



---

Article: THE BOURGES-BRUEHL COLLECTION: Reproducing Color from Glass  
Separation Negatives

Author(s): Jim Wallace, Joe Goulait and Hugh Talman

*Topics in Photographic Preservation, Volume 4.*

Pages: 1-13

Compiler: Robin E. Siegel

© 1991, Photographic Materials Group of the American Institute for Conservation of Historic & Artistic Works. 1156 15<sup>th</sup> St. NW, Suite 320, Washington, DC 20005. (202) 452-9545, [www.aic-faic.org](http://www.aic-faic.org). Under a licensing agreement, individual authors retain copyright to their work and extend publication rights to the American Institute for Conservation.

*Topics in Photographic Preservation* is published biannually by the Photographic Materials Group (PMG) of the American Institute for Conservation of Historic & Artistic Works (AIC). A membership benefit of the Photographic Materials Group, *Topics in Photographic Preservation* is primarily comprised of papers presented at PMG meetings and is intended to inform and educate conservation-related disciplines.

Papers presented in *Topics in Photographic Preservation, Vol. 4*, have not undergone a formal process of peer review. Responsibility for the methods and materials described herein rests solely with the authors, whose articles should not be considered official statements of the PMG or the AIC. The PMG is an approved division of the AIC but does not necessarily represent the AIC policy or opinions.

---

THE BOURGES-BRUEHL COLLECTION  
Reproducing Color from  
Glass Separation Negatives

by Jim Wallace,  
Joe Goulait, and Hugh Talman  
Printing and Photographic Services  
Smithsonian Institution

Abstract

From the middle 1930's through the early 1950's, the Bourges-Bruehl studio produced more than 1,500 sets of color separation negatives of paintings, drawings, and other works of art for publication in Life magazine. Each set of these separations consists of four 8" x 10" dry gelatin glass plates, corresponding to the yellow, magenta, cyan, and black plates used in the printing process. The condition of the collection, its cataloguing and storage, and the use of the plates to recreate full-color images for research purposes is discussed.

BACKGROUND

The Bourges-Bruehl Collection contains approximately 1,500 sets of four-color separations created primarily for Life magazine from paintings and drawings. Each set comprises four black-and-white 8" x 10" dry gelatin glass-plate negatives, representing the yellow, magenta, cyan, and black components of the image. The collection dates from approximately 1936 through 1953.

The separations are the product of the Bourges-Bruehl studio. Fernand Bourges has been described as "one of the great technical photographers produced during the first half of the 20th Century."<sup>[1]</sup> As a young man he worked in New York as a photo-engraver. His brother, Albert, specialized in the photo-mechanical field, but Fernand became an innovator in technical photography. Among the earliest commercial color photographers, Bourges was making color images for advertisers in the late 1920's.

Bourges and his partner, Anton Bruehl, made color history with the May 1, 1932 issue of Vogue by publishing a color

-----

Presented: June 3, 1990, Photographic Materials Group, The American Institute for Conservation of Historic and Artistic Works 18th Annual Meeting, Richmond, Virginia.

photograph of fruit and silver, "which in composition, color values, and use of light and shadows equalled anything published before and which today ranks with the finest contemporary work."<sup>[2]</sup>

Bruehl, described as "the master of composition and stagecraft," was responsible for arranging and lighting still-life subjects. Bourges remained the technician, at one point constructing an 8" x 10" one-shot camera to expose all the separation plates simultaneously.<sup>[3]</sup>

Together they produced 195 editorial pages for the Condé Nast organization through the Depression years of 1932-34, including photographs for Vogue, Vanity Fair, and House & Garden. The cover of Color Sells, a 1935 Condé Nast publication, shows the pair shooting an illustration for a Cannon towel advertisement. During this time, their commercial accounts included most of the largest advertisers in the country.

It was the technician Bourges who also enjoyed photographing paintings for Life, probably beginning in 1936.<sup>[4]</sup> This is the work contained in the Smithsonian's Bourges-Bruehl Collection. While the vast majority of these separations were published in Life, credits are also listed for Time, Harpers, Fortune, Vanity Fair, New York World, Art Treasures, and others. Publication credits extend through 1953.

Artists represented in the collection include Van Gogh, Van Dyck, Vermeer, James Abbott McNeill Whistler, Andrew Wyeth, Edward Hopper, George Bellows, Winslow Homer, John Trumbull, John Sloan, Renoir, Rembrandt, Picasso, and others too numerous to list.

On his retirement, Bourges presented the collection to Louis Siple's American Museum of Photography in Philadelphia. Following Siple's death, the museum's entire collection was purchased by the 3M Company, which gave it to the George Eastman House International Museum of Photography in 1977.<sup>[5]</sup>

However, the Bourges four-color separation plates were the only significant component of the gift not related to the Eastman House's collections policy. Because of the subject matter, they were donated to the Smithsonian Institution's National Museum of American Art in 1981.<sup>[6]</sup>

In 1986 the collection was transferred to the Institution's Office of Printing and Photographic Services.

THE COLLECTION

The collection was in 55 cartons requiring approximately 55 cubic feet of storage. The glass plates were still in the original brown kraft jackets from the Bourges-Bruehl studio. In every case all four separation plates were in a single jacket.

Upon examination it was determined that the plates were generally in very good condition. In most cases thus far, the set of four glass plates was easily removed from the paper jacket and separated. Some minor surface dirt was found, but overall the plates were fairly clean.

Each negative in a set is usually labeled as to the color it represents: "Yellow, Red, Blue, Black". It must be remembered that these are the ink-on-paper printing colors. While "Yellow" does refer to process yellow ink, "Blue" refers to process blue ink, which is actually cyan. Similarly, "Red" refers to process red ink, which is magenta. "Black" represents the black values in the shadow areas of the image. (As the three primary printing inks do not produce a good black, this negative is used to add contrast and depth to the final reproduction.)

The labeling was usually done by writing on the glass base side of the plate. In some instances, however, the labeling was done by scratching lines on the emulsion side. In such cases, one line signifies yellow, two lines represent red (magenta), three lines blue (cyan), and four lines represent black. Sets have also been found with the plates not labeled as to color; but the color can be easily determined by examining the color patches appearing in each image.

Besides color separation patches, each plate contains both a grey scale and registration marks. The registration marks -- generally an "X" in each corner -- were photographed with the original painting or drawing and are critical in manually aligning, or registering, the image during printing.

In the initial steps of processing the collection, the glass plates are removed from their kraft jacket and placed individually in new archival paper jackets. Caption and numbering information contained on the original enclosure is photocopied onto the four new jackets. Each jacket is also labeled with the color it contains. The original labeling terminology (Yellow, Red, Blue, Black) has been used to maintain consistency with the labeling of the original plates.

The collection of glass plates was accompanied by an index card file. These were apparently created as the separations were shot and contain a variety of useful information about the images. This includes the number assigned to the image by Bourges, the artist of the original work and its title, the date the separation was taken, the location where it was taken, the publication for which it was taken, and the publication date. In many cases this information is incomplete.

The card file was used to develop a preliminary computerized catalogue of the collection by creating a simple database using Lotus 1-2-3. The information from each card was entered into the computer worksheet and then printed using 1-2-3 Report Writer. This provided two printed reports: one sorted by separation number and another by artist.

In addition, the Lotus worksheet was exported into R-Base and FoxBase database formats for future use.

This data will be augmented and annotated as the entire collection is examined, processed, and returned to full color.

#### SEPARATIONS TO FULL COLOR

Several techniques were tested to use the negatives to recreate the full-color images.

#### Lithographic Printing Proof

Since the plates were originally photographed as negatives for lithographic reproduction, the first method tested used a standard modern lithographic proofing technique. The image selected was Charles Sheeler's "City Interior" (BB #3998-2). One reason for this choice was the inclusion in the jacket of a tear sheet featuring this image from the August 8, 1938 Life magazine. It was hoped that a comparison could be made between this reproduction and the test.

To protect the four original glass plates, copies of each were made using Kodak Direct Duplicating Film 4168 and sent to Bassett Printing, Bassett Virginia. Since the negatives are continuous tone, and the process tested requires screened separations, Bassett screened each one using a standard 150-line screen. The screened film was then used to make a "match print" proof of the image. This photomechanical process involves individually exposing each screened negative onto photo-sensitive material. Powdered color dyes are then transferred and sealed

onto the material to create the image as it should appear on the press.

Viewed alone, the results seemed disappointing. The image looked flat with poor color saturation and suffered from an overall magenta cast. But compared to the tear sheet the results appeared considerably better. The Life reproduction was blocked up by excessive ink and looked quite poor. Also, the image quality had suffered because of moderate paper yellowing.

It was decided this technique was not the optimal way to process the collection. The resulting prints -- actually printing proofs -- would be screened, when continuous-tone reproductions were preferred. This was also a multi-step process requiring the services of a commercial printer. In addition to the vendor's charges for making the proofs, duplicate negatives would have to be made from each plate (too expensive and labor intensive), or the original glass plates sent to the printer (too dangerous to the collection).

#### Dye Transfer Prints

The next reproduction method tested was dye transfer printing. The test prints were made by Ctein, a dye transfer printer in Daly City, California. Ctein (also known as "Max Darkroom") is senior columnist for Darkroom Photography magazine.

Two different sets of separations were used for this test: Robert Brackman's "Angelica" (BB #4121-2); and Paul Gauguin's "Under the Pandanus" (BB #4425-7-B). Both had been taken for Life, but tear sheets were not filed with the jacket.

"Angelica" was published in the February 5, 1940 issue of Life, and "Pandanus" in the July 29, 1946 issue. Both reproductions were reviewed in bound library copies and were found to suffer from some of the same technical problems noted with "City Interior".

It became apparent that the separation plates had the capability to reproduce the image with better quality than the printing technology used at the time provided. For that reason a comparison with the original publication would not be used to judge the success of the test.

The original yellow, red, and blue plates for both images were sent to Ctein. (The black plate was not used; black is needed for ink-on-paper printing to produce maximum densities

which combinations of the three other inks cannot provide. This is not required in dye transfer.)

Ctein made test prints using both Pan Matrix and regular Matrix film. Even though the original plates were black-and-white, Pan Matrix was tested first because "the glass plates look(ed) to have a density range...just about right for printing on Pan Matrix film."<sup>[7]</sup> During his test printing Ctein found "the plates printed much more contrasty than I expected,"<sup>[8]</sup> and turned to the regular Matrix film which normally would have been used.

Regarding the Gauguin, as expected, "the color of the painting came out very different...from the reproduction in Life. Compared to the Life reproduction, the painting in the dye transfer is way too green."<sup>[9]</sup> Overall results of the Brackman test were considered superior to the Gauguin.

It was further observed that the color patches used by Bourges in these images were dirty and showed considerable wear. This makes it difficult, if not impossible, to balance the color scale and still have the paintings look right.

Ctein noted in his report comparing two prints from the Gauguin plates: "One is correctly balanced for the grey scale; the other was adjusted to produce skin tones more like what I'm familiar with in his work."<sup>[10]</sup> When the scales had been correctly printed, the painting assumed an overall greenish cast. When the painting was corrected subjectively, the grey scale shifted towards magenta.

Closer inspection indicated the grey scale had not been properly exposed in the beginning. Examining the gold frame around the painting, it is clear that the lighting was uneven: hot in the upper right, dark in the lower left. As the scales had been taped on the lower left of the frame, they were underlit and improperly exposed. This condition was not unique to the Gauguin. As more separation sets were examined, it became evident that the scales Bourges used were often worn, dirty, overlit, or dark.

One other interesting result was noted from the test. Specular highlights visible on the Brackman negatives disappeared on the dye transfer prints.

While the test clearly proved the color images could be reproduced using this technique, no subsequent dye transfers were made, primarily due to cost considerations.

### Ektachrome Transparencies

The last procedure tested, and the one which proved most effective for reproducing the collection, involved contact printing film positives from the original plates, and using those positives to make 8" x 10" E-6 transparencies.

This process involves three separate steps: the production of the film positives, the registration of the film positives, and the exposure and processing of the E-6 transparency. Only the yellow, red, and blue negatives are used. As before, black is not needed.

#### Film Positives

Testing several film types determined that Kodak Contrast Process Ortho Film produced the best results. An enlarger was used as the light source in conjunction with a photometer to standardize exposure.

Under safelight, an 80mm enlarging lens is stopped down to f/22. The enlarger and the photometer are turned on, and the probe placed in the center of the projected light field. The enlarging lens is raised until the photometer indicates a "null" reading (50% transmission).

The yellow negative was selected to determine the exposure for all three plates. It is placed over the photometer probe so the thinnest density of the negative can be read. By adjusting the aperture of the enlarging lens the photometer needle is set for a reading of 45% transmission. This will correspond to a set exposure (in this case 2.2 seconds).

Using these conditions the yellow negative is contact printed onto CPO film. The exposure remains the same for the red and blue negatives based on the assumption that all the glass plates had been exposed identically when originally taken. Apparent density differences among the plates are, therefore, the result of filtration for separation of the individual colors.

Next, the exposed film is then processed at a standardized developing time. (In this case at 80% speed, using Kodak Duraflo developer at 78°F, in a Hope 134 processor.) After processing, the film is ready for pin-registration prior to the production of the final transparency.

## Registration

The registration process insures that as the three film positives are contact printed onto E-6 film, they will align perfectly. This process uses a Kodak Registration Board and Punch and is done over a light box.

First, three pieces of cleared film (or clean-up sheets) are cut into strips approximately 8" x 3" and punched. One strip is placed on the registration pins. The film positive from the yellow negative is then placed beside it and the two are taped together.

A second punched strip is positioned over the registration pins, and the film positive from the red negative is placed beside it and over the yellow. The film positives from the yellow and red negatives are aligned perfectly using the registration marks which Bourges photographed, together with fine details (such as writing on the color patches). The film positive from the red negative is then taped to its strip and the assemblage is removed from the pins.

The film positive from the blue negative is registered to the yellow in the same way. The yellow is then removed from the pins and the red and blue are checked together to make certain they are in register. The separations are now ready for the final step: exposure onto E-6 film and processing.

In order to identify each film positive in the dark, the edge of the registration strip is cut with one, two, or three notches to indicate the color it represents.

One additional strip is also punched for pin registration. This strip will be used in holding the unexposed E-6 film in registration during the final printing process.

## Ektachrome Transparency Production

The three pin-registered film positives are used to make one 8" x 10" E-6 color transparency. This is accomplished by making three separate exposures onto a single sheet of Ektachrome Duplicating Film 6121 using properly filtered light with each film positive.

As the images are now positives, the light color complementary to the label color is used to make the exposures. This can be a point of confusion since the original Bourges labeling referred to printing ink, not photographic colors. The

following chart illustrates the path to determining the light filtration for the E-6 exposure:

<u>Bourges</u> <u>Label</u>	=	<u>Photographic</u> <u>Neg Color</u>	=	<u>Photographic</u> <u>Pos Color</u>
yellow	=	yellow	=	blue
red	=	magenta	=	green
blue	=	cyan	=	red

The following 75mm x 75mm Kodak gelatin filters are used in making the exposures:

No. 47B blue  
 No. 29 red  
 No. 61 green

Before making the actual exposures, however, the proper overall filtration and exposure settings for the E-6 emulsion being used must be determined.

This procedure is as follows (knowledge of standard color contact printing techniques is assumed):

From a starting filtration and exposure point (based on manufacturer's recommendation), one film positive is exposed onto a sheet of E-6 film with sequential exposures through the red, green, and blue filters. Exposure time and filtration are adjusted until a neutral-grey transparency results.<sup>[11]</sup> The proper exposure and filtration will be determined by trial and evaluation. In the initial tests, with a green film positive, these settings were:

140 cyan, 80 magenta, 100 yellow  
 f/5.6, 10.0 seconds

These values varied when different E-6 emulsions were used. This exposure and filtration test should be run for each emulsion batch.

Once overall filtration and exposure settings have been determined, the actual production of the E-6 transparency can proceed.

The 75mm filters are more easily handled in the dark when held in filter frames. They are also more easily identified in the dark by placing a thin strip of tape along the edge of the filter frame. The tape code should match the notches cut in the edge of the registration strips.

First, in total darkness the prepared pin-registered strip is taped to an unexposed sheet of E-6 film, and the assemblage placed on the registration pins. Next, using separate exposures and the proper filter, each film positive is individually placed in the frame and exposed.

After all three exposures have been made, the E-6 film is removed from the registration strip and processed normally.

## RESULTS

The resulting 8" x 10" transparencies were found to produce the best results in the most cost effective manner. In addition, this method allowed for in-house production of the project, eliminating the need to ship original glass plates to an outside vendor.

By trial and error, it was determined that proper color saturation in the final transparency can be controlled by the contrast of the film positives. Lower-contrast film positives produce final transparencies with a washed out appearance. Higher-contrast film positives will result in final transparencies with increased density and color saturation.

Modifications to the filtration and exposure of the final E-6 film should not be made once the settings producing neutral grey have been achieved.

Examining the final transparencies also confirmed earlier observations about the uneven lighting often used by Bourges. There is considerable variation in coverage and color temperature across many of the paintings. This may have been a result of Bourges' awareness of the limitations of four-color magazine reproduction at that time. It is possible Bourges used them only for general reference. Critical color reproduction was still not possible in mass circulation press runs. In addition, Bourges often shot on location, operating a large and bulky piece of equipment under almost certainly adverse conditions.

Also considered a potential contributing factor is the spectral response of the emulsion(s) used on the glass plates. Depending on the panchromatic response of the plates, results could be deficient in one or more of the separations.

For these reasons the grey scales and color patches, while of some use, are often misleading. Consequently, color correcting for these references alone will probably produce inferior results. Thus the development of standard exposure-and-

processing procedures for film positives and final E-6 transparencies was necessary.

Nevertheless, in general the separations produced by the Bourges-Bruehl studio can generate excellent full-color transparencies. They embody an important collection both in terms of representing what was then state-of-the-art magazine color separations, and in preserving documentation of the paintings themselves.

#### FUTURE WORK

Because only a small percentage of the collection has been processed, future work will concentrate on first re-jacketing all the remaining plates. Following that, the entire collection will be processed into color transparencies.

Upon completion, the transparencies will be used to master a video disk segment. Combined with the existing database, to be updated and corrected as processing continues, the images will then become available to researchers.

Authors

- Jim Wallace, Director/Curator, Smithsonian Office of Printing & Photographic Services (OPPS)
- Joe Goulait, Chief of the Color Branch, OPSS
- Hugh Talman, Chief of the Black & White Laboratory Branch, OPSS

Acknowledgements

The authors wish to thank Mr. Peter Krause for his support, advice, and assistance in identifying the techniques used in this project. In addition, special thanks are due to Mr. Chester Zhivanos of the OPSS Services Branch for his invaluable assistance in proofreading, editing, and correcting this work, as well as locating references in the Smithsonian Library.

NOTES

1. Siple, Louis Walton, A Half Century of Color, (Macmillan: New York, 1951).
2. Ibid.
3. Ibid.
4. The earliest reference found in Bourges' card file is 1936.
5. From notes taken by Eleanor Fink, National Museum of American Art, in 1979 based on conversations with Andrew Eskind, George Eastman House.
6. Letter from Andrew Eskind, Director Interdepartmental Services, George Eastman House, to Harry Lowe, Acting Director National Museum of American Art, October 19, 1981.
7. Personal communication, electronic mail, July 31, 1989.
8. Personal communication, electronic mail, September 13, 1989.
9. Personal communication, electronic mail, September 19, 1989.
10. Personal communication, letter, November 13, 1989.
11. Personal communication, letter, October 23, 1986.