ABSTRACTS OF PAPERS OF THE FALL CONVENTION AT NEW YORK, N. Y.

OCTOBER 16–19, 1939

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

Photographic Duping of Variable-Area Sound; F. W. Roberts and E. Taenzer, *Ace Film Laboratories,* Brooklyn, N. Y.

In release print laboratories it is necessary to have some method of quickly making duplicate sound negatives which are used to replace damaged original negative sections. New negative may, of course, be re-recorded from a release print, but inasmuch as recording equipment is not always available, a suitable photographic process had to be developed. For this process, the following criteria were set up:

The quality of sound from the dupe negative should be high, so that a trained observer would have difficulty in telling where a dupe had been inserted. All developing should be done in the regular release print positive bath at standard developing time. Inasmuch as this bath is in constant use, no special machine need be started to develop a dupe. The dupe negative must have the same optimum print density as the original negative, and the same fog value in order that the inserted dupe may be printed on the same printer light as the original.

The method that was developed operates as follows: Master positives of every reel of a release and the accompanying cross-modulation tests are first printed on high-contrast title stock. A density of 2.20 is used, a family of cross-modulation curves having indicated this value as best. The reels of master positive are stored, but the cross-modulation test positives are detached and printed on regular positive stock to make dupe negative cross-modulation tests. The test

from reel *1A* is printed at three negative densities, and the tests from the remaining reels are printed to a density of about 1.80. Cross-modulation prints at several densities are then made from each of the dupe negative cross-modulation tests, and from these prints the optimum print density for each dupe negative test is determined. Reel *1A* gives a three-point slope curve of negative density *vs.* print optimum density.

The print optima of the dupe negative tests are now compared with the print optima of the original negative tests (these data being on file). If the dupe values are different from those of the original, the slope curve of *1A* is used to find the negative density that will yield a print density the same as that of the original, and these values of corrected negative densities are kept on file for use when it becomes necessary to make a dupe from the stored master positive.

The paper includes a complete cross-modulation treatment of the subject and a demonstration.

A Sound-Track Center-Line Measuring Device; F. W. Roberts and H. R. Cook, Jr., *Ace Film Laboratories*, Brooklyn, N. Y.

The types of instruments now in use for measuring the position of sound-tracks on film are not completely suited to the use of a release print laboratory. Microscopes using micrometer stages or oculars are slow in operation because they require mental arithmetic to arrive at the distance from the film edge to the sound-track center-line. Projection types are slow in threading, and require a darkened room. The release print laboratory requires a small quick-threading device which gives a direct reading of sound-track position.

A device that fulfills these requirements has been built, and consists of a curved film-gate in which the film is held against a guiding edge by means of a spring parallel. This gate is mounted in *V*-slides which permit motion in a direction perpendicular to the length of the film. Motion is provided by a hand-lever-operated cam, and the position of the gate is measured by a one-ten-thousandth dial indicator.

The gate has in it a hole directly under the sound-track, and beneath is mounted a small incandescent lamp. Directly above the gate is an optical system consisting of a standard 32-mm microscope objective and a 10-power Huygen's eyepiece. The normal cross-hairs of the eyepiece have been replaced with a parallel hair device consisting of two very fine hairs whose mounts slide in *V*-ways perpendicular to the direction of the film. Both hairs operate together and are operated by a common cam and lever which cause them to move; and as they separate or close, they always remain parallel to each other and equidistant from the optical center of the instrument.

The operation is as follows: With film in the gate the operator places a hand on each of the two levers, which are moved simultaneously until the two cross-hairs are directly over the bias lines or over corresponding peaks of modulated variable-area track. The one-ten-thousandth dial indicator then indicates the track center-line position to the nearest ten-thousandth of an inch. With the instrument, a film may be inserted and a reading taken in ten seconds.

Volume Distortion; S. L. Reiches, Cleveland, Ohio.

The contention that a linear recording and reproducing system represents the

ideal, and that sound handled by such a system will be exactly represented, is not borne out by experience. Systems have been built which meet this requirement within limits that are not detectable by the ear and yet these systems do not reproduce sound as it actually is produced. In many cases a definite non-linear response curve is provided to compensate for some factor that is not covered by the above contention. It is the author's thesis that this discrepancy is due to the ear sensitivity to frequencies as a function of loudness.

Using the ear sensitivity curves presented by Fletcher and Munson of the Bell Telephone Laboratories (which have been verified by other observers) it is shown how the ear introduces frequency distortion to a linear system when the sound is reproduced at a level other than the level at which it is produced. It is shown how a sound reproduced above the incident sound level introduces excessive low frequencies. The case for a sound reproduced at a lower level is also examined and the conclusion is drawn that this case accentuates the high frequencies.

It is further shown that the possibility of correcting for the limited volume range of all sound systems may lie in the type of amplifier response curve.

A description is given of three methods used to achieve the desired amplifier characteristics: (*1*) a mechanical method, (*2*) a linear-non-linear system, and (*3*) a selective by-pass system. Circuits are given and the important operating points of each are discussed. The objections to each system are also given.

Further, a brief summary, with diagrams, describes the various set-ups used to record with these amplifiers. This covers work for radio, disk record, and sound-film.

Television Control Equipment for Film Transmission; R. L. Campbell, *Allen B. DuMont Laboratories,* Passaic, N. J.

A television film chain with particular reference to amplifier, sweep, and power circuits in the film pick-up unit is described.

Many improvements in television circuits have been made possible by recent advances in circuits and circuit components in radio and allied electronic fields. Application of some of the newer ideas to motion picture film pick-up equipment has resulted in improved performance and simplicity of operation.

Circuit arrangements which permit flexibility in transmission standards are considered and their application discussed. Also the anticipation of possible future improvements in picture quality is indicated in some circuit capabilities.

Simplification of controls from the television projectionist's standpoint is discussed.

The Production of a Three-Dimensional Motion Picture; J. A. Norling, *Loucks and Norling,* New York, N. Y.

Some problems involved in the production of satisfactory three-dimensional motion pictures have not received much mention in the literature dealing with stereoscopy. Their practical solution has contributed marked improvements to the three-dimensional picture of today.

The fundamental problem in projecting three-dimensional pictures is that of providing a "right-eye" picture that will reach only the right eye and be prevented from reaching the left eye, and to do the same for the "left-eye" picture. To attain this result two methods have been employed with success, namely: the

"anaglyph" in which substantially complementary colors are employed in the viewing devices, and polarized light.

The screen surface upon which three-dimensional pictures are projected by polarization methods is of extreme importance. The selection of the proper type of screen raises real problems but these also have been overcome in a practical way.

Considerations Relating to Warbled Frequency Films; E. S. Seeley, *Altec Service Corp.*, New York, N. Y.

Some warbled frequency films, intended as signal sources for acoustical response measurements, appear to have been made and used without full realization of the true nature of the warbled signal and the manner in which such a signal is affected by a non-linear transmission system. It is pointed out that the warbled signal is a frequency-modulated signal; hence the signal may be represented by a carrier frequency and a series of side-frequencies, all of which are steady and discrete. It is pointed out, and substantiated experimentally, that the signal must be regarded in this light when considering the effect on it of a non-linear transmission system. The frequency structure of one "warble film" in use is calculated and shown graphically. Fundamental requirements for a suitable warbled frequency film having sinusoidal modulation are discussed and values for modulation rate and for modulation depth are recommended. The side-frequency array provided by the recommended modulation constants is shown in graph form. Expressions are derived giving the frequency relationship and relative amplitudes of the side-frequencies resulting from the non-sinusoidal frequency modulation which contains two components of modulation rate, one component having an associated phase constant. The side-frequency structures corresponding to some assumed combinations of two rates are calculated and illustrated. Certain assumptions are made for distortion or departure from sinusoid of a modulating frequency and the effects on the side-frequency structure are shown. From the latter calculation recommendations are derived for tolerances of departure from sinusoidal modulation for a warbled frequency film.

A Transmission System of Narrow Band-Width for Animated Line Images; A. M. Skellett, *Bell Telephone Laboratories*, New York, N. Y.

A new method of transmission and reproduction of line images, *e. g.*, drawings, is described which utilizes a cathode-ray tube for reproduction, the spot of which is made to trace out the lines of the image twenty or more times a second. The steps of the complete process are: (*1*) the transcription of the line image into two tracks similar to sound-tracks on motion picture film; (*2*) the production from these tracks of two varying potentials by means of photoelectric pick-up devices; (*3*) the transmission of these potentials; and (*4*) their application to the cathode-ray deflector plates to effect reproduction. Satisfactory transmission of fairly complex images, *e. g.*, animated cartoons, could be effected within a total band width of 10,000 cycles.

Science and the Motion Picture; H. Roger, *Rolab Photo-Service Laboratories*, Sandy Hook, Conn.

The motion picture is a product of science. There is ample historical material available for those who wish to convince themselves of this fact, but a brief review is given of the work of Muybridge and Marey in order to clarify the cause of their inventions. The ensuing discussion centers around the question, "Has science maintained its interest in the motion picture and has it utilized its advantages to its full extent?"

In this paper the word "science" is taken broadly and includes research, dissemination of knowledge, and industrial application. Motion picture's application to science is divided into two distinct categories and are discussed in detail:

(*1*) The motion picture as an aid to scientific research;

(*2*) The motion picture as a medium for the dissemination of knowledge.

The paper concludes with descriptions and demonstrations of interesting material from the files of the Rolab Photo-Science Laboratories. Also an inside view is given of production activities of an unusual character.

The Problem of Distortion in the Human Ear; S. S. Stevens, *Harvard University,* Cambridge, Mass.

The amount of distortion produced by the ear upon a simple sound-wave has been measured by analyzing the electrical output of the ears of animals and by indirect experiments with human ears. The amount of distortion in a sound-wave which the human ear is just able to detect has also been determined, and it is found that the threshold of audible distortion is intimately related to the amount of distortion occurring in the ear itself. Hence the transmission characteristics of the ear determine the tolerances for distortion in sound reproduction.

Report of the Standards Committee; E. K. Carver, *Chairman.*

Proposals have been received from the ISA Secretariat for International Standardization of raw-film cores; 16-mm sound-film; projection reels; projection reel boxes; 8-mm film dimensions; and definition and marking of safety film.

Most of these proposals differ from the SMPE standards only in tolerance. Some of the tolerances appear to be unimportant and some important. The European practice for projection reels differs so widely from the American practice that it is deemed impossible to come to an international agreement. Standardization of 16-mm projection reel boxes appears to be outside the range of useful standardization.

The international standard definition of safety film has been cleared up in all points except the question of nitrogen content.

The question of sound-track dimensions for 35-mm and 16-mm film was clarified, to a considerable extent, at the Hollywood meeting of the Committee but no definite conclusions have yet been reached.

No satisfactory standard for 16-mm sound-film sprockets has yet been attained.

The publication of the Academy standard 2000-ft release print has been delayed pending further questions by the Academy.

Some Industrial Applications of Current 16-Mm Sound Motion Picture Equipment; W. H. Offenhauser, Jr., and F. H. Hargrove, *The Berndt-Maurer Corp.,* New York, N. Y.

Sixteen-mm sound motion pictures are potentially one of the most effective means through which industry can develop a broad, cost-cutting communication system within the organization itself.

Many latent applications for internal films exist; the cases in business where the improved transfer of ideas afforded by films can be most profitable are almost unlimited. Several specific instances are cited.

Sixteen-mm equipment is simple, easy to operate, reliable, and economical. With it, a member of the industrial organization who knows his company's products, policies, and structure can readily produce films that are, in every respect, profitable internal communications media.

Future Development in the Field of the Projectionist; A. N. GOLDSMITH, New York, N. Y.

The highly diversified activities required for the production of a motion picture find their effective culmination in the work of the theater projectionist. The unusually concentrated value embodied in the reels of film corresponding to a feature picture can be brought to the theater audience and made the basis for commercial returns only through the activities of the projectionist.

Nevertheless the public is little aware of what goes on in the projection room.

The projectionist is in part compensated by the likely stability of his activities. His present position in the theater is important. Future developments in the motion picture field, such as three-dimensional sound, wider use of color, and the like, will make his work even more important. The possible inclusion of television projection in theater programs will require his mastery of the new field which is sufficiently similar to his present activities in its broad outline to enable its handling by the theater projectionist.

The Projectionist's Part in Maintenance and Servicing; J. R. Prater, *Congress Theater*, Palouse, Wash.

It is the duty of the projectionist to see that all projection equipment is kept in condition to give excellent service dependably and efficiently. It is impossible to accomplish these results by depending upon memory alone. The projectionist must establish and keep written records of all necessary maintenance data. He must follow a written schedule in making inspections and in doing maintenance work. He must establish a reliable system for checking and ordering supplies and spare parts at regular intervals.

The projectionist should do as much of actual service work as his knowledge, ability, tools, and available test equipment will permit. At least nine-tenths of trouble shooting should be done before any trouble exists. He should obtain detailed drawings of internal and installation wiring of all electrical equipment, besides identifying the points at which tests may be made. He should prepare a written outline of all tests that could be made if various troubles existed. Then he should actually make all possible tests in advance, wherever possible, without causing damage, by deliberately creating the trouble and then correcting it. He should immediately record the exact results of each test in the written outline. In this way, simple tests may serve as well as or better than elaborate ones.

The professional service engineer with special test equipment is a necessity to the finer and more difficult parts of modern servicing, but the projectionist who

makes the best of what resources he has can also do a very valuable part of the job.

Suggestions for Encouraging Study by Projectionists; F. H. Richardson, *Motion Picture Herald*, New York, N. Y.

This paper stresses the great importance of expert work in theater projection rooms and points out that pride in performance is essential to high excellence. If the status of projection were elevated to a higher plane there would be as a result improved excellence in results both on screen and through loud speakers. It offers a suggestion concerning the contacts of the Society with the projectionists' organizations.

The Production of 16-Mm Sound Pictures for Promoting Safety in the Mineral Industries; M. J. Ankeny, *Bureau of Mines, U. S. Department of the Interior*, Pittsburgh, Pa.

The paper deals chiefly with experience in developing 16-mm direct sound recording technic in producing safety educational films. Attention is called to the fact that direct 16-mm recording and photography have a great potential usefulness in the field of education, not as a competitor of 35-mm, but as a means of extending the use of sound motion pictures into fields that 35-mm is unable to serve.

Some of the difficulties encountered in underground motion picture photography and how these difficulties were met are described; also the types of film used and the various printing methods that have been employed in order to arrive at a most satisfactory procedure.

The method employed in recording sound directly on 16-mm film, in which the double-system variable-area is used, is described in some detail.

Artificial Reverberation for Motion Picture Studios; P. C. Goldmark and P. S. Hendricks, *Columbia Broadcasting System*, New York, N. Y.

An electroöptical method of producing reverberation synthetically will be described and the latest model of the equipment will be demonstrated. The method employed consists basically of recording the original program on the rim of a phosphor-coated disk by means of a modulated light-source and then picking up the continuously decaying sound images after a predetermined time interval by means of photocells.

The exponential decay curve of the phosphorescent substance will produce an infinite number of secondary sound impulses to which any desired decay characteristic can be applied. This reverberation signal is then mixed with the original program in the proportion required.

This new reverberation device has been successfully employed in radio broadcasting and can be used in phonograph as well as in motion picture sound recording, where the scenic effect or script requires a type of sound which, due to the deadness of the sound stage, might not readily be available.

This synthetic reverberation device would replace the use of so-called echo chambers, at the same time introducing an appreciable amount of flexibility without degrading the quality of the original sound.

Delivering Laboratory Results to Theater Patrons; J. R. Prater, *Congress Theater*, Palouse, Wash.

A discussion emphasizing the importance of actually delivering the benefits of laboratory research and developments to the theater patrons who furnish the financial support for practically the entire motion picture industry.

Accomplishments in photography, sound recording, projection, and sound reproduction are discussed briefly. Examples are given of various ways in which theater screen results may suffer regardless of the excellence of films and equipment.

It is pointed out that whatever can be done to increase the projectionist's technical knowledge, ability, and pride in good workmanship will ultimately benefit the entire industry. To this end, it is suggested that if possible, information from the JOURNAL of the Society of Motion Picture Engineers be made easily available to projectionists.

A New Non-Intermittent Motion Picture Projector; F. Ehrenhaft and F. G. Back, New York, N. Y.

The authors have designed a projector wherein the optical compensation is effected by means of a rotating glass prism. The problem was originally attacked from the viewpoint that by eliminating the errors inherent in the rotating glass prism, a projector could be designed that would be both simple and practicable. The dimensions of the rotating glass prism and its optical placement result from basic optical laws, and the arrangement depends upon the size of the image and on the materials. Errors inherent in the rotating glass prism are (*1*) Nonlinear displacement on the screen causing a lack of definition: (*a*) errors of the center rays, (*b*) errors of the corner rays, (*c*) errors caused by shrinking of the film; (*2*) Chromatical errors; (*3*) Spherical errors: (*a*) caused by the size of the prism, (*b*) caused by the deviation of light in glass; (*4*) Astigmatism caused by the movement of the prism; (*5*) Side images (projection of more than one frame on the screen); (*6*) Limited focus; (*7*) Defects by reflection.

Elimination of these errors was achieved by: (*1*) (*a*) Limitation of the effective rotation angle, (*b*) use of a curved gate, (*c*) establishing the tolerable limits of film shrinkage; (*2*) Calculating size and displacement of the colors at the extreme position of the prism; (*3*) (*a*) Use of special lenses or additional lenses corrected for glass instead of for air, (*b*) compensation by a curved gate; (4) Slip-shaped diaphragms; (*5*) Use of diverse diaphragms; (*6*) Use of special lenses or additional lenses; (*7*) Diaphragms for the condenser and screening off the edges of the rotating prism. Relation between amount of light on the screen, absence of flicker, and arrangement of condenser and lamp-filament.

These factors will be treated by means of illustrations and diagrams. A working model will be shown and test-films projected to illustrate what has been accomplished up to now.

A Flexible Time-Lapse Outfit; W. W. Eaton, *Eastman Kodak Company*, Rochester, N. Y.

An apparatus is described which has been designed to enable single movie frames to be made automatically at intervals conveniently adjustable over a wide range. It is known as the Electric Time-Lapse Outfit, and is designed primarily

for the Cine-Kodak Special. It consists of an electromagnet which mounts on the camera and interacts with the one-frame shaft, and suitably housed condenser-resistance circuits which supply impulses to the electromagnet and cause pictures to be taken. By expanding basic times through an interval multiplier, pictures may be made automatically at intervals throughout a range of $^1/_4$ second to 24 hours. The exposure time is completely independent of the time between pictures and may be set throughout a range of $^1/_{100}$ second to 6 seconds. In addition, where artificial illumination is required, a lamp control is provided which automatically turns the lights on and off for each exposure, regardless of the time between pictures. The whole outfit operates on self-contained batteries, and is entirely portable.

Automatic Slide Projectors for the New York World's Fair; Fordyce E. Tuttle, *Development Dept., Eastman Kodak Co.*, Rochester, N. Y.

Special slide-changing projectors were designed and built for the Kodachrome exhibit in the Eastman building at the New York World's Fair. The individual screen images are seventeen feet wide and twenty-two feet high. Eleven machines are synchronized so that panoramic scenes one hundred and eighty-seven feet long may be shown. Indexing of the slides is controlled by notches in a sound-film so that the entire program is automatic.

The slides in each machine are arranged in two rows, and each machine has two gates and two complete optical systems. All the slides in one row are rigidly bolted to a ring-gear forty-eight inches in diameter. For each new picture the ring-gear is spring-indexed into a new position. While one gear is being moved the other is stationary, and the picture being projected is in the stationary row. An optical compensator geared to the ring-gear corrects for any inaccuracies in indexing, and the image is optically "dowelled" on the screen. The accuracy of registration is such that one slide may be substituted for another without movement on the screen.

The light-source used is a 2500-watt, high color-temperature tungsten lamp. Water-cells and refrigerated air are used to cool the film in the gates. The shutter system is located between the lamp and the gate in order to minimize the heat at the gate. Shutters in the two beams are interlocked in such a way that while they are being moved the light to the screen is constant. The cross-dissolve may be rapid or slow depending on the type of transition desired.

Slide projectors similar in structure are also being used in the Perisphere Building. There the slides are projected in rapid enough succession to show motion.

Motion Picture Theater Auditorium Lighting; B. Schlanger, New York, N. Y

The various functions of motion picture theater auditorium lighting are discussed. Particular analysis is made of the lighting which is used during the period in which the motion picture is projected. Past and present lighing practices in this respect are explained. The advantages and disadvantages of these practices, and a new type of lighting are discussed. It is proposed that the illumination levels of the interior surface of the auditorium be at greater levels than have been heretofore found to exist. A definite relationship between the screen brightness and that of the auditorium surfaces is indicated as desirable. Recent tendencies toward higher screen brightnesses have made a very low intensity lighting in the

auditorium much more undesirable, and therefore have made it more important to arrive at a new solution for motion theater auditorium lighting. The realism of the projected picture can be considerably heightened by proper surface illumination. Controlled reflected light coming from the screen and re-reflected from the interior surfaces is discussed as a medium for lighting.

Lenses for Amateur Motion Picture Equipment (16-Mm and 8-Mm); R. Kingslake, *Eastman Kodak Company*, Rochester, N. Y.

In all motion picture photography and projection, lenses of high relative aperture must be used. However, on account of the small size of the amateur frame, the focal length is short, and the linear aperture of the lens is therefore small, resulting in considerable depth of field. Thus in cine work, great lens speed is not automatically associated with small depth, as is the case in ordinary photography.

Moreover, as the entire motion picture frame must be seen by the eye at a glance, the angular field covered must be much smaller than in still pictures which may be examined critically and deliberately. This fact is of the greatest assistance to the lens designer because high aperture and field are inevitably somewhat incompatible, and types of lens construction which favor aperture generally cover a relatively small field.

Perspective considerations usually require a projection lens covering only about half the angular field covered by the taking lens, which fact enables projection lenses of very high relative aperture to be made. Some of the types of construction commonly used in amateur cine lenses are described, including an account of the Kodak line of 16-mm and 8-mm lenses.

Tape Splicers for Film Developing Machines; J. G. Capstaff and J. S. Beggs, *Eastman Kodak Co.*, Rochester, N. Y.

The splicers described make a strong, waterproof tape splice for sprocketless developing machines, and have proved very successful. The ends of the films to be spliced are placed one at a time in a punch and die, where three holes are punched on the centerline of the films, the ends of which are then trimmed. The two holes away from the ends are placed over two pairs of pegs, which are in a straight line and spaced so that the abutting ends of the film are separated by $^1/_{16}$ of an inch. A piece of 1-inch wide waterproof adhesive tape, previously placed adhesive-side up and symmetrically under this space, is now wrapped around the film. The tape sticks to itself through the two holes near the ends of the film, thus preventing the tape from loosening when the emulsion swells. The splice is quite thin, and there is nothing about it to catch in the machine or blow-off. It is also very dependable and will not mar film in taking up or make the roll out of round.

An Investigation of the Ground-Noise of Photographic Sound Prints; O. Sandvik and W. K. Grimwood, *Eastman Kodak Co.*, Rochester, N. Y.

This paper deals with the effect of the negative sound-track on the ground-noise of the print. Data are presented showing the influence of negative density and negative gamma on print ground-noise for fine, medium, and coarse-grain negative emulsions.

The Backward Perspective—a Résumé of Three Years of Progress in the Film Library of the Museum of Modern Art; Douglas L. Baxter, *Museum of Modern Art Film Library*, New York, N. Y.

In 1936 a paper was read before the Society outlining the organization and aims of the Museum of Modern Art Film Library, then in its first year of existence.

The present paper deals with the activities of the Film Library during the intervening three years, giving a brief résumé of its growth in the local, national, and international fields, and tracing its development from the position of an unrecognized institution with rather limited headquarters to one where the opening of its permanent headquarters in its own $2,000,000 building was considered of sufficient national importance for the President of the United States to make it the occasion of a nation-wide broadcast.

In international circles the importance of the Film Library has won such recognition that in response to its invitations representatives of twelve foreign nations as well as representatives of the Library of Congress and the Division of Cultural Relations of the State Department attended the first annual Congress of the International Federation of Film Archives held in New York in July, 1939.

The present activities and future plans of the Film Library are explained. The paper is amplified by the showing of *The Movies March On*, a recent issue of the "March of Time," devoted to the work of the Museum of Modern Art Film Library.