

CHAPTER II

THE REMOVAL OF THE SILVER IMAGE

BLEACHING. — The bleaching process has the purpose of making the bromide print, correctly prepared according to the previously described method, suitable for the bromoil process. To this end the silver image must be made to disappear and in its place that condition of the gelatine produced which renders it possible for it to take up the greasy ink. *The bleaching solution has, therefore, two functions: it must remove the metallic silver, imbedded in the gelatine film, which forms the bromide image, and at the same time cause a tanning of the gelatine film corresponding to the image that disappears. In the place of the silver image there then exists an invisible tanned image in the gelatine film.*

There are a large number of chemical compounds known to photographic technique, which enable us to dissolve out the metallic silver imbedded in the gelatine film. Such are, for example, the many reducers which have found practical application. Many of these chemicals also cause changes in the gelatine simultaneously with the solution of the silver. But not one of the hitherto known bleaching solutions possesses the double power required of it: solution of the silver image and corresponding tanning of the film. Some produce too great a tanning which acts upon the whole film, and the result in inking-up is muddy flat prints, which do not lend themselves to artistic modification. With other

bleaching solutions a differential tanning of the gelatine is produced, but at the same time they so alter the surface of the gelatine that it becomes glossy all over, and only takes even soft inks with difficulty.

My experiments have led to the compounding of a bleach which completely fulfils the requirements set for it; the silver image is quickly and completely removed, while simultaneously a tanning of the film, strictly analogous to the disappearing image, is effected; easier and more certain inking-up is rendered possible, and besides this the advantage is obtained that the differences of relief, produced in the gelatine by the bleaching process, can be influenced to a wide degree by varying the temperature of the water. The composition of this bleaching solution, which prepares the gelatine film in the most perfect manner for the bromoil print, is as follows, three stock solutions being required:

I. Cupric sulphate	200 g	2 oz.
Water	1000 ccm	10 oz.
II. Potassium bromide ..	200 g	2 oz.
Water	1000 ccm	10 oz.
III. Cold saturated solution of potassium bichromate.		

A concentrated bleach is made by mixing:

Solution I.	3 parts
Solution II.	3 parts
Solution III.	1 part

To every 100 ccm of this mixture should be added 10 drops of pure hydrochloric acid (10 drops to $3\frac{1}{2}$ oz.). This concentrated bleach will keep indefinitely and

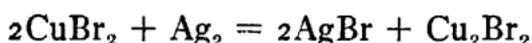
should be diluted before use with three to four times its volume of water. The use of a more concentrated solution is not advisable, as irregularities frequently occur in consequence of too rapid bleaching, especially towards the margins of the prints.

The color of the concentrated bleach is green, or when diluted, yellowish; the solution must be absolutely clear. When the stock solutions are mixed there is usually some cloudiness, but this is cleared up by the hydrochloric acid. By standing for a long time at low temperatures a precipitate is sometimes formed, but this is of no moment. The compounding of this bleach should be made with the greatest accuracy. Inaccuracies or modifications in its composition are serious, because although the solution does not lose in bleaching power, yet the invisible tanning action is then often not completed in the desired manner. Too great an addition of hydrochloric acid for example, accelerates the process of bleaching, but the inking-up of prints thus bleached is frequently difficult. If the bleaching of the shadows of the bromide prints goes on slowly, the reason as a rule lies in the fact that the prints were overdeveloped and have an excessively dense silver deposit.

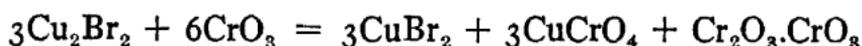
The bromide prints should be immersed in this bleaching solution, after previous soaking in cold water. If they have been correctly made, the image rapidly grows weaker and after a few minutes its greyish-black color changes into a pale citron yellow. If the bromide print was developed too far, the bleaching takes rather longer, as the shadows, developed right through to the base, require a lengthy period for solution. If several prints are to be bleached at once, the best procedure is to place one print in the solution and turn it film side

down when the first traces of bleaching are noticeable. Then the next print should be immersed with the film up and by thus proceeding gradually it is possible to bleach a large number of sheets simultaneously in the one dish. Continual movement will prevent the formation of air bells. If air bells adhere to the film, they protect those places from the action of the bleach and dark points or spots of unchanged metallic silver remain, the subsequent bleaching of which naturally prolongs the process. The same applies to prints which lie on top of one another.

With too slow bleaching, the hydrochloric acid may be gradually increased, *at the most* to double that prescribed; one should not hasten the bleaching process by warming the solution. The bleaching is rapidly effected in warm solutions; yet generally the film of moderately hardened papers is so altered that they swell up too much even in cold water and take the ink badly or not at all. The dilute bleaching solution will keep and may be used repeatedly as long as it acts; when it becomes exhausted, the slowing up of the bleaching cannot be hastened by the addition of hydrochloric acid. The chemical reactions in the bleaching bath are, according to Dr. P. R. von Schrott, as follows:



The cuprous bromide, Cu_2Br_2 , which is formed, reduces the bichromate as follows:



It sometimes happens that bromide prints, in spite of

long immersion in the bleaching solution, apparently will not bleach and only change their color to brown.

The reason for this usually unimportant phenomenon is, as a rule, that such prints have not been sufficiently washed and still contain hypo.

It may also happen that prints which have lain on top of each other in washing are badly washed in parts; then the image bleaches, *but the film shows dark patches or streaks at those places which still contain hypo.* Such apparently unbleached prints should be left for about 10 minutes in the bleaching solution; *the disturbing coloration, whether of the whole picture or only of parts, disappears completely in the subsequent baths,* even when the image had apparently remained at full strength.

If such a print, apparently not bleached or spotty, is immersed in the sulphuric acid bath mentioned below, the discoloration of the film is quickly removed by its action; the print then often passes through a phase in which it appears to be a negative, the secondary image becoming visible on the yellow ground, and then bleaches out completely. With such prints it may also happen that it is only noticed after removal of the stain that unbleached traces of the silver image still remain. Then the bleaching must be repeated.

If the color of the bromide print only changes to brown even after protracted immersion in the bleaching solution, otherwise retaining full gradation, and remaining unchanged even in the sulphuric acid bath, though it bleaches out in the hypo, the print cannot be inked. The reason for this difficulty is improper composition of the bleaching solution, or occasionally improper development and fixation of the bromide print. It may

also be due to excessive use of the bleaching solution; 3 to 4 ccm (50 to 70 minims) of concentrated bleaching solution should be allowed for every 13 by 18 cm (5 by 7) print.

Obviously all these processes may be carried out by diffused daylight. The bleached-out prints should be repeatedly washed, until the drainings are quite clear, and should then be immersed in the following bath:

Sulphuric acid, pure	10 ccm	77 min.
Water	1000 ccm	16 oz.

In this bath any remaining color disappears quickly and completely, and prints, which have apparently wholly or partially resisted bleaching, are also very rapidly decolorized in this bath. Any spots and streaks also disappear. If, however, there is anything left, then the bleaching was not complete, and unreduced metallic silver remains in the film. After the sulphuric acid bath the prints should show the pure color of the paper base; the film side ought to be hardly different from the back in color. With prints that have been over-developed, a certain slight variation of color remains in the film, which, however, in no wise prejudices the inking-up. If there are still some spots, they are usually due to a slight precipitate lying on the surface of the film, which can be easily swabbed off. When this point of colorlessness is reached, and it usually requires only a few minutes, it is useless to leave the prints longer in the acid bath. They should be washed in repeated changes of water and immersed in the following fixing bath:

Hypo	100 g	1 oz.
Water	1000 ccm	10 oz.

The use of this fixing bath is essential and is based on the following considerations. During the bleaching process a secondary silver bromide image is formed in the gelatine film. This secondary image is not visible on white and yellowish bromide papers, because it is whitish-grey. If a bleached print, which has not been fixed, is exposed for a long time to daylight a distinctly visible blue-grey image is formed, which naturally is troublesome in the further operations. This secondary image of silver bromide is completely removed, however, by the fixing bath.

The ordinary acid fixing baths can also be used without disadvantage for fixing. If the sulphuric acid is not sufficiently washed out, decomposition of the fixing bath may ensue, which will be made apparent by the unpleasant smell, and which is prejudicial to the action of the bath. Care should be taken that the prints do not stick to one another in the fixing bath and that they are thoroughly fixed out, as the secondary bromide image that is not removed will make its appearance in insufficiently fixed places and may cause darker patches.

Washing then completes the preliminary preparation of the prints.

For the sake of completeness it should be mentioned that the prints may be immersed in the bleaching solution in the darkroom after the first development, and can be fixed after the solution of the silver image. This shortened process is, however, uncertain and can not be recommended.

THE INTERMEDIATE DRYING. — *After the bleaching process outlined in the previous section the print must be dried without fail.* While drying after the development and fixation of the bromide print is advisable but not absolutely necessary, *the intermediate drying after bleaching is of the greatest importance.* It is possible that the later operations may be successful in spite of neglect of this recommendation. As a rule, however, various mishaps occur when the intermediate drying is omitted. In many cases the ink can only be caused to adhere with difficulty, in others, not at all; sometimes the inking will proceed up to a certain point and then suddenly completely stop. Sometimes the image appears as a negative, that is to say, the ink is taken up by the high lights and rejected by the shadows. All these failures will be obviated by the intermediate drying at this stage. Whether this intermediate drying takes place rapidly or slowly is practically immaterial; naturally it ought not to be so prolonged that the gelatine suffers.

The prints thus prepared can either be again soaked in water and immediately worked up, *or kept and treated at any time.* It is very convenient, especially for an amateur, to have a stock of such ready prepared and dry prints, because he is then in a position to work when he finds time and opportunity. The prints, prepared and dried as has been described, will keep indefinitely. With correct treatment there can be seen on the gelatine film of the dry print scarcely a trace of the bleached-out image; only in the very deepest shadows a slight coloration of the film, tending to grey, can sometimes be noticed. It is advisable, therefore, to mark the print on the paper side before bleaching, as otherwise it is subsequently difficult to distinguish this.

Before we go any further, the whole preliminary process is summarized once more:

Development,
Fixation,
Washing,
Bleaching,
Short washing,
Sulphuric acid bath,
Short washing,
Fixation,
Washing,
Intermediate drying.