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Acoustics of Studios and Auditoria

By V. S. Mankovsky. Published (1972) by Hastings House, Publishers, Inc., 10 E. 40 St., New York, NY 10016. 396 pp. incl. Table of Contents, Appendixes, Index. Diagrams. 6 by 9 in. Price \$15.

Editorial Note: For the first time in many years, the *Journal* is fortunate in having two reviews for the same book. Each reviewer is a consultant in acoustics and each found the book, translated from the Russian, of significance in the field of acoustics. Both reviews are analytical and informative. Although in the main the two reviewers are in agreement, we believe that the readers will find the different approaches especially stimulating.

This book represents primarily an outstanding example of the determination of Russian scientists to discover, catalog and digest the development of world technology during the post World War II period, and then to re-research many aspects of it for themselves. One result of these objectives is a textbook for the teaching of acoustics to Russian engineers. The translation into English text was accomplished by A. G. Clough, with editing by Christopher Gilford of the University of Aston, Birmingham, England. The extent to which the author has gathered so much material and organized its presentation well will represent its primary value to engineers in this country.

One fascination of the ingestion-digestion process is the list of references including American and English classics such as Lord Raleigh, Knudsen, Morse as Russian references (W. C. Sabine graciously excepted). As in most reviews, the author wearied of regression. In the frequent brief sorties into stereophonic sound, there is no summary or reference to the classic work of the early thirties by Harvey Fletcher and his associates, which in this reviewer's opinion should be required preliminary reading for any worker in this field.

This is not a book for the neophyte. It is a fascinating mixture. It is academic, scholarly. It carries one subject — such as reverberation — through to the extreme before introducing a broad background for comprehension. Therefore, it will be appreciated at first reading only by the sophisticated reader; others will require repetitive study. In contrast, and a good feature, after each theoretical or mathematical development, a concise and significant summary of the resulting facts is given.

Nor is the book a handbook for the instant expert. It properly discusses the needs for many practical features such as double windows and floating floors; but modern details of design are not there. The discussion of noise control for ventilation system is especially sketchy, weak and old, as compared with the *ASHRAE Guide*; also the vital determination of required duct attenuation as a function of frequency and the matching with modern sound traps.

There is a good development of wave acoustics in enclosures including a discussion of the three general classes of resonant modes (axial, tangential and oblique). But the reasons are not explained for the differing rates of decay and the resultant aberrations in the late decay period, which are the plague and the challenge of reverberation chamber design.

There is a good treatment of the varieties of sound absorbing materials and their tailoring for frequency dependence. But the blithe reference to perforated facings may extend a dying generation of misguided studio design.

There are many treatments which display the academician's urge to force a complex subject into a simple mathematical format. One example is the treatment of sound distribution from a single trumpet-type horn, ignoring the strong dependence on frequency; another example is the vastly simplified mathematical concept of (very complex) columnar loudspeakers. These may be justified by the very correct (and little understood) concepts for uniform coverage of audience with direct sound. However, by failing to acknowledge many vast complications, a false sense of mastery may be engendered.

There is a fascinating dichotomy between the acoustical design of recording studios in contrast with motion-picture theaters (cinema auditoria). An early and thorough background is laid in the development of the concepts of direct and reverberant sound fields, reverberation time, the acoustic ratio (direct to reverberant sound intensity), directivity of the sound sensor (microphone), its effect on the acoustic ratio, and finally an "equivalent" reverberation time. Then the all-important influence of early reflected sound on intelligibility is introduced. Unfortunately, the emphasis is placed on equivalent reverberation (time for 60-dB decay) rather than on the rate of decay, thereby detracting from the vital importance in modern design of the ratios of direct-to early reflected-to reverberant sound level. (I had hoped to find more emphasis on the significance of binaural hearing in this subject, but we all fail in respect for the unknown — this mysterious concentrating factor.)

The application of these concepts to design of recording studios is well presented, including, in this case, the important contribution of early reflected sound. The existence of studios with controllable reverberation time is acknowledged, but the reasons and varieties of control, based on type of sound source or ensemble, microphone technique, isolation between multiple microphones, cohesion between performers, etc., are not discussed. Yet these are the concepts behind the development of modern American studios having a wide

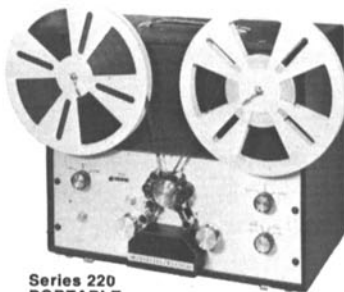
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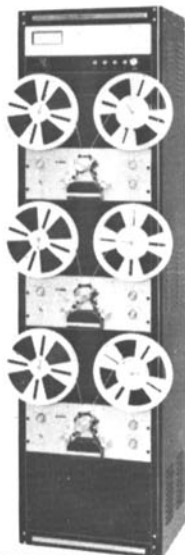


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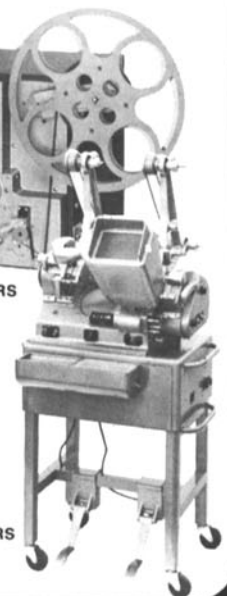
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range (10 to 1) variability of reverberation and control of early reflections. Again, illustrating the excellent summaries, a detailed example is given for the design of a classical recording studio having a reverberation time of 1.7 seconds (for music scoring).

Somehow in the application of these concepts to the motion-picture theater, something seems (to this reviewer) to go awry. I can't be sure whether the author believes differences in the apparent reverberance for music versus speech, etc., can be accomplished in the theater acoustics or in the soundtrack. Criteria for reverberation time versus frequency and theater volume are taken from the oldest texts, where they were derived for maximum advantage for unamplified voice. In this event, the subtleties of the apparent acoustic environment, incorporated in the soundtrack, would be obliterated in the larger theaters, leaving the music score always the winning performance. (Of course, the reviewer is here acknowledging one of the fascinating and challenging quandaries for the theater designer — and, if I may say, the sound departments.)

But it is specifically in the area of reverberation control that the author, having so clearly discoursed on early reflections, seems at cross purposes in theater treatment. He repeats over and over the recommendation of applying absorptive treatment on the walls and ceiling nearest the sound source. This leaves the more distant surfaces exposed. Thus, for most of the audience, early reflections would be killed and the later ones would persist; this is most destructive of intelligibility in speech and clarity in music. This notion is developed by the author on the altar of the "equivalent" reverberation time, i.e., to produce a shorter than normal apparent reverberation time by reducing the initial level of reverberant sound.

This problem, frankly, results from an insufficiently detailed view of the early decaying sound in a room and the vital importance of the early reflected sound which augments audition. This is inherent in the concept of the echogram, the catalytic concept brought to this country immediately after World War II by Prof. Irwin Meyer. The subject is only lightly touched by Dr. Mankovsky in the last chapter dealing with acoustical measurements. Yet it is the meticulous development of this feature, along with the control of Direct, Envelopmental and Reverberant sound ratios, which are the keys to success or failure in the modern auditorium. Perhaps this subject will be the medium for a sequel to the present volume and Dr. Mankovsky's skillful digesting and organizing for another useful volume. —Paul S. Veneklasen, Paul S. Veneklasen & Assoc., Consultants in Acoustics, 1711 Sixteenth St., Santa Monica, CA 90404.

The book was translated from the Russian by A. G. Clough, and was edited by Christopher Gilford, a Reader in Acoustics, Department of Building, University of Aston, Birmingham, England.

Of the ten chapters of which the book is composed, only two relate specifically to studios and auditoria, while the remainder is devoted to the exposition of the princi-

ples of architectural acoustics. There is very little in the book which has not already appeared in American texts, although it is interesting to learn of the expressions used by another country in treating specific phases of the subject. Unfortunately, such expressions may also lead to slow reading. For instance, in this country, the Greek letter tau is used for the sound-transmission coefficient, that is, the fraction of the incident sound transmitted through a partition, and ten times the logarithm of one over tau is called the sound-transmission loss of the partition, expressed in decibels. In Russia, tau is used to designate the sound-transmission loss, while the corresponding coefficient is designated by the Greek letter alpha (reserved here for the absorption coefficient) with the subscript "trans." Another difference lies in the way noise levels are rated. In this country, when a disturbance is measured with the common sound level meter, the rating is expressed as so many decibels followed by the letter of the network employed in the test, like 80 dB-A, 90 dB-C, etc. In the table on page 381 of the book, the noise levels of various sound sources are simply designated as decibels, without a postscript.

The only two American books used for references are L. L. Beranek's *Acoustical Measurements*, published in 1949 and Vern O. Knudsen's *Architectural Acoustics*, published in 1932. This reviewer is quoted on page 60, but no reference is cited.

The book is used as a text for a course on Acoustics for Film Studios and Cinema for students specializing in sound technique in the Leningrad Institute of Cinema Technician. Considering the purpose of the book, however, it contains no discussion of microphones and their principles of operation, or a discussion of optical and magnetic sound recording. Possibly the mechanics of sound recording are contained in another publication, unlike John G. Frayne and Halley Wolfe's *Sound Recording*, which concerns itself with both the acoustic and electroacoustic aspects of studios.

The book, therefore, provides essentially the basics of architectural acoustics, and does it well. It is copiously illustrated and clearly written. The mathematics employed are those taught in the first and second year of our technical colleges. —Michael Rettinger, Consultant on Acoustics, 5007 Haskell Ave., Encino, CA 91316.

Fotografi, Teori och matteknik (in Swedish)

By Gunnar Lenning. Published (1971) by Almqvist and Wiksell Forlag AB, 26 Gamla Brogata, Stockholm C, Sweden. 390 pp. Illus. Diagrams. 6 by 9 in. Price 95:20 Sw. kr.

As Mr. Lenning has indicated in the introduction, *Fotografi* was written to fill the need for a basic textbook in photography primarily for use at the Chalmers school (CTH) in Gothenberg, Sweden. The result is an excellent, easy-to-read, up-to-date text directed toward the student with a freshman or sophomore college background in mathematics, physics and chemistry. Although the book is written from the physicists point of view, in-depth theoretical and mathematical presentations are



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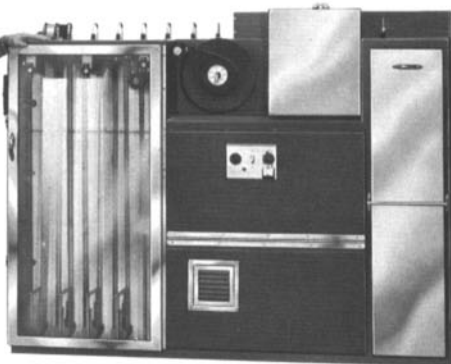


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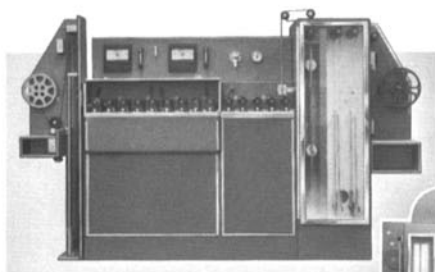


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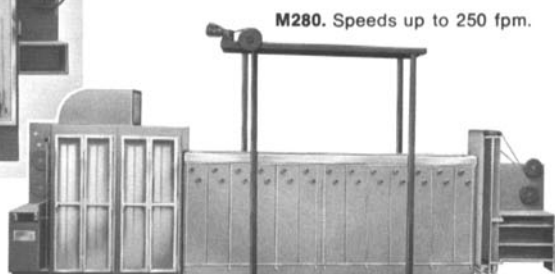
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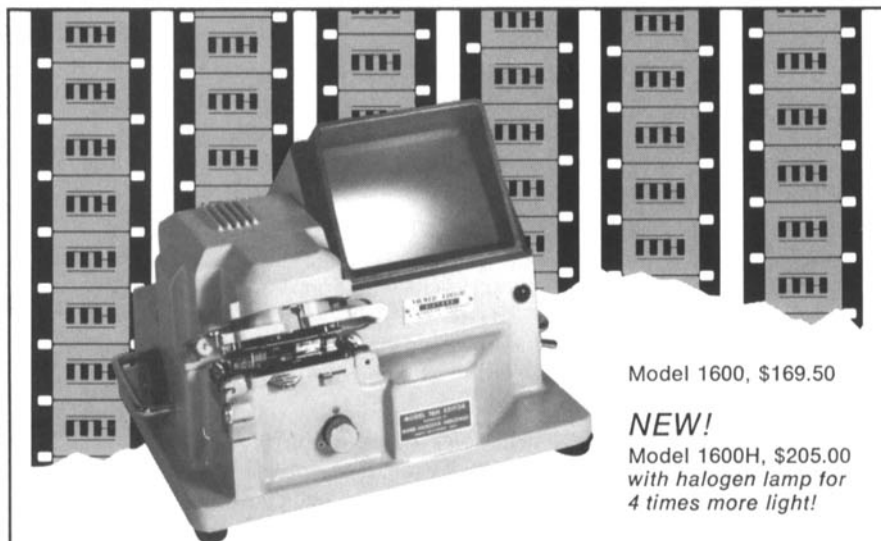


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kept to a minimum. Rather, photography is presented as a whole with emphasis on its uses as a creative tool for measuring and recording. Thus *Fotografi* should have appeal both to the student and the practicing photographer desiring a better knowledge of the subject.

The book is divided into 14 chapters. The 14th chapter contains work problems and their solutions which might be used in the classroom or by the independent student. An excellent bibliography is included for those who wish to pursue further various aspects of photography.

The contents are divided by chapters as follows:

1. Radiation, the Picture and Information (a general discussion of the image to be recorded as well as holography in black-and-white and color)
2. Theory of Photographic Reproduction (including sensitometry, densitometry and tone reproduction)
3. Silver-Salt Systems (of particular interest is a good discussion of basic emulsion making)
4. Non-Silver Systems (including reflex-copying, diazo-systems, electrophotography, photopolymerization and phototropic systems)
5. Optical Geometry and Photometry
6. Color Impression and Color Measurement
7. Color Photography
8. Recording Invisible Radiation (including IR, UV, X-ray, and radioactivity)
9. High-Speed Photography
10. Movie Techniques and Movement Analysis
11. Micrography and Microscopy
12. Limits of Photography (excellent presentation of the limits of the medium and of image formation)
13. Photographic Techniques and Some Applications (including camera types, exposure measurement and projection)

In summary, Mr. Lenning has accomplished what he set out to do, i.e., produce an excellent basic text in photography in the Swedish language. The book should be popular in Sweden and elsewhere, if translated, where a good, well-written, basic text in photography is desired. However, no book review is complete without some constructive criticism. The text is written from the physicists viewpoint and unfortunately chemistry suffers. Chapters 3, 4 and 7, dealing with Silver-Salt Systems, Non-Silver Systems and Color Photography, could be improved in future editions by amplifying discussions dealing with chemistry. It is true that a good understanding of image formation, interpretation and display must be based on an understanding of the physics involved. It is also true that in most cases there would be no record to interpret, measure or display if it were not for chemistry to amplify the latent image and convert it to a form which can be used. This is particularly true in color photography which would not exist, at least in the form we know it today, if it were not for organic chemistry. A good basic education in the chemistry of photography is as necessary as an education in physics if the student is to realize the potential of the medium and keep up with the rapid changes and developments in photography which are occurring today.
—Albert E. Anderson, Eastman Kodak Co. Rochester, NY 14650.