

The New Photographer Handbooks: No. 3

PERFECTION IN THE PIGMENT PROCESSES

By

CHRIS. J. SYMES, F.R.P.S.

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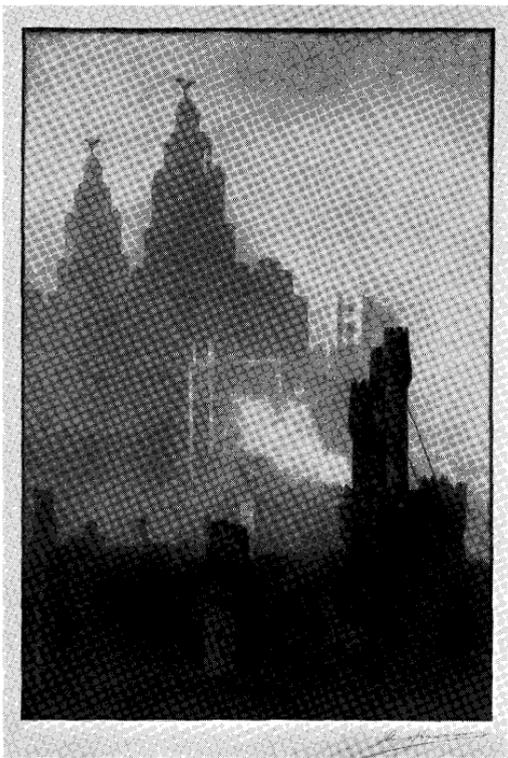
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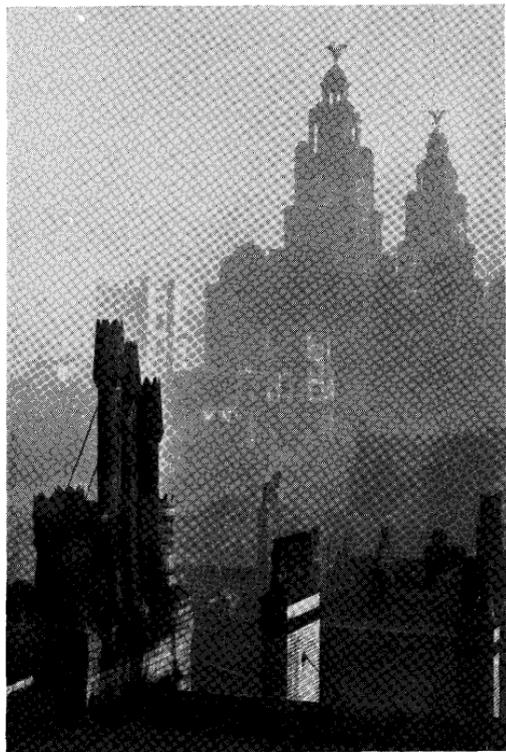
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PERFECTION IN THE
PIGMENT PROCESSES



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Straight Bromide print reversed for transfer, showing depth of image required, for comparison with Bromoil Transfer opposite.

CONTENTS

<i>Chapter.</i>		<i>Page.</i>
	INTRODUCTION	1
I.	"BROMOIL": THE NEGATIVE AND PRINT	3
II.	TANNING	11
III.	INKING	20
IV.	FAULTS AND REMEDIES	28
V.	BROMOIL TRANSFER	32
VI.	THE OIL PIGMENT PROCESS	40

ILLUSTRATIONS

FRONTISPIECE	"LIVERPOOL" (Bromoil Transfer)
"	" (Bromide Print)
FACING PAGE 20	"THE CANAL" (Bromoil Transfer)
"	" 32 "BRUGES—A SUNLIT STREET" (Bromoil Transfer)

INTRODUCTION

IN the evolution of the pictorial photographer there are usually three distinct stages; the first, in which technique is gradually acquired; the second, in which that technique is used as far as possible to express the artistic emotions aroused by the beauties of nature; and the third, in which it becomes necessary to modify or control the result given by purely photographic means in order to attain pictorial perfection. There are many methods of control. Amongst these may be mentioned the modification of the negative by retouching; the combination of two or more negatives to make a single print; the alteration of a print by the application of pigment, crayon, or pencil by hand; and the gum-bichromate process.

Above all, there are Oil, Bromoil, and their derivatives, Oil and Bromoil Transfer.

Oil, usually known as "Oil Pigment," is a photographic process in which a paper, coated with gelatine, is sensitized in such a manner that by exposure under a negative it is selectively tanned or hardened, and soaked in water so that the greasy pigment (ink) applied will "take" only in proportion to this hardening, forming a pigment image on a paper-gelatine base.

Bromoil is a somewhat similar process, but in this case it may be explained that a suitable bromide print is prepared and bleached in a solution that also tans the gelatine of the emulsion in proportion to the amount of metallic silver in the image, with the result that, following certain other necessary operations, the ink will only adhere, as in the Oil process, in the same proportion.

The picture so obtained also consists entirely of a pigment image on a gelatine-paper base.

Oil and Bromoil transfers are developments of the same processes whereby the pigment image of the oil or bromoil print is transferred by pressure to another paper or support.

The application of the pigment, being effected by hand by means of a specially designed brush, is entirely under the control

of the worker who may, if so desired, make an exact replica of the original print or, if the subject requires modification, alter it by adding or withholding ink in those portions where it is considered advisable, retaining the original gradations in the remainder.

The relationship of tones may be considerably varied, offending objects removed entirely, and unpleasant detail and spotty areas massed without the alterations being obvious in the finished print. Equal control is practically impossible by any other photographic process.

It is proposed, in the following chapters, to make reference to the characteristics of the negatives and prints most desirable for these processes, the advisability of making appropriate differences between prints designed for transfer as distinct from prints directly inked, and thereafter express a few opinions as to the principles involved and to offer hints for the solution of special technical difficulties.

With reasonable care to ensure good technique, these processes are by no means difficult, but it is important that for the best results, each and every step should be considered specially in relation to the ultimate result.

It is not proposed to discuss in this handbook anything in the nature of the physical and chemical reactions of these processes. My intention is rather to give complete working instructions as far as possible, and a general idea of the fundamental principles involved, and I venture the opinion that until research has provided greater knowledge of the structure and properties of gelatine than is at present available such discussion, even if possible, would be of little practical value.

Bromoil and its transfer, being more popular, will first be dealt with, and the description of the Oil Pigment process will be given subsequently, as, on account of the print being limited in size to the dimensions of the negative from which it is printed, it is now seldom employed.

C. J. S.
1924.

CHAPTER I.

“BROMOIL.”

THE NEGATIVE AND PRINT

THE first step in the making of any photographic print is the production of a negative, which, after a correct exposure in the camera, by development for an appropriate time is made suitable for the particular printing process to be employed. Should a moderate error in calculation or judgment of the correct time be made, it is usually possible to remedy the mistake by the selection of a paper, from the many makes and grades available, of such a contrast that will enable a perfect print to be made.* That is to say that an over-developed negative may be made to give a satisfactory print on a grade of paper known as “Soft,” and an under-developed negative will require a “Contrasty” paper. The rule is that the printing paper may be chosen to suit the negative.

For many reasons it is desirable that the worker in bromoil should confine his attentions to one grade and make of paper. This being admitted, the permissible latitude mentioned is unavailable.

It is, therefore, most important that the time of development of the negative should be exactly calculated to give a bromide print of the characteristics required for the process. To do this it is necessary to bear in mind that a bromoil is naturally rather more “contrasty” than the original bromide print. This print must, to a corresponding degree, possess less contrast than if it were intended to be the final result, *i. e.*, the high lights should be *very* slightly veiled and the shadows by no means as dark as the paper is capable of rendering—in short—a greyish print.

It follows then that the *negative* must be of such a contrast to give this type of print normally, that is, by appropriate exposure and development.

* See *The N.P. Handbooks Nos. I. & II.*

Assuming the print is to be made by enlargement—as usually is the case—a “soft” negative is essential. A negative of this character can only be obtained by shortening the time of development. As a general rule the time should be half normal. (It is understood that normal development means development for that time given by the plate maker for average negatives or for contact printing on P.O.P. (Printing out Paper). Half the normal development only is required if a condenser lantern be used, but if a reflector type of enlarger be employed the time should be two-thirds normal.

It may be a useful guide to mention that a negative which will give a soft and fully-graded print by contact printing on *vigorous gaslight paper* will give a bromide print of the correct range by enlargement in a condenser lantern, and a negative which gives a soft but good print on a soft grade of gaslight paper is suitable for the reflector type of enlarger.

Suitable variations according to the *contrast* of the *subject* should also be made and methods of attaining these are very fully discussed in Chapter V., pages 49-51 of No. 1 of *The N.P. Handbooks*, “Perfect Negatives.”

It is advisable, too, that a full exposure be given in every case in order that the shadow detail may be sufficient—*double* that indicated by an exposure meter is the *least* that will be found expedient in practice.

If due consideration be given to the variation in subjects and development adjusted accordingly, it will be found that while negatives of different densities will be produced, their contrast or range of tones will be identical for all practical purposes.

If the print is to be produced by contact printing, the exposure of the plate should be governed by the same rule, but development should be two-thirds normal.

It is preferable, however, that the correct development of the negative be found by actual experiment—though the foregoing is sufficiently accurate and will be found to be a useful guide.

The Bromide Paper for Bromoil

It has been stated, and with truth, that practically any gelatino-bromide paper, not super-coated, may be used success-

fully for bromoil, and super-coated papers, assuming that the extra coating is gelatine, *can* be employed, provided appropriate treatment is found and applied, but many papers are now available which do not call for special handling and the beginner is advised to confine his attention to these.

It may be taken for granted that all papers made for the process are suitable, and, in addition, I have found by experiment that the following papers work admirably:—

- Kodak “Royal”—white and tinted. (*For Bromoil*)
- „ “Permanent Rapid”—smooth and rough. (*ditto*)
- Barnet—Cream Crayon.
- „ Ordinary.
- „ Tiger Tongue.

These papers are mentioned as being, in my experience, suitable for BROMOIL, those suitable for bromoil transfer will be mentioned in the section dealing with transfer. It does not *necessarily* follow that a paper suitable for bromoil is equally suitable for transfer.

The Development of the Bromide Print

In this connection I have somewhat modified my opinion from that expressed in my last published papers (*The New Photographer*, April 14th, 1923, *et sequentia*). In those articles I stated that it was necessary to give the bromide print the minimum correct exposure and the maximum development; whereas I am now convinced, after many experiments, that there is no difference in the resulting bromoils from prints fully developed and those which have received more than a certain minimum as hereinafter explained. The effect of this modification is to permit a certain latitude in the preparation of the print which, formerly, I considered open to controversy, although the possibility was then indicated.

The time and temperature method applied to the development of the paper also described is therefore of limited value, but still applicable in those cases where full development is given. It is, however, not proposed to discuss this method, because it is now superseded by the “Watkins” method of “Factorial” development. This was then described as preferable, is still

available, and indeed forms the only reliable method of utilising the latitude above referred to and of obtaining that desirability for the process—*prints of constant depth*.

Full details of this scheme of development, as advocated and elaborated by Dr. B. T. J. Glover, may be obtained from the No. 2 Handbook of this series, "Print Perfection."

It is possible, nevertheless, for an experienced worker to make a good bromoil from a print which has received considerably less development than the minimum stated as advisable, but it is undesirable that a novice should attempt to do so, for he will only make difficulties for himself.

For uniformity of result and ease of working it is important that the depth of image should reasonably be constant within the permissible latitude of development specified, as a varying depth may involve variations in later operations. This will cause a needless uncertainty and mitigate against standardization.

Most developing mixtures, during the decomposition that takes place in development, give rise to the production of tanning agents. It has been mentioned previously that before a print can be pigmented (*i.e.*, the ink applied) a solution is used which has a *selective* tanning action, and if there should be in development a *general* tanning, it is obvious that difficulties will arise during the pigmentation of the print, unless the general tanning referred to be compensated by later variations. It is impossible to know the extent of this general tanning. Consequently it is impossible to make appropriate alterations in the later operations, except by long experience.

Nothing in the foregoing should be read as implying that it is impossible to make a bromoil from a bromide print produced with a developer giving rise to this general tanning. This by no means is the case, for the writer has made many successful bromoils from prints developed with an M.-Q. mixture—one of the worst offenders in this respect. It is, however, a possible source of error and complication. It is advisable that if there be a developing mixture free from this disadvantage it should be employed in preference. Such a developer is Amidol, and a

formula suitable for all the papers mentioned and all those papers specially manufactured for the process (except chlorobromide papers*) is:—

Sodium Sulphite (anhydrous)	¼ ounce
<i>or</i>	
Sodium Sulphite (cryst.)	½ ounce
Potassium bromide (10% solution)	10 minims
Amidol	25 grains
Water to	10 ounces

Dissolve the chemicals in the order given and make up a fresh mixture for each batch of prints as the mixed developer *will not keep*.

The Watkins factors, between which there is the latitude previously mentioned, for bromide prints intended for bromoil, are a minimum of eight and a maximum of sixteen. This system automatically compensates for variations in time necessitated by alterations of temperature and ensures the production of uniform prints.

Reference should be made to the No. 2 Handbook of this series, which, as already stated, explains the system fully. For the sake of completeness, however, it is briefly described in the following paragraphs.

The word "Factor" in this connection means the figure by which the time taken for the first appearance of the image, counting from the moment of pouring on the developer, is multiplied in order to give the total time of development.

There are theoretical reasons in relation to subsequent operations which make the shorter factor preferable. These are slight and it may be taken that any factor between eight and sixteen will give bromide prints of practically identical appearance and bromoils of equal quality. Nevertheless the novice is advised to adopt one factor only and to work to this always. TEN is strongly recommended as, not only are the factorial calculations easily made mentally, but it is sufficiently in excess of the minimum to render harmless any slight mistake in timing the first appearance.

* "Vitegas" is the only paper of this type made for Bromoil and the makers' Amidol formula should be used.

The first essential in making a bromide print is to determine the correct exposure. This depends on the factor selected. The relationship of exposure-time and development-factor is constant, *i.e.*, if varying exposures are given (within certain limits) and the development times also varied so that if the two (exposure-time and development-factor) be multiplied together the product remains the same, the prints will be equal. For example, if the exposure given in the first case be ten seconds and the development factor 16, the product of the two is 160 (10×16): an exposure of 20 seconds equals double the first mentioned, consequently the factor applicable is halved, *viz.*, eight ($20 \times 8 = 160$): similarly with 16 seconds the factor is 10.

Having selected the factor to which it is proposed to work, a test strip should be made for each and every print.

Experience will enable an approximate exposure to be judged by the appearance of the image on the easel in the case of an enlargement, and by inspection of the density of the negative in the case of a contact print. Exposures of this estimated duration, together with others of half and double the time, should be given to the test strip; *i.e.*, if the exposure is judged as twenty seconds, ten seconds and forty seconds should be given as well. A simple way of doing this is to expose the whole test strip for the shortest of the three, then cover up with a card about one-third of the strip and continue the exposure for as long again, and then cover up two-thirds for double the time then given, and stop. With the example the whole would be exposed for ten seconds, one-third covered for ten seconds, and two-thirds covered for twenty seconds, so that the first exposure will be 10 seconds, the second $10 + 10 = 20$ seconds, and the third $10 + 10 + 20 = 40$ seconds. With a small quantity of the developer to be used, the test strip should be developed to the same factor to which it is proposed to develop the bromide print; fixed, rinsed and then examined in *white light*. The method of development is as follows:—

The test strip is placed in a dish, the developer poured on in an even sweep and the time noted; the strip is watched for the first appearance of the image—it should be just plainly visible—and the time again noted. The difference between the two times gives the “time of appearance,” and this, multiplied by the

factor, gives the total time of development. (It may be mentioned here that it is not absolutely essential to develop the bromide print to exactly the same factor as the strip, though it is preferable. It is possible to develop the test strip to the longest factor (*e.g.*, 16) and work out arithmetically the exposure required for any other factor or *vice versa* in the manner described above). If the estimated exposure is fairly accurate, one test is usually sufficient to enable the correct exposure to be determined. If all the exposures are incorrect, the procedure must be repeated—the test will indicate in which direction. Should there be too wide a margin between any two of the results it may be desirable to expose another strip, halving the time of the nearest two for the middle exposure and halving the difference between that and the selected two extremes for the other two; *i.e.*, if, in the example given above, twenty seconds gives too light a print and forty seconds too dark, the second test should be 25, 30, and 35 seconds. At this point it would be as well to mention that the developer should be made up in accordance with the formula given and not diluted, for it has been conclusively proved that dilution within reasonable limits has no effect other than that of prolonging development, providing always that dilution is not carried to such an extent that exhaustion of the developer occurs before development is complete. Another point which should be remembered is that the test strip should be so placed as to include the extremes of light and shade (*i.e.*, the lightest and darkest tones) in the print.

A test strip, having been exposed, developed and fixed in accordance with the above instructions, indicates the correct exposure. The print is given the exposure appropriate to the factor selected and developed thereto in the manner described for the test strip. With the Amidol developing mixture at 60°F., a factor of sixteen, the average time of appearance is fifteen seconds, and the total time of development $15 \times 16 = 240$ seconds, or four minutes.

After development prints should be well rinsed and fixed in a *non-acid* solution of hypo—three ounces in a pint of water—for at least ten minutes if a single-weight paper is used, or fifteen if double. *On no account whatever must acid hypo or a hardening*

bath be used. It is not advisable that the hypo solution should be stronger than that mentioned because blisters may result from using too strong a solution. There is a good deal to be said for the practice of using *two* fixing baths, the print being immersed in the first for half the time and completed in the second.* It is very important that prints be thoroughly fixed and the times mentioned regarded as a minimum. The prints should be kept moving and always under the surface of the hypo solution until fixation is complete.

The prints must subsequently be washed in running water or frequent changes for *at least two hours—three is better*.

Too much stress cannot be laid on the necessity for very thorough fixation and washing—if either be scamped, trouble in the after processes is inevitable.

After washing, the prints may be dried and, if so, they should be hung or pinned up so that drying is uniform; or alternatively the next operation (bleaching or tanning) may be proceeded with before drying the print.

CHAPTER II.

TANNING

THE preceding chapter dealt with methods of obtaining suitable prints for the process. Having thoroughly mastered the production of uniform prints, the principles underlying the following operations should be considered.

Now gelatine has the property of absorbing and holding water and, if a suitable piece of bromide paper be taken—it is immaterial whether exposed or not—and half of it soaked in water at about 70° F. for ten minutes, the other half being kept dry, it will be found, the superfluous water being blotted off, that if the oily pigments or ink used be applied to both portions, it will only take on the dry half and not where the gelatine has absorbed water. That is to say that the pigment will only be repelled where the gelatine holds water, and take where it is dry or hard.

Certain chemicals exert a hardening action on gelatine and this action renders it both insoluble and unable to absorb water; some of these—notably chromic acid and some of its derivatives—in conjunction with gelatine, are sensitive to light and within certain time limits exercise this hardening action only where light has acted. It follows, therefore, that if a paper coated with plain gelatine be immersed in or painted over with one of these chemicals, dried in the dark and printed out under a negative in the usual way, a positive showing a faint image will result with the shadows hardened and the lighter tones and lights also partly hardened according to the amount of light passed by the negative. If this print be soaked for such a time as may be found by experiment, the gelatine will absorb water in inverse proportion to the hardening action, so that if an oily ink be applied it will only take on the hardened portions, and in proportion to the amount of hardening. Thus a positive in pigment will be formed on the gelatine coating of the paper. (This, by the way, is the basis of the "oil pigment" process). A solution of copper chloride and sodium chloride, or copper sulphate and potassium bromide, will bleach or so alter the image of a bromide print as to render it practically invisible, and, if chromic acid

* See *The N.P. Handbook No. 2.*, pages 64 and 65.

or one of the bichromates be added to either of these solutions, a selective hardening action, similar to the foregoing, will take place in proportion to the amount of silver in the print at any particular point. So, whereas in the former case the hardening or, preferably, "tanning" is *directly* due to the action of light on the sensitized gelatine, in the latter it is *indirectly* due to the action of light owing to the intermediate production, by exposure of the bromide print to light, of an image in metallic silver.

¶ We see, therefore, that in the operation of bleaching there are two actions proceeding simultaneously—the one the bleaching of the image, and the other the selective hardening or tanning of the gelatine. In order that both bleaching and tanning may be complete at the same time it is very necessary that the solutions comprising the tanning mixture are made up accurately and that it should be used at a temperature not lower than 55° nor higher than 65° F.

It may be deduced from the foregoing that where there is no light action (or resulting silver image) the gelatine should remain unaffected and retain its full power of absorbing water, *i.e.* there should be no hardening or tanning. This is an essential feature of a good tanning formula.

The Tanning Solution

The formulæ given fulfil this condition. There have been a large number of others published, many of which are good, and some bad. Some of them, especially the older ones, contain a number of unnecessary ingredients, including some that are chemically incompatible, and others involve the use of an acid bath—a most unnecessary complication, as it involves an action on pure gelatine, *i.e.* where it has been unaffected by light or where there is no image in silver.

I have tried many bleachers and have found none better than the following :—

Formula

The first—the outcome of considerable investigation by Mr. Raymond Crowther, a well-known authority on Bromoil—is as follows :—

10% solution of copper sulphate	170 minims
10% solution of potassium bromide	130 minims
1% solution of chromic acid	45 minims

For use add water to make up 3½ ounces.

An easy and accurate way of making up 10 per cent solutions is to measure 10 ozs. of water, pour it all into the bottle intended for the solution, marking the level of the water in the bottle with a file, pour out about two ounces, weigh 480 grains of the chemical, and put in the water remaining in the bottle; wait till all is dissolved and fill up with water to the mark on the bottle. One per cent. solutions may be made in a similar way, but the quantity of the chemical should be 48 grains.

The second formula is the result of a great number of my own experiments, and consists of two solutions :—

A	{	Cupric chloride	160 grains
		Sodium chloride	2½ ozs.
		Hydrochloric acid	3 minims
	{	Water	10 ozs.
B	{	Potassium bichromate	55 grains
		Water	10 ozs.

For use, take one ounce of each and add two ounces of water.

It is important that the purest ingredients should be used, that solutions be mixed up exactly as directed and that all bottles should be chemically clean. It is advisable, too, especially in districts where the water is hard, to use distilled water. If either chromic acid or cupric chloride is bought in larger quantities than are required for immediate use, it must be placed, at the time of purchase, in well-stoppered bottles, the stoppers of which should be thoroughly waxed, as both these compounds are deliquescent—that is, they readily absorb water from the atmosphere and liquefy. When this happens it is impossible to weigh them with any degree of accuracy, as the quantity of water absorbed must remain unknown. The chromic acid and potassium bichromate solutions should be kept in the dark and will keep well if distilled water is used in making them up. If hard water is employed they become useless in a short time, and if no other is available the solution should only be made up as required. The other solutions keep

indefinitely. Any excess of undissolved sodium chloride in solution "A" of the second tanning solution should be allowed to settle at the bottom of the bottle.

All dishes should be chemically clean and, if possible, two dishes should be set apart for the preliminary soaking and tanning and used for nothing else. A dilute mixture of hydrochloric acid and potassium bichromate is a very effective cleanser.

Preliminary Soaking

If the bromide print has been dried it should be soaked in water before tanning for five minutes or until limp at a temperature of between 55° and 65° F., and it is desirable that the following operations, namely, tanning, washing, and fixing be conducted at the same temperature. The preliminary soaking is designed to ensure uniform bleaching. If the print has not been dried it may be taken direct from the first washing water as soon as washing is complete. Work must never be commenced on a print that is *partly* dry—it must be either taken from the washing water or thoroughly dried.

Tanning

The superfluous moisture is mopped or blotted off; if blotting paper is used it should be "Pure Photographic"—and the print then placed in a dish for tanning. The tanning solution, mixed in accordance with either of the above formulæ, is poured on in an even sweep and the dish rocked to secure even action. The image will gradually disappear. With Mr. Crowther's formula the image will vanish almost entirely and the way in which the print bleaches affords some indication of whether previous operations have been correctly performed. If the print fades to a brownish grey and finally nothing is visible except a faint green in the deepest shadows and the time at 60° F. does not exceed 3½ minutes, it may be assumed that everything is in order up to this point. The print should be left in the tanning mixture for about thirty seconds after bleaching is apparently complete, *i.e.*, after the change from the brownish to the greenish tint. If the image turns reddish and the shadows appear reluctant to bleach, the operation may have been conducted at

too low a temperature or either fixing and washing or both, not completed. In the former case the shadows will probably fade to the correct greenish tint in time, but in the latter it is unlikely that bleaching will ever be effected properly, the reason being that, not only will the tanning mixture be exhausted by the presence of the results of improper fixing and washing, but it will enter into combination with them and attack the higher lights and fail to tan the shadows, causing the image to ink up afterwards as a negative instead of a positive—a fault that is generally known as reversal. If the image disappears in a streaky fashion it also may be presumed that it is due to faulty washing or fixing.

With the second bleacher the image fades to a faint brownish tint in approximately three minutes and the print should be removed immediately the last vestige of black has disappeared. With this solution, also, there is an indication as to the correctness of preceding operations, for if the time exceeds three-and-a-half minutes at 60° F. it points to insufficient fixing or washing, with similar consequences to those outlined above. Should it take less than two minutes, probably the time of development has been too short. If the temperature is too low the blacks may fail to bleach completely or may hang back after the rest of the print is finished.

Neither bleacher should be used for more than one print.

After tanning, the prints should be washed for ten minutes at least, or if the second formula be used, until the yellow stain has gone. In neither case must any of the tanning solution be carried over into the next bath or *general tanning* will take place.

Fixing

The prints should then be fixed in a weak solution of hypo—2 ozs. hypo to 20 ozs. water is about right; a plain hypo solution may be used, but, in my opinion, it is preferable that it be slightly acid. Ten grains, no more, of metabisulphite of potassium may be added to 20 ozs. of hypo solution of the above strength. Prints bleached by the second formula change from a brownish to a faint greenish tint in this bath.

Then the prints should be washed for half-an-hour to remove the hypo.

If it is not convenient to proceed with soaking and inking immediately, prints may be dried after washing.

For bromoil, I am of the opinion that equal results may be obtained whichever method is adopted provided the time of soaking is accurately determined. Many authorities prefer to dry their prints and re-soak and it is certainly a convenience not to have to prepare each print separately immediately before inking, which otherwise is necessary. It is also conducive to good results if a number of prints are inked up in succession—"Practice makes Perfect."

Soaking

In this part of the process the gelatine of the bromide paper absorbs water in inverse ratio to the amount of hardening effected during bleaching. The temperatures given below may be regarded as constant, but the *time* required varies according to the make of paper, the amount of water already taken up during washing, the hardness of the pigment to be used subsequently and, to some extent, on the manner in which the ink is applied. *This time must be found by experiment.*

In practice I have found the following suit my method of brushwork, assuming that "Encre Machine" is to be used, as is best, without dilution or thinning:—

Kodak, "Royal"	75° F.	20 mins.
" " "Permanent"	75° F.	25 mins.
Barnet, "Cream Crayon"	70° F.	20 mins.
" " "Ordinary"	70° F.	20 mins.
" " "Tiger Tongue"	70° F.	20 mins.
" " do. in card thickness	75° F.	30 mins.

If after tanning, fixing and washing, the prints are to be dried and inked up afterwards, they should be soaked, previous to drying, for the same time and at the same temperature found by experiment to be correct for immediate inking. Then swab with cotton wool as described in the following chapter, dry, and when convenient to pigment them, re-soak for 15 to 30 minutes at such a temperature as will bring them to the right

condition—70° F. is approximately correct, though both time and temperature should be determined experimentally in this case also.

It may be observed that if the print be soaked before drying as described above, it is possible for the emulsion to attain the right condition at any reasonable temperature provided sufficient time be allowed, but this temperature should not be less than 60°F., at which it will take about one hour.

Vitegas—the grade specially prepared for bromoil—invariably requires drying after tanning. It need not be soaked after washing and the approximate time for soaking after drying is ten minutes at 60°F.

It is not necessary to maintain the soaking water at a constant temperature—it is quite sufficient that it should be at the point given when the print is first immersed.

A simple method of finding the right time of soaking is partly to cut a dry print so that it may be torn later into four pieces; bleach, fix, and wash the whole print without detaching. After half-an-hour's washing detach one of the quarters and place it in water at the indicated temperature for soaking; leave the rest of the print washing for ten minutes and tear off another quarter and place that in another dish at the same initial temperature and repeat at ten minutes' intervals with the remaining two pieces, giving the last ten minutes, using separate dishes and taking care that the temperature at the time of immersion is the same in every case.

Each of the four parts will then have been soaked at a known temperature for differing times—in the example given the times will be 10, 20, 30 and 40 minutes—and although, on account of the different times in the washing water, the test will not be absolutely accurate, it will be near enough for all practical purposes.

All four pieces should be placed together and inked up, in the manner to be described, at the same time. The best result, using the pigment as supplied, will show the right time to soak.

In summer it may be found necessary to *decrease* the time of soaking considerably on account of an *increase* in the temperature of the washing water.

Some guide as to whether the print is ready for inking, apart from the test described above, is given by the feel of the paper in the soaking bath. If the surface of the print is gently felt the lights will seem slimy or slippery and the shadows rough to the touch when soaking is adequate. If the print be taken out and the surface moisture blotted off, the image will show in slight relief and the amount, with experience and practice, also gives a fair indication.

Neither of these pointers should be relied on as an absolute test—they should only be used in conjunction with such a test as outlined above.

An excess of relief usually denotes over-soaking and an absence the reverse, but the amount varies not only with different papers but also with different batches of the same paper, and the test by touch varies correspondingly.

The methods advocated above, being generally in accordance with the views of the leading authorities on the subject, and being the result of long investigation and practical experience, may be regarded, previous to the final soaking, as *standardised*.

The reader, possibly, may think that, up to this point, the instructions have been unnecessarily full, but it must be pointed out that the whole secret of success *depends on the preparation of the print*, the subsequent operations being comparatively simple.

To recapitulate, the following points are essential and must be kept in mind :—

- (1) Ample exposure of the negative.
- (2) Development of the negative to such a degree of contrast as will give a bromide print of the grey character described; *i.e.* of a short range of tones with the darker shadows eliminated.
- (3) Development of the bromide print to a constant factor of between eight and sixteen with the prescribed Amidol formula.
- (4) Thorough fixation in a *plain* 15% hypo solution.
- (5) Thorough washing for a minimum of two hours.

- (6) Absolute chemical cleanliness of all utensils during the following operations.
- (7) Soaking before tanning in plain pure water for five minutes and mopping off superfluous moisture.
- (8) Accuracy in making up the tanning mixture, and the pouring on of this solution in an even sweep, removing the print from the bath as instructed for the particular mixture employed.
- (9) Brief but thorough washing so that *no* tanning mixture is carried over into the fixing bath.
- (10) Fixing for five minutes in an acid hypo solution of the given strength.
- (11) Washing for 30 minutes.
- (12) The determination of the correct time of soaking by experiment.

CHAPTER III.

INKING

THE preparatory operations having been completed in accordance with the instructions contained in the first two chapters, the print is ready for inking; but before proceeding to describe the method it would be advisable to set forth the materials necessary :

Materials

Brushes. These are the only expensive articles required. Substitutes for those specially manufactured for the process are most unsatisfactory. The best are those made of genuine pole-cat hair : they are very expensive and, as far as I know, can be obtained at present only from The Autotype Co., London.

Messrs. Sinclair (of London) supply a less expensive brush which is very reliable and efficient. One large and two smaller brushes will serve to commence with—the sizes recommended being Nos. 24 or 28, 14, and 10, and these may be added to as may be found convenient. It is desirable to have two of the larger size, if possible, as most of the work falls on the big one, and a clean brush is often useful.

Inks or Pigments may be obtained from Messrs. Sinclair, The Autotype Co., or Horsells of Leeds, through any photographic dealer. These inks are made expressly for bromoil, and although certain lithographic inks may be used, possibly with success, there is no reason why anyone should go to the trouble of seeking them out and experimenting to make them of the right consistency when the above are available and suitable for use as manufactured. "Encre machine" and "burnt umber" will be sufficient to start with. A range of coloured inks is obtainable so that prints may be made in almost any tint. The technique of the process should be thoroughly mastered, however, before colours are used, as certain difficulties arise on account of their composition and varying viscosity, and also with regard to their transparency or opacity.



THE CANAL.
C. J. Symes, F.R.P.S.

Medium. Megilp the ordinary artist's quality—may be used with any of the above inks, and so may prepared linseed oil—either boiled or raw. The manufacturers of the pigments make a special medium which should be used with ink of similar manufacture. Generally speaking, linseed oil, being slow drying, should be reserved for transfer only—a quick drying medium is better for bromoil. “Encre Taille Douce” (a soft black ink) may be used with “Encre machine” to thin it down in place of a medium.

Plate Glass. A piece of plate-glass, some sizes larger than the largest size of print worked, is about the best thing upon which to place the print for working. A fair substitute is three-ply wood, if covered with a sheet of wet blotting paper.

Palette. Another piece of glass will be required for use as a palette—an old half or whole-plate negative will serve.

Palette Knife. This should have a narrow rounded point, and should be much stiffer than those ordinarily used for oil painting. An old table knife can be used instead and serves quite well.

Petrol is required for cleaning brushes, prints, and palette, and, if the worker is unfortunate, clothes and domestic articles. The best grades only should be used, as the inferior spirit leaves grease on the brushes or whatever it is used to clean. *Carbon Tetrachloride* is really more efficient than petrol and does not leave any grease afterwards, but it is about five or six times the price.

Soap and water should be used about once in three months to clean the brushes additionally. A cake of good quality soap is held in one hand, the brush moistened with water and twirled on the soap, then rubbed on the palm of the hand under a running tap, and repeated until the lather is quite white. *All* the soap must be washed out before hanging the brush up to dry.

Cotton Wool is used for swabbing the print previous to inking, and is very useful in other operations. The ordinary grade as sold by chemists for dressings—as long as it is not antiseptic—is quite good enough.

Blotting Paper. That sold for photographic purposes is better, but "Ford's" is quite safe to use. There may be a small percentage of hypo in the latter, but as it is not generally required for use till just before inking, the small quantity will not matter.

Inking

Firstly, it should be mentioned that as it is most desirable that the ink should be used mainly at full strength, the time of soaking must be so adjusted as to allow this. Within certain limits it is possible to get quite a good bromoil from a print that has been oversoaked, by thinning or diluting the pigment. The result, however, will be lacking in the quality obtained by using the hard ink on account of the thinner deposit. The lights will not be so clean nor will the colour be good.

I, therefore, must emphasise that most particular attention must be paid to the time of soaking in the manner previously described, for assuming that everything else has been done correctly the ease of inking is *directly dependent* thereon.

When soaking is complete the print should be taken from the water, laid on the glass plate, and gently swabbed all over with the cotton wool, provided this has not been done previously in the case of prints dried before inking, taking care that no grit or foreign matter is on the surface. This removes a slight deposit sometimes left by the bleacher and should never be omitted. The whole surface must be *firmly* but *gently* and *evenly* gone over or markings will show afterwards. Surface moisture should then be blotted off and a squeegee may be used with care (the gelatine is now in a very delicate condition and should be treated accordingly), or the moisture may be removed by lightly dabbing with a thoroughly washed soft linen handkerchief, quite free from starch. After blotting off the moisture the image should be visible in slight relief. When there is no water to be seen on the surface of the print, inking may be commenced.

A little pigment, about the size of a pea, is squeezed out of the tube, taken on the point of the palette knife and spread as thinly as is possible on the palette. Next, the largest brush may be taken and dabbed lightly on the ink so as to take up a little on the points of the hairs only; the brush should be

tapped two or three times on the clear glass of the palette to distribute the ink evenly on the brush and then be lightly dabbed on the print. A point where there are both light and shade may be selected first, to enable the worker to see how the ink takes, and, in time, to judge whether the gelatine is in the right condition. The brush should be held vertically by the thumb and two first fingers as near the top as may be convenient. Held in this manner the points of the hairs touch the surface of the print at slightly less than a right angle. This imparts a slight dragging action which deposits the ink. A slight emphasis on the downward movement, just as the brush touches the print, helps the ink to take, and is inclined to soften contrast, while if the brush is smartly drawn away, or if the upward movement is emphasised it tends to increase contrast. This latter motion should not be exaggerated as it will not deposit but remove the pigment and is generally referred to as "hopping;" moreover, the gelatine will not stand more than very little of it without serious loss of quality and it is quite possible that it may cause blisters.

The dabbing motion, which may be compared to the way in which an impatient man taps a pencil on his desk, should be continued till the print is evenly inked and has attained the desired depth.

If due care in all the necessary steps of the preparation of the print has been taken no difficulty need be anticipated. It is only necessary for the evenly charged brush to be placed gently on the print, which will accept the ink naturally (*i.e.* without being forced) only in proportion to the degree of tanning at that particular area. It will be necessary to repeat the placing of the brush several times in the same place to attain full depth. "Dabbing" is simply this placing of the brush on the print time after time in rapid succession. It is astonishing how soon the action becomes automatic. It should be as gentle and even as possible: there should always be some ink on the brush—if it is not well charged it is inclined to leave bits of hair instead of ink and also to remove what ink has been deposited. If a very fine grain is desired in the finished print, the brush may be used, after inking is practically complete, with very little or no ink thereon to smooth out and clear the

print, giving a rather heavier emphasis than usual on the down stroke. Care should be taken to keep the brush free from water at all times during inking; if it becomes wet not only will it refuse to deposit the pigment but will remove that which already has been placed on the print in spots. The glass should be wiped and all water cleared off the surface before inking is started.

It is a convenience to mask the print, either during printing, or during inking by placing strips of paper—cut with a straight-edge—along the margins. They will adhere to the print quite easily and should be removed when pigmentation is finished.

Should the inking be prolonged more than twenty minutes, as it may well be in dealing with large sizes, the emulsion will get too dry on the surface, in which case it will take both on lights and darks. If the drying has not gone too far, the print may be brought to the right condition again by floating it on the soaking water for ten minutes, after which inking may be resumed. In bad cases, immersion for about five minutes at room temperature is sufficient, but care should be taken that the ink is not smudged in blotting and that no fluff from the blotting paper adheres to the print.

An alternative method of keeping the emulsion moist and in the proper condition is to add a slight quantity of glycerine to the soaking water. The proportion of glycerine to water should not exceed 5%, *i.e.*, 1 oz. to 20 ozs. of water. At this strength the time during which the emulsion retains its moisture is extended by 10 to 20 minutes and, possibly, a little longer in damp weather. The addition of glycerine does not entail any alteration in the time or temperature of soaking, but it is just possible that the presence even of such a minute quantity in the finished print may render it susceptible to the influence of damp which may adversely affect its keeping qualities. It is not practicable nor advisable to wash a completed bromoil, so the glycerine cannot be dispersed by this means.

It will be found, as previously stated, that provided the time of soaking be correct, the ink at full strength will take quite easily, but occasionally it may be necessary to soften or let down the ink, not primarily on account of over-soaking but for

the purpose of control—to mass shadows, to subdue or reduce lights, and to eliminate irritating or insistent detail.

With some papers there is a slight preliminary difficulty in getting the ink to take and before thinning the pigment it must be made certain that this is not the case. To make sure, it is only necessary to dab continuously with a fully-charged brush on a dark portion of the print in proximity to a light, and if the hard ink eventually takes and gives a good rich colour no dilution is called for. Should the result be a grey (presuming a black ink) inclined to be very grainy, and the whites remain clean, *over-soaking* is indicated and the ink may be softened.

If the pigment takes on the lights as well and also is grey and grainy in the shadows, under-soaking is the cause and re-soaking is called for—not a thinning of the ink. This condition is sometimes mistaken for reversal, but this will be discussed in a later chapter. It may be caused by general tanning through some of the tanning mixture being carried over with the print into the fixing bath.

The thinning of the pigment should be done little by little, with frequent trials, whether to overcome an error in soaking or for the deliberate control of the picture. A drop of medium—and by a drop I mean *one minim*, as near as can be guessed—should be taken on the point of the palette knife and well worked over the surface of the pigment as spread on the palette. The whole of the mixture should be scraped off and re-spread as thinly as possible. A trial should then be made and if found necessary the dilution may be repeated, adding a drop at a time, and also making a trial each time till the softened ink just takes nicely.

The beginner would be well advised to aim at producing an exact replica of the original bromide print first of all, and when he can do this with certainty experiments in control may be essayed. It serves no useful purpose to fluke a successful result here and there—the worker must be the master, not the process.

This mastery will come in time and then the worker will have acquired sufficient technical knowledge to know how to alter or control the bromoil as he wishes.

Control

As a rule, it is better to start with a clear idea of what is wanted and to work with that end in view—that is by withholding ink rather than putting it on and then taking it off.

The massing of spotty areas, such as foliage, is accomplished by accentuating the downward stroke and dragging motion of the brush. In bad cases it may be helpful to thin the ink down a little: care must be taken in this event not to thin down the pigment too far, as it is inclined to become warmer in colour as the degree of dilution increases, the result resembling double toning—a most undesirable effect.

If it should be necessary to lighten parts of the print the most effective way is to accentuate the upward stroke of the brush—which should be clean—withdrawing it smartly from the surface as it touches.

It is desirable sometimes to heighten the contrast between contiguous light and dark areas, in which case "Hopping" may be resorted to. The brush—moderately charged—is lightly held, dropped on to the print and instantaneously and smartly lifted. This action removes ink from the lights and drives it into the darks. It should only be used as a last resort and then sparingly—it is inclined to spoil the surface, may raise blisters, and the darks thus emphasized cannot afterwards be lightened conveniently, except by such methods as scraping the *dry* print with a very sharp knife as in negative retouching.

High lights may be lightened by the use of a pointed piece of soft india rubber.

No attempt should be made to remove hairs deposited by the brush, bits of grit and foreign matter from the print until both paper and pigment are dry, when they may be brushed off—they come away quite easily—or lifted with the point of a sharp knife.

A certain amount of spotting and retouching may be done on the *dry* print: conté crayon of an appropriate colour is useful for darks and a sharp pointed knife for the removal of dark spots in light portions.

In the completed bromoil there is sometimes a glossiness in the shadows which is presumed to give them an appearance of depth and is preferred by some workers on this account. Others do not care for this as it differs from the lighter portions of the print which are, comparatively, matt.

There is something to be said on both sides and those to whom the gloss is objectionable may remove it by immersing the thoroughly dried print either in carbon tetra-chloride or a non-greasy grade of petrol. The former is non-inflammable, but if petrol be employed, this operation *must not be performed in a room in which there is a naked flame.*

A dish, a size larger than the print, is filled with either of the two solvents mentioned to a depth of about $\frac{3}{8}$ " and the bromoil to be treated is held by one edge and slid under the surface of the liquid, left for a minute or so, and removed by the edges alone. On no account must the surface be touched nor the dish agitated or rocked during immersion. The sliding in of the print and its removal must be gradual and fairly slow, or the ink may spread. On removal, it should be placed, face upwards, on a piece of blotting paper to dry, which will only take a few seconds. It must not be hung up to drain and it should be kept horizontal from the time of immersion till all the liquid has evaporated. All the gloss will then have vanished.

* * * *

Such is the bromoil process, and in the hands of an experienced worker no other process can give equal quality with anything approaching the same control, excepting its predecessor, the Oil Pigment Process and its derivative, Bromoil Transfer, both of which are described in subsequent chapters.

CHAPTER IV.

FAULTS AND REMEDIES

DIRTY DISHES. A great many faults are attributable to dishes and utensils that are not chemically clean; the importance of this point cannot be over emphasized. A dish, for example, that has been used for hypo should never be employed under any circumstances for the soaking before tanning or the operation of tanning itself.

Vulcanite, xylonite, wood and papier maché dishes are very liable to retain traces of solutions previously contained. Enamelled metal dishes may be used but not after the enamel is cracked, as the tanning mixture may be decomposed by contact with the underlying metal. It is most desirable that porcelain or glass dishes be used in preference to any other for these two operations, and if possible they should be retained solely for these purposes.

If it is necessary to use dishes which have been used for other purposes they should be cleaned with a mixture of weak solutions of either hydrochloric or sulphuric acid and potassium bichromate, as previously mentioned, and thoroughly washed with plain water. This mixture, besides being a very efficient cleanser, is not likely to leave any harmful contamination behind, nor is it, in itself, a possible cause of trouble, which is more than can be said for anything in the nature of washing soda or commercial soap mixtures.

Reversal

REVERSAL—the print inking up as a negative instead of a positive—is probably due to insufficient washing of the bromide print and slight hypo or developer contamination in subsequent stages.

If hypo is present in any appreciable quantity it will prevent the tanning solution from working and usually declares itself by the presence of only partial bleaching in the tanning bath, usually in the form of irregular streaky lines. In this case there is no remedy, but reversal, which only reveals its presence

when inking is commenced, may often be cured by cleaning the print with a swab of cotton wool soaked in petrol, allowing it to dry thoroughly and re-soaking. If all the petrol has not evaporated before re-soaking, the print will take ink indiscriminately.

Reversal may also be due to the use of *hard water* in making up the chromic acid or bichromate solutions or to an excess over the correct proportions of copper sulphate or copper chloride.

For some time I was under the impression that both the chromic acid and bichromate solutions decomposed and lost their tanning power after approximately twenty days, but after consulting a well-known chemist and supplying him with an analysis of the water used—which is extremely hard—I was informed that the deterioration was due to a chemical action between the compounds held in solution by the hard water and chromic acid or potassium bichromate, whereby another compound was formed which was deleterious and which prevented these tanning agents from exercising their functions in the bleacher. Accordingly, I have since used distilled water and have not observed, up to the present, any change in the action of the two solutions.

Refusal of the Ink to "Take"

may be due to working in a room the temperature of which is too high, or, what is more likely, to under or over-soaking.

The latter will be shown by an excessive relief, and if not extreme may be remedied by dilution of the pigment.

In the case of under-soaking, indicated by a lack of relief, the ink may take more easily on the lights than the darks giving rise to partial reversal which disappears with continued inking. Longer soaking is called for. (See Chapter III., page 25).

A similar state of partial reversal is caused by the use of stale paper or paper that has been improperly stored. In this case dry and re-soak.

An incorrectly mixed bleacher may be the cause and in this case there is no remedy. Other faults to which this reluctance of the pigment to take may be due are the use of too hard an ink, which should be softened, and an excessive or insufficient

bleaching—in the former case longer soaking and possibly the use of a thin ink may enable a print to be made, but in the latter nothing is likely to be efficacious. A print sometimes declines to ink up on account of the swabbing with cotton-wool being omitted; the remedy is obvious, though if any amount of pigment has taken it may be necessary to clean the print with petrol, as previously instructed.

Slowness in Inking

is generally caused, assuming correct brush action, by slightly insufficient soaking. It may be cured by soaking, without drying, at room temperature for a short time.

Unevenness

Where there are large areas of even tone—such as the sky—is sometimes happens that it is impossible to get an even deposit of pigment. The cause is surface drying of the emulsion and re-soaking by immersion—floating on the surface of the soaking water is ineffective—is the only remedy. Inking may be proceeded with after blotting off the surface moisture, care being taken that no fluff adheres to the print.

Indiscriminate Taking of Pigment

is caused by insufficient soaking and this is indicated by a lack of relief. The print should be cleaned with petrol, dried, and re-soaked for a longer time. It may be due, also, to the use of too soft an ink, and the use of a harder ink, after cleaning and re-soaking, should meet the case. Stale paper or paper that has been stored under improper conditions sometimes refuses and sometimes takes all over. There is no effective remedy.

It may also be due to the carrying over of some of the tanning mixture in the emulsion of the print into the fixing bath. This causes a general tanning, and in slight cases may be cured by soaking at a higher temperature. It is better, of course, to *prevent* it by thorough washing between tanning and fixing.

Dirty Brushes

Graininess of image is most probably due to dirty brushes or brushes too highly charged. Cleansing the print with petrol, drying and re-soaking, is the only cure, though if a clean brush is available the pigment *may* be persuaded to coalesce therewith.

Excessive Contrast

Soaking at too high a temperature is the cause and is usually accompanied by an unusual readiness of the print to take the pigment in shadows and half-tones while it refuses in the lighter portions altogether. When this happens the print should be very carefully cleaned with petrol—the gelatine will be very tender—dried and re-soaked at a low temperature (about 55°F.) for ten to fifteen minutes. If it is still too contrasty, dilute the ink.

Patches and Markings

Patches which ink up irregularly are sometimes noticed, and may be due to several causes. Air bubbles, if the marks are circular or semi-circular in shape, are a probable cause and may occur during the first fixing, preliminary soaking, bleaching, second fixing, or final soaking. There is no remedy except careful retouching, but they may be prevented by adequate rocking, and thorough immersion in every bath. If the patches are irregular in shape and lighter than their surroundings, they may be caused by the print not being evenly covered in pouring on the developer or bleacher; if they are darker than the rest of the print, they may be the result of soaking too many prints at a time; of the prints sticking together; and/or rubbing one another in one or other of the various solutions, or possibly of the pouring of hot water into a dish containing prints in order to raise the temperature. Retouching is the only remedy, but prevention is better and the causes set forth suggest the obvious precautions. Amongst other things, too, patches are the result of dirty fingers touching the surface of the print instead of handling it by the corners or edges, and abrasions of the surface caused by dragging it out of dishes, tanks, etc., over the edge.

Although this list of difficulties is a lengthy one, if the instructions of this handbook are faithfully followed and interpreted with common sense, the majority of those mentioned will never be encountered. They are stated more particularly as warnings and not as a deterrent to the practice of one of the most beautiful and elastic of photographic processes.

BROMOIL TRANSFER

BROMOIL TRANSFER, as its name signifies, is a development of the bromoil process whereby the pigment image of the bromoil is transferred to another base or support.

In this Chapter it is proposed to discuss the differing characteristics of negatives, papers, and essential alterations in procedure between prints primarily intended for bromoil as distinct from prints designed for transfer: the previous chapters of this series of articles referred to bromoil only—the necessary modification for “Transfer” alone will be described herein.

In quality a transfer resembles an etching, which is not surprising when it is considered that the papers and inks employed are similar. Further, this process has the advantage of retaining, where desired, the *photographic* rendering of half-tones—a practical impossibility in an etching.

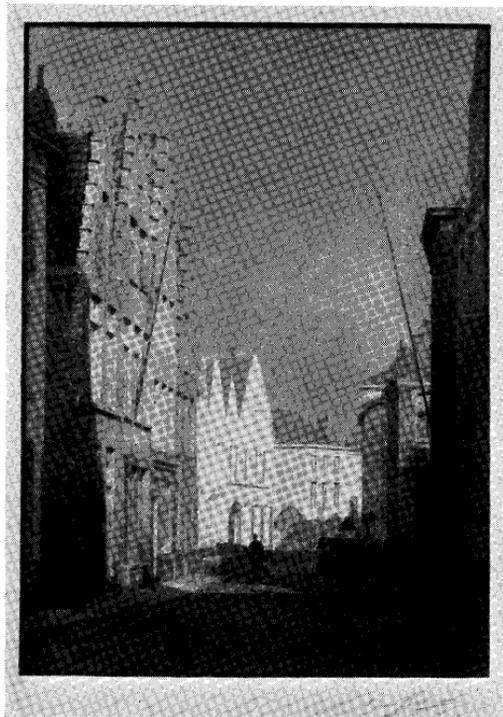
In the preceding chapters it was mentioned that it is necessary to acquire a sound technique in the making of bromide prints before proceeding to bromoil, and similarly it is essential to master bromoil before transfer is attempted.

Suitable Bromide Papers

Bromide papers which I have used successfully are:

- Kodak, “Royal”
- „ “Permanent”
- „ “Velvet”
- Barnet, “Smooth Ordinary”
- „ “Semi-matt Card”

Of the above, Kodak “Velvet” requires different treatment from the others, it being super-coated—that is, an additional layer of non-sensitised gelatine has been super-imposed over the sensitive emulsion—and the action of the bleacher must extend to this coating. This necessitates a stronger and darker print than is described for the other papers. The highest lights must be distinctly veiled, development must be full, and, on



BRUGES—A SUNLIT STREET.

C. J. Symes, F.R.P.S.

account of possible variations in the hardness of the super-coat, it is advisable to test *each batch* for time of soaking. The last I used required ten minutes at 65°F. In other respects the procedure should be as described. Papers manufactured for bromoil, generally, are suitable, providing their surface is smooth or semi-matt.

The Negative

Whilst it is perfectly possible to make a transfer from a bromide print made from a negative primarily intended for bromoil, the print and consequently the negative is all the better for being slightly more contrasty, and this involves a slight increase in the time of development. Exposure should still be made on the lines previously laid down. For contact printing a normal time of development is required. If the negative is intended for enlargement with the aid of a condenser lantern, half this time of development is more appropriate.

The Bromide Print

The negative described above will give, as is required, a slightly stronger or more contrasty print than in the case of prints intended for bromoil, but still well within the range of the paper. The chief difference between the prints required for transfer and those for bromoil is that the very highest lights should be perfectly clear and not veiled for transfer, whereas for bromoil a slight veiling is desirable. (Kodak "Velvet," as already mentioned, is an exception.) It is permissible to have very slightly deeper shadows, too, but these must not be nearly as black as the paper is capable of giving.

There is rather a larger margin of latitude in respect of the development of the bromide print for transfers than for bromoil. The minimum factor advisable is six, and the maximum sixteen as for bromoil. The former instructions for development apply otherwise.

It has been stated that the shorter the factor the greater is the ease in which the transfer of the pigment is effected. To determine if this were the case I made a series of prints under experimental and uniform conditions and varied the develop-

ment factor only from two to twenty, rising in the steps 2, 3, 4, 6, 8, 12, 16 and 20. There was little difference in the resulting transfers, but the amount of ink retained on the print in the shadows increased as the development factor became greater up to twelve, and the last three showed no appreciable difference. The inference drawn therefrom was that prints developed to the longer factors took more ink than those in which the shorter factors were employed and that the most desirable factors to use lay between six and ten, the shorter factors—2, 3 and 4—being rather too short to work accurately, and the longer factors 12, 16 and 20 requiring an apparent over-inking, difficult to estimate, in order that the shadows should have adequate depth.

Although I have just stated the kind of negative and print most suitable for transfer, there is quite sufficient latitude in the operation of inking to allow the production of good transfers from softer or harder negatives once the technique has been acquired; my aim, however, is to describe the *normal* process and the standardised production of good quality prints.

Preliminary Soaking, Bleaching, and Fixing are precisely the same as described for bromoil, and do not call for any special comment. The washing after the final fixing may be reduced to fifteen minutes.

Soaking

From this point, the fact that the pigment image has to be removed must be kept in view, and all the following instructions are designed to facilitate transfer.

Soaking must be most accurately determined in the manner described in the bromoil section, and the time must be so arranged that the pigment will just take sufficiently without dilution. Any softening of the ink for general pigmenting is accompanied by a distinct loss of quality. The right condition almost borders on over-soaking. It will be obvious, therefore, that there is no latitude whatever. The print must be soaked for an exact time at the standard temperature for the paper. Every following operation is directly dependent on these points being strictly observed.

Each worker must determine this time for himself, but I give the times which suit my manner of inking with "Encre Machine" at full strength as an indication:—

Kodak "Royal"	75°F. . .	25 minutes.
," "Permanent"	75°F. . .	30 "
," "Velvet"	65°F. . .	10 "
Barnet "Smooth Ordinary"	70°F. . .	20 "
," "Semi-Matt Card"	75°F. . .	30 "

After soaking, the print should be placed on the glass slab, as for bromoil, and inking commenced, or it *may* be dried and re-soaked as described in Chapter II, but the quality of the resulting transfer is not quite as good.

Inking

It being easier to transfer the half-tones and lights than the shadows, the former should be inked up first, very little ink being taken on the brush to start. The print should be completed, as far as possible, with the pigment at full strength, and only if it is impossible to get enough depth should recourse be made to any medium—that is to say—there must be a groundwork of hard ink before the softer is applied, as diluted ink does not transfer with the same facility. Of course, if it be necessary to add more ink than the paper will take naturally, or for the purpose of control, a thin pigment may be used but its application left till last. Again, the inking should be as gentle and rapid as possible—it must not be driven into the gelatine, and the longer the print takes to ink, under ordinary conditions, the more difficult will it be to transfer. A 15×12 print should not take more than thirty minutes. If the print surface loses its moisture, it may be re-soaked as described in Chapter III.

Materials for Transfer

The Press. An ordinary domestic mangle, provided that the rollers are not worn or badly scored, makes a very efficient press and has the great advantage that, in the majority of cases, it is already installed as part of the household furniture. The small wringing machines with rubber-covered rollers do not exercise sufficient pressure to be of any use, and the same applies to the small burnishers with steel rollers that are sometimes

converted for use in transferring; they lack the substantial construction necessary to give even and firm pressure. Etching presses are excellent for the purpose, but for most people the price, even when second-hand, is prohibitive. The Autotype Co. has recently placed on the market a specially-designed machine which leaves nothing to be desired; it has many advantages over any makeshift and is an absolute necessity if much work is to be done with ease and comfort.

The *Sandwich or Carrier* is the means of protecting the bromoil and transfer paper while they are being passed between the rollers of the press. A piece of three-ply wood, some sizes larger than the largest size of transfer paper used, forms the base. On this is placed a sheet of blotting paper on which the inked bromoil and transfer paper are laid; over these a piece or two of printers' blanket, and finally a piece of stout millboard, completes the sandwich; the three-ply wood and blotting paper, and the printers' blanket and millboard corresponding to the bread and the bromoil and transfer to the meat—hence the name.

Printers' blanket may be obtained from dealers in artists' materials, or box cloth may be used instead, and can be purchased from tailors or livery makers. It should be nearly as large as the three-ply wood forming the base of the carrier. If an etching or copper-plate press is employed the blotting paper and two or three pieces of printers' blanket only are required.

Transfer Papers. Practically any paper may be used for the final support. Perhaps etching papers are best of all, and they may be obtained, through dealers in artists' materials, in all sorts of tints and surfaces. Generally, the only essential of a transfer paper is that the surface should be able to stand the bromoil being stripped therefrom without pulling off the surface.

Preparation of the Transfer Paper

The transfer paper may be used dry, but it is preferable that it be in a damp condition (not wet) when the transfer is made. A dry paper does not take the ink so well and is not as easily stripped; the result, however, is slightly more contrasty than if a damp support is employed.

Some time previous to work being commenced an hour is sufficient—the paper, on which it is proposed to transfer the bromoil, should be put to soak for about five minutes, care being taken that it is totally immersed and that no air bubbles form on the surface, and then placed between sheets of blotting paper. It will be in the proper condition in about one hour and will maintain that condition in a cool room for about two or three hours. If a number of transfers are to be made, a sufficient number of sheets should be soaked, one laid on a sheet of blotting paper, another sheet of blotting placed over it, then another sheet of transfer paper, more blotting paper—and so on, the last sheet of transfer paper being covered with two or three sheets of blotting paper to keep the moisture in.

Transferring

As soon as inking is finished, the bromoil should be taken from the glass plate and, if an etching press is used, placed face upwards on a piece of blotting paper laid on the bedplate. Over this is placed the prepared transfer paper and above that a piece of printers' blanket. A second or third piece of blanket is then placed over the whole with one edge almost under the roller so that a fair space is left between the edge of the transfer paper and that edge of the top piece of blanket. The press being adjusted to the right pressure, which must be found by experiment, the whole is then passed under the roller and back, care being taken that no creases form during the operation or the transfer will be marked where they form.

If a mangle be employed, the bromoil is similarly taken and placed on the blotting paper covering the base of three-ply wood. Over this is placed the transfer paper, then the printers' blanket and millboard. The base board of the sandwich should then be put between the rollers and the mangle screwed up as far as possible by hand—too much pressure cannot be obtained with any ordinary mangle—and the whole passed through and back.

After passing the bromoil and transfer paper through the press, they should be turned over, the position of the corners marked in order to secure registration in case it is necessary to re-ink and re-transfer any portion, and the bromoil stripped from the transfer paper.

One corner should be lifted and the two papers slowly pulled apart, both being examined carefully in order to see that there are no patches where the ink has not transferred. Should there be such patches—they usually only occur where the pressure is unequal—it is only necessary to replace the bromoil and transfer in position and pass through the mangle again, preferably in the other direction to which it was first put through, and if desired placing a pad of folded newspaper on the top of the sandwich in order to increase the local pressure.

After stripping, the transfer should be scrutinised to see if there is sufficient depth in the print. If there is not, the bromoil may be soaked for about ten minutes and re-inked in those portions that require it and re-transferred, registration being secured by matching the corner marks previously mentioned.

Before transferring, the pigmented bromoil may be masked with strips of paper—they will adhere quite easily, or the dried bromide print, previous to tanning, may be trimmed as desired.

The majority of the workers employing this process deem it advisable and, in fact, necessary in order to get sufficient depth, to make two or more pulls on the same transfer, *i.e.*, the print is inked up as fully as is considered sufficient for the first time and transferred, re-soaked and re-inked in those portions that then require strengthening, and re-transferred, and if necessary, the operations again repeated till the desired effect is produced. It is claimed for this method that the control is greater than if a single pull be made, but, in the writer's opinion, equal control is possible during inking, and repeated "pulling" has the disadvantage that a merging of the tones is almost always evident, accompanied by a slight degradation throughout and of the lights in particular.

It always has been my practice to make single pulls only and this is decidedly easier, as there is no need for registration. If soaking is accurate, inking thorough, and the pressure of the press sufficient, there is no difficulty in the transference of the image. In both cases the bromoil retains a small proportion of the ink applied to the shadows and a certain allowance has to be made on this account, but not so much as might be expected, the tendency, in the case of single pulls, being towards blocked

up shadows—the only drawback of this method. This, however, is not likely if the original bromide print had not exceeded the permissible depth in the darks.

No retouching of the transfer should be attempted till the paper is dry and then almost every method is available. Carbon pencils, conté crayon, chalks, and stumps, inks diluted with paraffin, india-rubbers, and a sharp knife may be used as fancy and skill dictate.

Care, cleanliness, and precision in technique are required throughout, but once success has been attained—and it *will* come with practice—the results are so pleasing, full of quality, and so under control that it is unlikely that any other process will ever prove as absorbing.

CHAPTER VI.

THE OIL PIGMENT PROCESS

A BOOKLET on the Pigment Processes would not be complete without reference being made to the earliest—the "Oil Pigment Process." This process is now seldom used. It is necessary for the print to be made by contact printing in daylight and the present prejudice against the use of large cameras renders the production of enlarged negatives essential if the prints are intended for exhibition. Large size plates are expensive, and the high cost, together with the technical difficulties of making enlarged negatives, have caused the process to fall into disuse, except in the case of a few devotees.

In Oil Pigment printing, a paper coated with gelatine is sensitized either by immersion in, or by coating with, a bichromate solution. It is then exposed under a negative to daylight which effects the selective tanning required and is subsequently washed, soaked, inked up, and the image may be transferred as described in previous chapters.

Herein it is proposed to consider the type of paper suitable, the two methods of sensitizing, the characteristics of the negative required for each method, the depth to which printing should be carried, and the appropriate after-treatment.

The preparation of the print, as will be inferred, is far simpler than is the case with bromoil; consequently it is less open to errors in manipulation, more reliable, and its quality as a pigment print is distinctive and compares favourably with bromoil; prints transferred from an oil print are at least equal to bromoil transfers.

Suitable Papers

Practically any "double transfer" paper, as used in the carbon process, may be employed and the Autotype Company of London have recently placed on the market a paper, specially

coated for the oil process, which is reputed to be very easily worked. It is possible to coat one's own papers, but it is a messy operation and very difficult to get an even coating. The saving in cost is so small that it is a futile proceeding to attempt it.

Sensitizing the Papers

(1) By IMMERSION.—A 2½% solution of potassium bichromate* is made up, preferably if it be kept for any time with distilled water, placed in a clean dish a size larger than the paper to be treated, and the paper slid under the surface as quickly as possible, taking care that no air bubbles are formed, kept completely under for three minutes, and slid out in the same direction as entered. It is then held by one corner to drain for a minute or so, then the next top corner is taken and slowly brought to a level with the one first held which is lowered and relinquished. The second corner is held for another minute, the third corner brought up and dropped and finally the fourth so that the superfluous liquid runs round the edge only and *does not run back over the printing area*. If there should be a blob of the sensitising solution left when the fourth corner is held, the paper may be pinned up to dry and a piece of blotting paper applied to the bottom corner tip to absorb the excess.

An eminent worker of the process, Mr. Fred Judge, recommends that, after immersion, the paper, provided its surface is smooth and *not rough*, should be squeezed face down on to a thoroughly cleaned piece of glass or ferrotype plate and left to dry with the object of securing a perfectly even coating. The writer has not tried this method, not having used the process for some time, but that it is efficient is beyond question.

By Coating

A 10% solution of ammonium bichromate† is made up and immediately before use is mixed with an equal quantity of pure alcohol (methylated spirit may be substituted for alcohol if desired and it is considerably less expensive). The mixture is thoroughly shaken up and poured into a dish of sufficient size to take the brush. That most suitable is known as the "Blan-

* Potassium bichromate, 120 grs., water to 10 ozs.
† Ammonium bichromate, 480 grs., water to 10 ozs.

chard" brush and is made by folding an old piece of flannel, free from fluff, to make from six to eight thicknesses. A piece of glass, rectangular in shape, is put down vertically in the centre of the folded flannel, the edges of which are pulled up on each side and a stout piece of elastic passed over the outside to hold the whole in place.

The brush should be of a length exceeding the longer side of the paper to be used. Then the paper, coated side upward, is placed on a sheet or two of blotting paper, pinned down by two corners—small sizes may be held by left hand thumb and second finger at the two corners—and coating proceeded with. The brush is placed in the sensitizing solution, moved about therein to absorb the mixture evenly, drained for a few seconds and then rapidly, firmly and evenly moved across the whole sheet vertically and then horizontally. The paper should then be pinned up to dry and will be ready for printing in about twenty minutes. Prints thus sensitized are perfectly evenly coated.

Papers may be sensitized in any artificial light or diffused daylight, but must be dried in the dark and subsequently exposed to the light as little as possible. They are of approximately the speed of P.O.P.—somewhat faster if anything. It is desirable that the paper coated should be larger than the negative or the portion thereof to be printed—about half an inch margin all round is required. Papers should only be sensitized as required; they will only keep in good condition for about forty-eight hours.

The Negative

For paper sensitized by *immersion* the type of negative required is similar in contrast to that required for bromoil, *i.e.*, one which will give a soft, well-graded print on vigorous gaslight paper, whereas negatives for papers sensitized by *coating* require a longer development by about 20% or such time as will give a good contact print on soft gaslight paper.

It is not proposed to give working instructions for the making of enlarged negatives—they may be found in any good photographic text book—but it may be mentioned that plates or films are essential—paper negatives being generally considered unsuitable—that the positive transparency should be absolutely

free from light fog, and of delicate contrast. That is to say that if, when dry, it be placed face down on white paper, it should look like a soft print of good quality under glass without any appearance of over printing. The final enlarged negative should be given the correct exposure (which necessitates a trial on a smaller plate of the same batch) and the correct time of development for the particular method of sensitizing the paper chosen. Plates known as "ordinary" or "slow" are recommended for both transparency and enlarged negative.

Printing

should be carried out in a diffused or reflected light as for P.O.P.—not indirect sunlight—and should be carried to such a depth that detail is just visible in the lightest parts. Examination of the print should be made from time to time and this inspection should be done by reflected light in a room and not in the open or where the print is being exposed. It is a convenience in the after processes to mask the negative during printing to provide a margin to the print—any method with which the worker is conversant will serve. Some printing frames are made with sliding adjustable "L" pieces and these are very convenient and simple to use.

After printing, the print should be thoroughly washed till all the yellow stain has gone—one hour in running water or twelve changes of five minutes each should be sufficient. It may then be dried or immediately prepared for inking.

Soaking

As in bromoil the time and temperature of soaking vary considerably according to the make of paper. With normal grades, *i.e.*, those not hardened, 65° F. is the normal temperature and thirty minutes the usual time. Hardened papers may require a greatly increased temperature—85° F. being required with extreme examples. The right time and temperature should be found by experiment as indicated in chapter II.

Subsequent Operations

The after processes of pigmenting the print—control, re-touching, and transfer, if desired—are precisely the same as for bromoil, the only difference that may be noticed is that the oil print seems to retain its moisture for a longer period.

Faults

This process, being so much simpler than bromoil, does not offer so many opportunities for error, and, accordingly, mistakes should be more easily traced.

Under and over-soaking present the same symptoms and the remedies applicable to bromoil also apply to oil.

Over and under-printing are practically the only other likely mistakes and, if excessive, are incurable. If not extreme, over-printing may be counteracted by increasing the time of soaking and sometimes an increase in the temperature is also necessary.

Under-printing, if slight, can be cured, if found out in time, by soaking at a lower temperature or diluting the ink, but, as in all photographic processes, considerable under-exposure is fatal and irremediable.

* * * *

In conclusion, the writer desires to express the opinion that, for pictorial work, no other processes offer such exquisite quality with equal possibility of control—with the possible exception of photogravure—and that therein lies the danger that the control available may be abused by the inexperienced worker, or those without sufficient artistic knowledge, and made to give results which are obviously false. The greatest proportion of the honest criticism directed against bromoil, oil, and transfer is due to the exhibition of misplaced efforts of this kind.

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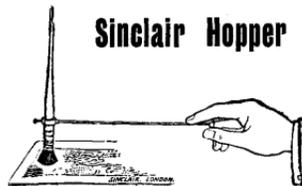
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