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Axial Lighting for Macro-Photography

By Sandy Weiss, BCEP, PI

This feature provides step-by-step instructions for assembling a homemade axial lighting apparatus to make the photography of small shiny subjects much easier than by conventional means.

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Feature

Axial Lighting for Macro-Photography

By Sandy Weiss, BCEP, PI

Background:

Macro is the type of photography encompassing close-up work where the finished magnification of the image of the subject is anywhere from about .5 times (X) to 25 X life size on film. This type of photography is used for documenting small things, or small aspects of larger things requiring close inspection or ease of demonstration. This discipline fits the niche between "normal" and "micro" photography.

Most photographers with a minimum of special accessories and training can take good macro-photographs, as long as the subject is simple, lighting is sufficient, extreme depth-of-field is not necessary, and high magnification is not required. Anyone who has undertaken macro work for evidence photography however, has probably learned that all the above parameters for "simple" subjects don't normally exist in practice. We don't often need to photograph insects and wildflowers where pretty colors and textures make even the most rudimentary attempts at macro-photography appear spectacular. We are often required to capture the non-aesthetically pleasing images of small scratches and other witness marks on shiny surfaces or in hard to get at locations where reflections are common and shadows from nearby aspects of the object are troublesome. In this type of situation, axial lighting can be a useful tool.

There are many ways to light macro-subjects for proper exposure. The only thing all the lighting formulas have in common is they either cause light to bounce off or pass through the surface of the subject. In either case, the light must be controlled to achieve proper exposure and supply the photographer with the desired image. Axial lighting provides illumination to the subject from the same axis as the lens of the camera. This is useful when photographing highly reflective surfaces and/or small objects with a high relief to size ratio. Other types of lighting could cause a larger amount of unwanted reflections or shadows on parts of the subject, causing a need for extra exposures to be taken and displayed before all aspects of the subject can be viewed. Due to the low contrast of axial lighting, (the relative absence of highlights and shadows), it provides not only greater latitude for exposure errors but also relative ease of reproduction and analysis of the resultant images.

This shell casing is easy to photograph with any type lighting. However, the oblique lighting commonly used for this type of work will show surface landmarks, but will also leave some relief aspects in total shadow.

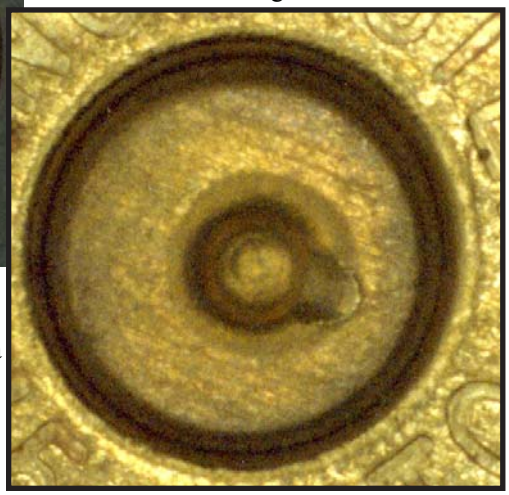
Axial lighting done properly, will allow both the surface characteristics and the detail of the lower surfaces of the indentations to be captured in the same image.

How-To:

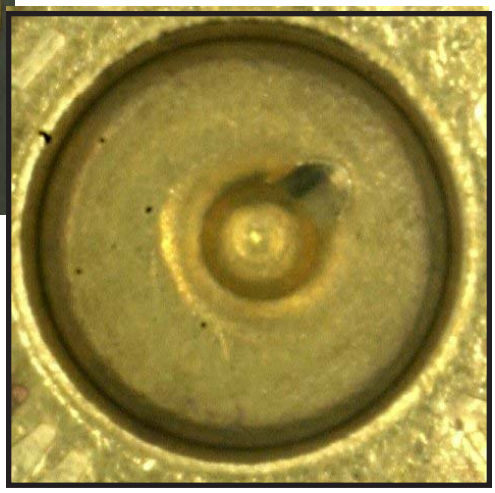
Whatever the use, macro-photography presents two major challenges: one is the shallowness of the depth of field a lens provides when it is very close to the subject, as it will be when shooting at magnification, and the other is the difficulty encountered in lighting a macro-subject properly. Figuring out how to overcome these challenges is the major hurdle in macro-photography.

It is a rule of optics, that the higher the magnification endeavored, the shallower the depth-of-field will be. Photographs taken at magnifications of 1X and above will, even when exposed at very small apertures, have depth-of-field measuring in millimeters or parts of millimeters. It is often necessary, to capture the requisite detail on shiny objects, to position them at an oblique camera-to-subject angle, and use the exposure illumination to highlight the

desired details. This method can be practical, but the oblique angle can both create unwanted shadows and, due to limitations of depth-of-field, leave the subject partially out of focus. Axial lighting allows exposure of shiny subjects, arranged in a parallel plane to the light-receptive material of the camera, without the problem of resultant specular highlights.



This image was taken with the axial lighting apparatus described in this article using an Olympus OM-2 with a 90mm macro lens, a Vivitar 283 flash and Kodak 400 speed film. Notice the lack of shadows at the base of the shell casing. Also notice the lack of shadows and highlights on the subject surface.



This image was taken with this apparatus and a Nikon D1-X with a 60mm macro lens and a Vivitar 283 flash. The camera was set at its lowest ISO, f36 and a shutter speed of 1/400 of a second. The flash was set at auto and the purple range. The variable power module on the flash was inadequate to make the flash small enough so I used the automatic. Make sure to leave the flash far enough outside the apparatus so the sensor can register the reflected light.

No matter how sophisticated the camera, trial and error is still the best way to determine the proper exposure settings for this type of work. Take an educated guess for a starting point and bracket both directions. Enlarging lenses work well on a bellows for macro photography lenses if the proper adapters can be found. The physically smaller size of the enlarging lens, when compared to a macro-lens, allows the lens to be closer to the subject, while still allowing working room for the photographer while providing the same or even more magnification than a macro lens. It can also be possible to provide additional lens-to-subject working distance by using longer enlarging lenses while retaining adequate magnification. Most photographers already have long focal length enlarging lenses on hand, while long focal length macro lenses can be very expensive to purchase. Remember to factor for extra exposure when using a bellows or tube extension as a part of your close up equipment. The further the lens is extended from the camera, the more light the system needs for adequate exposure.

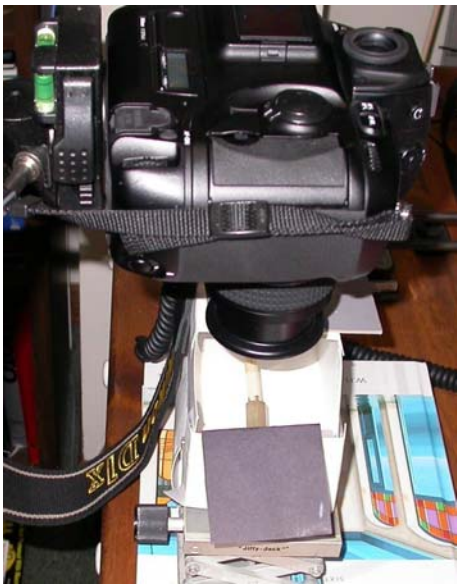
There is a commercially made axial-lighting apparatus on the market manufactured by SIAX. Their website is) http://www.dcmsistemes.com/siaxi.html. The SIAX apparatus is nice but has 2 drawbacks. First, it requires electricity for illumination. Second, it is not easily portable. The apparatus you can build by using the instructions on the following pages uses any detachable flash for illumination and it can be disassembled an infinite number of times, folded flat and put into a field-kit for ease of portability.

I have used the pictured apparatus for both film and digital imagine. It works well for either. My obvious choice for this work though is definitely digital. It is very reassuring to take a test exposure, remove the Compact Flash Card from the camera, put it into the card reader attached to the computer and look at the test exposure in a graphics program. Any number of adjustments can be made immediately and then try again.

In my last assignment using this apparatus, I was asked to document the fine scratches on the sides of some brass shell casings. I would normally bend a paperclip to create

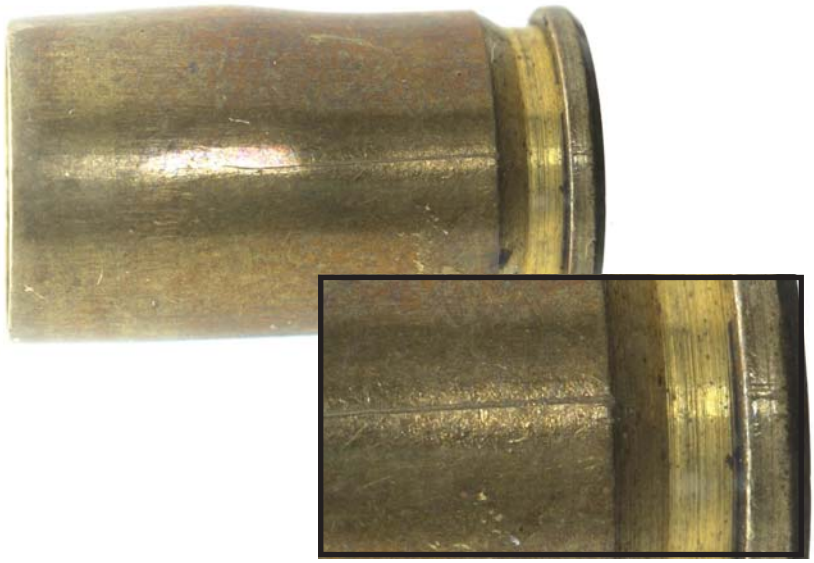
Notice the dowel rod supporting the shell casing. It is loosely taped to the top of the electronic flash, in order to make it easy to revolve the casing under the lens. Also notice the seperation between the flash and the base of the apparatus. Keeping the flash back a few inches allows enough bounced light to make it back to the sensor and turn off the flash after an very small exposure. If the flash were slid forward into the light tunnel, the flash would fire as if on manual each time, severely over-exposing the subject. I place a small gray card on top of the light tunnel to concentrate the light. It may also be necessary to use an umbrella over the camera when photographing very shiny subjects to eliminate refelections from the ambient illumination.

a cradle to hold the casing under the lens. In this case, the project manager wanted the entire circumference of the casing documented. I handled this challenge by purchasing a wooden dowel slightly smaller in outside diameter than the inside diameter of the casing. I marked the dowel in 45 degree increments, and inserted it into the casing. You can see from the photo that I then taped the dowel to the top of the flash. I left the tape loose enough to allow rotation of the dowel between exposures.



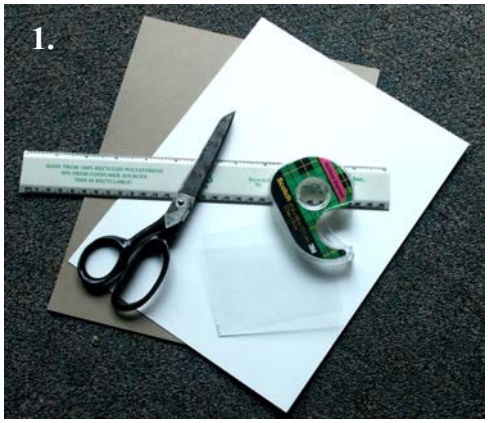
After determining the proper exposure for this subject, it was very simple and quick to make exposures of the entire circumference. Details of one of the the resultant exposures can be seen below. I routinely bend a small piece of black paper and hang it over the end of the apparatus. The black end wall raises the contrast of the resultant images by at least one full f-stop. Removing the black paper creates the lowest possible contrast images due to back-flash reflections from the source flash.

I used a tripod for this assignment so the resultant images could all be assembled into a montage if desired, with a minimum of variance in the images. A tripod is totally unnecessary though in normal use, due to the shortness of exposure delivered by the electronic flash.

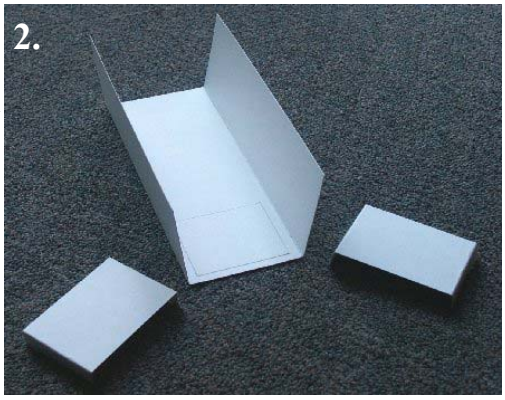


It may appear that the only subjects I photograph with this apparatus are shell casings. However, that is far from the truth. It is wonderful for small electronic circuits, screws, bolts, nuts, bearings, gears, and any other small shiny objects with high relief. I have often been asked how to use this technology for larger subjects. The simple answer is, buy bigger glass and use bigger cardboard.

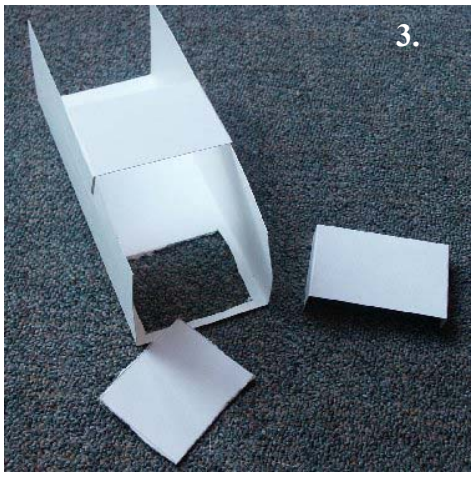
To build this apparatus, follow these simple steps;



Supplies needed:
2 sheets of thin 8 ½ X 11 cardboard
Scissors (and razor knife if available)
Ruler
Tape
A piece of thin glass (Kodak projector slide cover glass 3 ¼ X 4 (Cat. No. 140 2130) works perfectly)

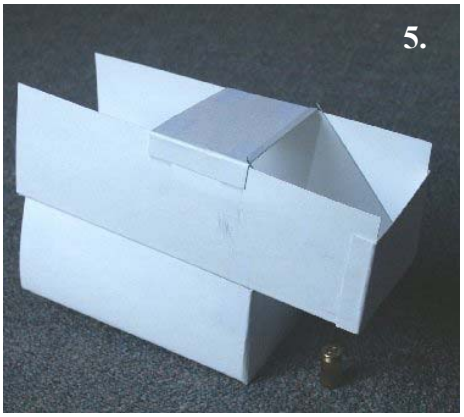


Measure and cut a strip 2 ¼ X 8 ½ off the narrow side of one of the 8 ½ X 11 cardboards.
Fold the remaining 8 ½ X 8 ¾ sheet into 3 sections. 2 ¾ X 3 ¼ X 2 ¾ X 8 ½.
Mark a rectangle on the 3 ¼ inch section, 2 ¼ X 2 3/4, ¼ inch from the end
Cut and remove the section.
Cut the 2 ¼ X 8 ½ section in half on the long end.
Fold up edges of the 2 small pieces ½ inch from either end.



Tape one small section on the end of the channel with the cutout.
Tape the other section on top of the channel, 2 ¾ inches from the end with the cutout.

Put the glass into the channel and it will be at a 45-degree angle over the cutout when nestled into the front guide and supported by the upper guide.



Assemble a base by taking a full 8 ½ X 11 sheet and measuring 2 ½ then 3 then 2 ½ and then 3 inch divisions on the board.
Cut 4 slits along the measured lines, 2 ½ inches into the board.
Fold along lines into a rectangular box. Fold in and tape the flaps.
Tape channel to box as shown.
See people actually making these units in the photos on page 17!