THE PREPARATION AND USE OF "PAPIER SEPIA."

BY PROF. R. NAMIAS.

ACCORDING to experiments that I have been carrying out, an excellent paper for sepia tones can be prepared by applying the solution given below to a good quality of paper—such as that supplied expressly for this purpose by the house of Steinbach, of Malmedy (Prussia):

A.—Green ferric-ammonio citrate. 20 grammes
Citric acid..... 5 "
Distilled water..... 50 cc.
B.—Silver nitrate..... 5 grammes
Distilled water..... 20 cc.

These two solutions may be mixed upon the day of using or some days beforehand. The liquid is made up to a bulk of 100 cc. by the addition of distilled water, and in this way a sensitizing solution is prepared with very little trouble, which may be used in the following way:

The paper may easily be coated by hand, or by means of machinery of a similar type to that used for coating the ordinary blue printing papers. If with one coating the paper does not give as vigorous an image as is wished, a second coat can be given after the first is dry. This Papier Sepia will keep well for months, especially when it is kept in a dry state; and it will be found on trial that it needs a shorter exposure than is the case with albumenized paper. Indeed, with some papers that are on the market it will be found faster than gelatino-chloride.

The most important reaction which takes place when this Papier Sepia is exposed to light is the reduction of the ferric citrate to ferrous citrate. This partly accounts for the reduction of the silver salt present (citrate), which becomes reduced to the state of metallic silver. This is the chief reason why the paper on exposure takes a brown or blackish tint. At the same time, there is a direct change in the silver citrate, brought about by the action of the light, which blackens it, or which, at any rate, predisposes it very strongly to reduce completely by contact with the ferrous salt which forms.

The paper should not be printed out so fully that all the details are visible, even those in the shadows. It is quite sufficient to leave off when these are faintly indicated, because in the washing, which should take place immediately after printing, there is a further reduction of the silver citrate, which brings about a great increase in the vigor of the print. Exposure to light alone can never bring this reaction between the ferrous salt and the silver citrate about completely, on account of the absence of sufficient moisture in the sensitive paper to act as the vehicle by means of which the two salts are brought together. This washing may therefore be regarded as a partial development—the ferrous citrate being completely restored to its condition of ferric citrate by reducing the silver salt to metallic silver.

All the ferric salt that has not been reduced by light is easily got rid of by the washing. Only part of the silver which has not been reduced is removed by this washing. The silver forming the image possesses a very unpleasant yellow color, which becomes more and more yellow the longer the print is left in the water.

This water development is best carried out by immersing the paper for two or three minutes in running water, or, failing that, by changing the water in the dish a few times. It is followed

by immersion in a fixing solution made of a five to ten per cent. solution of hypo (not stronger), in which the print is left for from one to two minutes. The fixing should not be unduly prolonged nor the solution too strong, or the image will be reduced in vigor.

Fixing at once changes the yellow of the print to a brown, and gets rid of the rest of the unreduced silver salt, which, if left in, would discolor the whites. After fixing, the prints may be washed for ten minutes in running water. As the paper dries the image becomes much stronger, and changes to a beautiful sepia tone. This Papier Sepia—differing altogether from the ordinary commercial printing-out papers which contain silver—is capable of giving, by mere fixation and without toning, images of an excellent tone, altogether different from the yellowish-brown tones which other preparations yield.

It may be as well to point out here that Papier Sepia differs very widely from the papers which print right out, by the entire absence of silver chloride in the sensitive medium, and especially by the fact that the reduction of the salt of silver is carried on to a much greater extent when it is the ferrous citrate that does it than when it is left to the light alone to act directly upon the silver citrate. In the case of papers which print right out, on the other hand, this is done by the direct action of the light itself alone, and the metallic silver is never set free unless it is after long-continued exposure—the effect of exposure in the ordinary way being the production of silver sub-chloride and other colored compounds, the result of the reduction of the organic silver salt or salts in the paper.

It may be thought at first that the yellow image upon Papier Sepia, obtained by development with water, does not itself consist of metallic silver (which is usually supposed to have a black color), but of some silver compound. It should, however, be pointed out that of all metals silver is the one which, prepared in the moist way by reduction from one of its compounds, may wear the most diverse aspects. Reduced silver, as Carey Lea has shown, may have a golden, a brown, a copper, a black, or almost any color, according to the details of its production.

As far as the change of color in the hypo is concerned, I am inclined to attribute this to a slight sulphurization, facilitated probably by traces of iron present in the image.

As confirming the view that the constitution of the image on Papier Sepia is totally different from that in ordinary direct printing silver papers, it may be pointed out that it is impossible to tone it with gold before fixing. I have verified this, and find that no matter what may be the composition of the toning bath employed, it is impossible to modify to an appreciable extent the color of the image produced by plain water development. The image on Papier Sepia, so developed, does not contain those reduction products of silver salts which, as I have shown elsewhere, is the principal cause for the easy deposition of gold upon the picture.

Nevertheless, I find it an easy matter to tone Papier Sepia with gold if it is done after fixing. Perhaps, in such a case, the small quantity of silver sulphide which is formed by the fixing bath facilitates the deposit of the gold. However, a good result cannot be obtained with all formulæ, and I find that a bath containing an alkaline sulphocyanide like the following is preferable:

Water	1000 cc.
Ammonium sulphocyanide	25 grammes
Pure gold chloride	5 grammes

With this bath a fine deep purple tone is obtained. A similar tone can be got by using a combined toning and fixing bath made up simply of the hyposulphite solution and gold chloride (half a gramme of the latter to 1000 cc. of the

fixing bath). The presence of a lead salt in this bath tends to make the tone darker and less purple.

The permanence of the images on Papier Sepia simply fixed out is very great. It is at least as good as, if not better than, that of pictures on emulsion papers treated in separate baths. I have stated elsewhere that prints on Papier Sepia toned, after fixing, with gold in the method just stated are extraordinarily permanent. I have prints so obtained which, without varnish or other protection, have been exposed for the last three years to a strong light continuously; yet they are still exactly in the same condition as when they were prepared. If a protecting coating is desired, a light varnish of paraffin wax dissolved in benzine will be found useful.

It was in 1900 that I drew attention to the usefulness of Papier Sepia for making prints from negatives of industrial and similar subjects—furniture, hardware, machines, tools, etc.—and I have had the good fortune to see the paper grow greatly in popularity. This has been due to the facts that it is cheaper to make and to use than ordinary printing-out papers without any toning being necessary, it gives excellent prints with a smooth matt surface without any coating of collodion or gelatine to increase the difficulties of retouching. For pictorial postcards, where enough of one kind to make it worth while to adopt a photomechanical process are not required, Papier Sepia will be found economical and satisfactory.

Now, a few words upon the employment of Papier Sepia for copying plans, tracings, etc. Many important works in Italy have adopted it entirely for copying their working drawings. It can be used in the same way as the ordinary blue print paper, and then gives a copy with white lines on a brown ground. But it has this advantage over the ordinary blue print: Its brown ground is so non-actinic that a copy made in this way makes an excellent negative, from which any number of positive prints can be made, either on Papier Sepia or on blue print paper, as may be preferred. About a year ago I noted that when the paper is being used under these conditions to form a negative from which positives are afterward to be printed, it is better to use for fixing the negative, not a solution of sodium hyposulphite, but a saturated one of sodium sulphite. When this is the case, we get, instead of the dark brown image, a strong yellow one, which, although lighter in appearance, will be found still more opaque to the actinic rays.

The fixing of Papier Sepia can be carried out as well with sulphite as with hyposulphite, for, as I found by experiment, the organic silver salts are very soluble in sodium sulphite. Any one who thinks of using Papier Sepia for the copying of drawings in this way would do well to note what has been said on the substitution of sulphite for hypo, since, when the negative prints are so obtained, it is much easier to get the positives with a pure white ground. As far as the question of stability is concerned, the constant exposure of the paper negative to strong sunlight for printing generally leads to a slight lightening of the darkest parts when hypo has been used, which is not the case when the fixation has been accomplished with sulphite.

Prints on Papier Sepia make excellent originals for process work, especially in photo-zincography with albumen. It is convenient sometimes to make a print on this paper, to go over the parts which it is desired to reproduce with Indian ink, and then to remove all the rest of the photograph, which can be done easily by immersing the print in a solution of hypo to which one or two per cent. of potassium ferricyanide has been added.

I should like to add a few words about some experiments I have made during the last month or two with other sensitive mixtures of silver salts which have had some interesting results. I noticed that if in the preparation of Papier Sepia a sufficient quantity of ferric oxalate was added, I got prints in which the images were still blacker, even when fixing only was employed. The formula which I found by trial to be the best is the following:

A.—Green ferric-ammonio citrate. 15 grammes
Ferric oxalate..... 10 grammes
Distilled water..... 50 cc.

B.—Silver nitrate..... 5 grammes
Distilled warer..... 25 cc.

Solution A is made slightly warm, in order to facilitate the dissolving of the ferric oxalate; then B is added to it, and the whole is made up to 100 cc. by the addition of distilled water.

Paper prepared in this way will only keep in a good condition for a few days, for the ferric oxalate in the presence of silver nitrate forms a combination which is very prone to reduction, like that on platinum paper. With the ordinary platinum toning baths applied after development with water, and before fixing, the image takes a very black platinum tone, such as cannot be obtained with any other paper and platinum toning.

Papier Sepia, prepared without ferric oxalate, is not capable of being toned with platinum.

WATERING THE COLTS. By Henry Troth.