Patented Nov. 29, 1938

2,138,486

UNITED STATES PATENT OFFICE

2,138,486

PHOTOGRAPHIC DEVELOPER

Ernst Fournes and Hans Diamant-Eerde,
Vienna, Austria

No Drawing. Application December 20, 1935, Serial No. 55,412. In Austria December 31, 1934

8 Claims. (Cl. 95—88)

This invention relates to durable photographic developers and fixer-developers for halide—gelatine-silver emulsions containing the known organic reducing agents.

In order to simplify operation and to standardize photographic developing of halide-silver-gelatine emulsions, standardized chemical solutions ready for use are put on the market. This possibility, however, is restricted to certain classes of recipes only, and more particularly to those containing alkali carbonate. When caustic alkalies are used, the durability of the majority of developer solutions containing the usual organic reducing agents is very limited. Caustic alkali, however, acts as an accelerator, and enables photo-chemical problems to be solved, which present insurmountable difficulties as long as alkali carbonate is used. The reason for the poor keeping properties of such developers containing caustic alkali is their ready liability to auto-oxidation in the air, that is to say when exposed to the atmosphere.

The present invention is based on the discovery that such developers containing caustic alkali can be protected from atmospheric oxidation to a far greater extent than is possible with the usual additions of sulfite. It is a known fact that carbohydrates, including among others grape sugar (dextrose), gain in reducing power when they are treated with alkali, this phenomenon being known in the "Fehling solution". Furthermore, von Euler and collaborators have recently proved that grape sugar solutions containing caustic alkali possess in a high degree the property of consuming oxygen from the atmosphere (cf. "Zeitschrift für physiologische Chemie", 217, pp. 1 et seq.). At the same time it is probable that the decomposition of the carbohydrate molecule by the alkali plays an essential part which becomes the more pronounced the higher the alkalinity of the carbohydrate solution is.

In the alkaline decomposition of carbohydrates there apparently become evolved bodies which possess greater reducing power than the carbohydrates themselves, such as for example methylglyoxalic compounds, glycerine aldehyde, tartronic acid, and the like; from these unstable bodies there can become evolved, by alkaline condensation, still higher molecular products.

We therefore added to developers containing caustic alkali, grape sugar and other carbohydrates such as fruit sugar or cane sugar, in the expectation that the reducing bodies generated in this way would protect the developer substance proper from the deleterious action of the air. And experience has shown that developer solutions produced in this way are actually capable of being kept for a longer time than those made up with sulfite alone.

Sugars, such as grape sugar and its derivatives such as saccharic acid, have it is true been used in the photographic art, but never in conjunction with free caustic alkali to produce a particular reducing effect.

For an example of the use of grape sugar in photography, reference may be had to Valenta, "Photographische Chemie", Austrian Patent No. 16,502, and German Patent No. 185,348, in which mention is made of the use of the alkaline salts of saccharic acid. Saccharic acid, however, possesses far weaker reducing power than sugar solutions containing caustic alkali.

With the present invention we have also succeeded in solving a further problem in connection with photographic developing. Present day striving after standardization and saving of labor demands the production of fixer-developers, that is to say solutions which are capable of developing and fixing in a single bath. This result is achieved by adjusting the concentration of the developing and fixing chemicals in the single solution in such a manner that the developing process sets in rapidly and proceeds at such a rate that it is practically finished by the time the fixing action starts. The necessarily high velocity of the developing process can be obtained by the addition of caustic alkalies, but at the expense of the durability, that is to say keeping properties, of the developer. Thus it has not proved possible hitherto to provide a successful and durable fixer-developer solution, in spite of the promising reports of various authors (cf. among others Bunel and Desalme, "Revue francaise de photographie", 1921, p. 129; Valenta, "Photographische Korrespondenz", 1914, p. 347; Lumiere and Seyewetz, "Revue francaise de photographie", 1921, p. 17).

This desirable result can be achieved with full practical success by the addition of grape sugar and other carbohydrates of a nature to yield, with caustic alkali, reaction products having an affinity for oxygen, to fixer-developer solutions made up with the addition of caustic alkali.

The use of grape sugar among other ingredients is indeed to be found in the British specification No. 216,976, but it is there proposed for the purpose of regenerating photographic fixing baths, and it is not used in the presence of caustic alkali, nor for the purpose for which it is used in the present invention, namely to pro-