ABSTRACTS OF PAPERS OF THE FALL CONVENTION AT HOLLYWOOD, CALIF.

OCTOBER 21–25, 1940

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.

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Black Light for Theater Auditoriums; H. J. Chanon, *General Electric Co.*, Cleveland, Ohio, and F. M. Falge, *General Electric Co.*, Los Angeles, Calif.

The demand for near-ultraviolet radiation, commonly called "black light," in the production of fluorescent effects has shown the need for a technical approach to the problem. New technics of measurement as well as design information, data on sources and material are necessary to insure most effective use of these new media.

The paper covers design information on the lighting of fluorescent carpet, decorative wall and ceiling murals, and other decorative applications. Information on light-sources, standard filters for absorbing the visible light emitted by the sources, as well as response characteristics of various types of fluorescent materials have been obtained. The effect of extraneous visible light in masking the brightness of the fluorescent material is discussed. One convenient method of measuring the near-ultraviolet energy from mercury light-sources in existing installations is explained.

Acoustic Design Features of Studio Stages, Monitor Rooms, and Review Rooms; D. P. Loye, *Electrical Research Products, Inc.*, Hollywood, Calif.

A survey was made of studio experience, as one step in the determination of the most nearly ideal design characteristics practicable for studio stages, review rooms, and other units. Acoustic measurements were also made of Hollywood studio units of these types. These data were correlated with the information obtained in the survey, and used as a valuable guide in the determination of the optimum characteristics and dimensions recommended for major studio scoring stages, monitor rooms, dubbing rooms, review rooms, and studio theaters.

These data are described in detail, and recommendations regarding the studio units are given. These recommendations include the optimum reverberation and other acoustic characteristics, and also the most practicable sizes which experience and theoretical considerations indicate to be desirable.

Information regarding Hollywood preview theaters is included in an appendix.

Stability in Synchronous Motors; S. Read, Jr., and E. W. Kellogg, *RCA Mfg. Co., Inc.*, Camden, N. J.

For the most part, since the advent of talking pictures, motors have been employed whose performance is above reproach. The various types of motor, however, differ widely in their ability to resist load irregularities and in their tendency to oscillate when a disturbance occurs. For the more critical applications these factors deserve careful consideration when the type or design is being selected. The principal types of synchronous motor are (*1*) the variable-reluctance or induced-pole motor, (*2*) the separately excited motor, (*3*) the ac-dc motor, (*4*) the hysteresis motor, (*5*) the low-speed multi-tooth motor (of the type used for electric clocks), (*6*) the polyphase, uniform torque modification of number *5*, and (*7*) selsyn motors.

Many of the characteristics of synchronous motors may be best understood by assuming that the polyphase winding produces a uniformly rotating magnetic field, but estimating the stiffness and stability demands a knowledge of the manner in which the a-c input varies with mechanical displacement. Generous pole-face grids are essential for stability. Ac-dc motors have certain elements of instability as well as stabilizing factors, which are not present in straight synchronous motors. The magnitude of these effects can to some extent be controlled by the external circuit arrangements. Selsyn motors are less readily damped than regular synchronous motors, and for this reason arrangements by which the synchronous motors can be interlocked from standstill are of interest.

Ground-Noise Reduction Systems; E. W. Kellogg, *RCA Manufacturing Co.*, Camden, N. J.

The principal purpose of the paper is to formulate a statement of the desired characteristics of a ground-noise-reduction system, in terms of such factors as prompt opening, peak reading, and filtering. In this it is assumed that anticipation is not employed. It is desirable to limit the filtering to a single stage of resistance-capacity filtering (or equivalent). Slow closing helps filtering and peak reading. The better the peak reading properties of the circuit, and the less the filtering delay, the smaller can the margins be made without causing too frequent clipping.

A number of circuits are discussed which have been proposed for improving the filtering without sacrifice of quick opening, or reasonably rapid closing.

In some operations, anticipation is entirely practical, and if this is done it appears possible to provide an almost perfect envelope current.

Editing a Motion Picture; I. J. Wilkinson and W. Hamilton, *RKO Radio Pictures, Inc.*, Los Angeles, Calif.

The paper is an attempt to reduce to words a portion of the mechanical and artistic elements involved in the process of editing a motion picture. The authors realize that they are dealing with a highly controversial subject but feel that, as there is so little pertinent material available on this phase of motion picture production, this paper may serve as a preliminary to a study on a larger scale.

Consideration is given to the origin of film editing and its advancement from the purely mechanical craft of the early days to its present status as a contributing factor in the entertainment and dramatic values of the motion picture of today.

Demonstration film is presented to illustrate various editing technics and to show the possibility of their use as a means of drastically altering original story and dramatic conception.

Line Microphones; H. F. Olson, *RCA Manufacturing Co.*, Camden, N. J.

A line microphone is a microphone consisting of a large number of small tubes with the open ends, as pick-up points, equally spaced along a line and the other ends connected by means of a common junction to a transducer element for converting the sound vibrations which converge upon the junction into the corresponding electrical variations. Several types of line microphones with the useful directivity along the line axis are described as follows: a simple line, a line with progressive delay, and two lines with progressive delay and a pressure gradient element.

A Line Type of Microphone for Speech Pick-up; L. J. Anderson, *RCA Manufacturing Co.*, Camden, N. J.

The development of a line type of microphone is discussed, having directional characteristics which are relatively independent of frequency, and which are of such size as to be readily portable. Uniform directional characteristics are obtained by constructing the line in such a way that the effective length becomes less with increasing frequency. Physical size limitations are largely responsible for confining the microphone to speech pick-up applications.

A Method of Calibrating Microphones; F. L. Hopper, *Electrical Research Products, Inc.*, Hollywood, Calif., and F. F. Romanow, *Bell Telephone Laboratories*, New York, N. Y.

Methods of determining the performance characteristics of microphones, by acoustic measurements are described. Factors involving the accuracy of the methods are discussed. The correlation between a microphone's performance as determined by acoustic measurement and by listening tests is reported. Application of both types of test to a studio type of cardioid microphone is given as an example.

General and Design Considerations of Low-Noise Microphones; A. L. Williams and H. G. Baerwald, *The Brush Development Co.*, Cleveland, Ohio.

With the development of the microphone art toward increased fidelity, thermal agitation noise becomes the principal limitation and therefore a major problem. Its physical side has been discussed in a recent publication where the factors on which noise performance depends have been analyzed, and a suitable noise rating based on aural perception has been proposed. The purpose of this paper is to outline some practical consequences. Different microphone types are discussed in regard to their noise performance and, particularly, to their inherent limitations of noise reduction. Multiple piezoelectric microphones which lend themselves particularly well to the design of quiet units, are treated in more detail. The noise performance of different sound-cell types is given including a recent developmental unit which tends to realize the inherent efficiency of the piezoelectric type of microphone to a fuller extent. The practical realization of the qualities of piezoelectric units in a microphone depends on a suitable choice of the associated circuits and tubes; the principles and limitations of their design are indicated. Application is also made to the design of minimum-noise combinations of different microphone types, particularly to an adjustable-hypercardioid (unidirectional) combination of ribbon and sound-cell type. Some performance data of a corresponding experimental model are given.

A 200-Mil Variable-Area Modulator; R. W. Benfer and G. T. Lorance, *Electrical Research Products, Inc.*, Hollywood, Calif.

A modulator using a new vibrating-mirror unit has been developed for recording double-width variable-area sound-track. The noise-reduction shutter is at the slit, making it possible to record, with noise reduction, Class *A* push-pull track comprising two standard bilateral tracks, one of which is located in accordance with the dimensional standards for single track. While this has been its principal use to date, it is readily adaptable for other types of track. A visual monitor shows operation of the noise-reduction shutter and the amplitude of signal modulation in both directions from the base-line with a positive indication of peak overload. An exposure meter is included to serve as a check on lamp current and track balance. The light-source is a tungsten filament lamp which will properly expose fine-grain emulsions to "white" light or standard emulsions through an ultraviolet filter.

An Investigation of Some Factors Influencing Volume Range in Photographic Sound Recording; W. K. Grimwood and O. Sandvik, *Eastman Kodak Co.*, Rochester, N. Y.

This is an extension of an earlier investigation of background noise. The present paper deals more specifically with the relation between volume range and the type of photographic materials and the sensitometric conditions used. A brief study of the effect of the spectral quality of the radiation used in recording and printing is included.

Measurement of Photographic Printing Density; J. G. Frayne, *Electrical Research Products, Inc.*, Hollywood, Calif.

When the spectral sensitivity of positive film is simulated by the use of a suitable combination of phototube and optical filter in the integrating sphere densitometer, the printing density of any type of negative, irrespective of grain size, with

any type of base or backing, may be accurately determined. Printing density is practically independent of the type of light-source or filtering employed in the printer. Relationships between printing and visual diffuse densities for various types of negatives have been established.

Stabilized Disk Record Cutters; S. J. Begun, *The Brush Development Co.*, Cleveland, Ohio.

Where it is desirable to obtain good quality in disk recording, the cutter used must have a wide frequency range and a low content of harmonic distortion. Furthermore, care must be exercised that the sensitivity of such a cutting device should not be affected by temperature changes. This is particularly important in case the recording equipment, for some reason, does not work in air-conditioned rooms.

The sensitivity, as well as the amount of harmonic distortion generated for magnetic and crystal cutters, depends upon the temperature. In a magnetic cutter, the characteristic of the damping material varies sufficiently with temperature change to require constant temperature conditions. With respect to a crystal cutter, it has been found that a crystal element will drive a recording stylus with negligible distortion if its temperature is of the order of 30°C or above. For this reason, a crystal cutter has been developed with a built-in thermostat to control a heating element, which will keep the cutter temperature constant within narrow limits.

The design of such a cutter and the performance characteristic are described in detail. The high degree of stability of such a temperature-controlled cutter is shown.

A Portable Disk Recording-Reproducing Machine; J. C. Davidson and C. C. Davis, *Electrical Research Products, Inc.*, Hollywood, Calif.

The *RA-280* equipment is intended as a portable high-quality disk recording and reproducing machine. It was designed primarily to include a feed-back recorder, a vertical and lateral reproducer, and an amplifier with equalizers and suitable switching arrangement for recording or reproducing.

The turntable drive includes an electrically and mechanically balanced motor, a precision worm and gear, and an oil damped mechanical filter. Vibration is prevented from reaching the turntable by a bellows type coupling. The filter consists of a reed-type spring surrounded in oil and provided with suitable linkage to the turntable.

It is felt the electrical and mechanical requirements for a high-quality machine have been met. The frequency flutter has been maintained at ±0.03 to ±0.06 per cent and mechanical-noise pick-up is below the threshold of feeling and shows no optical pattern in the recording.

An Improved Playback Horn Equipment; G. R. Daily, *Paramount Pictures, Inc.*, Hollywood, Calif.

A dolly-mounted, high-quality two-way horn system for playback and announcing service on production recording stages is described. A reflex-type horn cabinet is mounted on a four-wheel steerable dolly, together with a 50-watt amplifier and cable reel. The horn unit can be rotated on the dolly to direct it at the ac-

tion, or be readily removed from the dolly for use on parallels, or suspended from ceiling girders. An extension connection is provided for a W.E. *750-A* speaker for low-level direct recording of playbacks. An extension director cut-out horn control is provided. The mixers' playback control box provides, (*a*) mixing from any two of four film or disk input positions; (*b*) extensions for cueing by phone monitored by the director or actors; (*c*) connections for portable disk recording from a bridging circuit across the film recording main amplifier output, and (*d*) film recording connection from the playback circuit.

Improved Motor Drive for Self-Phasing of Process Projection Equipment; H. G. Tasker, *Paramount Pictures, Inc.*, Hollywood, Calif.

Process projection photography requires that the shutter of the projector and that of the camera open and close simultaneously. The relation between the shutter speeds and the pole frequencies of normal motion picture motor systems is such that there may be one, four, or five incorrect shutter relationships for each correct one, if the motors are interlocked at random. Earlier methods of insuring correct phasing between camera and projector shutters did not take proper account of the economic importance of fast and reliable operation. This paper presents the results of a time and economic study indicating savings of many thousands of dollars annually per studio, accruing from the use of a motor system which automatically phases the shutters of camera and projector, and which has a very high degree of reliability. The design and performance features of such a motor system are described in their relation to earlier efforts along this same line, together with a report on three months' production use on the new system.

Twentieth Century Camera; G. Laube, *Twentieth Century-Fox Film Corp.*, Hollywood, Calif.

Offering a means for cutting costs of production and fitting admirably in the picture of modern streamline equipment, the new Twentieth Century Silenced Camera recently made its official debut to an assembly of cine-technicians and cameramen. Although the camera was designed primarily to reduce noise, it also embodies many of those conveniences and devices which spell speed and aid in cost cutting.

The camera has been designed and built along new principles and, instead of trying to hold the noise in the camera case or the blimp, the noise has been reduced at its source to the end that the fast-moving reciprocating parts are as light and as small as possible and when assembled yield uniform acceleration and deceleration, with a resultant optimum movement of the film and a reduction in noise-making vibration. This, when coupled with a patented sound insulating mount for the film moving mechanism, reduces the noise output to a level substantially equivalent to the noise level of the best blimped camera available. Other features included in the camera are described in the paper.

Electroöptical Slating and Cueing Device; D. B. Clark, *Twentieth Century-Fox Film Corp.*, Hollywood, Calif.

As a direct result of the necessity of reducing budgets and cutting corners in motion picture production, many labor-saving devices have lately become evident in the studios. Among the more important of these is a new slating device de-

veloped and used by the camera department of the Twentieth Century-Fox studios.

Designed mainly to save time and film and to put bigger and better slates on the film, the device is a complete unit comprising its own optical system, its own illumination, and carries means for mounting various changeable indicia. These are all assembled in a small casing adapted to be swung into and out of a photographing position a few inches in front of the camera lens to slate the film in the camera. When not in use, the device hangs inconspicuously beneath the sunshade, where it is readily accessible for changing the indicia for successive shots and is easily swung into slating position by a simple twist of the wrist by the camera operator. When using the slating device in production, the camera case need not be opened for cueing and marking takes. This is done photographically, and the film ordinarily wasted by needless exposure is saved for use.

One of the novel features resides in the indicia carrier member which is designed to provide a smooth flat field, including the changeable numbers to yield a clean-cut reflection when the indicia are projected upon the film, said carrier member being readily removable from the casing for changing the data.

In operation the device is swung into a photographing position within the sunshade directly in front of the camera lens before the camera starts turning and, since the device itself blocks off all light except the illuminated indicia, the first frame of the slate can be used as a synch. mark or a cue mark. Under this arrangement, the slating indicia would be photographed on the film while the camera was coming up to speed, thus saving film which is ordinarily lost. Provision is made for operating the illuminating light either from a battery or the 220 a-c that drives the camera motor, the light being controlled by a switch that automatically cuts in as the device is moved into a photographing position.

Photoëlectric Method of Rating the Light-Speeds of Lenses; D. B. Clark, *Twentieth Century-Fox Film Corp.*, Hollywood, Calif.

Photographers and cinematographers have realized for some time that something was wrong with the present method of calibrating light-stops on lenses. As various makes of lenses were interchanged on shots throughout the making of a motion picture, it became more and more obvious that the *f*/ rating did not represent a true value of the light-transmitting capacity of the lens. As a result the real tough job of a cameraman has been to match negative densities in a procession of shots that have been made on lenses of different makes, different focal lengths, and different stops. Even though the lenses are rated as to light-speed and calibrated under the *f*/ system, it is still a guessing game, since some of these ratings are as much as one hundred per cent in error when reduced to actual transmitting capacity of the lens. Since the *f*/ system is the only system used at present for rating the light-speed of lenses, cameramen have been forced to use this system but have found that it is merely a guide and can not be depended upon where accuracy is required. In view of all this, it is believed that a system for rating the light-speed of all lenses based upon actual light transmitted through the lens, regardless of make, size, or any other physical characteristic of the lens, should be of value not only to lens makers, to give them a reading on the overall efficiency of the lens, but also to the cinematographer, to give him an actual effective rating as to the light-valving capacity of the lens.

Such a system has been used in rating all lenses in the camera department of this studio. Disregarding all physical dimensions or characteristics, each lens in the department was calibrated according to the actual value of effective light transmitted with respect to a predetermined reference base. The reference base was established by measuring the effective light transmitted through a 35-mm lens set at $f/3.2$, the source of light being a uniformly lighted field of fixed intensity. This same field was used as the source of light for all lens calibrations. The result was a lens system wherein a light-speed rating represents the same amount of light regardless of make or size of the lens and where the different light-stops on the different lenses indicate a true proportional value of the basic light.

A New Treatment for the Prevention of Film Abrasion and Oil Mottle; R. H. Talbot, *Eastman Kodak Co.*, Rochester, N. Y.

A new type of lacquer has been devised which may be simply and rapidly applied to either one or both sides of 16- and 35-mm films and which may be readily removed in ordinary processing equipment by the use of carbonate solution. The function of the lacquer is to absorb all the ordinary cinch marks and other abrasions commonly found on ciné films which have been in service in the trade. Tests in the field have indicated that the lacquer is somewhat more resistant to abrasion than are the normal film surfaces. When the lacquer has been removed and replaced with a fresh coat, the film is found to be in essentially as good condition as when new. The lacquer is useful in protecting negatives, master positives, duplicating negatives, and prints from all ordinary abrasions. In addition, the lacquer because of its glossy surface eliminates the mottle or flicker on the screen due to oil on the film.

Report of the Committee on Preservation of Film; J. G. Bradley, *Chairman.*

A statement of the work of the Committee as a whole and individual reports of sub-committees on the following subjects: (1) handling and winding of film; (2) safe and economical storage, size of vent per unit weight of film determined, microfilm testing methods developed; and (3) printers for old and shrunken film.

Production Quality Sound with Single System Portable Equipment; D. Y. Bradshaw, *March of Time*, New York, N. Y.

The *March of Time* requires equipment of great portability and simplicity of operation, yet retaining good quality. By using Class *B* push-pull, variable-area recording, a complete noise-reduction sound system weighing fifty pounds was obtained. This single system was used in production of the feature picture *The Ramparts We Watch.* Problems arise from (*1*) recording on panchromatic negative, (*2*) lack of control over negative processing, (*3*) instability of recording unit caused by rough use of camera on which it is mounted, and (*4*) distortion due to lateral track shift. Means for overcoming these handicaps sufficiently have been found. Single system can be used without great sacrifice in quality, where time and space are factors.

Some Laboratory Problems in Processing 16-Mm Sound with Black-and-White and Color Films; Wm. H. Offenhauser, Jr., *Precision Film Laboratories*, New York, N. Y.

The duplication of 16-mm films involves many relatively intricate problems not encountered in the laboratory processing of 35-mm sound-films. These problems have given rise to procedures and apparatus radically different from those in use in 35-mm.

The two major differences that are especially significant are (*1*) the use of reversal for original films; (*2*) the existence of but one row of sprocket-holes on the 16-mm sound-film.

It is interesting to note that all our present standards in 16-mm blindly assume the negative-positive method of operation, ignoring entirely the reversal and Kodachrome. At the present time even the emulsion position of the 16-mm film is standardized on the basis of a 35-mm sound negative and 35-mm picture negative as originals. As a result, our 16-mm dimensions so derived from 35-mm are inconsistent with the projector dimensions at present in use, and inconsistent with the pressing needs arising from the direct 16-mm field.

Much of the difficulty arises from the rather obvious lack of concern displayed by the 35-mm entertainment industry and the very rapid simultaneous growth of direct 16-mm in educational and industrial applications especially in connection with the duplication of sound on Kodachrome.

Some of the special processes and special apparatus features involved are described which have made possible workable solutions to the problems involved.

Reduction of Sprocket-Hole Modulation in Film Processing; M. Leshing, T. Ingman, and K. Pier, *Twentieth Century-Fox Film Corp.*, Hollywood, Calif.

One of the contributing factors to sound-track degradation is sprocket-hole modulation. This is probably more commonly known as 96-cycle modulation and results from non-uniform action of developer around the perforation holes during the time of processing. Its chief remedy is turbulation.

The practical aspects of controlling the amount of sprocket-hole modulation is described herein. Curves showing the increase of this distortion due to diminished turbulation are included as well as those showing the intermodulation of recorded sound by sprocket-hole agitation. Photographs showing various types of sprocket-hole modulation are also presented. There are also shown samples of modulation contributed by developing machines through mechanical defects, such as pressure created by binding rollers and mechanical frictions introduced in the processing machine proper. A complete description of the turbulation methods employed at the Film Laboratory of Twentieth Century-Fox Film Corporation at Hollywood is disclosed and the various sensitometric means of control relative to this problem are given.

Some Observations on Latent Image Stability of Motion Picture Film; K. Famulener and E. Loessel, *Agfa Ansco Corp.*, Binghamton, N. Y.

The observations reported are the result of an investigation to determine definitely the effect of a delay between the exposure and development of modern motion picture films. The stability of the latent image in terms of speed, gradation, graininess, and color response has been studied.

In general, a definite speed increase was noted on negative emulsions, a decrease on positive emulsions. There were also changes in gradation and graininess. The detailed findings, which vary considerably with the individual emulsion type

are given, followed by a general discussion and interpretation of the results. A brief review of the literature is included.

Fixing Baths and Their Properties; J. I. Crabtree, H. Parker, and H. D. Russell, *Eastman Kodak Co.*, Rochester, N. Y.

In addition to removing the unreduced silver halides from an exposed and developed emulsion, the fixing bath should (*a*) arrest development immediately, and (*b*) harden the gelatin film so as to prevent excessive swelling during washing and reduce mechanical injury during handling.

The fixing agent usually consists of sodium or ammonium thiosulfate, or a mixture of sodium thiosulfate with ammonium chloride. The bath also contains an acid (usually acetic acid) to arrest development, sodium sulfite which inhibits the precipitation of sulfur, and potassium or chrome alum which tans the gelatin.

The addition of developer carried into the fixing bath tends to cause the precipitation of aluminum sulfite but this can be prevented by (*a*) revival of the bath with acid at intervals, or (*b*) the addition of boric acid which also extends the *p*H range over which effective hardening is obtained. The exhaustion point at which revival should occur may be determined with *p*H indicators.

Various fixing bath formulas are included and their properties discussed in terms of (*a*) developer capacity, (*b*) sludging and scumming propensity, and (*c*) hardening life.

The Effect of Developer Agitation on Density Uniformity and Rate of Development; C. E. Ives and E. W. Jensen, *Eastman Kodak Co.*, Rochester, N. Y.

A number of essentially different methods of developer agitation of interest in motion picture work have been studied experimentally. In one case the film was held against the inside wall of a conduit through which the developer was pumped at predetermined velocities so as to maintain the required conditions of turbulent flow. By mounting a loop of film on a pair of rollers, the effect of variation in running speed of the film was studied. Tests were made of the effectiveness of liquid jets and also of wringers and scrapers for periodic renewal of developer at the emulsion surface. In order to determine the relative importance of different degrees of developer agitation and of developer renewal by the process of unaided diffusion, the rate of development was varied widely by adjustment of the developer formulas.

Negative Exposure Control; D. Norwood, Hollywood, Calif.

It would be desirable to have negative exposure control on the basis of an exact science. Toward this end the functioning of the human eye as it views a photo subject, and then the photographic reproduction of the subject, is studied. The brightness of the photo subject is broken down into its components of reflectance, a constant, and incident illumination, a variable. The mechanism of the eye acts to compensate for changes in the variable incident illumination. Recognition of the tone of the object is based on its fixed property of reflectance. It is this constant that determines the print density used to portray the object. Between the subject's fixed reflectance and the print's fixed density lies the variable of negative density. A system is proposed whereby a given reflectance in the subject is repre-

sented by a fixed density in the negative. Many advantages derive from this system. Operation of the system involves negative exposure control by means of measurement of incident light. Measurement of effective incident illumination is best accomplished by means of a photoelectric meter specifically designed to respond to the three dimensional characteristics of incident illumination. The system described is free from many of the influences which tend to cause undesirable variations and errors in negative exposure. It provides a means of putting negative exposure control on the basis of an exact science.

Hollywood's Low-Temperature Sound-Stage; R. Van Slyker, Los Angeles, Calif.

The California Consumers Corporation, of Los Angeles, set aside one of its large ice storage buildings to introduce to the studios a new method of making realistic snow scenes.

The purpose of the ice storage building was to furnish a low-temperature sound-stage, where water ice could be used for snow, and enable the casts breath to become visible, as actually occurs in cold or wintery climates.

Snow is manufactured on the low-temperature sound-stage by means of specially constructed portable blowers, grinding 50-pound blocks of ice and expelling through suitable nozzle a fine, aerated snow, directed to the set where and when needed.

The introduction of Technicolor to the low-temperature sound-stage created many new problems in ventilation, due to the low temperature of the atmosphere and quantity of air movement needed to remove gases and smoke from the stage during shooting periods.

The unusual heat load requirements necessitated the construction of external bunker systems, to augment the existing refrigeration for color production.

This was accomplished by the combined use of water ice and ammonia refrigeration in these bunkers, giving a total refrigerating capacity of approximately 650 tons in the system to chill 64,000 cfm of fresh air to 20 °F.

NBC Television Covers the Republican National Convention of 1940; H. P. See, *National Broadcasting Co.*, New York, N. Y.

Television transmission facilities were installed at the Republican National Convention of 1940 held at Convention Hall, Philadelphia, June 24th to 28th. This marked the first time that a news event of national importance, transpiring at a point greater than twenty-five miles distant from New York City, was successfully televised and viewed by NBC's television audience in the New York Metropolitan Area. Program transmission was continuously maintained during each of five daily sessions. These transmissions totaled thirty-three hours and seventeen minutes.

This paper describes the method by which the National Broadcasting Company originated the television pictures at Philadelphia and transmitted them through the facilities of the Bell System to New York, where they were radiated from Station W2XBS, the television transmitter atop the Empire State Building tower. The signals from New York were received by the General Electric Company by means of a specially constructed receiving system near Schenectady and re-transmitted on Station W2XB to the television audience in that vicinity. The audi-

ence consisted of approximately 40,000 persons scattered throughout New York, New Jersey, and Connecticut.

The equipment and its functions are described. Reference is made to the mode and continuity of operation as distinguished from newsreel participation at the same event.

Problems in Television Image Resolution; C. F. Wolcott, *Gilfillan Bros., Inc.*, Los Angeles, Calif.

This paper is primarily thought-provoking, and states problems involved in the consideration of suitable standards now before the National Television Systems Committee.

Resolution is discussed from a standpoint of the number of lines and fields within the limits of presently assigned channels. Related problems touched upon are flicker frequency *vs.* illumination, and some of the difficulties which must be guarded against with colored images, such as raster displacement occasioned by superimposed extraneous magnetic fields or voltages.

The effects of motion, which tend to smear detail, are discussed in relation to frame and field frequency.

The major limitations of present scanning-spot shape and intensity distribution, which determine the vertical and horizontal widths of confusion, have been removed in the laboratory, introducing the possibility of markedly improved definition with a given number of lines and fields which must be reckoned with in determining standards.