ABSTRACTS OF PAPERS

FOR THE

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The Papers Committee submits for the consideration of the membership abstracts of papers to be presented at the Fall Meeting that have been received thus far. It is hoped that the publication of these abstracts will encourage attendance at the meeting and facilitate discussion. The papers presented at Meetings constitute the bulk of the material published in the Journal. The abstracts may therefore be used as convenient reference until the papers are published.

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Recent Laboratory Studies of Optical Reduction Printing; R. O. DREW AND L. T. SACHTLEBEN, *RCA Manufacturing Co.*, Indianapolis, Ind.

This paper reports recent laboratory work that has resulted in marked improvements over previous 16-mm reduction print quality. Improvements in image quality accrue from exposure of the print with ultraviolet light, and from the use of reflection-reducing coatings on the lens surfaces, while speed variations are reduced by increasing printer speed to as much as twice the normal film speed. These improvements involve only relatively simple changes in commercial reduction printers.

Precision Recording Instrument for Measuring Film Width; S. C. CORONITI AND H. S. BALDWIN, *Agfa Ansco*, Binghamton, N. Y.

The film passes through a film gauge, one member of which is fixed and the other movable. The latter is attached to one plate of an electrical condenser. Changes of film width are translated into changes of capacitance. The electrical condenser is connected to a parallel tuned circuit which acts as a load in the screen-grid circuit of a crystal oscillator. A 0—1 dc milliammeter is connected in series with the screen grid. The circuit is tuned to some point off resonance. The dc screen-grid current corresponding to this point operation is balanced out. Therefore, any changes of capacitance will vary the screen-grid current. For a width variation of 0.250 mm the relationship between screen-grid current and film width is linear.

A continuous recording milliammeter is connected in the meter circuit. Its chart velocity and film velocity are maintained at a fixed ratio. The accuracy of the instrument is ±0.002 mm.

Some Characteristics of Ammonium Thiosulfate Fixing Baths; DONALD B. ALNUTT, *Mallinckrodt Chemical Works*, St. Louis, Mo.

A brief description of the history and nature of ammonium thiosulfate is given. Several practical formulas employing this agent are presented and their advantages discussed. Some of the differences in characteristics between the ammonium thiosulfate and sodium thiosulfate fixing baths are pointed out.

An explanation is offered to account for the apparent discrepancies in the effects of concentration on clearing time reported by previous investigators. The speed of fixation of ammonium thiosulfate is shown to be greater than that of sodium or lithium thiosulfates and greater than that of mixtures of ammonium chloride and sodium thiosulfate.

Motion Pictures in Aircraft Production; NORMAN MATHEWS, *Bell Aircraft Corp.*, Buffalo, N. Y.

The great numbers of aircraft needed in this war posed new problems in the training of maintenance personnel in sufficient numbers; every plane in the air requires that there be three to twelve men on the ground for servicing. Each branch of our armed forces was faced with the big job of training many men rapidly, not only in the maintenance of aircraft, but in every phase of modern warfare. A great share of this training job could be done by means of motion pictures.

Although the U. S. Army was producing an extensive series of training films dealing with aircraft maintenance, the Bell Aircraft Corporation believed that it, too, could help in this respect. Its service department had been in the field close to the problems of maintaining one particular type of aircraft and it was from their experience that material could be drawn for the production of training films dealing with servicing the *P-39*, the Army Airacobra.

In April of this year the motion picture division of this company was organized and production was begun on an extensive series of films, each dealing with a specific service operation. All work was to be done in 16-mm and, with the exception of the laboratory, all phases of motion picture production were handled in the division. Working closely with the service department, the details of the various operations were carefully checked for accuracy and instructional value. The small staff was organized into two crews, each alternating weekly in the writing and shooting of scripts. All phases of production on a number of films were kept moving simultaneously, with the added advantage from a working point of view of having one crew follow a picture through from the initial script stage to the final release.

Aside from being used by the Army these films were to be used by the company's service department to train a rapidly expanding personnel and to help with service training in the field. Service representatives throughout districts in the various war-fronts were equipped with small sound projectors and complete sets of these films. A broader distribution was to be effected by the Army itself, which is placing these films in all bases where these planes are in service. The success of the films in aiding the training program is evidenced by their designation as official Army training films, and further by the results of a questionnaire aimed at an evaluation of them.

Pilot training is another subject being treated in film to tie in with the Army's recently organized safety campaign. It is planned also that soon the work of the motion picture division will be expanded to include industrial training, for which there is an urgent need today in the aircraft industry with its rapid expansion and the introduction of new methods of fabrication.

The Practical Side of Direct 16-Mm Laboratory Work; LLOYD THOMPSON, *The Calvin Company,* Kansas City, Mo.

Laboratory practice for direct 16-mm production differs somewhat from 35-mm methods. Thirty-five-mm laboratory practice as we know it is largely confined to negative-positive, and 35-mm color is mostly done by special service laboratories and not by the studio or release print laboratories.

Direct 16-mm production calls for the reversal type of processing, the negative-positive method, and color developing. Some producers own laboratories for doing the first two, but color is processed by the manufacturer. However, independent laboratories are printing color. It is the purpose of this paper to explain how some of these processes are used in direct 16-mm production, especially when the methods differ from conventional 35-mm practices. Some of the subjects discussed are: processing originals, work prints, reversal printing, dupe negatives, color printing, control methods, special laboratory equipment, *etc.*

Sixteen-Mm Editing and Photographic Embellishment; LARRY SHERWOOD, *The Calvin Company,* Kansas City, Mo.

The paper will first discuss the essential equipment necessary to the editing of 16-mm film, with a detailed analysis of the types of commercial equipment available. Also will be included certain equipment that has been developed outside the commercial field.

The second section will concern itself with the technique and methods that have been developed and proved to be applicable to the editing of 16-mm film. This section will take up the methods of identifying film; of synchronization; of matching work print with original, both sound and photography, without edge-numbering; and the technique of preparing film for the laboratory, with particular regard to the methods employed in laying in mattes to produce dissolves, double exposures, trick effects, *etc.*

The third section will concern itself with the importance of trick effects in industrial and educational motion pictures; how trick effects might be utilized as an integral part of the educational process; and examples will be given to show how trick effects might be employed to eliminate footage, so essential to the production of this type of film.

Carbon Arc Projection of 16-Mm Film; W. C. KALB, *National Carbon Co.*, Cleveland, Ohio.

This paper summarizes the characteristics of the high-intensity carbon arc as applied to the projection of 16-mm film. It includes a description of the carbon trim, color quality of the light, magnification, optical speed, and power requirements of the projection lamp. Intensity and distribution of screen light are discussed in relation to the operating characteristics of projectors commercially available and the transmission characteristics of heat filters, shutters, and available types of lenses. Resulting screen illumination is interpreted in terms of screen dimensions and audience capacity under conditions conforming to recommended projection standards.

Laboratory Practice in Direct 16-Mm Sound-Film Production; W. H. OFFENHAUSER, JR., Washington, D. C.

In a paper such as this, it is not uncommon to find minute detail of machinery design and operation that is of little interest to any other than those who use the machinery or its product. If, however, a motion picture film laboratory is defined as but one of a series of tools necessary to accomplish the effective transmission of intelligence by means of the 16-mm sound motion picture as a communication medium, the laboratory takes on a new aspect—that of function. It is with function that this paper deals, together with its inescapable results in machinery and machinery operation.

Before our entry into the present World War, 16-mm films had been widely used for advertising and ballyhoo purposes; advertising seemed best able to supply the largest sums for 16-mm production budgets. With our entry into the war, the voices that had cried in the wilderness a decade ago for instructional and training uses of film were finally heard; the death knell for the ballyhoo film occurred "for the duration," and training films marched in to displace and overrun them. This limitation of function was a blessing in disguise; the industry was permitted for the first time to clear decks of non-essential frills and strip for action.

Direct 16-mm sound-films are generally of two kinds: black-and-white, and color (usually Kodachrome). In both cases the original picture is developed by the film manufacturer or his agents; the cost of development is included in the price paid for the film.

The sound used is scored as a sound negative after the picture is edited; it is from this stage onward that the commercial laboratory enters. In the case of black-and-white, a fine-grain duplicate (intermediate) negative is made of the picture, release prints being made from the original sound negative and the intermediate picture negative. In Kodachrome, a black-and-white fine-grain positive print is made of the sound, the Kodachrome duplicates being made from the original Kodachrome picture and the black-and-white fine-grain sound-track print.

The paper deals with procedures, and presents some of the highlights of equipment and operational techniques used in the volume production of high-quality copies.

Film Distortions and Their Effect on Projection Quality; E. K. CARVER, R. H. TALBOT, AND H. A. LOOMIS, *Eastman Kodak Co.*, Rochester, N. Y.

The three main types of film distortion are (*1*) Embossing due to differential shrinkage or hardening of the emulsion caused by local absortion of heat in the dense portions of the picture; (*2*) Fluted edges due either to stretching of the edges or shrinkage of the center; (*3*) Short edges or buckle due to shrinkage of the edges while in the roll.

Careful tests have failed to show any effect on the screen, such as in- and out-of-focus effects, due to image embossing. Measurements of the magnitude of the distortions show that these are ordinarily much less than the depth of focus of the lens. Laboratory tests as well as field experience indicate that fluted edges very rarely cause distortion of the image on the screen.

Short edges, however, produce a type of buckle which often shows in- and out-of-focus effects. This is due to the fact that short edges leave a fullness in the center similar to the bottom of an oil can. Under some circumstances this fullness causes a movement back and forth in the projector gate causing in- and out-of-focus movement. Short edges are commonly caused by loss of moisture from the edges of the film when wound up in a roll immediately after processing. When such films are placed in tin cans, the rate of loss is reduced so that moisture has time to diffuse from the center of the film to the edges and permit uniform shrinkage. A scarcity of tin and substitution of cardboard boxes makes it desirable to dry the film more thoroughly on the processing machines so as to avoid this quick loss of moisture during the storage period before projection. Trouble can be avoided also by wrapping the film in moisture-vaporproof envelopes before packing in cardboard boxes or by the use of cardboard boxes of a highly impermeable type.

Effect of High Gate Temperatures on 35-Mm Film Projection; E. K. CARVER, R. H. TALBOT, AND H. A. LOOMIS, *Eastman Kodak Co.*, Rochester, N. Y.

In a study of the effects of high temperature arcs on 35-mm motion picture film in the projector gate, high-speed Cine Kodak pictures (1400–1500 frames per second) were taken of the image of the 35-mm film on the projection screen. In making these pictures an *E*-7 projector with a Macauley Hy-candescent lamp was used and the image was sharply focused on the projection screen. A portion of this image was used as a target for the high-speed Cine Kodak so that when this Cine Kodak picture was projected one could observe the appearance of the 35-mm image during various portions of each frame. The shutters of the 35-mm projector were thrown slightly out of synchronism so that the appearance of the image as it came to rest in the gate could be determined. When the high-speed 16-mm pictures were projected, it was observed that the 35-mm image was in sharp focus during only a small part of its stay on the projection screen. After the pull-down, the film comes into the gate out of focus, and slowly moves into focus. As it moves into focus it always moves toward the lamp, as if the emulsion were expanding, thus causing the film to curl away from the emulsion. In some cases it does not come into sharp focus until after the flicker blade has passed. The above phenomena occur during all normal projections but are more prominent at higher temperatures. The 35-mm projected pictures appear to be perfectly sharp, even though the high-speed analysis shows them to be out of focus during a large fraction of their stay on the screen. If the image is in focus during the last fraction of a second before the next pull-down, it appears sharp to the eye regardless of the fact that it was out of focus during the first part of its stay on the screen.

Under certain definite circumstances, however, in- and out-of-focus effects are observed on the 35-mm screen. When these are observed, the high-speed movies indicate that the film comes into the gate out of focus, moves toward the lamp and, therefore, toward sharp focus, but before it reaches sharp focus a sudden drift toward the lens occurs. Thus the film never reaches its position for sharp focus and gives the in- and out-of-focus effect.

A further study of these effects was made by cutting away part of the projector gate so that a high-speed Cine Kodak can be focused directly onto the film in the gate. This study showed exactly the same effects as described above but, in some respects, made them clearer.

The Use of High-Speed Photography in Analyzing Fast Action; E. M. WATSON, *Capt., Ordnance Dept., Watervliet Arsenal,* Watervliet, N. Y.

Various methods and devices may be used in studying action that is too fast for unaided visual observation. In almost every set-up the following points must be considered: (1) Means must be devised for placing the image (with necessary sharpness and steadiness) on the medium where the exposure is to take place; (2) Arrangements must be made for starting and stopping the exposure; (3) Means must be devised for placing the subsequent exposures on recording material at the proper time and location to obtain the desired results.

The principal methods for studying high-speed action are the *shutter method* and the *stroboscopic method.* The former is used where subjects radiate light of themselves or reflect utility light not used to determine exposure time; exposure time is determined by the shutter. The stroboscope is used where other light does not materially interfere with stroboscopic light; exposure time is determined by the stroboscopic flash.

Whenever the subject being investigated does not repeat its motion at all or not often enough to use a stroboscopic device, it is necessary to use some form of photography for quickly recording the action for later study; when complications are not great, still cameras can be used. When a single picture is insufficient and the motion occupies approximately the same area, causing multiple images to overlap and be confused, one must resort to motion pictures. Motion pictures taken at speeds moderately in excess of the regular projection speed can be taken with an intermittent camera. When the film speeds up to about ninety miles per hour it is necessary to use some kind of device for placing the image on the film while the film is moving at a constant linear speed. If these additions are to be exceeded it is then necessary mechanically to support the film in motion or allow it to remain stationary and move the light which affects the exposure.

In any kind of high-speed photography, all the limitations of ordinary photography are encountered plus some special restrictions imposed by the high speed. As types of cameras are changed to obtain increased speed, compromises in image quality and exposure must be made.

There is opportunity in high-speed photography for anyone having only modest equipment, but many of the applications require very expensive equipment which has little versatility.

Effect of Composition of Processing Solutions on Removal of Silver from Photographic Materials; J. I. CRABTREE, G. T. EATON, AND L. E. MUEHLER, *Eastman Kodak Co.*, Rochester, N. Y.

To insure the permanence of the photographic negative or print it is necessary to remove all residual hypo and silver. The effect of composition of the processing solutions on hypo removal has been discussed in a previous paper. The factors which govern the removal of residual silver are considered in the present paper.

The retention of silver in the photographic material gives rise to a yellowing of the non-image area of the negative or print under adverse storage conditions, the stain consisting of silver sulfide produced either by decomposition of complex silver thiosulfates or the action of hydrogen sulfide present in the atmosphere on the residual silver salts.

Present practice of using a single fixing bath to exhaustion except in those cases where the concentration of silver is kept at a minimum by electrolysis does not insure the complete removal of residual silver. With films the use of two fixing baths is necessary but with prints intended for archival purposes three fixing baths are required; preferably with a water rinse between baths. Two fixing baths are sufficient for the normal processing of prints. Data on the limiting concentrations of silver in the fixing baths and the photographic materials are given.

The following factors affect the rate of removal of silver: (*a*) the *p*H of the fixing baths and the wash water, (*b*) the nature of the hardener employed in the fixing bath, and (*c*) the temperature of the wash water. Practical recommendations are given for the removal of silver to produce photographic negatives and prints for (*a*) archival storage, and (*b*) normal keeping periods.

Copper and Sulfide in Developers; R. M. EVANS, W. T. HANSON, JR., AND P. K. GLASOE, *Eastman Kodak Co.*, Rochester, N. Y.

The formation of excessive fog by a developer containing copper or sulfide is well known. However, no quantitative method for determining the concentration of either copper or sulfide in a developer appears to have been published. In this paper, polarographic methods of analysis for these substances are given together with photographic determinations of the effect of concentration on fog, thus demonstrating that the analyses are capable of determining the minimum amount of copper or sulfide required to cause fog under the conditions used.

The fogging action of a developer which has accumulated sulfide by bacterial action is shown to be the same as that produced by a fresh developer containing the equivalent quantity of sodium sulfide.

Factors Affecting the Accumulation of Iodide in Used Photographic Developers; R. M. EVANS, W. T. HANSON, JR., AND P. K. GLASOE, *Eastman Kodak Co.*, Rochester, N. Y.

Development of uniformly flashed motion picture film has been carried out in developers of varying composition and the amount of iodide, which remains in the developer, determined by analysis. The amount of iodide in the developer was found to increase under the following conditions:

(*1*) Development to a higher density.
(*2*) Increasing the footage of film for a given volume of developer.
(*3*) Increasing the time of development for the same density.
(*4*) Increasing the strength of the developer.
(*5*) Increasing the proportion of the surface covered by image.

These results are explained by a kinetic equilibrium between the rate of release of iodide from the developing portion of the emulsion and the rate of removal of iodide from the developer by the undeveloped silver halide.