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# PREVENTION OF POPPING OF TRANSPARENCIES

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This invention concerns treatment of photographic transparencies to prevent them from popping.

Popping is a characteristic of many photographic transparencies during optical projection in a slide projector which uses an electric lamp as a light source. After a short period of projection the transparency moves relative to its frame so that it is no longer in focus requiring refocusing. This is known as popping.

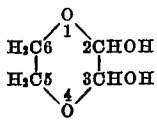
Various theories have been suggested for the phenomena of popping such as curvature due to different coefficients of expansion of the layers which make up the photographic transparency; another theory relates the popping to moisture absorption of the gelatin layer of the transparency while still others have been suggested.

In order to overcome popping, various solutions have been proposed such as cooling the light from the projection lamp by passing it through a heat absorbable glass or glass cell, coating the transparency with a waterproofing material to prevent moisture absorption, sandwiching the transparency between glass covers, and the like. We have found a simple method of dipping the transparencies in an aqueous bath which prevents popping during a projection period as long as 3 minutes in a slide projector.

One object of this invention is to provide a method of eliminating the popping in photographic transparencies. Another object is to treat photographic transparencies subsequent to processing in an aqueous bath with an anti-popping material. A further object is to provide an anti-popping dipping solution which also plasticizes the transparency so that it will withstand handling and the like.

Our invention consists of treating photographic transparencies with a solution of 2,3-dihydroxy-1,4-dioxane and allowing them to dry. A solution is prepared by dissolution 2,3-dihydroxy-1,4-dioxane in water to a concentration of about 5 to 15%. After the transparencies have been processed and washed during the normal processing operation, they are dipped in this bath from 1 to 5 minutes, although the period of time is not critical. A surplus solution is removed with a squeegee or may be removed by dipping in a water bath. The transparencies may then be dried either at room temperature or in a warm oven.

2,3-dihydroxy-1,4-dioxane which has the following structural formula:



may be prepared by reacting ethylene glycol with glyoxal in a vacuum over $P_2O_5$ (Journal Chemical Society 1955, 1036).

A polymethylene glycol may be added to the aqueous solution as a plasticizer to the treatment bath to a concentration of 2.5 to 5%. Such glycols as hexamethylene-1,6-diol, 3-methylpentane-1,5-diol and glycols with at least 6 carbon atoms may be used, provided they are water soluble.



The following examples are intended to illustrate our invention but not to limit it in any way.

*Example 1*

Fully processed colored transparencies comprising film base containing colored dye images located in a sequence of gelatin layers were dipped in a solution of 7.5% 2,3-dihydroxy-1,4-dioxane and 2.5% hexamethylene-1,6-diol for 2 minutes, squeegeed and dried in an oven at 120° F. These transparencies did not pop in an optical slide projector with a 250 watt lamp during a 3 minute projection period. A similar untreated colored transparency popped in 15 seconds.

Similar colored transparencies were also treated with 10% and 15% solutions of 2,3-dihydroxy-1,4-dioxane alone and with mixtures of 2,3-dihydroxy-1,4-dioxane and hexamethylene-6,1-diol at 5% plus 2.5%, 5% plus 5%, 10% plus 2.5% and 15% plus 2.5% concentrations respectively. None of these treated slides popped during 1½ minutes' projection time using the above described projector.

*Example 2*

Fully processed black-and-white transparencies were dipped for 2 minutes in a solution of 7.5% 2,3-dihydroxy-1,4-dioxane and 2.5% hexamethylene-1,6-diol, squeegeed, and dried. The resulting slides did not pop during 1½ minutes in the same projector.

Although the transparency may be dipped in the anti-popping solution for a longer period than 1 minute, longer dipping appears to give no improvement in popping characteristics. Apparently, the amount of dihydroxydioxane which is absorbed into the transparency is not sufficiently increased during the subsequent time to give any improvement in popping characteristics.

We claim:

1. A process for treating gelatin coated photographic transparencies to avoid popping during optical projection comprising dipping the transparencies in an aqueous solution of 5–15% of 2,3-dihydroxy-1,4-dioxane, removing the transparencies from the solution and drying.

2. A process for treating the surface of gelatin coated photographic transparencies adapted for optical projection comprising dipping the transparencies into an aqueous solution containing 5–15%, 2,3-dihydroxy-1,4-dioxane and a water-soluble polymethylene glycol having at least 6 carbon atoms, removing the transparencies from the solution and drying.

3. A process for treating the surface of gelatin coated photographic transparencies adapted for optical projection comprising dipping the transparencies into an aqueous solution containing 5–15% 2,3-dihydroxyl-1,4-dioxane and 2.5 to 5% of a water-soluble polymethylene glycol having at least 6 carbon atoms, removing the transparencies from the solution and drying.

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