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## A NEW BROMOIL PROCESS

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LAST year, having mastered the Paget color process after a hard struggle, I thought I would try the Bromoil process, also described by some of its originators and dealers in the outfits as an easy one. I secured Mortimer's book on the subject, also Sinclair's Handbook, and hunted up in three leading photographic magazines all the notes and articles that have appeared during the last seven or eight years. In this mass of information, while there was a general agreement in method, there were also some discordances and some absolute disagreements, but no one seemed to find any difficulty in the inking. The bleaching processes recommended for the bromide print varied a great deal, time and temperature being neglected, the former especially, while the latter varied from 65 degrees to 80 degrees Fahrenheit with a general agreement that a higher temperature was one of the causes of failure.

Perhaps before I go any further I had better explain the principle underlying the Bromoil process.

A print is prepared on bromide paper in the usual way—some details will be given later—and then the image is bleached out by a suitable solution and washed. The gelatine medium carrying the silver salts on the paper is acted on by the silver reduced by the developer and hardened by it in proportion to its amount. In the shadows, where most silver is deposited, this action is at the maximum; and in the highlights, where it is least or absent altogether, it is at the minimum, and intermediate effects are produced by the intermediate tints in proportion to their depth. As a consequence of this hardening the gelatine loses more or less its property of swelling in water. The highlights if not tinted swell normally, the heavy shadows little or none. We have, then, in place of the silver print an image of it in relief in the gelatine. The next thing is to make that image visible, and this is done with an oil pigment applied to it with a suitable brush. The ink is rejected by the highlights and taken by the shadows and half tones in proportion to their depth. With regard to the relief, it is generally claimed it must be low, barely, if at all, visible. However, with this claim I disagree because, though I am now tolerably skilful with the brush, I can not produce anything but a smudge with a low-relief image.

It occurred to me that if I could make a bleacher that would allow the use of higher temperatures, I could produce a higher relief and perhaps find the inking easier. So then followed a long series of experiments in composition of the bleacher, method of using it, and the effect of varying temperatures of the solutions.

While I am not quite satisfied that I have the best possible composition of bleacher, I have one that is satisfactory. It is necessary to leave the print in it a definite time at ordinary room temperature, then to clear it, complete the bleaching, and, after washing, to raise the relief at a relatively high temperature, which, however, varies with different papers. At the maximum temperature, raising a high relief, the inking is very easy, and the resulting print may have nearly the full detail in the negative. Lower temperatures, though still relatively high as compared to those given by Mortimer and others, give more diffusion and increase the skill needed in inking.

In the description of the process that follows I will at first confine myself to the papers that will stand the maximum temperatures and give a print of full detail. Heavy papers, preferably double-weight, are best. The bromide papers I have used for this include all the Wellington styles including the Platino, which many writers say is not adaptable to the Bromoil process, and the Eastman Kodak Co.'s Royal. The other Eastman papers need different treatment, to be detailed later, as so do all the gaslight papers I have tried. Some of the latter can not be used at all, as the gelatine is tanned too hard in manufacturing.

The best print is one that has all the detail needed in both highlights and shadows, but especially in the highlights, as it is almost impossible to print in detail on the wet print, though it may be done on it when dry by one having the necessary skill. There should be only moderate contrast and the printing need not be very deep. If one has to print deep to get detail in the highlights, then one must ink for contrast as advised later. It is true that with practice the operator can handle some very difficult prints, but it is better to begin with a technically good one.

I prefer to develop with amidol—probably dianol will do just as well—and give such an exposure as will allow full development, and fix in plain 10 per cent. hypo. Then wash. The print may then be dried and bleached later, first soaking it in cold water for a short time, or bleached at once. I prefer to bleach at once when possible.

#### THE BLEACHING BATH

Copper sulphate . . . . .	25.7 grams or 396 grains
Potassium bromide . . . . .	17.2 grams or 265 grains
Potassium bichromate . . . . .	4.3 grams or 66 grains
Water . . . . .	1,153 cubic centimeters or 39 ounces
Hydrochloric acid, a few drops to clear.	

If distilled water is used no acid may be needed. Most natural waters contain carbonate of lime, which acts as an alkali; no more acid must be used than will just dissolve the small precipitate. This is important, as too much acid makes the bleaching too rapid, which is not desirable.

The wet print is immersed in enough bleacher to cover it comfortably, and left in it for 30 minutes. Care must be taken to keep the print entirely covered all the time. Do not treat more than one print at a time in same tray unless a large one. Some papers bleach more than others, but generally the image will be merely changed to a light brown and the entire print heavily stained yellow. Wash in running water or in several changes till the water is colorless. The portion of bleacher used can be returned to the stock bottle.

The acid bath consists simply of water to which has been added strong sulphuric acid at the rate of two drops to the ounce. The print is put in this for a few minutes till the color is started from it and is in solution. Then wash, and the yellow color and most of the image will disappear. To complete the bleaching, put the print into 10 per cent. hypo for a few minutes till the image entirely disappears or only the faintest indication is left. Wash, and then the print is ready for the next operation, soaked in cold water and then put in the

hot water, or it may be dried and kept till required, which is sometimes very convenient.

The relief is raised in hot water at 160 degrees Fahrenheit for papers named and to get full detail. There are some technical difficulties about this. The temperature must be maintained or not allowed to decrease more than 5 degrees Fahrenheit in the ten minutes' immersion required, and it is not advisable to keep the vessel used over a lamp or other source of heat, because the Wellington papers are weighted and sink to the bottom and if heated too much they may stain. The Royal floats generally and the heat causes currents, keeping it at the surface and making continual shaking necessary, because if portions are allowed to surface dry, they will take the ink differently from the rest. The method I find best is to use a large vessel—a granite-ware bowl, the larger the better; it should hold at

least three or four gallons—and with that the temperature will not fall much. At the expiration of the ten minutes, remove the print, put in a tray of cold water for a few minutes, then lift and let drain and put on the inking pad.

The inking pad can be bought ready for use, but six thick pieces of blotting paper a little larger than the print will do very well. These should be wet, superfluous water drained from them and superimposed six deep. They must not be too wet, or water will rise over the edge of the print and prevent the ink from adhering or may rise right through a thin paper and have the same effect. That is one reason why the use of a thick paper is advised. If it is necessary to ink a print right up to one edge—it is better always to leave a margin—put a strip of cheesecloth under that edge. On the other hand, in the case of a print requiring prolonged inking, it may be necessary to wet the pad during the process.

The print being on the pad, the next thing is to surface-dry it. This is done with a loosely folded clean handkerchief, with which it is gently dabbed over till no water shows on the surface when looked at obliquely. The relief should now show plainly; the edges of the print rising above the image between them and the image itself showing varying relief representing light and dark portions. The print is now ready for inking.

For this it is necessary to have the proper stag's-foot brushes, a tube of black ink, and one of Roberson's medium, all of which, with many other items, can be got from Ralph

Harris and Company, 26 Bromfield Street, Boston, Mass. It is desirable to have a full assortment of brushes, as a dry brush comes in very handy now and then, but there should be at least one each of Numbers 12 or 14, 8 and 4 to begin with. A small palette knife and a palette—a bit of old scrap plate glass about six inches square is as good as anything else—must be procured. Later, inks in all colors can be obtained.

For a small print squeeze out of the tube a little ink about the size of half a pea and spread it out on the palette with the knife in a circle about one and a half inches in diameter. Then dab the large brush several times on this ink, and then dab it on a clean part of the palette to even it. If the ink has dried out somewhat and spreads very stiffly, it may be necessary to add to the portion on the palette a very minute drop of Roberson's medium, but generally it comes in good condition ready for use. If when the inking has progressed some way it seems hard to get enough ink on the print, the medium may be added.

The brush being charged with ink and the print in place on the pad, start out at one corner of it, say the lower left. The brush must be held lightly at the end of its handle and in a vertical position between the thumb and the first and second fingers and the print tapped, very lightly, with a freshly charged brush. The tapping must be rapid, several taps a second, and at the same time the brush must travel up to the upper left corner. On reaching there, move inward half the face of the brush and start a line parallel to the first and running down to the bottom of the print, then again move the brush inward and start to

run up to the top of it and so on till it has all been gone over. In doing this the brush may be replenished if necessary, remembering always to make the taps very gentle at first. As the brush gets drier, the taps may be made rather heavier. At the end of the first covering of the print, there will be very little ink on it, the image will be faintly outlined, and the highlights—sky, for instance—will show little or no change. Go over the print again, filling the brush with ink rather more frequently and running its center between the rows of lines made by the first inking. Then turn the print and run the brush at right angles to its first direction, crossing the lines. By this time there should be considerably more ink on it, though it may still look very light and the detail be lacking. Without recharging the brush start working over it again, giving rather harder quick taps, and gradually the detail will appear and the print take a darker tone. It is a good plan to have a duplicate bromide print before you as a guide, and it will show you where more ink is needed. If the foreground, say, is much too light, charge the brush rather more freely and, instead of tapping, press the brush down rather slowly and withdraw it rather slowly. This will deposit the maximum of ink and destroy detail, but that can be restored by gentle tapping when enough ink has been deposited.

The only way to learn to ink is to practice, and these hints are meant simply as a guide; every one will learn to get results by his own methods finally, and it is a great deal easier to do than the description of it would indicate. However, it may be remembered that a quick tapping with a partially or wholly dry brush gives detail, and a slow stroke means heavier deposit of ink and loss of detail.

With regard to power to modify the print I will illustrate what can be done by an example. Suppose you have a negative taken, possibly, on an ortho. plate, which gives in a straight print poor planes, the foreground perhaps not dark enough, the middle distance and the distance too dark. The first stages of the inking may be done mechanically, then the foreground should be worked to proper depth, the middle distance should be kept lighter in tone, and the distance still lighter, and every one blending into the other. This is not at all difficult to do, and if one plane gets too dark it can easily be reduced with a dry brush. Working with the high relief there is no danger of spoiling a print by carelessly getting even a dark portion of it too dark. If the pigment will not come off, or is too slow in coming, it may be "hopped," that is, the brush held rather high may be allowed to fall on the spot and be caught on the rebound and this continued till the work is done. This should not be done often, however, as it is hard on the brush. As said above, also, detail can be increased or decreased locally by varying use of the brush.

Anyone who will follow all the directions here given cannot fail to get a good print, though perhaps only a straight one the first time of trying, and will soon learn to modify where needed, and most prints do need a good deal of modifying. I do not recommend the process for very small prints except for practice, but it is the only one for large ones, except, of course, for records. With regard to time consumed: rather early in my experience it took me fifty minutes to ink a 10 by 14. There was a very imperfect sky, too light in the middle and too dark at the corners, but by putting on all the color possible in the middle and keeping back the corners, it was made perfectly even. Many other minor changes were also made.

Some changes are needed when using other bromide papers. Under this are included all the Eastman Kodak Company's grades except the thin papers, which are not suited to the process. These require the same bleaching method, but it is better to make the whole process continuous. That is, the print should be developed, fixed, washed, at once bleached, cleared, washed, and the relief raised without any intermediate drying between processes.

If not convenient to ink at once, the print may be left lying in the last wash water or in the cold water after raising the relief. The temperature used for this latter process must not exceed 125 degrees to 135 degrees Fahrenheit. The P.M.C. handled in this way gives very good results, but if temperature of 160 degrees Fahrenheit is used, it gives tremendous relief, which will not take the ink. Also the same happens if the process is interrupted by drying the paper. The beginner had, however, better try the first-named papers until he has gained some experience.

All the gaslight papers I have tried also require a temperature of about 125 degrees

Fahrenheit. With a higher one some of them give an enormous contrast—they might be useful with a very flat negative. However, the Bromoil process is best adapted for large work, so the bromide papers are the best to use.

As said before, diffused prints may be obtained by lowering the temperature of the water used to raise the relief. The amount of such reduction will depend on effect desired. I would advise that the 160 degrees Fahrenheit class be tried at, say, 145 degrees Fahrenheit and that be reduced further if found necessary. The other papers may be tried at about 120 degrees Fahrenheit and P.M.C. at 115 degrees Fahrenheit. It must be remembered that much more care in inking will be required for these lower reliefs. Especially a freshly-charged brush must be applied very lightly and plenty of dry brushes must be on hand. My present impression, however, is that this plan is most useful where the negative is too hard and gives a print of the same character. Then a moderate reduction of the temperature of the water used to raise the relief may remedy the fault. For the rest, if a soft print is needed, it is better to make negative or enlargement with a soft-focus lens and raise the relief at the high temperature so as to preserve the ease of inking. If one has no soft-focus lens, a thin bit of transparent celluloid, placed before or behind an ordinary lens, will give enough diffusion for most purposes.

At the present time, with many chemicals scarce, it may be difficult to get amidol. Some writers claim they have got good results with prints developed with alkaline developers—those like metol-hydro, containing carbonate of soda or potash—but I have not yet tried them, and there is the chance the alkali may affect the gelatine.

If instructions are carefully followed, there should be no trouble in getting good results every time, but in case a print seems to be inking flat, sometimes throwing it back into water a little hotter than that first used and then inking for contrast will give good results. If there is much ink already on the print, it may be soaked off partially—it will not all come off—with gasoline before returning it to the hot water.

When the print is finished, pin it by the corners to a board or a heavy pasteboard—a box lid is very handy—to dry, and do not attempt to mount it for several days as the ink may smear where touched. Do not varnish it till it is at least two weeks old. Mount dry with a thin streak of liquid glue round the edges but not quite reaching them.

The process is a very interesting one, and it grows on one the more one practices it. I hope many amateurs will try it. It will be found a much simpler thing to do than to describe. In this paper I have tried to cover all points and some of the information the beginner will not need at first, though I advise him to read it all.

#### ADDENDUM

The preceding reports results as obtained on paper procured more than a year ago. Samples obtained recently show considerable changes, due, I presume, to war needs.

I have so far been able to get only Platino in Wellington paper. At the temperature previously used to raise the relief—160 degrees Fahrenheit—the emulsion simply washed off, and one sample of Royal did the same, but a later one, while standing the temperature, would not take the ink. I thought at first the gelatine had been hardened too much, but after a good deal of experimenting I found it was only necessary to lower the temperature of water used to about 125 degrees Fahrenheit to get perfect results. The Wellington Platino also did much better, but required careful inking.

A later discovery was with a portion of a sample of Royal more than a year old. Eight months ago this needed 160 degrees Fahrenheit and worked well, but tried recently it would not take the ink. Lowering the temperature to 115 degrees Fahrenheit gave very good



results. A sample of No. 8 P.M.C., also more than a year old, refused the ink when relief was raised at 160 degrees Fahrenheit, but also worked well at 115 degrees Fahrenheit.

Out of this came a method of testing any batch of paper as to its worth for the Bromoil process and which, if followed, will remove all the uncertainty due to the paper employed.

Bleach the print as directed, and then cut it into three pieces. Raise the relief of one at 160 degrees Fahrenheit; one at 125 degrees, and the third at 115 degrees.

No. 1 shows emulsion washed off and, of course, is useless. It is not washed off—relief is rather high—will not take the ink. Relief is right and ink is taken freely.

No. 2. Takes ink but image is rather flat—needs a higher temperature. Takes ink properly. Takes ink fairly but gives too hard an image—needs lower temperature.

No. 3. Image too flat—needs higher temperature. Image right.

I do not think that a lower temperature than 115 degrees Fahrenheit will ever be needed, but it might be reduced as low as 100 degrees Fahrenheit if desirable. If no image can be got at any of these temperatures, it may be concluded the paper on trial is no good for the purpose.

Having found out the right temperature to use to give a good image with an average print, the necessary change to be made for a hard one or a too soft one is easily found; 5 degrees Fahrenheit will make an appreciable difference.

I am sending a print from a portrait negative made by O. E. Aultman, on Royal paper as now supplied. Data: Print overprinted, development shortened, result desirably soft, relief raised at 125 degrees Fahrenheit. I recommend this paper; it takes ink easily with the right relief; after going over the print twice, it may be applied freely.