A DEVICE FOR RAPID PRESENTATION OF MONOCHROMATIC STIMULI¹

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Many stimulus generalization experiments employ relatively monochromatic visual stimuli, but the requirements of automation and economy often dictate compromises in the precision with which the stimulus may be specified. A mechanized double monochromator provides intense light and good chromatic isolation, but with a small field and at high cost. A continuous interference filter on a motorized rack and pinion is relatively economical, but specification of the precise wavelength and the bandwidth of the beam is often inadequate. Both methods require a minimum of 3-4 sec access time and reliability depends greatly on mechanical components. Individual

interference filters may be obtained with high transmission and narrow bandwidths, but users have had to attend personally to stimulus changes.

A simple device constructed to insert 2-in. square interference filters into a light path has been used for several months. A section of the unit is shown in the left of Fig. 1. Within the filter box, several frame filter holders are mounted so that each may slide vertically in individual grooves. Each filter mount is linked to a lever arm which pivots on a rod fulcrum. Vertically mounted, heavy-duty solenoids can be activated to elevate any of the filters into a position intercepting a light beam passing through the filter box. Since a frame holds 2-in. square filters, the lever is designed for a 2-in. vertical lift. On the lever the distance from fulcrum to the frame link is $2\frac{3}{4}$ in. The solenoid link is $\frac{5}{8}$ in. from the fulcrum producing an approximate 5:1 lift ratio. The frame, closed on three sides, is cut, bent, and

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Fig. 1. Drawings of the stimulus projector.

soldered of $\frac{5}{16}$ -in. brass channel. The inside width of $\frac{1}{4}$ in. permits use of standard B glass mounted filters. Bausch and Lomb filters can be packed in the frames with paper shims. The grooves are $\frac{1}{8}$ in. deep and are milled into two $\frac{3}{8}$ by 6 in. aluminum walls; the lever passes through a slot in the groove. The lever is a $\frac{3}{32}$ by $\frac{3}{8}$ in. bar into which $\frac{1}{8}$ -in. holes are punched for the fulcrum and two links. Links are 1 in. long and are milled from $\frac{3}{8}$ -in. aluminum stock. The fulcrum is $\frac{1}{8}$ -in. stainless steel rod stretched between the two end plates. Heavy-duty solenoids are ample for the required 60-oz load (Guardian 4 HD, 24 v dc continuous duty, 86-oz maximum lift). They are fastened to the walls at a point where the excursion is less than $\frac{5}{8}$ in. and the slug is fully seated at full excursion.

A finished unit is shown in the right of Fig. 1. It was constructed for six filters but any number may be used if the light path is collimated. The frames limit the size of the collimated light path but a $1\frac{1}{2}$ -in. circle is adequate for most stimulus projection requirements. Other lens systems could produce almost any desired effect. In addition, forms may be projected by introducing templates in some positions. The solenoids place a mini-

mum space between filters, but by alternating them on opposite sides of the two walls, frames may be spaced as close as $\frac{13}{16}$ in. apart. The unit shown is 6 by 6 by 6 in. While filter access time has not been explicitly measured, it is less than 100 msec and is sufficiently rapid that one opaque insert has been used as a shutter for time-out periods and inter-trial intervals. No direction of movement on a standard pigeon key has been observed. By operating solenoids at full voltage and holding them at approximately 16 v, through a slow-operate relay and resistor, uniformity of operate time is insured for hours with no overheating. A foam rubber cushion on the floor and under the lid (because of the heavy pull and fast positioning, a lid is recommended) provides a quietly functioning unit. The device has functioned without failure for 100 hr (over 5000 operations).

While a set of narrow band filters is more expensive than a continuous interference filter, the unit's flexibility and ease of changing compensates for the added cost. Excluding filters, the solenoids are major components (less than \$5.50 bought in quantity) and the complete unit was built for \$40 and 16 hr labor.