BROMOIL AND BROMOIL TRANSFERS

Charles H. Partington

Bromoil Specialist, Photographer

Bromoils can be highly artistic pictorial prints. In the bromoil process, the photographer will find freedom to control the texture, tone, and even structure of his work. Part I of this article is an explicit description of the bromoil process—written by an expert. Part II tells about the bromoil transfer, a further step in the bromoil process and one which gives the pictorialist added freedom. The author, in Part II, also has a detailed description of three-color transfers and tells how the color pictorialist can achieve control in printing.

See Also Color—Paper Prints, Control In Photography, Oil Printing Processes

BROMOIL: PART I

THE BROMOIL process in photography represents a specific procedure capable of a greater amount of control than any other printing medium. It is especially suitable for those who aim at producing *pictures* with the camera, instead of straight photographs resulting from the action of light and chemicals only.

Bromoil workers should have the ability to combine artistry and manipulative skill. Any earnest worker who is willing to combine a knowledge of the process with diligent effort in practice, however, will get pleasing and interesting prints.

PRINCIPLE

The bromoil process is a method of producing prints in permanent oil pigments—on the gelatin base of a bromide (or chlorobromide) print. The image is formed by a deposit of pigment from an oily ink, which is applied by a brush to the bromide base.

When a bromide print is placed in a bleaching and tanning solution, the gelatin of the paper will be toughened according to the amount of silver deposit which formed the original image on the bromide print. When a lithographic ink is applied by means of a suitable brush, this ink is accepted in the portions of deep shadow and rejected where highlights are located. Intermediate tones vary, of course, between these extremes.

The image, originally a deposit of silver *imbedded in* the gelatin, is replaced in bromoil by a deposit of pigment *on the surface*. Being thus located, the material forming the image can be removed to reduce density, or it can be increased—thus making local control possible. This feature of the process makes it possible to produce, within reason, varied results as desired.

The steps in making a bromoil print are, in general, as follows:

1. Bromide enlargement is made—fully developed, but with scale of contrasts not too great
2. Print is bleached and dried—image has disappeared
3. Print (now known as the matrix) is soaked in water until highlights swell and a negative relief is formed
4. Print is relieved of excess surface water
5. Inking with engraver's ink takes place —special brushes (Fig. 1) and special technic used
6. Finished bromoil is dried

The bromoil process has been and can be greatly abused either by careless processing of the paper, poor materials and equipment, or lack of attention to the technic of inking. Attention to all phases of the process is therefore important.

It is also an opportune time to mention the following as regards materials, formulas, equipment, processing, and manual work. Many variations apply to these points according to the pet procedure of individual experienced workers. To present all or even a greater part of the different practices would require volumes. It remains, therefore, to detail one certain procedure and this, based on practice with bromoil, can be recommended to produce excellent results.

NEGATIVE QUALITY

There has been some argument about the kind of negative which is best suited to the bromoil process.

The best quality is represented by a negative of the thin, yet snappy variety, in which a full range of tone recording is visible when viewed by light reflected from a white surface. A print from such a negative would show no pure whites in the highlights nor solid black in the shadows. Exceptions

are such highlights as result from water on various surfaces, the catch light in the eyes in portraiture, the glint on glazed ornaments, polished metalware, etc. The other condition of solid black would appear as a hole in a closed box or the shadow line on the edge of a coat lapel in portraiture. Solid black resulting from insufficient illumination of dark objects or areas, should not be seen in the bromoil.

It follows from the above that negatives produced with contrasty lighting or harsh development, or both, should be avoided. Lighting should be soft but not flat. Development should be complete. If proper lighting prevailed, the matter of development should be cared for in a much diluted solution containing a diminished amount of accelerating agent and a prolonged period of immersion

PAPER

The very foundation of bromoil centers on selective tanning of the gelatin coating. It is important that the bromide paper be coated with an emulsion of the soft variety instead of the harder grade in general use for photographic work. An emulsion hardened when manufactured cannot be treated for selective toughening of the image. As the emulsion may toughen over a period of time, due to atmospheric conditions, it is of value to use paper as freshly coated as possible.

Kodalure, manufactured by the Eastman Kodak Company, or Velour Black, produced by the Defender Photo Supply Company, have emulsions especially suitable for bromoil. The latter offers grades DD, LER, C, N, and I with the first mentioned suitable especially for the novice. While some of the foreign papers are good, they are not as easily or as freshly obtainable as the domestic papers are.

THE PRINT

There is nothing exceptional in producing a print for bromoil but there are a few important points contributing to certain needs of the process.

All prints should have a white border of at least one-half inch. For 10 x 12 or larger prints, a wider border, say three-quarters of an inch, is better. This border serves as a safe edge.

The print should be exposed for a period allowing development of at least three minutes. Development should be complete to produce an image with full depth and range of tones when viewed by transmitted light. While there are several developers that may be of worth in bromoil it is generally conceded by the majority of experienced workers that amidol is ideal.

A stop bath, while not absolutely necessary previous to rinsing after development, will do no harm and insures elimination of the developer action.

(*Continued on page 529*)

FIG. 1. EQUIPMENT. Shown here are brushes, palette knife, and ink. It is not necessary for the beginner to have so many sizes of brushes, as the medium-sized brush shown in the middle and the two brushes at either side of it would be sufficient.

BROMOIL AND BROMOIL TRANSFERS

(continued from page 528)

Fixing must be in a plain hypo bath free of hardener, as selective toughening of the gelatin is the base of the process.

FORMULAS FOR BROMIDE PRINTS

Developer

Water	45 oz.	1350 cc
Sodium sulfite (dry)	500 grains	32 grams
Amidol	75 grains	5 grams
Sodium bisulfite (dry)	75 grains	5 grams
Potassium bromide	15 grains	1 gram

Acid Short Stop Bath

Water	64 oz.	1900 cc
Acetic acid (28%)	3 oz.	100 cc

Fixing Bath

Water	60 oz.	1800 cc
Hypo	10 oz.	300 grams

Fixing of prints requires 10 to 15 minutes, after which they should be well washed. While bleaching is sometimes cared for directly at this stage, it is far better to allow intermediate drying to take place. This tends to improve the inking operation.

BLEACHING

Previous to bleaching, dry prints should be soaked in water until limp. The phase of bromoil generally designated as bleaching is actually the tanning operation around which the process centers. Bleaching and tanning both take place at the same time. The chemicals forming the bleaching agent react with the silver of the image to form a compound that, in turn, is acted upon by the tanning agent to produce chromium trioxide. The latter is responsible for the actual tanning at such areas where the original

deposits of silver were located. The bleach removes the image in the bromide print; tanning serves to harden the gelatin and takes place in direct proportion to the amount of silver present in the image.

Disappearance of the image will be complete in about 2 minutes after the print has been placed in the bleach. Continued immersion for a short period thereafter is of value to insure complete action.

Washing after bleaching and tanning must be thorough as any of the chemicals not eliminated may result in slight general tanning of the entire emulsion. Such a condition would result in partial or complete failure when inking was attempted.

Fixing after bleaching in a non-acid 10% solution of hypo is necessary to avoid stained patches. Wash well after fixing and dry thoroughly. Drying, after any stage of processing is a step toward better results and is best accomplished by suspension from a clip hanger. Such procedure allows complete evaporation of moisture and avoids uneven action that may result when prints are laid out flat. Uneven drying may result in uneven inking and no amount of hopping can really correct this.

BLEACHING FORMULAS

Bleacher

Water	60 oz.	1800 cc
Copper sulfate	330 grains	22 grams
Sodium chloride (table salt)	1800 grains	118 grams
Hydrochloric acid—Add drop by drop and shake until fogged appearance clears	40 grains	2½ grams
Potassium bichromate	40 grains	2½ grams

Fixing Bath (after bleaching)

Water	60 oz.	1800 cc
Hypo	6 oz.	180 grams
Sodium sulfite	2 oz.	60 grams

BROMOIL AND BROMOIL TRANSFERS

INKING EQUIPMENT

The necessary inking equipment for a beginner as listed below is really sufficient for the experienced worker. Other equipment is merely a matter of individual needs or desires.

a. One large bromoil brush, size $1\frac{1}{2}$ inch, for inking
b. One smaller brush, size $\frac{7}{8}$ or $\frac{5}{8}$ inch, for hopping
c. One plate glass, $\frac{1}{4}$ inch thick, of a size about 4 inches greater than length and width of largest print to be made. This is the inking support
d. One small, stiff putty knife with blade about 3 inches long
e. One piece of glass about 5 x 7 for use as an ink palette
f. A quantity of bromoil ink and ink-reducing medium
g. A supply of naptha or carbon tetrachloride for cleaning brushes, etc.

There are two varieties of bromoil brushes in general use, the bristle and fitch. Made especially for the process, they are round in shape with dome formation on an angle as the working face. This shape is referred to as "stag foot" and establishes the proper angle of contact with the print when inking is accomplished.

The bristle brush tends toward a coarse, grainy effect while the fitch produces an even application of ink, softer tones, and better control. Each style has its own devotees. Good brushes are fairly expensive but if well cared for they will last indefinitely.

Bromoil brushes and ink are obtainable from Photo Utilities, Inc., 10 West 33rd Street, or George Murphy, Inc., 57 East 9th Street, both of New York City, and C. H. Partington, 2780 Highland Ave., Norwood, Cincinnati. In addition, other supplies are also available. The balance of equipment, other than the real specialties of brushes and ink, can be obtained locally as

it is general merchandise not confined to the bromoil process.

MATRIX

The original print, after bleaching and tanning, is known as the matrix. After processing, final washing, and drying, this matrix may be put aside until the inking operation is in order. While there have been claims that difficulties may develop if the inking is delayed for too great a period, the writer has had no such occurrence, having had no trouble with a matrix once left accidentally for twelve years.

PHENOMENON OF INKING

It is best at this stage to consider the most peculiar and interesting phase of bromoil—the phenomenon of inking (Figs. 2, 3, and 4).

Since the very beginning of bromoil it has been generally conceded that inking revolves around the fact that oil and water do not mix. The gelatin of the bromoil base is soft in the highlights, but hard in the shadows which were tanned and toughened in processing. When the paper is soaked in water, the soft gelatin of the highlights will naturally absorb more water than the hard shadow portions. A greasy or oily ink, brought in contact with the surface of the matrix would be rejected by the wet surface of the highlights and accepted by the dry portions representing the shadows.

While there is real foundation for the above supposition, the writer felt that the shadow portions were not actually dry. Any gelatin, subject to immersion in water can be expected to absorb moisture to some degree at least. With this thought as a reason for doubt on the matter, the microscope was put to use for close examination of ink acceptance or rejection by gelatin wet or dry, tanned or not tanned.

The following experiment was made. Strips of bromide paper were prepared to represent the various steps in the process of bromoil, as follows:

a. As received. No exposure, development, fixing, or bleaching bath.
b. No exposure or development but fixed to remove silver salts and present gelatin only.
c. No exposure but developed and fixed.
d. Same as *c* but passed through the bleaching operation also.
e. Exposed in 4 sections, developed and fixed to produce full black, three-quarter, one-half, and one quarter density with a final fifth section not exposed at all.
f. Same as *e* but in addition it was made completely ready for inking by bleaching and tanning.

It will be noted that *a*, *b*, *c*, and *d*, having no exposure, would naturally result in a gelatin free of toughening even though receiving the tanning treatment.

These 4 dry strips, (*a*, *b*, *c*, and *d*) when inked gradually and examined under the microscope until they have become completely covered by the deposit, appeared as in Figure 5. The effect was that of applying tar to a stucco wall, where the highest projections scraped the material off a brush first and continued action resulted in excess flowing to the valleys of the rough surface. A cross section of the toothed surface and the result is shown by Figure 6. Keep in mind, these strips were concerned with dry gelatin only, no exposure or developing having been made until *e* and *f*.

Two other sets of strips were soaked in water. One was allowed a period for complete softening of the gelatin while the other was given half such time. With ink applied, the completely soaked strip accepted such slight particles that they were barely detectable while the strip with short soaking accepted enough ink to produce a half-tone. See Figures 7 and 8.

These experiments indicated that dry gelatin, even though smooth to the touch, really has a rough surface of minute projections. When tendered a thorough soaking in water, the projections settle down, not to an absolutely flat surface but to a condition wherein the projections have been greatly diminished. Incomplete soaking does not completely level the tooth. No one knows absolutely what causes this inking phenomenon. From the above, the conclusion could be that it is not the wet surface of the gelatin in bromoil which rejects ink but the lack of tooth that makes the matrix unable to accept it.

Continuing with the experimental strips, the dry and soaked *e* strips were inked. Needless to say, in the dry state ink was accepted.

Another set of similar strips, given complete soaking, resulted as follows:

Strip *e* with visible exposed and developed sections due to omission of tanning, accepted some ink in proportion to the density of the silver deposit. This fact indicated that while not tanned, the silver deposit in the emulsion somewhat affected the ability of the gelatin to absorb enough water to completely level the tooth surface. However, while normal application deposited some ink, generous application gave a heavier result.

With the foregoing condition realized, it can be understood that even with tanning omitted, a partial bromoil condition exists. Normal inking would produce little or no deposit but generous application would show results. No doubt the Mediobrome process originated by Leonard Missone is based on this phenomenon, as ink is applied to an unbleached print that has been tendered a thorough soaking period.

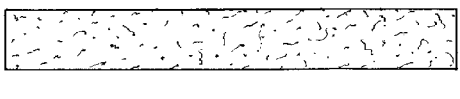
The next type of strip for an inking test was *f* with 5 ranges of density. These strips received full bromoil processing and represented the regular matrix. In the dry state, the ink, as could be expected, was accepted over the entire surface and in full density. A soaked strip resulted in an ink deposit varying from white to black in proportion to the density of the original range of exposure of the 5 areas. Figures 9 and 10 indicate the condition of the surface and cross sections.

The original theory of the phenomenon of inking (the wet surface, due to excess water in the untanned portions of a matrix, repels ink and the dry tanned sections accept it) seems to lose force in the face of the investigation described above. Actual observation while inking a toothed surface of a dry or tanned gelatin indicates that ink is literally scraped off the brush. On the other hand, the leveled surface of untanned gelatin, after soaking, has little or no tooth with which to separate the ink from the brush.

It has always been known that the platinomatte surface papers if prepared for bromoil can only be inked with difficulty. Glossy surface papers are practically impossible. In these two cases, the first surface being fairly smooth has only enough tooth to attract a little ink, while the second surface has what is almost no tooth at all.

With the foregoing ideas in mind it may be assumed that the phenomenon of inking in bromoil is concerned with preserving the tooth which attracts ink—instead of retaining water which repels it.

FIGS. 5 and 6. These show the four dry strips as they appeared when completely inked. The toothed cross section (below) indicates that ink has flowed into the "valleys" of the rough areas



FIGS. 7 and 8. These show the effect of soaking. The completely soaked strip (above) accepted such a small amount of ink that it was barely perceptible. The one given only half the soaking time (below) presented a somewhat hard gelatin which took more ink

FIGS. 9 and 10. A normal strip—with 5 ranges of density. These show the action of a typical toothed surface. The bromoil is drawn as it appeared through a microscope, from above and in cross section

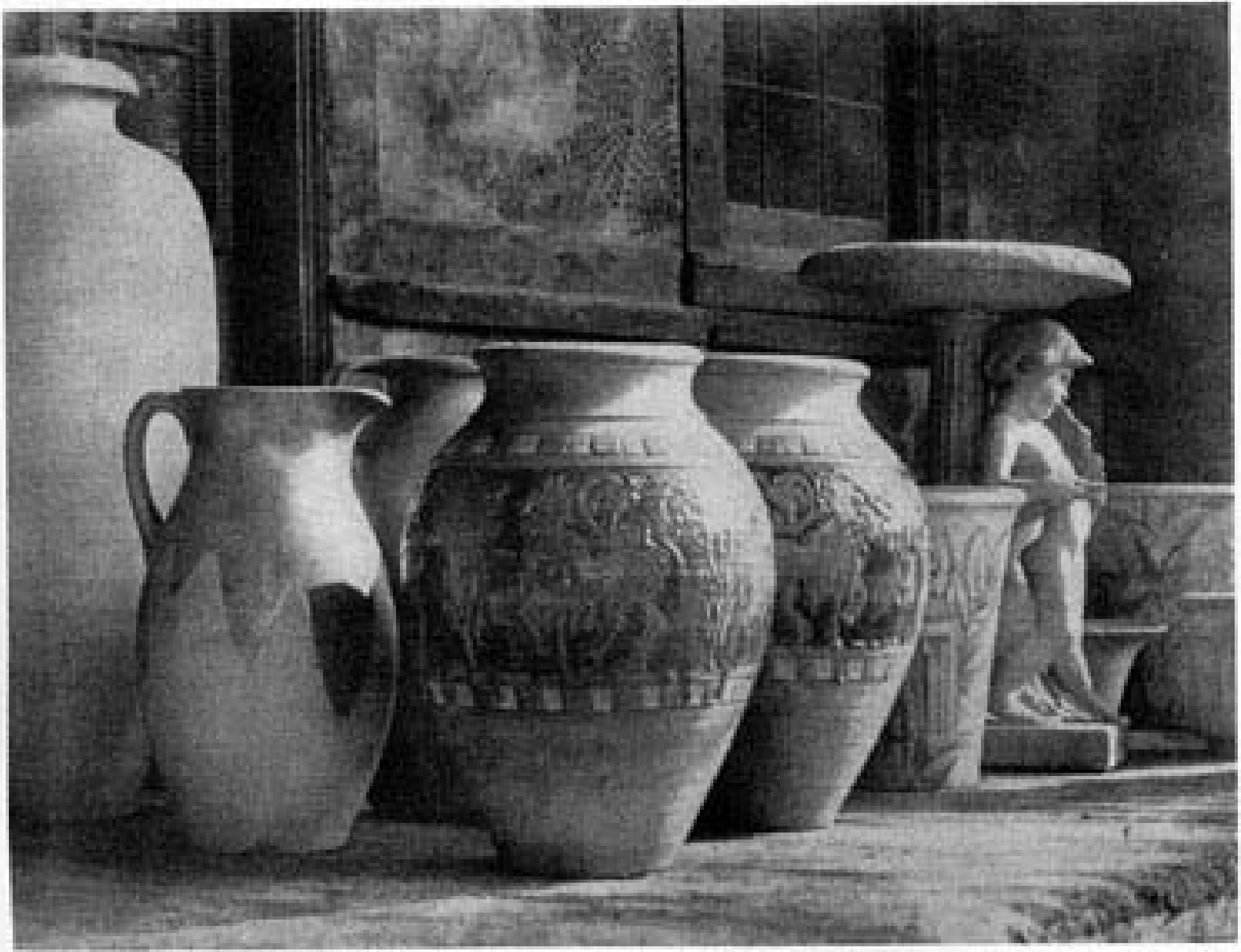


FIG. 2. FIRST INKING. With the first light coat of ink, a bromoil is apt to look washed out. An all-over image should be obtained, however, before local inking control begins, as this is a guide for the brush work

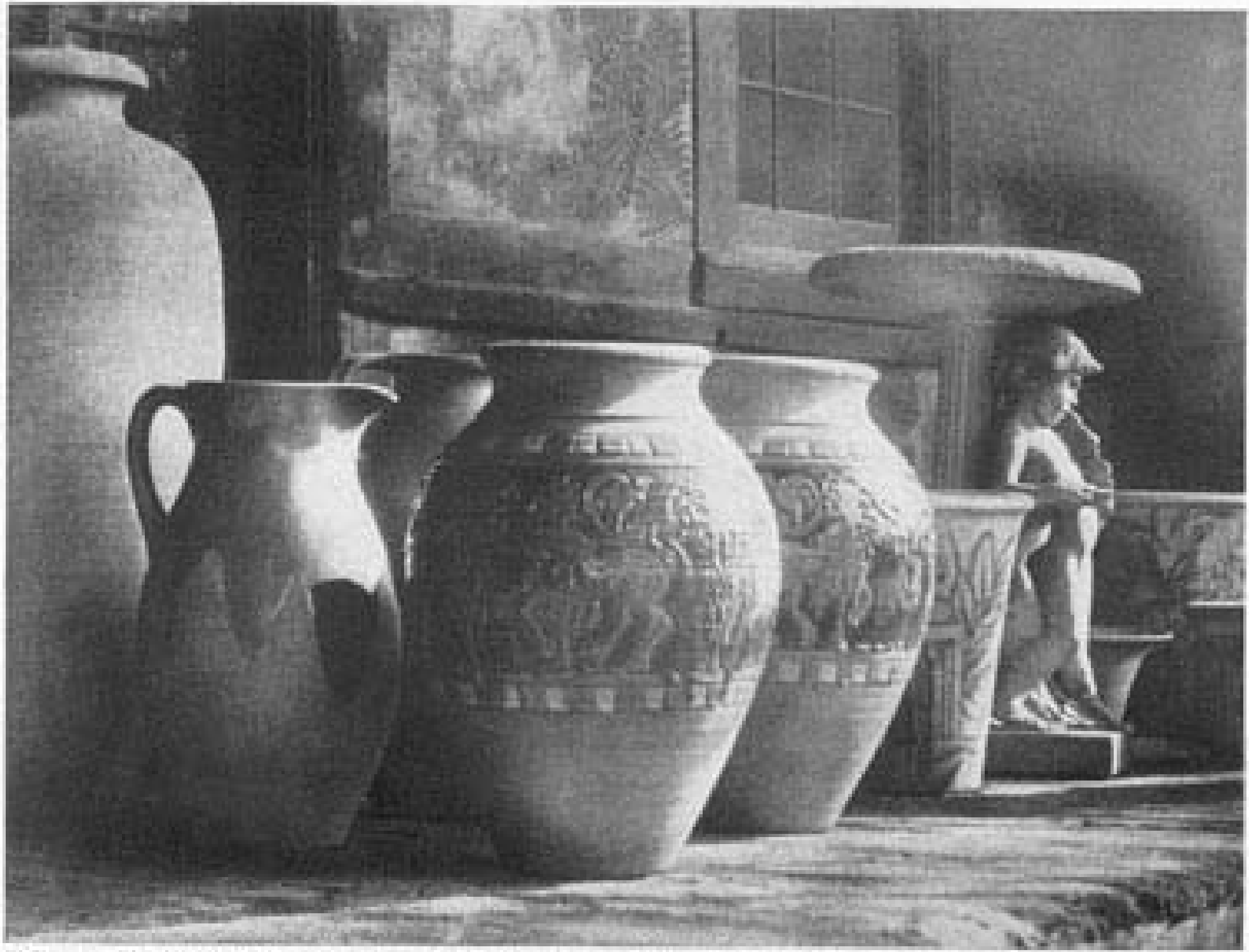


FIG. 3. HALF INKED. Portions of this have been fully inked. Work at this stage should be careful but somewhat swift—unless another soaking is anticipated

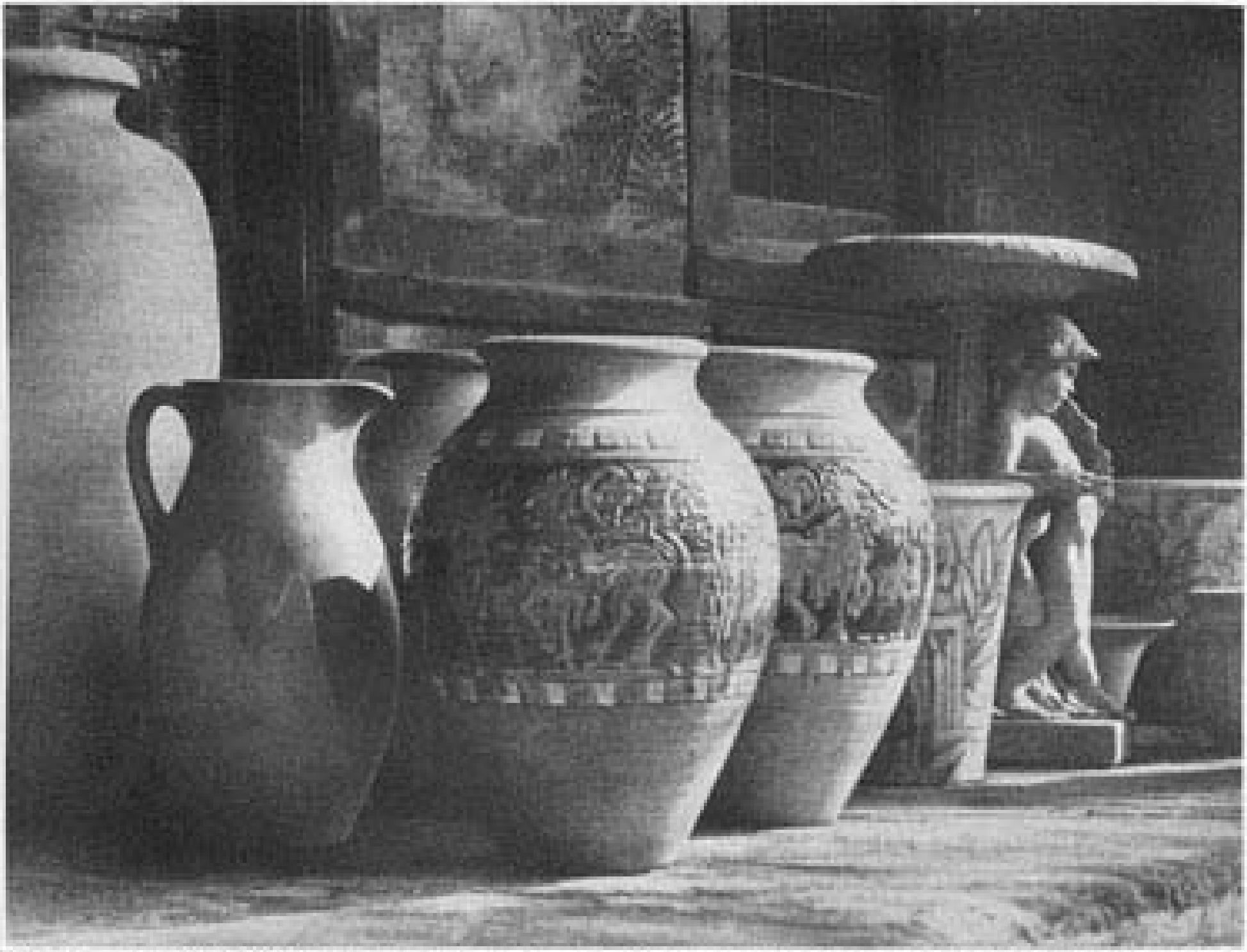


FIG. 4. FULLY INKED. The bromoil now has all of the tones and image contained in a similar bromide print. Hopping and other methods of local control have not yet been used, however

SOAKING

Soaking of the matrix as a preparation for inking is not the mere process of getting the gelatin wet. It is strictly a matter of obtaining the proper condition for producing the inking result desired.

Complete soaking can be accomplished by lengthy immersion in cold water or by a short immersion in a warm bath. The former refers to a period of from 2 to 10 hours at 60° to 75° while the latter is concerned with a period of from 15 to 45 minutes at 80° to 120°. High temperature is only necessary when the gelatin is too hard, either because it is coated or because it is not fresh. If the gelatin is really suitable for bromoil, a warm bath ranges from 85° to 95°.

Where time allows, the cold soaking is preferable. Warm water tends to weaken the gelatin thereby making it more liable to injury. The cold bath, due to long immersion, gives leveling of the tooth in the highlights and at the same time holds a better tooth in the shadows. Inking such a matrix results in cleaner highlights, richer shadows, and better sparkle throughout the entire print.

If soaking at any temperature has been too short, clean highlights will be difficult and shadows will be blocked. If soaking has been overdone, ink may be partly or wholly refused by the half-tones and even the shadows may be difficult to cover.

Soaking, when underdone, results in coarse effects. Shadows lack the real lustre so characteristic of a true bromoil. In addition it may be necessary to swab the inked surface under water to clear the general murky appearance. Resoaking one or more times before inking can be completed, may be necessary to supply moisture that should have been allowed to penetrate at the first instance of immersion.

RELIEF

It is not uncommon to encounter remarks or discussion on the importance or necessity of high relief appearing on the soaked matrix. The untanned gelatin in the highlights will swell due to softness and water-absorbing ability while the shadows remain at a lower level as they represent tanned or toughened areas which have absorbed only little water. The soaking operation develops the image in the form of relief which in many cases is easily seen.

Lack of relief is not always an indication of inking failure. If the gelatin of the original coating was too hard, little or no relief will appear and inking will be difficult or impossible. Being hard, soaking even to excess will not level the tooth and failure is evident.

Prominent relief comes with a generous coating of gelatin and in general is common to rough surface papers. A thin coating, as applied to certain surfaces, will show little or no relief. However, if the gelatin is sufficiently soft success in inking is certain to follow. It is a suitable coating and not relief that establishes the foundation of successful inking.

INK

Ink for this process somewhat resembles that used in lithography and while this product can, in some cases, be used with fair success, it is best to work with the mixture especially made for the bromoil process. Bromoil, being a process offering the greatest range of control, gains this flexible feature from several sources, among which is the ink itself. The control in such instance revolves around ink consistency.

Hard ink is best. With such an ink, clean lights, detailed half-tones, and brilliant shadows are not difficult to obtain. Hard ink results in contrast and brilliance while soft ink is concerned with a subdued but not necessarily dull rendering.

Some brands of ink, especially in black, are supplied in both the hard and soft variety. Both, however, are not necessary as hard ink can be softened by mixing with a suitable reducer. As only a very small amount of this medium produces a change, care is important when attempting a softer mixture. Diligent use of the putty knife must take place to assure an even blend.

While a proper emulsion and correct processing presents a matrix well adapted to hard ink and full tone values, likewise a soft ink has a particular use. Where the gelatin is especially soft and the power to reject ink is excessive, hard ink would be

attracted at deeper tones only. Softening of the ink will eliminate the difficulty and improvement will be noticeable at once. Other than a condition of such nature, due to an extra soft gelatin or excessive soaking, the use of a diluted ink is confined mostly to special effects.

Keep in mind that hard ink is used with a suitable emulsion and correct processing and results tend toward contrast and brilliance. Soft ink, in the main, is used with a matrix not suitable to the hard mixture and the effect tends toward softness and subdued tones.

If the original emulsion was not soft enough or if it became toughened with age, tooth in highlights and half-tones will be more prominent than with a proper coating. Also, if soaking was stinted, the same condition will prevail. In such cases, hard ink is a necessity for clear highlights.

INKING

Considering that the soaked bromoil matrix is composed of wet, soft paper and gelatin, and considering that ink is practically pressed on, the necessity of a flat, smooth foundation is obvious. Any ridges or projections beneath the matrix would be reproduced on the print. If the work table does not present a perfectly flat surface, it is necessary to employ a plate glass or metal foundation, the latter of course being of non-rusting or non-corroding material.

While it is possible to place the matrix directly on the support, the tendency to slip or drag up with the brush is sometimes a detriment. The use of a wet blotter under the matrix prevents this trouble. A well soaked blotter is placed on the support and the excess water removed by fair pressure from a hand roller.

The palette should be located close to the matrix support for convenience in charging the brush. A quantity of ink, equal to the size of a pea, is placed on the palette and spread with the putty knife to a thin layer about 2 inches in diameter. As inking progresses, the knife should be used off and on to keep the ink patch smooth.

The soaked matrix is placed on the support and most of the surplus water removed from the surface by means of a viscose sponge or a clean, soft chamois. Removal of all visible surface water remaining is accomplished by light but firm dabbing with a clean, soft cloth or handkerchief which is fairly free of lint. Be certain that all water has been removed, by glancing obliquely at the surface to catch the glint of any wet spots.

Inking is usually accomplished by using a brush made especially for the process. Formerly some work was performed with a plush roller and in late years the electric brush has been used. Such appliances are more a matter of saving time and results do not compare with hand manipulation of the typical brush. It must eventually be used anyway to clear the crude results of the other tools.

The bromoil brush hairs have tips which are natural needle points and not like the ground stubs found in paint brushes. The idea is to pick up extremely fine particles of ink and to deposit these on the matrix in the smoothest possible manner.

To charge the brush properly it is dabbed in the ink patch with about 10 to 15 rapid strokes about one-quarter inch long. It is then dabbed, in like manner, on a clean portion of the palette to remove excess ink and present an even distribution over the tips of the hairs before applying to the print.

Holding and operating the brush is difficult and important. Applying ink to the print involves a certain amount of artistry and technic, which, while being the natural talent of the few, must be developed by practice in others.

For the best results in reproducing a full scale tonal range, for a perfectly even coating of ink free of patch effect, and above all for least manual fatigue, holding the brush in suspension is highly recommended. This method is shown by Figure 11 with the brush suspended by the very end of the handle between the thumb and third finger while the index finger against the tip applies pressure.

Gripping lower, at the body of the handle, is not good form (Fig. 11). This is not only a tiresome procedure but makes it difficult to obtain the beautiful values and richness so characteristic of this process. In addition,

the life of the brush may be short due to the bending strain on the hairs. As the ink does not have to be stomped into the gelatin there is no need for harsh action.

The suspension method of brush work performs the proper action of scraping the ink off the hair and depositing it on the toothed surface of the matrix. Highlights remain clear even in the face of building up shadows within the same area of brush contact. No great pressure is necessary, therefore no breakdown in the gelatin will occur to mar the lights or produce a coarse granular effect.

Holding the charged brush as described and shown by Figure 11, apply an up and down motion at the rate of 8 or 10 strokes per second going no higher than about $\frac{1}{16}$ inch above the surface. By pressure from the index finger at end of handle, flex the tip of the brush hairs just enough to feel a cushion effect. Keep in mind that ink is to be practically pushed against the microscopic toothed surface of the matrix.

Begin at any selected point and work outward, in all directions over the balance of the print area. Remember at all times to have the brush only lightly charged and that this small quantity of ink is soon distributed; therefore frequent recharging from the palette patch is necessary.

Using only a lightly charged brush and applying the quick flexible stroke, the first contact shows only a light tone in full detail. It is an advantage to cover the entire print in this manner previous to building for depth and brilliance. By so doing, the quick, light deposit of greasy ink offers somewhat of a shield against too rapid evaporation of moisture in the matrix. This offsets the necessity of one or more resoaking periods before inking is completed. It affords the experienced worker free reign to finish a print as large as 16 x 20 without the slightest necessity of resoaking.

HOPPING

The suspended brush method of inking, especially after practice, renders complete depth with no excess ink to be removed from the shadows. The result will be clear, but brilliance may be lacking. In such case, keeping the brush lightly charged, slow the stroke speed by half, hardly lift the hairs off the surface, but make the upward movement a sort of pull back. The slower push downward deposits a little more ink in the shadows to add richness while the pull back effect removes any slight excess deposit at half-tones and lights. Such action results in additional snap generally and is called "hopping." See Figure 11.

A patchy result, that is, variation in density throughout the print is the cause of much woe to some workers. Such a result is due either to not keeping the brush lightly and evenly charged, to working longer in one spot than another, or to a brushing rate too rapid for the amount of ink applied.

Provided the original print, previous to bleaching, was of full tonal range, hopping to improve any areas is unnecessary. Where there is need for such procedure due to blocked areas locally or overdone inking generally, proceed as follows to lighten the heavy deposit:

Where no drastic action is required, the inking brush itself can be used. Considering it to be one of the preferred larger sizes, it is held in suspension the same as for inking except that the thumb and index finger only are used with pressure omitted. Figure 11 shows this idea. The action concerns a stroke with the same speed as inking but using about ½ inch of lift. The brush, lightly suspended between two fingers, then performs a light pounding effect.

Where excessive hopping is necessary a clean brush should be used. For local reduction use a smaller brush. The light brush is held between thumb and forefinger about 2 or 3 inches above the hair and, from 1 inch away, is thrown against the surface and caught on the rebound. The stroke may be slow or fast as required.

RESOAKING

Many workers resort to resoaking one or more times before a print is completed. If such procedure is necessary it is due to improper processing of the matrix, incomplete original soaking, or brush work that is too slow in producing results. If resoaking is performed, all moisture must again be blotted from the surface. Any runs in the ink which may be termed water marked, disappear with later brush action.

Another practice sometimes performed is that of swabbing. This concerns the use of cotton while the print is under water in a tray. This procedure is often mentioned as a method to brighten the print generally and clear the lights in particular. It will do just that but leave, in most cases, a crude granular effect not at all a natural texture in a good bromoil. The need for such procedure acclaims poor processing or lack of brush technic or both.

Resoaking may be all right for the beginner who, lacking experience and ability, cannot cover the print before evaporation sets in. Also, due to the lack of sufficient practice, an excess application of ink may make swabbing necessary to produce a more presentable job. Beyond these conditions, neither resoaking or swabbing should be in order.

BRUSH CARE

After completion of a work period in bromoil the palette and putty knife should be cleaned. The brushes need special attention and even the dry ones used for hopping must be cared for. The best cleansing mediums are naptha or carbon tetrachloride. Dip the brush ends in one of these liquids and wipe off against clean paper until all evidence of ink is cleared. Set brushes aside to dry after which they should be kept under cover to avoid accumulation of dust.

Brushes cleaned with naptha will be thoroughly dry within 24 hours. Using carbon tetrachloride requires only 1 hour or less for the same result. If brushes are again used before complete evaporation has taken place, especially in the case of naptha, dilution of the ink will follow and the detriment of extremely soft ink can be expected.

PRECAUTIONS AND SUGGESTIONS

The worker should not use an eraser or etching knife to clear lights, large or small, *after the print is dry*. This method is crude and will appear as such. The use of an artist's paper stump, wet at the point, will clear any sharp lights *while print is wet*. For larger spots, a small tuft of wet cotton twisted on the end of a match, is quite serviceable.

If sky is blank and a suggestion of clouds is desired, use a small wad of wet cotton. Should the sky area be perfectly white thereby offering no background for clouds, darken the section just a little by applying a softer ink. Wipe in cloud forms as desired and blend the resulting bald effect with a small dry brush. Artistry and practice are again of value with such an operation.

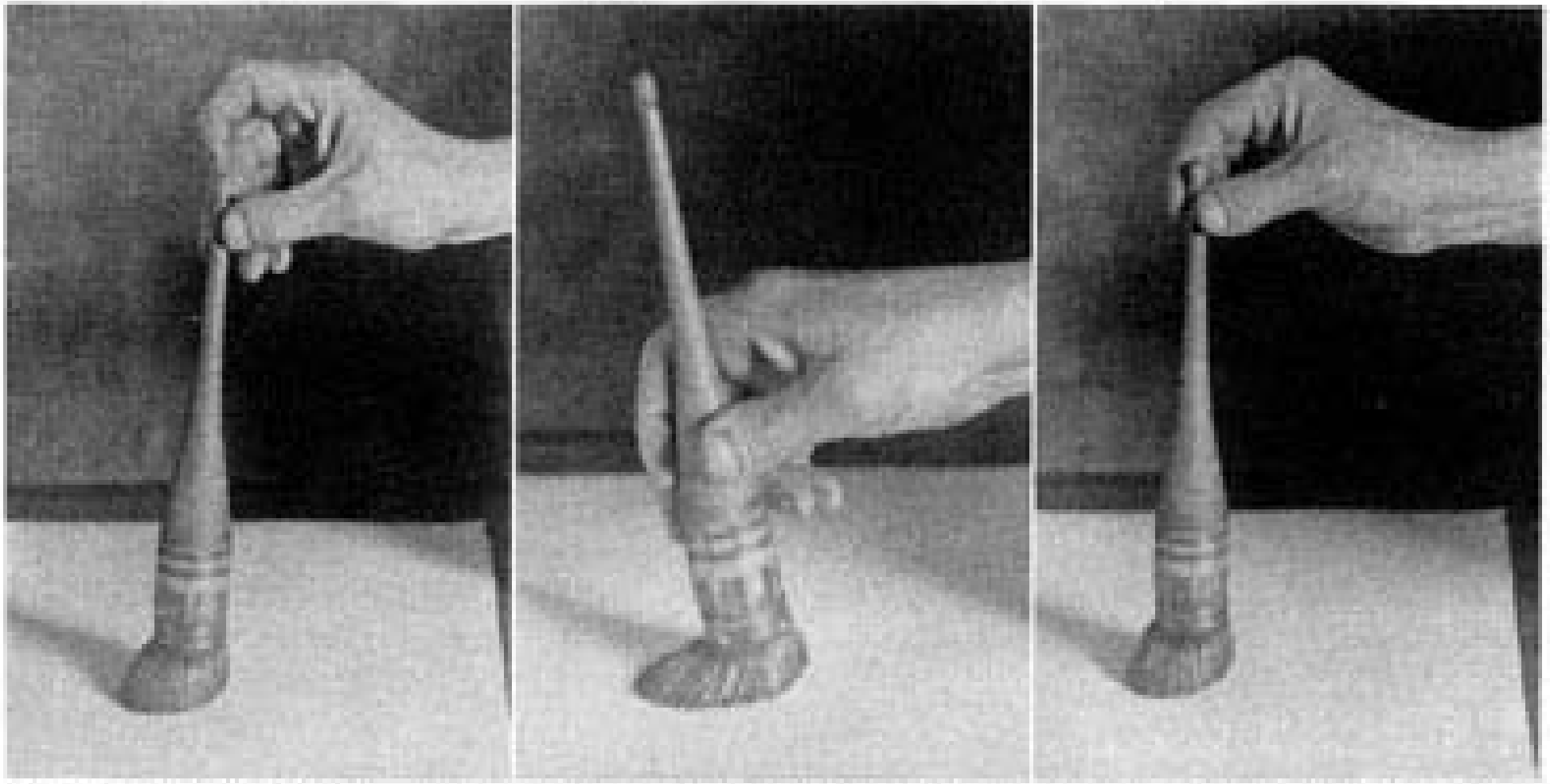


FIG. 11. BRUSHWORK. The illustration at the left demonstrates the correct handling of the brush. Notice that the index finger applies the pressure. The middle illustration shows *improper* handling, where too much pressure is applied. The right hand illustration indicates the position for *hopping*

Regardless of whether a completed print resulted from straight inking only or whether it involved the use of one or more control features, the main thing to keep in mind is *when to stop*. There are too many bromoils that fairly scream, "Overdone."

The bromoil process, depending for success not only on the action of light and chemicals but on a physical condition involved with gelatin, presents more chances for difficulties than encountered in most methods of producing prints. Provided all materials and processing are correct, excellent results will follow. Sources of failure in a number of cases are mentioned throughout this text, but a number of causes for difficulties are given here for further emphasis.

Brown spots on matrix appearing after bleaching may result from bare metal of enameled trays but more likely from dry amidol which has contacted the emulsion previous to development. Handle dry amidol with least agitation possible.

Fixing and washing must be thorough and the latter is best accomplished by soaking and draining. Allowing prints to remain in water for at least 5 minutes in each of 8 or more changes, and draining each print well before placing in another bath, guarantees better elimination of chemicals than running water which does not always reach the entire surface.

Every trace of tanning chemicals must be removed after bleaching and therefore washing at this stage is the most important of all. If these chemicals remain in the emulsion the gelatin when dry and exposed to light will show a general tanning. Even highlights would be affected and the production of a clear inked image would be difficult or impossible.

Water, according to locality, may offer trouble. Distilled water for all chemical solutions may be necessary and it is recommended *at all times for the bleacher*. Hard water will in most cases be a detriment to soaking of the matrix or may even destroy the real foundation for bromoil when used in general washing by offering a slight hardening effect to the gelatin.

Paper must not only have a coating suitable to bromoil but it must be fresh. Even though the expiration date holds leeway for making an excellent silver image, atmospheric conditions and time may produce a slight hardening so detrimental to gelatin for bromoil.

Some bleaching solutions tan only the deepest shadows and darker half-tones. It is almost impossible to gain even middle tones with hard ink and this condition can be so extreme as to require the very softest consistency to produce the lighter tones. With such soft ink, shadows will then be flat and blocked.

A bleacher that works too slowly often leaves too much of a visible image on the matrix which may penetrate the pigment and degrade the tonal quality. The bleaching formula included in this article is the selection of all that have been subject to test. It is honestly recommended as reliable.

While it may be economical to use solutions almost to a point of exhaustion, such procedure is not well adapted to producing good bromoils. Amidol developer has poor keeping qualities and should always be made up fresh. The bleacher is often mentioned as being serviceable as long as it removes the silver image. This however is not correct as bleaching may take place while the tanning effect is weak. Formulas given for developer and bleacher can be guaranteed for eight 11 x 14 prints and it is best to confine the action to this equivalent. Hypo is cheap and therefore a fresh fixing bath should always be in order.

It should be well remembered that success in bromoil requires a suitable emulsion, proper processing, thorough washing, and correct soaking. Proper processing means good chemicals and such are especially important where the bleaching and tanning solution is concerned. Use C. P. (chemically pure) salts, especially the copper sulfate and potassium bichromate, as these may otherwise contain foreign elements quite detrimental to bromoil processing. By diligent attention, the worker can produce a proper matrix and from this point a satisfactory print depends upon inking ability and technic.

BROMOIL TRANSFER: PART II

The bromoil transfer process involves transferring the pigment image of a bromoil

print onto the plain surface of any other piece of paper. A transfer results from the procedure of placing the freshly inked bromoil in contact with a sheet of suitable plain paper, applying pressure, and separating the two sheets. Ink from the bromoil is transferred to the plain paper, offering a print formed only by a deposit of pigment with no gelatin foundation. A bromide print intended for transfer should be reversed when the enlargement is made, as the final image is the opposite of the original.

Some workers produce transfers exclusively and it will therefore be well to compare the quality with bromoils.

Bromoil, at all times, produces more depth and brilliance than was rendered by the original bromide image. The pigment being located upon the surface of the gelatin and, even when dry, retaining a sheen from the grease vehicle, results in an effect more luminous than the silver imbedded in the emulsion.

The transfer, on the other hand, presents a rich, dull, velvety effect entirely different from the bromoil, yet beautiful in its own way. The bromoil transfer has the advantage over straight bromoil that more control is possible. Also, when the image has been transferred from the matrix, it can be re-inked and the transfer process can be repeated many times. At times, certain picture subjects will satisfy in bromoil but not as a transfer. Likewise, the reverse is true. It remains for individual taste to establish which form of an ink picture is desired.

EQUIPMENT

There are many kinds and grades of paper suitable for the transfer. For monotone work, a French paper known as "Ingres" renders excellent results. This is available in white and numerous shades. For full color work from three-color separation negatives, a stock known as "Aquarelle" is quite satisfactory.

These papers, as well as many others may be obtained from The Morilla Company, Inc. located at 34-36 Cooper Square, New York, N. Y. Sample books of various papers can be had from which to make a suitable selection.

The production of a transfer involves pressure applied in some form and is best when supplied by a suitable press. At times, nice work has resulted from pressure obtained with the common laundry wringer but an appliance made especially for bromoil transfer renders the best deposit and offers the most convenience in operation. There are two distinct forms of presses manufactured for the purpose. One is the two-roller type, similar to the wringer idea, where the work is pulled through by friction. A crank is applied to one roll while pressure, more or less, is obtained by screws which vary the distance between rolls.

The other type of press is concerned with a single roll operated by crank through reduction gearing. This allows a slow and smooth action. The roll, having a gear at one end meshing with teeth in a rack applied to a traveling table, propels the latter. The print pack placed on the table is not subject to a friction drag but merely rides under the roll and receives pressure as it passes. The position of roll and table being fixed, the need of adjusting screws is eliminated. Pressure, more or less as needed, is secured by the mere addition or subtraction of one or more sheets of paper to the print pack. With the thickness once established, the same pressure is assured at all times. The single-roll traveling table press is known by the trade name *Transit*.

THE SINGLE TRANSFER

In making a transfer, the difficulty of adhesion resulting in damage to the matrix, has often been a problem. To offset this trouble, various workers have resorted to spraying the transfer sheet with turpentine, coating with a weak starch solution, etc. However, none of these ideas insure a cure for the difficulty as well as the simple procedure of dampening the sheet with water.

The lengthy procedure of soaking and then placing the sheet between blotters under pressure previous to use is not at all necessary. Soak transfer paper in a tray while inking the bromoil. When it is ready, place it on a clean blotter and remove surface water with a viscose sponge. It need not be mopped as dry as the matrix previous to inking.

It has been determined, by continual practice, that when transfer is intended, the matrix should be soaked in warm water as it renders the gelatin softer and more pliable. Starting with an initial warmth of practically 95° and allowing soaking to continue

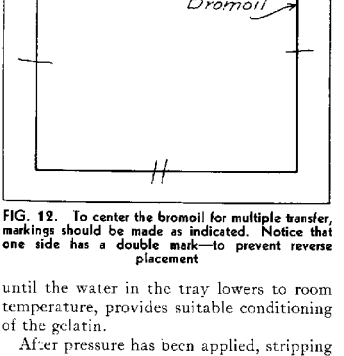


FIG. 12. To center the bromoil for multiple transfer, markings should be made as indicated. Notice that one side has a double mark—to prevent reverse placement

until the water in the tray lowers to room temperature, provides suitable conditioning of the gelatin.

After pressure has been applied, stripping of the bromoil should occasion just enough adhesion to require a firm and steady pull which emits a slight hissing sound as separation of the sheets takes place. This light adhesion is practically a necessity in proper transfer of the ink. Where little or no adhesion exists and the bromoil can be lifted instead of stripped the transfer will be weak in volume of ink deposit and poor in tonal range.

The print pack, mentioned previously, varies in make-up for the two types of presses. With either machine, the main section of the pack includes two blotters, the bromoil print, and the transfer sheet. With one blotter beneath the transfer sheet, place the bromoil face down on the latter and cover with the second blotter. Excess moisture driven out by pressure is taken up by the blotters.

When the double-roll press is used, the four sheets arranged as above are placed between two thin sheets of metal when passed through the rolls. The single-roll traveling table press guarantees greater resiliency as the space for passage of the pack is about $\frac{1}{4}$ inch. This excess over the four sheet combination is cared for by sufficient additional blotters or cardboard.

The amount of pressure required is difficult to state as there is no means of establishing or checking a definite force. A crushing effect, sufficient to curl up the blotters is not at all necessary. A few trials will establish this feature of proper pressure.

Full pressure at one pass of the pack will, in most cases, result in a bulge or wrinkle in the matrix at the end of travel. A blurred image may also be produced. Pressure should be light at the start and increased a little for each of four or five successive passages. This establishes gradual adhesion and allows for stretch of the matrix. The screws on the two-roll press supply the variation between passes while the single-roll machine simply requires another sheet of thin paper such as newsprint, for each increase in pressure.

Where the transfer is to be obtained from a single impression, results can be improved somewhat after full pressure has been applied by lifting the matrix first on one end and then on the other, doing this in sections to avoid slippage and consequently a double image. Exposing to the air in this manner for a few seconds and then again applying full pressure produces a slightly richer transfer of the ink.

A single transfer from a matrix first worked with hard ink and then followed by a light application of the softer consistency, will also produce a better quality.

MULTIPLE TRANSFER

No matter how nice a single transfer may be, the multiple print resulting from two or more impressions, each from a newly coated matrix, will render a quality not obtainable by any other method. However, much depends on reliable registration of the several impressions and the most simple and accurate procedure is outlined as follows:

After pressure has been applied and *previous to stripping the matrix from the transfer sheet*, apply a pencil mark to each of the four sides, approximately in the center. These marks need not be ruled, simply free-

hand strokes beginning about $\frac{1}{4}$ inch inward from the edge of the matrix and extending out over the transfer sheet. Matching these four freehand marks at each successive impression establishes correct registration at all times. Two marks on one side prevents possible reverse placement after first impression (Fig. 12).

Multiple transfer offers additional control in the form of one impression of hard ink and the other of soft ink. Certain areas may be transferred on first impression and inking omitted at this point for the second pass. Certain dark areas may be inked, and transferred more often than the balance of the print.

"PO-NEG" TRANSFER

An idea of a new and odd, yet pleasing presentation in a transfer, was gained while viewing an exhibition of drawings in an art school. Charcoal drawings on dark toned paper with highlights in white chalk seemed worth a trial in bromoil transfer. Dark-toned paper for such a transfer is available in the "Ingres" stock mentioned previously. Green, gray, and tan are suggested as offering nice effects.

The name of "Po-Neg," given to this form of transfer, is based on the fact that to produce this effect a positive and negative matrix are used. A positive transparency is first needed and, from that, a negative print on bromide is made. This negative print, representing an image of the highlights and lighter tones, is *inked in white*. Due to the necessity of obtaining a good body of white to cover the dark toned paper, from two to five impressions are required.

The white image is transferred first and must be thoroughly dry before the transfer receives the impressions of black ink. The black may require only one impression, or at the most, two coats.

Registration of the two images must be established by the original negative onto which marks made by a soft pencil or pen and ink are applied. These marks will show on the positive transparency and appear eventually on all prints. *Previous to bleaching*, using a ruler to contract a pair of marks on opposite sides of the prints, extend a pencil line across the white border used as a safe edge. See Figure 13. With prints face down on a printing light or other source of illumination, retrace the marks to appear on rear of sheets.

When the first white impression is made, and *before stripping*, extend the marks, using a ruler across each pair, out over the transfer sheet. These marks on the transfer are then matched for all following impressions.

The Po-Neg transfer has no value unless the dark toned paper is visible as a foundation. The effect is that of a charcoal-chalk sketch. Such an effect is provided in a portrait, for instance, by inking head and bust only, the latter being blended off toward the bottom. Any ink beyond the subject is wiped away on the bromoil with wet cotton to outline the area desired. As white ink on white paper is almost invisible it is best to apply a soft pencil to the rear of the positive print, using transmitted light from a printing box, and outline the image desired. Place the negative print in register with the positive and trace the lines so that both coincide. After inking either print, place face upward over the light and wipe off the ink to match the pencil outline on the rear.

The effect of a sketch can be enhanced by a little foreign touch produced by hand

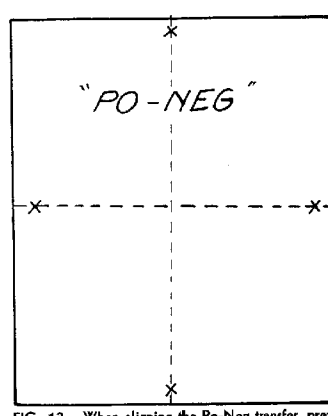


FIG. 13. When aligning the Po-Neg transfer, previous to bleaching, marks such as these are made on the prints. Explained in the text

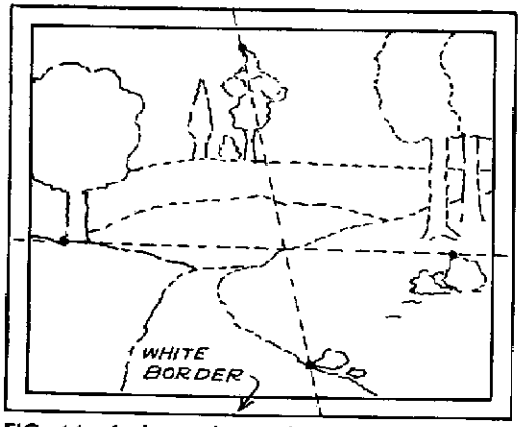


FIG. 14. In three-color transfer work, two portions of the image common to all three colors must be used for alignment. This method is explained in the text

strokes with a small water color brush charged with ink diluted with naptha. A few sketchy strokes around the edge of the image will transfer perfectly.

Such a print with a base of dark toned paper, a black positive image, and applied highlights in white is quite effective and well worth the effort involved. Using pale rose paper and red ink for the positive impression or a light blue-gray paper and blue ink offers interesting combinations in addition to the regulation black image.

THREE-COLOR TRANSFER

With the several processes involved to produce full color prints on paper, little or nothing is said in favor of bromoil transfer. Yet the effort concerned is no greater nor more difficult than necessary with other methods.

Generally speaking, the main features are the same as those of a good transfer in monotone. Beyond this, the only additional instructions apply to registration and certain control. It is taken for granted that a set of three-color separation negatives are at hand, but if not, their method of production can be found by seeing the article on *Color Photography: Making Separation Negatives.*

Registration must be effected with the set of three prints *previous to bleaching* and centers around the selection of small details in the subject matter which appear on *all three prints.* Due to color separation, a selected point on one print may not appear on the other two images.

Previous to bleaching locate a commonly visible detail at top and bottom of each print and as near as possible to the safe edge border. Using a ruler or straight edge placed accurately along the two selected spots, project lines across the white border as indicated in Figure 14. Do likewise with left and right edges and then, by transmitted light, as mentioned with the Po-Neg work, transfer the lines to back of print. The registration points are best near the center of each side if possible but it is more important that they be nearly opposite. Registration is less troublesome if marks represent a right angle relation.

Tri-color inks are available and a transfer of any one color should be allowed a drying period of at least twenty-four hours before another is applied. Lack of drying will result in the color on the transfer being offset by the matrix of the color that follows.

Where true rendering of the original colors is desired, it remains for the experienced worker to produce such results, as much depends on the ability to apply uniform applications of each color. However, for pictorial work the concern is with a picture in colors and not merely a color photograph. Variation in color or shade is of no real consequence. The beauty and interest in most paintings centers on colors not as they actually appeared, but as the artist saw or desired them.

The various points of control available in monotone work can also be applied to three-color prints. No other process of full color prints on paper offers the advantages of bromoil transfer to alter locally or even to change colors entirely. Red may be intensified when desired or blue may be reduced a little. Green may be changed in hue by applying more or less of blue or yellow.

Where drastic change is called for—as when a green house merges with the foliage in a landscape, simply omit inking this area in the blue and yellow which produce the green. When making the red impression, take the blue or yellow printer on which the house appears, ink this object in red and transfer separately.

The sequence of color impressions has been proved, by lengthy experimentation, to be of no particular consequence. The red with

its penetrating power can be applied first and thus is reduced in domination. With portraits however it is best to apply red last as it is quite a factor in rendering a satisfactory flesh color. A light impression at first is recommended and more may follow.

Much could be written on three-color transfer as the possibilities are legion. However, the least said the better as practice in producing such prints will reveal the wide scope of effects, control, variations, etc. available.

DIFFICULTIES AND SUGGESTIONS

When a transfer is made, the border of the bromoil may be cleaned perfectly with a wad of wet cotton. This results in clear paper around the transferred image and produces a nice effect in a cut-out mount. A small, narrow sable brush, moistened with ink diluted with naptha, used to apply a thin, frechand line around the edge of the image on the bromoil, offers a pleasing effect on the transfer.

A matrix used to produce a transfer can be inked up to remain as a bromoil if desired. Where a transfer is made at one time and another desired later, the matrix may be cleared of all ink by swabbing with cotton dipped in naptha. When dry it can be soaked again and inked as before.

The production of only one or two good prints should introduce the worker to the fascinating possibilities of this process. The production of more prints by continued practice will lead to original ideas and give the photographer the knowledge that he may now *build a picture* instead of merely *producing* one by the limited flexibility of normal photographic procedure.

BUFFERED DEVELOPERS. In order to control the alkalinity (pH) of a developer, buffering is often resorted to. With developers of the metol-hydroquinone-borax type, such as D-76, an increase in alkaline content is apt to result after mixing and this increase causes increased development speed and increased graininess. Boric acid and borax are often used as a buffer to help remedy this increase.

A typical buffered borax solution is the following D-76d:

Metol	2.0 grams
Hydroquinone	5.0 grams
Sodium sulfite	100.0 grams
Borax, granular	8.0 grams
Boric acid, crystals	8.0 grams
Water to make	1.0 liter

Actually, most developers are buffered to some degree, as many of the salts are buffering agents. Unlike replenisher, which keeps the developer up to general strength, the buffer keeps the developer at correct working strength—but does this by actually opposing one of the chemical forces within the solution.

In buffered borax developers, the borax and boric acid should always measure the same together. Then variations within that amount, changes in proportion of borax to acid, can control the amount of buffering accomplished—an increase of borax causing an increase of development rate, and an increase of acid causing a decrease of development rate.

CABINET PHOTOGRAPHS. Before America's Civil War, photographic family albums were literally cluttered with a kind of portrait known as cartes-de-visite. These were about 2¼ x 3¼ inches in size, characterised by extreme ornateness and exaggeration of pose. After the war, in the 1860's, a new size of photograph was introduced from England. This was 4 x 5½ inches in size and called the cabinet photograph.

Cabinet photographs provided greater scope for portrait photographers, who could now do better work, especially with posing and lighting. As a result of the larger negative, another element entered into portrait photography—retouching of the negative. Portraits became highly 'artistic' and the cabinet photograph extremely popular.

Cabinet photographs were produced in the following way: a glass plate was coated with albumen and then with a collodion layer. Then the silver bath was applied. The plate was developed in acetic acid and iron sulfate and fixed in potassium cyanide. Printing was done by sunlight on paper which was later fixed and sometimes toned in gold.

CALOTYPE PROCESS. In the calotype process a negative is produced on paper by