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RECOVERY OF SILVER USED IN PHOTOGRAPHIC WORK.

No Drawing.

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To all whom it may concern:

Be it known that I, LOUIS WEISBERG, a citizen of the United States, residing at Grantwood, in the county of Bergen and State of New Jersey, have invented certain new and useful Improvements in the Recovery of Silver Used in Photographic Work, of which the following is a specification.

This invention relates to a process for recovering silver used in photographic work. It is well known that in photographic work thin films containing compounds consisting of silver and a halogen are applied to sheets of glass, paper, celluloid, or other material. These silver salts are sensitive to light and after being properly exposed to the action of light, they are treated with a developer to fix the image, after which the unchanged silver salt is removed by means of a solution that will dissolve the same. A solution of sodium thiosulfate is most commonly used to wash or dissolve the unchanged or unaffected silver salt off the plates after the "developer" has been applied. In this hyposulfite solution the silver salt is dissolved, probably forming a double salt of the formula $2\text{Na}_2\text{S}_2\text{O}_3 \cdot \text{Ag}_2\text{S}_2\text{O}_3$. It is difficult to recover the silver from this solution on account of the solvent power of the hyposulfite solution or so-called "hypo" on silver salts, many of which are insoluble in other solutions. By my invention the silver can be readily recovered from such solutions as are used in photographic work.

Different methods for recovering the silver from the solution have been tried but give rise to certain objections. For example, the silver has been separated from such solutions by the addition of sodium sulfide, but on account of the strong unpleasant odor that arises, this method is objectionable and is prohibited in some localities for this reason. This is especially true for closed rooms or in the vicinity of residence districts. Another method that has been used is by precipitating the silver from its solution by means of zinc or other metals. This method is not entirely satisfactory because of its expense and slowness and the impracticability of thereby recovering substantially all of the silver.

By the present invention I am enabled to recover substantially all of the silver from the solutions in which it is dissolved, following the developing and fixing step in photographic work. My method is easy and con-

venient to apply and is economical as no very expensive materials are required, and the recovery of the silver from its solution is substantially complete. At the same time the method does not give rise to disagreeable odors or create a nuisance or require an inordinate amount of care and attention.

In carrying out this invention I make the solution, in which the silver salt is dissolved, alkaline by the addition of sodium, potassium, or ammonium hydroxide and add a reducing agent. I have found that ordinary sugar, such as cane sugar, or grape sugar, serves excellently as a reducing agent for this purpose. I usually prefer to use sodium hydroxide on account of its cheapness as well as its entire freedom from odor, and I preferably add a sufficient amount to the silver solution so that the concentration is about 1.5 to 2.0%; that is, I add sodium hydroxide to the amount of about 1.5 to 2.0% of the weight of the solution in which the silver is dissolved. The amount of sugar used should usually be slightly in excess of the amount theoretically required for reduction of the silver salt. In solutions of this sort, after they have been used to dissolve silver salts from photographic films, there has been found about one-third of an ounce of silver per gallon of the solvent, in which case about an equal weight of sugar should be used per gallon of the solvent, and a correspondingly larger amount when there is more of the silver salt in the solution.

This invention is applicable whether the silver salt used for the photographic film contains chlorine, bromine or iodine; also whether the "developer" is ferrous sulfate, pyrogalllic acid or other materials in common use for this purpose.

I may first add the alkali to the solution containing the silver salt and then add the sugar, or I may add the alkali and sugar in reverse order, or I may add them simultaneously. If the reaction is carried out in a boiling solution the time required to effect the separation of the silver is very short, say about ten minutes after boiling is started, but it is practicable to carry out the process at ordinary atmospheric temperatures, under which condition the time required to obtain substantially complete separation of the silver is about a day. In either case the solution should be permitted to stand for a while after the addition of the sugar and alkali. The silver deposits at the bottom of the ves-

sel in which the reaction is caused to take place and can then be separated by siphoning off the supernatant liquid, after which the residue which is substantially metallic silver, may be sent to the refinery where the pure silver may be recovered, or the silver may be converted into halogen or other compounds. If desired, the silver may be separated by filtration, but in small establishments at least the other procedure is preferable.

In the claims I use the word "sugar" in its generic sense and intend to cover thereby all substances chemically classed as reducing sugars.

I claim:

1. The process of recovering silver from solutions used in photographic work, which comprises adding sugar and a sufficient amount of alkali to cause substantially all of the silver to be precipitated.

2. The process of recovering silver from

hypo solutions, which comprises adding sugar in excess of the amount theoretically required to completely reduce the dissolved silver, and enough alkali to make a concentration of about 2% by weight in the resulting solution.

3. The process of recovering silver from hypo solutions, which comprises adding sugar and sodium hydroxide, the amount of sugar being slightly in excess of that required to reduce the silver salt.

4. The process of recovering silver from hypo solutions, which comprises adding sugar and about 2% of sodium hydroxide.

5. The process of recovering silver from hypo solutions, which comprises adding sugar and an alkali and raising the temperature to the boiling point.

In testimony whereof I affix my signature.

LOUIS WEISBERG.