adjusted so that the optimum print is obtained at the mid-range of the printer timing mechanism.

Calibration

1. Dial Selection

a. Subtractive Printing. Use the set of dials prepared for use with Kodak Color Compensating Filters (C, M, Y).

b. Additive Printing. Use the set of dials prepared for use with the particular beam-attenuating device on the printer.

c. When full-frame rather than gray-card densitometry is used, less than full correction may be desirable.[3] In this case, the red, green and blue negative density input dials must be selected accordingly.

2. Printer Selection Switch. Put this switch in the subtractive or additive position as applicable.

3. Calculator Setup

a. Enter the red, green, and blue densities of the selected typical negative scene on the red, green, and blue input dials.

b. Enter on the C, M, and Y output dials opposite the correct printer diaphragm stop the filter values used for printing the typical negative scene. (Enter the red, green, and blue beam-attenuator values opposite the reference dot if additive printing is used.)

c. Obtain a zero meter reading on the red, green, and blue circuits in the following manner: (1) Put the sensitivity switch on "low." (2) Hold the red circuit switch closed until a zero meter reading is obtained by turning the red set knob. Similarly, the green and blue circuits are adjusted for a zero meter reading using the appropriate green and blue circuit switches and set knobs. (3) Put the sensitivity switch on "high." (4) Repeat step (2) above, making the final small adjustments of the set knobs that are necessary to obtain zero meter readings in the red, green, and blue circuits.

4. After this initial adjustment, the red, green and blue set knobs remain untouched until the print film, print process or printer is changed.

Timing Operation

1. Enter the negative densities of a scene on the red, green and blue negative density input dials.

2. With the sensitivity switch on "high," obtain a zero meter reading for the red, green and blue circuits by turning the cyan, magenta and yellow dials (in that order) for subtractive printing, or by turning the red, green and blue attenuator knobs for additive printing.

a. Subtractive Printing. Obtain a zero meter reading in the red circuit by holding the red circuit switch closed and turning the cyan dial until the meter reads zero. Follow an analogous procedure in balancing the green and blue circuits, making the successive zero adjustments in these cases with the magenta and yellow dials. It is essential that the circuits be balanced in the order red, green, blue.

b. Additive Printing. To make the zero adjustment in the red, green and blue circuits, manipulate the red, green and blue beam-attenuator dials in the same way as the cyan, magenta and yellow dials are manipulated in the procedure for subtractive printing.

3. Read and Record Data

a. Subtractive Printing. Record the predicted cyan, magenta and yellow filter values appearing opposite the diaphragm stop used in printing the typical negative scene. (This is the same diaphragm stop used in calibrating the calculator.) If the diaphragm stop falls below the zero point of any filter scale, choose the filter values that are found opposite the smallest diaphragm stop *common* to all three filter scales.

b. Additive Printing. Record the required red, green, and blue beam-attenuation levels appearing opposite the reference dots. If a reference dot falls off either end of an attenuator scale, the basic printer light level must be adjusted for that scene.

Use of Data

1. Subtractive Printing. The filter values for each scene are obtained directly from the calculator, but the diaphragm stop must be modified according to the total *number* of filters in the pack. The two interfaces of each filter have the same effect as a neutral density of 0.04, which is approximately equal to the increase in log E per diaphragm stop on the Bell & Howell, Model D Printer. The diaphragm setting for each scene must therefore be adjusted up or down, according to the number of filters by which the new pack exceeds or falls short of the pack of the preselected typical scene. When a scene requires a filter pack containing three more filters than the typical scene, the diaphragm setting must be increased three stops; two less filters, decreased two stops, etc. This calculation can be done quickly at the time the filter values are being recorded.

2. Additive Printing. Beam-attenuator settings are read directly from the calculator without modification.

References

1. G. T. Keene, "A color timing calculator for subtractive motion-picture printers," *Jour. SMPTE, 67:* 404–408, June 1958.
2. J. G. Stott, W. R. Weller and J. E. Jackson, "Automatic timing of color negatives," *Jour. SMPTE, 65:* 216–221, Apr. 1956.
3. C. J. Bartleson and R. W. Huboi, "Exposure determination methods for color printing: the concept of optimum correction level," *Jour. SMPTE, 65:* 205–215, Apr. 1956.

Ed. Note: At the Convention a motion picture was shown to illustrate the timing results on a 400-ft test roll.

Discussion

Lewis Humphrey (Moody Institute of Science): Has there been any adaptation of this method to timing Kodachrome?

Deane S. Thomas (Eastman Kodak Co.): Not so far. Kodachrome is often considered so much more easily timed than color negatives, that a good first print is normal in many laboratories with Kodachrome. There is no reason whatever why this technique could not be used in the same way with equal success by anyone who wished to do so with Kodachrome or any other original material. Of course, some modification of the dials and gear linkage would be needed for different combinations of original films, print films, and densitometry.

Errata

George T. Keene, "A Color Timing Method and Calculator for Subtractive Motion-Picture Printers," *Jour. SMPTE, 67:* 404–408, June 1958.

On page 408, column 2, lines 11 and 12, *read:* Fortunately, the red-light absorption of the magenta filters is negligible *for* Fortunately, the blue-light absorption of the magenta filters are negligible.

D. W. Fassett, F. J. Kolb, Jr., and E. M. Weigel, "Practical Film Cleaning for Safety and Effectiveness," *Jour. SMPTE, 67:* 572–589, Sept. 1958.

On page 577, Table II, in the tenth column across the top from left to right, *read:* Personnel Hazard *for* Personnel sonnel Hazard; in Item No. 1, *n*-Butyl chloride, under the column Personnel Hazard, *read:* Mod. *for* None.