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A Symposium on 16mm Internegative/Positive Release Printing

ROBERT A. COLBURN, *Chairman*

This Symposium was first presented during the Chicago Section Regional Meeting held at Iowa State College, Ames, Iowa, November 8–9, 1957. At that time, the subject was comparatively new and many of the related problems still unsolved. The three competing 16mm laboratories in the Midwest then using the new medium welcomed the opportunity to get together and talk about their various problems and their methods of solving them. They were enthusiastic about the new products designed to meet a pressing need in the 16mm field. Since that time, much has been learned and several improvements have been made in the materials available and in the methods used.

It is still generally agreed that the finest quality 16mm release prints are obtained by printing directly from the 16mm originals on a color reversal print stock. But where a large number of release prints are required this method is a definite hazard to the original films, and is an expensive process.

For some years, especially since the introduction of Eastman Reversal Color Print Film, Type 5269, reasonably satisfactory release prints were obtainable through reversal color masters treated to reduce contrast. Although this method reduced the hazard to the original films and made the material available for other uses, it did not materially reduce the cost of release prints. More important, the substantial degradation of color values made its use unsatisfactory where color brilliance was essential.

The new Eastman Color Internegative Film, Type 7270 made it possible to make release prints on Eastman Color Print stock with full color brilliance at a greatly reduced cost. It also made it economically practical for a laboratory to handle its own color processing with complete control from start to finish within the individual laboratory. Due to the characteristics of this new material, certain methods of more precise control had to be devised and new printing equipment designed and built in order to take full advantage of the capabilities of the new medium.

This Symposium deals first with problems encountered in the three major steps of print production — preparation of originals, printing procedures and controls, and processing procedures and controls — and then takes up equipment specially designed and built for 16mm internegative/positive use. The laboratories which participated in the Symposium were: Geo. W. Colburn Laboratory, Inc., Chicago; Lakeside Laboratory, Gary, Ind.; The Calvin Co., Kansas City, Mo.

Preparation of 16mm Color Reversal Originals for 16mm Internegative/Positive Release Printing

By ROBERT A. COLBURN

The Geo. W. Colburn Laboratory sets up originals in A & B rolls to incorporate fades, lap dissolves and invisible splices; timing is both for color balance and exposure balance; originals are cued for automatic printer operation; and originals are treated to minimize the formation of Newton's rings.

THE MAIN OBJECT in preparing an original 16mm film for color internegative/positive release printing is to introduce adequate color correction, exposure correction, and fade- and lap-dissolve effects directly in the internegative so that release prints can be made on a high-speed color positive printer using a single uniform exposure and color filter pack throughout. Naturally, it is desirable to be able to do this on the first try, since remakes at this stage are costly to the laboratory.

The standard method of A & B roll setup as recommended by the Association of Cinema Laboratories can be followed by the client or by the laboratory editing department. This method has been reported in the *Journal* ("A report from the Association of Cinema Laboratories," pp. 383–386, July 1955). Several bulletins have been issued by the Association on the subject. The Geo. W. Colburn Laboratory has prepared its own bulletin, combining and condensing information especially applicable to its operations.

When the A & B rolls are ready for timing, the utmost in care, experience and judgment is required to achieve the exact color compensating filter needed for each scene to keep a given sequence in color balance, and the exact exposure needed to keep each scene in density balance. These two operations are handled separately. The entire film is carefully examined over a light box with actual color compensating filters laid over adjoining scenes until a satisfactory balance is obtained. This operation can be done more rapidly

Presented on October 20, 1958, at the Society's Convention in Detroit by Robert A. Colburn, Geo. W. Colburn Laboratory, Inc., 164 North Wacker Dr., Chicago 6.
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Fig. 1. Timing card used by Geo. W. Colburn Laboratory.

and easily if an edited reversal color work print is projected prior to the selection of these filters. The filters required are then recorded on the timing card (Fig. 1). For example, at 10 ft a 0.05 Magenta, a 0.10 Magenta and a 0.10 Cyan correction is needed. At 15 ft, standard filtration is satisfactory. Again at 42 ft a 0.10 Yellow and a 0.10 Cyan correction is needed, and so on throughout the film.

Generally speaking, a 16mm color original filmed by a competent producer on one emulsion and one type of film stock will need very little, if any, color correction. Where film types are intermixed, such as Daylight Kodachrome, Type A Kodachrome and Commercial Kodachrome and even the new Ektachrome Commercial Film, Type 7255, filter corrections will rarely exceed a CC.10 from standard, except where gross errors are made in lighting or where special effects are desired. With Anscochrome, we have found that while filter corrections from CC.30 to CC.50 are sometimes needed compared to the Eastman products for printing on Eastman Reversal Color Print Film, Type 5269, relatively small compensation is needed for internegative use. However, we do not recommend the intermixing of color originals of different manufacture unless special tests are made prior to printing the internegative. It might be well to point out here the danger of intermixing color originals of different manufacture or where extreme errors exist in color balance. The reproducing characteristics may vary so widely that adequate color compensation cannot readily be accomplished except by setting up separate C & D rolls. This, of course, adds considerably to the cost of the internegative.

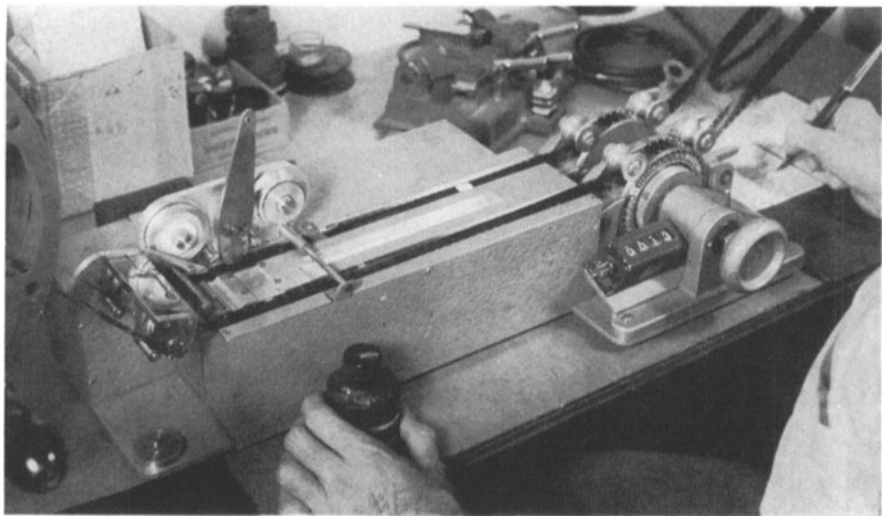

Fig. 2. Timing and cuing device for exposure correction.

Fig. 3. Final timing card.

Time for Exposure Correction

When the color timing operation is complete, the film is timed in the usual manner for exposure correction, taking into account the density values of the color correction filters. This is done on a specially built timing and cuing device (Fig. 2). Both the A & B rolls are passed through at the same time over identical illumination so that balance from one scene to the next can be maintained, although the scenes alternate from one roll to the other. The final timing card is made (Fig. 3) showing the exact footage from the Start Printer Sync of each roll where each change in exposure or color filtration occurs, or where a fade-out or fade-in is required. By this time, the color filters have been translated into A, B, C and D and are recorded in red.

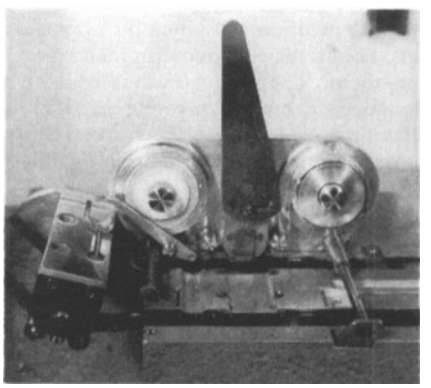

Fig. 4. Cuing device used to apply small patch of cuing tape.

As each change is recorded, a special cuing device is used (Fig. 4) to apply a small patch of Permacel cuing tape. This is a new pressure-adhesive metallic material with tenacious sticking power through subsequent cleaning and printing operations. It has positive electrical conductivity, and yet is easily and completely removable if a change should be desired. The patch then passes through an electrical testing device which is identical to the split roller actuator on the printer. The patch is placed (Fig. 5) directly between the perforations at an interval of 32½ frames ahead of the desired change.

After the timing cards have been completed, the original film undergoes a final cleaning while the charting operator (Fig. 6) perforates a strip of standard 35mm machine leader with a specially designed electromechanical punching device. The four buttons across the top are the four color filters, A, B, C and D. The seven buttons (partially covered by the operator's hands) control the proper neutral density filter combinations to effect eight different exposure values. The

Fig. 5. Patch is placed between perforations at an interval of $32\frac{1}{2}$ frames ahead of change.

Fig. 7. Completed chart. First row on the left actuates fade-out and fade-in mechanism. The next three give various combinations of neutral density filters. The last four give various combinations of color correction filters.

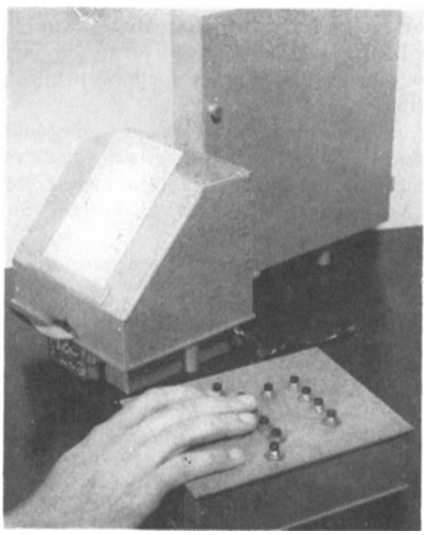

Fig. 6. Electromechanical punching device perforating a strip of standard 35mm machine leader.

single button in between operates the punch for the fade mechanism. To the left and right of the main exposure bank are buttons for advancing the chart to the next position.

Figure 7 shows a completed chart. The first row on the left indicates fade-out and fade-in, the next three indicate various combinations of 0.10 neutral density, 0.20 neutral density and 0.40 neutral density, giving eight exposure combinations. These neutral density filters allow for a range of $2\frac{1}{3}$ stops in increments of $\frac{1}{3}$-stop or, in more technical language, approximately 0.10 log E units. The last four rows indicate color filters A, B, C and D. This combination of four color filters allows for as many as fifteen different color variations (within the limits of the filters used, of course) in printing an individual roll of film. These filters can be changed as desired for any special requirements of a particular original.

In the final cleaning of the original film, we have found it undesirable to use a cleaner containing an antistatic ingredient. Although it cannot be detected visually, its residue can affect the sensitivity of the raw stock and cause spotting. Great care must be used in removing all traces of grease pencil, tape marks and other foreign matter. One procedure is to use a swatch of white jersey acetate rayon soaked with a *non*-antistatic solvent of the trichloroethane type with adequate ventilation, so that it is completely evaporated before contact with the film roll.* Some originals may become excessively scratched due to prior use as a projection

* Since this paper was presented the Laboratory has obtained a new CF-2 Ultrasonic Film Cleaner manufactured by the Lipsner-Smith Corp. This cleaning method has superseded the hand-cleaning method for all preprint materials, except for lacquered or magnetic-oxide striped originals.

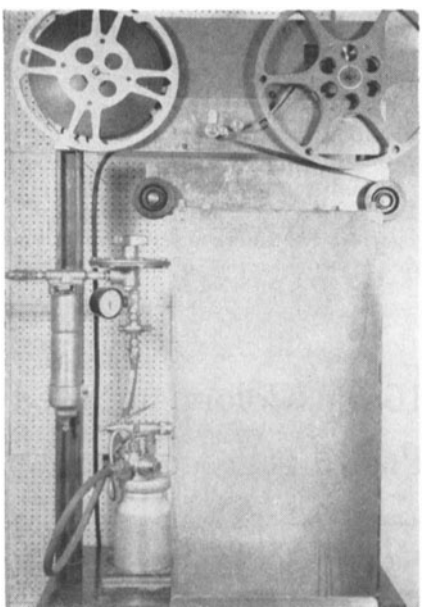

Fig. 8. Device for special spray treatment to prevent formation of Newton's rings.

original or an attempt to edit the originals directly without the use of a work print. These scenes require a special lacquering process before printing. In this case, subsequent cleaning must be done with Freon 113 solvent in order not to remove the lacquer.

Special Spray Treatment

Due to the slick emulsion characteristics of the internegative emulsion, it has been found necessary to use a special spray treatment to prevent the formation of Newton's rings. In this specially built device (Fig. 8), the original film is passed over an opening in the top of a Lucite box into which American Type Founders Non-Offset Mix #109 is sprayed under high pressure. Only the finest particles rise to the opening and form a coating, that is invisible to the naked eye, on the picture area of the film emulsion. There is some danger that if the spray gun is not adjusted properly, overly large particles may rise to the top and cause spotting. A special baffle has been introduced to prevent this.

In any case, if spotting should occur, the material can be effectively removed by a simple washing process. It has been reported that Eastman Kodak Co. is making some progress towards solution of the Newton's rings problem by the application of an over-coat on the negative emulsion; but for the present, spraying is required, particularly for the new Ektachrome Commercial and for Ansco Color, both having characteristically smooth emulsions after processing.

Edit. Note: Following the presentation of the paper, a color positive demonstra-

tion film was shown to illustrate the capabilities of the internegative printer designed and built by the Geo. W. Colburn Laboratory. A portion of the exposition accompanying the film is abstracted below:

The film was printed on Eastman Color print stock from a color internegative. The internegative was printed from various types of color reversal original. It was noted that valuable edited originals were protected by using the internegative for long printing runs.

The internegative printer employs both color and neutral-density filters to make instantaneous scene-to-scene color and exposure changes to correct for deficiencies in the original.

Uncorrected and corrected comparison scenes were shown to demonstrate the improvement possible when printing intercut original scenes with dissimilar emulsions, underexposure, and "old age" dye changes.

Other scenes were shown to demonstrate quick and normal length fade and dissolve effects, incorporated in the internegative by means of a variable shutter.

16mm Color Intermediate Negative-Positive Printing Procedures and Controls

By JOHN R. STILLINGS

Printing procedures and control techniques using an additive printer in the production of 16mm color positive prints from 16mm reversal color film are described. Matrix algebra is used in determining a basic exposure for each emulsion type and number used. These matrices can be used for initial printer calibration as well as for routine printer control.

PRINTING PROCEDURES and control techniques using an additive printer, parallel the procedures and techniques used in subtractive printing. The same precautions and safeguards are maintained, but with modifications due to the differences in equipment. Those differences as they affect the printing of Eastman Color Internegative Film, Type 7270 and Eastman Color Print Film, Type 7382 are discussed.

The printer can derive its information from two sources. One of these is a switching panel and the other is punched tape. The function of the switching panel is to provide a wide range of intensities of blue, green and red light. This allows the printer to be balanced to print Eastman Reversal Color Print Film, Type 5269; Eastman Color Internegative Film, Type 7270; Eastman Color Print Film, Type 7382; and black-and-white duplicate negative film. For each film type, there is an available range of 1.27 log exposure in each color, in 0.01 log exposure steps. The purpose of the punched tape input is to allow for scene-to-scene deviations from a standard printing level, in 0.02 log exposure steps. The switching panel is a control operation; the punched tape, a production printing operation.

Timing of original color film for printing is probably the most time-consuming and costly of all preparatory steps. It would be of economic importance to have one timing operation suffice for all subsequent printing steps. That is, it would be valuable to use one set of punched tapes, representing one timing, to print Type 5269 Reversal Color Print Film, Type 7270 Internegative, or black-and-white duplicate negatives. The goal is, in the case of duplicate negatives, to have a fully corrected duplicate which will print to the print film at one light.

The first step in setting up such a printer is to establish the "standard characteristic curves" for each film type. These curves are the sensitometric plots of a print-through of a silver step wedge, which yield a good visual and densitometric match to the original wedge. In the case of reversal print film, this is a one-step operation, silver wedge to print film. In the case of internegative it is silver wedge to internegative to print film.

The standard characteristic curve for Type 5269 Print Film was prepared by printing a silver step wedge onto the film at various color balances and densities, using the switching panel inputs to the printer to adjust the exposures. The exposure that gave the best visual match to the original step wedge was chosen, and the densitometric plot was made. This is our standard curve for the Type 5269 Print Film. The exposure was designated the basic exposure for that type and emulsion number. Since the goal is to achieve one timing operation to cover all possible release printing routes, this graph is also the goal plot for the overall print-through of Type 7270 Internegative to Type 7382 Color Print Film.

In printing and processing Internegative Print Film, Type 7270, it is very difficult, if not impossible to evaluate the internegative visually. There is no original negative with which to compare it, nor is there a simple negative to view. The general overall characteristic supplied by the masking dyes, as well as all the original colors which appear as their complementaries, limits the criteria for making an exact and accurate evaluation.

In order to fix one of the variables in a two-step process, first, our Type 7382 Color Print standard characteristic was defined and the Type 7270 standard characteristic then defined by means of this Type 7382 standard.

A silver step wedge was printed through to Type 7382 Color Print Film, using a piece of unexposed but processed Type 7270 as a filter. The exposure was adjusted by means of the switching panel until a good neutral print was made. This then established the Type 7382 Color Print Film standard characteristic curve. The exposure was called basic exposure for that Type 7382 emulsion.

A similar procedure was followed in the case of the Type 7270 Internegative, but without the cleared negative filter, until a negative was produced which when printed at the basic exposure on Type 7382 Print Film, yielded a print-through characteristic which matched the Type 5269 Reversal Print Film standard characteristic. The exposure given to the negative was then defined as the basic exposure for that emulsion number of film and the plot was defined as the standard characteristic curve for Type 7270 Internegative.

For routine day-to-day control procedures, Type 7270 Internegative is printed at the basic exposure for that particular emulsion and a densitometric plot is compared with the standard characteristic curve for Type 7270. In the case of the Type 7382 Print Film we have dispensed with the negative filter and merely print at the basic exposure for that emulsion and compare its plot with a graph of the original basic exposure, which was also printed without a filter. We do not get a neutral

Presented on October 20, 1958, at the Society's Convention in Detroit by John R. Stillings, Lakeside Laboratory, Box 2408, Miller Station, Gary, Ind.
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