ABSTRACTS OF PAPERS FOR THE ROCHESTER CONVENTION OCTOBER 12–15, 1936

The Papers Committee submits the following abstracts of papers for the consideration of the membership. It is hoped that the publication of these abstracts will encourage attendance at the meeting and facilitate better discussion of the papers.

G. E. MATTHEWS, *Chairman*

C. N. BATSEL	M. E. GILLETTE	H. B. SANTEE
L. N. BUSCH	E. W. KELLOGG	T. E. SHEA
A. A. COOK	R. F. MITCHELL	P. E. VON SCHROTT
L. J. J. DIDIEE	W. A. MUELLER	I. D. WRATTEN

"The Development of the Art and Science of Photography in the Twentieth Century;" C. E. K. Mees, *Eastman Kodak Co.*, Rochester, N. Y.

An account of the developments in practical photography during the past thirty-five years and of the progress that has been made in our knowledge of the scientific principles of photography.

"A Record Word-Spotting Mechanism;" R. H. Heacock, *RCA Manufacturing Co., Inc.*, Camden, N. J.

A word-spotting mechanism is described, which replaces the pick-up needle upon a predetermined spot of a phonograph record by pressing a remote release button after setting three reference readings previously established by the trial and error method.

The pick-up arm is held poised above the record by a direct electromagnetic pull upon the back end of the pick-up arm. When this electromagnet is de-energized the pick-up falls, due to the pull of gravity.

The speed of fall may be controlled by means of an adjustable exhaust port on an air dashpot. No catches or latches are used to release the arm. A manually operated open-circuiting release button is in parallel with a second open-circuiting switch in the electromagnet circuit, and this second switch is opened each revolution of the turntable by a fixed cam. To release the pick-up, the manually operated button is depressed, but the pick-up is not released until the second switch is cammed open by the turntable.

In this way the device is indexed with relation to the radial position of the record so that not only may the correct groove be repeatedly selected, but the desired portion of the groove may be consistently repeated. The effect of eccentricity of the record center hole with relation to the recorded grooves is eliminated. Variations in the size of the record hole are accommodated by means of a tapered centering pin.

Each of the mechanical parts, with the exception of the cammed turntable switch, is rigidly located upon the single pick-up arm unit. All necessary electrical parts for complete operation of the mechanism on a 105- to 125-volt, 50- to 60-cycle supply are located on the underside of the motor board.

"Modern Loud Speaking Telephones and Their Development;" C. Flannagan, R. Wolf, and W. C. Jones, *Electrical Research Products, Inc.*, New York, N. Y.

The subject of modern loud speaking telephones is discussed with reference to efficiency, power-handling capacity, response-frequency characteristics, and distributional characteristics. Improvements and their significance are pointed out. The latest types of loud speaker are described and certain development problems discussed.

"A Review of the Quest for Constant Speed;" E. W. Kellogg, *RCA Manufacturing Co.*, Camden, N. J.

The importance of constant record speed in machines used for reproduction of music was realized by Edison and many other pioneers in sound recording. Crude performance from other standpoints made it hardly worth while for the earlier workers to attempt to obtain extremely high standards of speed constancy.

The flyball type of phonograph governor came into the picture and has been worked so well that it has not even yet been superseded, although with synchronous motor drives for certain types of equipment, the governor is no longer necessary.

Recording sound photographically probably began with the work of Alexander Graham Bell, who made records upon glass disks; but not until long celluloid films were available and the motion picture became thoroughly established, did photographic sound recording become a competitor of the disk. As late as 1930 there were many engineers who advocated the disk for sound picture work.

While the same general principle applies to both mechanical and photographic records, the latter involves certain additional problems.

Among the earlier workers in this field, the expedients adopted by C. A. Hoxie and C. L. Heisler, of the General Electric Company, deserve recognition. Brief descriptions and discussions are given of a number of ingenious arrangements for improving speed constancy which have been employed by various inventors and engineers. Some of these expedients have been applied to record turntables and some to film equipment.

"The Schwarzkopf Method of Identifying Criminals;" J. Frank, Jr., *International Projector Corp.*, New York, N. Y.

At the present time there are only two means of sight identification generally in use—the still picture and the police headquarters line-up. Neither is particularly effective. The use of a sound motion picture which can be easily exhibited to widespread audiences in a short space of time is already regarded as one of the most useful developments in this field. Sound-film recording equipment of both the single- and the double-film type, and for both 16-mm. and 35-mm. technic, has been developed that provides for a picture about $3^1/_2$ minutes long. The special apparatus and the technic developed are described, and actual motion pictures of actor-criminals shown to prove the effectiveness of the method.

"Medical Motion Pictures in Color;" H. B. Tuttle, *Eastman Kodak Co.*, Rochester, N. Y.

Improvements made during the past year in methods, apparatus, and materials used in making medical motion pictures, particularly Kodachrome, and the characteristics of an emulsion suitable for exposure with artificial light are discussed. The uses of special accessories for medical motion picture photography are de-

scribed. A demonstration medical film will be shown at the conclusion of the paper.

"Color Photography;" C. E. K. Mees, *Eastman Kodak Co.*, Rochester, N. Y.

All processes of color photography depend upon splitting the light into the three primary colors—red, green, and blue-violet—making three separate pictures by the three colors, and then combining the three pictures again when they are viewed.

In the earliest processes, three quite separate negatives were made; from them three positives were made; and the latter were projected by means of three optical lanterns through suitable color filters so that the images fell on top of one another upon the screen and produced a color picture. Then methods were invented by which a multitude of tiny color filters covered the whole surface of the film, these filters being so small that they are invisible to the unaided eye. The picture taken through the filters and then viewed through the filters again is thus composed of a multitude of units, each of which is taken and viewed by one of the three primary colors.

A process similar to this is the lenticular film process, in which the film base is covered with microscopic lenses which form images of the three filters on the film. The three images are then projected again through the three filters fitted to the lens of the projector.

Another method of making the color pictures is to print each of the separation negatives, making the prints of colors complementary to the filters through which the pictures were taken; and then superimposing the prints so that the red filter negative is printed in blue-green; the green filter negative in magenta; and the blue filter negative in yellow. Essentially, this is the process used in producing color reproductions in magazines, each of the separate pictures being printed in its suitably colored ink and the printings being superposed.

In the multilayer processes, the three separation pictures are made in the depth of the film. The film has superimposed layers, each of which is sensitive to one of the primary colors. After exposure, the three images are converted into dye colors, either by the selective bleaching of dyes present in the coating or by the formation of dyes in the layers—by coupler development, for instance.

"Manufacture of Motion Picture Film;" E. K. Carver, *Eastman Kodak Co.*, Rochester, N. Y.

The manufacture of motion picture film may well be studied from the point of view of the research man, the technical man, the manufacturer, the machine designer, and the personnel man; the efforts of all of whom must be coördinated to produce motion picture film successfully.

The fundamental requirements of manufacturing, after the emulsions and support formulas have been worked out, are cleanliness and uniformity. These are only to be obtained by a careful elimination of dirt at the source, an elaborate system of tests, and meticulous control of all processes. The flow of materials should approach as nearly as possible the ideal of continuous production.

The raw materials used are cotton linters, sulfur, sodium nitrate, camphor, and solvents for the nitrate base; cotton linters, acetic anhydride, acetic acid, triphenyl phosphate, and solvents for safety base; and hides, silver, nitric acid, potassium bromide, and sensitizing dyes for the emulsions. The nitration and acetylation of cellulose require more careful control of the original cellulose and

of the conditions of reaction than is necessary for other purposes, but otherwise the standard practice is followed.

In making the "dope," the cellulose ester, plasticizer, and solvents are carefully mixed in large mixers, with continuous filtration.

The coating or casting is carried out on large drums or wheels many feet in diameter and up to approximately five feet in width. With some systems, flexible metal bands are used in place of wheels. The coating surfaces are carefully polished and plated in order to give a smooth surface to the film support. A current of warm air is passed around the periphery of the drum in order to evaporate the solvents from the "dope," after which the film support is stripped from the wheel and subjected to further treatment, such as subbing, tinting, further drying, *etc.* The subbing is necessary in order to make sure that the gelatin emulsion will adhere to the film base.

The simple processes of emulsion making are well known, and the special details can not be discussed in the present paper; but uniformity is here attained, as in other parts of the manufacture, by carefully testing all raw materials and rigidly controlling all the details of the process, demanding, as well, years of experience on the part of the emulsion maker.

The emulsion coating operation is carried out by passing the film support, subbed side down, under a roller partly immersed in a pan of melted emulsion. The speed of coating and the temperature of the emulsion govern the thickness of the emulsion coating. Immediately after the coating, the emulsion is chilled to set it in place, and then dried under carefully controlled humidity, temperature, and air-velocity conditions, by passing the film in festoons through a long tunnel drier. The air used in drying the emulsion must be controlled as to relative humidity within a very small range if best results are to be obtained, since the speed of emulsions is sensitive to changes in moisture content.

The slitting and perforating of a film should also be carried out under controlled humidity conditions. The slitting is done by revolving knives, equally spaced above and below the film, to get a shearing action, the upper knife having a keen razor edge, and the lower knife a sharp square edge. The perforating is done by punches and dies so accurately made that the punches can not be inserted in the dies by hand without injury, although when clamped in the machines, they go in and out thousands of times without appreciable wear. Each punch consists of eight punching members and eight positioning members. The positioning members have tapered ends and fit the holes previously punched so as to position the film exactly for the next set of holes to be made.

The wrapping, storing, and shipping of the film are carefully controlled, and every endeavor is made to see that the customer receives the film under the best conditions for use.

"Stability of Motion Picture Films as Determined by Accelerated Aging;" J. R. Hill and C. G. Weber, *National Bureau of Standards*, Washington, D. C.

Motion picture film of the safety type shows great promise as a material upon which to preserve records of permanent value, according to tests made at the National Bureau of Standards. This type of film, having a base of cellulose acetate, is designed for use where the highly combustible film of the ordinary theater type, cellulose nitrate, presents too great a hazard from fire and explosion. In addition to its safety features, it appears to have the additional advantage of

being much more lasting. Both types of film were studied by determining the effects of various accelerated aging treatments upon samples of new film. Samples of old nitrate were tested also to determine their condition after natural aging.

The most satisfactory accelerated aging treatment found consists in heating the film in a dry oven, at 100°C., a test employed to find the relative stability of record papers. The films were tested for physical and chemical properties before and after oven-aging tests of various durations, and changes in the properties noted. High retention of folding endurance and viscosity, and small increase in acidity are considered indicative of stability. The acetate film was found to be excellent in these respects. Large losses in folding endurance and viscosity, plus large increases in free acid in the material characterized the changes in nitrate under the heat test. Its poor stability was further indicated by rapid change of resistance to an ordnance test used to determine the condition of smokeless powder.

The cellulose acetate film withstood oven-aging for 120 days without serious chemical or physical changes, while the nitrate film deteriorated beyond usefulness after 10 days under the same conditions. The acetate appears to have lasting qualities comparable to those of permanent-record papers of high quality, and the optimal atmospheric conditions for the preservation of paper records are suitable for this film. Nitrate film is perishable, and its deterioration is greatly accelerated under warm, moist conditions. The preservation of valuable nitrate film is a complicated problem involving both elaborate fire protective measures and air-conditioning.

"Care of Slide-Films and Motion Picture Films in Libraries;" C. G. Weber and J. R. Hill, *National Bureau of Standards*, Washington, D. C.

Reference libraries of the future may contain files of photographic films in addition to shelves of conventional books, if the present trend toward the use of films for recording and copying the printed word continues. Hence, it appears that librarians, long the custodians of our valuable books and papers, are to be confronted with the problems involved in the care of records on photographic films.

The film used for records is of the safety type. It is no more inflammable than books; hence it offers no new problems in fire protection. It is very stable chemically, and should be lasting if properly made and stored. However, the safety film is quite sensitive to moisture changes, and is brittle when dry. It is pointed out that satisfactory service requires that the moisture content be controlled by air-conditioning the storage rooms or vaults. The ordinary type of motion picture films have a base of cellulose nitrate which is highly combustible. The storage of this type of film presents difficult problems of fire protection, and should not be undertaken by anyone not entirely familiar with the problems.

"Fire Prevention in the Motion Picture Industry;" H. Anderson, *Paramount Pictures, Inc.*, New York, N. Y.

The subject of fire prevention in the Motion Picture industry is extremely broad, since the motion picture industry embraces practically every known fire prevention problem.

It is of the utmost importance, because of the combustible nature of motion picture film, the necessary consideration that must be given to safety of life in the operation of theaters, and the serious financial effect of the interruption of

studio operations by fire. It is further complicated by the extreme susceptibility of sound recording and reproducing equipment and of finished motion picture film to fire and water damage.

Motion picture exchanges under the Motion Picture Producers & Distributors of America, Inc., have had an amazingly excellent fire record, the lowest fire loss record of any industry in the United States. This is the result of the adoption of active fire prevention measures by the exchanges, as described in this paper. It is suggested that the Society of Motion Picture Engineers interest itself in active fire prevention work in the industry, and that individual motion picture engineers keep fire prevention in mind in connection with their work, whether it be operation or design.

In design, where possible, non-combustible materials should be included, and the construction should be such that the apparatus is protected as far as possible against damage by the water or chemicals used for fighting fire.

The chemistry of fire extinguishing is discussed, as also the various types of fire apparatus. The principal types of fire extinguisher are described, and their effectiveness and defects brought out particularly with respect to their application to the motion picture industry. A description of experiments made with a new type of high-pressure spray system is given.

The standard methods of fire prevention in laboratory, exchange, and theater are discussed, and a detailed description is given of the fire problem in motion picture studios. The special apparatus necessary due to the severity of the problem, and the organization and procedure of the studio fire department are described.

While the National Fire Protection Association and insurance companies have established standard requirements for the installation of fire equipment in projection rooms, exchanges, and in connection with sound equipment, no set of instructions has ever been prepared for the benefit of motion picture projectionists at time of fire. The problem constantly arises as how to handle a fire properly in the projection room. It is recommended that the SMPE adopt a standard set of instructions which will tell the projectionist exactly what to do in case of fire.

A motion picture showing various fire-preventing devices, and fire apparatus in action in a motion picture studio will be shown at the conclusion of the paper.

"The Projection of Lenticular Color Films;" J. G. Capstaff, O. E. Miller, and L. S. Wilder, *Eastman Kodak Co.*, Rochester, N. Y.

In the projection of lenticular color films a large portion of the incident light is lost be absorption in the tricolor filters. To determine the feasibility of satisfactorily showing these films in large theaters, an experimental projector was set up embodying the few simple changes in standard theater equipment that were necessary to obtain the required large increase in screen illumination.

Successful demonstrations with the apparatus at *Loew's Rochester Theater* at Rochester and the *Center Theater* at New York have proved that it is quite possible to secure enough screen brightness to give a satisfactory showing of the lenticular films in the majority of theaters.

The principal changes made in the standard projection apparatus in order to obtain the greatly increased illumination were as follows:

(1) *Increased Relative Aperture.*—By substituting an $f/1.6$ projection lens for the $f/2.4$ lens commonly used, and by increasing the working relative aperture of

the 65-ampere high-intensity reflector arc so as to take full advantage of the increased aperture of the projection lens, it was possible to get 2.25 times the screen illumination obtained with the regular equipment.

(2) *Reduction of the Shutter Loss.*—A further increase was obtained by the use of a quicker pull-down and a corresponding reduction in the angle of the shutter blades; this may not, however, be feasible in practice.

(3) *Increased Filter Transmission.*—As a result of numerous practical tests it was found to be possible to increase the transmission of the tricolor projection filters by 33 per cent, without undue loss of color values.

(4) *Lower Print Density.*—The excellent tone reproduction obtained in the process, together with a modification of the optics of the lenticular film, makes possible a substantial lowering of the print density. The resultant increase in the brightness of the projected image amounts to some 25 per cent.

The large increase in the radiant energy directed onto the film has made it necessary to employ a heat filter in the condenser system.

Refinements in the present system are expected to produce additional small increases in illumination, and it is believed to be possible to develop other special equipment to take adequate care of the few (special) cases where it is necessary to project upon an unusually large screen.

"Effect of Lens Aberrations on Image Quality;" W. B. Rayton, *Bausch & Lomb Optical Co.*, Rochester, N. Y.

Lenses are used to form images for two principal purposes: first, to produce the most accurate record possible of the original object; and second, to produce a pleasing effect. The character of the image formed by a lens depends upon diffraction and upon the residual aberrations left after the designer and the manufacturer have done their best. For pictures of the first type it is desirable that aberrations be reduced to a minimum, but for pictures of the second type they are very often deliberately employed to produce desired effects. In motion picture projection, lenses of the first class are doubtless always desired. In motion picture photography, some attention has been given to achieving special effects by deliberately introducing aberrations into the lens.

Among the many aberrations that afflict lenses, one of the most important is chromatic. Since, in general, only two colors can be brought to a common focus, some thought has been given to the question of what two colors are best to choose to meet the requirements of various kinds of lighting and different types of sensitivity of the emulsion. Recent experiments indicate that for a combination of particular interest in motion picture photography, namely, incandescent lighting and super-pan emulsion, no significant difference in performance is detectable among lenses of 12-inch focus or less, depending upon whether the two colors chosen for chromatism are yellow and violet, or red and violet.

"Mercury Arcs of Increased Brightness and Efficiency;" L. J. Buttolph, *General Electric Vapor Lamp Co.*, Hoboken, N. J.

The low brightness, 15 candles per square-inch, of the Cooper-Hewitt mercury arc, while an asset in industrial illumination, has prevented possible applications of the lamp where high brightness and, consequently, small source areas are essential for use with reflectors and refractors, and are valuable for use where space is at a premium. The Cooper-Hewitt quartz mercury arc represented an increase of 500 to 1000 candles per square-inch, which permitted compact

reflectors but still meant too large a source for satisfactory control by optical means. This brightness has still been so low compared with the 10,000 foot-candles per square-inch possible with incandescent lamps and the 100,000 characteristic of the crater of the carbon arc, that little serious thought has been given to the mercury arc for projection or for long-range floodlighting work.

The recent development of so-called super-high-pressure mercury arcs has now opened up some of these possibilities. By designing a quartz mercury arc to operate at mercury vapor pressures of 20 to 30 atmospheres instead of the 1 atmosphere characteristic of the older high-pressure arcs, brightness of the order of 5000 candles per square-inch is attained in air-cooled lamps. By operating water-cooled arcs at higher pressure, brightnesses of 100,000 to 250,000 candles per square-inch have been attained during rather short lamp lives. Of the possibilities ranging in rating from 50 to 10,000 watts, only one unit thus far has been standardized for manufacture in the United States.

The 85-watt, type *H-3* mercury lamp may be thought of as a small version of the type *H-1*, 400-watt and the type *H-2*, 250-watt mercury lamp standardized during the past few years. It is operated from a similar reactive transformer providing 440 volts for starting and 250 volts at the arc terminals, at a normal arc current of 0.4 ampere. It is rated at 35 initial lumens per watt in the arc and for a 500-hour life. The quartz tube of the arc proper is enclosed in an outer insulating bulb of ordinary glass, which limits the short-wave end of the spectrum to about 320 μm. Through the visible and near-ultraviolet range the spectral distribution is similar to that of other high-pressure mercury arcs except for the unusual intensity of the 365 μm lines.

The effective dimensions of the light-source or arc proper are about 0.6 by 0.15 inch, but the discharge is of the constricted type, giving a higher maximal brightness than the dimensions would indicate in calculation.

This arc is of the oxide-coated electrode type, designed only for a-c. operation. Since the light output follows approximately the arc current, its intensity is variable; and although the flicker is not noticeable directly, it is such as to produce stroboscopic effects on moving objects, and may be a limitation in photography or in projection where motion is involved.

It is believed that the high intensity of the 365 μm lines and the high brightness of the source may permit application of the lamp to certain of the more highly specialized lighting problems in the motion picture industry.

"Trick and Process Cinematography;" J. A. Norling, *Loucks and Norling Studios*, New York, N. Y.

Process photography, which is the broad classification given to all branches of special and trick cinematography, plays an important part in making today's motion picture. Many articles have appeared relating to this subject, but, unfortunately, most of them have been devoted only to a discussion of the importance of this branch of photography and very few writers have divulged any of the details of the methods employed. This paper sets forth in general the underlying procedure in the various branches of the art, and treats many phases thereof in sufficient detail to be fully informative.

The branches of process photography disclosed include: transitional effects, such as dissolves and wipes; matte shots; simple and intricate multiple exposures; composites and montages; animated titles and presentation effects;

combined drawing and actual photography; optical trick printers and cameras; miniature projection background process; problems in making dupe negatives by projection, dodging, *etc.* Important steps are described and illustrated, and special apparatus will be shown and their essential functions and operation described.

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

Since the last report of the Standards Committee, drawings have been completed for a new booklet, changing the form of the drawings to conform to the American Standards Association specifications.

No fundamental changes have been made in the dimensions, but the 16-mm. sound-film drawing has been changed to a slight extent to conform better to current practice.

A sub-committee is at work on the question of a single type of perforation for both negative and positive, and the early proposal that a perforation having the dimensions of the old negative perforation and the shape of the new positive perforation be adopted as standard has been brought up again, due to the difficulty of accomplishing the adoption of the present standard perforation by the users of negative film.

The proposal made by the German Standards Association that 16-mm. film spools be standardized with square holes on each side has been referred to the sub-committee on sub-standard film, and a report has been received from them.

The standardization of 2000-foot reels is still under discussion.

"The Performance Record of an Automatic Recording Densitometer;" C. M. Tuttle and M. E. Russell, *Eastman Kodak Co.*, Rochester, N. Y.

A recording physical densitometer designed to read strips from the type II*b* sensitometer was described recently in *J. Opt. Soc. Amer.* This instrument has been in service in the sensitometric department of the Kodak Research Laboratories for about one year, during which time it has been operated steadily. Approximately 100,000 sensitometric strips have been read thus far. The instrument is capable of an output of about 550 strips per day.

Experience has shown that more repeatable results are attained with this instrument than by routine, visual methods. Comparative data accumulated in an experiment lasting several months will be presented, along with a time-study of the two methods of densitometry.

Certain features to be changed in the design of a new instrument will be discussed. The new instrument will be improved both as to ruggedness and speed.

The advisability of using devices of this nature in a release print laboratory will depend upon a number of factors, such as initial cost, quantity and quality of output, and ease of maintenance.

"A Developing Machine for Sensitometric Work;" L. A. Jones, M. E. Russell, H. R. Beacham, *Eastman Kodak Co.*, Rochester, N. Y.

The sensitometric testing of photographic materials requires that the testing laboratory be able to obtain the same results, with a high degree of precision, for identical samples of material, although the individual tests may necessarily be made at widely differing times. This necessitates that all the factors tending to influence the results be held constant over long periods of time. The present communication deals specifically with one particular phase of the sensitometric process, namely, the development of the samples.

The developing machine described is designed particularly for a laboratory in which a relatively large volume of sensitometric work must be done. It accommodates sixty strips positioned vertically on six metal racks which can be lowered into the developing solution simultaneously, and removed either simultaneously or individually, so that different development times may be given conveniently to different parts of the load.

The circulation of the developing solution across the face of the exposed material is sufficiently rapid so that further increase in violence of agitation produces little if any increase in the rate at which the latent image is converted into metallic silver. This circulation is of two general types: A relatively slow but uniform movement of the developer in the vertical direction is attained by a motor-driven propeller which forces the developer down into a well external to the main tank from the lower end of which it spreads out beneath a perforated false bottom in the tank and rises throughout the body of the tank, flowing back again into the top of the well. Much more violent agitation is accomplished by a set of vertical paddles which move back and forth close to the exposed surfaces. Both agitating elements are driven by a synchronous motor, thus assuring the same rate of circulation at all times.

The entire developing machine is water-jacketed with thermostatically controlled constant-temperature water, held at a temperature of 65° ± 0.1°F.

A careful analysis of the results obtained with the machine has been made, showing that the circulation throughout the body of the tank is so nearly uniform that the results are not influenced by (*a*) whether the heavily exposed end of the sensitometric strip is up or down, (*b*) the position of the strip within the tank, (*c*) or whether a complete or partial load of strips is developed at one time. Results indicate also that the agitation is of sufficient violence that the rate of conversion of the latent image into metallic silver is at or near the maximum attainable. The uniformity and reproducibility of development attained by using the machine are very markedly superior to that attainable with any type of hand- or machine-rocked tray with which we have had experience, and the use of this machine marks a very definite advance in the precision with which sensitometric values may be established.

"Some Aspects of Reduction Printing;" G. Friedl, Jr., *Electrical Research Products, Inc.*, New York, N. Y.

Information recently obtained by the Standards Committee indicates that various groups of dimensions are used for the picture image on 16-mm. reduction prints. These data are set forth and the different conditions are reviewed that may exist in the projection of prints reduced from 35-mm. negatives made with the present standard camera aperture of 0.631 × 0.868 inch, as well as "old silent" films. Some consideration is given also to variables introduced by shrinkage.

"The Influence of Sprocket-Hole Perforations upon the Development of the Adjacent Sound-Track Areas;" J. G. Frayne and V. Pagliarulo, *Electrical Research Products, Inc.*, Los Angeles, Calif.

An unmodulated sound-track when developed shows 96-cycle modulation. The effect is a maximum at the edge of the sprocket holes and diminishes exponentially for a distance of approximately 30 mils into the sound-track. A film modulated with a constant frequency shows 96-cycle amplitude and frequency modulation over the same area. Both effects are introduced principally during process-

ing of the film. A film having no sprocket holes on the sound-track side is entirely free of these effects.

APPARATUS PAPERS

"A New Type of Peak Reading Volume Indicator;" F. L. Hopper, *Electrical Research Products, Inc.*, New York, N. Y.

A new type of volume indicator is described that meets the requirements of sound recording. Its advantages are: indication of peak values of voltage; full indication for sounds of short duration; adjustment for slow restoring action for greater ease of reading; the device may be given the same sensitivity-frequency characteristic as that of the light-valve; use of a well damped long-scale indicating type of meter.

"A Neon Type Volume Indicator;" S. Read, Jr., *RCA Manufacturing Co., Inc.*, Camden, N. J.

A number of gaseous discharge lamps of the neon type have been used to indicate instantaneous peak amplitudes of audio-frequency voltages. When the instantaneous value of the signal voltage increases to the value at which the first lamp is adjusted to discharge, the lamp starts to glow. When the voltage is still further increased, additional lamps begin to glow as their discharge values are reached. As the instantaneous voltage decreases the lamps are extinguished in the reverse order.

Such a device provides a definite indication of the peak value, even though of extremely short duration. Due to the persistence of vision, such extremely short peaks are not lost, although voltages sustained over longer periods produce brighter glows. Only one-half of the voltage wave actuates the neon lamps; therefore, either positive or negative peaks may be noted. Any portion of the scale may be expanded or compressed as desired. Radiotrons of the Acorn type are used so as to achieve a compact unit.

The device is compared with volume indicators of other types, and some of its unique circuits are discussed. Diagrams and performance curves are included.

"A Neon Tube Oscilloscope as a Utility Instrument for the Projection Room;" F. H. Richardson, *Motion Picture Herald*, New York, N. Y., and T. D. Hover, *Ohio Theater*, Lima, Ohio.

A neon type of rotating mirror oscilloscope is described intended for routine use by projectionists to aid in eliminating noise due to microphonic tubes, improperly meshed gears, *etc.* The parts may be either purchased or built by the projectionist.

"Recent Developments of High-Intensity Arc Spotlamps for Use in Motion Picture Production;" E. C. Richardson, *Mole-Richardson, Inc.*, Hollywood, Calif.

In order to utilize high-intensity carbon arcs more effectively as sources of illumination for photographic purposes, two newly designed high-intensity arc spotlamps have been developed. Improvements have been incorporated in the design which particularly adapt the lamps for use under modern photographic conditions, particularly in the production of colored motion pictures, where uniformity of spectral distribution and intensity are vital factors.

In the design of the arc mechanism used in these lamps, vital improvements are: (*1*) increased rotational speed of the positive carbon; (*2*) continuous non-

intermittent feeding of both positive and negative electrodes; (*3*) rapid-action positive and negative manual adjustments.

The paper describes in detail the application of "Morinc" flat corrugated lenses to the new equipment, and illustrates, by means of graphs, the light distribution attained for various beam divergencies. The new equipment has had sufficient practical application in motion picture production to have proved its worth in photographing under both normal and Technicolor production.

"Film-Editing Machine Embodying Optical Intermittent Projection;" J. L. Spence, *Akeley Camera, Inc.*, New York, N. Y.

The Akeley-Leventhal editing machine is built around the Leventhal two-stage optical compensator, which substitutes an optical intermittent for the usual mechanical intermittent, thereby enabling the film to travel uninterruptedly past the projection aperture.

A single small piece of plate glass rotating once per picture cycle in synchronism with the film-feeding sprocket takes the place of the usual intermittent claws or intermittent sprocket. The system is a two-stage one, and should not be confused with single-stage compensators which make one-half revolution per picture cycle.

It is possible with this equipment to throw into synchronism a sound-track film and a picture film while both films are running. A simple selective means is provided for running sound-film only, picture film only, or both together. Reels 2000 feet long may be run without adjustment. A 6-inch picture having an illumination of 10 foot-candles is attainable.

Two motors are used for driving the machine, one constant- and one variable-speed. The simple temporary splicer employing the cellophane tape is built into the machine.

"New Recording Equipment;" D. Canady and V. A. Wellman, *Canady Sound Appliance Co.*, Cleveland, Ohio.

A new sound-film recorder for studio or portable use is described. Three flywheels in addition to a non-resonant drive sprocket filter enable the machine to operate satisfactorily on power lines of poor regulation. Tests have proved that violet surges on the power supply line have no noticeable effect upon the linear film speed. The recorder is unusually quiet in operation. It can be used on the set if need arises. Mention is made of recording lamp improvements, and a noise-reduction unit for operation in connection with glow lamps is described. A self-contained semiportable recording amplifier is also discussed.

"An Improved Reel-End Alarm;" D. Canady and V. A. Wellman, *Canady Sound Appliance Co.*, Cleveland, Ohio.

Scratching and mutilation of release prints by mechanical reel-end alarms in projectors are touched upon, and a description of an improved indicating device is given. Use is made of a light-source and a photoelectric cell. The light-rays from the light-source pass at a tangent to, or across, the film. When the point of tangency has been reached, the film that previously obstructed the light-ray allows the ray to reach the photoelectric cell, which, in turn, actuates the signalling device. The device is positive in action and automatic in operation. Nothing mechanical touches the film.

"Three-Wire D-C. Supply for Projection Arcs;" C. C. Dash, *The Hertner Electric Co.*, Cleveland, Ohio.

The introduction of the non-rotating, high-intensity, low-voltage, d-c. arc has

made it desirable to use a d-c. supply of as low voltage as practically possible. The auxiliary projection equipment, such as the spotlamp, dissolver lamps, and effect machines, are still equipped with arc lamps requiring 55 to 65 volts across the arc. In order to obtain the benefits of the new lamps using the Suprex type of carbon, it is desirable to have a d-c. source of the proper voltage for each type of lamp to be used.

Two flat-compounded generators may be connected in series so as to have the voltage of each generator available or the combined voltage of the two in series.

There has been developed a double-voltage motor-generator arranged so that low voltage is available for the non-rotating high-intensity projection lamps, and also double the voltage of the single generator for the auxiliary equipment. The design of this type of motor-generator may be such that changing the load on either generator does not affect the output voltage of the other generator. Performance curves of this two-unit motor-generator set demonstrate the steadiness of the output voltage with changes of load.

"A Demonstration Triode for Visualizing Electronic Phenomena;" F. E. Eldredge and H. F. Dart, *Westinghouse Lamp Co.*, Bloomfield, N. J.

To augment theoretical discussion with a practical demonstration, a new type *WL-787* triode has been developed for visualizing the electronic effect when changes are made in the grid and plate voltages of a vacuum tube.

The filament consists of several parallel oxide-coated wires, all of which are located in one plane so that the plate current will be uniformly distributed. The anode is the fundamental flat plate mounted parallel to the plane of the filament. The grid is a fairly open and conventional structure, mounted between the filament and the plate. The side of the anode facing the grid and the filament is coated with willemite, which shows a bright greenish fluorescence when bombarded by electrons of the plate current. A pronounced and clearly visible glow occurs at all points where the electrons strike, resulting in a definite pattern of the grid upon the plate. Plate size is such that the action can be observed by everyone in a room of reasonable size. Either alternating or direct current may be used to heat the filament and to supply the voltages for the grid and plate.

The demonstration triode, therefore, becomes a tool that can be used in the classrooms of universities, colleges, and technical schools to supplement the theoretical discussions. It is useful also for demonstrating visually any vacuum tube phenomena depending upon the fluctuation of the grid voltage to vary the plate current.