Proceedings of
The Radio Club of America, Inc.

Founded 1909

DECEMBER, 1942

Volume 19, No. 2

CONTENTS

THE RADIO CLUB OF AMERICA, Inc.
11 West 42nd Street * * New York City

THE RADIO CLUB OF AMERICA, INC.

11 West 42nd Street, New York City

Telephone -- Longacre 5-6622

OFFICERS FOR 1942

President
Paul Ware

Vice-President
Charles E. Dean

Treasurer
Joe J. Stantley

Corresponding Secretary
O. James Morelock

Recording Secretary
Lucius E. Packard

DIRECTORS

Ernest V. Amy
Edwin H. Armstrong
Harold H. Beverage
George E. Burghard
John L. Callahan
Lawrence C. F. Horle
Charles W. Horn
Harry W. Houck
J. Kelly Johnson
Frank King
Fred A. Klingenschmitt
Haraden Pratt
Frank H. Shepard, Jr.

COMMITTEES

Advertising - John L. Callahan
Affiliation - Ernest V. Amy
Budget - Joe J. Stantley
Entertainment - Harry W. Houck
Membership - Fred A. Klingenschmitt
Papers - O. James Morelock
Publicity - Austin C. Lescarboura
Year Book - George E. Burghard

MEETINGS

Technical meetings are held on the second Thursday evening each month from September through May at either Havemeyer or Pupin Hall, Columbia University, Broadway and 116th Street, New York. The public is invited.

MEMBERSHIP

Application blanks for membership are obtainable at the Club office. For the Member grade the initiation fee is one dollar and the annual dues are three dollars.

PROCEEDINGS

Editor - Charles E. Dean
Assistant Editor - John D. Crawford
Assistant Editor - Clarence J. LeBel
Assistant Editor - Milton B. Sleeper

Subscription: Four dollars per year, or fifty cents per issue. Back numbers to members, twenty-five cents each.

CLUB NEWS

ELECTION OF OFFICERS FOR 1943

At the time this is written the ballots for the election of officers for 1943 have been counted, and the slate for 1942 elected for another year.

In addition the following directors for 1943 have been elected by the membership or by the Board at its first meeting:

Ernest V. Amy
Edwin H. Armstrong
Harold H. Beverage
John H. Bose
George E. Burghard
John L. Callahan
Edwin P. Felch, Jr.
Lawrence C. F. Horle
Harry W. Houck
Frank King
Fred A. Klingenschmitt
Haraden Pratt
Milton B. Sleeper

SAMUEL JACKSON, JR. LOST IN SOLOMON'S NAVAL BATTLE

The sad news has been received of the death of Samuel Jackson, Jr., Lieut., j.g., which occurred on August 9th when the cruiser Vincennes, on which he was serving, was sunk in the Solomons.

He was born on February 22, 1905 in New York City, and attended school at Horace Mann and at Wesleyan. He lived at 12 East 62nd Street, New York, and was engaged in the real estate business at 9 East 46th Street. He joined the Club in the spring of 1940.

DICK PURINTON AT BUREAU OF SHIPS

Richard M. Purinton, formerly with Raytheon, is now a civilian employee with the Radio Division, Bureau of Ships, Navy Department, Washington. He is living at 4012-25th Road North, Arlington, Virginia.

(Cont'd. on page 27)

Proceedings of
The Radio Club of America, Inc.

me 19 | December, 1942 | No. 2

WIRE TRANSMISSION OF NEWS PICTURES

By John R. Hancock and Frank T. Turner*

Presented before the Club on December 11, 1941.

Any discussion of elec-
cal picture transmis-
n would be incomplete
hout some reference to
historical background
the art. As far back
1842 Alexander Bain, an
lish physicist, pro-
ed a method of facsimile
nsmission in which he
nned a type face by
ing an electrical con-
t with a stylus swung
oss the face of the
e by a pendulum. The
e was advanced a small
ction of an inch for
h swing of the pendulum.
e currents resulting
m this scanning were
be sent over telegraph
es to the distant re-
ver, where a stylus was
ng by another pendulum
eriod equal to the first
dulum across the face
prepared paper, the re-
ding being done by elec-
lytic means. We have
nd no record of this
aratus having been built,
it is interesting to note that it incorporates
the basic elements of a picture-transmission
tem. There is a means of progressively scanning
material to be transmitted, a transmission link
carry the currents generated by the scanning, a
ns for synchronizing the movement of the trans-
er and receiver, and a means of recording.

JOHN R. HANCOCK, following graduation from the Bliss Electrical School in 1927, spent a short time with the Western Electric Company making final tests on multiple switchboards. Later in the same year he started with RCA, and worked with Major Ranger and C. J. Young in the development of photo-radio and facsimile apparatus. From 1930 to the present time he has been with International News Photos engaged in the development of photo-electrically controlled apparatus, including photo-electric picture transmission and engraving. He has also designed special photographic enlarging equipment and cold-light sources.

FRANK T. TURNER, spent several years in chemical laboratories, after which he began work in electronics, including a period in the public-address field. He has been with International News Photos since 1936, designing amplifiers and special circuits for picture transmission. His work in this field included the invention of a vibrating-reed device with electro-magnetic drive and electrostatic pickup for use in a picture transmitter; in a practical installation this operated at 1800 cps. He is also engaged in development work on amplifiers and cutting heads for photo-electric engraving.

We find records of successful tests by Casselli between Paris and other French cities in 1865. In 1901 the Denison method, with scanning of letters on tape, was in use. This was limited to the transmission of printed matter, and could not handle pictures.

One interesting method of picture transmission was the Bart Lane system in which the picture to be transmitted was divided into a number of areas, the tone in each area determined by photoelectric means, and a character corresponding to this tone punched in a tape which could then be fed into a regular Morse transmitter.

Pictures were transmitted by the Korn system between Munich and Rome in 1922, and the first radio photo was transmitted from New York to London and back to New York on July 6, 1924.

In the United States the telephone company has carried out extensive engineering and commercial development in this field.

Figure 1 shows the first commercial transmission

th of International News Photos, Inc., New York City.

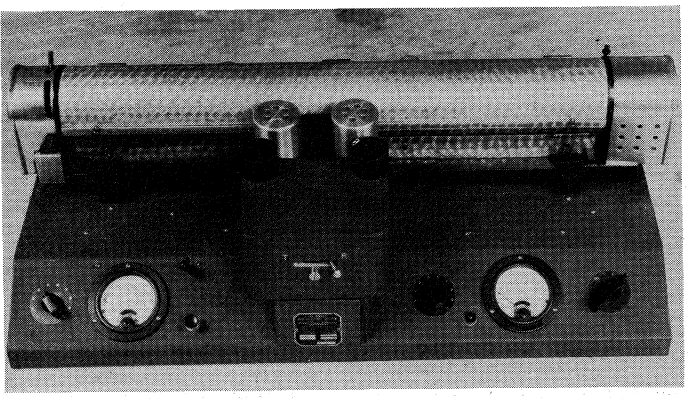


Fig. 4 - Transceiver of Previous Figure Receiving a Picture.

The Kerr cell, in which the plane of polarization of light passing through the cell is rotated by the application of voltage to the electrodes, is extensively used in European systems of picture transmission.

The use of a mirror galvanometer for recording, with its low power requirement of the order of a hundred milliwatts or so, made possible the development of this transceiver. The dimensions of the galvanometer are only 3/4 by 3/4 by 1 inch.

Still another method is by use of the crater lamp. This is a glow-discharge tube filled with neon and other gases, in which the electrode structure is such as to confine the discharge to a small crater. The discharge in this tube is capable of following satisfactorily the rapid variations of current here encountered. A suitable image of this crater may be focused directly on the receiving film. The crater lamp requires considerably more power than the mirror galvanometer. Recent development work on crater-lamp amplifiers in our laboratory, however, makes it possible to use this recording device in a compact and easily moved machine. Figure 5 shows a transceiver using crater-lamp recording.

SYNCHRONIZATION

It is necessary that the transmitting and receiving cylinders revolve in almost exact synchronism; a difference in the speed of the two cylinders of one part in a hundred thousand causes a perceptible distortion of the received picture. This synchronization may be accomplished in several ways, - by the use of a transmitted synchronizing signal

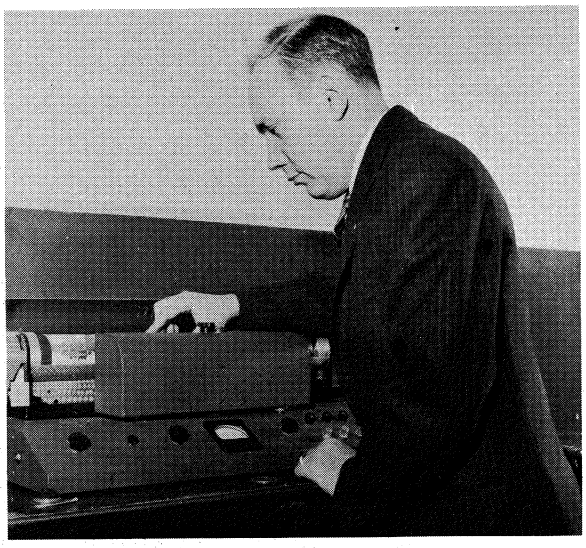


Fig. 5 - Transceiver Using Crater-Lamp Recording.

of some sort, or by the use of individual local frequency standards. It is this last method which we have found the most satisfactory.

In our apparatus, the cylinder is turned at 90 revolutions per minute by a small synchronous motor operating at 1800 revolutions per minute through a reducing gear. The 60-cycle current to drive the motor is generated by the local frequency standard. We use at present two different kinds of frequency standards, one of which employs an electrically driven 60-cycle tuning fork housed in a temperature-controlled chamber. The 60-cycle current from the tuning fork is applied to a power amplifier capable of delivering the 10 to 20 watts required to drive the motor. Figure 6 shows such a tuning-fork frequency standard and power amplifier.

Shown in Figure 7 is another frequency standard using a quartz crystal oscillating at 87 kilocycles. The output from the crystal oscillator is applied to a succession of multi-vibrator stages, each one dividing the frequency applied by a suitable factor. The last multi-vibrator gives an output of 60 cycles which is applied to a power amplifier as before. These crystal frequency standards are very dependable and very accurate, being capable of maintaining accuracies of better than one part per million for long periods of time. Only 10 or 15 minutes warming up is required to have sufficient stability to start transmitting. These frequency standards are heavy and bulky, which are their only disadvantages. The weight is 65 pounds.

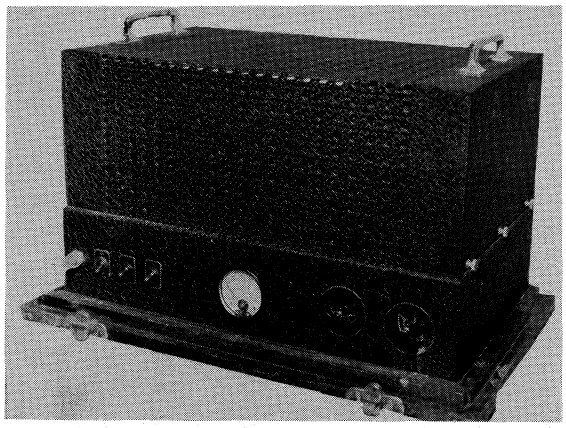


Fig. 6 - Tuning-Fork Frequency Standard Including Power Amplifier.

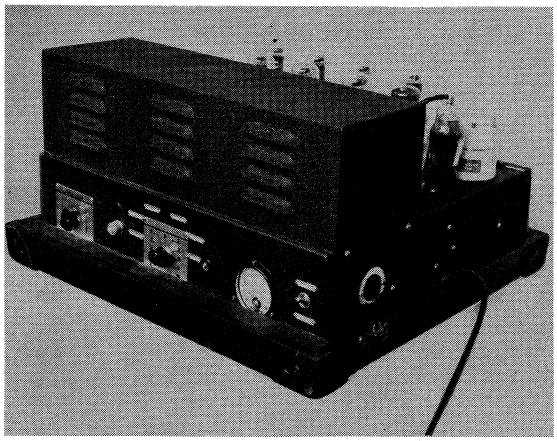


Fig. 7 - Crystal Frequency Standard.

Transmitted synchronization can be accomplished by the use of a carrier frequency which is a function of the speed of rotation of the transmitting cylinder. The motor at the receiving end can then be driven by an oscillator which is synchronized with the transmitted signal. This method has the advantage of requiring much less apparatus at the transmitting end than is required when local synchronization is used, but has the disadvantage of being inoperative during interruptions in the transmission link. In any system such as ours, where considerable use is made of regular message circuits, this can be quite a problem due to operator break-ins, etc.

Another method is the stop-start one which has been used in home radio facsimile. In this the receiving drum revolves a trifle faster than the transmitting drum, completing its revolution and coming to rest against a stop which is then released at the proper moment by a signal from the transmitter. For various reasons this is rather unsatisfactory for high-quality reproduction.

PHASING

It is necessary that the transmitting and receiving cylinders be in step so that the gap between the edges of the transmitted picture as it is wrapped around the drum is superimposed on the gap between the corresponding edges of the film on the receiving drum. To accomplish this, a dash or phasing signal consisting of a short pulse of signal for each revolution of the drum is transmitted at the start of the picture. This dash is applied to the control element of a glow-discharge tube at the receiving end; this energizes a relay that engages a clutch, causing the receiving drum to start its rotation at the proper moment. However, in operation a steady signal is first transmitted to enable the operators at both the transmitting and receiving ends to adjust the level of the signal to a value suitable for the telephone link used. Following this, the transmitting drum is started and the dash is transmitted; when the receiving apparatus has been phased, the latch engaging the lead screw is operated causing the cylinder to start its movement from right to left.

PRACTICAL ADVANTAGE OF TRANSCEIVERS

Our installations are often made in small newspaper plants some distance from the nearest main station and technician. Inasmuch as the same amplifier, the same scanning head, and the same motor and drum are used for both receiving and transmitting, there is no separate maintenance problem as would be the case if a separate transmitter were used. This means that at every place where we have a receiving installation, we have a transmitter which can cover us should a story break in the neighborhood. It is easy to convince a newspaper owner that he must supply a suitable location for the receiver on which his pictures are to be received. It is not so easy sometimes to get him to supply additional space in which to set up a transmitter. In addition, during the period of time between stories of national interest in his vicinity, the transmitter would be unused and uncared for, with the result that when needed we would probably find it not in working condition. This entire problem is solved by the use of the trans-

ceiver which occupies no more space than would apparatus capable only of receiving, and is always ready for instant use.

PORTABLE TRANSMITTER

In addition it has been necessary to develop smaller and lighter portable apparatus to be used for transmission only. We often find that when a story breaks, it is some distance from an existing installation, which would introduce considerable delay from the time the pictures were taken until they reached the location of a transmitter capable of putting them on the network for transmission to all points. In this case a man is sent out from the nearest office with a portable picture transmitter, which he sets up in a suitable location as near as possible to the scene of the strike, train wreck, plane crash, or what not. Such a set-up is often made in a photographic studio, as this assures the availability of developing apparatus for preparing the prints for transmission. Sometimes we may find that a photo studio is not available, in which case we set up in a hotel room, a private home, or other place.

Figure 8 shows the planning of a pickup with portable equipment, and Figure 9 shows the two-man team en route. In case a photographic studio is not obtainable, and a hotel room has to be used, we may set up our enlarger as shown in Figure 10 and the transmitter as shown in Figure 11.

USE OF TELEPHONE MESSAGE CIRCUITS

The International News system is based on the use of ordinary telephone circuits, and we have found that it is usually possible to transmit excellent pictures over such facilities. Some trouble is occasionally experienced on coast-to-coast transmission, due to delay distortion. However, it is only certain classes of telephone line which give this difficulty; it is possible to transmit a picture from New York to San Francisco over a regular telephone circuit, and print this picture in the paper in San Francisco so well that it is indistinguishable from use of the original.

In the early days of our operation, a long-distance call was placed in the usual manner each time that it was desired to transmit a picture. As the use of transmitted pictures by the newspapers increased, it became necessary to provide for more regular and frequent transmissions. We then contracted with the telephone company for the use of regular message circuits for certain fixed periods of time, as a half-hour or an hour or so at various times throughout the day, as best suited the dead lines of the papers being served. A number of such individual circuits might be set up at once and a signal originating at a central point fed out simultaneously over these circuits. Or repeating amplifiers in our stations might be used to transmit through a series of such circuits. This was quite satisfactory in those days when the number of transmissions per day was rather small.

Fig. 8 - Planning a Portable Assignment.

As our picture activities grew, we found that this was not sufficient service, and we now have a leased-wire network in operation twenty-four hours a day, linking the major points. Other points not requiring 24-hour service are connected to this network at various times throughout the day, as before. During a recent typical month, an average of 16 pictures per day were handled.

The transmission over these circuits is sufficiently constant that automatic volume control is not required. A level change of 0.1 decibel is not perceptible, but a change of 0.4 decibel shows in the picture.

The acoustic coupling into the phone circuit,

Fig. 9 - Cameraman and Wire-Photo Operator en Route with Portable Apparatus.

shown in Figure 2, has long since been replaced by improved methods. At the present time a 3-winding coupling transformer is used, one winding having a neon lamp across it so as to limit to 1 milliwatt the picture power going onto the line. This prevents disturbance to phone circuits in the same cable.

POSSIBLE TREND OF FUTURE DEVELOPMENT

Pictures have been transmitted with our apparatus over frequency-modulation links with considerable success. In one instance, shown in Figure 12, a picture was received over such a 40-mile link, having been transmitted (1) by telephone wire from our office in Boston to the local Yankee Network Studio, then (2) by a frequency-modulation pickup link at ultra-high frequency to the main transmitter, and then (3) via the regular frequency-modulation transmission to the receiving apparatus at the Massachusetts Institute of Technology. The quality of transmissions which have been obtained through the use of frequency-modulation links is excellent. The audio pass-band is usually far in excess of the requirements for picture transmission, and there is little trouble from delay distortion.

Experiments are still being conducted along this line, and it is expected that in the future frequency modulation will take an important place in the news-picture transmission network.

Another possibility is direct engraving. It is evidently possible to engrave a plate for printing, using a cutting tool controlled by the incoming signal, thus eliminating the intervening steps of the usual method. Considerable time is saved thereby but is is more difficult for the editor of the local paper to fit the reproduction into his plans for his daily picture page, because he has little control over the size of the reproduction when this method is used. Figure 13 is a proof from a printing plate which was made by photo-electric engraving.

See following page for Figs. 10, 11, 12 and 13.

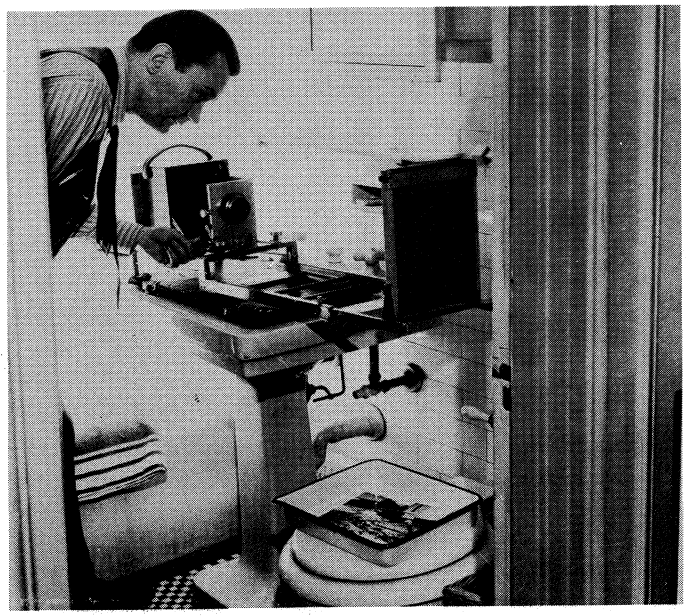


Fig. 10 - Making the Print for Transmission, Using the Portable Enlarging Camera Specially Developed for this work.

Fig. 11 - Transmitting the Picture onto the Wire Network.

Fig. 12 - Picture Transmitted by Two Frequency-Modulation Links.

Fig. 13 - Proof from Printing Plate made by Photo-Electric Engraving.

SUMMARY

Beginning with soundly conceived proposals as long ago as 1842, the art of transtting pictures electrically has advanced until it is now a regular part of newspaper blishing.

Equipment for both transmission and reception has been developed by International ws Service, using a vibrating-mirror galvanometer as the transmitting modulator and also the receiving light valve. The scanning is at 96 lines per inch and the cylinder rotes 90 times per minute, so that almost one inch of high-quality picture is transmitted r minute.

Synchronization of the transmitting and receiving mechanisms is accomplished without nding any synchronizing currents over the line; the synchronization is accomplished by ving at each end a standard-frequency generator, of which two types are in use. One has tuning fork and the other a crystal as the source of the standard frequency. The crysl standard is provided with frequency dividers so that it delivers a 60-cycle output, e same as the tuning fork. Each standard-frequency chassis is provided with a power plifier. In this way a power of 10 to 20 watts at a highly accurate frequency is obined for driving the motor which rotates the scanning drum at each station. Special ovisions are made for getting proper phasing before a transmission is started.

Permanent installations in newspaper offices of such equipment, with the ability to ceive or transmit, have the important business advantage that transmission is possible thout delay. In the case of news events at a distance from any permanent installation, rtable equipment is sent out with a crew of two men, who take the pictures and send them er ordinary long-distance telephone wires.

CLUB NEWS

(Continued from page 18)

ANNUAL BANQUET

The 33rd Annual Banquet of the Club took place November 20 at the Engineers Club, West 40th reet, New York. The guest speaker for this ocsion was Professor Alan Hazeltine of Stevens Initute, who is an Armstrong Medalist of the Club. e toastmaster was John V. L. Hogan, Honorary mber.

In his address Professor Hazeltine reported on e developments of radio which took place before e last war and during that war. He told how he tended a lecture by Edwin H. Armstrong during is period, which aroused his interest and led to e development of equations and formulas on the ansconductance of tubes and the characteristics coils. He mentioned how the DeForest audions re obtainable only with difficulty at that time, t with the help of Louis Pacent he got one and und that experiments checked the equations. During our participation in the war he went to Washington where he worked with the Navy and developed the Model SE-1420 receiver, a 6-band shielded design. During his speech Professor Hazeltine related various interesting accounts of his technical association with Paul Ware, Larry Horle, and others. Contrasting conditions at that time with those of the present day, he mentioned that before the last war radio was largely a matter of pioneer experimentation, and it was only in the course of time that an engineering basis was laid on which designs of equipment with predictable characteristics could be made.

Following Hazeltine's address, toastmaster Hogan called on various individuals who were present, starting with Harry Lubcke, who reported that television programs were continuing in the Los Angeles area. His own station of the Don Lee group was producing a good program every two weeks, with other transmissions between. One other station had begun

(Cont'd. on page 28)

and derivative form, but the essential concepts are likewise stated in words. The final chapter on hollow wave guides presents an excellent summary of the outstanding researches of Southworth and Barrow. Incidentally, Dr. Barrow was largely responsible for initiating and conducting the M.I.T. Conference last year and has written the editorial preface of this volume.

The volume is up to date in so far as any textbook can be, and flatters this magazine by making reference several times to the material on Ultra High Frequency Technique originally appearing in the April 1942 issue.

A word should be said about the general printing and binding. The book is printed in an offset process, so that the pages resemble a typewritten manuscript and the diagrams are not always uniform. The general impression is that the book was produced as quickly as possible, but this is no disadvantage when one considers the rapidity with which developments are being made in the communications field and the importance of u-h-f developments. A work of this scope which has been produced in less than a year is no mean accomplishment, and all things considered, the book appears to be quite (although not completely) free from errors of commission. Certain errors of omission are more readily apparent, for there is little material on transit time effects or on the input admittance of the usual types of negative grid control tubes operated at high frequencies. The sections dealing with radio receivers are rather skimpy and the u-h-f receiver developments which have already appeared in the literature are largely conspicuous by their absence. There is no treatment of u-h-f measurements as such although the final chapter, entitled "Laboratory Manual" is partial compensation for this omission.

But the overall impression is the principal item of interest to the reader, and it can be truthfully said that "Ultra High Frequency Technique" is a definitely worthwhile contribution to the engineering literature on electrical communication. It is probably the first volume of serious nature which aims to present recent u-h-f developments as part of the stock of knowledge which the communications engineer should have at his finger tips. It undoubtedly is a landmark in communication literature and might well be on the book shelf (if not on the desk) of every communication engineer.--B.D.

TELEVISION STANDARDS & PRACTICE

EDITED BY DONALD G. FINK. *McGraw-Hill Book Co., Inc., New York & London. 1943. $5.00.*

TODAY'S OUTSTANDING television book is "Television Standards and Practice." Donald Fink, himself a member of the National Television System Committee and Editor of its Proceedings, has assembled the important documents and reported the important meetings in a unified story.

Although the book is essentially a technical work, the first chapter and parts of subsequent sections are a must for executives, financiers, and lawmakers who soon will require an insight into present-day television and from whence it came.

Your reviewer has worked exclusively in television for fourteen years. He has witnessed misunderstanding and obstruction in the industry because one portion might not have known what another portion had already accomplished. Here is not a schoolbook on television technology, but a reference work on an entire industry. Let no man now tamper with that industry until he has "caught up" with what has gone before!

Sponsored jointly by the Federal Communications Commission and the Radio Manufacturers Association, the National Television System Committee brought together the executive-engineering leaders of television. The investigations and deliberations of this body were exhaustive; the spirit of cooperative search for truth a tribute to American Democracy. The job has been completed and now the creed has been published. A unique opportunity is afforded outsiders to inform themselves, and for the industry to spring to a flying start once peace had been declared.

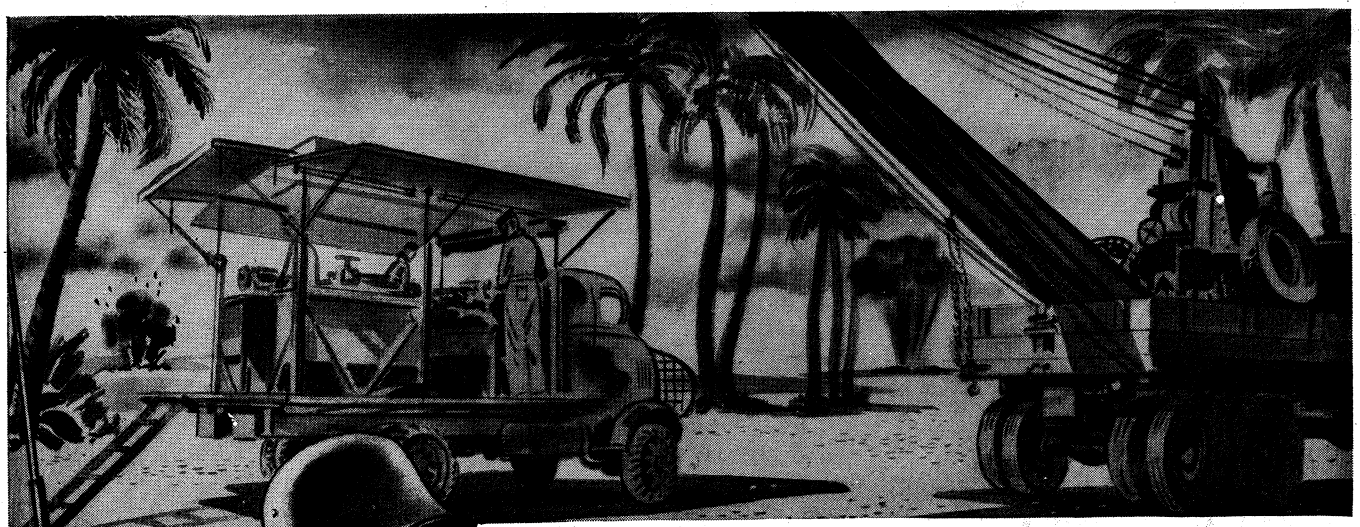
Needless to say, the engineering aspects of the art, from camera to reproducing screen, are covered in the ten chapters of the book. In addition, evidence and even the arguments as to why certain standards were chosen are told. References, bibliographies and appendices lead the reader to further information in any portion of the field. The book is unusual in that most of the text has not been previously published.

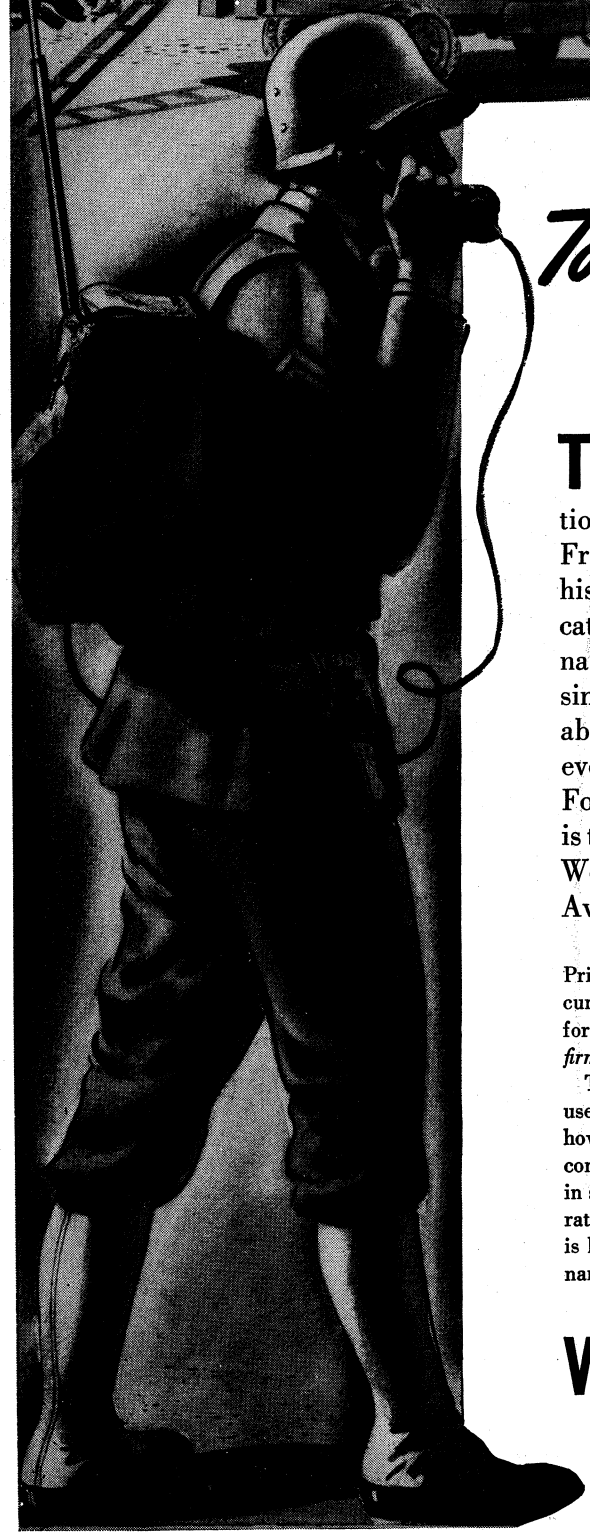
Your reviewer is proud to have been a member of the Committee and welcomes this opportunity to assist in "acquainting" American Industry with its soon-to-arrive infant; Television. -- HARRY R. LUBCKE.

A.S.T.M. STANDARDS AND DATA ON ELECTRICAL-HEATING AND RESISTANCE ALLOYS

By A.S.T.M. COMMITTEE B-4, *American Society for Testing Materials, 260 S. Broad St., Philadelphia, 1942. 160 pages, with heavy paper cover. Price $1.50.*

TWENTY-THREE SPECIFICATIONS AND TESTS of interest to radio and electronic engineers are here combined with four pertinent technical papers in a single convenient volume. A large portion of the book covers materials used in the manufacture of radio tubes and lamps, such as nickel and nickel-alloy wire and ribbon, mica stampings, grid wires, electrode support wires, strip and sheet metals for tube electrodes, and sleeves and tubing for cathodes. Methods of test and specifications are given for alloy resistance wires, alloy wires used for electric heaters, electric-furnace alloys, heat-resisting alloys, and thermostat metals. The papers cover a contact-testing machine, surge tests on contact materials, design of devices using thermostat metal, and methods of testing thermocouples and thermocouple materials. -- J. M.





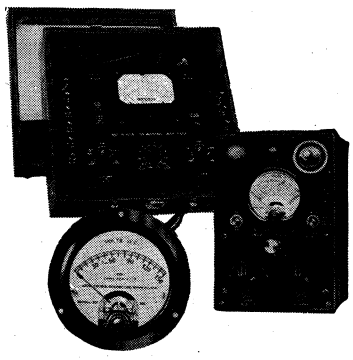
Tom is meeting familiar faces

EVEN 'OVER THERE'

TOM'S background in radio now stands him in good stead in the Signal Corps. Starting as a "ham", then a communications engineer . . . he knows how to spot and correct trouble. From the day he "joined up" he's been thoroughly at home in his new job. Even the test instruments he works with are duplicates of those in the shop back home. They bear the same name he's always banked on for measurement dependability since he built his first "ham" transmitter. And now that he's abroad, he's surrounded by these same familiar instruments even on the equipment and in the repair depots of our allies. For throughout the allied countries, too, the mark WESTON is the accepted symbol for dependable electrical measurement. Weston Electrical Instrument Corporation, 604 Frelinghuysen Avenue, Newark, New Jersey.

Priority restrictions have necessarily greatly curtailed the supply of WESTON instruments for many industrial needs. *Uncle Sam stands firmly at the head of the instrument line!*

To the great majority of instrument users not now engaged in war production, however, this has meant little, if any, inconvenience. The WESTONS they now have in service will see them through for the duration and beyond. *Long-life dependability* is built into every instrument bearing this name.



WESTON INSTRUMENTS

Laboratory Standards • Precision D-C and A-C Portables • D-C, A-C, and Thermo Switchboard and Panel Instruments • Instrument Transformers • Sensitive Relays • Specialized Test Equipment • Light Measurement and Control Devices • Exposure Meters • Aircraft Instruments • Electric Tachometers • Dial Thermometers