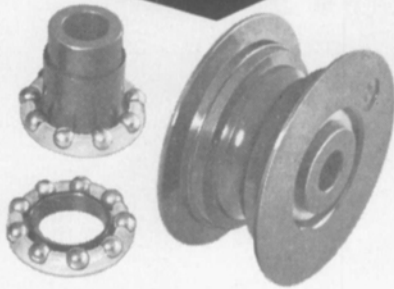
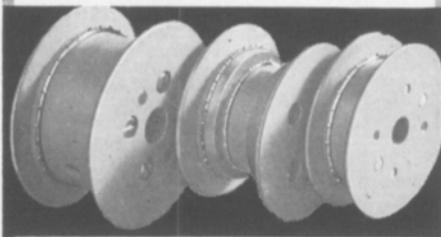


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**A System of Optical Design**

By Arthur Cox. Published (1965) by the Focal Press, 20 E. 46 St., New York, N.Y. 10017 and 41 Fitzroy Square, London, W.1., England. 668 pp. incl. Lens Performance Section. Illus. Diagrams. 9 1/2 by 7 1/2 in. Price \$55.00.

This is a comprehensive advanced treatise on the geometrical principles of optical design, with additional material on current techniques of performance appraisal, and a valuable chapter on considerations affecting the design of practical systems. It could serve as an advanced text for an intensive course in optical design, or a reference work for the non-specialist with a knowledge of elementary optics desirous of acquiring background information. Although the mathematical treatment is thorough, it does not require more than a knowledge of calculus and analysis, except for the portions on diffraction theory and Fourier transforms for which mathematical appendices are included. What is sacrificed in elegance and generality is offset by the accessibility of the basic concepts and an appreciation of their practical consequences.

First-order theory, which suffices for the preliminary determination of the characteristics of a lens, is covered in the first chapter, followed by a derivation of the characteristic function from Fermat's principle, and a systematic development of expressions for Seidel and fifth-order aberrations. Various meridional and skew ray-tracing methods are next described, with recommendations for adapting them to desk or electronic calculators. Two methods are given for determining the effect of small changes in curvature, thickness, or refractive indices. Detailed computational techniques for Seidel and fifth-order aberrations are the subjects of two lengthy chapters.

In view of the stringent demands being made today on certain photographic and astronomical optical systems, and the gradually, but significantly, increasing capabilities for manufacturing nonspherical optical elements, the generalized treatment of aspheric surfaces is most welcome, and should prove useful to designers of high-performance systems.

To establish realistic manufacturing tolerances, an analysis of the effects of decentering or tilting the surfaces of optical elements is necessary. However, since a practically realizable lens can depart from a theoretical design in an unlimited number of ways, for a manageable treatment the errors are restricted to "weak" decenterations, for which higher-order effects can be neglected. The computational tech-

niques for determining decentration aberrations and combining them with those of the centered lens are the subject of a chapter which concludes with a description of five ways in which elements can become tilted or decentered.

The discussion of diffraction theory introduces concepts from physical optics permitting a fuller understanding of the distribution of light in a real image, with emphasis again on computational techniques with which to assess designs.

Most of the modern methods of image evaluation are touched upon in the chapter on performance evaluation, including the spread function, contrast (modulation) transfer function, and spot diagrams. This chapter also includes a discussion of coherence and partial coherence, with spatial filtering applications.

Finally, the design notes give the reader the benefit of the author's broad experience with optical designing which, he holds, is still as much an art as a science, requiring insight and judgment.

This book can be commended on several counts. It covers its subject fully, laying a systematic foundation and building up to the point where the latest high-speed computing techniques can be applied. It offers material not previously available in a single book, including a wealth of examples based on patent literature, and much incidental information on the necessary mathematical tools, where these are beyond the assumed knowledge of calculus.—Allan L. Sorem, Eastman Kodak Co., Research Labs., Kodak Park, Rochester, N.Y. 14650.

**Applied Optics and Optical Engineering: Vol. I.**

Edited by Rudolf Kingslake Published (1965) by Academic Press, 111 Fifth Ave., New York 10003. 423 + xiv pp., 214 illus., 6 X 9 in. Price \$15.00.

Rudolf Kingslake, Editor, notes in his preface that "young men entering the field of optical engineering from physics . . . find that the regular physics and engineering textbooks are of little help. . . In optics the needed data are scattered widely in many different places or not available at all."

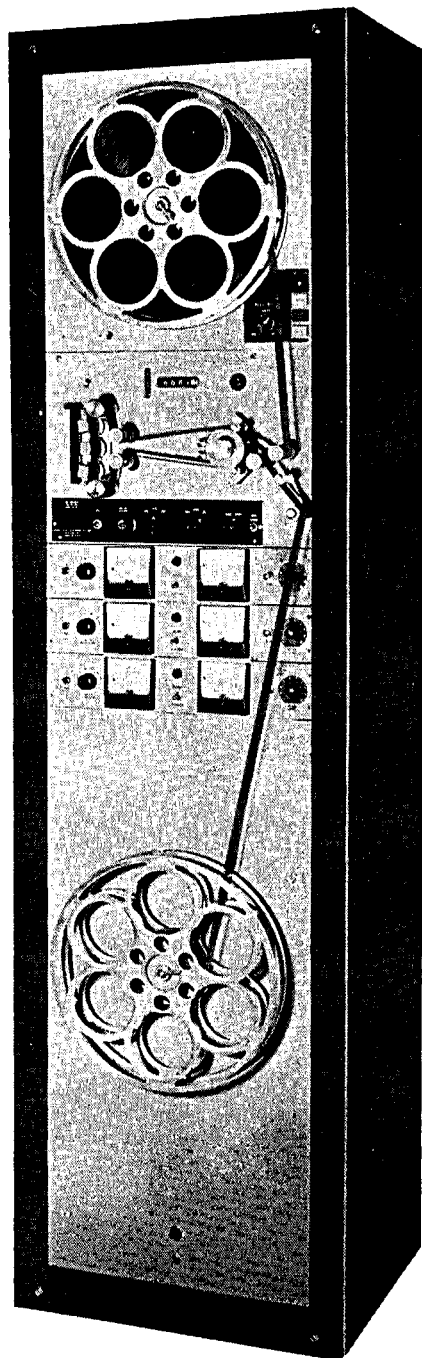
Dr. Kingslake has planned a series of five volumes, with 50 chapters written by specialists, to present the collected information in the field. His long experience and competence eminently qualify him for the undertaking.

The first volume covers "Light: Its Generation and Modification," and its 11 chapters are on photometry, light sources, filters, atmospheric effects, optical materials, geometrical optics, diffraction and interference, polarization, projection screens, and a final discussion on precision and accuracy.

To consider just one broad field, the chapters on wave phenomena are especially to be noted because they give comparatively simple and generally heuristic discussions of recent concepts which have been developed in lens performance, coherence phenomena, interference filters, etc. And it is interesting to be reminded that study of the effects of coherence on lens performance dates as far back as Abbe.

In so ambitious a program it is obviously a problem to condense the large amount of material into the compass allotted. For example, among light sources, illuminant C

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is given rather short shrift, and one can hope that it will be taken up again in a later chapter on colorimeters. Similarly, a good general discussion is given on photometry, but very little is said on the photometry of lens systems, and the quantitative importance to it of condensing and field lenses. Another example — in the description of the atmosphere, the height of the tropopause is mentioned, but the term itself, although rather technical, is not defined.

Nevertheless, a great deal of information has been collected for easy reference in this first volume, much of which in the past has been familiar only to specialists. Motion-picture and television engineers will find many items of interest in it (even though, on the latter, fluorescence is not discussed

as a light source), and it will be useful to them also as a general reference work.—*Pierre Mertz*, Consultant, 66 Leamington St., Lido Beach, L.I., N.Y. 11561.

### Microfilm Technology

By Carl E. Nelson. Published (1965) by McGraw-Hill Book Co., 330 W. 42 St., New York, N.Y. 10036. 307 + xiii pp., 117 illus. 6 by 9 in. Price \$16.00.

In his annual report of 1851 to the Board of Regents, Joseph Henry, Secretary to the Smithsonian Institution, said in part: "It is estimated that about twenty thousand volumes, including pamphlets, purporting to be additions to the sum of human knowledge, are published annually; and

unless this mass be properly arranged, and the means furnished by which its contents may be ascertained, literature and science will be overwhelmed by their own unwieldy bulk. The pile will begin to totter under its own weight, and all the additions we may heap upon it will tend to add to the extension of the base, without increasing the elevation and dignity of the edifice."

Little did Joseph Henry then know that, some half century later, the wholly unrelated art of motion pictures would develop, as a by-product, a medium—motion-picture film—which would help in the solution of an important portion of his problem, namely the physical bulk.

Carl E. Nelson has written a very detailed exposition of the problems involved in planning the use of microfilm for all the drawings of an engineering organization. The coverage runs from a background on the theory of the various photographic processes that can be used for original filming and copying (present day microfilm often has the same format as motion-picture film, but uses a different emulsion and usually has no sprocket-holes), to all the details of production, inspection, standards, retrieving, using, servicing, etc., that are involved in such a project.

The reader may be a little disappointed that all this elaborate thoroughness does not extend somewhat more to other microreproduction problems beyond the matter of engineering drawings. For example, for the reader's reference, the book contains, in a pocket inside the back cover, a "microfiche" of a 48-page bibliography. But the term "microfiche" does not appear in the index, nor in a glossary of terms, and nowhere does there seem to be any discussion whatever of its possibilities and problems in the copying and retrieving of pages of text. Also, as another example, there is no discussion whatever of the possibilities of opaque cards such as "microprints," as compared with film transparencies.

Despite this narrowness of objective, the treatment is so very detailed and the book, nevertheless, contains such a considerable amount of general information that it can be of significant value to anyone who deals with microreproduction in its various aspects.—*Pierre Mertz*, Consultant, 66 Leamington St., Lido Beach, L.I., N.Y. 11561.

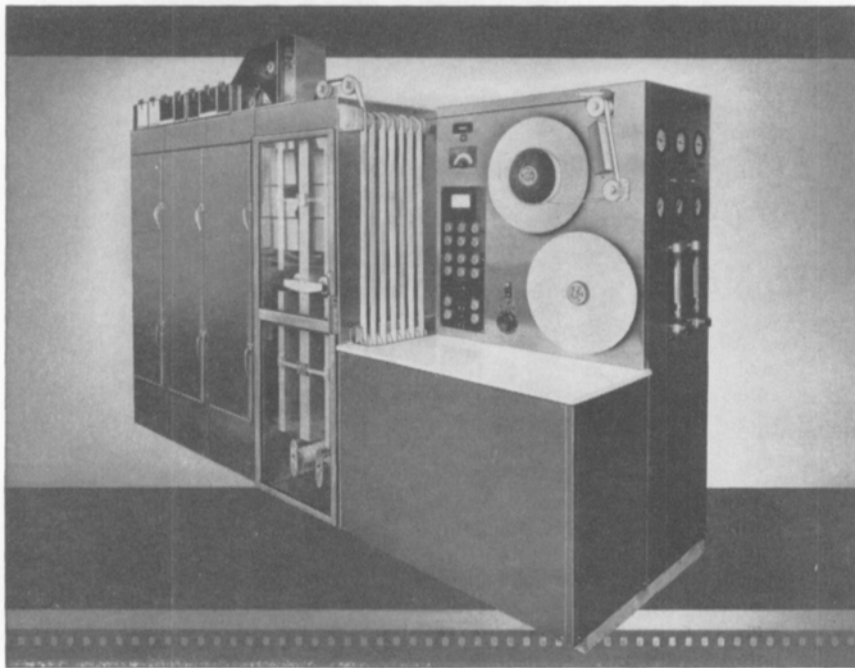
### A Source Book of Photographic History

(*Quellendarstellungen zur Geschichte der Fotografie*)

By Dr. Wolfgang Baier. Published (1965) in Germany by Fotokinoverlag Halle; distributed by Focal Press, Inc., 20 E. 46th St., New York, N.Y. 10017. 703 pp. in German + ix pp. Intro. and Table of Contents in English. 9½ by 6½ in. 313 illus. (captions in German). Price \$33.00.

This is a source book of photographic history to which people interested can turn for many of the original writings of those who laid the stepping-stones. The history of photography cannot be written by those who make it. Long-range perspective, good judgment based on experience, knowledge, interest and an historical sense pave the way for a good history. On the whole,

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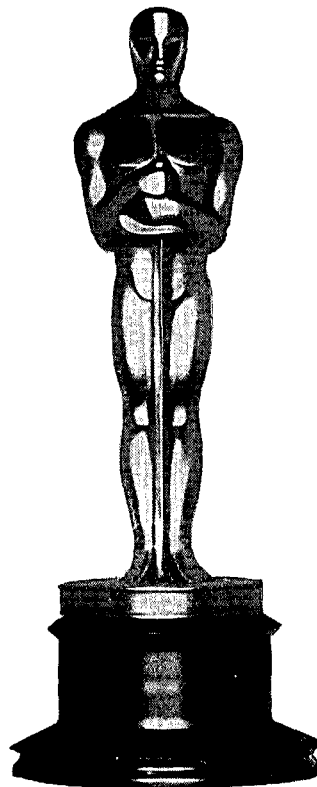
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the author of the present work seems to have these qualifications, although for the American and English reader, there are limitations. The title page, introduction and list of contents are in English; the rest of the book — over 550 pages of text — is in German. Essentially, the text is 50 years out of date but this is common to many histories. In this case, it tends to give a slant to the chemical and technical, with a definite lack of reference to the development of equipment. The book is quite weak on the aesthetic side.

On the whole, however, it is unique as a reference book and should be very valuable to the man who wants to "see if a subject is there." It covers the range from pre-

photographic history through the half-dozen or so main developments; it has an extensive section on technical applications and something on early theory and sensitometry. Modern theory is dealt with inadequately. In fact, the imbalance suggests that much of the modern literature is not available to the author. Motion-picture-photography as such is not dealt with at all, and the great developments in color photography in this century go practically unnoticed.

The book has a definite bias towards the German developments, and it is the author's avowed intention that it should have; perhaps this is not a disadvantage because the main course of photographic

history in the past century was determined by the French and British discoveries, and these have often been well documented. The German aspects have tended to be less well-known outside Germany, and the book therefore enables the photographic student and scientist to fill the gap.

One does feel that in a "source book," the original source material should be given in the language in which it first appeared. The author, however, was far away from the non-German sources, and therefore many of his quotations had to be from German versions of the original non-German literature.—*Walter Clark*, Research Laboratories, Eastman Kodak Co., Rochester, N.Y. 14650.

### Field-Effect Transistors

By Leonce J. Sevin, Jr. Published (1965) by McGraw-Hill Book Co., 327 W. 41 St., New York, N.Y. 10036. 136 pp. incl. index, 137 illus. 7½ by 9½ in. Price \$10.00.

The author thoughtfully introduces the reader to the field effect transistor (FET) by taking him through the basic physics of the device and relating this to FET characteristics.

Fundamental circuit applications are discussed to demonstrate both the advantages and shortcomings of FET, using the basics developed in the earlier chapters. Circuits with measured performance data are shown, ranging from high impedance, low noise, low drift amplifiers and digital applications to a bilateral constant current source.

The rather bright future of field effect transistors in higher frequency power applications is discussed, in terms of presently available devices and data.

The area of FET application to integrated circuits is discussed in the final chapter. Photon coupled circuits, as well as metal oxide semiconductor and thin film FET as related to integrated circuit fabrication is also explored. Little mention is made of the rapidly advancing subject of radiation damage to field effect transistors and semiconductors in general. This may be due to the rather sketchy information available when the book was compiled.

The author effectively relates the performance and in some cases the lack of performance of FET to the basic device physics. Excellent references, a good bibliography, and a complete index make this a good reference book.—*Harold Wittlinger*, 14 Mooresmill-Mt. Rose Rd., Pennington, N.J.

### Improvement of Teaching by Television:

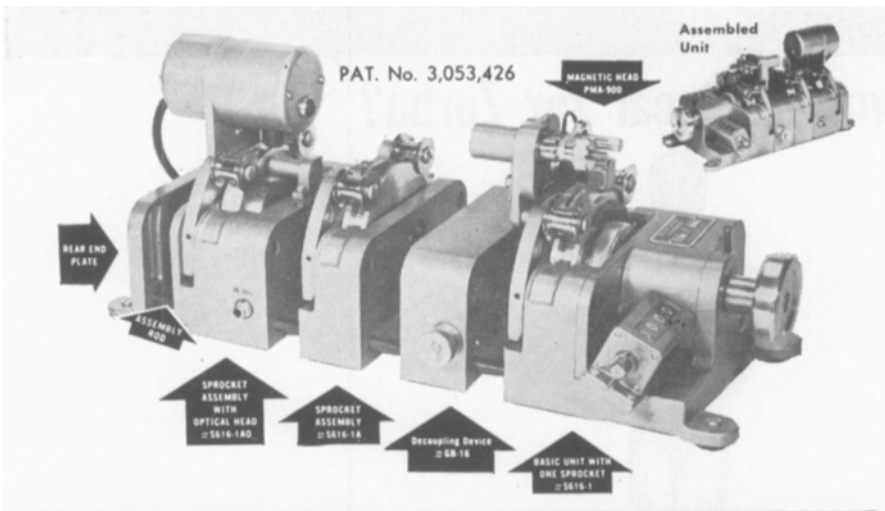
**Proceedings of the National Conference of the National Association of Educational Broadcasters at the University of Missouri, March 2-4, 1964.**

Edited by Barton L. Griffith and Donald W. MacLennan. Published (1964) by the University of Missouri Press, Columbia, Mo. 238 pp., incl. index, 6½ by 9½ in. Price, \$4.00.

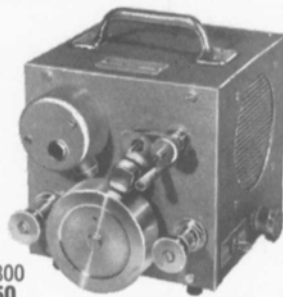
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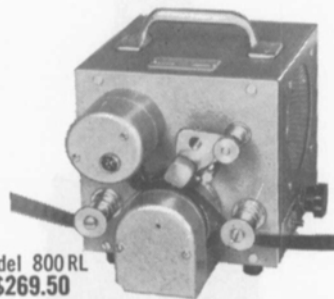
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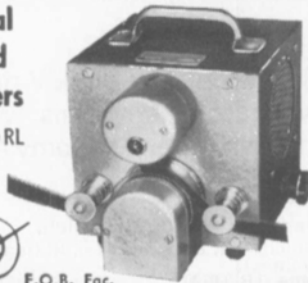
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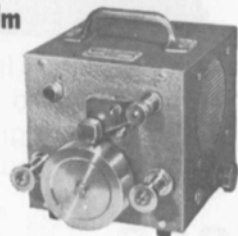
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to be uneven in both quality and interest. Nevertheless the interest is remarkably high; quality might have been improved had the editors not adhered quite so closely to the authors' words as delivered in the lecture hall.

Although the main concern of the conference recorded in this volume was with *improvement of teaching*, television engineers will be interested, for instance, in the James Madison Wood Quadrangle (Learning Center) at Stephens College, and the Missouri DAVE-DAVI Program: Proposed North Circle Project in St. Louis County, Mo. Buena Vista High School, east of Saginaw, Mich., reports particularly imaginative use of a \$40,000 television studio.

Television engineers might contemplate such remarks as, "Manufacturers have not

yet produced devices for the education market designed to meet the needs of the education market." Another speaker complained of "the paralyzing and inhibiting features of the television studio," and suggested that "the present widespread use of the studio [for instructional television] probably reflects the commercial origins of television more than the thoughtful analysis of what an optimum teaching and learning situation should be."

Many of the physical advantages of television are pointed out. For instance, televised instruction does not invariably have to be received in a classroom: a study at the University of Illinois found that students receiving instruction in their residence halls did just as well as those receiving the same televised lessons in class-

rooms. The implications here for solving problems of plant are obvious.

But it was to the solution of problems of education that the conferees primarily addressed themselves. A representative of the Des Moines, Iowa, educational television station (which is operated as a vocational training area for a technical-vocational high school), said that "educational television has not saved us any money. . . [or] . . . eliminated any pervading instructional problems." But it does make its contribution to improvement of instruction because "it requires, reveals, and facilitates the solution of numerous problems which otherwise go unsolved for generations."

Another author pointed out that "all of the comparative effectiveness studies [of the results] of conventional [instruction] and television instruction have shown no significant differences." Thus it is admitted that television can do the job of instruction at least as well as traditional classroom methods, and it can impose on the teaching profession a discipline of deep critical value. Furthermore, according to some conferees, television teaching is not as dehumanized as some believe, and may, like corporal punishment, hurt the teacher more than the pupil. One speaker quoted a child who told his "television teacher" when he first met her face to face: "You are the first teacher who has ever really understood me."—Ed.

*The following pamphlets are published (1965) by Educational Facilities Laboratories, Inc., 477 Madison Ave., New York, N.Y. 10022, a nonprofit corporation established by the Ford Foundation, and are available upon request.*

**Profiles of Significant Schools: Middle Schools**

By Judith Murphy. 64 pp., illus., 8½ by 11 in., paper cover.

**Profiles of Significant Schools: Schools Without Walls**

A Report. 56 pp., illus., 8¼ by 10 1/8 in., paper cover.

**The New Campus in Britain: Ideas of Consequence for the United States**

By Richard P. Dober. 72 pp., illus., 8½ by 11 in., paper cover.

Designers and engineers will find these booklets stimulating. They are generously illustrated with photographs (and sometimes overly so, as when a page in *Schools Without Walls* is dominated by a photograph of gala diners to illustrate "...the architects had invited the board members... to a restaurant in Cleveland in order to make some plans. As we sat at a long table in a rather crowded candlelit dining room, we discussed... etc. . . .").

On the other hand, most of the photographs are more meaningful than that, and the sketches of floor plans and site plans will be even more useful.

In both the *Profiles of Significant Schools*, references are made to provisions in the new schools for audio-visual equipment. *Middle Schools* reports that at the Bedford Middle School, Mount Kisco, N. Y., the audio-visual area can eventually be converted to a studio for closed-circuit television. McIntosh Middle School, Sarasota County, Fla., is evolving a closed-circuit system in its music area. Pleasant Hills, Pa., Middle

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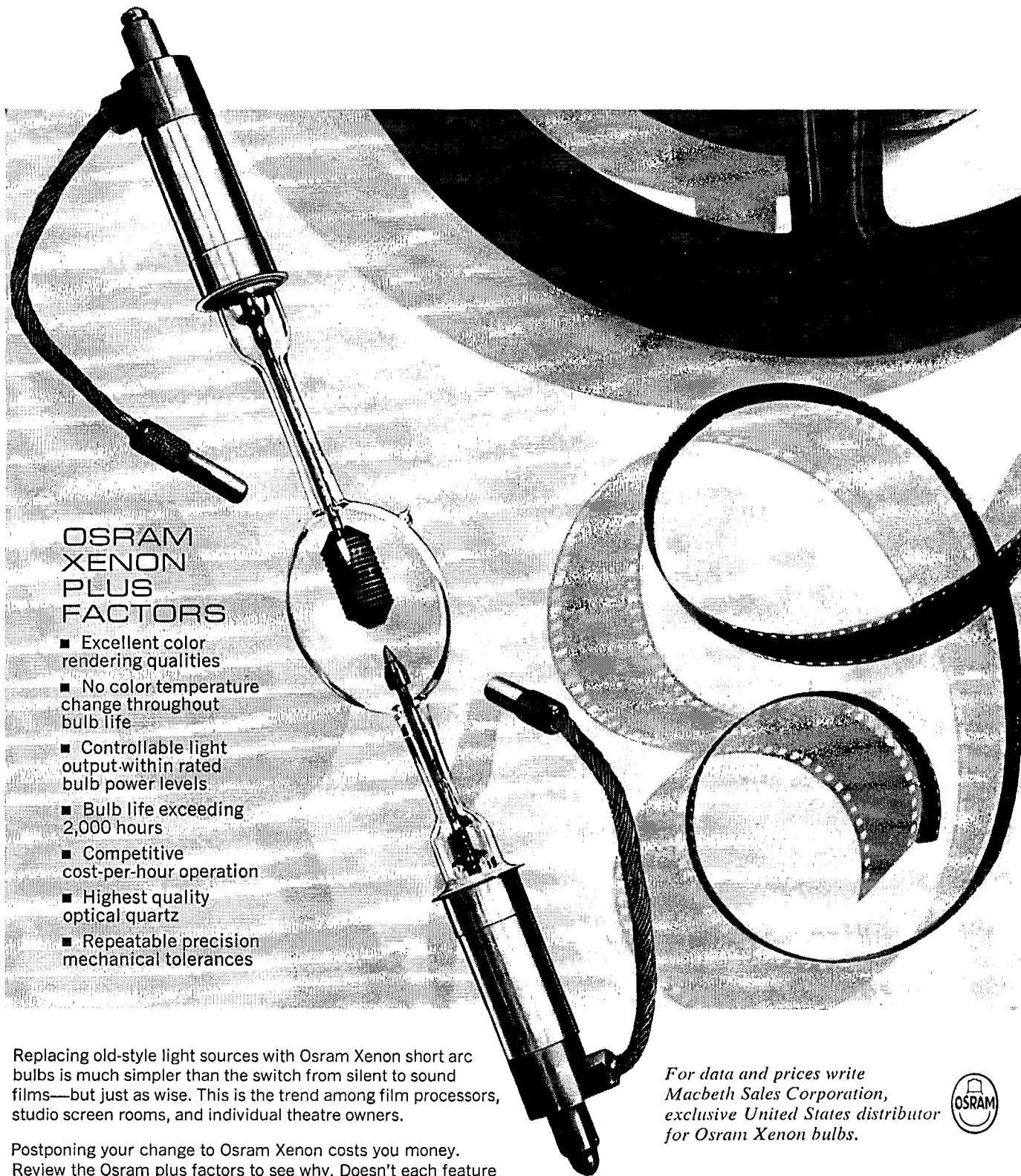
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School has provided an "unusual pre-fabricated unit combining a teacher's closet with various functional necessities such as public-address speaker, television outlet, and thermostat." Kennedy Junior High School, Natick, Mass., has a "... convertible auditorium. Use of Coil-Wal rolling partitions divides the auditorium into three self-contained areas in a matter of minutes, eliminating the need for other lecture halls." These areas are suitable for television and film projection.

*Schools Without Walls* refers to interior walls. Described is a new school pattern in which large open areas may be divided at will by use of demountable partitions. Separate chapters on "Use of Audiovisual Equipment" and "Acoustics" will commend themselves to television engineers involved with school design. The undivided classroom holding 100 children provides a fine display area for film and television showings, but some disadvantages appear when pupils are regrouped into smaller units. Although the writers of the report seem to be enthusiastically disposed to favor the wall-less floor plans, they do not hesitate to cite the many failures and drawbacks. In the last paragraph, they say, "How well these open-plan secondary schools will function remains to be seen." Specific schools are described.

In *The New Campus in Britain*, Richard P. Dober, Cambridge, Mass., campus planning consultant, outlines trends in the laying out of a number of new English universities. He discusses housing patterns, the development of communities, construction, "amenity" (meaning harmoniousness of design), teaching buildings, and "the continuous teaching environment," which, in the author's opinion, "is Britain's major contribution to university development and has ready application to all levels of higher education in the United States."

But for instructional television there appears to be no provision. Mr. Dober drops the single remark, "In such critical areas as instructional 'hardware'—gadgets and gimmickry—things have not advanced beyond the most elementary audio-visual aids." The British are establishing some fine guidelines in modern education, and to us it seems astonishing that they apparently are not trying out television as one avenue of relief of space and manpower shortages.—Ed.

### Standards of Television Transmission:

#### Factors Affecting Microwave Relay and Closed-Circuit Transmission of Educa- tional Materials

Compiled and Edited by Vernon Bronson and James A. Fellows. Published (1964) by National Association of Educational Broadcasters, 1346 Connecticut Ave., NW Washington, D.C. 20036. 90 pp. Paperbound. 7 by 10 in. Price \$2.50.

*Standards of Television Transmission* reports on a study conducted by the NAEB in cooperation with the Engineering and Education Staffs of the Federal Communications Commission, and the Jansky and Bailey Systems Engineering Division of Atlantic Research Corp. Intended for both educators and engineers, the information is presented in simplified form so that the

essential problems can be easily understood by persons with limited technical background. The book is mainly concerned with present and future technical requirements of educational television and with certain present technical limitations. FCC rules affecting educational television are examined; some possible detrimental effects are pointed out and suggestions for improvement are made.

Each of five sections in the book examines various aspects of a specific problem: I. Limitations and Potential of Present Television Equipment; II. An Interconnection Network for Educational Institutions; III. Technical Flexibility and Various Educational Needs; IV. Frequency Bands Available for the Interconnection of Educational Television; and V. An Application of the Computer Program to Selection of Microwave Channels. Four Appendixes are provided. Appendix A is intended for persons who require an explanation of the basic principles of television. Appendixes C, D and E are for engineers who wish to go beyond the body of the report and study certain matters in detail.

The "message" of the report, as set forth in the Introduction, is that the television system with which we are most familiar uses but one of many possible standards, and, for particular needs, appropriate technical standards should be identified and established. In other words, requirements of educational need in a given situation should determine the kind of television system which is established. The report points out (in Sec. I) that "The fact that broadcast standards are not adequate for all applications in educational television is well recognized."

In Sec. IV, the report discusses the inadequacies of present FCC rulings affecting educational television. For example, following a brief survey of the background of the FCC rulings, the report states, "The FCC rules are awkward for educational television in that some applications are for broadcast operations and others are for nonbroadcast facilities... Another indefinite area exists with regard to the need for using microwave network facilities to serve educational needs that sometimes involve broadcast stations and at other times, or at the same time, serve educational needs by interconnecting closed-circuit operations. Currently the FCC rules are not well suited to handling such a mixed usage." The Commission recognizes this and rulings have been made looking toward a partial or interim solution of this problem.

The book contains a number of highly significant facts excellently arranged and presented.—Ed.

### The People Look at Educational Television

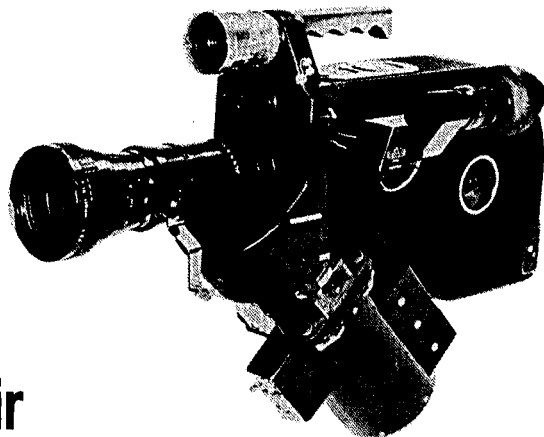
By Wilbur Schramm, Jack Lyle and Ithiel de Sola Pool. Published (1963) by Stanford University Press, Stanford, Calif. i-x + 209 pp., diagrams, tables 5½ by 8½ in. Price \$5.50.

*The People Look at Educational Television* might better have been titled *Schramm, Lyle, and Pool Look at The People Who Look at Educational Television*. For these excellent

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researchers have studied more than 30,000 TV viewers in depth, and came up with some fascinating analyses. Considering that the A. C. Nielsen Company "extrapolates the nation's taste on the basis of some 1,100 Audimeters attached to home receivers" (Skornia, *Television and Society*, 1965, p. 127), Schramm's and his associates' figures command respect.

Wibur Schramm, Director of the Institute for Communication Research at Stanford University, and Jack Lyle, Assistant Professor of Journalism at the University of California, Los Angeles, covered eight educational television stations across the country, while Ithiel de Sola Pool, Professor of Political Science at Massachusetts Institute of Technology, examined the educational television station in Boston, WGBH. New York's educational television station, WNDT, was just getting under way and was not included.

Chapter 1, "Educational Television—What It Is," and Chapter 3, "The Nine Stations and Their Programs," provide an excellent overview of the nature of educational television. In looking at the people who look at educational television, the authors did not look at those audiences who are watching during school hours in school, for such viewers they regard, naturally enough, as a captive audience. The "regular viewers" that they identified among the total population, they found to be "a remarkable audience, strongly representing the best educated people in the community, the people with the professional and managerial jobs, the people who are most active in civic and cultural affairs, the people who are the serious and purposeful users of the mass media."

For the technical developer and business manager of ETV, this book is a substantial guide. For, as the authors state in their final chapter, "The Significance of These Results," "the more we know about the kinds of people who select a particular kind of program, the easier it should become to devise and combine programs so as to appeal to different segments of the potential audience, and thus gradually to widen the station's coverage." With the opening up of UHF, the potential for increasing the number of channels is great. But if more channels are to be opened up, they have to be for known purposes.—*Ed.*

### Teach With Television

#### A Guide to Instructional TV

By Lawrence F. Costello and George N. Gordon. Second edition published (1965) by Hastings House, Publishers, Inc., 151 E. 50th St., New York, N.Y. 10022. A Communication Arts Book. 192 pp., 50 illus., glossary. 6½ by 9½ in. Price, \$5.95.

*Teach With Television* is a book for teachers to give to the technicians who staff school television systems and for technicians to give to the teachers who "perform" on instructional networks. For the technician, this little guidebook will provide insight into the material that his medium is designed to communicate. For the teacher, it will provide enough technical information for him to grasp the import of the problems faced by the technician.

This is not a technical book. The descriptions of equipments and methods are ex-

tremely elementary. It is useful, however, in that it can save the television technician from having to explain such rudiments as the difference between directional and non-directional microphones or the difference between and uses of kinescope and videotape recordings.

Chapters on "The Television Studio," "Organization of the Installation," "Administration and Television," and "Financing Instructional Television" provide guidance for school board members and administrators concerned with setting up facilities and staffing a system.

Dr. Gordon, Associate Professor of Education in the Communication Arts Group at New York University, and Mr. Costello, who at the time of his death in 1964 was Sales Manager for the Sony Corp. of America in New York City, have provided a useful overview, displaying great devotion to the principal of teaching with television. They favor closed-circuit systems over standard broadcasting for classroom use, and they weigh the merits of *total* television teaching. Television people toiling in the instructional field will want to acquaint themselves with *Teach With Television*, if not for its news at least for its philosophy and so that they can recommend it to inquiring laymen—*Ed.*

### Man, Education, and Work:

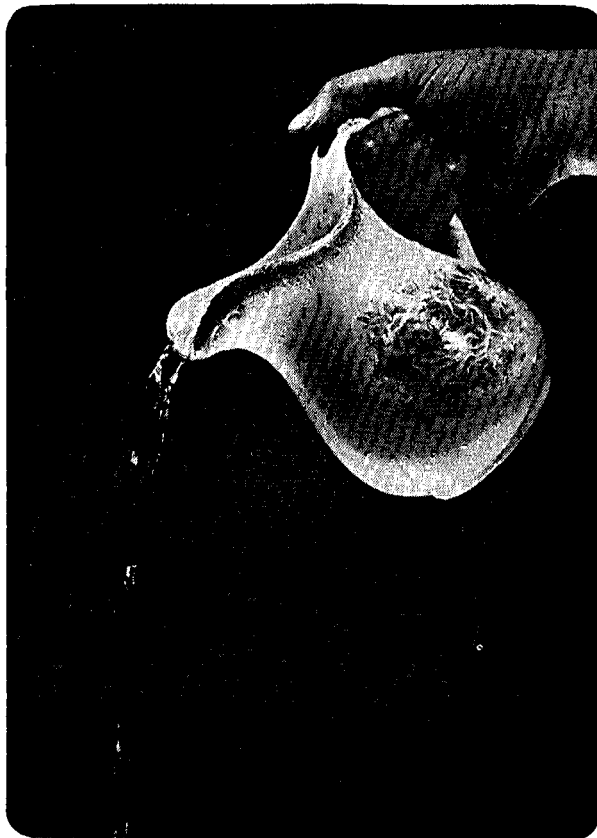
#### Postsecondary Vocational and Technical Education

By Grant Venn, assisted by Theodore J. Marchese, Jr. Published (1964) by the American Council on Education, 1785 Massachusetts Ave., N.W., Washington 36, D.C. xiii + 186 pp., bibliography. Paperbound. 5½ by 9 in., Price, \$1.50.

Motion picture and television engineers who are affiliated with the education world and who take part in the preparation of the young for a lifetime in the engineering field will find this a valuable and thought-provoking book.

*Man, Education, and Work* is not primarily concerned with the scholarly student who will eventually get his Ph.D.; the problem on which the book concentrates is that of the middle-level technician. "The major block to technical education during the last century and the first three decades of this century," states the report, "was the failure in this country to recognize the existence of a level of work between the skilled trades and the professions." The report gives credit to Pratt Institute as the pioneer in this country. "The technician's battle for occupational recognition has now, of course, largely been won. A first turning point came in the late 1920's . . . [due to a report of the Society for the Promotion of Engineering Education which identified] technical education as an essential part of the development of the profession."

*Man, Education, and Work* grew out of a conference of the American Vocational Association, which assigned to the American Council on Education the task of assessing "the place of occupational education within education as a whole and within a new technological economy." An introductory overview discusses today's dual problem of the shortage of manpower in the middle-



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level technical area and the pool of underemployed undereducated youth. A capsule history of vocational and technical education is followed by discussion of specifics in chapters headed, "Vocational and Technical Education in Secondary and Higher Education," "Other Opportunities for Vocational and Technical Education," "The Federal Government and Vocational and Technical Education," "Manpower Needs, Present and Future," and "Major Issues in Vocational and Technical Education."

The final, excellent, chapter offers conclusions and recommendations that stress the compelling need for the educational

system to concern itself with occupational education. Indeed, the report warns, if it does not, a separate system of education will emerge in the nation, and this will be unfortunate. Recommendations include vigorous urging that more research be done, that lines of co-operation be strengthened, that the offerings in technical and occupational education be greatly widened and deepened, that guidance be intensified, that the education system assume more responsibility for the "drop-out," and that interest, need, and ability be made the basis for enrollment in vocational and technical education, rather than financial capability.—Ed.

## CHEM Study Films to Improve High-School Chemistry Teaching

By DAVID W. RIDGWAY

*This report is an abridgment of a presentation made by David W. Ridgway, Director of Film Activities, Chemical Education Material Study, Lawrence Hall of Science, University of California, Berkeley, Calif. 94720, on March 31, 1965, at the Society's Technical Conference in Los Angeles.*

TWENTY-SIX motion pictures, averaging 20 min in length, produced by the Chemical Education Material Study (CHEM Study) are now being widely used by both secondary schools and colleges.

CHEM Study is the outcome of a recommendation of a committee of the American Chemical Society. The objective of CHEM Study was to improve the teaching of chemistry at the high-school level. CHEM Study, under the leadership of Glenn Seaborg, Chairman of the Atomic Energy Commission, in addition to the films, produced a textbook entitled *Chemistry—An Experimental Science*, a lab manual and a teachers guide. An unusual feature of the films is that they are directly integrated into the course. The production of all of the materials was made possible by a grant from the National Science Foundation. A new emphasis is placed on the experimental approach. Descriptive materials are de-emphasized and memorization and subsequent regurgitation are discouraged.

The films were designed to do those things which the teacher would find difficult or impossible to do in the classroom. The films concentrate on presenting experiments which teachers cannot do readily because of the expense of equipment, scarcity of chemicals or excessive setup time. The films also show experiments done with chemicals which would be too dangerous to handle in the average school classroom.

Animation plays an extremely important part because it can present effectively, in a few moments, abstract concepts and principles which the teacher could present only laboriously with words or ineffectively at the chalkboard.

Before the production of the film series was started, it had to be determined whether CHEM Study would set up its own studio and hire a production staff to do the films or whether it would be more practical to utilize already established commercial film production organizations.

While a certain unity and uniformity of product might be achieved by having one coordinated staff operating in a central headquarters, there seemed to be distinct advantages in utilizing already established commercial film production organizations. The established companies had competent staffs which had worked together effectively. Each one had special talents and provided some variety in presentation. Furthermore, CHEM Study used scientists at widely separated geographical points and it turned out to be possible, in every instance, to utilize a film production organization which was close to the collaborating scientist. Geographic proximity, too, made it possible for the scientist to work very closely with the script writer and with the entire film production operation. This proximity provided one of the essential ingredients without which it was found that good scientific films could not be produced.

Of the twenty-six films twenty four were made in color. For these, photography was done on commercial Ektachrome. Two of the films, where color was not essential, were made in 35mm black-and-white and release prints are made from a reduction dupe negative.

In addition to the normal 16mm release all the films have been adapted for use in an 8mm continuous cartridge sound projector. Half the films have been translated into Spanish. Translation of the remainder is in progress. Many of the films are being used on educational television.

### Discussion

*James A. Larsen (Academy Films):* Can you tell us what was the production cost of the films?

*Mr. Ridgway:* The production cost ranged from a low of \$11,300 to a high of \$29,800; the average cost was \$19,500.

*Mr. Larsen:* What was the average length, or were they all the same length?

*Mr. Ridgway:* The length varied from 13 to 24 minutes; the average length was 20 minutes.

*Mr. Larsen:* And what was the selling price in color or black-and-white, or did you offer them in both forms?

*Mr. Ridgway:* Except for the two films that were photographed in black-and-white, they are all in color, and we are not offering black-and-white prints of the color subjects. The prices vary in accordance with length—which is common practice. The lowest priced one, 13-min, is \$105; and the highest, \$180.