

INEXPENSIVE SLIDE COPIER

Mark Seng

Color slides exemplify a technological development almost everyone appreciates. The slide duplicator described here, which can be quickly made in a few hours at low cost, will enable you to copy any commercial or other slide or filmstrip at home. This self-storing slide copier can be used to copy, to correct displeasing color balance, zoom in on details, or convert a series of slides to filmstrips by using a filmstrip camera in place of the 35mm SLR camera typically used.

For example, pictures often have to be taken under fluorescent lighting producing incorrect color balance that is especially annoying where people have been photographed. A color filter or two behind the slide when being copied will correct the color balance at the same time an under or overexposed slide is corrected. Watching color slides projected from a trip to South American ruins, one teacher observed a small lizard on a rock in the foreground. She was able to zero in on it, enlarging this inconspicuous detail to a full slide that fascinated her Spanish students. The popularity of individualized instruction has re-awakened interest in filmstrips where sequencing and storage are potent advantages. With a filmstrip camera, slides can be copied and converted into filmstrips.

Requirements for Making Slide Copies

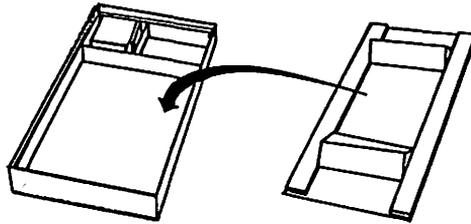
To copy a slide it is necessary to secure both the 35mm adjustable camera and the slide exactly parallel. Second, one must be able to focus the camera one to one (1:1).

Third, the slide must be illuminated by a light compatible with the slide film used. Finally, the slide must be backlighted with a simple flashlight to allow focusing. This slide copier meets these requirements and can be built quickly and inexpensively using any inexpensive, garage sale variety electronic flash.

Slide Copier Construction

Cut the black (on one side) cardboard to the specified sizes (see fig 4). An inexpensive carpenter's framing square ensures cutting the box square. Cut all dotted lines half-way through to facilitate folding. Use epoxy or white glue to fasten the parts. Five minute epoxy works well for gluing the yardstick pieces and for reinforcing corners. Fold two three by five cards lengthwise. Place the folded cards between two

SLIDE COPIER IS SELF-STORING



BOX HAS COMPARTMENT 3 by 5 CARDS
TO FIT FLASH ALIGN YARDSTICKS

Figure 1

long $13 \frac{7}{8}$ " yardstick pieces to ensure the yardsticks are glued exactly parallel to serve as guides for the camera mount, masonite board. (Fig 1) Next, tape two five inch pieces next to the long $13 \frac{7}{8}$ " yardsticks just glued to the base. These two short pieces, each touching a long stick, occupy the position they will have when the masonite camera stand is glued to them. Apply epoxy to the top of the short pieces only. Place the $\frac{1}{4}$ x 5" x $7 \frac{1}{4}$ " masonite camera mount on top of the short pieces, weighing it slightly with a book. This procedure makes sure the camera stand and camera will slide evenly back and forth without wobble, moving the camera closer to the slide being copied along the same axis.

Attach the 5" flash guide rails to the other end of the base watching that: 1) the two pieces are parallel and touch the $9 \frac{1}{2}$ " flash extension yardstick, and 2) the ends of the two sticks in the middle of the base are exactly even. See fig 3. The light box butts against these stick ends, locating the slide precisely parallel to the camera. If the slide is not parallel, part of the image will be out of focus.

Fold the light box and tape or glue the "flashed white opal glass or white plastic to form the front (see fig 3). Note that the white part of the opal glass lies outside the box. Glass stores sometimes carry this glass which is clear glass with a white coating on one side only. Reinforce the light box joints if desired with cloth or nylon net. This light box folds flat for storage in the box with all other parts. For a slide holder card use honeywell epoxy metal slide clips. If these Honeywell clips are not available, cut four pieces of cardboard $\frac{1}{2}$ inch by 2 inches long. Glue one above and below the slide to be copied to locate the slide each time in the same place. Next, glue another cardboard to each but overlapping the edge to prevent the slide falling out (fig 2).

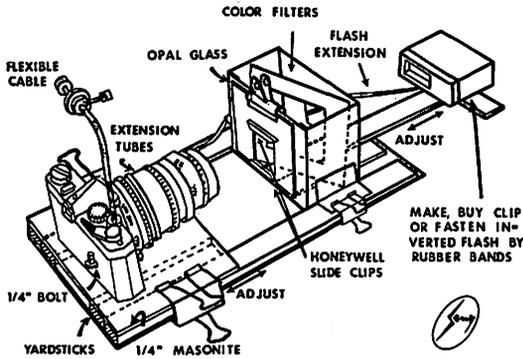


Figure 2

Flash Selection and Mounting (see fig 2)

Any electronic flash which provides adequate consistent light, will work. Because of the low light requirements, small units prove more desirable because they allow self-storage in the box. Next inspect the flash mount on your camera and fabricate a similar metal clip, perhaps of aluminum, to mount the flash unit to its crossbar. One may also secure the inverted flash to the crossbar with rubber bands using slide boxes to raise the flash to allow the light to strike the slide to be copied. (A couple of wires soldered to the battery clips will allow you to use larger batteries if desired rather than the tiny ones inside the flash.)

Utilization

Back light the slide with a flashlight or high intensity lamp with no filters. Select a normal slide containing skin tones, the most critical element. Use Kodak 64 slide film because it will usually require no filtration in contrast to other films. Using extension tubes, a macro lens, a reversing ring or a plus 20 close-up lens, focus the camera to achieve a full copy of the slide. Your first experience may produce slides with

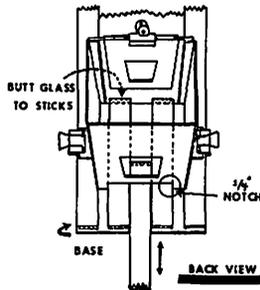


Figure 3

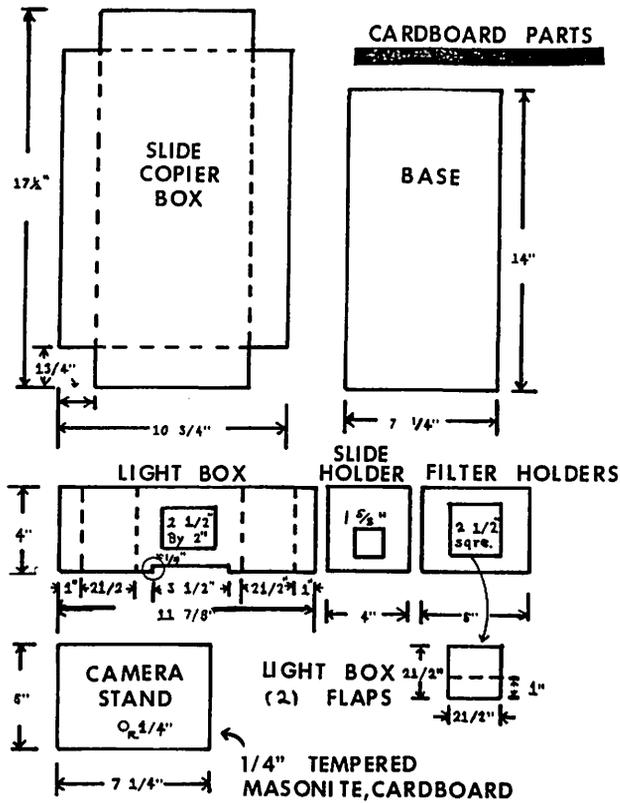


Figure 4

black borders indicating you had not moved the camera close enough. If desired, open the camera back and use a piece of frosted glass, invisible Scotch tape, or frosted acetate to observe the image with camera lens locked open, using a locking, flexible cable. Then set the camera at 1/30th, "X" for flash, and shoot a series of trial slides at various f stops, and the marked flash extension at various distances. Keep a record of exposures.

Color Correction

Mount colored cellophane, brown for example, in the cardboard frames. Or, buy Kodak "Color Compensating Filters," mounted in the same way. Because of the design of this slide copier, the filter is not in the optical path, allowing use of non-critical materials like cellophane. View the slide to be color-corrected through the filter to ascertain a starting point. Keep a log book for future reference.

Closing Comments

Contrary to conventional wisdom, the best lens opening is one or two stops from wide open. However, smaller f stops tolerate greater error by allowing greater depth of field. The adjustable flash location of this design permits you to select optimum lens aperture compensating by moving the flash farther from the slide.

MATERIALS NEEDED

Yardstick Pieces

Number	Size	Function
4	13 $\frac{7}{8}$ "	Camera tracks, box supports
5	5"	Camera guides, flash holder guides, flash crossbar
1	9 $\frac{1}{2}$ "	Flash extension rail
3	6 $\frac{7}{8}$ "	Box cross braces
1	3 $\frac{1}{2}$ "	Flash storage compartment, cut to fit

Miscellaneous Parts

Opal Glass 4" by 5" (Temporary substitution is white plastic)	Forms one side of light box with cardboard slide holder clipped to it. Order from: Edmund Scientific, Edscorp Bldg., Barrington, NJ 08007 Part number 2149, \$2.15 + \$1.30.
Frosted glass	For precise focusing. Edmund #30456 85¢, if ordered wth opal glass.
Electronic Flash	Use any cheap, small flash
Bolt, camera	$\frac{1}{4}$ " by $\frac{1}{2}$ " round head, or Allen screw
Slide clips	Honeywell makes them to reinforce slides but are used here to accept slide
Flexible Shutter cable	prevents camera movement
Color filters 5" epoxy	correct color imbalance
Study lamp, flashlight	For focusing first slide only (backlight)
Cardboard	Use a heavy weight poster board, black on one side. Use black side to eliminate light scatter on outside of light box, surface facing camera lens.
Camera stand	$\frac{1}{4}$ " x 5" x 7 $\frac{1}{4}$ " masonite
Mark Seng, Professor, University of Texas, Austin, Texas. 78712.	