

UNITED STATES PATENT OFFICE

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PHOTOGRAPHIC DEVELOPER

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4 Claims. (Cl. 95—88)

This invention relates to photographic developers and more particularly to photographic developers in dry form, such as in the form where the necessary dry components of the developers 5 are packaged in quantities sufficient to make up a selected quantity of liquid developer.

In my application Serial No. 626,203, filed July 29, 1932, I describe and claim photographic developers containing as their principal alkaline 10 component a substance resulting from the interaction with a strong alkali of a substance containing tetraboric acid ($H_2B_4O_7$). In that application it is stated that the substances interacting may predominate in borax or in strong alkali, 15 so that by including this range of compounds it is apparent that an alkali metaborate, such for instance as sodium or potassium metaborate, would be included in that description.

I have found, however, that the alkali metaborates have unusual properties in their dry and 20 relatively pure form as the principal alkaline component for dry developers, since these metaborates are far less deliquescent than sodium hydroxide, for instance, and therefore do not cake up the 25 packaged developer. Furthermore, their combination with CO_2 of the air is relatively slight, so that decomposition of the developer is negligible. Furthermore, there is not the difficulty and hazard in handling and packaging the metaborates 30 which is connected with the use of sodium hydroxide.

Very important in the use of these alkaline metaborates in developers is the fact that blistering of the negative or positive being developed is 35 avoided, for the reason that CO_2 is not generated by the acid in the fixing bath as is the case where sodium carbonate is employed, as the alkaline agent of the developer, it being impossible, of course, to completely free the photographic film 40 from all traces of developer by the time it reaches the fixing bath.

It is, therefore, an object of my invention to provide a photographic developer in dry form in which an alkali metaborate is employed as the 45 alkaline component. Other objects will appear hereinafter.

As examples of various developer formulæ in dry form, containing an alkali metaborate, such for instance as sodium metaborate, I would give 50 the following:

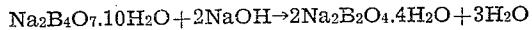
	Ex. I	Ex. II	Ex. III	Ex. IV	Ex. V
Elon.....	6.0	1.0	2.5	2.5	2.0
Hydroquinone.....	3.0	4.0	2.5	2.5	5.0
Sodium sulfite.....	30.0	30.0	30.0	30.0	100.0
Sodium metaborate.....	40.0	20.0	10.0	20.0	2.0
Potassium bromide.....	1.0	0.5	0.5	0.5

The proportions may, of course, be in grams or 60 any other suitable unit of weight.

These alkali metaborates may be prepared by at least two different methods. In the first place they may be prepared by the simple interaction in water solution of any oxygen acid of boron, or those of their alkali salts which are less alkaline 65 than the metaborates, with a strong alkali. In the case, for instance, where two molecular proportions of sodium hydroxide and one molecular proportion of borax are so reacted, one normally obtains sodium metaborate with eight molecules of water of crystallization ($Na_2B_2O_4 \cdot 8H_2O$).

A simpler method and much more efficient one for preparing the alkali metal metaborates is to merely mix together a powdered alkali metal hydroxide and an alkali metal salt of tetraboric 75 acid; preferably, the two alkali metals are the same. Assuming that sodium metaborate is being prepared, one mixes borax and caustic soda in molecular proportions. During the process, the caustic removes the water from the borax and 80 goes into solution, generating considerable heat. Borax, being soluble in the caustic solution, also dissolves and the whole mixture becomes liquid. Sodium metaborate is thus formed and the whole liquid will solidify on cooling. If the mixture is 85 stirred throughout the process, the metaborate will crystallize from the solution in a fine powder. Otherwise it will set to a solid which is difficult to grind.

The reaction by which sodium metaborate is 90 formed may be represented as follows:



This latter method of preparation was developed 95 by Mr. Arthur W. M. Dickins.

The other alkali metal metaborates may be prepared either by the dry method or from solutions by interaction of the proper metal hydroxide and the oxygen acids of boron or those of their corresponding salts which are less alkaline than the 100 metaborates.

The packages of dry developer may, of course, be prepared in any suitable way from the above or any other developer formulæ which may be worked out. The above formulæ, if in grams, require the 105 addition of one liter of water to make a proper developing solution. Hence, for one liter of developer the above formulæ should be compounded in grams. If a smaller or larger volume of developing solution than one liter is required, one prepares the developer in correspondingly smaller or larger proportions.

It will be seen from the above formulæ that they 110 all have common thereto a developing agent, sodium sulfite and an alkali metaborate. I do not claim any particular novelty to the proportions in the formulæ or to the ingredients therein, other than the alkali metaborate, as it will be apparent that various developing agents known to those 115

skilled in the art may be employed, and that the potassium bromide may or may not be present according to the use to which the developer is to be put. Other preserving agents than sodium sulfite may, according to experience, be employed if desired.

It will be noted that I do not substitute my alkali metaborate in equal proportions for sodium carbonate ordinarily employed in corresponding developer formulae. If the same amount of developing agent is to be retained in the developer formula, I generally employ about twice as much alkali metaborate as sodium carbonate ordinarily employed. However, I may employ less alkali metaborate by adjusting the developing agent accordingly. For instance, if a lesser ratio of metaborate to carbonate is substituted than 2 to 1, this reduction may be compensated for in the above formulæ by changing the ratio of elon to hydroquinone, namely by increasing the elon content.

As an alkali metaborate, I may employ sodium metaborate, potassium metaborate or ammonium metaborate. Others within this class will, of

course, be apparent to those skilled in the art from the above description.

I have found one very interesting fact in connection with the use of these alkali metaborates, namely, that with developing agents which contain two hydroxyl groups in ortho positions of the benzene nucleus (such as pyro and pyrocatechol) the developing power is relatively much less than with other common developing agents.

What I claim as my invention and desire to be secured by Letters Patent of the United States is:

1. A photographic developer in dry form comprising an alkali metaborate and a developing agent.

2. A photographic developer in dry form comprising an alkali metal metaborate and a developing agent.

3. A photographic developer in dry form comprising sodium metaborate and a developing agent.

4. A photographic developer in dry form comprising potassium metaborate and a developing agent.

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