PHOTOGRAPHIC LIGHTING EQUIPMENT

A Comprehensive Guide for Digital Photographers

Kirk Tuck

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ABOUT THE AUTHOR

Kirk Tuck is a corporate advertising photographer working in Austin, TX. His recent clients have included IBM, AMD, Dell, Freescale Semiconductor, Cerilliant Systems, Time Warner, Texas Gas Services, *Tribeza* magazine, *SC* magazine, Motorola, Salient Systems, and many others. Before diving into photography, Tuck was a creative director for a regional advertising agency where he won numerous industry awards for writing, television commercials, and print advertising. A former specialist lecturer at the University of Texas at Austin, College of Fine Arts, he currently serves on the advisory board for the Austin Community College photo department. Tuck teaches lighting and photography classes across the country.

Kirk Tuck is the author of *Minimalist Lighting: Professional Techniques for Location Photography, Minimalist Lighting: Professional Techniques for Studio Photography,* and, most recently, *The Commercial Photography Handbook.* He was also the photographer for the bestselling cookbook, *Creative Mexican Cooking,* by Anne Lindsay Greer.

Tuck writes extensively on the subject of commercial photography at www.visualsciencelab.blogspot.com.

When he is not writing books or blogs or photographing, you can find him in the Rollingwood Pool with the competitive swimmers on the Weiss and Weiss Aquatics Masters Team.

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1. THE EVOLUTION OF PHOTOGRAPHIC LIGHTING

Photography predates electric lighting. Think about that for a minute. Early photographers never had the option of plugging in a lamp and shooting after dark. It sure made for a shorter work day, but it made life tough for photographers to get results under any but the most optimal circumstances. Early films were so slow that they required exposures of up to a minute in full sunlight. Companies soon marketed chairs with neck braces attached so that photographers could try to make sure their clients didn't move during the long exposures. Many hand-coated film plates were ruined by unavoidable blinks and even body movements caused by breathing!

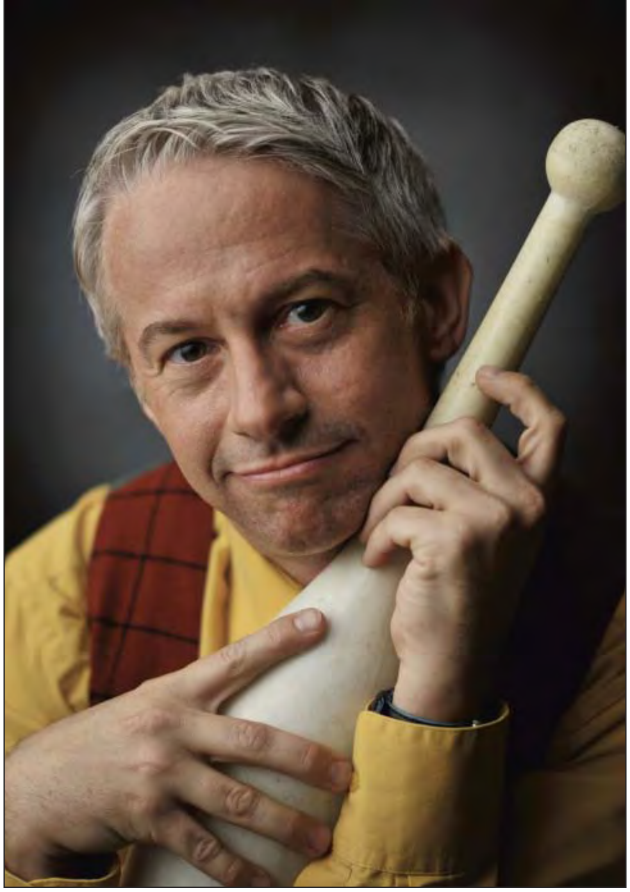
Above—A kids' track meet. Late-afternoon sky. The sun was modified by clouds low on the horizon, yielding beautiful light and just the right color temperature. I think most lit photographs are an attempt to emulate what we see all the time in nature. Cameras just need more help than our eyes.

FLASH POWDER

Photographers developed two strategies for dealing with the lack of light. They found ways to cope with long exposures and looked to artificial light sources. One early light source was called "flash powder." It was made of granulated potassium permanganate or ammonium nitrate and finely ground magnesium. It seems that most early photographers developed their own mixture, but one thing was true in every case: the mixture was extremely flammable, could be explosive, and the brighter it burned the more smoke it gave off.

Here's the way photographers (brave souls) used flash powder: First they would have to test the mixture, the distance from the subject to the flash powder, and the particular batch of hand-coated film they intended to use. Once they got a good idea of the right exposure based on their tests, they could move on to real subjects. All the cameras of the era were basically view cameras, so the photographer would evaluate the scene through the lens onto the dark, ground glass of the camera, focusing and composing on a very dim image. He would then close the shutter, stop down the aperture of the camera to his "pre-tested" f-stop, and put in a film plate. He would then pull the dark slide so that the film was open to the lens.

At this point, the photographer (or his unlucky assistant) would measure out a very exact portion of flash powder onto an elevated platform. When everything was set, the photographer and his assistant did a



Left—Once you master the basic lighting concepts, you'll be able to light quickly and spend the bulk of your energy building rapport with your subject. Rob Williams for Zachary Scott Theater. **Right**—Emotion in a shot trumps technical perfection. Doing both well makes your work good. Espy for Zachary Scott Theater.

precise little dance. As the photographer opened the shutter (generally a time exposure), the assistant would strike a flint or sparking device that would set off the flash powder. If everyone was lucky, all the people in the room would be blinded for a few moments by the flash. If they were unlucky, someone would be rushing to find water buckets with which to extinguish the fire.

The flash wasn't the quick $1/1000$ second that we've come to expect from modern electronic flashes. It had a burn time that, depending on the consistency of the powder, could last for up to a full second. But the purpose of these flashes was purely raw illumination. Early photographers didn't have the luxury of flashes that would freeze motion entirely. In fact, the 19th-century shutters were not even synchronized!

Pity the photographer doing early flash photography, as he usually only got to make one shot. No one wanted to wait around for a second experience after the uncomfortable brightness and a room full of acrid smoke.

PHOTO FLOODS

But things got better. Edison got to work on electricity and lightbulbs, and in just a few decades the movie industry got their hands on big, fat, high-output lights that, when coupled with advances in the speed of film, were able to be used reliably in most situations. The first large bulbs were called "photo floods," and if you shop carefully, you may still be able to find them for sale today. A cottage industry soon grew up, designing and making reflectors and holders for the lights. They were hot, did not last long (six to eight hours, at best), and weren't nearly as powerful as the newer generations of continuous lights coming onto the market.

Movie studios needed lights that were bright enough to fill in or compete with sunlight in order to tone down the high contrast of early movie film stock and soon figured out how to put carbon arc lights into artistic service. With technology "perfected" in the last quarter of the 19th century, inventors had figured out that if one applied current to two carbon electrodes in close contact, they would spark. If enough current was supplied and the electrodes were moved away from each other, creating an arc, the ionization and heat would create an incandescence that would give off a tremendous amount of light. Here's the catch: the carbon rods used as electrodes burned down during the process, and this affected the distance of the gap. Many methods were invented to keep the gap in stasis, including solenoid motors that were actually controlled by the rising and falling resistance of the electrodes as they got closer or farther away from each other. No wonder well-trained crews were needed to make the lighting on early projects.

Fortunately, film kept evolving quickly and photographers settled on a range of high-quality photo floods with a myriad of well-designed socket and reflector fixtures for decades. While photography continued to evolve, the next revolution in lighting had to wait until around 1930. It was the introduction of the flashbulb.

FLASHBULBS

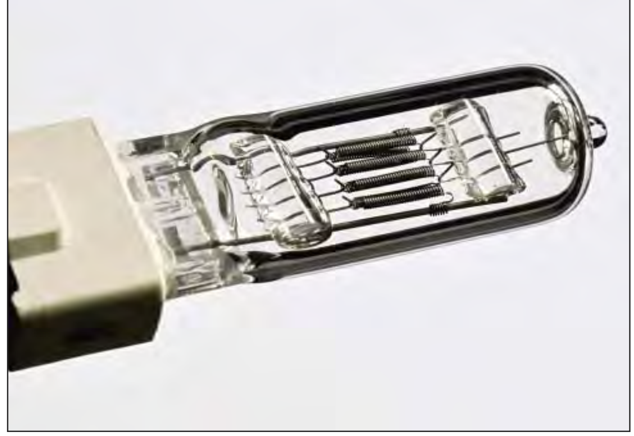
Flashbulbs were a convenient adaptation of flash powder made reliable and (relatively) safe. Most were made of thin, spun wires of magnesium, coated with a highly flammable primer and totally enclosed in a glass bulb. Flashbulbs came in many different sizes, depending on how much power a photographer needed and what sort of burn time could be tolerated. With faster films and reliable flash, the only remaining necessity was the ability to synchronize the time of the flash with the travel of the camera's shutter. Within a few years of the flashbulb's widespread adaptation, most cameras came equipped with synchronizing shutters. When the shutter hit the position where it was fully open, it would trigger a circuit that ignited the flashbulb.

A cool variation of the simple synchronization was focal plane (FP) flash sync. In some ways, the introduction of FP flashbulbs was an attempt to make lemonade out of lemons. Flashbulbs took a certain amount of time to ignite and start burning. The ramp up time was quick but not as fast as the flash from today's electronic flashes. The longer burning time of some flashbulbs meant that they could start burning and continue emitting steady light through shorter shutter speeds than the fastest shutter speed needed to hit full sync. In early focal plane shutter cameras, the sync speed (the shutter speed at which both shutter curtains fully expose the film to light) was around 1⁄50 second. With an instantaneous flash, any faster shutter speed would only expose a part of the frame at a time. That caused a dark band on part of the film where no light struck. The faster exposure meant that less and less real estate on film was exposed by flash.

Camera makers and flashbulb manufacturers used the long burn time of FP bulbs to their advantage. If they started the triggering process of the flashbulb before the shutter started to open, it would reach its optimum brightness as the shutter started to travel. If the sustained burn time was long enough, the flash would continue to burn during the entire time the shutter traveled, thereby exposing the entire frame of film evenly with the flash's light. While it didn't do a good job freezing action, the FP bulb was a great solution for proper illumination as well as early fill flash. In fact, this method is similar to that used by Canon and Nikon's modern flashes when set to FP TTL.

Other flashbulbs gave quicker flash durations with quicker ramp up times and quicker decay times. They were used on focal plane cameras extensively but were optimally used on leaf shutter cameras, which can efficiently synchronize at all shutter speeds (the shutter opens to expose the entire frame at every speed).

For the first time, flashbulb technology made instantaneous exposures on location, in any lighting condition, possible for photographers at every level of proficiency. Bulbs were generally matched to reflectors, and "guide numbers" were given for the combinations. Photographers didn't have access to flash meters or any sort of flash control, so they were required to take the guide numbers and translate them into the right f-stop for a given distance and film sensitivity rating. It made several generations of photog-



Above—One small tungsten-halogen bulb can generate a lot of light and an even greater amount of heat. Nearly 90 percent of its spectral radiation is in the infrared band. You can certainly understand why they call these "hot lights."

raphers quick at simple math. And it was important to get it right routinely because each flashbulb was a "one time use" light source. Once the bulb burned up its fuel it was discarded and a new one was plugged in. So much for the idea of "motor driving" one's way through a photo shoot.

Flashbulbs were very cool in that they moved photography out of the studios and into real-life situations like nightclubs, homes, and social events. As cool as they were, they were also quite hot. Many a finger, shag carpet, or fine piece of upholstery was burned or singed by the heat of a newly discarded flashbulb.

TUNGSTEN-HALOGEN BULBS

But continuous lighting didn't stand still. Lightbulb manufacturers went to work on two of the weak points of lightbulbs: they burned out too quickly and, as they burned out, they deposited carbon residue on the inside glass walls of the bulb, causing the color temperature to get lower and lower as the bulb was used up. The science guys realized that they could use a tungsten filament inside a quartz envelope, filled with halogen gas. The bulbs could burn hotter than conventional bulbs, and that was a benefit because the high temperature, in combination with the halogen gas, would keep residue off the sides of the glass envelope and continually redeposit the residue onto the filament. The result was bulbs that burned longer (the filament didn't deteriorate as quickly), burned at a constant color temperature (no residue on the envelope walls), and, an added bonus, they could be made in smaller packages than traditional incandescents.

The new bulbs were great for movie makers who needed consistent light output and color. And anything that was good for movie film was also good for still photographs. In fact, many of the film emulsions were identical in the two industries. This kept prices down for both camps.

A FLASH OF BRILLIANCE

In the meantime, a brilliant scientist at MIT, Dr. H. E. Edgerton, was working on a little project that would revolutionize the world of lighting. He learned that by using a glass tube filled with xenon gas he could create a powerful and short flash of light that was repeatable. He placed electrodes at either end of a tube filled with the gas and applied a current to the tube to make the gas receptive to ionization. In that