A WEDGE-TYPE ACTINOMETER

BY

CLARENCE R. SMITH

Aurora College, Aurora

During some experimental work with various mixtures used as photographic flash powders, the need arose for a method of testing the actinic power without the expensive and more or less elaborate equipment usually employed. For precision work the method ordinarily employed would be to expose a plate and measure the density by means of some form of densitometer.[1] As the work in hand involved light sources of widely differing intensity there was need for a method of wide range. Other desired features were, rapidity of manipulation, and direct reading with little or no calculation. A high degree of precision in results was not one of the requirements. These conditions seem to be satisfactorily met in the method here described.

On a 9x12 centimeter plate was prepared a photographic wedge covering an area 15 millimeters wide and 100 millimeters long with a density range from 0 at one end to a density having a transmission of approximately 1/200 at the other end. This wedge strip was made to come slightly above the center line of the plate so that by reversing ends of the plate, two prints could be made near together with the denser portions at opposite ends. The plate was covered with black paper except for the wedge strip.

If two sources of light at the same distance are used to make two prints of the wedge on the same plate in such a manner that they will be parallel and with reversed ends, there will be a position where the two prints will match in density and the light intensities can thus be compared, unless they differ so greatly as to be "off scale." In the practical use of this wedge, a standard exposure was adopted for one of the wedge prints in every test. In this case, for the standard print, an automobile headlight bulb of the blue variety was used. It was found that an exposure of 20 seconds at 5 volts (much below the rated voltage) and at a distance of 2 meters gave the desired print. For this exposure the calibration of the lamp is of no consequence, the only condition being that a standard print could be made, always of the same contrast.

[1]Huse, Emery, On the Photographic Intensity of Flashlight Materials, Jour. Frank. Inst., p. 391, Sept. 1923.

A calibration curve was next constructed showing the exposure values of various match positions along the standard wedge print when compared with the print of another source. For convenience, the lamp used was the same one mentioned above, but at 12 volts instead of 5. At 12 volts it had been carefully compared with a photometric standard and found to be of 14.9 candle power. By operating the lamp for various time intervals, various test exposures were made, the meter-candle-second value calculated for each, and a curve constructed somewhat similar to that of figure 1. For the curve actually shown in

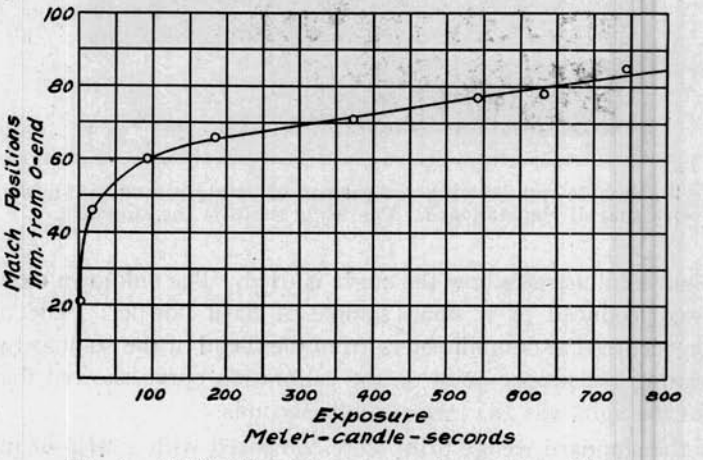

FIG. 1. Calibration curve for wedge with a filter.

figure 1, however, the test exposures (but not the standard prints) were all made through a neutral tint filter having a transmission of about 1/100, as it had been found that for the work in hand the range was otherwise not high enough.

For this work the plates used were Eastman 36 in 9x12 centimeter size. Tray development was used with Eastman formula D-61a, and in every case continued for 6 minutes, the temperature being approximately 65°F. In choosing the automobile headlight bulb, the blue glass variety was selected under the supposition that the closer resemblance of the light quality to that of daylight might be of some advantage. In making the two prints on each plate, of course it is essential that wedge plate and exposed plate always register accurately in the same relative position. This was accomplished by simply taking care to always crowd all plates to the same corner of the printing frame. When the filter was used, precaution was taken to always keep the same corner of this plate also to the same corner of the printing

frame so that possible variations in density over the plate would be accounted for in a constant way in the calibration curve. Match positions were found by sliding along the plate a slit placed perpendicularly to the two strips and long enough to include a narrow cross section of each. Even illumination was provided by a ground glass in front of a lamp.

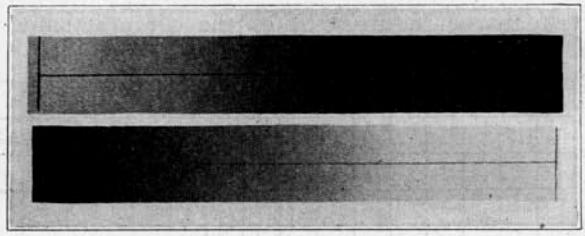

FIG. 2. Sample test showing comparison of print from an unknown light source with that of the standard. The lower strip is the standard.

Figure 2 illustrates how the curve is used. The unknown exposure here was produced by a small sample of flash powder. The match position occurred at 66 millimeters from the 0-end of the standard print, and locating the proper point on the calibration curve showed that the value of the light was 185 meter-candle-seconds.

If the standard wedge print were compared with a strip of merely uniform density, the range of the device would be only that between the two ends of the wedge, whereas by printing the test exposure also through a wedge negative, the range is greatly increased. The effect can be looked upon as equivalent to the use of a series of many different filters.

The curve shown as a sample in figure 1 can be made to present a better appearance by plotting the logarithms of the exposures instead of the actual values and in this form it would resemble more closely the familiar curves used to represent plate characteristics. However for the practical purposes at hand it was desirable to have the graph constructed so that meter-candle-second values could be read off directly and without computation.

A number of variations will suggest themselves for particular purposes. If greater precision were required through a narrow range, it would be better to have a wedge of less contrast and use only the more sensitive part of the curve. Using filters of greater density than that employed here would make it possible to work with greater light intensities. Considerable latitude may also be had by varying the

distance of the light source. In the work actually done, 2 meters was found to be a convenient distance in most cases. If the distance is taken as 1 meter, the readings will be directly in candle-power-seconds, while at other distances the inverse square law must of course be taken into account. Although the method was devised for flash sources of light, it could also be used for continuous sources by exposing for a definite time.