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PATENT SPECIFICATION

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COMPLETE SPECIFICATION.

Improvements in or relating to Photographic Developing Processes.

We, KALMUS, COMSTOCK and WESCOTT, INCORPORATED, a Massachusetts corporation, of 110, Brookline Avenue, Boston, Massachusetts, United States of America, Assignees of LEONARD THOMPSON TROLAND, of 110, Brookline Avenue, aforesaid, a citizen of the United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to the selective treatment of the exposed and unexposed portions of light-sensitive films by which one of the portions, for example the exposed portion, is made harder than the other portion, whereby the two portions react differently to subsequent treatment, as for example a hot water etch in which the relatively soft portion is dissolved off leaving the other portion in relief or a dye bath in which the dye is absorbed predominately by one portion.

It has been proposed to effect this selective hardening in the developing process by employing a pyro developer comprising pyrogallic acid and an accelerator such as sodium hydroxide or ammonium hydroxide. However, such developers have proved unsatisfactory, particularly in the production of motion picture film where a high degree of perfection and uniformity is required, owing to their inherent tendencies to harden the unexposed as well as the exposed portions, to vary from time to time in their action, to leave the exposed portions more or less friable, to produce chemical fog, etc. For example, the principle objection to a developer containing sodium hydroxide is its strong tendency to harden the unexposed as well as the exposed portions of the film; and the chief objection to the use of ammonium

hydroxide, particularly in developing motion picture film, is the difficulty of securing uniform results in successive mixtures, this being largely due to the strong tendency of ammonium hydroxide to lose strength by evaporation when in the concentrated condition in which it is kept prior to mixing with the developer.

Objects of the invention are to provide a film treating composition and method by which the aforesaid selective hardening may be effected throughout long series of images with uniformity, to restrict the hardening to one of the aforesaid portions of the film, to make the hardened portion of the film firmer and less friable, to reduce the chemical fogging action of the composition, to increase the speed of action of the composition without substantially affecting the quality of the action, and to produce images which are more sharply etched and which are less likely to become scratched or otherwise mutilated in production or in subsequent use.

According to the present invention the developer and hardening composition is prepared by mixing with a developer and hardener such as pyrogallic acid or other suitable polyhydroxybenzene whose oxidation product is a hardener, a fixed alkali accelerator such as sodium hydroxide and a salt of a relatively weak alkali, such as ammonium chloride or bromide or other halide.

The admixture of the salt of a weak base eliminates the objectionable effects of the fixed alkali accelerator which have heretofore rendered its use unsatisfactory. Instead of hardening the light-sensitive film more or less throughout, as pyro developers containing fixed alkali accelerators have heretofore done unless employed with a restrainer such as sodium sulphite, the fixed alkali and weak alkali

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salt product is notably free from this tendency. Moreover, in making relief images by etching off the unexposed portion of the film, the soft and delicate nature of the reliefs made with a hardener containing sulphite is avoided with this developer which yields exceptionally firm reliefs; and the reliefs are much more sharply defined, especially in machine operation, than reliefs produced by an ordinary pyro-ammonia developer.

A small amount of citric acid may be incorporated in the pyro stock solution for its preservative action on the solution before the developer is mixed. As is customary, potassium bromide may be added to the mixture to restrain fog, but as above stated one of the advantages of the fixed alkali and halide of a weak base combination is that it has this function. A satisfactory formula for use in developing and hardening motion picture film in a continuous-machine is as follows:—
 Pyrogallic acid .82 gms., citric acid, .02 gms., potassium bromide .40 gms., sodium hydroxide .34 gms., ammonium chloride .17 gms., and enough water to make a total of 100 c.c.

The sodium hydroxide and ammonium chloride react to some extent to form sodium chloride and ammonium hydroxide; and better results seem to be attained by separately adding the sodium hydroxide and ammonium chloride just before use. The preferred method of mixing is to mix the pyro in water, then mix in the chloride, and then add the sodium hydroxide.

This developer has the desirable characteristics of both the well-known pyro-soda and pyro-ammonia developers without the undesirable characteristics of either. It has the uniformity and reliability of pyro-soda, and the selectivity in hardening of pyro-ammonia; at the same time it produces less chemical fog than pyro-ammonia so that the developer may be made stronger and the develop-

ment more compete, and it does not tend to harden the unexposed portions of the emulsion as does pyro-soda. Moreover, this developer seems to be unique in that it produces firmer, sharper, less delicate and less friable reliefs.

This developer eliminates the use of a restrainer such as sodium sulphite which is easily oxidized and unreliable in action and which has a softening effect upon the reliefs, making all the gelatine spongy. The probable explanation of this marked difference in results is that the sulphite developer restrains the hardening action throughout both the exposed and unexposed portions whereas the developer herein claimed avoids any tendency to harden in the unexposed portion inasmuch as it avoids chemical fogging.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. The art of treating light-sensitive film having exposed and relatively unexposed portions which comprises mixing with a developer whose oxidization product is a hardener, a fixed alkali and a salt of a weak base in such proportions as to convert the fixed alkali at least in part into an accelerator having less tendency to harden one of said portions of the film, and hardening the other of said portions of the film with the mixture.

2. The art according to Claim 1 characterized in that the fixed alkali comprises sodium hydroxide.

3. The art according to Claim 1 or Claim 2 further characterized in that the salt of a weak base comprises ammonium chloride.

Dated this 30th day of August, 1923.

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