CHAPTER I

PRODUCTION OF THE BROMIDE PRINT

FAILURES in the bromoil process in the great majority of cases can be ascribed to the fact that the basic bromide print was not satisfactory. Therefore the method of preparation of the bromide print or enlargement deserves the most careful consideration, for the bromide print is the most important factor in the preparation of a bromoil print. *The beginner, especially, can not proceed too carefully in making his bromide print.*

Because of the extraordinary importance of this point, we must first define what is here meant by a perfect bromide print.

In deciding how to produce a satisfactory bromide print as a basis for a bromoil, we must exclude from consideration esthetic or artistic grounds.

The bromide print must be technically absolutely perfect, that is, it must have absolutely clean high lights, well graded middle tones, and dense shadows. Especial stress must be laid on the brilliancy of the high lights. It is best to compare these high lights with an edge of the paper which has not been exposed and is not fogged or, even better, with the back of the paper. The highest lights should show scarcely a trace of a silver precipitate and must therefore be almost as white as the paper itself. *Negatives which do not allow of the production of prints as perfect as this should not be used while the bromoil process is being learned.*

This apparently superfluous definition of a perfect bromide print has to be given in this way, because it only too often occurs in practice that *the worker himself is not clear as to what is meant by the expression, perfect bromide print.* This may be partly ascribed to the fact that the silver bromide process — whether rightly or wrongly need not be determined here — has not been properly appreciated among amateurs who are striving for artistic results. Bromide printing has frequently been considered not to be satisfactory as an artistic means of expression, and has therefore been considerably neglected. In many quarters it is considered as just good enough for beginners.

Nevertheless, the bromide process is *per se* an uncommonly flexible method and gives, even with a very considerable amount of overexposure or underexposure, that is, even when very badly handled, results which are considered usable. It is even possible that an improperly made bromide print, one for instance, which is soft and foggy, might in some circles be considered as esthetically more interesting than a perfect print. This is an undeniable advantage of the process. It may also become a danger, if an imperfect bromide print is used as a starting point in the bromoil process. If anyone is not sure on this point, let him compare his own bromide prints with such samples as are frequently shown by manufacturers in window displays and sample books. He will then see what richness of tones and wealth of gradation are inherent in the process. *If, however, an imperfect silver bromide print is used as a starting point for a bromoil, it can not be expected that the latter will display all the possibilities of this process.* If the bromide print is muddy, the work of inking will be dif-

ficult, and it will be impossible to obtain clean high lights. If it is underexposed and too contrasty, it can not be expected that the bromoil will show details in the high lights which were lacking in the bromide print. If the worker himself does not know that his silver bromide print is faulty, he is inclined to ascribe the difficulties which he finds in making the bromoil print and his dissatisfaction with the results, to the bromoil process itself. Most of the unsatisfactory results in bromoil work must be ascribed to the imperfect quality of the bromide print which is used, and this is the more important as this lack is not perceptible to the eye after the bleaching is completed. *Whoever, therefore, desires to successfully practice bromoil printing, must first decide impartially and critically whether he actually knows how to make bromide prints, and must acquire full mastery of this process.*

The technically perfect bromide print made from a properly graded negative can, as will later be described, have its gradations changed in the bromoil process without any difficulty, and thus be made softer or more contrasty. The advanced bromoil printer who is a thorough master of the technique of the process will therefore easily be able to work even with poor negatives; when making his bromide prints from such negatives, he will consider the ideas which he intends to incorporate in the bromoil print and will make his bromide print harder or softer than the negative and at the same time retain the necessary cleanness of the high lights.

The best starting point for a bromoil print, however, especially for the beginner, is and must be a bromide print as nearly perfect as possible.

A suggestion for the certain obtaining of such prints may be added here. When we are working with a negative with strong high lights, judgment as to the freedom of the bromide print from fog by comparison with an unexposed edge is not difficult. This is not the case with negatives which show no well marked high lights. In such cases it is advisable to *determine what is under-exposure* by making test strips in which details in the high lights and middle tones are lacking and, working from this point, determine by gradual increase of exposure the correct time which gives a perfectly clean print.

THE CHOICE OF THE PAPER. — One of the most important problems is to find a suitable paper for the process. Not all of the bromide papers which are on the market will give satisfactory results. *It is only possible to use papers whose swelling power has not been too completely removed in process of manufacture by the use of hardeners.* The principle of the bromoil process is that a tanning of the gelatine shall occur simultaneously with the bleaching of the silver bromide image. As we have already remarked, this does not affect the high lights and leaves them still absorbent, while the shadows are tanned and therefore become incapable of taking up water. The half-tones are tanned or hardened to an intermediate degree and therefore can take up a certain amount of water. *Therefore, in place of the vanished silver image, we get a totally or partially invisible tanned image in the gelatine film.*

The variously hardened parts of the gelatine film, corresponding to the various portions of the vanished bromide image, display the property acquired through different degrees of tanning by the fact that the portions

of the gelatine which remain unhardened and which correspond to the high lights of the silver image formerly present, absorb water greedily. Consequently they swell up and acquire a certain shininess, because of their water content; in addition they generally rise above the other parts of the gelatine film, which contain little or no water, and give a certain amount of relief when they are fully swelled. The portions of the film in which the deep shadows of the bromide image lay are completely tanned through, can therefore take up no water, and remain matt and sunken. This graded swelling of the gelatine film becomes more apparent, the higher the temperature of the water in which the film is swollen.

If, however, the paper was strongly tanned in the process of manufacture, the gelatine has already lost all or most of its swelling power before it is printed and, although the bleaching solution in such cases can indeed remove the silver image, it can no longer develop the differences of absorptive power which are necessary for a bromoil print; for, although the bleaching solution can harden an untanned gelatine layer, it cannot bring back the lost power of swelling to a film which is already hardened through and through.

Therefore bromide papers which have already been very thoroughly hardened in manufacture show no trace of relief after bleaching, and very slight, if any, shininess in the lights. This is the case especially with those white, smooth, matt, heavyweight papers which are especially used for postcard printing. When such papers are taken out of the solutions, as a rule, these run off quickly and leave an almost dry surface. It is generally not possible to make satisfactory bromoil prints on such

papers. It is true that the image can be inked by protracted labor; it is, however, muddy and flat and, as a rule, cannot be essentially improved even by the use of very warm water. Other types of bromide paper which have not been so thoroughly hardened may show no relief after bleaching, yet, after the surface water has been removed, they do show a certain small amount of shininess in the high lights when carefully inspected sidewise. With such papers the necessary differences of swelling can generally be developed if, as will later be more completely described, they are soaked in very warm water or in an ammoniacal solution. It is rare to find in commerce silver bromide papers which have not been hardened at all, or only very slightly hardened, in their manufacture. Such papers, because their films are very susceptible to mechanical injury, are not likely to stand the wear and tear of the various baths. On the other hand, as a rule, they usually produce a strong relief even in cold water, and therefore tend to produce hard prints. The greatest adaptability for bromoil printing may be anticipated from bromide papers which are moderately hardened during manufacture.

To determine whether a given brand of bromide paper is suitable for bromoil work, an unexposed sheet of the paper should be dipped in water at a temperature of about 30° C. (86° F.) and the behavior of the gelatine film observed. If this swells up considerably and becomes slippery and shiny, the paper has the necessary swelling power and can be used with success.

On account of the great variety of bromide papers which are on the market, we have a very wide choice as regards the thickness and color of the paper and the structure of its surface. It may be remarked here that

papers of any desired surface, even rough and coarse grained papers, can be used for bromoil printing, as easily as papers with a smooth surface. The difficulties experienced with very rough surfaced papers in some other processes do not exist in bromoil. Because of the elasticity of its hairs, the brush carries the ink as easily into the hollows of the surface as to its high points.

The thickness of the paper is of no importance in bromoil printing, except that the handling of the thicker papers is easier, because they lie flatter during the work and distort less on drying; also, as a rule, thick papers are easier to ink.

Gaslight papers can also be used if their gelatine films satisfy the above mentioned requirements. Therefore we have the widest possible choice in the printing materials for bromoil.

A great number of bromide papers of different manufacturers are well suited for bromoil printing; it is, however, advisable to make a preliminary investigation as to the amount of hardening they have undergone, for it occasionally happens that different emulsions of the same brand show quite different grades of hardening, so that on one occasion it is possible to make bromoil prints on them without the least difficulty, while the same paper at another time may absolutely refuse to take the ink. On account of the great popularity of the bromoil process in recent years, it can be easily understood that some manufacturers might seek a wider sale for their products by claiming for them a special suitability for this process. It is therefore a wise precaution to previously test even those brands which are advertised as specially adapted for bromoil printing, and not to depend too much on such claims.

DEVELOPMENT. — The processes of tanning in the film of a bromide print, produced by the bleaching of the silver image, which will be described later, are of an extremely subtle nature. We must therefore endeavor to avoid all causes for damage in this process and especially everything which tends to harden the whole film even to the slightest degree. Any tanning, which affects the whole gelatine film, has the same effect as general fog in a negative. It is well known that almost all the developers used in photography have more or less tendency to harden the gelatine film. A very considerable damage to the bromoil print through the use of a tanning developer might naturally be imperceptible to the eye. Yet this may at times manifest itself in a very undesirable and disturbing form, especially when the bromide paper has been so much hardened in manufacture that it possesses only just the necessary qualification for bromoil printing. It may then happen that the last remainder of swelling capacity can be taken from the paper by the use of a tanning developer. However desirable it might be and however it might simplify the process to be able to use any desired developer in producing the bromide print, to avoid trouble it must be observed that the use of developers which tan the film may seriously influence the result, even though it is possible to get some kind of prints in many cases. *If the worker is absolutely sure that the bromide paper which he is using is not strongly hardened and is therefore well suited for bromoil printing, he may undertake development with any one of the ordinary developers which he prefers.*

The developers, which do not exercise a hardening influence on the gelatine, are the iron developer and

amidol (diamidophenol hydrochloride). As the iron developer is not really suited to this purpose on account of certain unpleasant qualities inherent in it, it is advisable to use amidol for the development of bromide paper for bromoil printing whenever possible, and the best developer is composed as follows:

Amidol	1.7 g	12.3 gr.
Sodium sulphite, dry..	10 g	77 gr.
Water	1000 ccm	16 oz.

The sodium sulphite is first dissolved in water, and the easiest way is to pour the necessary quantity of water into a developing dish and sprinkle the pulverized or granular dry sodium sulphite into it while the dish is constantly rocked; solution takes place almost instantly under these conditions. Larger lumps, which would stick to the bottom of the dish, must be immediately stirred up. As soon as the sodium sulphite is dissolved, the amidol should be added and this will also dissolve immediately. The addition should be made in the order described, for, if the amidol is dissolved first, the solution is often turbid. If dry sodium sulphite is not available, double the quantity of crystallized sulphite may be used.

The amidol developer should be freshly prepared each time that it is used, as it does not keep in solution. The measurement of the quantities of amidol and sulphite given above does not need to be made with the most painstaking care, as small variations in the quantities are unimportant.

In using amidol developer the greatest care must be taken to avoid allowing amidol powder, in even the

smallest quantity, to come into contact with the bleached print ready for bromoil printing. Even the finest particles of amidol, although invisible to the naked eye, will produce yellowish brown spots on the gelatine which penetrate through the film and into the paper itself. These dots and spots, especially if, as is usual, they occur in large numbers, will make the print completely useless, and it is impossible to remove them.

If amidol developer is not available, *any other developer which is desired* may be used. As we have already stated, however, certain possibilities of failure are to be anticipated, but will not necessarily occur.

Every effort should be made to produce a bromide print as perfect as possible, with clean high lights.

The best bromide prints or enlargements for bromoil printing are those which are *correctly exposed, but are not developed out to the greatest possible density.* A print which is thus fully developed is very satisfactory as a bromide but offers certain difficulties in bromoil printing, which will be described later. *Therefore the development should be stopped as soon as the lights show full detail without any fog, but before the shadows have reached full density.* The deepest shadows should then be of a deep greyish black, but should not be clogged up. When a bromide print is properly exposed, there is sufficient time between the appearance of the details in the lights and the attainment of the deepest possible black in the shadows to easily select the proper moment for cessation of development. It is, however, desirable not to go beyond this stage of development, for the reason that *a very dense silver deposit distributed completely through the gelatine emulsion to the paper support is not easily bleached out.* When this difficulty

occurs, the bleaching solution is generally, but incorrectly, blamed for it. If, in spite of this difficulty, complete bleaching is attained, the shadows of the image usually retain a yellowish color which cannot be removed by the baths which follow the bleaching. If it is intended to ink up the whole surface of such a print, this discoloration of the shadows is not important, for it will be completely covered by the ink. But if the print is to be treated in a sketchy manner, and some parts of its surface are not to be inked, this cannot be successfully done on account of the yellowish coloring of the shadows.

Underexposure must be carefully avoided, for details which are not present in the bromide print will, of course, not appear in the bromoil print.

Overexposure will occasionally give usable results, if the development of the overexposed print is stopped at the proper point. In such cases, we must usually expect some deposit in the high lights and consequently a certain fogging of the image, though this can often be overcome, at least partly, by swelling the print at a higher temperature. Perfect prints cannot be expected, if the basic print is lacking in quality. If the overexposure is not too great, the print can be improved to a certain extent by clearing it in very dilute Farmer's reducer. Treatment with this reducer has no deleterious effect on the later processes. The Farmer's reducer should only be used for a slight clearing up of too dark parts of the bromide print; for this purpose the parts of the moist print which are to be reduced should be gone over with a brush dipped in very dilute reducer and immediately plunged into plenty of water, to avoid any spreading of the reducer into other parts of the image.

Developing fog should naturally be avoided as much as possible. Fogging of the bromide print is caused by the formation of a more or less dense silver precipitate without any relation to the image over the whole surface of the print. As the bleacher takes effect wherever metallic silver is present in the film, the result in such cases is a general tanning of the film, which is detrimental to the production of the necessary differences in swelling power in the gelatine. The tanned gelatine image is then also fogged.

Consequently the best results may be obtained from very brilliant, but not excessively developed, bromide prints.

We must also *avoid falling into the opposite extreme in the development of the bromide print, by getting too thin prints lacking in contrast.* In prints which are too thin, only a very small quantity of metallic silver has been reduced in the development, and this lies wholly on the surface of the film. Such prints usually show full detail, but the contrasts between the lights and the shadows are too small. Since the tanning produced by the later bleaching occurs because of the presence of metallic silver in the film, and since its intensity depends on the quantity of this silver, we cannot obtain the necessary difference in swelling power by bleaching the film of prints which are too thin because of insufficient development. The result is a weak tanned image in the gelatine film; bromoil prints thus produced can consequently only exhibit a very short scale of tone values, and this cannot be essentially lengthened by the use of the bromoil process alone. Such bromide prints may find a special application in combination transfers, which will be described later. It is also pos-

sible, under certain circumstances, to use incomplete development as a method for producing soft bromoil prints from contrasty negatives.

CONTROL OF THE SILVER BROMIDE PRINT. — Although in bromoil printing the most various renderings can be obtained from a perfect bromide print, by variation of the temperature of swelling and by proper handling of the inking, it is also possible, under some circumstances, to vary the final result by proper treatment during the making of the bromide print, especially when we are not dealing with normal negatives. If, for instance, we have to deal with a very thin negative, it is possible that even the extreme possibilities offered by the bromoil process are not sufficient to insure the attainment of the desired modulation, for, as will later appear, the possibility of increasing the difference in swelling in the film is limited by the limited resisting power of the gelatine. In such cases, we must take advantage of the accumulation of all possible aids and therefore, in making the bromide print, do all that is possible in order to bring out desired objects, which are only indicated in the negative and do not show sufficient detail.

Therefore, if we desire to increase the contrast of the negative in the final print, we should use a harder working paper and add potassium bromide to the developer.

If we desire to get soft prints from a contrasty negative, we may use different methods. The simplest way is the use of a very rapid and consequently soft working paper. Ordinarily, however, this method is not sufficiently helpful. We must therefore also use suitable methods in later steps of the process, such as making the difference in swelling in the gelatine layer as small

as possible in order to bring down the contrast, or inking up with soft inks.

A very reliable process for the production of soft prints or enlargements, even from contrasty negatives, is the following: the proper exposure for the densest portions of the negative should be first determined by means of a trial strip; then a full sized sheet of paper is exposed for exactly the time which has been determined, soaked in water until it is perfectly limp, and then placed in the developer. As soon as the first outlines of the image appear, the print is placed in a dish of pure water and allowed to lie there, film down. As soon as development has ceased, the print is taken out of water, dipped into the developer for an instant, and then immediately put back into the water. This method requires considerable time for full development, but produces prints or enlargements of especial softness. In this process, the developer which is absorbed by the film is soon exhausted in reducing the heavy deposit in the shadows, so that their development ceases, while enough developer still remains unexhausted in the other portions of the image to keep on developing. With very dense negatives, developer warmed to 25° C. (77° F.) can be used for the production of soft prints, but it must be very much diluted and carefully used, for development proceeds very quickly. Very soft prints may also be obtained by bathing the exposed bromide prints for about two minutes in a one per cent solution of potassium bichromate before development. This solution is thoroughly washed out of the print, and it is then developed.

Yet with very hard negatives all these remedies frequently fail, because the high lights are almost com-

pletely opaque to light because of their density. In such cases the negative itself must be improved. The ammonium persulphate reducer usually recommended for such plates, which acts more strongly on the lights than on the shadows, is, however, too uncertain in its action and may imperil the negative. It is better to adopt *Eder's chlorizing method,* which enables one to improve too contrasty negatives in a convenient and certain manner. The principle of this process is as follows: the metallic silver of the negative is converted into silver chloride, which is again developed. This redevelopment is accomplished in such a way that the silver chloride on the surface of the film is first reduced to metallic silver; if development is continued, the reduction is continued to the bottom of the film. The delicate details, lying on the surface of the film, are thus first developed, while development of the overdense high lights, in which the silver deposit extends right through to the glass, is finished only after some time. It is therefore possible to stop development at the instant at which the shadows and half-tones are completely redeveloped, while the overdense high lights are, for instance, only half developed, and therefore only half consist of metallic silver, the lower half being still silver chloride. If the development is interrupted at this stage and the negative placed in a fixing bath, the still undeveloped silver chloride is dissolved. The shadows and half-tones thus retain their original values, and only the overdense deposits in the shadows are reduced. If the development is not stopped at this stage, but is carried through to completion, the negative is obtained unaltered, and the process can be repeated. If the second development is stopped too soon, the

negative may be endangered and a very thin negative, lacking in contrasts, obtained.

The practical application of the chlorizing process is effected by bleaching the negative in the following solution:

Cupric sulphate ..	100 g	1 oz.
Common salt	200 g	2 oz.
Water	1000 ccm	10 oz.

As soon as the negative is completely bleached, which should be judged not only by transmitted light but also by examination from the glass side, it should be well washed and immersed in a slow-acting developer. All these processes can be carried out in daylight, and the second development of the negative is best controlled by frequent examination of the glass side. Development should be stopped when the shadows and half-tones are blackened, and there is still a whitish film of silver chloride in the high lights. Observation of the negative by looking through it is not advisable, for the negative very soon appears dense by transmitted light, because the metallic silver formed in development masks the silver chloride. As soon as the development is considered to have gone far enough, the plate should be rinsed and then fixed and washed in the usual manner. After a few trials, the judgment of the correct stage at which to stop development presents no difficulty.

I ordinarily use the chlorizing process in the following way, which practically excludes any possibility of failure: the negative is completely bleached in the solution just mentioned, and then washed for five minutes. It is then developed in any desired developer until it shows by transmitted light practically the same

density, though in a brownish color, as it had before chlorizing. It is then rinsed off, placed in a solution of hypo, *not stronger than two per cent,* and carefully watched by light passing through the plate; it is taken out as soon as the desired stage is reached, well washed, and dried. In this modification of the chlorizing process the condition of the plate can be observed at every stage. The final negative, to be sure, does not consist of pure metallic silver, but as a rule of a combination of silver and silver chloride; but such negatives are sufficiently permanent for making prints and enlargements on bromide paper.

It is also advisable to lessen the harsh contrasts in a normal negative, either by masking the more transparent parts on the glass side, or by holding them back in printing or enlarging. Briefly, every possible means should be employed in order to obtain as good and harmonious a bromide print as possible.

The beginner is strongly recommended, however, in his first trials with bromoil, to start as far as possible with normal negatives and correct, and especially very clean, bromide prints. The use of this process for the improvement of the results from difficult negatives should be left for more expert workers.

It is often desired to provide landscapes with clouds, and this can be easily attained if enlargements are used as the basis for bromoil prints. Acceptable results are given by a process, which has often been recommended. This is, after blocking out the sky on the negative, to enlarge the landscape, develop the print and again place it while still wet on the enlarging screen and expose for the clouds, disregarding the existing image, and then develop the clouds.

I might describe here another process for obtaining clouds, because it is especially suitable for the bromoil process. If there is no object in the negative which is cut by the upper edge of the plate, it is extremely easy to introduce clouds into such a landscape, and at the same time lengthen out the picture at the top. A cloud negative suitable for the landscape is chosen, and the relative exposures for the landscape and clouds found as accurately as possible by test strips. The landscape negative is then focused on the enlarging screen so that there is plenty of paper above the upper edge of the plate, and then the exposure is made while the upper part of the paper is covered with a card, which is kept moving constantly between the light source and the enlarging screen, so that the upper edge of the plate is not imaged on the screen. After the exposure is finished, the paper is shifted down on the screen until the upper edge of the paper comes at the place which was previously occupied by the edge of the plate, the landscape negative is changed for the cloud negative, and the clouds are exposed on the upper and hitherto unexposed part of the enlarging paper, while the landscape is protected from exposure by means of a piece of card, shaped like the previous one for the sky, and continually moved to avoid a sharp line of separation. In the subsequent development a perfectly uniform picture is obtained, in which there should be no visible trace of its compound nature.

Obviously, in the preparation of the bromoil print, it is advisable to employ to the utmost the many possibilities which bromide printing offers. Thus too thin parts of a negative may be held back by proper blocking out on the back and numerous other possible modi-

fications, which have been described in textbooks and technical journals, but which cannot be further dealt with here, may be profitably employed.

FIXATION. — *The developed bromide print should be well rinsed and fixed in the usual way.* If the rinsing is omitted or is too superficial, complete or partial reduction phenomena may occur in the fixing bath, and make the print unusable.

The bromide print should be left in the hypo solution for about 10 minutes, and care should be taken, if several prints are simultaneously treated, that they do not stick to one another. Then should follow thorough washing for removal of the hypo; if traces of hypo remain in the film, the subsequent bleaching is rendered more difficult, as the image does not disappear but only turns brownish. While it is feasible to subject the bromide print to the bleaching process, as soon as it comes from the washing, *an intermediate drying is an advantage;* for the gelatine gains greater resistance by this drying.