The Bostick & Sullivan Book of Modern Carbon Printing

A contemporary approach to the classic hand made carbon print

$39.95

Dick Sullivan HonFRPS

Cover image, Dick Sullivan, “Rocks I - Spahn Ranch” Neg. 4x5, c. 1968, carbon print 2006, 16 x 20 in,

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The Bostick & Sullivan Book of Modern Carbon Printing

Being a manual of technique, with a bit of history,
irrelevant trivia, and philosophical
musings by the author.

Dick Sullivan HonFRPS

The Bostick & Sullivan Press
Santa Fe, New Mexico
www.bostick-sullivan.com
www.carbonprinting.com

Dedicated to:

Melody Bostick, who has been my wife for 42 years.
Thank you for making my life rewarding and fun.

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Fig 1. Herbert Ponting's brown tone carbon print.
H. R. "Birdie" Bowers. 1913. Bowers died with Sir Robert Falcon Scott returning from the South Pole on the ill fated expedition. There was huge public interest in the Antarctic expeditions and many carbon prints were made and sold to the public. Some of the carbon prints are now selling in the $10,000 price range.

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Fig 2. Crowning Glory, Vaughn Hutchins, carbon print.

Foreword to this edition

From the late 19th century through the first half of the 20th century, carbon was one of the elite photographic processes. A photographic studio could order carbon tissue in dozens of colors from a number of manufacturers. This was not unusual, as one could order dozens of surfaces and varieties of photographic paper in the early part of this century, as well. A portrait in carbon would cost more than one in platinum. The increase in price was due to the fact that a carbon print was more labor intensive to make. From the post World War II period onwards, carbon printing was in decline. Dye transfer replaced the color carbro print as a printers proofing tool, and the prerequisite large negative needed for contact printing of carbon was more trouble than it was worth to the average hobbyist. Ironically commercial production of carbon heard its death knell at about the time fine art photography was beginning to grow commercially.

Not surprisingly, much of the knowledge of the process of making carbon tissue has died out. Though there is some literature on the making of the prints, there is precious little on the making of the tissue and I suspect it was more of a matter of "everyone knows that!" rather than being a closely guarded mystical secret. 19th and early 20th century instructions manuals offer some useful information but often leave much to the imagination. Detailed instructions, such as "coat and dry in the normal manner," or "clean the glass in the manner of a collodion plate, " can be exasperating. The instructions are sometimes quaint as: "Don't hang tissue to dry near the cesspit as gasses can fog the tissue." I think my all time favorite is, "Bring up the fire in the hearth before coating the paper."

Fig 3. Dogwoods, Yosemite Valley, Dick Sullivan.
Carbon print 2006, neg c. 1968, print 2006. 16 x 16 in,

Since carbon tissue ceased being commercially available in the early 1980's, there have been a few die-hard printers making their own tissue, one sheet at a time. They have preserved the art and craft of carbon printing. I am indebted to those who have helped me.

My quest to make the tissue has taken me several years of full time endeavor and along the way, I have had the privilege of meeting many truly astonishing people. In October 2001, I was able to spend time with Pierre Brochet, then in his nineties, and living in a Norman farmhouse in the Fontainebleau forest outside Paris. He is keeping the carbon flame burning by cranking out tissue on a coating machine in the basement of his barn. The ceiling there is about 5 feet 4 inches. While Pierre can comfortably walk around in the studio I had to crouch or risk a skull fracture. Pierre prints not only in carbon, but copper gravure and Daguerreotype as well. Apparently years of boiling mercury have served him well! He is a man with a big heart and he generously shared the secrets of his homemade carbon tissue-coating machine with me. Pierre is also not one to let the world pass him by. He proudly showed me his studio full of big screen Macs and Photoshop ®.

While in France, I met Camille Favre who lives in the Paris suburbs. He showed me how a man in a wheelchair can manipulate a coating machine and make tissue and then go on to make gorgeous prints. He was very inspiring to watch. He, too, shared his secrets with me. Camille's unique carbon work needs wider recognition. He makes very thick tissue and his images are transparent wobbly pieces of hard gelatin which he displays in freestanding frames. They are really carbon transparencies. Camille also donates a good deal of time teaching neighboring school children photography.

Then there was the bunch of carbon diehards gathered at the Internet Listserve carbon dis-

Fig 4. Gordon Mark, carbon print , 2006.
From an orignal in-camera 12 x 20 negative. Print was made on an experimental green tissue. There was quite a controversy at the B+S studio as to whether there was any possible use for green tissue. Gordon took up the challenge and did quite well.

cussion group at http://rmp.opusis.com/mailman/listinfo/carbon

Without this wonderful bunch, I'd have been lost to the winds. They all indulged my constant yammering and questioning about carbon printing, and were very helpful.

Sandy King is a retired professor of Spanish Language at Clemson University, who is also a passionate and highly knowledgeable carbon printer. Sandy also made a presentation on carbon at the Alternative Photographic International Symposium in Santa Fe in 2001, and more than anything else, brought the carbon curse upon me!

I also need to credit the Carbon Study Group, which grew out of an independent study class I taught the summer of 2006 at the Santa Fe Community College. The class worked out of the Bostick & Sullivan studios and has continued on as the Carbon Study Group, meeting weekly. The group varies at times but the core is Howard Efner, Carol Becvarik, Gordon Mark, Molly Bass and me. Also, Howard has been invaluable in helping me with arcane chemical issues. Howard's long experience as a chemist has proved invaluable. In early 2006, he helped me completely revise my carbon tissue formula. We think we have removed the chemical agents that cause unsensitized tissue to go bad over time if not kept frozen. The newly, formulated tissue is more flexible and behaves better in all aspects of the printing process.

Fig 5. Dayspring on High, Alexander Keighley, carbon print c. 1890.

Gordon "Hobo" Mark, photographer, artist, fine woodworker, and maker of the famous Hobo camera over the years has stood and stared at my prototype machines with me and offered invaluable engineering advice. Artists are engineers too!

The rest of the crew at Bostick & Sullivan should be thanked for their indulgence. Mark Brown who runs the shipping department literally, had to crawl under the coating machine to get to the shipping computer. My youngest son, Dana Sullivan, almost had apoplexy when I was measuring the space over his lab to see if the tissue could run up and over his platinum salts weighing table as it came off the machine. My eldest son Kevin, makes gorgeous 20 x 24 negatives on his 48 inch printer. And last but not least, thanks to my wife of 41 years, Melody Bostick, for letting me have the Bostick & Sullivan Visa Card and Home Depot credit card, and forgiving my lapses in updating the prices on the web site.

Thanks to Dan Haygood of Phoenix Arizona, who found the missing commas, periods, and words misused. It is one step closer to a professional book, because of his fine work.

And thanks to all who have helped me and are not mentioned here.

—Dick Sullivan

Background of the carbon print

Carbon tissue has not been commercially available for over a quarter of a century, and not surprisingly, many of the old time carbon printers and tissue makers are no longer alive. There were books and manuals on how to make the prints, but precious little on how to make the tissue. The old manuals describing the techniques of carbon printing from the turn of the century were designed around the tissues that were then available. Many of the techniques of carbon printing have not changed in the 150 years since its invention but there has been some significant changes as well. Sometimes things in the old manuals just do not work. Clearly they did then, but don't work now and I suspect much has to do with the purity of materials. I laugh at the description of filtering glycerin through a piece of linen to remove the clots. Today my glycerin is as clear as distilled water, however back then, it was a by-product of the soap industry. One can imagine one of our ancestors out behind the barn stirring a wood-fire-heated vat of glycerin with a wooden canoe paddle. Technology *does* change.

None of the working procedures for making carbon prints are set in stone. There is a wide-open world here for workers in carbon to perfect the process. After you have mastered making good prints with the standard procedure, experiment and play with ideas. And yes, please share them with us.

What is a carbon print?

Carbon prints are photographic images made of pigment in a gelatin binder, making them permanent. The major ingredient that makes up the dark portion of a carbon print is lamp black, sometimes called furnace black. Simply put, it is soot.

There are two major uses for lamp black today. One is in printer's inks and the other is to make tires black. You never saw a car tire fade and you'll never see a carbon print fade. Lamp black is carbon, is reasonably friendly to the environment, and permanent.

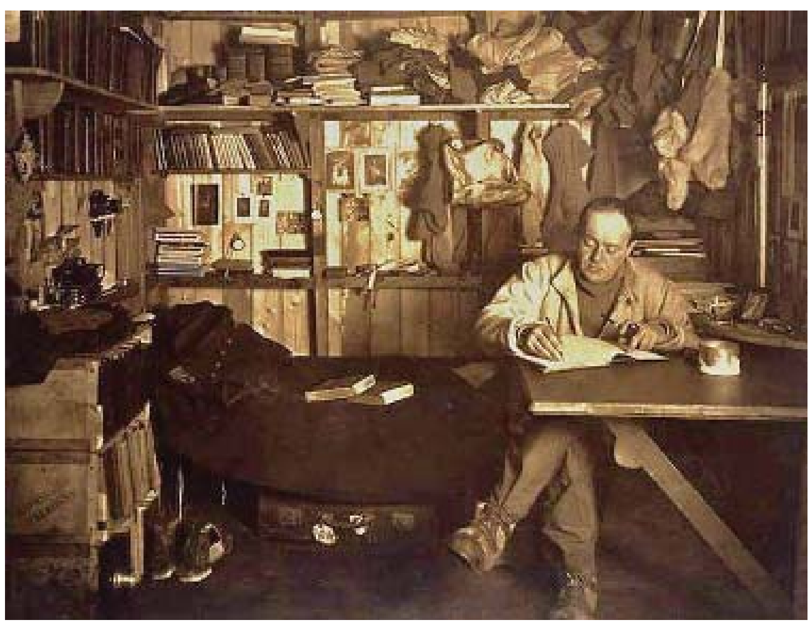


Fig 6. Herbert Ponting , Sir Robert Falcon Scott in his cabin. Taken at Antarctica. Carbon print c. 1912.

Soot, otherwise known as lamp black, is made up of extremely fine particles, much of it as fine as cigarette smoke. It is real tricky to weigh out 500 gm of the stuff without half of it taking off and floating about the lab. The packing crew at Bostick & Sullivan hates the stuff, as it always makes a mess when being weighed and bottled.

If permanence was all that there was attractive about a carbon print I doubt anyone today would be excited about making them. However, in the early days, carbon prints were revered for their permanence since most early silver processes were quite fugitive.

Carbon is unique among photographic processes in that it achieves its variation of color density by varying the thickness of the image layer. Darker portions of the image are thicker while lighter portions are thinner. Most other photographic processes achieve the variation from light to dark in the image by either placing dots closer together or further apart. The only other process that I am aware of that works like carbon is the Woodbury process, which was only used for a very brief period of time and is closely related to the carbon print.

Fig 7. Major General Edward McLaughlin. Carbon print

c. 1890. The author thanks his great grandon Harry McLaughlin for sharing this wonderful 4 x 5 inch carbon print. The image is pristine after over 100 years. He looks right out of a Rudyard Kipling novel.

Besides the extreme permanence, one of the attractions of the carbon print is that there are a myriad of ways to make them. Carbon prints can achieve an almost infinite variety of appearances due to the colors, the surfaces they are mounted on, and image textures. A matte surfaced carbon print is virtually indistinguishable from platinum prints when the color is matched. I suspect many carbons today are masquerading in collections as platinum prints or some other process. The Autotype Company., who manufactured carbon tissue at the turn of the century, made a tissue specifically colored to mimic a platinum print.

Sandy King, who has been active in the carbon print revival movement, has done some sensitometry on the carbon print and says it has a true straight-line response, unlike most other photo processes. Thus, in a carbon print you get great blacks, highlight separation, and the great delicacy of mid-tones.

Carbon can also be processed to show a relief. With a print on a high gloss surface, the highlight values will shine and reflect light, while the deep shadows will be matte black. This is a dead giveaway that the print is carbon.

Fig 8. The author's first successful attempt at putting a carbon print on opal glass.

Image is a night picture of the Blue Swallow motel in Tucumcari, New Mexico. Negative 2000. Print 2002.

Carbon is also one of the few permanent high detail photographic processes that can be made in virtually any color. Carbon prints can be made on a multitude of surfaces, such as canvas, plastic, paper, and just about anything gelatin will stick too.

One can produce stunning luminous images by putting carbon images on white opal glass. Opal glass is highly luminous and transmits 85% of the light striking it. It is made by flashing a thin 1 millimeter coating of white glass flashed on to a water clear glass base. Some glass is sold in the stained glass industry as "opal" glass, but it is just an opaque colored glass. Bostick & Sullivan has tracked down the last remaining maker of flashed white opal glass, and now imports it for sale. Opal glass windowpane pictures were popular in the 19th century. Carbon prints can be put on canvas and hand colored for interesting effects. A.M. Marton, in his classic work on the carbon process, mentions this as a good method for portraits. Carbon is probably the most flexible of all the alternative photographic processes, allowing the practitioner an almost infinite array of possibilities.

An apprentice woodworker learning to cut dovetails with a chisel will surely not do it perfectly the first time. Unless you are destined for photographic sainthood, you too will probably fail more than once in learning to make carbon prints.

There is a common misunderstanding that carbon printing is hard to master. Carbon is relatively easy; however it is not a quick fix for your photo habit. If you are looking to push a button and hear the swish of your ink jet printer spit out a great print, forget it, carbon is not your thing. Like baking bread, it's a busy process and it can take some time, but overall it is a reasonable and rational process. Once you learn the craft you can repeat prints exactly. They can be stunningly beautiful and if properly cared for, they will surely outlast their maker.

Though not difficult, carbon printing offers a wider world of options than most photographic processes and thus provides many avenues for exploration. I myself have only barely opened the doors to what carbon can provide. Some of the extensions of the process that I will mention in the following text I have only heard or read about, and have not mastered myself. Others working in the proceess may find them avenues to explore. The tiny community of carbon printers today is a sharing group, always willing to pass on tips and new discoveries. Most everyone I know respects the myriad of ways that good carbon prints can be made, and conversely, the infinite ways things can go wrong.

Undoubtedly, as carbon becomes a more common process, the "Holy Grail" pretenders will arise. These will be the folks who have figured out one way that works for them, and strike out on a quest to prove "their way" is the only way to make a good carbon print. Ignore them, smile, and nod graciously, as they will be beyond reason and discussion. As you progress in your print making craft, you will find ways to make your prints unique.

What is not a carbon print

Today you may hear people who are apparently totally ignorant of the history of photography referring to digital prints as "carbon prints." These are not real carbon prints, but rather mechanical prints, made from inks that are carbon based, and printed out of an ink jet printer. Sometimes these same ink jet prints are referred to as "pigment prints," which historically, especially in Eastern Europe, was the preferred name for carbon prints. The great Czech photographer Josef Sudek called his carbon prints "pigmente" prints. There is currently a very annoying trend, annoying at least, to the photographically literate, of renaming ink jet prints. People are using terms like giclee, pieziography, Cone, pigment, carbon, and so on to describe ink jet prints, and are also appropriating two names that have a long and revered history: "pigment" and "carbon."

Introducing the carbon print

The tissue

Carbon tissue was made in the past by coating a uniform layer of gelatin and pigment on rolls of paper. Bostick & Sullivan uses resin-coated paper or a polypropylene support for the tissue. These have advantages over regular paper in that they do not absorb water, sensitized tissue can dry faster, and they are dimensionally stable. The coating may contain other ingredients besides gelatin such as sugar, soap, wetting agents and glycerin, and perhaps even an eye-of-a-newt or two. The name "carbon tissue" comes from the frequent use of lamp black as its primary pigment which is primarily carbon. The paper or plastic on which it is coated is fairly substantial and calling it "tissue ,“ can be a bit confusing as today we think of tissue as a thin soft paper. The plastic or paper backing of the "tissue," is not used in the final image and is thrown away, thus Its use is purely to support the pigmented gelatin during the process.

Sensitizing

The tissue is not sensitive to light until it is soaked for a minute or two in a chromium-based solution and then dried.

Exposing

When the sensitized tissue is dry, it is contact exposed with a strong light in the 350-450 nanometer UV range. In the past, a carbon arc light was commonly used. Carbon arc is a light similar to the searchlights used in 1940s movie premiers. Today we can use UV fluorescents, high intensity metal halide, or mercury vapor light systems. Exposure lights that are used for platinum printing work well for carbon printing.

When the sensitized tissue is then exposed to UV light through a negative, the chromium compound is changed from a dichromate to a chromate. This change causes the gelatin to harden in linear proportion to the amount of light striking it.

The carbon "problem"

The tricky part that bedeviled the early inventors of the carbon print was the fact that after exposure, the hardened surface is on top and the soft soluble unexposed gelatin is on the bottom. The original idea was to coat the final support paper with the pigmented gelatin and then develop on the same support. If one tried to wash away the unexposed portion of the gelatin with warm water from the top down, the soft bottom layer would wash away, first taking the harder top portion of the tissue with it.

The solution to the problem

To get around this problem a method was devised whereby after exposure the tissue is briefly wetted and pressed face down on a piece of gelatinized final support. The tissue and support are allowed to sit under light pressure for a while, allowing the top surface of the wet tissue to stick to or mate to the gelatinized support paper. The sandwich of the tissue and the support is then placed in warm water, and the plastic support (the tissue) separates from the gelatin and then is thrown away.

Later in this book you will find an annotated historical timeline of the invention of the carbon process. It is quite interesting to see the names of those involved and imagine the countless hours spent trying to solve the carbon problem. When the problem was eventually solved, I am sure it raised a chorus of ,"Why didn't I think of that?"

Developing the image

By exposing the tissue and transferring to the final support, the soft unexposed portion of the gelatin is on top where it can be washed away without taking the image portion with it. The image is developed by washing away the soft unexposed gelatin. If all goes well, an image appears, made of the remaining hardened gelatin and carbon pigment.

Different methods have evolved to soak the tissue, remove the paper, wash away the unhardened portion of the tissue, and transfer the image to a sheet of paper. Several will be described later in this text.

Fig 9. One of the author's very first carbon prints. From a darkroom enlarged negative. Original was a 2 and 1/4 negative taken around 1968. The carbon print was made in 2001.

The image is reversed

Due to the way the process is carried out, if the negative is printed in the normal manner emulsion side to the tissue the image will be reversed. In some cases, such as pictures of anonymous landscapes, this reversal would not be a concern, but in others it presents a problem. (Undoubtedly some would not approve of that kind of messing around with Mother Nature.)

Modern printers can print the negative with the emulsion side up due to the fact that modern films are very thin unlike older glass plates, and thus there is only a very slight degradation of the image. Another option is to use a double transfer method where the image is transferred one more time, thus bringing the image back into the correct orientation. This is described later in the text

The image

When the process is complete, the resulting image is composed of gelatin and pigment and is quite permanent. Copies have survived for nearly a century and a half and are still in pristine condition with absolutely no fading observed.

One can make carbon prints in a range of colors that is virtually unlimited, and when using color separation negatives and process color tissues, stunning full color images can be made.

Why make carbon prints?

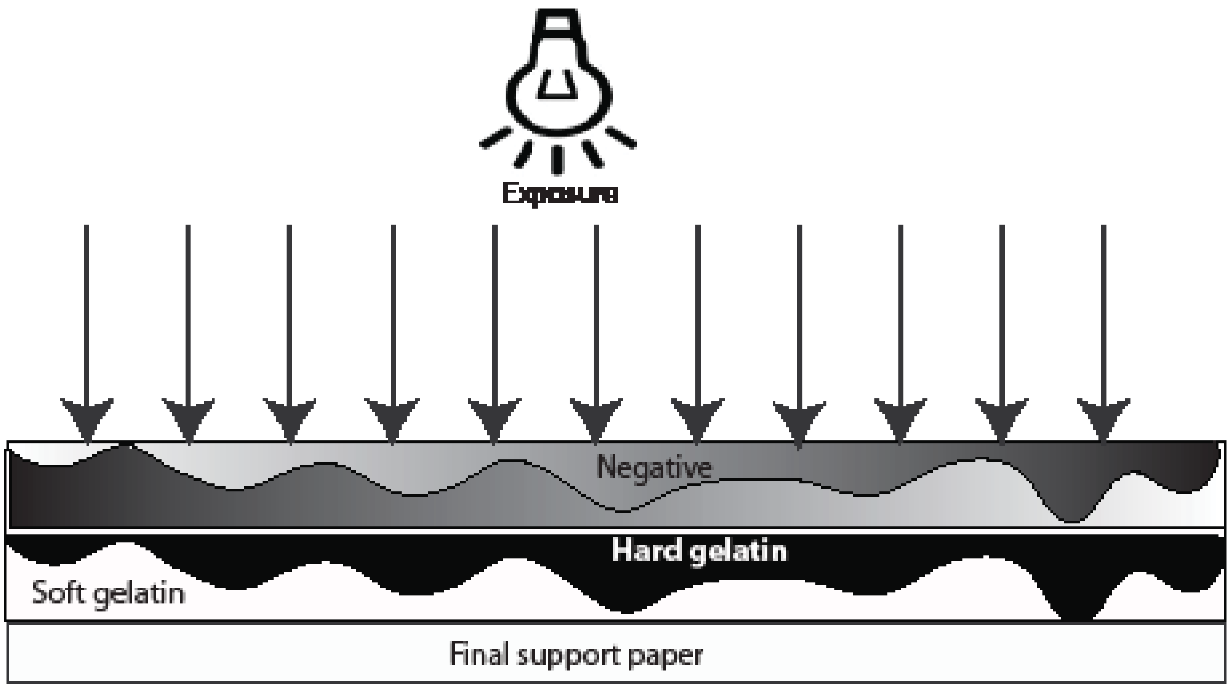
After reading the above description, a reasonable person might wonder why on earth, in this day of digital photography, anyone would pursue this apparently insane endeavor of making carbon prints. Good question, but let's look at this issue a little further.

The photography critic A.D. Coleman illuminated an earlier theory proposed in the 1940's by the late New Mexico photographer Walter Chappell. Chappell proposed that photographers fall into two basic categories: print-makers and image-makers. If you choose digital ink jet prints as your medium you unquestionable fall into the image-maker category. If you choose carbon as your medium you will fall without question into the print-maker category.

Let's look at it from another angle. I believe it is a celebration of the craft. Why do the best craftsman furniture makers cut dovetails by hand and prefer handtools over machines? Why are the best Isle of Aran sweaters handknitted? How much handicraft goes into making a Steinway piano? If you've read this far, you are probably one of those people who get warm fuzzy feelings when looking at a Maria Martinez, San Ildefonso pot. One can argue permanence. Yes, carbon prints are among the most permanent of photo processes. One can argue beauty and perfection. Yes, carbon prints can display depth, luminosity, surface texture, and a faithful response curve like no other process, but the ultimate appeal is the fact that they are made in a craft manner, they are handmade objects. One does not simply push a button to make one, so in a real sense they share that aspect with the Steinway, Aran sweater, or the Maria pot. A handmade object embodies part of the artist in the object.

A carbon print is an authentic handmade work of art. I cringe at the thought of anyone calling a digital print, "handmade."

First attempts were to attempt to develop directly on the pigment support



Direct printing

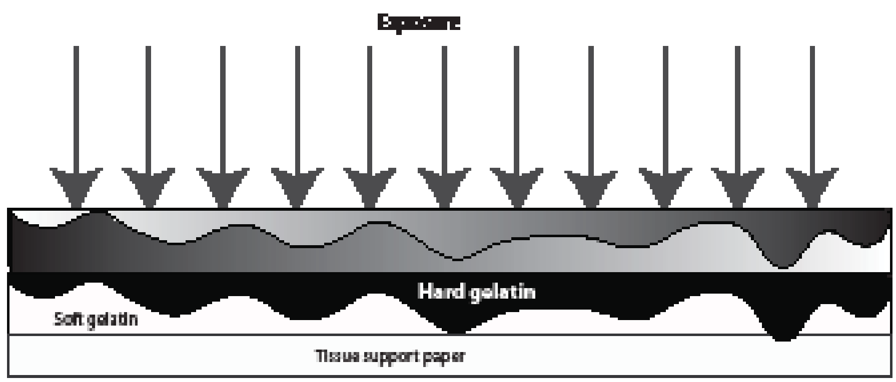
The first attempts at carbon printing tried to develop the pigmented gelatin directly on the su paper. This caused a problem due to the unhardened gelatin being underneath the ex- osed and hardened image portion of the gelatin/pigment layer.

As we can see the underlying soft gelatin washes away taking the upper image portion with it

Later methods were perfected that allowed this one step carbon printing and is called direct carbon. The Arvel process was one example of this and Arvel paper was made commercially in early part of the 20th century and enjoyed some use but was not as popular as the later indire method which is shown on the next page.

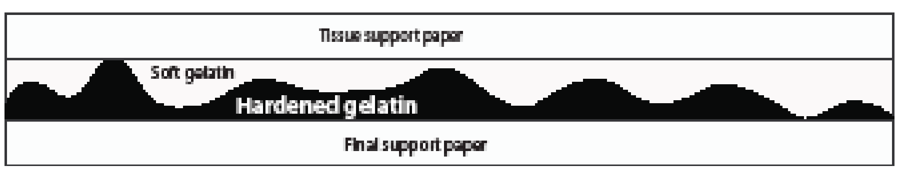
Sir Joseph Wilson Swan's Method

The tissue is exposed under a negative

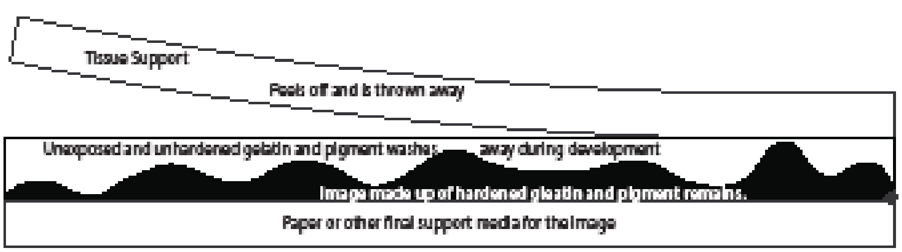


The negative is taken away after exposure

The exposed tissue is flipped over and mated to the final paper



In this manner the soft gelatin is on top and the image remains.



Comments on Supports

If properly sized or treated, carbon prints can be made on most any flat surface. Supports fall into these categories:

- Microporous ink jet papers..
- Synthetic papers and plastic.
- Fixed-out photo paper.
- Hand-sized art paper.
- Exotica – glass, canvas, etc.

Each of these supports has it advantages and disadvantages,

Microporous ink jet papers

These are the most forgiving and are highly recommended for the beginning printer. The gelatin surface hangs on for dear life. They almost never blister or shed. These papers have millions — if not billions — of invisible microscopic holes blasted in them with a laser or some other electronic means. These holes suck and hold the surface of the gelatin.

On some of these papers it is impossible to tell the printing surface from the back-side. The boxes come marked which side is correct, but if flipped when out of the box, it is hard to tell which side is the correct one. One of the dealers told me a trick, which is to touch a corner to the tip of your tongue. You can definitely feel the printing side stick to your tongue.

There are many microporous papers out there. However, the market changes fast, and papers come and go on a weekly basis, so it is a little hard to make any firm recommendations here.

It is best to beg, or borrow, a few sheets to test, before investing in a quantity of paper. Some companies offer sample packs which may be the preferred way to go. Some of the high end ink jet art papers are *not* microporous and will *not* work, so make sure your ink jet paper is microporous. There are reports that some microporous ink jet papers pucker or wrinkle on the surface during the clearing phase, so this is all the more reason to test the paper before buying in quantity.

The common papers like Epson, Canon, or Kodak sold off the shelf at your local electronics store, are not very archival,. They may, however, be good for some experimentation.

Moab papers from Legion has some nice ones that appear to work. Photo Warehouse in Oxnard Ca. also has some good ones. The choices are endless, so shop around, and seek out samples where you can. Check out www.carbonprinting.com for the latest reports on papers.

Synthetic paper or plastic.

Mr. McGuire: I just wanna say one word to you. Just one word.
Ben Braddock: Yes, sir.
Mr. McGuire: Are you listening?
Ben Braddock: Yes, I am.
Mr. McGuire: "Plastics."

Anyone over 50 surely remembers this defining scene from the film, *The Graduate*. Ben was a career-making role for Dustin Hoffman.

When I was studying photography at UCLA in the 70's, no one would dare put a print on RC paper. RC had serious problems. According to Howard Efner it had to do with the type of titanium oxide used as a whitener in the paper, and not the resin coating system itself. The problem was corrected soon, but the damage was done to its reputation.

The two contenders in the synthetic support world are Yupo and microporous Melinex. (Not all Melinex is microporous.) Melinex is an archival Mylar made by Dupont in Japan. It is used to line boxes used to store valuable prints and drawings, and other rare art work. It was the favorite of choice for prints made by the now defunct Ataraxia Company. It has a very glossy surface., which is great for showing relief, but may not suit the taste of all printers.

However polyester, (Mylar, Melinex, etc) is not the same as the 1970's RC paper, and in, fact Wilhelm Research rated Ataraxia Carbon Prints on Melinex polyester at greater than 300 years, displayed in interior lighting conditions. Wilhelm Research says tests are still ongoing, and it may eventually exceed that. We'll probably not hear more about this, as Ataraxia is out of business.

Yupo is the current star in the synthetic paper field. It was invented in Japan for outdoor signage, and was designed to take all kinds of environmental abuse. It languished for years as an industrial product, and then, suddenly, was discovered by water color painters. After a while, it made its way into the art supply stores, where it can usually be found. It is a semi-matte paper, and is not as glossy as Melinex. You may not know it is plastic just by looking at it. It is *not* microporous, and therefore, is prone to shedding or blistering if not properly processed. It has one really nice feature: if you don't like the print, you can wash it off with household bleach, and re-use it!

Yupo should be washed with some hot water and detergent before use, as it may have some

Fig 10. Dick Sullivan, carbon print, Echo Park.
Original 8x10. One of the authors early prints from lay down tissue.

release agents on it. We have found some sheets that did not hold until second usage, and so we routinely wash each sheet before use. This is maybe not necessary in all cases, but it does prevent the occasional shedding.

F ixed out photographic paper.

To fix it out, just place it in a tray of unhardened fix. Fix for five minutes, and wash. If it is foggy fix it in Farmer's Reducer. — a great way to use up any old enlarging paper lying around.

Hand sized Art

This is perhaps the most elegant way to go. However, art papers are best left to the experienced printer. These papers can introduce a lot more variables into the printing process, and until you have got your printing technique down, it is best not to add any more problems to the system than necessary.

Exotica

These are processes in and of themselves and are covered in separate sections. This area offers lots of opportunities for the printer with an experimental bent.

Setting up to make your First print

The things you will need

The section "Tools and Equipment" has a detailed list of the things you may need to acquire for making carbon prints. It's fully annotated.

The print making process in brief

There are an almost infinite number of variations to the following steps. For the beginning carbon printer, I am outlining a procedure I feel will give successful results. After you have developed the basic skills of making carbon prints, you can modify, shorten, or even eliminate some of the steps outlined below.

As you advance, you will undoubtedly work out your own personal way of making prints. Many advanced carbons printers will most likely be appalled at the busyness of the basic procedure described here. Nonetheless, it is the most reliable route to getting your first good print. As you gain experience, you can start to cut corners and speed up the process.

Some variations to the steps will be covered in later sections.

Do not use a prized original negative for your learning adventure!

Remember to check out **www..carbonprinting.com** for updates to this manual and any tips or tricks that have come to us from the carbon printing community.

Fig 11. Howard selects a digital negative made from a scan of an 8 x 10 negative.

He has put a black border around it in Photoshop®. The negative is in a 2 mil Krystal Klear envelope and it will remain in the envelope during exposure. The envelope provides nice protection for the negative and does not visibly affect the print.

The single transfer method

For your learning session it is recommended that you use the single transfer method.

Issues

- It is faster – one step to a finished print.
- If put on art paper, the paper needs to be pre-sized.
- The image is reversed if camera negatives are used. This was a problem of concern in the older days, as glass plates cannot be printed from the backside.

Preliminary steps to making carbon prints

Select a negative to print. For your first print, choose one that has a busy image. Avoid lots of smooth tones, flat skies, nudes with smooth skin tones. A nice tree-filled landscape or similar negative will hide some uneven sensitizing and development. This, of course, is for your beginning prints; as you develop the skills you'll find it trivial to sensitize smoothly. It's like the first time you learned to drive a stick shift car and you jerked yourself down the street. Later you wondered how you managed to do that!

Prepare your negative with a safe edge

The function of the safe edge is to prevent a solid black or, preferably, a mid-tone gray edge around the perimeter of the image. The margin area will often print beyond the dMax, be overly-hardened and will often shed from the support during development. When this happens it comes loose in development and forms what is called a "flag." The motion of the water during development can cause this "flagging" loose portion of the gelatin to pull off part of the adjacent image.

Any method of providing a grayed or blacked out edge to the negative will work as a safe edge.

Here are some methods for making a safe edge:

- Tape your negative into a Rubylith® mat.
- If the negative is digitally generated just put a gray margin on it.
- Use a window matt and tape this down on the outside of the print frame so it images a soft edge at the margin of the print.

Sensitizing the tissue

Inspect and cut the tissue

Inspect the tissue for any imperfections that might interfere with the print. This would include any bubbles or tiny paper clots, or damage that might have occurred to the tissue during handling.

Bostick & Sullivan carbon tissue is made on a plasticized backing. It doesn't soak up the dichromate during sensitization, so it dries fairly fast. It also tends to coil less in dry climates. The one disadvantage is that it tends to dimple or crease easily. This problem is almost always in appearance only. If you happen to accidentally crease it or cause a slight bump, do not worry. Now is a good time to mark the back of the tissue with the contrast grade you to which you intend to sensitize it to.

If you are making small prints it may be more efficient to cut a larger sheet and sensitize that and then cut it into smaller pieces.

Fig 12. Howard has inspected his tissue and is cutting it into the size..

Decide on a contrast grade

Contrast is controlled by the percentage of dichromate in the sensitizer solution. Lower percentages produce higher contrasts and slower printing speed.

Start with a 2% or 3% sensitized tissue if you are using a "platinum" style negative. Use a 1% solution if it is a silver style negative. Historic contrasty glass plates may need as much as 5% or more to compensate for their high contrast.

Contrast grades greater than 6% and less than 1/2% are possible, but are for the more advanced worker. Rarely will one need greater than 4% or 5%. Theory says you can go extremely low in percentage but print times will go way up.

Mix the sensitizer

Weigh out the amount of dichromate you will need for your selected contrast. For 1000 ml of 1% solution ,weigh out 10 gm of the potassium dichromate, then add this to 500 ml of water. Mix thoroughly until it is all dissolved. (Do not allow any crystals remaining in the solution to go into the sensitizing tray as they will cause black spots in your prints.) For a 2% solution, use 20 gm of dichromate; for a 1/2 %, use 5 gm.

After the dichromate is fully dissolved add 500 ml of isopropyl alcohol. Do not use ethyl or denatured alcohol as it creates agents that can cause fog. The temperature of the final solution should be about 55° F. Other solvents like acetone can be used but I prefer Isopropyl alcohol and you can buy it at the local drugstore. In the US it usually comes in two varieties: a 90% and a 70%. Either will do. You can make adjustments for the extra water or you can just ignore it, the extra water won't have much effect.

Brush sensitizing

Use a tray a bit larger than the tissue you have cut. Pour out some coating solution in a cup. If you have a liter of solution and you start dipping your brush in it, you will contaminate the whole liter with pigment and gelatin that the brush has picked up from the tissue.

Have a clean foam brush ready. Do not use one that has sat out in the light and has exposed dichromate in it.

Fig 13. With the print in the tray load the foam brush with sensitizer.

Fig 14. Continue loading the brush and brushing.

There is a sloppy pool of sensitizer flowing across the tissue.

Brushing the sensitizer

First, place the tissue in the bottom of a flat-bottomed tray.

Dip the foam brush into the solution or get it sloppy wet by pouring. Start brushing the tissue in the bottom of the tray. You will usually have bit of a curl at first, but it will soon relax and lay flat. Coat with enough solution that it floods the surface of the tissue and you have solution moving about over the surface of the tissue. If the tissue soaks up solution and the slight pool of solution diminishes, add more solution. Do this for 2 1/2 to 3 minutes.

Gently Squeegee the surface

At the end of the sensitizing time, lift by one corner with a gloved hand and hold it up to drain for a few seconds. Lay it face up on a piece of glass or plastic with a layer or two of newspaper under the tissue to absorb sensitizer from the back. Make sure your squeegee blade is wiped clean, and very gently squeegee the front surface. Lift the tissue by a corner and hang to dry in a room devoid of exposing light, or in a dark box made for drying.

I find that trying to squeegee the back side is risky and is not necessary.

Hang the tissue or lay on screens to dry

Use clothes pins, clips, or whatever works well for you. I find screens problematic, as they contaminate quickly.

Fig 15. The tissue is now placed on a piece of paper and very gently squeegeed.
Do not attempt to do the back side. The newspaper will absorb most of the sensitizer.

You can dry the tissue with a fan

You may aim a fan at the paper to speed drying. In damp climates, a longer drying time may be needed. A gloved hand lightly stroking across the tissue will detect sticky moist tissue. It should glide across without too much resistance.

The drying time may vary according to the humidity in the room. When dry, the tissue will have lost its stickiness.

The major point about sensitizing tissue is consistency. You will be printing, in many cases, with a tissue that is not bone dry. If the tissue is too wet you could ruin a negative, so be careful.


Fig 16. Hang the tissue in a convenient dark dust free area to dry.

Sandy King points out that tissue goes from insensitive when very wet to highly sensitive when almost dry to less sensitive when dry.

If you live in a very dry climate, the tissue may dry and coil tightly, making it difficult to place in the printing frame with a negative. If this is the case, you may need to humidify the tissue.

Sensitized tissue can be used for up to 2 days or longer if sealed and frozen. Over time it will eventually begin to fog, and may spontaneously expose, and it may not even stick to your final support.

Warning: Tissue that is too wet and not thoroughly dry may ruin your negative! Kaput! Nada! We are quite fond of Krystal Seal envelopes for protecting negatives during exposure. Bostick & Sullivan sells them.

Mark the tissue on its back with the date and percentage of sensitizer with a Sharpie pen.

Once the tissue is dry (see warning above) it is ready for exposing.

Frozen sensitized tissue appears to last for weeks if not months.

Cut the tissue

Assuming you are making 8 x 10 prints:

(If you have sensitized a larger sheet and will be making smaller prints, now is the time to cut it to size.)

Cut the sensitized tissue into pieces approximately 10 x 12 inches. For other sizes, cut at least an inch larger in all dimensions.

You should also look for any particles of pigmented gelatin that may have come loose from the edge of the tissue and have gotten stuck to the front surface. A light wiping with a clean, dry facial tissue will usually remove any stray bits that might have collected on the surface. Little black specs in your print are almost always caused by edge particles getting stuck on the surface of the tissue during sensitizing.

Minor scratches and dents, and trivial damage done to the surface of the tissue during sensitizing will not show in the final print. When wet during sensitizing the tissue will often show exaggerated surface imperfections that disappear when dry.

Exposing the tissue

Expose under a UV light source as you would any other alternative photography process contact print. For this exercise, if you are using an in-camera, negative you will expose your negative backwards from the normal way, as the print reverses itself. You may lose a slight amount of sharpness, but it is normally not noticeable. If you make digital negatives reverse them from the normal orientation and also put on your safe edge by adding black edges. With historic glass plates, printing backwards can be a problem due to their thickness. We will discuss the transfer process that avoids this in a later section.

For prints in size less than 11 x 14 inches, a split-back print frame will work. For larger prints, a vacuum frame is recommended. With care, larger prints can be made using a split back frame, The Bostick & Sullivan tissue is thin and flexible enough that you should be able to get good contact with most 11 x 14 inch and smaller prints. Large split back frames have difficulty holding the image flat.

Most of my platinum negatives, and some are dense!, print in the 4 to 8 minute range. Of course, print times will vary significantly according to the exposure unit used. You will need to experiment and make test strips to determine your printing times. If you get your digital negative making skills honed, you will find that all your prints can be done with the same percentage of sensitizer and print times.

Dichromates in a colloid photographic system, such as the carbon process, have a peculiar phenomenon called "latent" exposure. What this means is that even after the negative and tissues are removed from the light, exposure

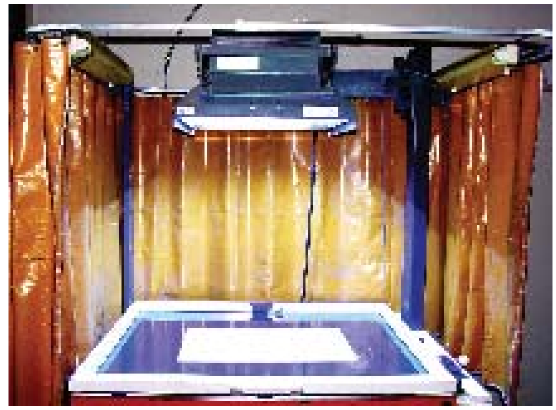


Fig 17. The dried sensitized tissue is exposed. This is done under an ultraviolet printing unit. Any unit used for alt photo UV printing will work.. B+S used a homemade one, as seen below, for years.

Fig 18. Here is a homemade exposure unit. It is made using a hydroponics metal halide grow light. See Appendix — C for more information.

continues. Therefore, it is not advisable to put an exposed piece of tissue in the dark cabinet, go to lunch, return, and then mate and develop it. You could find the tissue a 1/2 stop or more overexposed.

At this point you have sensitized, dried, and exposed a piece of carbon tissue. The preceding steps will be the same for both printing on photo paper and hand-sized art paper, and for the double transfer process.

Mate the final support to the tissue

Notes on final support papers

I highly recommend a microporous ink jet paper as a final support paper for beginning carbon printing. (See the section "Comments on Supports" on page 23) Once you have that technique down, you can advance to preparing your own art paper. You will know if it is your paper sizing technique or your printing technique if you are having problems. I know of no art paper that works off the shelf as a final support paper. The small amount of experimentation that I have done has led me to believe that art paper needs to be heavily sized to the point of being shiny. This may be objectionable to some people, and yes, there are some possible cures for this. I say "possible" since the carbon printing revival is quite new, and there are unseen territories to explore.

Fig 19 - 22. Remove the tissue and support from the mating bath.

Quickly remove them together, face-to-face and lay them on your squeegee surface and this time very firmly squeegee them together. They can now sit for at least 15 minutes and you may let them sit all day if you are batch processing your prints.

Prepare the cool mating bath

Prepare a bath for the mating step by filling a tray with cool water not over 68 ° F. For each liter of water add 10 ml of isopropyl alcohol. You may also add a drop or two per liter of Tween 20 (Polysorbate 20) or Kodak Photoflo.

Bubbles in the print can be caused by air being trapped between the tissue and the final support. This air can be as fine as a fog-like film of tiny bubbles on the tissue. There are often small pinpoint size bubbles observed on the surface of the print during development and most of the time they will disappear during drying.

Put final support in cool bath

Place the final support paper in the mating bath; wipe it with your gloved hand as an added measure to remove any bubbles that might have formed.

Dip the tissue in cool bath

Quickly dip the exposed tissue into the mating bath face up into the tray. With a gloved hand, gently and quickly see that the tissue is thoroughly wetted, wiping any bubbles away.

Pull out together face to face

Do this in 65° F. water. You will want to wait about 30 to 45 seconds, then flip the tissue over. Now pull the tissue and the support paper out face-to-face. If you are having problems with blisters or image shedding from the support, it is most likely due to the water being too warm and/or too much dip time. This is the major problem encountered by beginning printers. And yes, your dip time can be too short. If the tissue still has some curl to it after the mating dip, it may be too short of a dip. Often a sign of too short a dip time is the corners tend to lift during squeegeeing.

Squeegee together

Once on the squeegee table, squeegee the pair together to remove air and water. The first squeegeeing should be as firm as you can without sliding the tissue. Do this in both directions and then do it very firmly for a stroke or two.

Blot edges

Blot the back of the tissue with a paper towel around the margins of the final support where it meets the tissue. This wetness is said to be able to seep into the print and cause the edge of the print to pull loose during development. This I have not noticed in my work. Do not put any uneven pressure on the back of the print with your fingers if possible.

Some modern carbon workers use a piece of glass to hold the print down and then weighting the plate glass. According to A.M. Marton, this is not necessary though many contemporary workers invariably practice it. I do not do it and have not had any problems.

From the time you lift the tissue and the support paper from the mating bath until you are finished squeegeeing should take no more than 20 to 30 seconds. It sounds tricky but it is pretty natural and you should get the hang of it fairly quickly.

Wait

Now, wait at least 15 minutes for the tissue and support to mate. Water will migrate deeper into the tissue. As this happens there is a vacuum-like action which causes the gelatin to stick to the support.

If you are batch processing your prints, you may leave them sit all day if necessary.

Developing the tissue on support paper

After the mated pair of the exposed tissue and the support paper have mated for at least 15 minutes, bring water in a tray to 100° F. Very gently take the mated pair and slip them into the tray. With your gloved hands, gently push the pair down into the water.

Let it soak

Let the mated pair soak for at least 5 minutes. You may eventually see pigment begin to ooze out slightly from the edges of the tissue. This may not happen if the margins are fully exposed.

If you try to remove the tissue too soon, you will ruin the print. Patience is needed here. A little longer won't hurt. I've seen the tissue float free with no harm when I was doing something else and forgot the time.

I may be overly cautious here, as this applies mostly to my experience with gelatinized paper. Supports usually part quickly with little problems. Hand-sized paper is a more ticklish affair and

Fig 23. The tissue backing is peeled off.

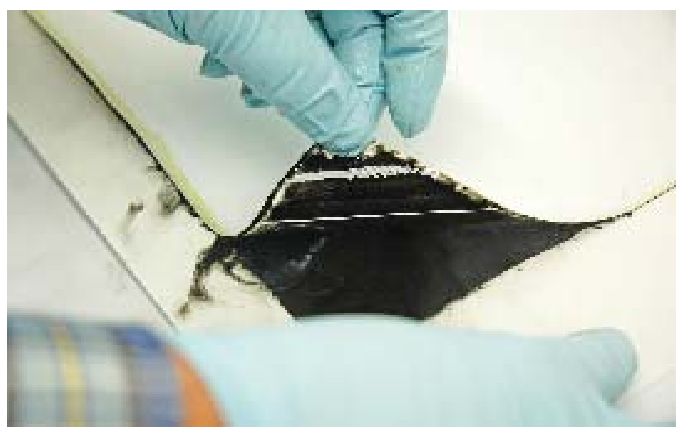


Fig 24. You can see some of the oozing on the edge of the tissue.

After soaking for 5 minutes in water at about 105 Deg F., you may peel off the tissue. What you will have at this point is not an image, but a piece of paper covered with black goo.

can present problems, so go cautious at first and then you can shorten the peel time.

Peel off the backing

After about 5 minutes, gently peel back the tissue backing of the tissue and remove it from the final support. If the tissue resists, wait longer. If it still persists, gently begin warming up the water. Do this very slowly. Patience is the guide when learning. Later you can experiment with speeding up the development process, but in the beginning, go slowly. Time is on your side during development.

Gooey mess

Once you have parted the tissue backing from the support, you will see your support paper covered with black goo. You may throw the tissue backing away now.

If you see light spots about 1/4 inch in diameter, they are your fingerprints from pressure on the back of the tissue. Don't worry; they almost always even out in the development. Sharp white spots with clean edges are an indication that the tissue tore free from the support. That's bad news.

Continue to develop the print

Continue to develop the print. You can do this by holding the corner of the print and moving it gently side to side in the water.

A.M. Marton cautions against lifting the print from the warm water and allowing it to cool as this can cause reticulation, frilling, and other evils. I've not seen this to be the case however.

Too much agitation overdevelops the highlights. Agitation can also cause the edges to tear. Many papers will float, so one good method is to lay it upside down in the tray and just let it sit and develop.

At first it may appear uneven and mottled with big light and dark patches. However, the print will gradually even out as the unexposed gelatin and pigment washes off. There will come a point where the development slows way down. Hold the print up by a corner and observe the run off. If there is more than a little tint to it, the development is not complete. Actually there always seems to be a minute trace of pigment run-off so a small amount is ok.

When the print is finished developing you can move it to a tray of cold water to set it. This will stop any further development. You can now harden and clear with formula later in the text, but most printers don't find this necessary today.

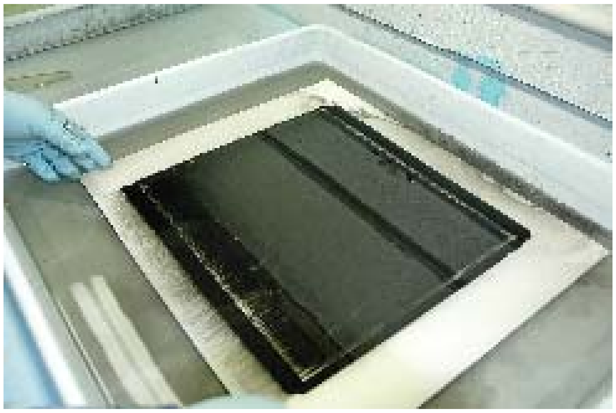


Fig 25. The warm water development begins.

It's fun to do, but it is the touchiest part of the process. At this stage pateince is on your side. Too much agitation or too high a temperature speeds up the development, but also risks blistering or shedding of the print.

Fig 26. Here the development is nearly complete.

Some pigment can still be seen bleeding off the image.

Fig 27. You may rub off any black edges that were exposed.

These are on the outside the safe edge. The image is soft at this stage but will harden as it dries.

Fig 28. A pad of YUPO as it comes from the art store.

The Double Transfer Method

Prior to this step you will have prepared your tissue, sensitized and exposed it as described in "The Single Transfer Method" above.

Mate to temporary support

In this step, instead of mating to a final support paper, you will mate and develop on a piece of plastic or vinyl. Some plastics work and some do not. It appears to have something to do with the molecular film on the surface of the plastic. Bostick & Sullivan sells a floppy vinyl material that holds the image and is consistent.

In some cases, you may want a hard piece of sheet plastic. Howard Efner has found that putting a coat of Treewax (tm) enhances the holding ability of the plastic. This is not a new technique, as waxing was invariably done in the classic period of carbon printing. Put a light coat on to the plastic and then buff it off. Buff all you can get off. Buff nice and hard. It's just the molecular film you need. Oddly enough, Johnson's Floor Wax™ does not seem to work.

Develop on temporary support

After the exposed tissue has been mated and squeegeed to the vinyl for 15 minutes it can be developed. It is a bit touchier than most supports so keep the development temperature below 105° F. and perhaps stay below 100° F. If you run into shedding problems, let the mated

Fig 29. Carbon print, Howard Efner.

This is the final image from the previous discussion. It is still wet and was photographed while it was stuck up on the backboard of the sink. The print, at this stage, is still very fragile. A mere touch with a finger can cause damage.

pair sit for a longer time, perhaps even for one hour. Also be careful not to agitate it too much during development. A white-bottomed tray is useful to judge development., since it is nearly impossible to see anything with a black tray. If your temporary support is hard plastic, we have found that letting it sit face down in the water, supported on the edges so it does not rest on the bottom, works very well for development. Just let it sit undisturbed for 10 minutes or more, and it will develop itself. This method only takes a slight bit longer ,and you don't risk the edges frilling, blistering or shedding.

When fully developed, hang to dry.

Making the Gelly Cubes.

You will be doing double transfer a bit differently from what you may have seen described in the historic literature. The Gelly Cube method is a development of the Carbon Study Group; whether it is unique or not, is not known. It seems likely someone else may have come up with it in the past. Nonetheless, it is a great time saver, since one does not have to double size art paper as a final support as described in the classic literature.

Procedure:

- Put 120 gm of hard 250 Bloom gelatin into a liter of cold water and let swell for 1/2 hour. ("Bloom" is a standard measurement of the hardness of gelatin. Lower numbers mean the gelatin is softer.)
- Melt the swollen gelatin in a crock pot or double boiler. After melting, let it sit for 1/2 hour to release the bubbles.
- Pour into plastic ice cube trays and freeze.
- After the Gelly cubes have frozen, pop them out into zip lock bags, and put back them in the freezer.

You may have to briefly set them in a tray of hot water to release them from the ice cube trays. This makes a 12% solution. You can dilute your melted gelatin to lesser percentages by adding warm water to the mix.

Transfer to final support

Soak final support paper

After cutting to size, place the final support paper in a tray of cool water. Remove from the water and place on squeegee surface, and gently squeegee off the water on the surface.

Soak the temporary support (vinyl) in cool water for about 5 minutes.

Mate temporary support to final paper support

Melt a sufficient amount of Gelly Cubes in a microwave or small double boiler. You will need enough gelatin to flood the surface of the paper.

The melted gelatin should be in the range of 80° - 95° F. when used.

Pour gelatin on the surface of the wet paper you are going to use as the final support. Cover it well. You may spread it about with a foam brush.

Lift out and drain the temporary support with the image on it from the bath.

Apply face down to the gelatin-wet paper on the squeegee surface.

Squeegee the temporary support down to the paper forcing out the gelatin. (Yes, it's a bit messy!) Continue squeegeeing until the two are mated. There may be puckers on the edges but they go down as the gelatin cools and sticks them down.

Wipe

Wipe the paper and edges gently with a paper towel.

Dry

Let the mater pair dry undisturbed. You may gently move it to a drying screen, but don't fiddle with it. If it starts to peel prematurely it will leave stress marks. Drying may take as long as 24 hours in a humid environment.

Peel

When dry, peel the print off the temporary support. Usually it will pop off by itself.

You can wash the vinyl support in hot water to remove any gelatin or pigment particles and use it again.

Matt and present

Matt and frame the print in your normal manner.

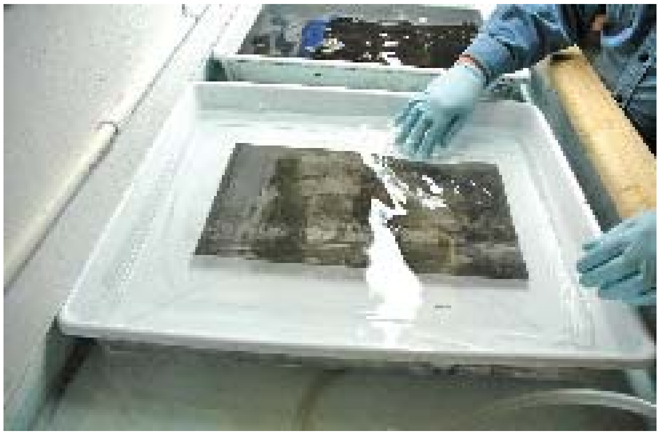


Fig 30. The print made on floppy vinyl is finished developing.

Development is complete when there is only a small amount of pigment bleeding from the print. There will always be some pigment bleeding off.

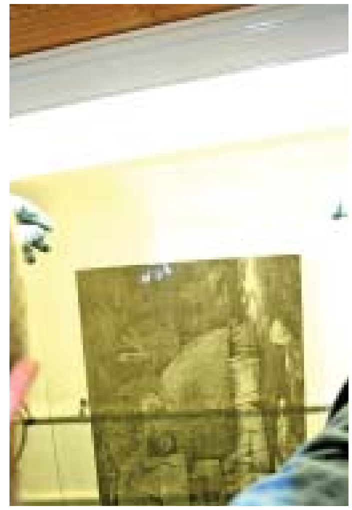


Fig 33. Howard Efner holds up the temporary support to inspect it.

Fig 31. Gordon Mark pours an 8% gelatin mixture.

He spreads a sloppy coat of it around with a brush on the support. Work quickly before the gelatin sets

Fig 32. Gordon now pours on melted gelatin.

He then lays lays down the vinyl temporary support with the image on it face-down to transfer.

Fig 34. Squeegeeing down onto the temporary support.

The print now needs to dry. It will need to be flipped over so the paper side is up to allow drying. The drying time may be as long as 8 hours or more.

Lampblack in the Past

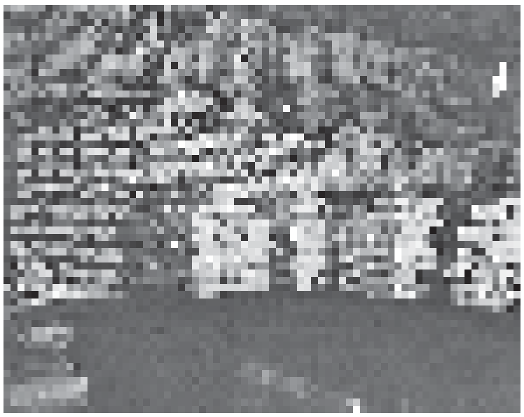


Fig 35. Piles of carbon sacked and ready to go. John Vachon, United States Office of War Information.

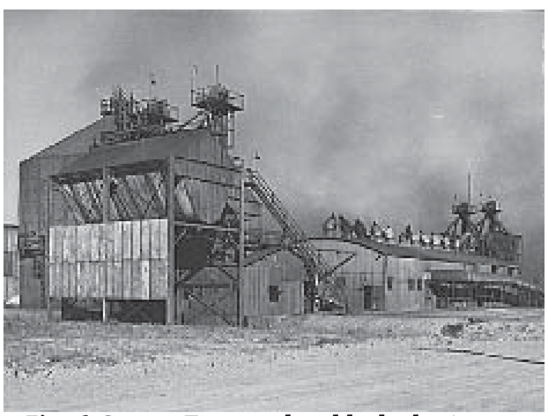


Fig 36. Sunray Texas carbon black plant, John Vachon 1942, United States Office of War Information.

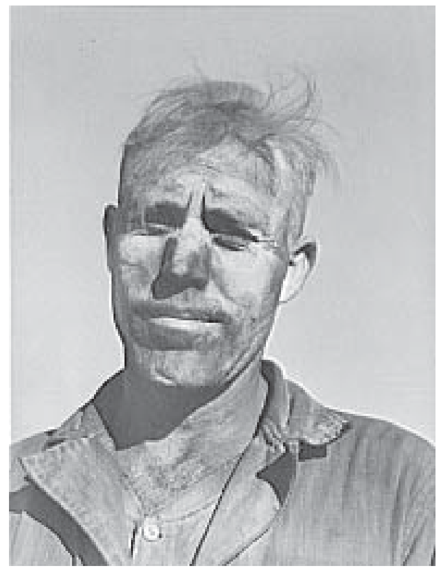


Fig 37. Lampblack worker, Sunray texas, 1942, John Vachon, United States Office of War Information .

One can imagine the horrors of working in a place like this in the 30's and 40's. Coal miners got black lung disease from the soot in the mines, obviously this is another great source for this disease. Howard Efner, who worked as a chemist in the petroleum industry, says its still a dirty messy job, but modern safety and environmental precautions now prevail. One of those sacks of lampblackcould pigment enough tissue to last a printer several lifetimes. If carbon printing takes off, I can assure you, it will have zero effect on lampblack futures.

Cheat Sheet — Single Transfer

1. Select a negative and put a safe edge on it.
2. Cut your tissue to size and inspect for any damage or adhering particles.
3. Determine your sensitizer percentage. 1% (or lower) for a soft negative, or 3% (or higher) for a contrasty negative.
4. Make a sensitizing solution at 60° F. using approximately 50% isopropyl alcohol and 50% water. Keep in a range of plus or minus 5° F.
5. Sensitize tissue for 2 minutes.
6. Lightly squeegee the gelatin surface while laid on its back on newspaper.
7. Hang to dry in a dark dry place.
8. Expose tissue.
9. Place tissue and final support in bath of cool water at 60 Deg for 30 to 45 seconds.
10. Squeegee together face-to-face. Apply firm pressure to remove air bubbles.
11. Allow to mate for 15 minutes.
12. Develop in water 100° to 105° F.
13. Hang to dry. Do not squeegee.
14. Mount and display in your favorite manner.

Cheat Sheet – Double Transfer

1. Select a negative and put a safe edge on it.
2. Cut your tissue to size and inspect for any damage or adhering particles.
3. Determine your sensitizer percentage. !% for a ,soft neg, 3% for a contrasty negative.
4. Make a solution at 60° F. using approximately 50% isopropyl alcohol and 50% water.
5. Sensitize tissue for 2 minutes.
6. Lightly squeegee the gelatin surface while laid on newspaper.
7. Hang to dry in a dark dry place.
8. Expose tissue .
9. Place tissue and <u>temporary support</u> in bath of cool water at 60° for 30 to 45 seconds
10. Squeegee together face-to-face. Apply firm pressure to remove air bubbles.
11. Allow to mate for 15 minutes.
12. Develop in water 100° F. to 105° F. <u>Be careful not to go over 105 ° F.</u>
13. When fully developed, place in cold bath or water to set the gelatin.
14. Hang to dry. Do not squeegee.

Transfer Step

1. make a warm 12% 250 Bloom gelatin solution
2. Wet final support paper, lay on glass, and gently squeegee water off water.
3. Wet the temporary support with the image on it for about 1 minute in 60° F. water.
4. Pour and brush a sloppy coat of gelatin onto the wet paper.
5. Quickly squeegee the temporary support on to the gelatin coated paper with image facing the wet gelatin. Squeegee very gently until a thin film of gelatin is between the wet final support and the image on the temporary support.
6. Allow to thoroughly dry, perhaps up to 8 hours.
7. Peel off.
8. Mount and display in your favorite manner.

Developing the print — a discussion

Fig 38. Yester Chapel, carbon print,- Andrew Glover

Herein lies the magic and mystery of carbon printing. All carbon printers will eventually work out their own developing procedure. We've discussed this before, but here we'll go into more detail.

The two biggest problems that occur during the development stage of the process are: gelatin lifting off the support during tissue separation, and blisters. This is especially a problem with hand-sized art papers. Both problems can be reduced to zero with patience. To remove the paper backing of the tissue gently, take hold of one corner and gently and steadily pull it free. Natural instinct will cause one to hold ones breath during this operation. It is virtually impossible not to.

Local development

Be cautious at first, but later you can play with directing a very gentle spray of water over parts of the image you want to lighten. For overexposed prints, you may find that raising the water temperature and letting the print soak upside down for half an hour, might just save the print. There are methods described in the section on print reduction that just might save a print. Most of these tricks are risky, and advisable for only a last ditch effort.

Temporary supports -- a discussion

A temporary support needs to have several qualities. One is that it must "hold" the gelatin image during development. Secondly it must release the image during transfer. Oddly, two materials that look the same on the surface will have quite different characteristics. Some will shed the image during development. Your image appears as the pigment begins washing off, and just as it is nearing completion, it all slides right off the support. Rats!

Sometimes the same material will be a bit forgiving and hold the image long enough for a development to take place, and give a usable final image for transfer, but then suddenly will shed the image which is frustrating beyond belief.

Worse yet, the same material that works well may not the next time you buy some. It may be your supplier changed manufacturers, or the manufacturer changed production technology. After suffering through this I found that if the support sheds, waxing with Treewax ® is the answer. A bit of extra time and energy makes all temporary supports act the same.

Comments on advanced and experimental techniques

Much of the following information will be information on advanced and experimental techniques. We are quite early in the modern renaissance of carbon printing, and much of this has not been thoroughly tested by me or any other modern printers. If the technique has not been fully tested, it will be noted clearly. Those who had perfected this arcane art have long passed by and all we have left is their writings. It would be a shame not to pass on some of A.M. Marton's tips on multi-printing or printing on clear or opal glass, just because I or any other modern printer had not thoroughly tested and perfected the technique. Part of the fun of carbon printing will be exploring some of these techniques.

You can be the first to explore some of these areas.

Most of us were floundering around in the early days of platinum printing. But as the platinum printing community grew, we all got smarter, and everyone benefited. We are in that stage of carbon printing. There is a lot to still be learned, so as you explore and discover things about carbon printing, share it with the rest of us.

Join the discussion forum at www.carbonprinting.com and share your tips and experience with us.

Reducing and intensifying carbon prints

Toning and Intensifying — experimental

Marton and other earlier authorities provide formulas for intensifying carbon prints. Some involve the use of dyes that may or may not be fugitive, and others the use of silver that is developed out into the carbon image. The use of such techniques is suspect in terms of permanence, but it must be also noted that, being built upon a carbon image itself, which is not likely to fade, they are, for the most part, probably more permanent than ordinary silver prints.

The reader is provided this information for experimental purposes only. At this time, I have not tested most of these techniques.

Chocolate Brown tested

This one I have tested and it is quite amazing.

- Bathe the print for about 2 minutes in a 1/2 % solution of ammonium dichromate.
- Rinse in several changes of water, or running stream for 3 to 5 minutes.
- Bathe print in standard print fix for 3 minutes. Either hardening or non-hardening.
- Wash and dry in the normal manner.

Some split tones may appear and I believe with some experimentation split tones may be achieved in a controllable manner. The color on a brown-black carbon tissue resembles Hershey chocolate.

The image is intensified so you will need an underexposed print.

Sepia brown — Not tested

Soak for a time in 1% solution of potassium permanganate

Immerse in a weak solution of pyrogallic acid

Deep black — Not tested

Like sepia but pyrogallic acid is used instead of Gallic acid.

Soak for a time in 1% solution of potassium permanganate

Immerse in gallic acid solution

Clear in ammonium sulfide

Warm black — Not tested

Soak for a time in 1% solution of potassium permanganate and silver nitrate

Multiple printing

Carbon offers the exciting possibility of printing multiple layers in multiple colors. Prints can be made by laying down two images onto temporary supports where one can be a soft highlight image of one color, and the other can be a contrasty shadow image in another color. Most commonly, the highlight would be brown and the shadow being black, but historically many combinations were done. Marton describes a tri-tone image made by doing a shadow print in black, a mid-tone in green, and a highlight in blue. Thus a picture of a tree would show the tree in green, the sky in blue, and the shadows and trunk in black! Marton says this is accomplished by using a three colored layer of carbon tissue. I have not accomplished such a feat as of yet, and must take Marton's word for this. One could also do this in three separate lay-downs or transfers. Naturally, this is an advanced technique, and of course you double or triple the number of ways to mess up. But then no one climbs Mt. Everest because it is easy.

The digital negative, of course, offers a multitude of ways to play with multiple carbon printing.

MORE ABOUT FINAL SUPPORTS

Plastic

Mr. McGuire: I just wanna say one word to you. Just one word.
Ben Braddock: Yes, sir.
Mr. McGuire: Are you listening?
Ben Braddock: Yes, I am.
Mr. McGuire: "Plastics."

Anyone over 50 surely remembers this defining scene from the film,*The Graduate*. Ben was a career-making role for Dustin Hoffman.

When I was studying photography at UCLA in the 70's, no one would dare put a print on RC paper. RC had serious problems. According to Howard Efner it had to do with the type of titanium oxide used as a whitener in the paper, and not the resin coating system itself. The problem was corrected soon, but the damage was done to its reputation.

However polyester, (Mylar, Melinex, etc) is not the same as the 1970's RC paper, and in, fact

Fig 39. Carbon print by Hisun Wong, Shanghai, China.
Carbon print made by Ataraxia.

Wilhelm Research rated Ataraxia Carbon Prints on Melinex polyester at greater than 300 years, displayed in interior lighting conditions. Wilhelm Research says tests are still ongoing, and it may eventually exceed that. However, we'll probably not hear more about this, as Ataraxia is now out of business.

Now there is a new kid on the block: Yupo. This is a Japanese product. Can you imagine a worse name for a product destined for the American market? Sounds a lot like "Yugo". This paper is what is called BOPP. "Yupo BOPP!" Sounds like a new Japanese dance step. BOPP: biaxially oriented polypropylene. It is a synthetic paper designed for labels, outdoor signs, and other uses where the environment can cause ordinary paper to quickly deteriorate. In other words it is for rough environments. It was never intended as an art paper, but it was quickly discovered by the water color painting world and even books have been written on how to water color on Yupo.

Nonetheless, no one has tested Yupo for 100 years and accelerated testing is according to Dr. Efner, more wishful thinking than science. What we do know about it is, that from all indications from its chemical makeup, it should be as archival as a good paper. One advantage is that it is impervious: that is it will not absorb pollutants. One of the issues that has been raised about modern buffered “archival” papers is that the buffers are hygroscopic alkali compounds, which can actually absorb and hold the nasty stuff that would cause an image to fade.

Yupo has a nice, smooth, paper-like surface and is quite attractive. If detail is what you are looking for Yupo is about the best surface you are going to find for a carbon print.

We’ll talk about this again in another hundred years.

Fixed-out photo paper as a final support

Many people prefer fixed-out photo paper for a final support. It works well and is reasonably permanent. Most photographers are surprised to find out that virtually all modern photo paper is made from wood pulp. Nonetheless, it is permanent. Today, some papers are made of plastic. Ilford makes some color papers on Melinex, which is an excellent support. Melinex is a high-end Mylar made by Dupont in Japan is exceedingly permanent and archival. Melinex is approved for use in lining boxes to put Renaissance drawings and other fragile art objects, as it does not out gas or absorb pollutants. Check Ilford’s web site to see which papers are made on Melinex. At this writing I believe IlfoColor is one of the papers. These papers also have a sheen to them in the highlights. Some may find this attractive, and others may find it offensive. The situation with photographic enlarging papers is quite in flux at the moment, so it’s best to check. I was also surprised to find out that color papers were no more expensive than B+W papers.

If one is lucky enough to inherit a pallet load of out-of-date photo paper that is a bit foggy, instead of fixing, use a bath of Farmer’s reducer to bleach out the fog.

To use as a final support just fix out the paper with no exposure, wash, and dry. To use soak for a minute in the mating bath, prior to adding the exposed carbon tissue.

Relief

Carbon, along with its close cousin the Wooodburytype process, are unique photographic processes with the ability to show relief. There are two type of relief: *specular* and *dimensiona*l.

Specular relief will show on when carbon prints are placed on a very glossy support. The shiny surface of the support shows through the thin white areas of the print, whereas the dark areas have lots of lampblack, which produces a flat matte surface.

Dimensional relief is where the black portions are high enough to show as three dimensional peaks, while the white's make up the valleys.

This is an issue that will get a lot of carbon printers twitterpated one way or the other. Some adore it, some are neutral, and others do not like it. I suspect a majority of prints made in the late 19th century were made by double transfer. If you use double transfer, you will get little or no relief. It is for this reason, I believe, classic period prints usually show no relief. Double transfer was necessary to keep the image from reversing during processing. Modern printers can flip the negative with little loss of detail, but a glass plate cannot be handled this way. There were mirror attachments made for cameras,but they were apparently a bit clumsy and not often used, and one had to know beforehand that the negative was destined to be printed in carbon.

Carbon prints on canvas

This has not been tested at Bostick & Sullivan but A.M. Marton describes a process for doing carbon on canvas:

- Scrub the canvas well with a brush and soap.
- Dry thoroughly.
- While drying make a gelatin soup:
    1. 80 gm hard gelatin
    2. 1000 ml water
    3. Swell for 1/2 hour and heat until dissolved. Then add 2 gm of chrome alum dissolved in a small amount of hot water. This should be added stirring in a little at a time.
- The gelatin mixture is applied to the canvas with a brush.
- Dry
- Brush on another coat.
- Dry
- On the third coat, the print is transferred from the temporary support by pressing into intimate contact to the gelatin-wet canvas. It is then allowed to dry and the print separated from the temporary substrate in the normal manner.

Marton then goes on to say , that if a coating of isinglass is placed on the print, it then can be painted upon.

Isinglass is made from the swim bladders of fish and can be obtained from home beer brewing suppliers. (Yummy!)

A Modern method

We have done a bit of experimenting with carbon on canvas, and this method appears to offer promise. We used primed painter's canvas from the art store.

Wet the canvas and gently squeegee it face up — white side up — on the glass.

Apply a healthy dose of 12% warm gelatin and spread about with a foam brush. Work fast if the room is cold! As in double transfer, place your temporary support with an image on it face down, and gently squeegee it to the canvas. Allow to dry. it takes quite a bit longer than a double transfer on to paper. When dry, peel it off. It will be glossy. The gloss can be dulled by soaking in cool water and hanging to dry. If there are uneven spots on the surface, a light brushing with a thin coat of 2% or 3% gelatin may even it up. Cornstarch added to the warm gelatin solution can add a matte finish as well.

Carbon prints on glass

This is the classical method. Much is lifted from A.M. Marton's Modern Methods. I have modernized the process to some degree.

Warm gelatin will dry and stick to glass. Carbon prints will not stick to glass, as they stick by a vacuum-like effect created by the capillary action of the water moving into the gelatin. A carbon print *will* stick to gelatin so the glass first needs to be prepared with a gelatin surface to hold the carbon image.

It was popular in the past to put the images on Opal glass, which is a pure clear glass with a very thin coating of white glass on the surface. Opal glass is processed the same as regular glass.

First, clean with ammonia, and then rinse with hot distilled water and let air-dry.

Method 1 - A. M. from Modern Methods

- Place gelatin in cold water. and let the gelatin swell for 10 minutes.
- Dissolve with gentle heat.
- When dissolved, add enough 10% chrome alum to thoroughly precipitate.
- Drain off the water.
- Dissolve in acetic with gentle heat and then add the alcohol.
- Warm plate to approximately 85° F. and flow on.

The image can now be transferred to the glass either as a single or double transfer. Some of the details are left to the modern workers imagination as this is all the Mr. Marton provides in his 1905 book.

Sullivan's method

Clean the glass thoroughly. Soak in some 50% laundry bleach and water. Wash with hot water and dry. Make a pad out of paper towel and dampen it with isopropyl alcohol. Polish the glass with the alcohol dampened paper towel and some Bon Ami powder. (Do not use any other kitchen cleanser. Etcher's whiting from an art supply store can be used also.) Dust off any power left when dry.

Using a foam brush, coat with a thin layer of amino silane. (Available from Bostick & Sullivan.) You do not need much, just a thin coating. Let dry overnight. Use the glass as a final support by squeegeeing the tissue to it in the normal manner.

When making carbon prints on glass, you should make the transfer print at least one step more contrasty, and one stop darker.

Amino silane is used in the glass industry to get glue to adhere to glass. It has two molecular hooks: one for protein (glue,) and the other for silicon (glass.) One hooks to glass, the other to proteins (gelatin, in our case.)

Clearing and hardening

Why harden a print?

Hardening supposedly made the prints more durable. Perhaps this was done in the past so they could be washed in batches, or maybe people handled prints carelessly. Most modern workers just wash, and avoiding the clearing and hardening process part altogether.

Marton's clearing bath

This is a combination clearing and hardening bath. A.M. Marton, in his 1905 treatise (see Bibliography,) describes it thusly:

"This bath has good keeping qualities and works well until exhausted. Filter well through cotton before using."

"Carbon pictures upon paper hardened in this bath may be handled like albumen prints once dry. They may be re-wetted and stacked up for mounting with the least fear of injury."

"Prints may also be cleared in a plain alum bath and then can be soaked in alcohol for a few minutes and then dried in a cool air stream. This will speed up the drying process."

Marton's Clearing and hardening Formula		
Potassium alum	30	gm
Sodium sulfite	20	gm
water	3000	ml

Mix up the preceding formula, and bathe prints for 5 minutes in 68 Deg F. bath. Rinse for 5 minutes, and then hang to dry.

Fig 40. Close-up of a wet carbon print showing relief.
Wet prints will always show more relief than dry ones.

The History of Carbon Printing

I find it fascinating that so much time and energy went into the development of the carbon process. We need to remind ourselves that far from being an art process, hobby, or pastime, photography in the mid-eighteenth century was a burgeoning technology with a serious place in the economic development of the times. Often, new discoveries were delivered to the appropriate national academies of science in sealed packages and under guard!

Virtually all of the photographic processes in use at the time were fugitive. This was partially due to the processes themselves, and to some extent, to not fully understanding how to make them permanent.

I don't feel any carbon printer is complete without knowledge of the foundations of his or her art and craft.

The following is cribbed from On the Production of Photographs in Pigments, G. Wharton Simpson, M. A., 1869 and *The Autotype Process*, 4th ed., no author listed.

M. Nicephore de Niepce — 1814

Developed what is considered to be the first photographic process by exposing a bitumen coated plate.

Mungo Ponton —1839

Produced images on potassium dichromate coated paper.

M. Becquerel — c. 1849

Noted Ponton's effect only worked on sized paper, and not unsized, paper and concluded that it had to do with the organic compounds in the sizing.

Made images with starch-coated paper treated in alcohol and iodine.

William Henry Fox Talbot —1849

Patented a photoengraving method, whereby a plate was coated with gelatin and other substances, and chromic acid, exposed, and then, the soluble portion was washed off producing an intaglio printing plate. Talbot is recognized as inventing the positive/negative photographic process, but it is not widely known that he was involved in this venture as well.

Poitevin — 1855

Invented what is generally regarded as the first "carbon process" by coating a paper with an organic material and potassium dichromate. After exposure, it was moistened, and then oily ink was rolled over the image, thus, in effect making an almost lithographic image.

He then developed a second technique by adding ink to the organic material, and washing away the soft parts

Lafon de Camarsec — 1855

Described a sensitized bitumen plate that was rendered sticky, and then coated with fusible enamel colors.

Dr. Phipson—1857

Noted that Dippel oil turned black, by the action of light. He also noted the image could be fixed in hydrochloric acid. (Dippel oil is a foul smelling oil sometimes called bone oil and was used to keep foxes and other animals off the farm by soaking rags in it.

Thomas Sutton — 1857

Added charcoal to a dichromated solution of albumin and exposed it. Subsequent repeated washing produced an image.

Testud de Beauregard — 1857

Proposed a modification to Poitevin's method where the pigment was added after the organic coating to keep the highlights white. His proposal involved lamp black in oil which the oil was later removed with ether or thin collodion.

John Pouncy — 1858

Showed carbon prints at the London Photographic Society. (Later The Royal Photographic Society of Great Britain.) Pouncy did not reveal the details of his process at that time but, the photographic world was a buzz with discussions of the process and how it was done. This engendered a large amount of bitter feeling. Eventually the process was revealed with the publication of the patent. According to Simpson, the author from which these notes were cribbed, writing 10 years after these dates, the process was not successfully reproduced by amateurs or professional photographers, for the most part, the implication being that Pouncy left out some important details in his patent.

MM. Henri Garnier and Alphonse Salmon — 1858

Described at the French Photographic Society a method whereby paper was coated with iron citrate, exposed, and dusted with carbon.

M. Gabriel de Rumine – 1858

At the same French Photographic Society meeting, described a method similar to that of Beauregard above, but used boiling water to remove the oily substance.

Charles Seeley — 1858

Seeley is the first American in this search for the perfect carbon print. He described a gum, carbon, dichromate process, but after learning that Poitevin had beat him to it, ceased to promote it.

Duc de Luynes — 1856 1858

Offers a 2000 franc (£80) prize for improvements in photography. Beauregard, Garnier and Salmon, and Pouncy were considered.

Reportedly, Beauregard "broke down" before the commission. Garnier and Salmon put forward a different process than the previous iron citrate described in that they used sugar, albumin, and dichromate in a dusting on process and reported to have performed well. Pouncy's process was tested by the commission since he was unable to attend.

The commission decided to split the prize between Garnier and Salmon, and Pouncy.

Laborde — 1858

First notes that the exposure hardens from the top, down, and describes this as the difficulty in obtaining a full tonal range image.

J. C. Burnett — 1858

Points out the same fact as Laborde in more clear terms, and indicates the direction in which efforts need to be made, in order to obtain full range prints.

Blair —1858

Noted the top-hardened bottom-soft problem, and attempted to solve it by exposing through the back of the paper. The results were somewhat successful, but he got a lot of paper granularity in the image.

Sir Joseph Wilson Swan — 1858 and later

Swan begins working on an inverse process without being aware of Burnett's or Blair's proposals.

Swan's first attempt was to coat glass with gelatin, carbon, and dichromate and then expose it in a camera, through the glass, thus exposing the underside, leaving the top soluble. This was unsuccessful, due to the low light level obtained through the camera lens.

M. Jourbet — 1859

Developed a process he called phototype. Showed pictures in 1860 far surpassing anything seen until then, according to Simpson. Simpson also says that as of 1867, the details of Jourbet's process were still unknown.

Poitevin — 1860

Coats glass with collodion, and then perchloride of iron and tartaric acid. Left to dry in the dark the collodion becomes insoluble. When exposed to light it again becomes hygroscopic. The glass was humidified and dusted with carbon, which adhered to the exposed portions. It was dried, and then transferred to a paper coated with gelatin, making a sandwich which was left to dry. The gelatinized paper was peeled off, transferring the image from the glass to the paper.

Fargier— 1860

Used a similar process to Poitevin, but after exposure, plunged the plate into warm water which released the collodion. He then developed the image on the collodion, and attached that to a piece of gelatinized paper. **Mr. Bingham of Paris — c 1860**

Bingham reports success, assumedly commercial in nature, with Fargier's process.

Fig 41. Redwoods in Sunlight, Vaughn Hutchins, carbon print

Poitevin — 1863

Coats paper with pigment, gelatin, perchloride of iron, and tartaric acid. When the paper is left to dry, it becomes insoluble. Exposure to light renders it soluble, whereby it is washed removing the exposed gelatin.

No one else seems to have succeeded with this.

He then proposed dipping the paper in pigmented milk. When the exposed print is immersed in it, the unexposed parts would precipitate out the casein and pigment in the milk.

Pouncy — 1863

Coated thin transparent paper with carbon, pigment, and dichromate. It was then developed in a suitable solvent. If Bitumen was used turpentine was the solvent and water was used for gelatin. The resulting image was backed by a white backed mount. Later, he was able to transfer the image to paper.

Orbernetter — 1864

Proposed treating paper with iron chloride (sesqui), copper chloride, hydrochloric acid, and water. The image is developed in sulpho-cyanide of potassium and sulfuric acid. When exposed to chlorine gas, the image formed is made of chloride of copper which is then heated and converts some of the paper to carbon.

Joseph Wilson Swan — 1864

We now come to the apex of all of this invention and discovery. His first process was nearly the same as described in the carbon primer above, except that the tissue was mounted to the final support with shellac, instead of wet adhesion.

Swans process attracted considerable attention and many others advanced the process, or were still proposing others.

Simpson's 1867 book is based on the shellac mounting system, and not the wet adhesion process we use today.

Frank Eliot — 1865

Proposed using the "perchloride of iron softening under light effect" and putting white pigment on black paper. Finding a white pigment that would not be stained by the iron was the difficulty.

J. R. Johnson — 1868

Proposed the wet adhesion process used today.

Issues of Carbon Printing

Fog

It is quite possible to print carbon without fog. Early Pictorialists often used no real whites and no real blacks in constructing their images. Thus, in many instances, fog was not considered to be a problem.

These variables increase the risk of fog:

- Higher percentage of sensitizer.
- Longer drying time.
- Vapors in the drying room (smokey wood fires in the old days!)
- Aquarius being in the House of Mars(just kidding — but then maybe not!)

The point being that fog creeps in on little cat's feet and leaves just as quietly. (Apologies to Robert Frost.)

Paul Lehman recommends a pre-wash of the unsensitized tissue, and dry, and then sensitizing the tissue to eliminate fog. This adds one more step which may be time consuming for many. As we continue in the renaissance of carbon printing, we may, in fact, learn how to eliminate some of the printing problems with carbon.

Shedding and peeling

Every carbon printer, will on occasion, see the print just slide off the paper or support. The main cause of this is wetting the tissue in water too warm, or for too long prior to the mating step. Some cases can be solved by lowering the water temperature or shortening the soak time. Quickly get to the squeegee point. The time of the soak includes any time prior to the squeegee step! Some supports just will not hold a carbon print, so that may also be the problem. In that case, use a different support, one that is known to hold the print.

Dichromates

One can use potassium dichromate, ammonium dichromate, or sodium dichromate. A.M. Marton gave preference to sodium dichromate. Other authorities dismiss it. I've not tried it.

Potassium dichromate is the slowest and contrastiest; ammonium is faster and softer working. Individual workers can adjust their working style to suit their preference in the various sensitizers. Most choose one type of dichromate for sensitizing their tissue and work with that one for consistency.

Workers in carbon during the later period (1905 - c.1950) preferred using ammonium potassium chromate. Apparently this compound is unobtainable from commercial sources today as it was in the past and has to be made in-house.

Ammonium potassium chromate is supposed to be cleaner working and have fewer tendencies to fog. Tissues sensitized with ammonium potassium dichromate are thought to last longer and fog less with age.

Ammonium potassium dichromate appears not to be available for purchase so one has to make their own. It can be simply compounded by the worker in the printing lab. It does require the use of ammonium hydroxide. Household ammonia can be used to produce a 20% solution.. It's a stinky process. Whether or not it is worth the trouble one will have to try it and decide. For the courageous here's a recipe:

Procedure

In a 1 liter glass vessel, place 200 grams of potassium dichromate.

Add unscented household ammonia while stirring, until the solution turns from orange to bright yellow. Most US supermarkets sell ammonia in a lemon scented variety and an unscented variety. Do not use the peppermint, or lemon scented versions of household ammonia.

Continue to add ammonia until a slight scent of ammonia comes off the surface of the solution. Fan the top of the beaker, wait a few seconds and, waft some with your hand, and sniff. When you can just detect the ammonia, your are finished.

Add water to bring the total volume to 1 liter. If you are already above 1 liter, the store bought ammonia was not strong enough to make a 20% solution. You will need to adjust your working percentages for sensitizing accordingly.

Stronger percentages can be made by using commercial "880" ammonia but this is dangerous, nasty stuff to work with, and the fumes are exceedingly strong. This is not to be attempted unless you have the facilities and skills to work with strong ammonia.

Tools and Equipment

One of the most frustrating things about alternative photographic printing, or, for that matter, any complex process, is to get half way through a process and find out that you need a critical item. Some of the items listed may seem mundane but we'll go over them so you can make sure that you have all the things that are needed before you start your first print.

I've tried to recommend the most common materials. Too often folks will try to "exoticise" a process and come up with weird off-the-wall materials just to make the process look more arcane and to add a mystique. A great carbon print lies in the print itself, not in the tools used to make it.

All of the temperatures are given in the awkward and unique Fahrenheit scale, as most workers in the US are comfortable with this system.

Let's briefly go over what you will need on your quest to become a carbon printer. If you are currently a platinum printer, much of this will be familiar and you may have many of the items you may need; but note, there are some differences in tools and workspace.

Your workspace

The printing room

You are playing with soot and other pigments. It can get messy even for the neatest worker, so for domestic tranquility, choose an area that can take some abuse. Mom's kitchen won't do. Back in the late 1800's there were darkrooms set up specifically to do carbon prints.

Illumination of the print room

As is the case with many alternative photographic processes, you will not need a true blacked-out darkroom. The carbon process is a bit more sensitive to light than the platinum process, so you do have to be careful about fogging your tissue after it is sensitized. I am currently using 70-watt sodium vapor yard lights as safelights. I am using three of them to light an area of about 900 sq. feet, and the illumination is bright. Yellow bug lights will work, and are a bit cheaper. Standard OC darkroom safelights are ok, but are a bit overkill, and don't put out much light. You do not need the well adjusted spectrum necessary for enlarging paper, as it is thousands, and even millions, of times more sensitive than carbon or platinum.

Climate control

Extremes of hot, cold, and humidity can play havoc with carbon. Early books on the subject were full of warnings about the conditions in the darkroom. The best environment for carbon printing is a temperature between 60° and 70° F. and ideally 40% to 70% relative humidity. High humidity is more of a problem than extreme low humidity. I routinely make carbon prints in 10% relative humidity in the winter in Santa Fe. Our town is at 7000 feet in altitude I have often commented that we live in a partial vacuum, but my two sons claim it is all in my head.

The sink

A darkroom-style sink and a worktable are also highly desirable. Working without a sink is possible, but quite painful, as you will need quite a bit of water for development. As the tray cools, you will periodically adjust the temperature by adding more hot water, a real pain without a darkroom sink.

Worktable and Tee Square

A worktable is essential. A large table is nice for cutting tissue from the large rolls. The tissue comes in 36 inch wide rolls so a Home Depot sheet rock tee square and a standard box cutter works well for cutting tissue.

Ventilation

A moderate amount of ventilation is needed.

> **Chromium compounds in solution do not vaporize and therefore you are not in danger of breathing "chromium fumes." If you use isopropyl alcohol in sensitizing your tissue you will have a small amount of fumes to deal with. This is not too much of a danger, but some ventilation will be needed. If you use any solvents in the sensitizing step definitely do not work in a confined unventilated space; although highly unlikely, fume buildup could become EXPLOSIVE. You would notice a strong and almost gagging amount of fumes before this could happen, however, but err on the safe side.**

Print and tissue drying facility

I use a wire strung across the sink and wooden spring clothespins for hanging sensitized tissue and prints to dry. A trick my father taught me is to attach a spring at one end to keep the wire taut, as wires tends to stretch and sag. Some may prefer screens for drying. They are good but tend to use up more room. The big advantage with screens is that you don't have the drippy bits hanging over your sink or floor. Blotters, hanging screens, whatever your choice, they all work Ok. The screens will need frequent washing, as the dichromate will collect on them and expose in the light which can cause problems if it transfers to the tissue.

Wet table or glass squeegee platform

I use a table with a plate-glass top and an aluminum channel around the perimeter to catch the run off. This is a bit much for the casual printer. Any glass tabletop or a piece of plate glass resting on an upturned tray in the sink, will work. Squeegeeing is the messiest part of carbon printing, and anything you can improvise to lower the mess level will make your life easier.

Other things you'll need

Hot water

You will need water at least 120 Deg F. You will use mostly 105 Deg F. water for development but you will need hotter water to boost tray temperatures at times, and to hot soak final support paper. I once taught a carbon workshop in an apartment rooftop darkroom in Mexico City. I asked the photographer, the darkroom's owner, if he had hot water. I was assured it was plentiful. As it turns out his idea of hot water was an 800 watt hotplate and a tea kettle. We actually managed to develop 11x14 prints but it was a challenge.

De-gassed water

Ordinary water out of the tap can contain trapped air. This appears to be seasonal, sometimes you get no trapped air, and at others the water is really gassy. You have undoubtedly seen the bubbles on the inner surface of a glass tumbler that has been left to sit for a few hours. These same bubbles from air trapped in the water can form between your tissue and the support and cause tiny shiny specks in your print. Classical works on carbon printing say to use de-gassed or well water. You may or may not find that your tap water is acceptable for carbon printing.

Filling a pail with hot water and letting it cool and sit overnight will de-gas water. Any convenient 5-gallon pail will work. Just fill it up a day ahead of your print session. If you need more than buy a plastic 25-gallon trash container. Distilled water works as de-gassed water, so in a pinch use a jug of supermarket distilled water. It is perhaps a bit pricey for a production carbon lab but at about $.79 per gallon, not too bad for personal work.

I have found that gassy water is not a problem if you keep the temperature of the developing water low., that is do not go much above 105° F. This is my observation, under my conditions, but yours may be different, however.

Ice

When the tap water is too warm, ice may be used to lower the temp of the presoak prior to mating, and for lowering the temperature of the dichromate sensitizing bath. During the summer when my tap water is warm, I buy 10 lb. sacks for about a dollar each at the local mini-mart. I am considering getting a small ice maker now.

Freezer

A freezer is nice to have but, not absolutely essential. Storing 3 bags of ice in the freezer atop the fridge in the kitchen could create quite a bit of domestic friction. You can also store the tissue in a freezer, since it increases its life span after sensitizing. Do not store sensitized tissue along with food. If you are serious about carbon printing and have the space, that old freezer that Uncle Harry has on his back porch, that he has been trying to foist off on you for years now, might be a good deal.

Electric fan

Any small to medium-sized electric table fan will do. A fan is absolutely essential if you print under metal halide lights. The tissue could melt on to your negative if it gets too hot!

Plate glass

You will need a piece of 1/4-inch plate glass 4 inches in each direction larger than the largest support you will be making. So if you are making 8 x 10 prints I suggest using a 12 x 14 inch piece or 14 x 14 inches. Glass shops often have small scraps in these sizes since plate glass is largely used for large windows. Have the glass shop "sand" the edges well. You can tape the edges to keep the blood factor down, but the tape has a tendency to wear through and expose razor sharp edges. Sanding is best, but even then, be careful and check their work, as some shops don't sand too well. There is another edge treatment called grinding which is really nice, but more expensive, and some shops don't do it.

Temporary support material

This will be used if you do double transfers. Bostick & Sullivan sells a temporary support material. This is a clear vinyl that works well.

Some plastics and things like slipcover material will work but some have a mold-release like substance that prevents it from holding the image. Don't buy in quantity until you have tested it. Most people will do single transfer to begin with, so this is not much of an issue.

Squeegee

This is a standard window-washer squeegee. Buy extra rubber replacement strips while you are at it. The replacement strips are about $2.00 a piece and they are often hard to find, so get them while you can. I have a nice 12-inch brass professional model squeegee at around $12.00 that I like. The plated ones have a tendency to corrode and rust after a while, so spend a few bucks more and go for a brass deluxe one.

Paper towels — lots of them

Buy a bundle of 6 rolls of a better quality brand. The blue heavy-duty ones found at auto supply shops and Home Depot are excellent as well. Cheap ones fall apart. You will need a lot of towels.

Rubber gloves

Buy some decent latex or blue nitrile "examination" gloves. Buy lots of them, you'll need them. Don't do carbon printing without them.

Dust mask

A good quality paper mask is sufficient. Used when mixing dry chemicals. Not needed during the print making cycle.

Trays

You will need at least two white photo trays of the proper size, at least 1 inch larger than the support you will be printing on

Scissors

I love the spring-loaded Fiskars brand of scissors. They are very easy to cut straight lines with. Regular old fashion scissors will suffice.

Printing frame

A good spring-back contact printing frame or a vacuum frame is ideal. Bostick & Sullivan sells strong, split-back frames. In a pinch use two pieces of the 1/4-inch plate glass. Put one on the bottom and one on top.

Printing light

You will, of course, be making contact prints and will need a UV light source. A UV light source made for platinum printing will work. A 1000-watt metal halide warehouse lighting fixture works great, and may be the cheapest source of good printing light. (See Appendix C -Printing Exposure Lights.) If you have a graphic arts plate maker. you're lucky. as these are excellent. Sunlight is very iffy with carbon printing. as it is with any alternative process. It is unreliable and only available during the day — unless you live in the Polar Regions. Also, during the summer and in some climes full sun can cause heat to build up and cause the tissue to melt onto your negative. If you have to, you can make do with the sun.

Dark cabinet, dark drawer or paper box

After you sensitize your and dry your tissue and drying it you will need a dark, dry place to store it. A dark closet or a large old photo paper or film box will do, too.

Masking tape

Both black photographic tape and masking tape will be useful. The black tape will be used to provide a safe edge around your negative for printing.

Thermometer

Any good darkroom wet thermometer that reads in the 105 deg F. range will do.

Bostick & Sullivan Tissue

At this moment in time, Bostick & Sullivan is the only company in the world making carbon tissue for fine art print making in commercial quantities.

Yes, you can make your own tissue.

For the last two decades, making one's own tissue has been the only way to indulge oneself in the carbon printing ritual. One of the problems teachers of carbon printing have had is making enough tissue for a class. If a teacher has 10 students and the class is to last three days, then each student will probably need about 20 square feet of tissue if they are making 8 x1 os'. That means 200 square feet of tissue. Having ten 4 x 5 foot flat glass tops for the tissue making puts a real strain on things. Making tissue for use during a workshop is highly problematic, but having a demonstration session to teach students how to make their own is a good possibility, and I recommend that at some point all carbon printers should learn the art of making their own tissue.

A negative

Carbon is a contact process, so you will need a negative the size of the print you wish to produce. A negative made for the platinum process work well. Negatives made for "normal" silver printing can be made to work, too, but are on the edge.

A word of warning: do not attempt your first carbon printing session using one of your prized negatives. Even skilled carbon printers have been known to make mistakes and lose a negative. If the tissue is not thoroughly dry or gets too hot during the exposure, that printing session will be a significant moment in your carbon print making life.

Chemicals

Ammonium or potassium dichromate — sensitizer

Buy from Bostick & Sullivan.

Warning: it is poisonous and it looks like orange soda to children! Treat accordingly. Do not store in the kitchen refrigerator. Dichromates are poisonous if ingested and can also cause serious skin lesions with chronic and prolonged contact. Always work with gloves when using dichromates. Always use a dust mask when weighing out powder.

Isopropyl Alcohol

It is sometimes called rubbing alcohol, and can be purchased in most any drugstore.

Potassium metabisulfite for clearing agent

Bostick & Sullivan sells this too. Most workers today do not clear their prints. Working methods today appear to sufficiently clear the prints in the wash without a separate clearing step.

Failures, their cause and remedies

Much of this section has been shamelessly lifted from A.M. Marton, 1905. SOme modifications have been made for the contemporary worker with additions by the author.

During sensitizing, the gelatin coating on the carbon tissue softens and runs down in streaks.

- Cool the bath to 50°F.
- Cool down coating room.

The tissue buckles and is uneven, making it difficult to get a flat contact with the negative.

- This happens often with homemade lay-down tissue. Tissue is too thick. See Appendix A—Making Your own Carbon Tissue.
- After sensitizing the extra fluid was not wiped evenly from the back of the tissue.

During development the tissue does not adhere to the transfer support or final support paper.

- Too warm a mating bath.
- Too long a dip in the mating bath.
- Too short a mate after squeegeeing the two together.
- Insufficient sizing on art paper.
- If synthetic paper is used, residual mold release that has not been not washed off.

When attempting to remove the tissue backing paper it, tears through the darker parts of the image.

The edges of the tissue lift off during development.

- The tissue remained too long in the water before the mating squeegee step.
- The water in the mating bath was too warm.
- The margin of the print was not blotted and dried after mating.

After development, the image is too dark.

- Either the print was overexposed. The tissue was left too long after sensitizing or the tissue was too old. [We've not seen this to be a problem.]

The image appears too light, or has no half tones, and develops rapidly.

- Usually caused by too little exposure.
- Too weak of a sensitizing bath.
- A granular surface or a black network appears on the surface.
- Tissue placed in water temperature too high prior to first transfer or mating.
- Sudden temperature changes during development.
- In lay-down tissue, too soft a gelatin was used. Use a higher Bloom number — 200 to 250 Bloom is best.

Small shiny specks appear in print or tiny bubbles in the print.

- Air was trapped between tissue and support prior to squeegeeing.
- The development was started at too high of a temperature.
- The clearing bath was too cold.
- Tap water from the tap sometimes contains lots of dissolved air.
- Water is too hard. Soft water is always best for carbon printing.

Remove any froth from the tissue with a soft brush before mating. Add some isopropyl alcohol to the mating bath. Add Tween 20 to the mating bath. After dipping and before mating spray a light spray of isopropyl alcohol on the gelatin surface of the tissue and then mate. Use degassed water. I fill a tub with hot water and let it de-gas overnight.

The tissue image fails to adhere to the support.

- The tissue remained in the cold water too long before it was mated to the final support or transferred to the temporary support.

Remedies

- Place the mated pair under pressure for at least one hour
- Start development cool water and slowly bring the temperature up

The image has little black flecks.

- Dirt or tissue trapped between the tissue and support. Often caused by particles shedding from the cut edge of the tissue during brush or dip sensitizing. Wipe the edges gently with a tissue before exposing to remove any loose particles.
- Dirty transfer water bath is often the cause.

The image appears granular.

- The tissue was dried at too high a temperature.
- Tissue was not in contact with support long enough.

The image appears cloudy, especially in the lighter parts — looks patchy

- Pressure of the fingers on the back of the tissue; and the pressure of the hands on the moist back when doing the first transfer. Too much pressure on the squeegee.

The image does not leave the temporary support when making the final transfer.

- Faulty waxing of the temporary support.

Final words from the author

So you've gotten this far? If you are already part of the small fraternity, of carbon printers you probably want to whack me upside the head with a two-by-four.

"This guy is nuts", you're thinking,

"No one in their right mind could make a print this way. "

Yes, there *are* a myriad of ways to make prints, and one of the joys is discovering what works best for you, and what gives you the print style you are looking for. Some like matte prints, some like glossy, some like high relief, some hate it. Ah, the joys of soot printing.

Most likely, though, you have never made a carbon print in your life — most people haven't. Since you have not consigned the book to the fire on the hearth presumably you have some interest in pursuing the carbon process. Welcome to the club!

We are developing a carbon printing web site at **www.carbonprintng.com**, so keep an eye out there for supplements to this book and new information on carbon printing. We expect that some very important information will be found there so check often. We will be putting up a gallery, so your scans of carbon prints will be very welcome.

—Dick Sullivan

Annotated Bibliography

Marton, A. M., A New Treatise on *The Modern Methods of Carbon Printing*, Second Edition, Bloomington Illinois, 1905.

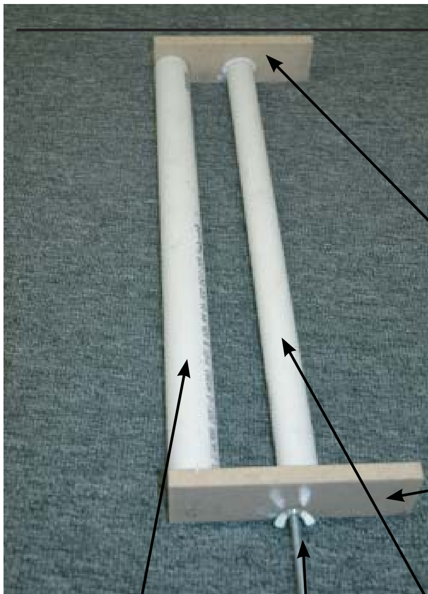
I am deeply indebted to A.M. Marton's seminal work on the process. This is one of the most complete, if the not the most complete, work in the field. Marton's work answered many questions I had that other works could not.

T*he Autotype Process*, Anonymous 4th edition, Spencer Sawyer, Bird & Co., London 1875

G. Wharton Simpson, *On the Production of Photographs in Pigments*, Thomas Piper, London 1867

Viscount Hanworth, FRPS, AMIMech.E, AMIEE, *Amateur Colour Carbro Printing,* The Focal Press, London and New York, 1955.

The American Carbon Manual, E. Wilson, 1868



Fiig 43 Howard Efner has come up with this nifty coating die.

This is used for making laydown carbon tissue. it's a one hammer project and should cost less than $10.00. One can make a much larger piece of tissue than one can with the pour and spread method using this tool. It lays down a smooth coat in one quick pass before the gelatin has a chance to set.

The threaded rod runs through the pipe. The pipe fits loosely so the pipe can move. The rod is tightened by the wing nuts and sets the pipe in position for thickness adjustment.

Fig 42. Lay it on a flat surface, preferably a piece of plate glass.

Loosen the wing nuts on the adjustable rod and place a dime under each end to set the height. This will adjust the level of the gelatin as it is poured and spread. One can use other larger coins or pieces of matt board to get different heights.

Fig 44. Here is the coating die in use.

Howard is pulling it towards him -- to the right. Gordon is doing the pouring. it is essentially a two person job.

Appendices

Appendix A — Making your own carbon tissue

This is called the "lay-down" carbon tissue manufacturing process.

> *Making tissue in very large sizes becomes highly problematic as the gelatin will cool too fast to evenly spread over a larger area. Efner's coating die method shown later in this section can be use make larger tissues.*

The Standard Method

Setting up

Secure a piece of 1/4-inch plate glass. 20 x 24 or larger is a good size. Have your glass shop sand the edges, so you won't cut yourself.

Level it on your table top by placing pieces of modeling clay under each corner and using a spirit level to level the glass by pressing down on the corners.

The gelatin mix

Pigments from your local paint store are very good. They usually have to be purchased in 1 gallon quantities, which is quite a lot for making carbon tissue. Many Benjamin Moore paint Stores sell pigment in 1-quart cans so that is a nice option. You can buy Cal Tint pigments in 1 pint bottles from a number of online sites. One reliable one is: http://www.artstuf.com/

1	liter	cool water
90	gm	250 Bloom gelatin
30	gm	table sugar
10	gm	glycerin
12	gm	paint store lamp black pigment

Preparing the gelatin

- Stir gelatin into 1 liter of cold water. The colder, the better and faster the swelling. Allow to swell for 1/2 hour.
- In a double boiler or small electric crock, they make small ones, melt the gelatin. This will take about 1/2 hour.
- Add sugar and glycerin when the gelatin is thoroughly melted. Stir until dissolved.
- Add pigment when all the sugar is thoroughly dissolved. DO not let pigment sit on the bottom, not being mixed in,. It can "fry" and will become granular.
- Let the gel sit for 1 to 2 hours while kept warm so it will not set. The gelatin, at first,

will be full of air, and this will allow the air to escape.

- You will need some type of framing device to keep the gelatin from running off the glass. I use a Neilson metal photo frame, but any metal frame will do. Make a size to fit on the glass and the size of the tissue you will make,
- Clean the glass thoroughly, and place the frame face down on the glass. Pour the warm gelatin into the framed area and spread it evenly about with a coarse-toothed comb. Work quickly. If the gelatin cools, it will not coat evenly and you will have a mess. If this happens scrape up the gelatin and put it back in the pot and start over.
- After, about five minutes, and the gelatin has set to the point that you can touch it without it sticking to your fingers lay a sheet of stout paper that has been dampened, but not drippy-wet, onto the gelatin and squeegee or smooth down with a flat ruler.
- After an hour or so, you can remove the tissue from the glass. You will need to cut it free from the frame with a single edged razor blade.
- Hang, or lay, on a clean covered table top to dry overnight.

After you have applied the paper to the set gelatin you will notice that you can peel it right off again. This might lead one to think something has gone awry. Don't fret. As the paper dries it will adhere firmly to the gelatin.

A coarse-tooth comb is excellent for spreading the gelatin as it does not impart a lot of air.

Efner's Coating die method

Howard Efner has worked out a method using what he calls a "coating die. "It takes a little bit of work to make the die but it does make coating a bit easier, and provides a nice, smooth, even coating.

Appendix B — Marton's endless list of reducing agents

These are compounds that are put into solution for reducing an over-exposed print. The compounds are given in their modern names. Marton, in his 1905 book gives descriptive, buy often confusing comments on each of these compounds. I've not tested them. It appears that the stronger the reduction, the harder it is to control the action — so the stronger ones need to be used with great care. I find that Cascade brand dishwashing detergent works but has to be used in very dilute solutions.

- Sulfuric acid – strong.
- Hydrochloric acid – moderately strong.
- Acetic acid – weak to strong depending on dilution. Marton says a strong solution can develop a print while cold.
- Ammonia – moderate.
- Ammonium carbonate – moderate but weaker than ammonia.
- Sodium carbonate – very moderate. Marton's favorite.
- Sodium hydroxide – very strong.
- Sodium chloride – very weak, good for clearing up veiled highlights.
- Borax and boric acid — weak and easily controlled.
- Calcium chloride – highly recommended, easily controlled.
- Barium chloride – very strong, will dissolve off the gelatin if left too long.

Appendix C — Printing Exposure Lights

I have found that the cheapest and easiest way to acquire a serious carbon exposure light is to build your own, using what is called an industrial metal halide luminaire. These are the lights you commonly see illuminating Home Depot or modern supermarkets. They are fast replacing fluorescent lighting in large commercial buildings.

They come in various wattages, but the most cost efficient all around, is the 1000 watt systems. You will need a ballast, a lamp, and a reflector. Your local electrical supply house should be able to supply you with all three ,and the price will be around $300.00 or less, if you can convince your supply house to give you the "professional" discount. You are unlikely to find metal halide lumenaires at Home Depot or neighborhood hardware stores, though they can probably order one for you, but the electrical supply house will likely stock them, and if they are friendly enough, will provide some advice on wiring, etc.

One step better are the metal halide lights sold for hydroponic gardeners. The ballast is separate from the lamp unit, and is much easier to mount, as you can set the heavy ballast on the floor.

Some samples of reliable units:

Venture Lighting: Catalog: V90AM6514,with reflector and Universal lamp.

Grainger has warehouses in most major cities and they sell a nice unit for $257.00 + lamp. The lamp is about $60.00. The lamp is rated for 20,000 hours, which is a lot of print time.

There are some ultra cheapies lurking about. I ordered one, and it didn't work. I sent it back. After receiving the third one, which was badly packed, and destroyed by the shipper I finally broke down and bought a unit from my local supply house that has worked perfectly ever since.

You don't need anything fancy. What you are looking for is the basic standard 1000 watt unit. There is a new version on the market called "pulse start" which starts faster and costs about 20% more, and they'll work as well, and give you the advantage of a faster start. You will most likely find your electrical supply house stocks a "multi tap" unit. Multi tap units are excellent but you can buy one specifically for the voltage you expect to be using. In the US this would most likely be 120 volts.

There is one downside to using the standard lights, and that is they don't start up instantly. They take about 4 to 5 minutes to come up to full brightness. Thus you cannot put them on a timer. Even if you tried to use a timer, you would need a solenoid to handle the high wattage. The slow start time is not much of a problem for the serious printer. They do what I call managed printing. You will most likely be in the area when the timer goes off, and all you'll need to do is to pull the print out from under the light and put in the next one if that one is ready to go.

Mounting the light will depend on your individual situation and skills.

Appendix D — Sir Joseph Wilson Swan's Carbon Process Patent

When we make a carbon print, we, in a real sense, are connecting to the past. Every modern carbon print made shares in this legacy.

The carbon print was a giant leap in the world of photography. It was the first process to be absolutely permanent. Carbon did not use precious metals like gold, or silver. Joseph Swan was one of the giants of 19th century science. Later knighted, he was also a co-inventor of the light bulb with Edison. In a brilliant stroke, Edison and Swan decided not to make lawyers rich, so instead of a long series of lawsuits, they joined forces and Swan ran the *Ediswan* Co. in Great Britain. The following is the original specification for Sir Joseph Wilson Swan's patent for the carbon process.

SWAN'S CARBON PROCESS: The Specification of the patent

From The American Carbon manual by E. Wilson, 1868

My invention relates to that manner or style of photographic printing known as carbon or pigment printing. In this style of printing, carbon or other coloring matter is fixed by the action of light passing through a negative, and impinging upon a surface composed of gelatine, or other like substance, colored with carbon or other coloring matter, and made sensitive to light by means of bichromate of potash, or bichromate of ammonia, or other chemical substance having like photographic property ; those portions of the colored and sensitive gelatinous surface which are protected from the light by the opaque or semi-opaque portions of the negative, being afterwards washed away by means of water, while the parts made insoluble by light remain, and form a print. This kind of photographic printing, although possessing the advantage of permanency, and affording the means of insuring any required tone or color for the print, has not come into general use, because of the difficulties hitherto experienced in obtaining by it delicacy of detail, and complete gradation of light and shade.

The difficulties referred to were more particularly experienced in attempts to employ paper coated with the colored gelatinous materials, and arose from the fact, that, in order to obtain half-tone, certain portions of the colored coating lying behind or at the back of the photographically-impressed portions required to be washed away, and the employment of paper in the way it has been employed hitherto, not only as a means of supporting the colored coating, but also to form ultimately the basis or groundwork of the print, obstructed the removal of the inner or back portions of the colored coating, and prevented the obtaining of half-tone.

Now, my invention consists in the formation of tissues adapted to the manner of printing referred to, and composed of, or prepared with, colored gelatinous matter, and so constructed, that while they allow, in the act of printing, free access of light to one surface of the colored gelatinous matter, they also allow free access of water, and the unobstructed removal of the non-affected portions of the colored matter, from the opposite surface, or back, in the act of developing ; and I obtain this result either by the disuse of paper altogether, or by the use of it merely as a backing or temporary support of the colored gelatinous matter ; the paper, so used, be-coming entirely detached from the colored gelatinous matter in the act of developing, and forming no part of the print ultimately.

My invention consists, furthermore, in the special mode of using the said tissues, whereby superior half-tone and definition in the print are obtained as aforesaid, and also in a mode of transferring the print, after developing, from a temporary to a permanent support, so as to obtain a correction in the position of the print in respect of right and left. In producing the photographic tissues referred to, I form a solution of gelatine, and for the purpose of imparting pliancy to the resultant tissue, I have found it advisable to add to the gelatine solution, sugar or other saccharine matter, or glycerine. To the said gelatinous solution I add carbonaceous or other coloring matter, either in a fine state of division, such as is used in water-color painting, or in the state of a solution or dye, or partly in a fine state of division, and partly in solution.

With this colored gelatinous solution I form sheets or films, as hereafter described ; and I render such sheets or films sensitive to light, either at the time of their formation, by introducing into the gelatinous compound bichromate of ammonia, or other agent of like photographic properties, or by applying to such non-sensitive sheets or films, after their formation, a solution of the bichromate, or other substances of like photographic property. This latter method I adopt when the sheet or film is not required for use immediately after its formation. I will, in my future references to the bichromate of ammonia or the bichromate-of potash, or to other chemicals possessing analogous photographic properties, de-nominate them ‘ the sensitizer;’ and in referring to the colored gelatinous solution, I will denominate this mixture ‘the tissue-com-pound.’ When the tissue to be produced is required for immediate use, I add the sensitizer to the tissue compound; but, where the tissue is required to be preserved for some time before using, I prefer to omit the sensitizer from the tissue-compound, with a view to the tissue being made sensitive to light subsequently, by the application of a solution of the sensitizer.

With respect to the composition of the tissue-compound, it will be understood by chemists, that it may be varied without materially affecting the result, by the addition or substitution of other organic matters, similarly acted upon by light, when combined with a salt of chromium, such as I have referred to. Such other organic matters are gum arabic, albumen, dextrine; and one or more of these may be employed occasionally to modify the character of the tissue-compound, but I generally prefer to make it as follows : I dissolve, by the aid of heat, two parts of gelatine, in eight parts of water, and to this solution I add one part of sugar, and as much coloring matter in a finely divided state, or in a state of solution, or both, as may be required for the production of a photographic print with a proper gradation of light and shade. The quantity required for this purpose must be regulated by the nature of the coloring matter employed, and also by the character of the negative to be used in the printing operation. Where it is desired that the coloring matter of the print should consist entirely or chiefly of carbon, I prefer to use lampblack finely ground and prepared as for water-color painting, or I use Indian-ink ; and where it is desired to modify the black, I add other coloring matter to produce the color desired. For instance, I obtain a purple black by adding to the carbon, indigo and crimson-lake, or I add to the carbon an aniline dye of a suitable color ; where the coloring matter used is not a solution or dye, but solid matter in a fine state of division, such as Indian-ink or lampblack, I diffuse such coloring matter through water, or other inert liquid capable of holding it in suspension ; and after allowing the coarser particles to subside, I add, of that portion which is held in suspension, as much as is required, to the gelatine solution. In preparing tissue to be used in printing from negatives technically known as ' weak,' I increase the proportion of coloring matter relatively to that of the tissue-compound; and I diminish it, for tissue or paper to be used in printing from negatives of an opposite character.

Having prepared the tissue-compound as before described, I proceed to use it as follows: For preparing sensitive tissue, I add to the tissue-compound more or less of the sensitizer, varying the quantity added, according to the nature of the sensitizer, and to the degree of sensitiveness to be conferred on the tissue to be produced from it. For ordinary purposes, and where the tissue-compound is made according to the formula before given, I add about one part of a saturated solution of bichromate of ammonia to ten parts of the tissue-compound; and I make this addition immediately previous to the preparation of the tissue, and I maintain the tissue-compound in the fluid state, by means of heat, during the preparation of the tissue, avoiding the use of an unnecessary degree of heat; I also filter it through fine muslin or flannel, or other suitable filtering medium, previous to use; and I perform all the operations with the tissue-compound, subsequent to the introduction of the sensitizer, in a place suitably illuminated with yellow or non-actinic light. In forming tissue upon a surface of glass, I first prepare the glass, so as to facilitate the separation of the tissue from it. For this purpose, I apply ox-gall to the surface of the glass (by means of a brush, or by immersion), and allow it to dry. The glass is then ready for coating with the tissue-compound, or I apply to the glass a coating of collodion, previous to the application of the coating of tissue-compound. In this case, the preparation with ox-gall is unnecessary. When collodion is used, the collodion may consist of about ten grains of pyroxyline in one ounce of mixture of equal parts of sulphuric ether and alcohol. I apply the collodion by pouring it on the surface to be coated, and draining off the excess, and I allow the coating of collodion to become dry before applying the coating of tissue-compound. I generally use a plane surface on which to form the tissue, but surfaces of a cylindrical or other form may sometimes be used advantageously. In preparing sheets of sensitive tissue on a plane surface of glass, I prefer to use the kind of glass known as plate, or patent plate. Before applying the sensitive tissue-compound, I set the plate to be coated, so that its upper surface lies in a horizontal position, and I heat the plate to about the same temperature as the tissue-compound, that is, generally, to about 100 degrees, Fahrenheit. The quantity of the tissue-compound that I apply to the glass varies with circumstances, but is generally about two ounces to each square foot of surface coated.

After pouring the requisite quantity of the tissue-compound upon the surface of the plate, I spread or lead the fluid by means of a glass rod or soft brush, over the entire surface, taking care to avoid the formation of air-bubbles; and I keep the surface in the horizontal position, until the solidification of the tissue-compound. In coating other than plane surfaces, I vary, in a suitable manner, the mode of applying the tissue-compound to such surfaces. In coating a cylindrical surface, I rotate the cylinder in a trough containing the tissue-compound, and after having produced a uniform coating, I remove the trough, and keep up a slow and regular rotation of the cylinder until the coating has solidified. After coating the surface of glass or other substance as described, I place it in a suitable position for rapid drying, and I accelerate this process by artificial means, such as causing a current of dry air to pass over the surface coated, or I use heat, in addition to the current of air, or I place it in a chamber containing quick-lime, chloride of calcium, or other substance of analogous desiccating property. When the tissue is dry, I separate it from the surface on which it was formed, by making an incision through the coating to the glass, around the margin of the sheet; or I cut through the cylindrical coating near the ends of the cylinder, and also cut the coating across, parallel with the axis of the cylinder, when, by lifting one corner, the whole will easily separate in a sheet. When the tissue-compound is applied over a coating of collodion, the film, produced by the collodion, and that produced by the tissue-compound, cohere, and the two films form one sheet. Sometimes, before the separation of the coating from the glass, I attach to the coating a sheet of paper, for the purpose of strengthening the tissue, and making it more easy to manipulate. I generally apply the paper, in a wet state, too. the dry gelatinous surface; and having attached the paper thereto in this manner, I allow it to dry; and I then detach the film and adherent paper from the glass, by cutting around the margin of the sheet, and lifting it off as before described. Where extreme smoothness of surface, such as is produced by moulding the tissue on glass, as described, is not of importance; and where greater facility of operation is desired, I apply a thick coating of the tissue-compound to the surface of a sheet of paper. In this case, the paper is merely used as a means of forming, and supporting temporarily, the film produced from the tissue-compound ; and such paper separates from the gelatinous coating in a subsequent stage of my process. In coating a surface of paper with the sensitive tissue-compound, I apply the sheet, sometimes of considerable length, to the surface of the tissue-compound contained in a trough, and kept fluid by means of heat, and I draw or raise the sheet or length of paper off the surface with a regular motion ; and I some-times apply more than one coating to the same sheet in this manner. After such coating, I place the coated paper where it will quickly dry, and seclude it from injurious light.

The sensitive tissue, prepared as before described, is, when dry, ready to receive the photographic impression, by exposure under a negative in the usual manner, or by exposure in a camera obscura, to light transmitted through a negative in the manner usual in printing by means of a camera. I prefer to use the sensitive tissue within two days of the time of its preparation. Where the tissue is not required for immediate use, I omit the sensitizer from the tissue-compound as before mentioned ; and with this non-sensitive tissue-compound, I coat paper, glass, or other surface, as described in the preparation of the sensitive tissue or paper. In preparing sheets of non-sensitive tissue by means of glass, as described, I use no preliminary coating of collodion. I dry the non-sensitive tissue in the same manner as the sensitive, except that in the case of the non-sensitive tissue, seclusion from daylight is not necessary.

The non-sensitive tissue is made sensitive, when required for use, by floating the gelatinous surface upon a solution of the sensitizer, and the sensitizer that I prefer to use for this purpose is an aqueous solution of the bichromate of potash containing about two and a half per cent, of this salt. I apply the sensitizer (by floating or otherwise), to the gelatinous surface of the tissue; and after this, I place it in a suitable position for drying, and exclude it from injurious light.

In applying to photographic printing the various modifications of the sensitive tissue, prepared as before described, I place the sensitive tissue on a negative in an ordinary photographic printing-frame, and expose to light in the manner usual in photographic printing; or I place it in a camera obscura in the manner usual in printing by means of a camera obscura. When the tissue employed is coated with a film of collodion on one side, I place the collodionized side in contact with the negative; or where it is used in the camera, I place the collodionized side towards the light passing through the camera lens. Where the tissue is not coated with collodion, and where paper forms one of the surfaces of the tissue, the other surface being formed of a coating or film of the tissue-compound, I place this last-named surface in contact with the negative; or, when using it in the camera, I present this surface towards the light transmitted by the lens. After exposure for the requisite time, I take the tissue from the printing-frame or camera, and mount it in the manner hereinafter described, that is to say, I cement the tissue, with its exposed surface, or, in other words, with that surface which has received the photographic impression, downward, upon some surface (usually of paper) to serve temporarily as a support during the subsequent operation of developing, and with a view to the transfer of the print, after development, to another surface; or I cement it (also with the exposed or photographically impressed surface downward), upon the surface to which it is to remain permanently attached. The surface, on which it is so mounted, may be paper, card, glass, porcelain, enamel, &c. Where the tissue has not been coated with collodion previous to exposure to light, I prefer to coat it with collodion on the exposed or photographically impressed side, before mounting it for development, but this is not absolutely necessary; and I sometimes omit the coating with collodion, more particularly where the print is intended to be colored subsequently. Or where I employ collodion, with a view to connect the minute and isolated points of the print firmly together during development, I sometimes ultimately remove the film it forms, by means of a mixture of ether and alcohol, after the picture has been finally mounted, and the support of the film of collodion is no longer required. In mounting the exposed tissue or paper previous to development, in the temporary manner, with a view to subsequent transfer to another surface, I employ, in the mounting, a cement that is insoluble in the water used in the developing operation, but that can be dissolved afterwards, by the application of a suitable solvent; or one that possesses so little tenacity, that the paper or other support, attached temporarily to the tissue or paper by its means, may be subsequently detached without the use of a solvent.

The cements that may be used for temporary mounting are very various, but I generally prefer to use a solution of India-rubber, in benzole or other solvent, containing about six grains of India-rubber in each ounce of the solvent, and I sometimes add to the India-rubber solution a small proportion of dammar-gum, or gutta-percha. In using this cement, I float the photographically impressed surface of the tissue upon it, and I treat, in a similar manner, the paper or other surface intended to be used as the temporary mount or support during development; and, after allowing the benzole or other solvent to evaporate, and while the surfaces coated with the cement are still tacky, I press them strongly together in such a manner as to cause them to cohere.

When the photographically impressed, but still undeveloped tissue is to be cemented to a surface, that not only serves to support the picture during its development, but also constitutes permanently the basis of the picture, I prefer to use albumen or starch paste as the cementing medium; and where I employ albumen I coagulate or render it insoluble in water (by means of heat, by alcohol, or other means), after performing the cementing operation, and previous to developing. In the permanent, as in the temporary mode of mounting, I cement the tissue, with its photographically impressed surface downwards, upon the surface to which it is to be permanently attached. After mounting the tissue, as before described, and allowing the cement used time to dry, where it is of such a nature us to require it, I then submit the mounted tissue to the action of water, sufficiently heated to cause the solution and removal of those portions of the colored gelatinous matter of the tissue which have not been rendered insoluble by the action of light during exposure in the printing-frame or camera. Where paper has been used as a part of the original tissue ; this paper soon becomes detached by the action of the warm water, which then has free access to the under stratum or back of the colored gelatinous coating, and the soluble portions of it are therefore readily removed by the action of the water; and by this means the impression is developed that was produced by the action of light during the exposure of the tissue in the printing-frame or camera, and the picture remains attached to the mount, cemented to the photographically impressed surface previous to development. I allow the water to act upon the prints during several hours, so as to dissolve out the decomposed bichromate as far as possible. I then remove them from the water, and allow them to dry, and those not intended for transfer, but that have been permanently attached to paper, previous to development, I finish by pressing and trimming in the usual manner. Those which have been temporarily mounted, I transfer to paper, card, or other surface. In transferring to paper or card, I coat the surface of the print with gelatine, gum arabic, or other cement of similar character, and allow it to dry. I then trim the print to the proper shape and size, and place its surface in contact with the piece of paper or card to which the transfer is to be effected, such piece of paper or card having been previously moistened with water, and I press the print and mount strongly together ; and, after the paper or card has become perfectly dry, I remove the paper or other supporting material, temporarily attached, previous to development, either by simply tearing it off, where the cement used in the temporary mounting is of a nature to allow of this without injury to the print, or I apply to the temporary mount, benzole or turpentine, or other solvent of the cement employed, or I immerse the print in such solvent, and then detach the temporary mount, find so expose the reverse surface of the print; and, after removing from the surface of the print, by means of a suitable solvent, any remains of the cement used in the temporary mounting, I finish the print by pressing in the usual manner. If, however, the print be collodionized, and be required to be tinted with water-color, I prefer to remove the collodion film from the surface of the print, and this I do by the application of ether and alcohol.

Having now set forth the nature of my invention of ' Improve-ments in Photography,' and explained the manner of carrying the same into effect, I wish it to be understood, that under the above in part recited letters-patent, I claim: First, the preparation and use of colored gelatinous tissues in the manner and for the purpose above described. Secondly, the mounting of undeveloped prints, obtained by the use of colored gelatinous tissues, in the manner and for the purpose above described.

Thirdly, the re-transfer of developed prints, produced, as above described, from a temporary to a permanent support."

END

About the Author

I built my first darkroom in 1960. That year I also enlisted in the United States Marine Corps, where I followed up my new found interest in Navy and Marine base hobby centers, which were equipped with the most modern and up-to-date equipment. My skills advanced to the point where I was hired as an instructor and lab assistant in the base hobby photographic center at Marine Corps Airbase Futenma Okinawa. I was a helicopter mechanic, but since the base did not have an assigned photographer, I did double-duty taking grip-and-grin pictures with a SpeedGraphic of officers receiving a promotion — usually standing in front of their chopper gripping the Colonel's hand, and grinning like a cat.

Fig 45. Dick and Melody leaving for dinner at Birr Castle, Ireland.

The dinner was hosted by Lord Rosse who sponsored a conference on Victorian Women Photographers. Dress was 1870's formal. Dick is the one in the silk top hat. Photo by Terry King FRPS

By the time I received my discharge in 1964, the photography passion had a total grip on me. I married the lovely Melody Bostick in 1966 and we bought a house two years later, where I converted a 4 x 6 foot pantry into a darkroom. I became interested in historic processes after I had bought one volume of a multivolume encyclopedia of photography at a garage sale, for a dime. It was volume E-F-G. I made a gum print from a half -page description. It was pretty good for a first try!

In 1973, I started attending the Master Class program at UCLA. It was an incredible program — and among those I was able to study with was: Bob Heineken, Edmund Teske, Garry Winogrand, and Leland Rice.

While at UCLA, I met Joan Myers and we struck up a friendship that has lasted now into its third decade. I taught her to make gum prints, but Joan eventually started making platinum prints. Her new and more elite interest rubbed off on me, so I decided to make my own platinum salts to save money. Long story short: in 1980, was born Bostick & Sullivan which has been in business now for over a quarter of a century.

In 2000, I was elected to a Fellowship in the Royal Photographic Society of Great Britain, and in 2002 I was elected to an Honorary Fellowship.

In 2001, after Sandy King's lecture at our Alternative Photographic International Symposium on carbon printing, I got hooked on the carbon process. After a number of years of dedicated research, Bostick & Sullivan is producing high-quality carbon tissue.

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Fig 46. Carbon print, Hisun Wong, Shanghai China. Print made by Ataraxia