negative pancromatic films, the grain structure is slightly more than on films developed in Buffered Borax.

The formula set forth in Example 2 has a faster processing time even than that set forth in Example 1. The solution of Example 2 will develop a negative image on black and white motion picture film in from 12 to 15 seconds. This solution also works at normal room temperatures without the use of a pre-hardener.

The fixing solution used with these high speed developers takes approximately 55 seconds as compared with the 3 to 5 minutes normally required.

It will be understood in each of the two examples shown that the several chemicals employed as preservatives, alkaline agent, accelerators, restrainers may be used in different strengths which may vary from 25 to 200% in accordance with the experience of those skilled in the use of these chemicals.

The following are given as illustrative developing solutions in accordance with the invention:

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*Example 1*

		Grains
	The sulphate of p-methylaminophenol (graphol, metol, elon) -----	60
5	Hydraquinone -----	1200
	Sodium hydroxide -----	1100
	Sodium sulphite -----	3062
	Sodium phosphate (tri-basic) -----	328
	Boric acid (crystals) -----	100
10	Potassium bromide -----	165
	Potassium sulfocyanate (crystals) -----	150
	Water to make 1 gallon.	
	Developing time at 75° F.—15 seconds	
	Developing time at 70° F.—20 seconds	
15	Developing time at 65° F.—25 seconds	

In the above formula it will be understood that sulphate of p-methylaminophenol, usually referred to as metol, is a high factor developer giving detail quickly and building up density slowly. The hydroquinone is a very much slower developer which is frequently used in combination with metol. The sodium sulphite is utilized as a preservative and as a solvent for the silver halides. The sodium hydroxide is an alkaline agent, the sodium phosphate (tri-basic) is here used to improve the tonal quality in the development of the silver nitrate. The boric acid (crystals) are a less energetic accelerator here employed, and have been found in the present solution to improve the image slightly. The potassium bromide is a restrainer. The potassium sulfocyanate (crystals) are a fog inhibitor and operate to keep the image clear during the development.

*Example 2*

35	The sulphate of p-methylaminophenol (Graphol).....	50 grains....	200 grains.
	Hydroquinone.....	300 grains....	2 3/4 oz.
	Sodium Sulphite.....	1 3/4 oz.....	7 oz.
	Sodium Hydroxide.....	2 7/8 grains....	2 3/8 oz.
	Sodium Phosphate (Tri-Basic).....	1/4 oz.....	1 oz.
	Boric Acid.....	50 grains....	200 grains.
40	Potassium Sulfocyanate.....	75 grains....	300 grains.
	Water.....	32 oz.....	1 gallon.
	Developing time 12 seconds at 70° F.		

A developer capable of producing a full and satisfactory development of black and white negative motion picture film of the general type above referred to in a substantially shorter time than the development period required for Examples 1 and 2 has been evolved from a relatively small number of the ingredients employed in these examples.

*Example 3*

55	The sulphate of p-methylaminophenol.....	8 grains....	64 grains.
	Hydroquinone.....	150 grains....	1,200 grains.
	Sodium sulphite.....	3/4 oz.....	3,062 grains.
	Sodium hydroxide.....	137 grains....	1,100 grains.
	Potassium sulfocyanate.....	20 grains....	160 grains.
	Water to make.....	16 oz.....	1 gallon.
	Developing time at 70° F.—5 seconds.		

The formula of Example 3 includes the developing agents sulphate of p-methylaminophenol and hydroquinone together with sodium hydroxide and potassium sulfocyanate. Sodium sulphite is added to this solution as a preservative. It will be understood that the several ingredients of the formulas illustrated in Examples 1, 2 and 3 are subject to substantial variation to produce desired gradations in the characteristics of the developer employed. I have found such variations to be practicable within the following limits.

For each gallon of water to make the sulphate of p-methylaminophenol must be included in its usual proportion of 30 to 100 grains although 60 grains within limits of about 10% more or less is preferred. The

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amount of hydroquinone employed is subject to substantial variation which will produce a corresponding variation in the development rate. I have found that between 1200-1300 grains represent a maximum amount of hydraquinone which may be used, and that most of the benefits of high speed development are lost if an amount less than 625 grains is used. Sodium hydroxide is employed at the rate of approximately 1½ to 3½ oz. although 2½ oz. within 10% more or less is preferred. Potassium sulfocyanate may be employed at the rate of 100 to 300 grains, although the relatively restricted amount of 150 to 160 grains is preferred. Sodium sulphite is added to the solution as a preservative, and to be fully effective for this purpose must be employed at the rate of about 7 oz. The sodium phosphate, boric acid, potassium bromide included in the formulas of Examples 1 and 2 to control and smooth the action of the developer have been omitted from the formula of Example 3 in the interest of greater speed of development.

When used for the development of black and white motion picture film the developer of Example 3 will produce a completely developed image in about 5 seconds' time. The developer of Example 3 is found to produce a satisfactory image, but is practicable for use only when provision can be made for an extremely accurate control of the immersion time of the film in the developer.

The developer of Example 3 has also been utilized and has been found most satisfactory as use for a developer in the reversal process for black and white moving picture film which, after exposure, is reversed and is projected as a positive film. An exposed strip of reversible black and white moving picture film was developed in the developer of Example 3. A satisfactory first development of the film was obtained in approximately 45 seconds as compared with the 2 to 3 minutes' interval required for this development stage with the developers of Examples 1 and 2, and as compared with the usual 12 minutes or more required with present commercially available developers.

The invention having been described what is claimed is:

1. A high speed photographic developer for black and white moving picture and similar films having for each gallon of water between 30 and 100 grains of sulfate of p-methylaminophenol, between 625 and 1300 grains of hydroquinone, between 1½ and 3½ oz. of sodium hydroxide, and between 100 and 300 grains of potassium sulfocyanate as ingredients thereof.

2. A high speed photographic developer for black and white moving picture and similar films having for each gallon of water 60 grains of sulphate of p-methylaminophenol within 10%, between 625 and 1300 grains of hydroquinone, 1100 grains of sodium hydroxide within 10% more or less, and between 150 and 300 grains of potassium sulfocyanate as ingredients thereof.

3. A high speed photographic developer for black and

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white moving picture and similar films having the ingredients in about the proportions given:

The sulphate of p-methylaminophenyl	-----grains--	8
Hydroquinone	-----do-----	150
Sodium sulphite	-----oz---	34
Sodium hydroxide	-----grains--	137
Potassium sulfocyanate	-----do-----	20
Water to make 16 oz.		

4. In the development of black and white moving picture and similar films the step of immersing said film in a bath having the composition of claim 3 at room temperature for a time interval in accordance with the following schedule: 5 seconds at 70° F.

5. A high speed photographic developer for black and white moving picture and similar films having the ingredients in about the proportions given:

	Grains	
The sulphate of p-methylaminophenol	-----	60
Hydroquinone	-----	1200
Sodium sulphite	-----	3062
Sodium hydroxide	-----	1100
Sodium phosphate (Tri-basic)	-----	328
Boric acid (crystals)	-----	100
Potassium bromide	-----	165
Potassium sulfocyanate (crystals)	-----	150
Water to make 1 gallon.		

6. In the development of black and white moving picture and similar films the step of immersing said film in a bath having the composition of claim 5 at room temperature for a time interval in accordance with the following schedule:

- 15 seconds at 75° F.
- 20 seconds at 70° F.
- 25 seconds at 65° F.

7. A high speed photographic developer for black and white moving picture and similar films having the ingredients in about the proportions given:

The sulphate of p-methylaminophenol	-----	50 grains	-----	200 grains.
Hydroquinone	-----	300 grains	-----	2¾ oz.
Sodium sulphite	-----	1¾ oz.	-----	7 oz.
Sodium hydroxide	-----	275 grains	-----	2½ oz.
Sodium phosphate (Tri-Basic)	-----	¼ oz.	-----	1 oz.
Boric acid	-----	50 grains	-----	200 grains.
Potassium sulfocyanate	-----	75 grains	-----	300 grains.
Water	-----	32 oz.	-----	1 gallon.

8. In the development of black and white moving picture and similar films the step of immersing said film in a bath having the composition of claim 7 at room temperature for a time integral in accordance with the following schedule: 12 seconds at 70° F.

No references cited.

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