PRICE—TWENTY-FIVE CENTS

FM AND TELEVISION

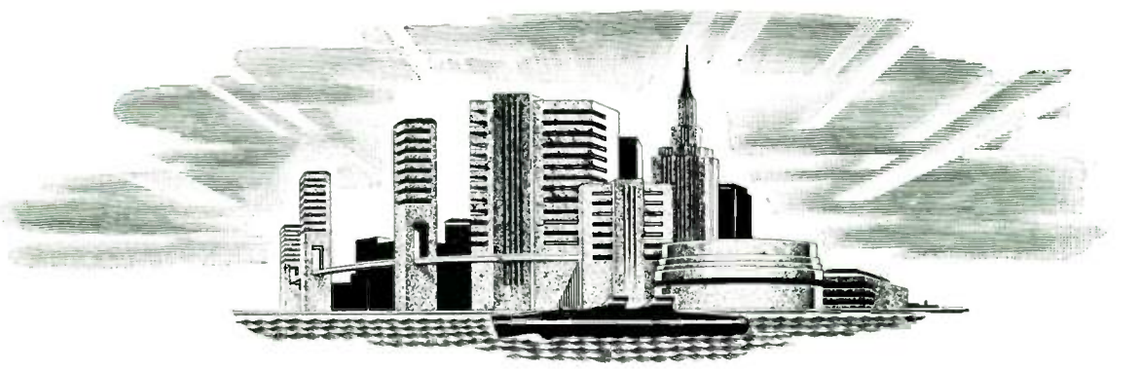
APRIL 1944

COMMERCIAL TELEVISION TECHNIQUES

FM & Television Products Directory

★ ★ Edited by Milton B. Sleeper ★ ★

TELEVISION 1954 A. D.



Back in 1944, you few men of vision in broadcasting management clearly foresaw that the addition of sight to sound would open up vast new business possibilities.

You took a tip from experimental commercials during the war years which showed the spectacular effectiveness of mass persuasion by television. Shortly after victory, television time *did* leap into great demand . . . just as you thought.

DuMont anticipated, just as you did, that there would be a peacetime scramble to be "first with television." So they completed their designs for telecast equipment that set new highs in signal transmitting efficiency and new lows in maintenance and operating costs.

Then the DuMont Equipment Reservation Plan was formulated so that you prospective television station owners could *have* that equipment in operation at the earliest possible postwar moment. This plan placed DuMont's extensive experience in television station building and management at your command. In addition, this plan gave you "postwar priority" in the equipment you needed.

That, you thought, was one sample of television talk that sounded down to earth . . . it would cut down your trial-and-error losses, and put your telecasting business on a sound and practical footing at the earliest possible moment.

So you dropped a line to DuMont and got on the Television bandwagon—on time . . . back in 1944.

We know it's 1944! So you're invited to learn about the DuMont Plan now. Send for our new booklet "Planning Your Television Station." Do it today!

DUMONT *Precision Electronics and Television*

ALLEN B. DuMONT LABORATORIES, INC., GENERAL OFFICES AND PLANT, 2 MAIN AVENUE, PASSAIC, N. J.
TELEVISION STUDIOS AND STATION W2XWV, 515 MADISON AVENUE, NEW YORK 22, NEW YORK

NC-100XA

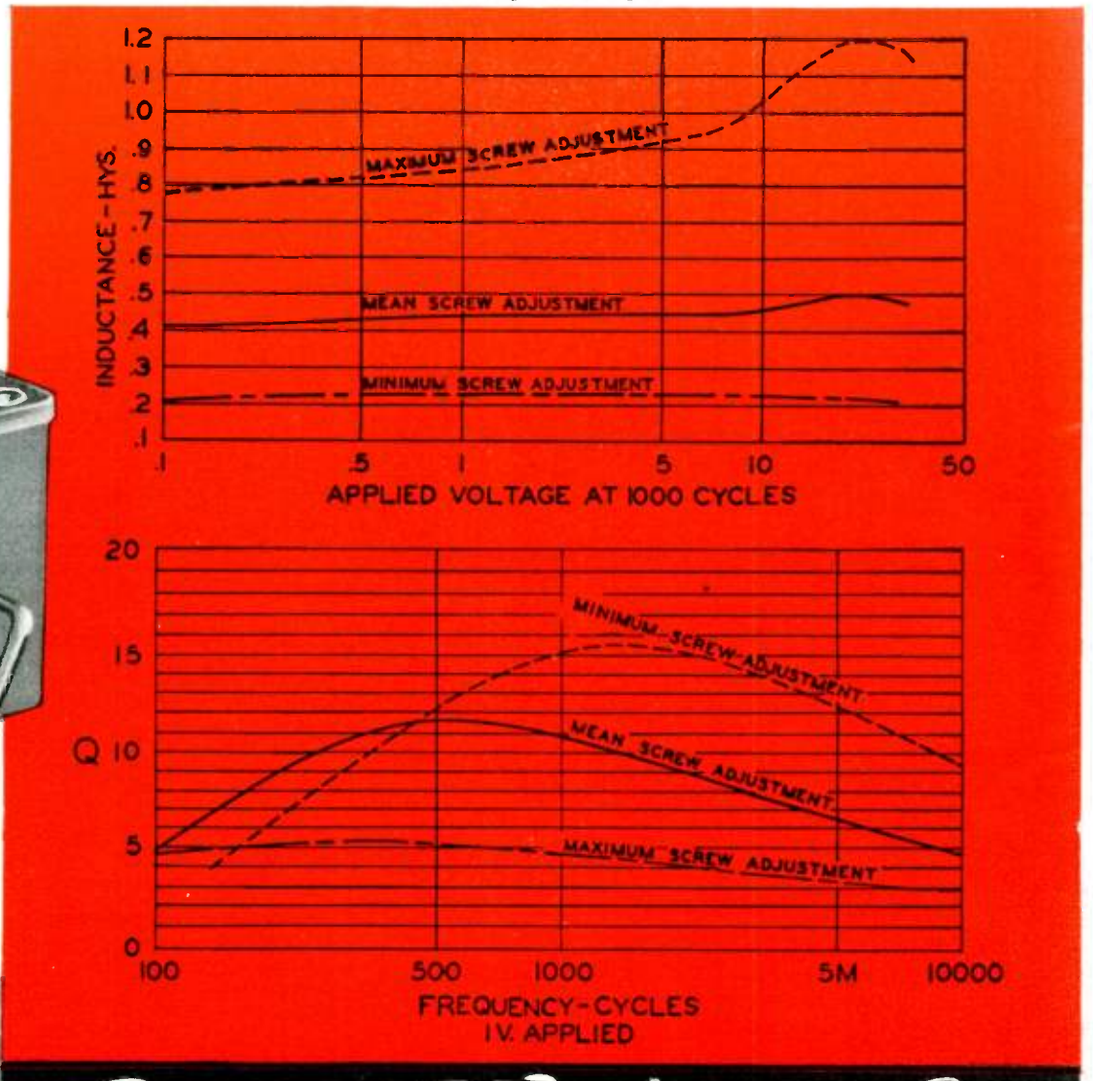
» The NC-100XA has gone to war. Under the pressure of the emergency following Pearl Harbor, many stock receivers of the NC-100 series went into action, and served brilliantly. Since then growing experience has led to a long series of minor changes and improvements, culminating in the superb receiver shown in the photograph above. We cannot show what is inside the cabinet until after the war, but a glance at the front panel will make any amateur recognize an old friend. It is stripped for action and in battle dress, but it is still the old reliable NC100XA. And like its amateur prototype, this new Navy model is winning an impressive reputation for brilliant performance and absolute reliability.

NATIONAL COMPANY, INC., MALDEN, MASS.

Can YOU use this

VARIABLE INDUCTOR

Culminating a number of years of research, the UTC Variable inductor is an ideal tunable device for peaked amplifiers, filters, etc. This sealed unit measures $1\frac{1}{4}$" x $1\frac{7}{16}$" x $1\frac{7}{16}$". Available in inductance value from 10 Mhy. to 10 Hys.



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EXPORT DIVISION 13 EAST 40th STREET, NEW YORK 16, N. Y., CABLES: "ARLAB"

FM AND TELEVISION

FORMERLY: FM RADIO-ELECTRONICS — COMBINED WITH
FM RADIO-ELECTRONIC ENGINEERING & DESIGN,
AND APPLIED ELECTRONIC ENGINEERING

VOL. 4 | APRIL, 1944 | NO. 4

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GORDON CROTHERS, *Circulation Manager*

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The publishers will be pleased to receive articles, particularly those well illustrated with photos and drawings, concerning radio-electronic developments. Contributions will be neither acknowledged nor returned unless accompanied by adequate postage, packing, and directions, nor will FM Magazine be responsible for their safe handling in its office or in transit. Payments for contributions are made upon acceptance of final manuscripts.

THIS MONTH'S COVER

Because television is an entirely new medium of expression, equally new combinations of art and science must be evolved for its effective use. This requires as serious a program of research as any purely scientific project. Recognizing this, the television broadcasters are working in close cooperation with advertising agencies and producers to learn by actual experience the possibilities and the limitations of television for entertainment and advertising. A typical experiment in television technique is illustrated on this month's cover, showing the first attempt to use a big-name band. This was Fred Waring's Chesterfield program, transmitted from the DuMont station W2XWV, New York City.

WHAT'S NEW THIS MONTH

1. FM Transmitters
2. That Dead Mackerel
3. FM Portables

1. A fairly accurate estimate of the market for new FM transmitters, antennas, audio equipment, and associated apparatus can be made from definite figures now available.

Using estimates which were filed in 16 new applications for construction permits, we find that the average expenditure for studios and transmitters will be $52,700. Most of these stations will use 10-kw. transmitters with 4-bay antennas to cover an average of 13,400 square miles or, roughly, a radius of 65 miles.

Within this group, the lowest estimated cost is $16,000, and the highest, $150,000. Among the applications not included above is one from the Nashville Radio Corp. which calls for an investment of $200,000 in plant and equipment, and that from the FM Development Foundation which plans to spend $150,000. Also excluded are the five projected stations in which NBC will invest some $813,000.

Taking the average figure of $52,700, which is definitely on the conservative side, this indicates that the 127 stations in 33 states for which applications have been filed will cost upwards of $6,500,000.

Judging from the present rate at which FM applications are being filed, it is entirely reasonable to expect that the number will be doubled by the end of this year. This will give us a backlog somewhere in excess of $15,000,000 at the time permission is granted to resume broadcasting station production.

That isn't much when it is compared to the present rate of radio production for the War. However, it does indicate some substantial orders for a few companies, because they will be distributed among a relatively small number of manufacturers who are firmly established in the broadcasting station equipment field.

2. Nearly three years ago, a very angry FCC chairman, shouting at the assembled representatives of the American broadcasting system, told these gentlemen: "The NAB is like a dead mackerel in the moonlight: it both shines and stinks."

Since that day, the broadcasting industry has had no peace, no security, no

(CONTINUED ON PAGE 60)

TESTING TOMORROW'S RADIO TUBES

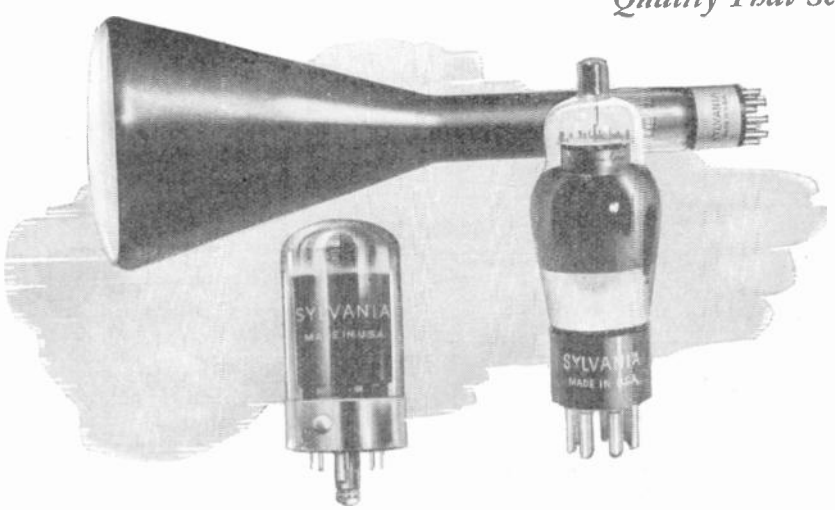
• Early in the war, Sylvania engineers stepped up experiment to perfect more rugged and more sensitive radio tubes for vital military communications.

Engineers added to a great array of precision checking instruments. They designed and built special new instruments to detect variations in radio tube characteristics never charted before.

This intensive research program has developed improved radio tubes. Many are now military secrets. But they promise to make postwar radio reception a revelation of clarity and fidelity.

After the war, as in the past, it will pay you to sell Sylvania.

Quality That Serves the War Shall Serve the Peace



RADIO DIVISION EMPORIUM, PENNSYLVANIA

SYLVANIA

ELECTRIC PRODUCTS INC.

RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVICES, INCANDESCENT LAMPS, FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES

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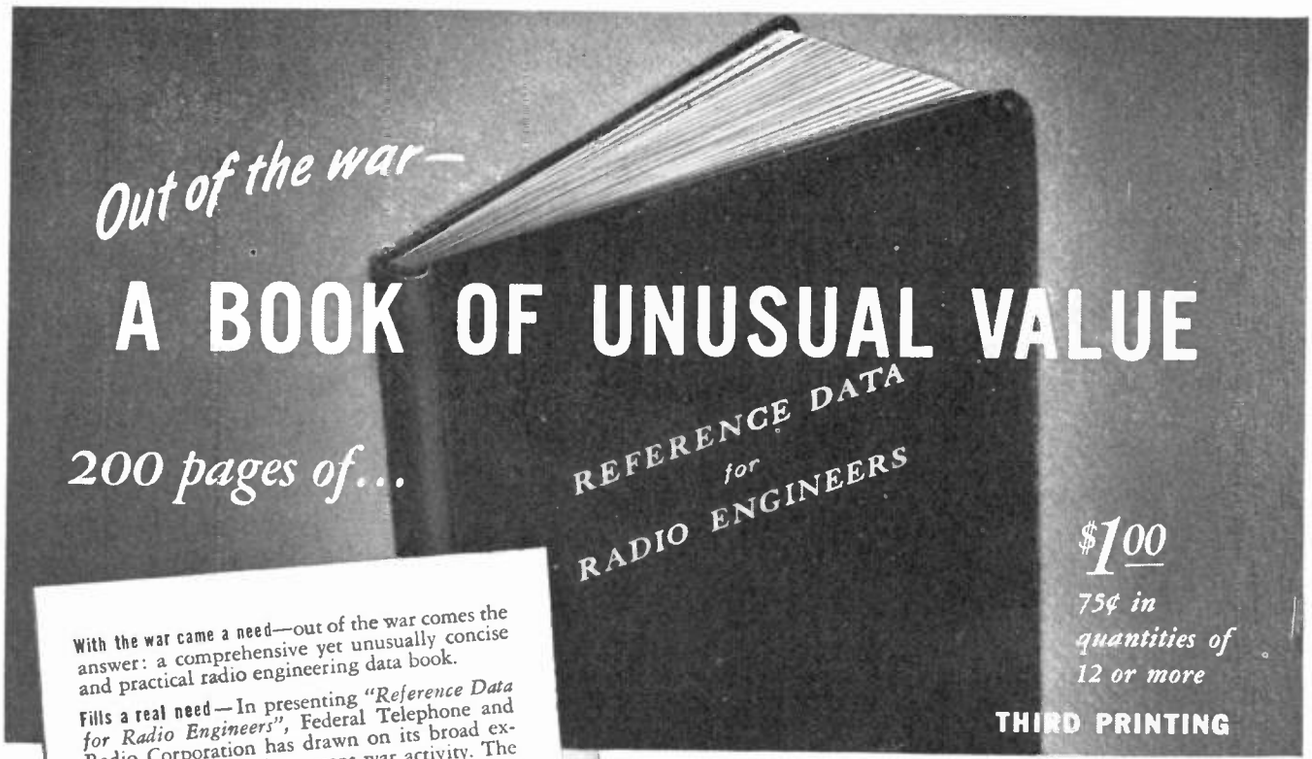

Out of the war—

A BOOK OF UNUSUAL VALUE

200 pages of...

REFERENCE DATA for RADIO ENGINEERS

$1.00

75¢ in quantities of 12 or more

THIRD PRINTING

With the war came a need—out of the war comes the answer: a comprehensive yet unusually concise and practical radio engineering data book.

Fills a real need—In presenting *"Reference Data for Radio Engineers"*, Federal Telephone and Radio Corporation has drawn on its broad experience as well as its current war activity. The needs of both the engineer and the technician have been considered. Hence much fundamental data are included to bridge the gap between the concise handbook and the standard radio engineering text book.

Timely and essential data—such as those on Fourier Analyses of Non-Sinusoidal Waves, Relaxation Oscillators, Antenna Arrays, Transmission Lines, Wave Guides and Resonators have been included. Also much pertinent information *outside* the field of radio.

For quick, easy reference—a glance at the partial table of contents shows the wide range of useful theoretical and practical data included — charts, graphs and tables, plus numerous illustrations — all arranged for ready use.

Edited for today and tomorrow — The impetus of War production has shown the need for an absolute minimum time lag between research, production and utilization of equipment. This one compact volume places at your fingertips information that should be on the desk of every radio man or woman engaged in research, development, production or operation.

Order your copy today— In serviceable green cloth binding, $1.00 a copy; 75¢ a copy in quantities of 12 or more. The order form at the right is for your convenience.

Material for this Reference was compiled under the direction of the Federal Telephone and Radio Laboratories in collaboration with other associate companies of the International Telephone and Telegraph Corporation. This group of companies possesses experience gained throughout the world over a period of many years in the materialization of important radio projects.

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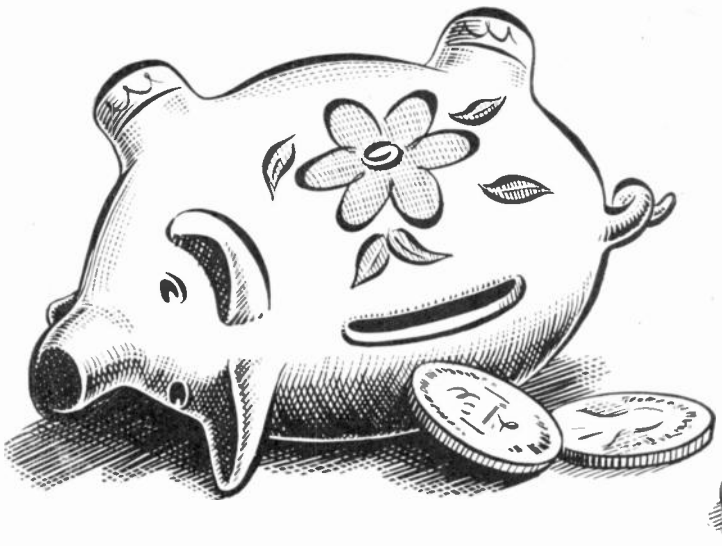
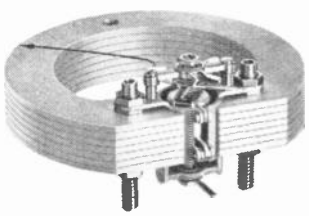


READY WHEN THAT RAINY DAY CAME

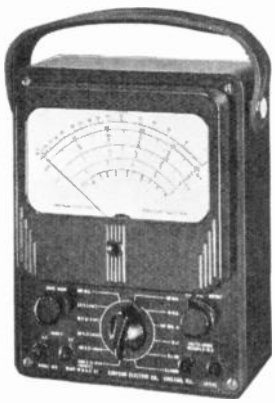
WHEN today's big emergency came along, one of America's greatest resources was the know-how and productive skill stored up by industry. Accumulated through the years, this practical experience made possible the building of the world's mightiest war machine.

Simpson Instruments offer an example. Into their making has gone all that 30 years of experience can contribute to the design and manufacture of electrical instruments and testing equipment. From this long specialization has come a noteworthy advance in instrument design — a basic movement of a type long recognized for its greater accuracy and stamina, and which now for the first time has been made a matter of rapid mass production.

Fortunately, this patented Simpson movement was ready and waiting when today's emergency brought a tremendous demand for electrical instruments. It enables Simpson to build them fast, and build them well.



The Simpson Movement is a full bridge type with soft iron pole pieces. It refines this basically better movement to its finest expression, and eliminates the slow, costly construction which before now limited its application. Today this production speed is all-important. Tomorrow, the economies of mass production will mean far greater dollar value, in instruments that stay accurate.



SIMPSON ELECTRIC COMPANY
5200-5218 W. Kinzie St., Chicago 44, Illinois

Simpson

INSTRUMENTS THAT STAY ACCURATE

Buy War Bonds and Stamps for Victory

Reserve your place NOW in the coming great new industry

...TELEVISION

USE THE G-E EQUIPMENT RESERVATION PLAN TO ESTABLISH YOUR POST-WAR PRIORITY

TELEVISION has become a fast-moving practical reality. In five major areas — Schenectady-Albany-Troy, New York City, Philadelphia, Chicago and Los Angeles — live talent and film programs are being telecast regularly by established television stations that have been in operation for a number of years.

Advertisers and agencies are now working with many types of programs, and testing commercial techniques and advertising methods that add "visual demonstration" to the present "audio salesmanship" of conventional broadcasting. These experiments are making television history! A successful television relay system already links Schenectady and New York; New York and Philadelphia — forecasting a practical *nation-wide* system of commercial television service.

At Schenectady, in the world's most powerful and best equipped television station, WRGB, General Electric has built the *complete* television system — from transmitter to receiver — antenna to television relay — right down to the air-conditioning and studio equipment . . . ready for your inspection, demonstration and study.

THE G-E TELEVISION EQUIPMENT RESERVATION PLAN

and the brochure, "Television Broadcasting Post-war"

We have mailed these two G-E publications to our list of prospective television broadcasters. The Equipment Reservation Plan will enable you to establish a post-war priority on television equipment. It will enable us to plan definitely for large-scale post-war production — thereby giving you the fastest possible post-war delivery.

If you are interested in entering television broadcasting and have not received these G-E publications, we shall be glad to send them to you. Address *Electronics Department, General Electric, Schenectady, New York.*

General Electric can supply the COMPLETE television broadcast system

COME TO SCHENECTADY... AND SEE THE WORLD'S MOST POWERFUL AND BEST-EQUIPPED TELEVISION STATION

WRGB, General Electric's workshop television station in Schenectady, exists solely as a proving-ground for equipment and programs. Here, G.E. has gained vast experience in the perfection of the *complete* television system. Here, G.E. has established the technical standards for each specific equipment by *actual performance.* Here, G.E. has gathered a huge backlog of programming knowledge from over 500 shows telecast over WRGB.

All of this research, equipment, and "know how," covering over twenty years of television experience, is at the service of prospective television broadcasters.

We do not pretend to be able to solve all the problems of programming. That is a job which the entertainment business and the news business can do — and we are confident they will do it.

We do not pretend to know all about how to make television an effective, economical advertising medium. That is a job which advertisers and advertising agencies can do — and we are confident they will do it.

We do not pretend to know all the answers involved in the business of operating television stations, tying them together as networks, and making them pay. That is a job for those whose business is broadcasting — and we are sure that they can and will do that job.

The success of television will require the closest kind of teamwork between show business, the news business, the advertising business, the business of manufacturing television broadcast equipment and receivers, and the business of retail sales and service of receivers.

General Electric believes that the strongest contribution we can make to this teamwork is television research and engineering, and the manufacture of high-quality television transmitters and receivers to sell at the lowest possible prices.

G.E. also contributes the facilities of station WRGB as a proving-ground to *all* of these separate industries. We are now working with some of the most progressive elements in these businesses. The continuing co-operation of each one in this common effort will advance greatly the coming of national television, and enable it to grow rapidly into the great new industry that will give employment to hundreds of thousands and provide a new world of entertainment to millions.

Electronics Department, General Electric, Schenectady, New York

---

• *Tune in General Electric's* "The World Today" *and hear the news from the men who see it happen, every evening except Sunday at 6:45 E.W.T. over CBS network. On Sunday evening listen to the G-E* "All Girl Orchestra" *at 10 E.W.T. over NBC.*

STATION AND STUDIO EQUIPMENT • TRANSMITTERS • ANTENNAS • ELECTRONIC TUBES • RECEIVERS

GENERAL ELECTRIC 158-C2 **FM · TELEVISION · AM**

See G.E. for all three!

WRH

NEW LETTER CONTEST for SERVICEMEN!

ELEVEN 1st PRIZE WINNERS IN 5 MONTHS IN CONTEST #1!

Yes sir, guys, the hundreds of letters received were so swell that *double* first prize winners had to be awarded each of the first four months and there were *triple* first prize winners the fifth and last month . . .

SO—HERE WE GO AGAIN!

Get in on this NEW letter contest—write and tell us your *first hand* experiences with *all* types of Radio Communications equipment built by Hallicrafters including the famous SCR-299!

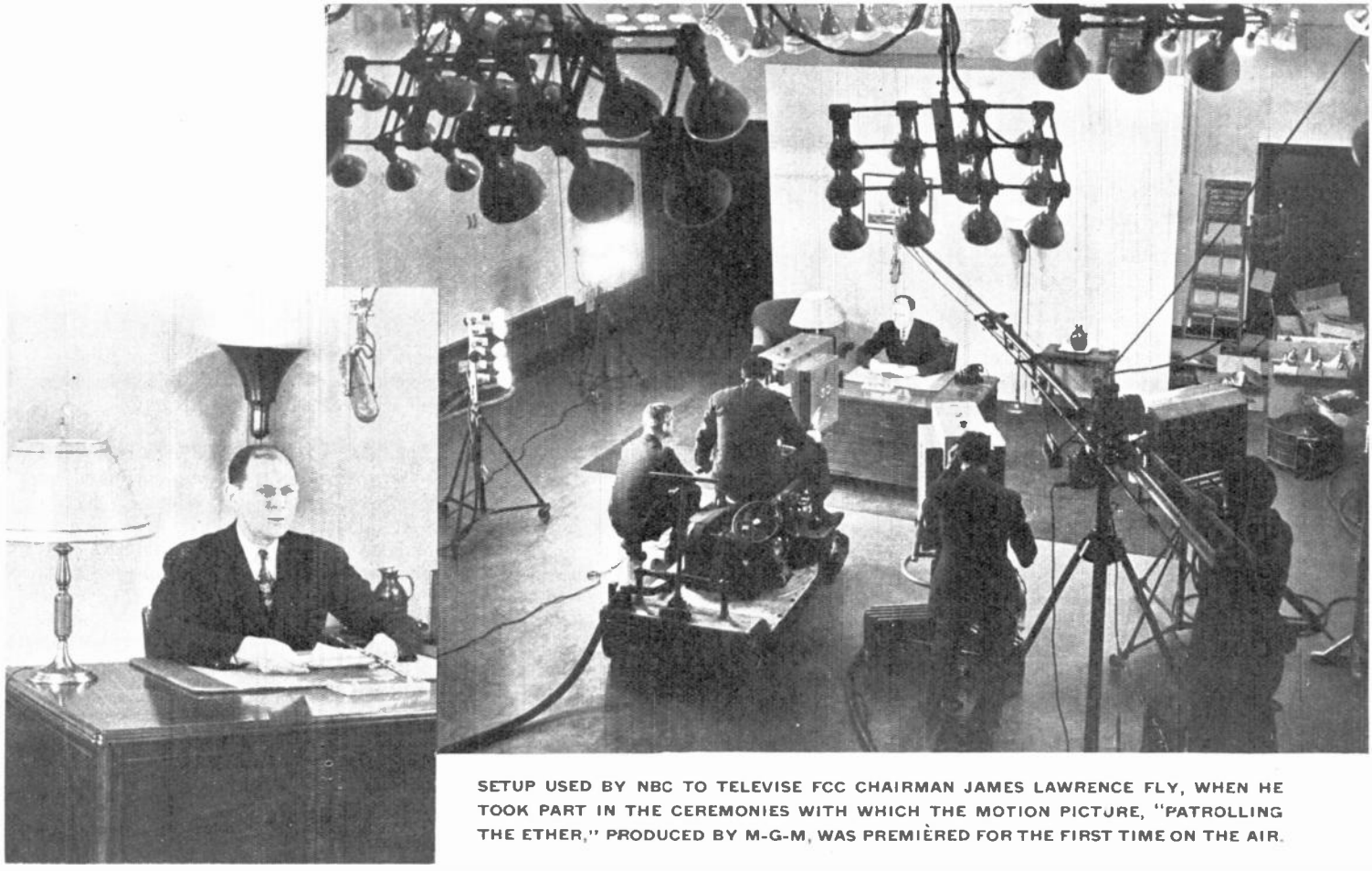
RULES FOR THE CONTEST

Hallicrafters will give $100.00 for the best letter received during each of the five months of April, May, June, July and August. (Deadline: Received by midnight, the last day of each month.) . . . For every serious letter received Hallicrafters will send $1.00 so even if you do not win a big prize your time will not be in vain. . . . Your letter will become the property of Hallicrafters and they will have the right to reproduce it in a Hallicrafters advertisement. Write as many letters as you wish. V-mail letters will do. . . . Military regulations prohibit the publication of winners' names and photos at present . . . monthly winners will be notified immediately upon judging.

BUY MORE BONDS!

hallicrafters RADIO

THE HALLICRAFTERS CO., MANUFACTURERS OF RADIO AND ELECTRONIC EQUIPMENT, CHICAGO 16, U. S. A.



SETUP USED BY NBC TO TELEVISE FCC CHAIRMAN JAMES LAWRENCE FLY, WHEN HE TOOK PART IN THE CEREMONIES WITH WHICH THE MOTION PICTURE, "PATROLLING THE ETHER," PRODUCED BY M-G-M, WAS PREMIÈRED FOR THE FIRST TIME ON THE AIR.

MOTION PICTURE PREMIÈRED BY TELEVISION

A Major Television Event as It Was Viewed by a Very Realistic Newspaper Reporter

BY JACK GOULD *

TWENTY years ago many a radio fan was vitally interested in pulling in stations some thousand miles or more away. Today, if a listener on the eastern seaboard chances to pick up San Antonio or Louisville, he doesn't give it a second thought, and is concerned only if the program is good or not. Except for offering perhaps a silent prayer that his set will not break out in a rash of squeals, he cares not a whit about the gadget's innards.

Curiously enough, television seems bent on thinking in the radio terms of 1924. A new tube that can reach up to something called megacycles provokes loud hurrahs from Radio Row. Every increase in the size of the image or every extra line of detail is duly noted to the tune of multicolored pamphlets and a variety of publicity releases. Undeniably, these developments should and do excite members of the engineering profession, but the matter ends there.

Just as he knows he can get DX on his receiver, so, too, has the listener been informed a few million times that a picture can be sent through the air. Open-mouthed amazement over the basic invention has long since given way to the assumption, nurtured almost wholly by the trade, that Hollywood and Broadway are going to tremble in their boots once television gets going in post-war style. Whatever the engineer's unsung lot, he might as well resign himself to the fact that the public has a blissful disregard for his labors and is going to judge television by one standard: *the show as it finally reaches his living room.*

Admittedly, this does not make allowance for several factors which perhaps should be told in full to the public. It is no great secret that the assignment of frequencies will have a tremendous bearing on when and how the public as a whole will see and hear television. If there is to be a battle royal over allocations — and there has been an indication or two in that direction — it might be better to explain it as such, rather than jockey for position through claims that will either confuse the layman or lead him to expect too much too soon.

A recent case in point was the first première of a motion picture over television, shown in New York, relayed to Schenectady and Philadelphia and, through duplicate prints, in Los Angeles and Chicago. The National Broadcasting Company and Metro-Goldwyn-Mayer jointed forces for quite a ceremony in New York. Mr. Fly, chairman of the Federal Communications Commission, came to New York to be televised, and sundry other souls were invited to have a look and partake of refreshments at the Ritz-Carlton.

(CONTINUED ON PAGE 59)

* Radio Department, *The New York Times*, Times Building, New York City.

FM RECEIVING SET STANDARDS

Classification of FM Receiver Performance Will Put Emphasis on Quality of Reproduction

BY M. B. SLEEPER

THE degree to which reception is improved by FM broadcasting depends upon the performance of the individual radio set.

That is something of direct concern to broadcast stations and to sponsors, because greater entertainment value in program reception *means more listeners, more listening time, and more attentive listeners.*

New Measure of Value ★ Only since the advent of FM, making possible a decided improvement in home reception, have sponsors and broadcasters, given serious consideration to the difference between programs as they are heard in the studio and in the homes of radio listeners. Yet this is a decisive factor of audience reaction. We can appraise the importance of raising the entertainment value of home reception in this manner:

1. Since radio must compete with other things that people like to do, or need to do, the quality of program reproduction in the home is one of the determining factors in radio's bid for listener's time. A program may be worth its $10,000 production cost if heard at the studio, but in the home, all that expense is wasted if the reproduction has no entertainment value. Only news programs are wanted to the extent that listeners merely require the reporter's words to be intelligible. That is why it has come about that so many AM receivers, notably those which afford inferior reproduction, are only turned on for news programs, and are then turned off promptly.

2. Even if a radio set is turned on, it must compete with various distractions for the listener's attention. A sponsor who has seen and heard his program at the studio may feel impelled to congratulate the cast and the producer for an excellent performance. He may say, with honest enthusiasm, "That certainly wowed 'em!" But the studio isn't the place to judge a program from the listeners' point of view. *The entertainment value of a program, and the effectiveness with which the sponsor's message is put across, depends upon the manner in which the sounds are reproduced by the sets tuned to the station.*

3. When these two sets of competitive conditions are put together, it is easy to see that a decided improvement in the reproduction of radio programs as heard in the home will increase the initial interest that causes people to turn on their radio sets and tune to a particular station or program, and the subsequent interest that holds their attention.

Programs vs. Reproduction ★ Broadcasters, sponsors, and research organizations have conducted continuous listener surveys to check on the *number* of sets tuned to specific programs. But no one has investigated the qualifying answers to the question: "How does the program sound in your home?"

Perhaps it is better not to know what the answers would be. Before the War, radio set manufacturers told the public that the latest and greatest scientific advances of the radio art, including something called "studio tone" or "concert quality," could be bought for $19.95. Thus it is easy to see that radio reproduction in the home has been only remotely related to program originations in the studio.

Under those circumstances, if the reproduction from such radio sets reduces concert artists to the talent level of the Hoozier Hot Shots, or if big-name bands sound as they would be heard over a poor telephone connection, but louder, what could be done by broadcasters and sponsors?

If the number of sets tuned to a given AM program were classified by the quality with which the studio program was reproduced, the results would be so discouraging that sponsors would get the idea that they might as well turn to third-rate night clubs for radio talent. And if our artists could hear themselves as they are heard by most of the radio audience, they would quit the broadcasting studios.

The other limiting factor of reproduction was AM transmission. The only means available to the AM station for overcoming background noise heard from loudspeakers, as well as static noise and interference caused by other stations, was to increase power. That has not been an effective answer.

These circumstances have resulted in a situation which prompted Archibald M. Crossley to say: "Radio (audience) research today is something like a television image beginning to take form. So far only noses have appeared clearly, and we have been very busy counting them — so busy that we have ignored the fact that these noses belong to people — people who have ears and brains — people who think — people who have likes and dislikes — people who not only listen but buy."

Why People Don't Listen ★ There is no end to a program of research that could be conducted into the question: "Why do people listen to programs?" To this end, audiences are being psychoanalyzed, people are being queried at short intervals during a single program, and their emotions are being recorded with the Program Analyzer.

But there's another side to this question that will yield even more useful information quickly, and the answers are direct and simple to obtain. It is: "Why do people *not* listen to programs?" Or, to state it less succinctly: "Why do sponsor's messages not inspire more action?"

Sponsors, broadcaster, agency executives, and producers don't know these answers because they do their listening at broadcasting studios and audition rooms. They don't have time to get out and hear their programs as the radio audience hears them, or they would understand that *the quality of reproduction in the home is as important as the program and the presentation of the sponsor's message!*

The radio audience can make a very significant list of reasons why they don't listen at all, or why they don't listen more attentively to AM programs they would enjoy greatly if they heard them in a studio audition room. Such reasons, therefore, are not related to program content, but only to the reproduction of the programs as they are heard in the home on AM sets. The reasons will be found to lie in one of two groups:

1. I don't like to listen to radio, or I get tired of listening, or the radio annoys me. These reasons mean: "I don't like the way it sounds."

2. I just turn it on because it's so quiet in the house when I'm alone, or I play it softly to put me to sleep, or I turn it on for background music when we have company. These reasons mean: "It is not sufficiently articulate (because of inferior audio quality) to catch and hold my attention."

Thus it is clear that all efforts to attain a maximum audience, and the maximum attention of that audience are ultimately screened through the quality of the pro-

gram reproduction in each individual home.

FM Changes the Picture ★ Sponsors, directors, research agencies, and broadcasters have given little consideration to the quality of reproduction as the final, determining factor that can make their combined contributions succeed or fail in the individual homes which make up the 30,000,000 American radio families. — Nor could they accomplish much within the limitations of AM broadcasting and reception.

Now, however, the development of FM changes that situation completely. FM broadcasting and reception makes possible essentially perfect reproduction in the home of programs created in the studio. It can make every living room an audition room. It can make every listener say: "Your program sounds practically the same in my home as when I heard it at the broadcasting studio." That is not possible with AM. It is both possible and practical with FM.

Of course, FM will not bring about the ideal condition of providing actual studio reproduction in every home equipped with radio, because FM sets capable of such reproduction are not cheap, and some homes cannot afford them.

The ideal condition, within practical limitations, is one in which every home has the best FM set the family can afford.

Most radio manufacturers have been consistently indifferent toward the idea of selling quality of reproduction. That will probably be the case when set production is resumed after the War. We shall probably have sets in the lowest price brackets offered with claims of affording the benefits of "revolutionary FM reception." While they will bring in FM programs after a fashion, the reproduction will be no better than the prewar AM cracker boxes.

Standard Performance Ratings ★ If that happens, sponsors will lose all the benefits from this opportunity to gain more listeners and to increase the attention value or psychological impact from distinctly improved reproduction of their programs.

What can sponsors or agency executives do about it? Unfortunately, there's very little they can do about it. But the FM broadcasting stations can do a great deal, and they can do it through FM Broadcasters, Inc.

They can set up grades of FM receiver performance by which the public can judge the various makes and models, and make a well-informed choice that will not be based on exaggerated advertising claims, by pressure from salesmen who are paid extra commissions to push special and usually inferior models, or by such outward manifestations such as the size of the cabinet.

THERE is no thought of paternalism behind the suggestion that standards be set for the performance of FM receivers. Such standards will be a great service 1) to listeners whose ears are no adequate gauge of performance, 2) to sponsors whose programs will have greater entertainment value and effectiveness if they are heard with the realism which good FM receivers can provide and, finally 3) to radio set manufacturers who can increase both employment and profits if they have a lever with which to raise the miserably small prewar average unit of sale.

It is possible that the FCC may bring pressure to bear in this direction if the industry does not take the matter in hand. This was suggested by Chairman Fly's remark at the FMBI Conference when he said: "FM stands today on the threshold of as tremendous a development as did AM in the 1920's — perhaps a much greater development and a faster rate of growth. . . . Let us not manufacture the very transmitting and particularly receiving equipment which will destroy the great advantages of FM. Let's plan the optimum in terms of public service made possible by this great invention."

Purchasers definitely informed as to the grade of performance of each set can then balance cost and appearance against the quality of program reproduction, and arrive at an intelligent decision.

Most prewar AM sets were bought on appearance and point-of-sale features, and not on value represented by performance. That is one reason why so many people today own radio sets with a miserable little table-model chassis and speaker mounted in an enormous piece of furniture.

Such sets looked all right, and sounded about as good as those their friends owned, and so they bought them. With FM, it's different, as the public will learn when sets can be bought once more.

A Grade A receiver, for example, would assure practically perfect program reproduction and freedom from static within the 50-microvolt area of any FM station. A Grade B receiver would provide the same sensitivity and limiter action, but sacrifice some of the quality of reproduction, while a Grade C model would deliver static-free reception only within a 1,000-microvolt contour, and drop to the third level of reproduction. Other sets, including those without limiters, would fall into the Grade D category.

When sets are definitely labelled as to their performance, this information, plus a coverage map of local FM stations, will tell Mr. Jones that he must have a Grade A or B receiver to get static-free reception where he lives from the stations he wants to hear, or that he can't get true FM results from a Grade D receiver wherever he lives. Or when Mrs. Smith complains that her radio doesn't sound as good as Mrs. Brown's, the dealer can tell her the exact difference in the grade of performance to be expected from the two sets.

And as long as people are human beings, they are going to want sets with Grade A labels if there is any way to afford them, and if they can't, they will prefer Grade B to Grade C!

Exactly what specifications should be set up for performance grading we shall not presume to say. The proper source of that decision is the FM broadcasting engineers and the manufacturers of transmitters. They are responsible for meeting definite FCC specifications of signal quality and coverage. Since they know the characteristics of the transmission, they are in the best position to establish the standards of reception.

The adoption of such standard labelling by two or three manufacturers will bring about its universal use.

The benefit to radio advertising and radio advertisers would be enormous, and the information that research organizations could get from the question, "What make and model set do you own?" related to the grade of performance of the set, would add a new and vital dimension to audience surveys.

FM AT ANRA CONVENTION

NO. 1 item of interest to the editors and publishers of U. S. newspapers, when the American Newspaper Publishers Association meets at the Waldorf in New York, will be Frequency Modulation.

It has been stated repeatedly from many sources that any town or city that can support a daily newspaper can afford and support an FM broadcasting station. Newspapers are one of the logical organizations to operate such stations, and the publishers are asking for details.

Speakers who will give them all the information they want are Major E. H. Armstrong, who is in sympathy with their interest in this idea, Dr. W. R. G. Baker of General Electric, and Walter J. Damm who is vice president of *The Milwaukee Journal* which owns and operates WMFM, and president of FM Broadcasters, Inc.

The abandonment of the FCC's investigation into newspaper-operated stations and their acceptance of pre-peace applications for FM construction permits has aroused great interest on the part of newspaper publishers in FM broadcasting, since stations intended for local coverage are direct competition for advertising.

G. E. has invited the publishers to attend a television demonstration at Schenectady after the convention.

TODAY'S PLANS FOR TELEVISION'S FUTURE

General Electric's Executives Outline Their Thinking about Postwar Television Developments

ON April 6th, at a luncheon given to representatives of the press in New York City, General Electric made the first disclosure of the Company's official thinking about the development of television in the period immediately following the War. Because G.E. has been reluctant, up to this time, to take a position on this subject, meanwhile making substantial contributions to the art, there was unusual interest in this affair — so much so that larger accommodations were required than were originally reserved at the Waldorf.

The principal speaker, after Dr. W. R. G. Baker's introductory remarks, was J. D. McLean, commercial engineer of the transmitter division and very able spark-plug of G.E.'s television activities.

Without attempting to prove anything except, perhaps, the spell that words can cast upon adults as well as adolescents, McLean introduced his talk by telling of a survey made by the Psychological Corporation among 1,000 men and women and 500 boys and girls of high school age in various parts of the country. They were asked what new inventions would raise their standard of living after the War.

Of the adults who expressed an opinion, 58.5 per cent said "Television," while "Radar" was a poor second with only a 24.1 per cent showing. Opinions of high school students followed those of their elders.

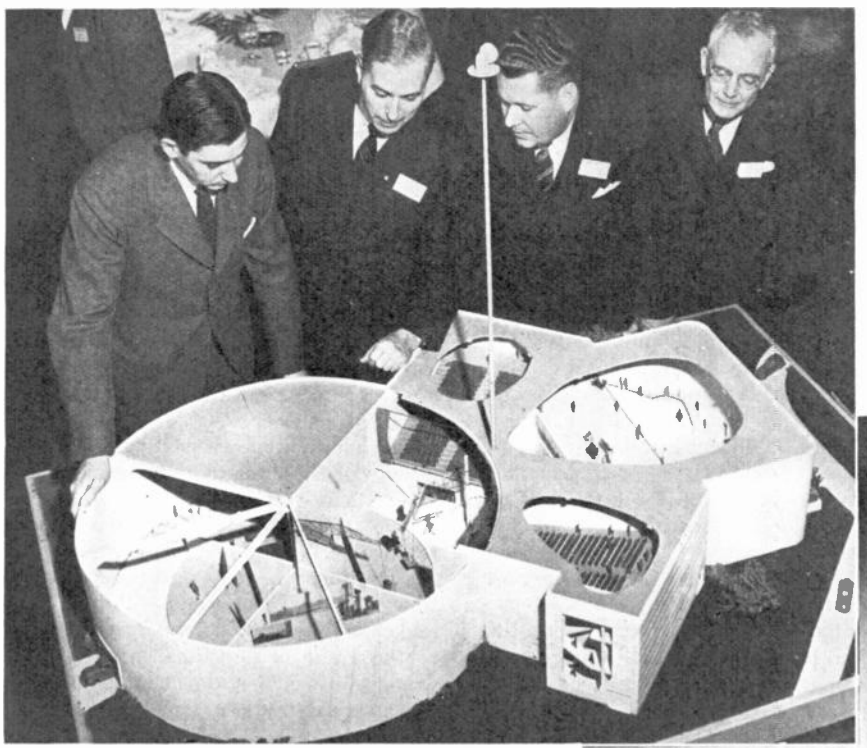
Such is the responsibility taken on by those who have promised to furnish television to the American public. And such is the faith of our public in the printed word! Probably few, if any, of those queried had ever seen television reception, and if they had, they undoubtedly went away with the firm conviction that it will be perfected soon.

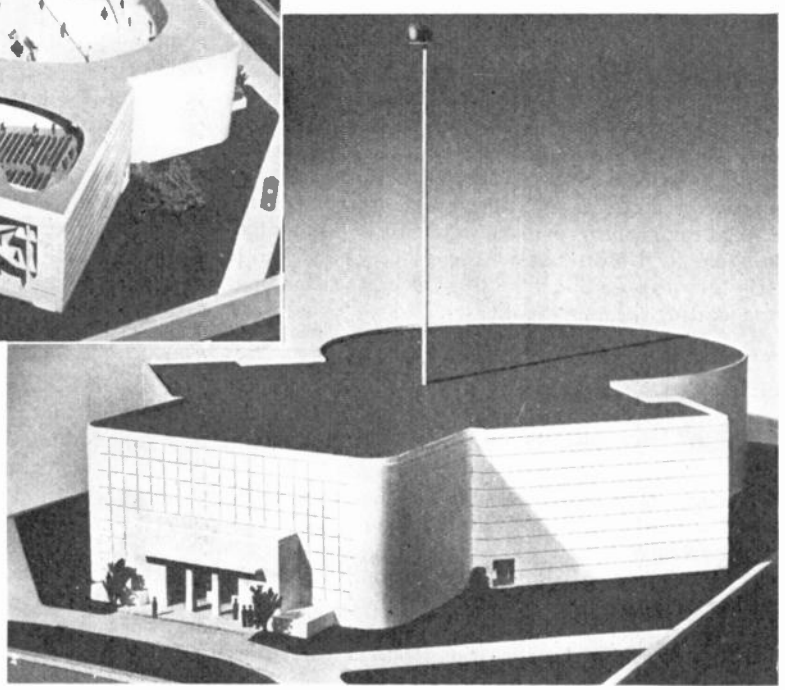
And no doubt it will be. During this period of war, such plans and preparations as are made must be predicated on that assumption. At the present time, if any company should succeed in carrying its development program forward to the point where any startling improvement in television reception could be demonstrated, the Signal Corps and the Bureau of Ships would promptly institute an investigation to determine why engineering talent had been put on such work when there is still a serious shortage of engineers for military projects.

Meanwhile, there is no restriction against thinking, and the words of G.E.'s executives made it clear that very serious thought is being given to plans that will give television a sound start, and eliminate as many initial errors as possible.

One of the major economic problems faced by television broadcasters is the matter of making expensive programs available to the largest number of people possible, thus increasing the circulation with a corresponding reduction in the cost per listener.

The first step, according to G.E. plan-





ABOVE, AFTER G.E.'S HOTEL WALDORF TELEVISION LUNCHEON, J. D. McLEAN, TELEVISION ENGINEER, J. K. GANNETT, V.P. OF AUSTIN COMPANY, AND H. L. SHEEN OF CANADIAN G.E. LOOK INSIDE THE MODEL OF TOMORROW'S TELEVISION STUDIO.—RIGHT, EXTERIOR OF MODEL SHOWN ABOVE

ning, is the construction of master television stations in the large centers of population. These stations would have extensive studio facilities and staffs capable of originating complex programs such as musical comedies and Broadway plays.

A model of such an installation, designed by the Austin Company in cooperation with General Electric, was exhibited. It represents the advanced design and functional construction which the basically new techniques of television require. Since television should incorporate the best from radio, stage, and motion pictures, this studio is intended to combine the functions of each of these media in a building ideally suited for the production of television programs. As the accompanying illustrations show, a large area is designed to have a revolving stage 96 ft. in diameter, to permit rapid change of scenes. The turntable arrangement would eliminate duplication of technical.

The outer area, around the stage, would be used for the construction and storage of sets and properties. Doors at the rear of the building would permit advertisers to bring products as large as airplanes onto the stage. Audience seating areas, with drop partitions, would allow one audience to witness a program while guests coming in to see the next show were being seated.

The reflector antenna on the tower of the studio building is intended to beam video and sound signals to a transmitter located on high ground, central to the coverage area.

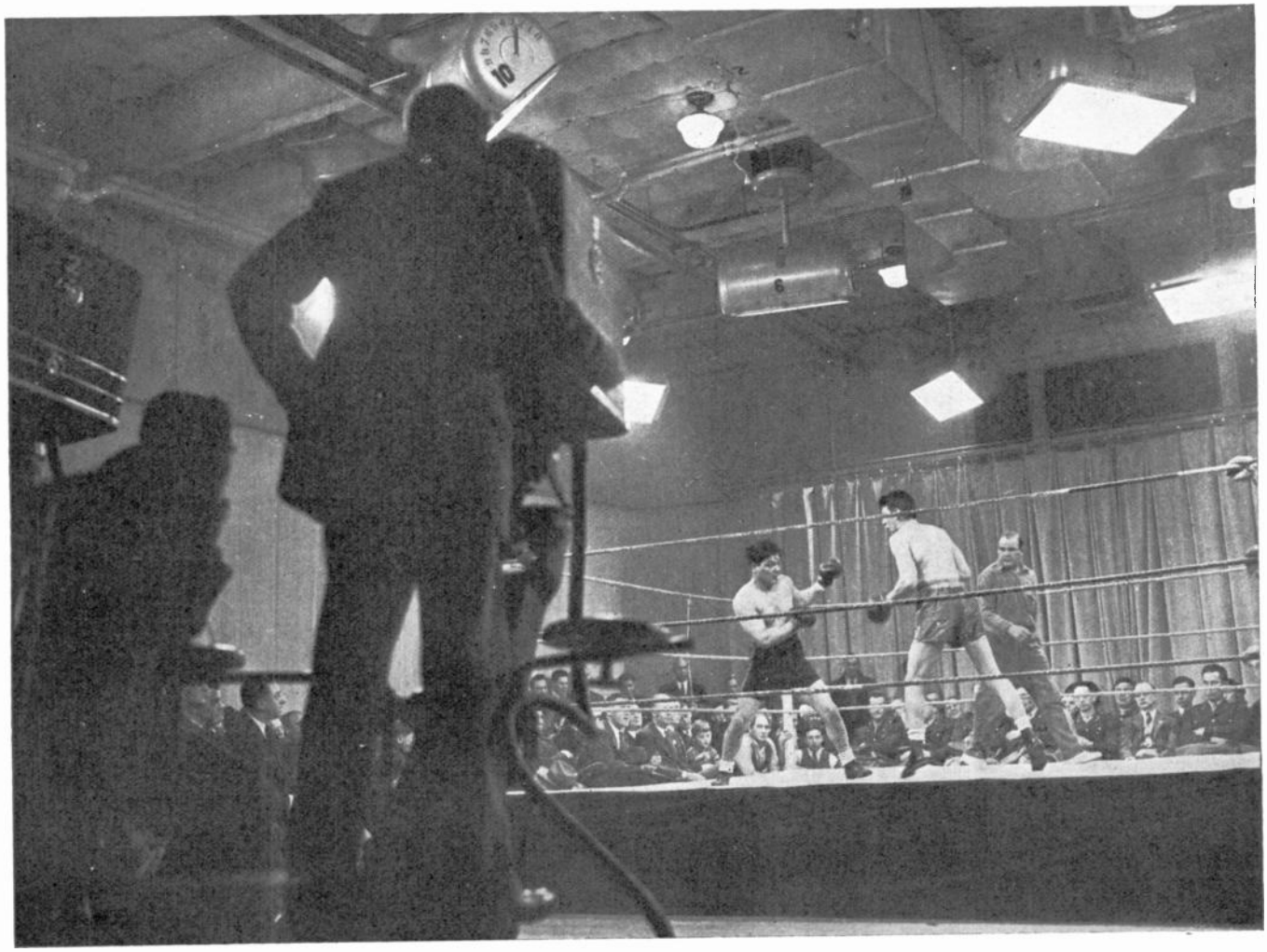
Concerning networks for the distribution of television programs originating at the master stations, G.E. engineers expressed the belief that point-to-point transmission on ultra-high frequency beams has certain great advantages. The company does not propose to operate such facilities, but officials foresee one net starting in New York City and extending to Schenectady, Syracuse, Rochester, Buffalo, Cleveland, Toledo, Chicago, and Detroit. Another would run from the same starting point to Hartford, Providence, Worcester, and Boston, while a third would go south to Philadelphia, Baltimore, Washington, and Richmond, and west from Philadelphia to Harrisburg, Pittsburgh, and Cleveland.

Unattended relay units, spaced at line-of-sight points, would carry programs in both directions. It is estimated that the relays could be spaced perhaps 20 miles apart on flat land, and up to 60 miles between elevated points.

Smaller communities would be served by satellite stations, according to G.E. thinking. These will be relatively inexpensive installations, perhaps without any local studio facilities, or with truck units that could take sound pictures for transmission from the local satellite.

The estimated time given for putting new master stations on the air was 18 months after the end of the War. There are now nine stations actively on the air, but these will have to be rebuilt and modernized. As of March 1st, applications had been filed for 40 stations. They will serve about 30,000,000 people. General Electric estimates that, within five years after the War ends, 100 master stations will be on the air, covering population centers which include 67,000,000 people, or about half the population of the United States. This, of course, assumes the concurrent establishment of networks.

IN THE STUDIO OF WRGB, SCHENECTADY, G. E. PUTS UP A STANDARD RING TO TELEVISE BOXING MATCHES AND WRESTLING BOUTS



A-N STANDARD LIST OF RF CABLES

Official Specifications for Standardized Cables To Be Used on Army and Navy Equipment

November 18, 1943

To: ALL SERVICES, DIVISIONS AND BRANCHES, OCSIGO, AND ALL FIELD ACTIVITIES UNDER CONTROL OF THE CHIEF SIGNAL OFFICER
ALL INSPECTORS OF NAVAL MATERIAL; COMMANDANTS, ALL NAVY YARDS; SUPPLY OFFICERS IN COMMAND, ALL NAVAL SUPPLY DEPOTS
ALL THOSE CONCERNED WITH THE DESIGN AND MANUFACTURE OF ARMY OR NAVY EQUIPMENT UTILIZING R.F. CABLE AND PULSE TRANSMISSION CABLE

1. The following Army-Navy Standard List of Radio Frequency Cables has been selected jointly by the Signal Corps and the Bureau of Ships. The purpose of this list is to effect an immediate reduction in the number of types of cables used for radio frequency transmission, video, intermediate frequency, radio frequency test equipment and direct current pulse transmission used in radio and radar Service equipments.

2. Careful study and investigation by the qualified representatives of the Services and Industry have determined that the first or preferred category of the Standard List is capable of supplying cables for the above applications for all radio and radar equipments now in production or in the design stage. The second category provides additional cables which are currently being used in production equipments or for replacement of rigid lines in existing equipments.

3. IT IS MANDATORY THAT ALL RADIO FREQUENCY CABLES, FOR THE ABOVE APPLICATIONS, TO BE USED IN NEW EQUIPMENTS OR EQUIPMENTS IN THE EARLY DESIGN STAGE WHICH ARE UNDER THE JURISDICTION OF THE SIGNAL CORPS OR THE BUREAU OF SHIPS, BE SELECTED FROM THE FIRST OR PREFERRED CATEGORY. FURTHER, IT IS MANDATORY THAT ONLY CABLES FROM BOTH CATEGORIES OF THIS STANDARD LIST BE USED IN RADIO AND RADAR EQUIPMENTS NOW IN PRODUCTION UNDER THE JURISDICTION OF THE SIGNAL CORPS OR THE BUREAU OF SHIPS. NO OTHER CABLES OF THE SUBJECT TYPE SHALL BE MANUFACTURED FOR ARMY OR NAVY END USE EXCEPT WHEN DIRECTLY PURCHASED BY THE SERVICES FOR MAINTENANCE OF EQUIPMENTS ALREADY IN THE FIELD AND FOR WHICH NO CABLE ON THIS STANDARD LIST IS APPLICABLE.

4. In the event that it is believed that certain equipment for the Signal Corps or Navy requires a cable of specialized design, for which a suitable cable is not included in the Standard List, a specific waiver to use such a cable must be obtained from the Service concerned. Requests for such waivers, made in duplicate and accompanied by a statement giving the engineering considerations which make the proposed type necessary, shall be forwarded to the Commanding Officer, Signal Corps Standards Agency, 12 Broad Street, Red Bank, N. J., when Signal Corps equipment is concerned; and to the Chief of the Bureau of Ships, Navy Department, Washington, D. C., attention Code 930G, when Navy equipment is concerned. All such request will be referred to the Army-Navy R. F. Cable Coördinating Group for engineering review and technical recommendation. Where Signal Corps equipment is concerned, final approval will be made by the Signal Corps Standards Agency and transmitted to the organization requesting the waiver. Where Navy equipment is concerned, final approval will be made by the Bureau of Ships and transmitted to the organization requesting the waiver.

5. Where cables of the subject type not covered by the Standard List are being used in existing production lines they may continue to be produced and used pending action on requests for waivers.

6. The provisions of this directive are in no way intended to hamper or restrict new developments in the field of Radio Frequency Cables.

7. The provisions of this directive shall take effect immediately.

Office of the Chief Signal Officer
Headquarters, Army Service Forces
War Department

Chief of the Bureau of Ships
Navy Department

FIRST CATEGORY PREFERRED CABLES — NOVEMBER 18, 1943

Army Navy Type Number	Replaces Old Cable Number	Inner Conductor	Dielectric Material Note (1)	Nominal Diam. of Dielectric (Ins.)	Shielding Braids	Protective Covering	Nominal Overall Dia. (Ins.)	Lbs. Per Foot	Nominal Impedance Ohms	Nominal mmfd. Per Foot	Maximum Attenuation Db/Ft. 100 mc.	Maximum Attenuation Db/Ft. 3000 mc.	Maximum Operating Voltage Rms	Average Watts Rating (4) 200 mc.	Average Watts Rating (4) 3000 mc.	Remarks
RG-58/U	RG-4/U(2)	20 A.W.G. Copper	A	0.116	1	Vinyl	0.195	0.025	51	30	0.062	0.403	1,900	160	35	General purpose small-size flexible cable
RG-59/U	Uniradio 32(2) EX-391(2)	22 A.W.G. Copperweld	A	0.146	1	Vinyl	0.242	0.032	70	22	0.050	0.33	2,300	225	45	General purpose small-size video cable
RG-5/U	RMA 16(2)	16 A.W.G. Copper	A	0.185	2	Vinyl	0.332	0.087	51	30	0.04	0.28	3,000	310	65	Small microwave cable
RG-6/U	KS 9168(2) KS 9226(2)	21 A.W.G. Copperweld	A	0.185	2	Vinyl	0.332	0.082	75	20	0.037	0.26	2,700	...	..	Small-size video & IF double-shielded cable
RG-7/U	AS-48 WC547 62064 K31(2)(3) 21B-255-7/30-XV(2)(3)	19 A.W.G. Copper	A	0.250	1	Vinyl	0.370	0.080	95	14 (max.)	0.030	.....	.....	...	..	Low-capacitance, air-spaced
RG-8/U	PT5 WC543 WC549 CASSF-50-1	7/21 A.W.G. Copper	A	0.285	1	Vinyl	0.405	0.106	52	29	0.027	0.25	4,000	480	90	General purpose, medium-size, flexible cable
RG-9/U	B452	7/21 A.W.G. Copper	A	0.280	2	Vinyl	0.420	0.150	52	29	0.027	0.25	4,000	480	90	Double-shielded, medium-size, low-level circuit
RG-10/U	CASSF-50-1A	7/21 A.W.G. Copper		0.285	1	Vinyl & Armor	0.445	0.146	52	29	0.027	0.25	4,000	480	90	Same as RG-8/U armored for Naval equipment
RG-11/U	WC552 WC562(2) CASSF-70-1(2)	7/26 A.W.G. Copper	A	0.285	1	Vinyl	0.405	0.096	75	20	0.027	0.25	3,500	...	..	Medium-size, flex. video & communication cable
RG-12/U	CASSF-70-1A(2)	7/26 A.W.G. Copper	A	0.285	1	Vinyl & Armor	0.445	0.141	75	20	0.027	0.25	3,500	...	..	Same as RG-11/U armored for Naval equipment

RG-13/U	21B-290-7/26 XXV B492	7/26 A.W.G. Copper	A	0.280	2	Vinyl	0.420	0.126	75	20	0.027	0.25	3,500	...	..	Double-shielded IF cable
RG-14/U	RMA 10 KS 9269(2)	10 A.W.G. Copper	A	0.370	2	Vinyl	0.545	0.216	51	30	0.022	0.20	6,000	730	135	General-purpose semi-flex. power trans. cable
RG-15/U	KS 9220	15 A.W.G. Copperweld	A	0.370	2	Vinyl	0.545	0.197	75	20	0.022	0.20	5,500	650	115	Medium-power, for continuous flexing
RG-16/U	KS 9286	0.125 Copper Tube	A	0.460	1	Vinyl	0.630	0.254	52	30	0.018	0.16	7,500	940	165	Medium-power, hollow inner conductor for pressurization
RG-17/U	CASSF-50-2 KS 9256	0.188 Copper	A	0.680	1	Vinyl	0.870	0.460	51	30	0.014	0.15	11,000	1,460	225	Large, high-power transmission cable
RG-18/U	CASSF-50-2A	0.188 Copper	A	0.680	1	Vinyl & Armor	0.910	0.585	51	30	0.014	0.15	11,000	1,460	225	Same as RG-17/U armored for Naval equipment
RG-19/U	CASSF-50-3	0.25 Copper	A	0.910	1	Vinyl	1.12	0.740	51	30	0.012	0.125	14,000	2,050	285	Very large, high-power transmission cable
RG-20/U	CASSF-50-3A	0.25 Copper	A	0.910	1	Vinyl & Armor	1.16	0.925	51	30	0.012	0.125	14,000	2,050	285	Same as RG-19/U armored for Naval equipment
RG-21/U	KS 9230	16 A.W.G. Resist. Wire	A	0.185	2	Vinyl	0.332	0.087	51	30	0.16	0.93	.....	...	..	Special attenuating cable, small temp. coef. of attenuation
RG-22/U	WC 551	2 Cond. Copper 7/26 A.W.G.	A	0.285	1	Vinyl	0.405	0.107	95	17	0.04	.....	1,000	...	..	Small size, twin conductor cable
RG-23/U	B 601 B 602	2 Cond. Copper 7 21 A.W.G.	A	0.400	2	Vinyl	0.650 0.995	0.490	125	13	0.05	.....	3,000	...	..	Balanced, dual coaxial cable
RG-24/U	B 601A B 602A	2 Cond. Copper 7/21 A.W.G.	A	0.400	2	Vinyl & Armor	0.715 1.010	0.670	125	13	0.05	.....	3,000	...	..	Same as RG-23/U armored for Naval equipment
RG-25/U	A2 62101 KS 8623(2) KS 9311	19/0.0117 Tinned Copper	A	0.308(5)	2	Neoprene	0.565	0.205	50	60	1 mc. 0.007 1 mc.	.....	8,000 (Peak)	...	..	Medium-size, pulse cable
RG-26/U	A1 KS 9347	19 0.0117 Tinned Copper	D	0.308(5)	1	Vinyl & Armor	0.475	0.280	50	60	0.007 1 mc.	.....	8,000 (Peak)	...	..	Similar to RG-25/U armored for Naval equipment
RG-27/U	B1 62102 KS 9036	19/0.0185 Tinned Copper	D	0.455(5)	1	Vinyl & Armor	0.650	0.273	50	60	0.004 1 mc.	.....	17,000 (Peak)	...	..	Large-size pulse cable, armored for Navy use
RG-28	B2 62103	10 0.0185 Tinned Copper	D	0.455(5)	2	Neoprene	0.805	0.370	50	60	0.004 1 mc.	.....	17,000 (Peak)	...	..	Large size, pulse cable
RG-57/U	RG-43/U WC 550 TCSSF-95-1	2 Cond. Copper 7/21 A.W.G.	A	0.472	1	Vinyl	0.617	0.225	95	17	0.04	....	3,000	...	..	Large size, twin-conductor
RG-39/U	KS 8086	22 A.W.G. Copperweld	C	0.196	2	Waxed Cotton Braid	0.292	0.10	70	28	0.018 10 mc.	.....	1,000	...	..	Rubber cable, for high flexibility
RG-41/U	62039(2) KS 8498(2)	16/30 A.W.G. Tinner Copper	C	0.250	1	Neoprene	0.425	0.15	70	28	0.014 10 mc.	.....	1,000	...	..	Rubber cable, twisting applications

SECOND CATEGORY TABLES NOVEMBER 18, 1943

Army Navy Type Number	Replaces Old Cable Number	Inner Conductor	Dielectric Material Note (1)	Nominal Diam. of Dielectric (Ins.)	Shielding Braids	Protective Covering	Nominal Overall Dia. (Ins.)	Lbs. Per Foot	Nominal Impedance Ohms	Nominal mmfd. Per Foot	Maximum Attenuation Db Ft. 100 mc.	Maximum Attenuation Db Ft. 3000 mc.	Maximum Operating Voltage Rms	Average Watts Rating (4) 200 mc.	Average Watts Rating (4) 3000 mc.	Remarks
RG-29/U	KS 9137	20 A.W.G.	A	0.116	1	Waxed Cotton Braid	0.179	0.021	51	30	0.062	0.403	1,900	160	35	Small-size video, equipment wiring
RG-54/U	G.E. Delay RG-30/U	7/26 A.W.G. Copper	A	0.185	1	Vinyl	0.275	0.041	58	27	0.04	0.28	1,500	...	..	For a specific equipment
RG-31/U	PT5 CASSF-50 1 WC 549	7/21 A.W.G. Copper	B	0.285	1	Vinyl	0.405	0.106	51	31	0.028	0.30	2,000	...	..	To be replaced by RG-8/U
RG-33/U	KS 8919	10 A.W.G.	A	0.370	..	Lead Sheath	0.470	0.390	51	30	0.020	0.175	6,000	730	135	For a specific equipment
RG-34/U	Bendix No. A 107145A	7/21 A.W.G.	A	0.460	1	Vinyl	0.625	0.224	72	21	0.018	0.163	6,500	...	..	For a specific equipment
RG-35/U	CASSF-70 2A	9 A.W.G. Copper	A	0.680	1	Vinyl & Armor	0.910	0.525	71	21	0.013	0.138	10,000	...	..	Replaces rigid lines in Naval equipment
RG-36/U	CASSF-70-3A	0.162 Copper	A	0.910	1	Vinyl & Armor	1.16	0.805	69	22	0.011	0.116	13,000	...	..	Replaces rigid lines in Naval equipment
RG-37/U	D164818	20 A.W.G. Tinned Copper	C	0.140	1	Waxed Cotton Braid	0.190	0.04	50	38	.....	.....	1,000	...	..	For a specific equipment
RG-38/U	D163296	17 A.W.G. Tinned Copper	C	0.196	2	Waxed Cotton Braid	0.292	0.11	50	38	0.018 10 mc.	1.05	1,000	...	..	Attenuating cable
RG-40/U	D163480	22 A.W.G. Copperweld	C	0.196	2	Neoprene	0.420	0.15	70	28	0.018 10 mc.	.....	1,000	...	..	For a specific equipment
RG-42/U	KS 9167	21 A.W.G. Resist. Wire	A	0.196	2	Waxed Cotton Braid	0.297	0.05	76	20	0.175	1.02	.....	...	..	Special attenuating cable, small temp. coef. of attenuation
RG-55/U	KS 9138	20 A.W.G. Copper	A	0.116	2	Waxed Cotton Braid	0.201	0.034	54	30	0.062	0.403	1,900	160	35	Small size IF cable for equip. wiring

Notes: (1) Dielectric Materials: A — Stabilized Polystyrene. B — Polyisobutylene. C — Synthetic Rubber Compound. D — Synthetic Rubber Compound, with layers of Conducting Rubber. (2) Replaces with minor mechanical variations. (3) Replaces with minor electrical variations. (4) Average power rating calculated on basis of inner conductor having 70° F. temperature rise above ambient. (5) This value is the diameter over the second layer of conducting rubber.

SPOT NEWS NOTES

Items and comments, personal and otherwise, about manufacturing, broadcasting, communications, and television activities

9 New FMBI Members: Since 36 new members were added at the time of the January FMBI Conference, the following broadcasters have been admitted:

Indianapolis Broadcasting, Inc., Indianapolis, Ind.
Great Trails Broadcasting Corp., Dayton, Ohio
KLZ Broadcasting Company, Denver, Colo.
Pennsylvania Broadcasting Company, Philadelphia, Pa.
South Bend Tribune, South Bend, Ind.
The Sun Company of San Bernardino, San Bernardino, Calif.
Transcript Publishing Association, North Adams, Mass.
WGAR Broadcasting Company, Cleveland, O.
WKY Radiophone Company, Oklahoma City, Okla.

George C. Furness: Of National Carbon Company, one of the best known figures of the early days of radio broadcasting, passed away in New York City on April 10 after a brief illness. He managed the *Eveready Program* which, on February 12, 1924, was the first commercial broadcast to be handled on a network of radio stations.

Chicago: Ellinger Sales Company, 9 South Clinton Street, has been appointed midwest representative of Karp Metal Products Company, Inc., manufacturers of metal cabinets, racks, and sheet metal parts, whose factory is at 129-30th Street, Brooklyn 32, N. Y.

Harry Sadenwater: Radio operator on the NC1 round-the-world flight in 1919: "If FM communication is needed anywhere today, it's needed in aviation."

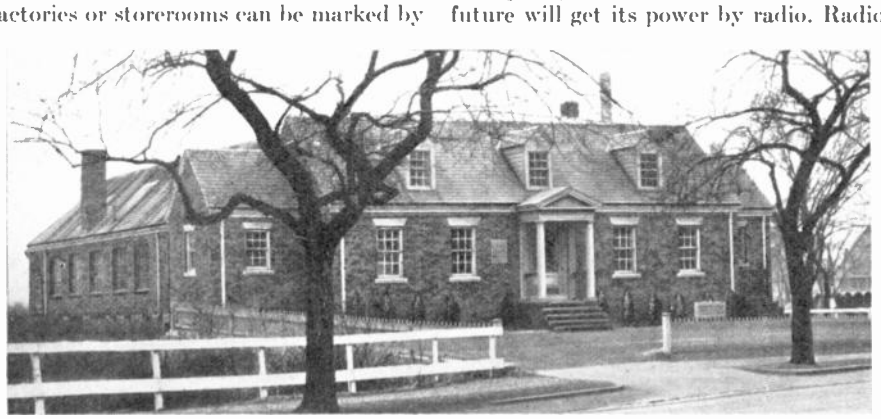
Warning: Obstructions and dark spots in factories or storerooms can be marked by a new sticker offered by Avery Adhesives, 451 E. Third Street, Los Angeles. Measuring 4 by 2 ins., the shining surface, bearing broad, diagonal black and white bands, shows up clearly in the dim light. Special adhesive requires no moistening, can be applied quickly, and peeled off easily.

Little Caesar: The latest prank of Baby Face Petrillo is an amazing commentary on the philosophy of those who have held the ladder on which some of our labor leaders have climbed to power. This small potato, who started in the labor "business" by preying upon musicians in Chicago's Chinese restaurants, has now grown so great that the Chicago public schools must ask him for permission to rebroadcast, over the Board of Education's FM station, the WBBM *Workshop for War* program. And as if to furnish evidence that he is unfit to serve in any capacity of leadership, he refused to allow this program to be rebroadcast so that the children could hear it on the FM receivers with which the schools are equipped.

Dr. A. N. Goldsmith: Engineering consultant and vice president of RTPB, has moved his offices to 597 Fifth Avenue, New York 17, N. Y.

Out from Under: Camouflage paint and nets are being removed from the Universal Microphone plant at Inglewood, Calif. The exterior is being repainted, and the electric signs are being set up again on the roof.

W. A. Ready: President of National Company, Inc., Malden, Mass.: "We have seen the suggestion published that miniature cameras would be focused by radio on 'the principle of radar, perhaps'. We have been told that automobile engines were pretty old-fashioned. The car of the future will get its power by radio. Radio will soothe the baby and make the begonia plant grow faster. Radio will press your pants. O.K. Some of these things sound amusing, but when a sufficient number of million people believe them, they are not funny. Lots of people believe they have been promised these things when the War is over, and the goods are not going to be delivered."



NEW OFFICES AND DEMONSTRATION LABORATORY OF ELECTRICAL APPARATUS COMPANY AT 1200 SOLDIERS FIELD ROAD, BOSTON, ADJACENT TO HARVARD UNIVERSITY

Joseph K. Fabel: Has resigned as assistant District manager of the New York ANEPA office to fill the newly-created office of vice president in charge of sales for Allen D. Cardwell Mfg. Corp., condenser manufacturers at 81 Prospect Street, Brooklyn 1, N. Y.

Government Frequencies: Testifying before the House Select Committee to Investigate the FCC, Chairman Fly stated that 5,096 channels, between 10 and 162,000 kc., have been assigned to Government agencies. The Army has 2,189 of which 875 are for its exclusive use. The Navy has 1,882, of which 550 are not shared with any other service.

The total does not include international short-wave stations. They are licensed to commercial broadcasting companies. The Office of War Information and the Co-ordinator of Inter-American Affairs then contract for all the time and program the stations. The number of frequencies thus employed was not disclosed.

K. B. Warner: Secretary and general manager of the American Radio Relay League, completed 25 years of service in that office on April 26th.

Brookville, Pa.: Signal Corps has approved an expansion of Sylvania Electric Products plant. Tube sealing and exhausting equipment will be set up in the added 13,500 sq. ft., permitting the completion of sub-assemblies previously made at the Brookville plant. Employment will be increased to about 1,000.

Gilbert Yette: Who closed down the Press Wireless station at Manila in December, 1941 with the message, "The soldiers are coming," died recently in the Japanese prison camp at Los Banos, Philippine Islands. His capture was announced by the State Department in May, 1943.

(CONTINUED ON PAGE 56)

NEWS PICTURE

HERE, at last, is a photograph of the "Lighthouse Tube", finally released from the cover of military secrecy. A G.E. development, this strange-looking tube is one of a series of sizes used for radio transmission at frequencies of 1,000 mc. and even higher. The particular tube illustrated is suitable for television relay transmitters and ST links for FM stations. The success of the lighthouse design points the way to the use of relatively high power in transmitters operating above 1,000 mc. Now that the Army and Navy have removed these tubes from the classified list, we shall hear much more about them. In all probability, they will be used widely in postwar equipment.

OFFICERS AND EXECUTIVES OF NEWLY FORMED WCEMA. NAMES ARE GIVEN BELOW

WEST COAST ASSOCIATION

California Companies Form West Coast Electronic Manufacturers Association

ALWAYS a top-rank market for radio equipment, with a special status of its own, California has now become a center of production as well. According to figures compiled by the newly-formed West Coast Electronic Manufacturers Association, the total production of its 46 members has reached a volume greater than that of the entire radio industry in some of the prewar years.

Officers of the Association, recently elected on a permanent status, are: H. L. Hoffman, Hoffman Radio Corporation, president; Jack Kaufman, Heintz & Kaufman, Ltd., vice-president; Herb Becker, Eitel-McCullough, Inc., secretary; and Howard Thomas, Packard-Bell Company, treasurer.

The group in the photograph above comprises the officers and executive committee. In the upper row, left to right, are: Lew Howard, Peerless Electrical Products; E. Danielson, Remler; James L. Fouch, Universal Microphone; Clayton Bane, Technical Radio; and E. P. Gertsch, Air Associates. In the lower row, left to right, are: Herb Becker, Eitel-McCullough; H. L. Hoffman, Hoffman Radio; Jack Kaufman, Heintz & Kaufman; and Howard Thomas, Packard-Bell.

A check-up of production, made by the Association, shows that members' production on military contracts placed by the Dayton offices of the Signal Corps went over the top in February. It is further claimed that the California area was the only area which met February quotas set by Dayton.

Membership of the WCEMA is divided into the San Francisco Council and the Los Angeles Council. Following is a list of the member companies and their WCEMA representatives:

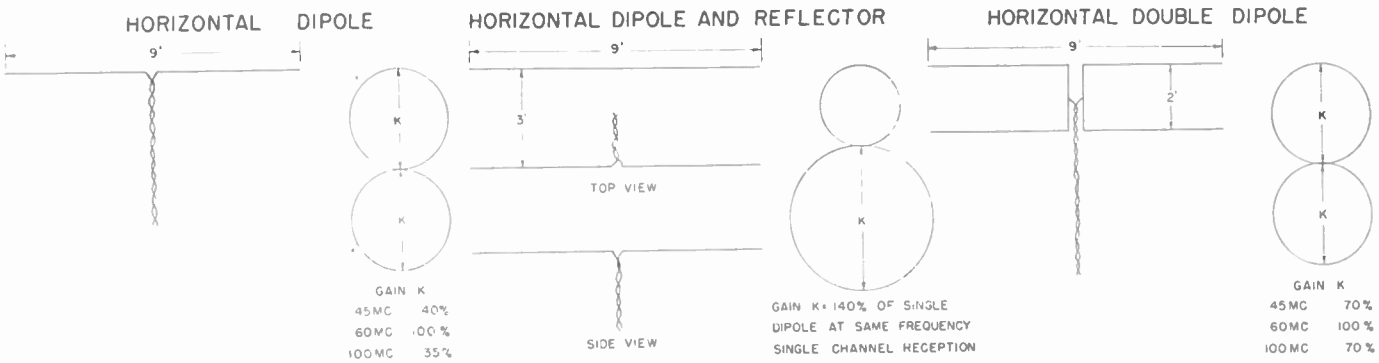
SAN FRANCISCO COUNCIL

Butte Electric Co., San Francisco — R. R. Armstrong.
Dalmo Victor Company, San Francisco — Paul Byrne
Eitel-McCullough, Inc., San Bruno — Jack McCullough
Electrical Products Corp., Oakland — Milton Mausshardt
Fisher Research Laboratory, Palo Alto — Gerhart Fisher
Gardner Electric Co., Emeryville — W. W. Wahlgren
Girard-Hopkins, Oakland — J. C. Hopkins
Heintz & Kaufman, Ltd., So. San Francisco — Jack Kaufman
Hewlet-Packard, Palo Alto — David Packard
Industrial & Commercial Electronics, Inc., Belmont — R. C. Shermund
Jennings Radio Mfg. Co., San Jose — J. E. Jennings
Lenkurt Electric Co., San Francisco — L. G. Erickson
Kaar Engineering Co., Palo Alto — John M. Kaar
Lewis Electronics, Los Gatos — Mason Shaw
Litton Engineering Labs., Redwood City — J. G. Copelin
Pacific Radio Crystal Co., San Francisco — A. S. Matthews
Remler Company, Ltd., San Francisco — E. G. Danielson
E. M. Sargent Co., Oakland — E. M. Sargent
Speed-X Mfg. Co., San Francisco — Les Logan
Technical Radio Co., San Francisco — Clayton Bane

LOS ANGELES COUNCIL

A.B.C. Products, Inc., W. Los Angeles 24 — Mrs. B. Wilson
Air Associates, Inc., Inglewood 43 — Elmer Gertsch
Altec Lansing Corp., Hollywood 28 — G. L. Carrington
American Microphone Co., Ltd., Los Angeles 7 — F. A. Yarborough
Bendix Aviation Corp., Pacific Division N. Hollywood — J. A. Haney
Cinema Engineering Co., Burbank — Art Davis
Communications Equip. Corp., Pasadena — Ray Kimball
Dallons Laboratories, Los Angeles 27 — Oscar Dallons
Electronic Specialty Co., Los Angeles 26 — D. A. Marcus
Gilfillan Brothers, Inc., Los Angeles 6 — Leslie Howell
Henry Mfg. Co., W. Los Angeles 25 — J. E. Irwin
Higgins Industries, F. E. Dine, Trustees, Santa Monica — F. E. Dine
Hoffman Radio Corp., Los Angeles 7 — H. L. Hoffman
Littlefuse, Inc., El Monte — Ashford M. Wood
Marine Radio Service, Wilmington — Paul F. Wiser
Memovox, Inc., Beverly Hills — Walter Fagan
Monitor Piezo Products Co., S. Pasadena — H. E. Blaisiev
Newcomb Audio Products Co., Los Angeles 7 — Robert Newcomb
Packard-Bell Co., Los Angeles 15 — H. D. Thomas
Peerless Electrical Products Co., Los Angeles 1 — Lew Howard

This is a highly integrated group, for it includes manufacturers of finished equipment which consume parts, tubes, and crystals produced by the other companies. Labor conditions are particularly favorable in California. About 60% of the employees of these companies are women.



FIGS. 1, 2, 3, SHOWING THE ANTENNAS USED IN THE PRELIMINARY TESTS, AND THE DOUBLE DIPOLE WHICH GAVE IMPROVED RESULTS

TELEVISION BROADCAST COVERAGE

Presenting Multipath Distortion Data Obtained by an Exhaustive Survey in the New York City Area

BY ALLEN B. DU MONT AND THOMAS T. GOLDSMITH, JR.*

Summary ★ An extensive field survey has been made of the three television transmitters in the New York territory. The survey consisted of observations of many receivers permanently installed in the metropolitan area and of observations made with special receiving equipment mounted aboard the cruiser *Hurricane II*. Continuous recordings of field strength and still photographs have been made.

This paper deals extensively with the multipath problem in television broadcasting which causes multiple patterns in the received picture. Extensive use is made of photographs and diagrams illustrating the appearance of these patterns and explaining the causes of these various types of *ghosts*.

The findings of this survey definitely lead to the conclusion that the lower frequency channels provide the least multipath interference in metropolitan territory such as New York City. Reasonably good reception is found from all three New York stations at distances beyond five miles up to the distances where signal level becomes too low for satisfactory receiver operation.

Photographs are used to exhibit the quality of reception and types of programs now current in good locations around New York City.

Introduction ★ In the deliberations of the N.T.S.C. (National Television System Committee) before the adoption of standards in June, 1941, very little attention was given to the effect of secondary images or ghosts, upon the received signal. It was generally assumed that if a picture of 525 lines definition was faithfully transmitted and a receiver capable of reproducing that picture was employed, the resulting image would show no appreciable loss of detail. It is quite understandable how this happened. The only transmitter in operation was transmitting on a frequency between 44 and 50 mc., relatively few receivers were in operation and the picture was not viewed in the critical way it is today. With the elimination of this channel to make room for FM transmissions, and television broadcast stations going into operation on frequencies between 50 and 84 mc. it has become apparent since that time that secondary images are the No. 1 technical problem of the telecaster. Although this paper is concerned with television broadcast coverage generally, particular stress will be laid on the subject of secondary images because of their great importance.

To understand the problem of television transmission, it must be kept in mind that, unlike audio broadcasting, where multiple signals arriving several hundred micro-seconds apart cannot be detected by the ear, in television a difference of about 10 micro-seconds causes one picture to be superimposed on the other but displaced one inch from it.

The results and conclusions are based on television transmissions in the area covered by the New York stations which extends in a radius of approximately 75 miles from Manhattan. Although this area may not be typical of conditions throughout the United States, nevertheless similar problems in secondary images will be experienced in any locality with tall buildings, bridges or hilly terrain, and the other problems covered will be met with universally.

General Receiving Conditions ★ There are three television stations transmitting in this area —

Station WNBT of the National Broadcasting Company operates on Channel No. 1, 50 to 56 mc. Its antenna is 1,300 ft. high and its video transmitter output is 6.0 kw. peak power, while the sound transmitter operates at 3.5 kw. peak power.

Station WCBW of the Columbia Broadcasting System operates on Channel No. 2, 60 to 66 mc. Its antenna is 1,000 ft. high and its video transmitter output is 2.5 kw. peak power, while the sound transmitter operates at 1.0 kw. peak power.

Station W2XWV of the Allen B. Du Mont Laboratories, Inc., operates on Channel No. 4, 78 to 84 mc. Its antenna is 650 ft. high and its video transmitter output is 6.0 kw. peak power, while the sound transmitter operates at 1.0 kw. peak power.

Transmissions are staggered, WNBT operating Monday afternoon and evening with films, WCBW operating on Thursday and Friday evenings with films, and W2XWV on Sunday, Tuesday and Wednesday evenings with live talent and films. All three stations transmit test patterns Wednesday afternoons between 3:00 and 4:30 P.M. for service purposes. All transmitters are located near the center of Manhattan Island within a radius of one mile.

Some 6,000 television receivers are in

* President and Director of Research respectively, Allen B. Du Mont Laboratories, Inc., Passaic, N. J.
Paper presented before Joint Meeting of Institute of Radio Engineers (New York Section) and Radio Club of America, December 1, 1943. Reprinted from Proceedings of the Radio Club of America.

operation and are being used to receive the transmitters. As a considerable number of these were of our own manufacture and were installed by the factory, the field problems encountered have undergone careful study leading to valuable solutions. To start with, only one station was in operation: W2XBS of the National Broadcasting Company operating on 44 to 50 mc. As we did not know what other stations might be on later or on what frequencies, simple dipole receiving antennas were installed with a twisted pair lead in, Fig. 1.

This particular antenna was generally used except in outlying areas where weak signals prevailed, in which cases a reflector was added, and a coaxial cable used to connect the antenna to the set to provide the maximum signal to the receiver, as in Fig. 2.

When W2XBS shifted frequency to the new No. 1 channel, 50 to 56 mc., and became WNBT, it was found advisable to cut the antennas so they would resonate at the new frequency to provide maximum signal strength and also to prevent deterioration of the picture quality due to the narrow band characteristics of the antenna. Considerably increased secondary images were noted on this higher frequency channel, and in a number of cases we found that it was advisable to install reflectors in high signal areas to sharpen the directional characteristics and reduce secondary images. With WCBW of the Columbia Broadcasting System on a frequency of 60 to 66 mc., and W2XWV of the Allen B. Du Mont Laboratories, Inc., on a frequency of 78 to 84 mc. going on the air, it was soon found that those receiving antennas and lead-ins were not suitable because of reduced signal pick-up on the still higher channels and the loss of picture detail. A broad band receiving antenna, consisting of a double dipole together with

TABLE 1. LISTENER REPORTS

Number of Reports	*Location*	*Approximate Distance From Transmitter*	*Estimated Distribution Percentage*
53	Manhattan	0– 5 miles	9.8
44	Bronx	4–12 "	8.1
53	Brooklyn	3–13 "	9.8
70	Queens	3–15 "	12.9
56	Nassau County, N. Y.	13–30 "	10.3
6	Richmond County, N. Y.	10–20 "	1.1
32	Westchester Co., N. Y.	12–30 "	5.9
1	Suffolk County, N. Y.	40 "	.2
1	Orange County, N. Y.	55 "	.2
21	Hudson County, N. J.	1–9 "	3.9
36	Bergen County, N. J.	4–20 "	6.6
36	Passaic County, N. J.	10–30 "	6.6
70	Essex County, N. J.	8–20 "	12.9
26	Union County, N. J.	11–25 "	4.7
6	Morris County, N. J.	20–35 "	1.1
9	Middlesex County, N. J.	20–40 "	1.6
5	Monmouth County, N. J.	25–40 "	.9
1	Mercer County, N. J.	45 "	.2
1	Sussex County, N. J.	45 "	.2
2	Philadelphia, Pa.	85–95 "	.4
14	Connecticut	25–50 "	2.6
543			100.0

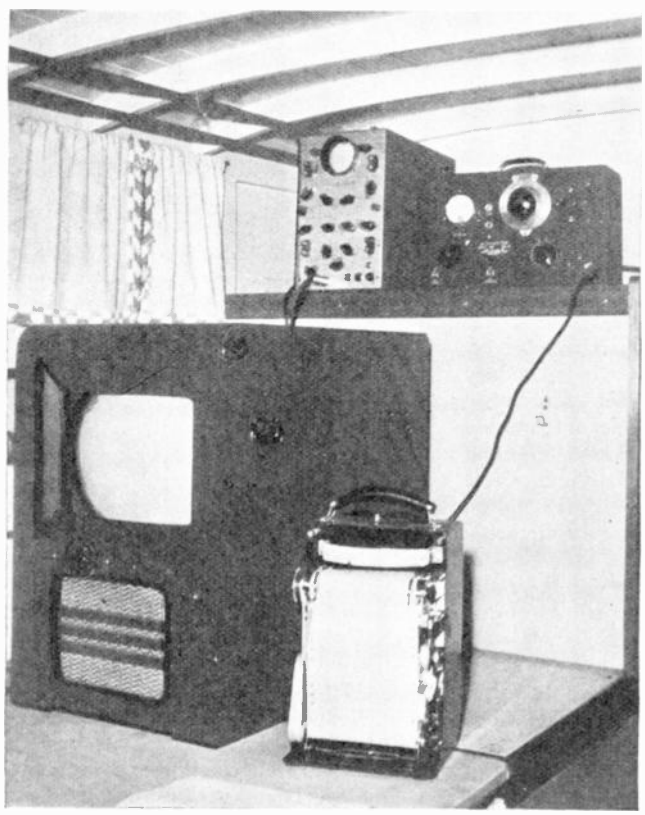


FIG. 4. RECEIVER AND RECORDER SET UP ABOARD THE BOAT USED TO EXPLORE RECEPTION CONDITIONS IN THE N. Y. AREA

FIG. 5. THE HURRICANE II WITH THE DOUBLE DIPOLE EMPLOYED BY AUTHORS TO OBTAIN RECEPTION DATA PRESENTED HERE

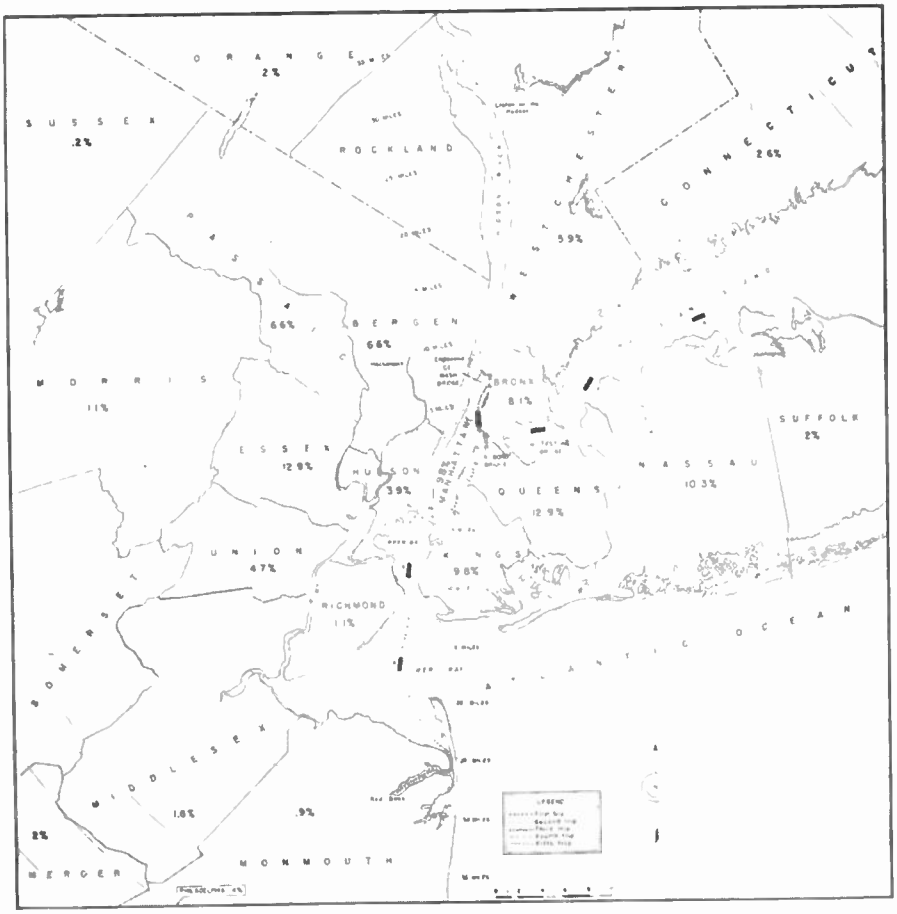


FIG. 6. MAP SHOWING THE DISTRIBUTION OF TELEVISION RECEIVERS IN THE NEW YORK AREA, AND POINTS WHERE RECORDINGS, SHOWN IN FIGS. 22, 25, 26, 27 WERE TAKEN

a low loss lead in, Fig. 3, has been utilized for the past year with good results as far as signal strength and picture detail are concerned, although greatly increased secondary images in certain areas became very objectionable.

Generally speaking, the greatest difficulty has been experienced with secondary images within a radius of about eight miles from the transmitters. This should be more or less expected, for within that area the tall buildings and bridges of New York City are located. Difficulty is also experienced outside of this area where the receiving antenna is blocked by hills or buildings, or is located between the transmitter and a prominent hill.

Signal strengths of above 500 microvolts at the receiver have generally been obtained at distance up to 35 miles from WNBT and W2XWV, and up to 20 miles from WCBW. It has been found that signal strengths of 100 microvolts at the receiver are adequate in quiet locations.

Table 1 gives a summary of listener reports received by W2XWV in connection with its transmissions during the past nine months. This gives an idea of the distribution of receivers.

It is interesting to note in this connection that a number of listeners at distances up to one hundred miles are receiving programs. These listeners have usually erected 40- to 50-ft. poles for their antennas and, in some cases, have added additional RF amplification to their sets. At these locations the signal is influenced by atmospheric conditions.

While diathermy interference has not been particularly objectionable except in isolated cases, it may become a serious problem after the War if the use of such equipment is greatly increased. Hence, it is important that action be taken to see that either operating channels are assigned to this service or, preferably, that the apparatus be shielded adequately.

Interference from automobile ignition has not been serious within a 40-mile radius from the transmitter. In a few cases it has been necessary to relocate the antenna to minimize its effect.

Practically no difficulty has been experienced from natural atmospherics (static and thunder storms) within 40 miles from the transmitter. Over the past several years, a receiver located about 20 miles from the transmitter has been operated during thunder storms with lightning flashes close by, with no effect on the picture or sound.

The synchronism of pictures has been very satisfactory from all three stations on the majority of receivers and up to dis-

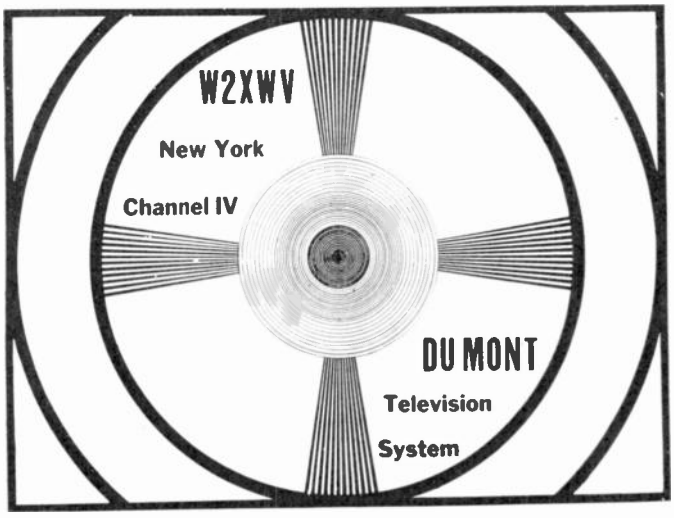


FIG. 7. STANDARD TEST PATTERN EMPLOYED AT STATION W2XWV

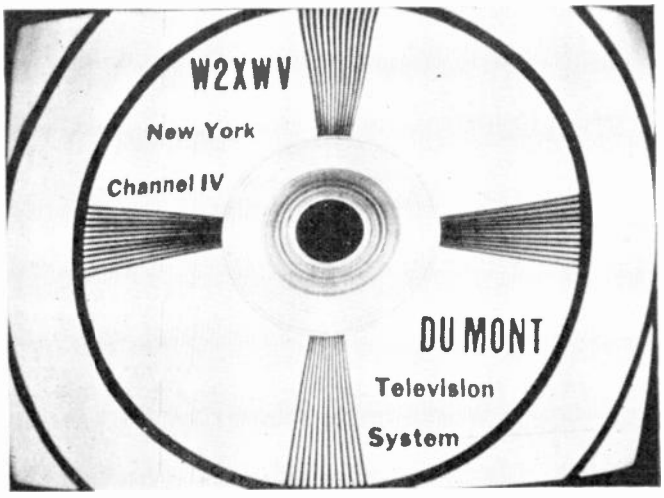


FIG. 8. RECEPTION OF PATTERN ON W2XWV'S STATION MONITOR

tances of 75 miles, provided multipath conditions are not too severe. It has been found necessary to use a ratio of not more than 2 to 1 between peak video transmitter power and peak sound transmitter power if reasonably good sound quality is to be maintained.

Field Tests ★ In order to obtain a comprehensive overall picture, field tests of the signals radiated from the three television stations in New York City have been made, using calibrated television receiving equipment installed aboard the cruiser *Hurricane II*, Fig. 4.

The tests aboard ship have been found to be particularly useful as compared to a previous survey made with the equipment installed in a field survey truck, as all readings are taken at a fixed elevation. The readings are not influenced by always-present nearby structures, as in the case of a field truck, and the cause of distant secondary images at considerable distances can be more readily determined. Waterways are available, so that a complete circle can be made of the transmitters, and radials can be run in a north, east and south direction. The field intensity was recorded on a continuous-paper Esterline-Angus 1-milliampere recorder, running at a recording speed of 0.71 ins. per minute. The sensitivity of the receiver was changed as necessary to prevent overloading of the recorder, and the microvolts input to the antenna terminals of the set were measured for calibration using a Ferris Type 18B Microvolter. During the calibration, the dial settings of the contrast control were recorded and the microvolts output from the Ferris 18B Microvolter were recorded. The calibration signals were applied to the antenna terminals through a 100-ohm resistor.

Although the recorder used gives valuable data, and is generally sufficient for field measurements on audio transmitters, a film record of the received pictures at various intervals is necessary to interpret video results. In the case of dynamic rather than static secondary images, a motion picture record is vital. Films have been taken illustrating the results at various locations.

During the field runs, the antenna was connected to the receiver through a simplex cable and could be rotated to keep it in line with the transmitter, Fig. 5.

The antenna was a double dipole, one section above the other, the signal being taken off from the centers of the two connecting bars joining the centers of the dipoles. The antenna center was approximately fifteen feet above the water line of the boat.

Power for the receiver, the monitoring oscillograph, and calibrating microvolter, was taken from a 60-cycle, 115-volt generator, driven by one of the Chrysler marine engines.

Numerous test runs were made between the following points during the past three years, also shown in Fig. 6.

1. From Englewood, New Jersey, to Red Bank, New Jersey (South).
2. From Englewood, New Jersey, through the Harlem River, and out the Long Island Sound to Huntington, Long Island (East).
3. From Englewood, New Jersey, up the Hudson River to Croton-on-Hudson, New York (North).
4. From Englewood, New Jersey, to Hackensack, New Jersey, through the Hudson River, Lower Bay, Newark Bay, and Hackensack River.
5. Circuit of Manhattan Island.

The recorder records show interesting phenomena of interference patterns and rapid variations of signal intensity where buildings and terrain offer interfering and reflecting surfaces.

Ghost Patterns ★ Several types of ghost patterns have been observed, some of

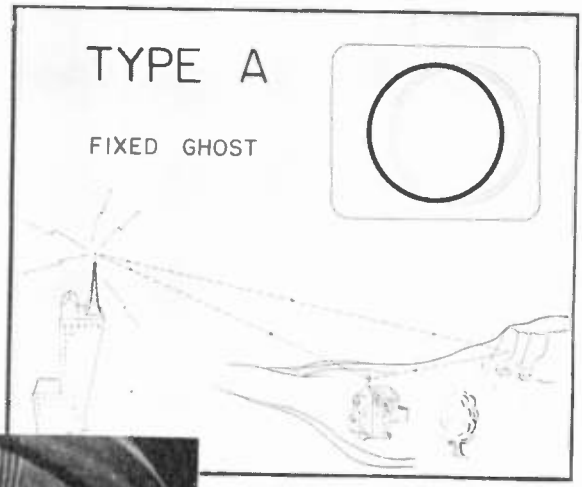


FIG. 9, ABOVE. TYPICAL CONDITION NEAR A TELEVISION RECEIVER WHICH CAN CAUSE A FIXED GHOST, DUE TO MULTIPATH DISTORTION. IN MOST CASES, THE GHOST PATTERN APPEARS AT THE RIGHT OF THE MAIN PATTERN

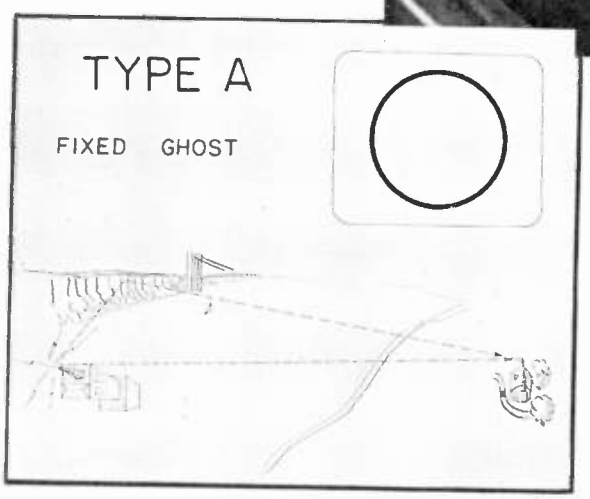


FIG. 10, BELOW. IN THIS CASE THE REFLECTION IS FROM AN OBJECT NEAR THE TRANSMITTER. THIS ALSO CAUSES A FIXED GHOST AT THE RECEIVER. FIG. 12A, RIGHT. ACTUAL PHOTO OF A FIXED GHOST, DISPLACED TO RIGHT OF MAIN PATTERN

which may be briefly classified as follows:

Type A — Fixed ghost
B — Smear ghost
C — Racing ghost
D — Pulsating ghost
E — Negative ghost
F — Bouncing pattern
G — Sync. ghost

These ghost patterns are most readily observed when the receiver is in motion, but these characteristic interference patterns can be interpreted for many fixed location receiving sets.

The Type A (fixed ghost) and Type B (smear ghost) are the most common.

As a number of examples of distorted test patterns are shown later, Fig. 7 illustrates the test pattern used at the transmitter, and Fig. 8, this test pattern as observed on the station monitor.

Type A — Fixed Ghost ★ A fixed ghost appears as another and generally weaker pattern displaced usually to the right of the main pattern. It may be caused either by a reflecting object near the receiver, Fig. 9, or near the transmitter, Fig. 10, or at some intermediate point. In certain cases this reflection only occurs within a narrow arc, Fig. 11. The three figures illustrate only a few of the many position conditions which can produce a rather crisp displaced pattern in addition to the main picture. For such a fixed ghost, a reflecting object near the transmitter can give appreciable energy to the receiver over a path of greater distance than the straight line from the transmitter to the receiver. If the receiver is at rest, or is moving in a direction such that the difference in these two paths is not changing rapidly, then the ghost pattern may remain essentially fixed and be of an unchanged relative intensity with respect to the main pattern.

An ellipse diagram is useful in determining the relative position of transmitter secondary target and receiver for these fixed ghosts. The displacement of the ghost pattern from the main pattern can be measured on the face of the cathode-ray tube. From this displacement, measured in inches, converted to micro-seconds, one can then compute the difference in path length of the ghost path over the direct path from the transmitter. The ellipse pattern can then be drawn.

Place a dot representing the transmitter on paper and another dot representing the receiver at a distance proportional to the distance from transmitter to receiver. These dots will be foci of an ellipse. To determine the amplitude of the ellipse next plot a point on the line extended from the transmitter through the receiver and at a distance beyond the receiver proportional to half the path difference computed from the cathode-ray tube screen. This would locate one possible target which could cause the spurious ghost pattern. Now using this point, describe through it an ellipse about the two foci. A reflecting object located anywhere on the ellipse could produce a type A fixed ghost pattern of the measured displacement observed on the cathode-ray tube screen.

Many times the use of such an ellipse plotted directly on a map will help in identifying the sources of ghost images.

Ghost patterns displaced a lesser or a greater amount will require respectively thinner or fatter ellipses about the same foci for a given transmitting and receiving location.

Some examples of type A ghosts might be mentioned. In Fig. 9 is a condition quite prevalent in Montclair, New Jersey, where the antenna is located between the Watchung Mountains and the New York transmitters. It can be considerably reduced by directive antennas using reflectors. Fig. 12 is a typical pattern where the receiving antenna is approximately one-eighth of a mile from the mountain, and Fig. 12A where it is located about one-half mile away. It also occurs in Maywood, New Jersey, and other points in a small sector as shown in Fig. 11. This condition is very difficult to correct, as the angle between the direct and secondary image is extremely small, so a directive antenna does not help. Some improvement has been accomplished by using two antennas and feeding the output into a phasing arrangement to cancel out the secondary image.

Type B — Smear Ghost ★ In the smear ghost, the receiver screen has no separate and distinct test patterns displaced, but particularly the wedged lines which run vertically appear blurred and have no crisp definition. Such loss of high-frequency resolution may be expected when the receiver is located at a point such that practically no direct energy is received, but nearly all of the energy at the receiving antenna comes over paths reflected from nearby objects, Fig. 13. If these reflected energy paths are numerous and have only small differences in path, then the several patterns received will not be appreciably displaced, but will tend to smear one another, causing poor resolution. In some cases, the wedge running vertically in the test pattern can exhibit periodical regions of good and poor resolution running down the wedge. This smear ghost is quite common at fixed receiver locations in New York City, where the receiver is located in a canyon between several tall buildings. If a receiver is in motion, such that a number of local reflecting surfaces give the main energy to the receiver, then these smear ghosts can come and go with the relative motion of the receiver antenna.

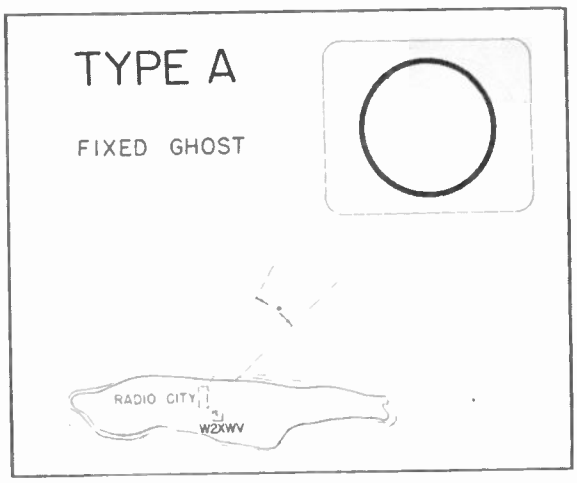


FIG. 11. THE NARROW-ANGLE REFLECTION IS DIFFICULT TO OVERCOME. ORIENTING ANTENNA DOES NOT HELP

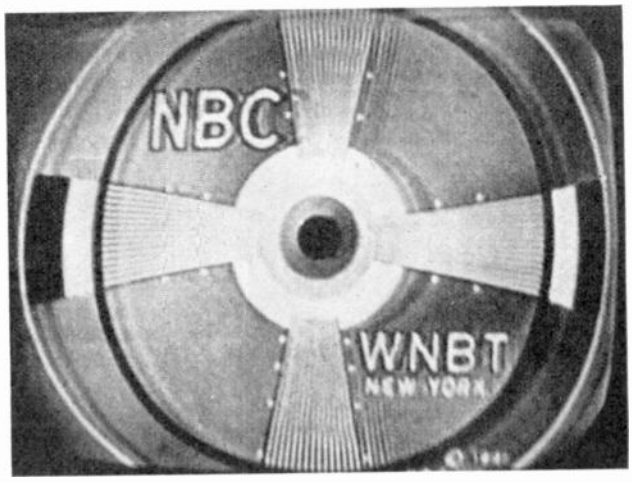


FIG. 12. GHOST DUE TO MULTIPATH DISTORTION FROM A REFLECTING OBJECT ONE-EIGHTH MILE FROM THE RECEIVER

Figures 14 and 15 show typical patterns. They were taken in Warwick, New York, a town situated 45 miles from the transmitter and located in a valley with no direct signal path from the transmitter. A 1,600-ft. hill screens the receiving location from the transmitter.

Another typical location is in the Valley of the Hudson River between the George Washington Bridge and almost to Tarrytown, New York. At some spots in this section it occurs even though the transmitting tower can be seen from the receiving location.

Likewise, a receiving antenna located on the top of the 42-story building at 515 Madison Avenue, which houses the Du Mont transmitter, about one mile from the NBC transmitter on the Empire State Building and in direct line of sight, cannot resolve more than a 200 line definition picture from NBC. This because of the many secondary images from numerous buildings in the skyscraper section between the two television stations.

However, the direction of travel of this racing ghost may be either left to right or right to left, depending upon the relative motion of the receiver with respect to surrounding objects. A probable explanation of such racing ghosts is reception of signals from an extended headland scattering reflections from any portion of the headland, Fig. 16.

The receiver will accept a direct signal from the transmitter not reflected by such a headland. Other signals are received over several different paths but reflected from the extended headland. At a given position of the receiver, some one of these reflected path signals will arrive in phase with the direct

in., for example, causing an appearance of a travelling ghost, racing from right to left across the main pattern. If the receiver moves in the opposite direction,

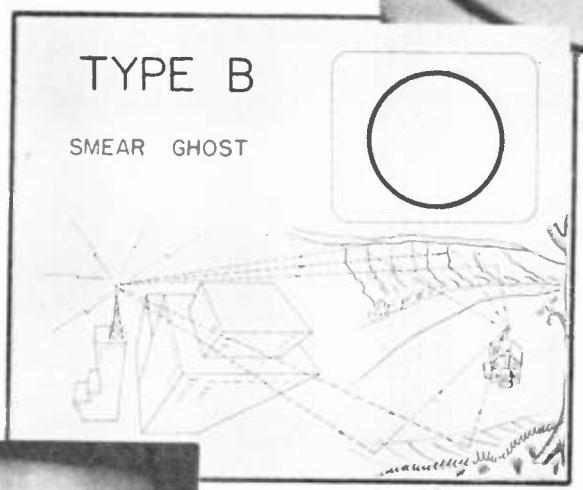
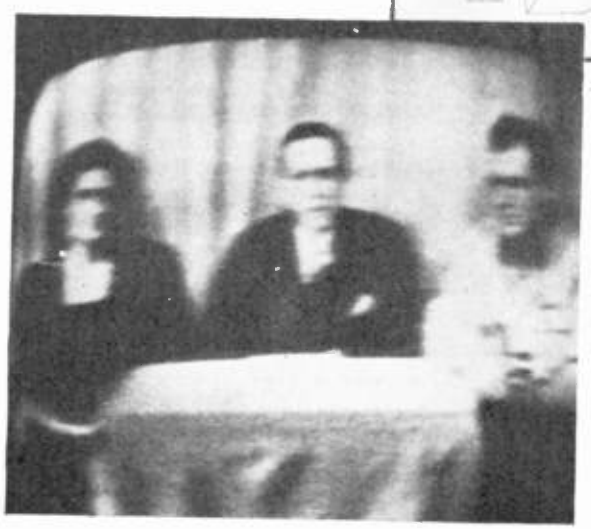


FIG. 13, RIGHT. UNDER CONDITIONS ILLUSTRATED, NO DIRECT SIGNALS CAN BE PICKED UP AT THE RECEIVING ANTENNA. RECEPTION DUE TO REFLECTIONS FROM A NUMBER OF OBJECTS RESULTS IN THE SMEAR GHOST

FIGS. 14, ABOVE AND 15, BELOW. TWO TYPICAL EXAMPLES OF SMEAR GHOST IMAGES DUE TO REFLECTED ENERGY PATHS ARRIVING FROM SEVERAL DIRECTIONS OF COMPARATIVELY SMALL ANGULAR DIFFERENCE. THIS CONDITION IS COMMON WHERE THERE ARE MANY HIGH BUILDINGS



Type C — Racing Ghost ★ The appearance on the screen for the racing ghost is a main image of good intensity with ghost patterns of relatively weak intensity which appear to travel rapidly across the main image when the receiver is in motion. carrier and consequently will register a ghost pattern, say, 3 ins. to the right of the main pattern. However, upon a small motion of the receiver, perhaps parallel to the headland, this 3-in. displaced ghost signal will no longer arrive in phase, but may arrive out of phase and thus be practically neutralized, whereas energy over one of the other reflected paths now may be in phase with the main signal and its ghost image will be strong enough to be predominantly visible occurring, for example, at a displacement of 2½ ins. In the same way, as the receiver moves along for a wave length or so further, other reflected path signals may cause the predominating ghost to appear at 2 ins., 1½ ins., and 1 then one should expect the racing ghost to appear to move from left to right.

Among the places where this condition has been noted are along the Palisades below the George Washington Bridge, and at the confluence of the Harlem and East Rivers.

Type D — Pulsating Ghost ★ A pulsating ghost has been observed wherein the ghost image is displaced to the right of the main image and in which the ghost image will vary up and down in intensity while the main image stays nearly fixed in intensity, Fig. 17.

Such a pulsating ghost image was observed when approaching the Whitestone Bridge, sailing east from the transmitter. The displacement of the ghost image from the main image could be correlated with the distance to the Whitestone Bridge, and as the boat approached the Whitestone Bridge the ghost pattern came

closer and closer to the main image. As the signal of the reflected pattern beat successively in phase and out of phase with the signal over the direct path, the ghost image was intensified and annulled. As soon as the boat passed the bridge a steady signal with no secondary images was obtained.

It was observed that the reflected signal in the case of WNBT's transmission on 50 to 56 mc. was weaker than the direct signal, while the reverse was true in the case of W2XWV, operating on 78 to 84 mc. when the boat was near the bridge. In this case, the reflected signal was more than three times the signal strength of the direct signal, and at some points this delayed signal actually took over synchronizing of the receiver, causing the direct path signal to appear with weaker intensity to the left of its normal position on the face of the cathode-ray tube. This is an unusual occurrence.

This same condition prevails near the many bridges around New York City. Its effect extends for about ½ mile from the larger bridges, such as the Whitestone and George Washington bridges.

The photograph of Fig. 19 illustrates this negative ghost wherein the lettering appears displaced well to the right of the picture and seems to be white instead of the original black.

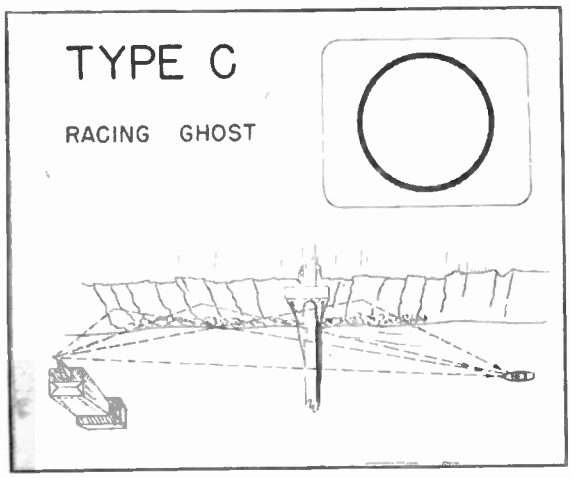


FIG. 16. RACING GHOST, PROBABLY CAUSED BY OUT-OF-PHASE RECEPTION OF SEVERAL REFLECTED SIGNALS

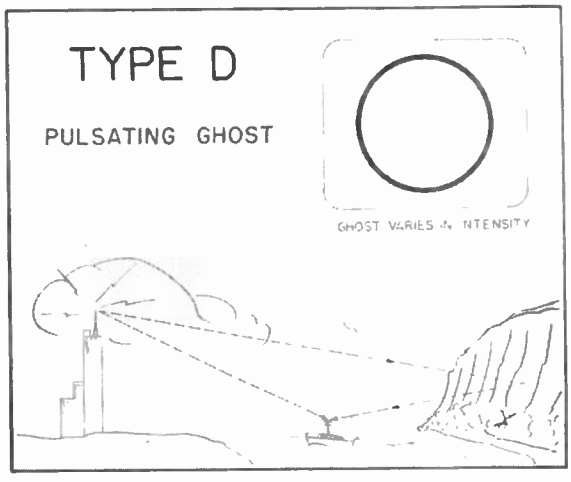


FIG. 17. PULSATING GHOST DUE TO REFLECTION BEATING IN AND OUT OF PHASE WITH DIRECT PATH SIGNAL

Type E — Negative Ghost ★ Under some conditions, a main image, say of a black signal, can be observed while a ghost image appears displaced some distance to the right, the ghost image being white instead of black, thus being reversed in polarity. Out-of-phase signals combined with a gray field produce reversed intensity which is frequently observed, as in Fig. 18. Another simple way of observing such a ghost pattern is the appearance of the horizontal blanking signal displaced slightly from the left side of the picture. Since this signal is no longer blacker than black, this blanking signal appears upon the normal test pattern and indicates a negative ghost appearing as a white vertical bar.

One of the locations where this has been observed is in the Hudson River above the George Washington Bridge, for a distance of about 5 miles.

Type F — Bouncing Pattern ★ 1. Sometimes a test pattern will be present which has good resolution and which has practically no displaced ghost pattern at all, but nevertheless this rather clean pattern will rise and fall in intensity. Such a pattern could be produced where the receiver gets no direct signal from the transmitter but gets two approximately equal intensity signals over approximately equal paths from rather widely separated reflecting objects, Fig. 20.

If the receiver is moving with respect to

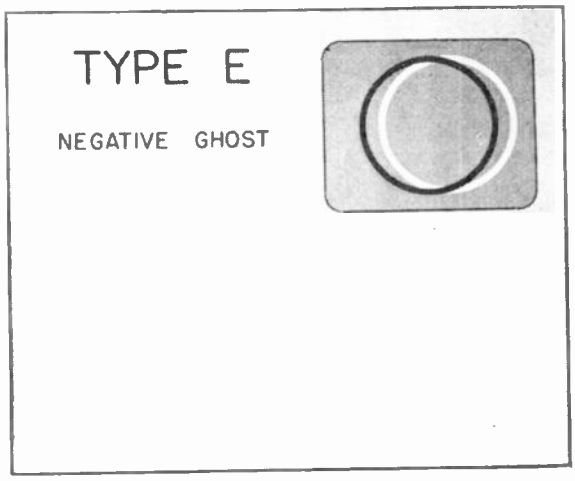


FIG. 18. OUT OF PHASE SIGNALS CAUSE A WHITE GHOST OF A BLACK IMAGE UNDER SOME SPECIAL CONDITIONS

FIG. 19. PHOTO OF AN IMAGE IN WHICH A WHITE GHOST APPEARS OFFSET TO THE RIGHT OF THE BLACK LETTERS

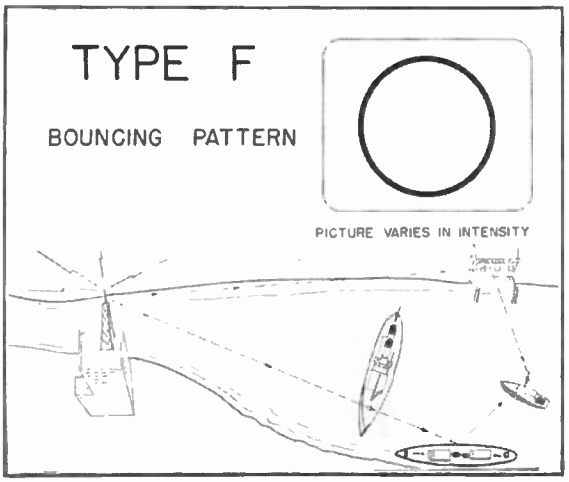


FIG. 20. WHEN A BOUNCING GHOST IS PRESENT, THE RESOLUTION IS GOOD, BUT IT CHANGES IN INTENSITY

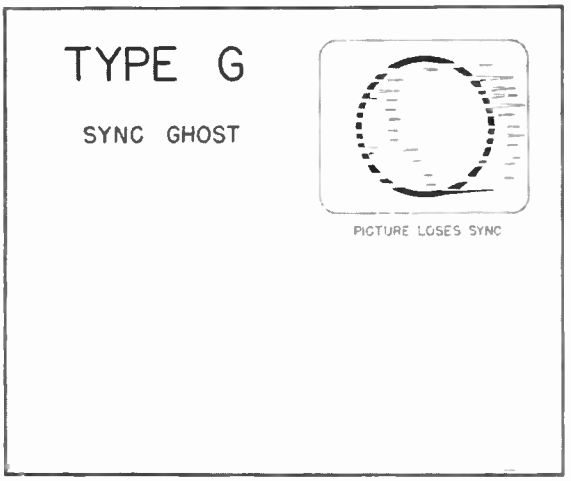
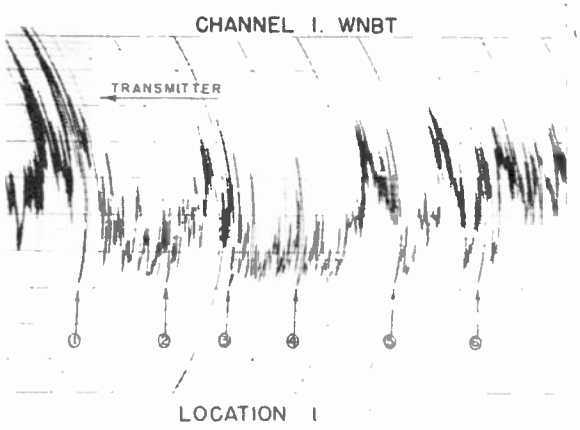


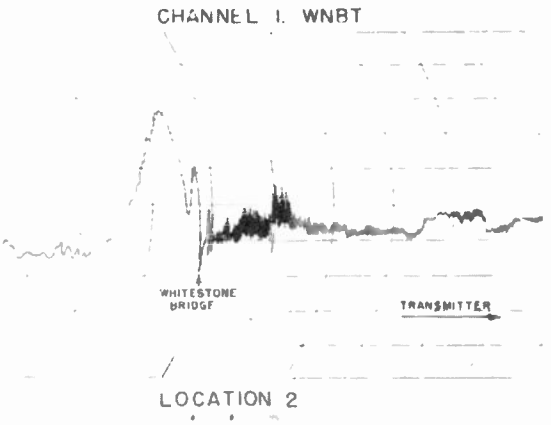
FIG. 21. SYNC GHOST OCCURS WHEN VIDEO COMPONENT IS STEADY, BUT SYNC SIGNAL CHANGES IN INTENSITY

these two objects, then the energy over these two nearly equal length paths will combine so as to give resultant energy varying over a possible value from nearly zero to approximately twice the energy of each path separately.

2. If the path difference is only slight, but insufficient to produce a predominantly visible displaced ghost, then a receiver at rest could exhibit this bouncing pattern where the pattern varies up and down in intensity if the transmitter frequency should vary slightly and periodically.

3. A bouncing pattern can be produced where energy is received directly from the transmitter over the main path and energy is also received over a path reflected by a bridge between the receiver and the transmitter and at some distance from the receiver so that the angle between these two received signals is very small. In this case the energy reflected down from the bridge may be of approximately the same magnitude as the energy over the direct path, due to the fact that the bridge received its energy with less attenuation than the





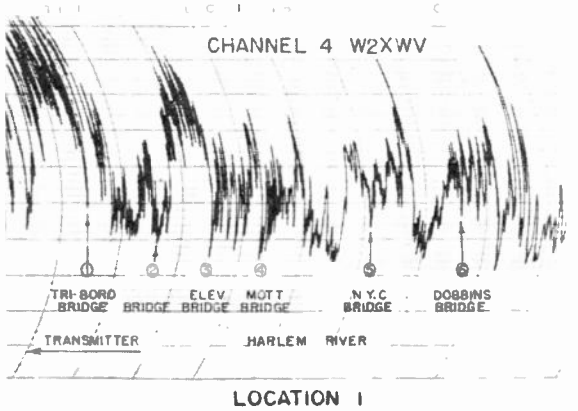


FIG. 22. FIELD STRENGTH INTENSITY RECORDED IN THE HARLEM RIVER, WHERE SHARP VARIATIONS WERE FOUND

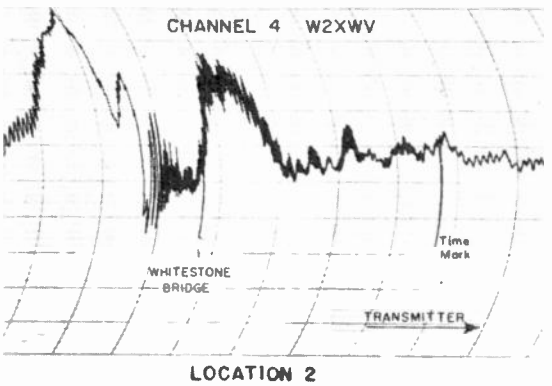


FIG. 25. CHANGE IN FIELD STRENGTH RECORDED WHEN THE BOAT PASSED UNDER WHITESTONE BRIDGE

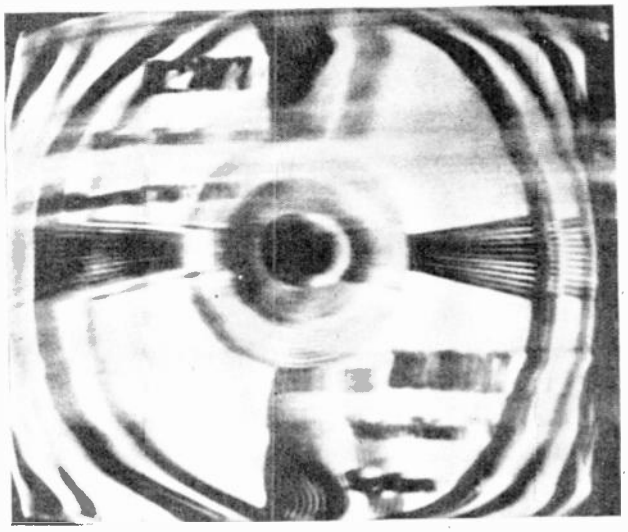


FIG. 23. PATTERN RECEIVED ON THE HARLEM RIVER

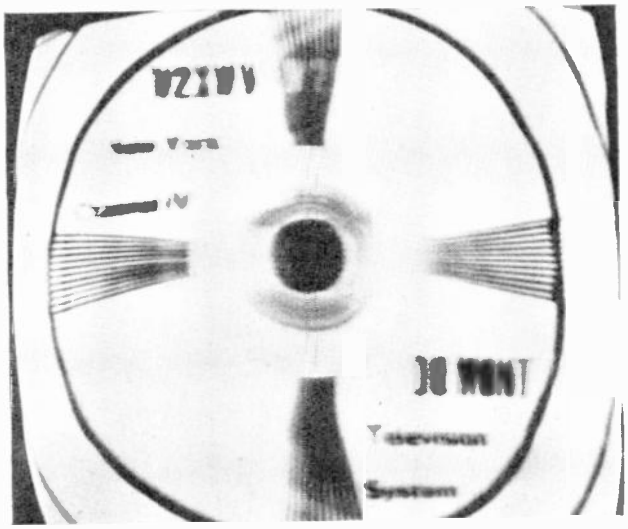
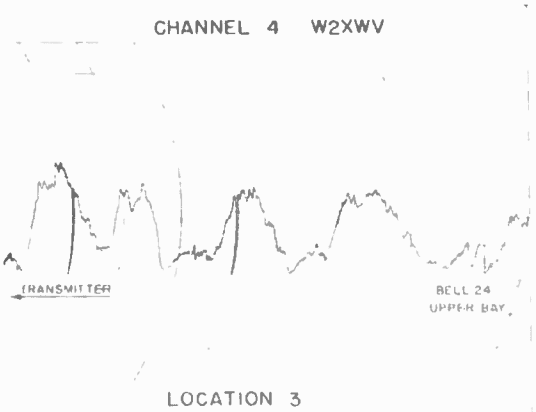


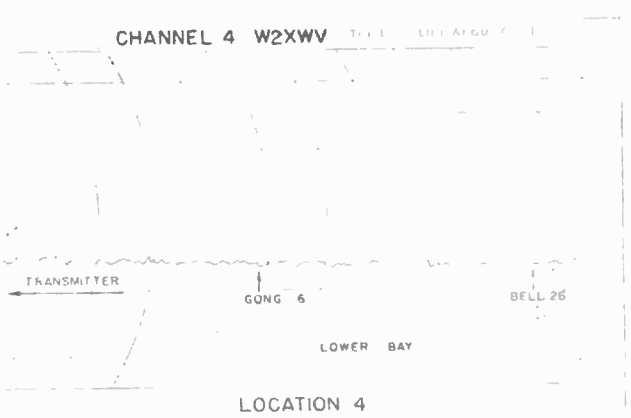
FIG. 24. PATTERN AT ANOTHER POINT ON HARLEM RIVER

energy over the direct path beneath the bridge, since a direct path would be, let us say, much closer to the salt water. The receiving antenna would accept the signals over the two paths with very little time delay between the two. Still, as the receiver antenna moves there would be a beat in and out of phase of the two carrier signals.

4. A bouncing pattern can be observed both on the direct path pattern and on ghost patterns when a receiver is at rest and a surface of reflection of secondary energy is in motion. A typical example of this type of interference has been observed where an airplane flying overhead makes a direct energy pattern go up and down in intensity. With careful observation of the interference, it sometimes can be seen that the airplane causes a displaced ghost to appear and disappear periodically, but this ghost is frequently of very low intensity compared with the main pattern.

Type G — Sync. Ghost ★ Under some conditions, it has been noticed that a pattern may have certain ghosts present, but is





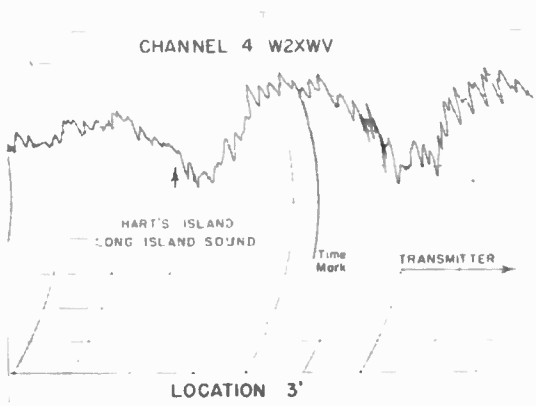


FIG. 26. RECORDINGS TAKEN AT A POINT WHERE ONLY REFLECTED SIGNALS COULD BE RECEIVED

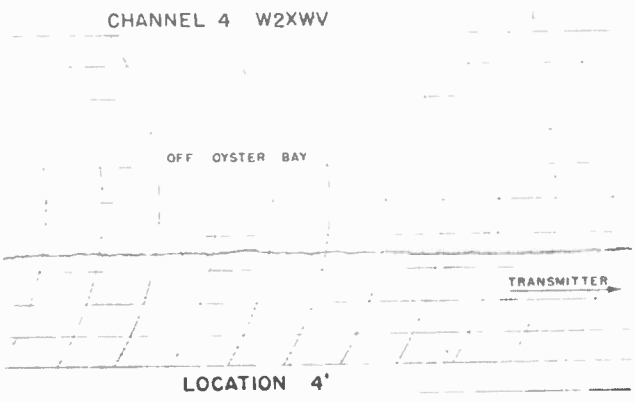
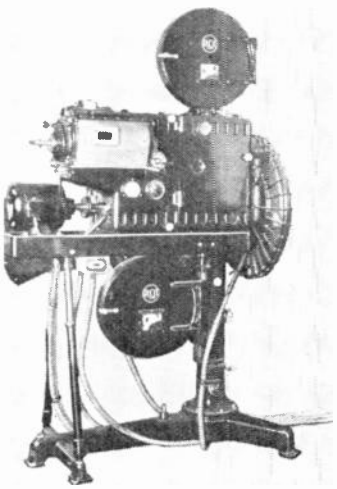


FIG. 27. RECORDINGS OF STABLE SIGNALS WHEN THE BOAT WAS IN THE CLEAR FROM THE TRANSMITTER, ABOUT 8 MILES AWAY

IN VIDEO EQUIPMENT FOR TELEVISION BROADCASTING

Portable television camera developed by RCA engineers. An improved version of earlier models, this camera uses an orthicon-type pickup tube; has a built-in view finder and focusing device.



Film projector developed by RCA television engineers. Special construction allows regular movie film (24 frames per second) to be used with 30-frame-interlaced system of television broadcasting now in use.

RCA engineers developed and first constructed nearly all of the major equipment units used in the present method of television broadcasting.

RCA engineers produced the first all-electronic synchronizing generator, the iconoscope which was the first successful studio pickup tube, the orthicon which, with its higher sensitivity, made outside pickups practical and the film projector which makes possible the use of standard movie films.

RCA engineers designed the first "broadcast type" television field pickup equipment. They established the video equipment system which is used today in a number of stations. They set up and placed in operation the first successful combination of all of these units. In short, they produced the electronic system of television as we know it today.

The experience in television broadcasting which these achievements represent goes back over fifteen years. All of these developments were "before the war." They are the things we can talk about now. They are the "pattern of the past" on which the future can be predicted.

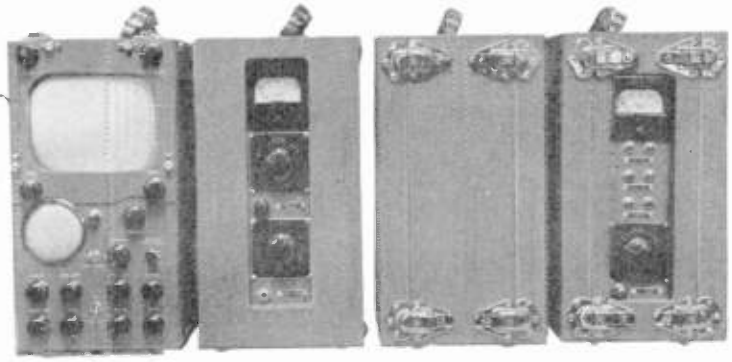
RCA BROADCAST EQUIPMENT

RCA

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION • CAMDEN, N. J.

LEADS THE WAY . . In Radio . . Television . . Tubes . . Phonographs . . Records . . Electronics



Remote television pickup equipment developed by RCA. Units of this type are presently used by NBC in regular broadcasts from Madison Square Garden — broadcasts which are picked up and rebroadcast by stations in the Philadelphia and Albany-Schenectady areas.

AFTER THE WAR THERE WILL BE MANY IMPROVEMENTS

In video equipment one of these will be a new high-sensitivity pickup. Another will be widespread use of the RCA-developed 6AC7 tube which makes possible 6 mc. band-width amplifiers with a gain of 20 per stage. There will be new cameras, new synchronizing generators, new control layouts — new equipment throughout that is simpler, more convenient and more efficient.

BUY MORE WAR BONDS

Telecasting a miniature set. De luxe studio cameras of the type shown here were built by RCA for NBC, CBS and others. These cameras use an iconoscope for pickup. Postwar cameras will use improved pickup tubes — will be smaller, lighter, less expensive.

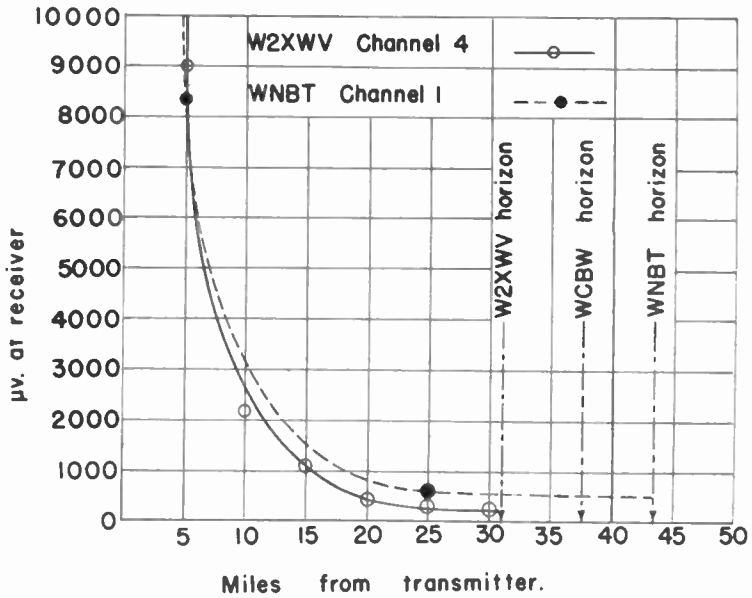


FIG. 28. MEASURED MICROVOLTS AT THE RECEIVER, FROM W2XWV, WCBW, AND WNBT

reasonably constant in intensity while the synchronizing signals come and go, Fig. 21.

This type of interference is best observed by noting the "tear-out" of the pattern horizontally which recurs cyclically and also by noting the video signals on the oscillograph. On the oscillograph, the synchronizing signals seem to go up and down in intensity while the major video components remain relatively unchanged. These distortions of the synchronizing wave forms upset the normal function of the "front porch" of the synchronizing wave forms so that the "tear-out" of the pattern is influenced by the relative blackness or whiteness of the associated lines of the picture.

For example, the relatively dark portion of the wedges in the center of a test pattern may cause "tear-out" at the point in the presence of sync. ghosts, while the relatively brighter portions of the remainder of the test pattern stay reasonably stable. The low-frequency response characteristics of the television receiver synchronizing circuit will cause certain receivers to be more susceptible than others to sync. ghost interference.

The best way to diagnose the presence of sync. ghosts is the observation of the video wave form on an oscillograph, wherein the blacker-than-black level cyclically is depleted of all signal while the picture region of the video wave forms remains relatively unchanged. A possible cause for such sync. ghosts might be the beats in and out of phase of a secondary path signal which arrives displaced in time by approximately the duration of the horizontal synchronizing signals period. The bobbing up and down of the synchronizing components may also be related to those causes of negative ghost patterns.

While the preceding analysis might lead one to believe that only one of these various types of ghosts is present at one location, actually one or more may be present.

Recordings ★ While it is impractical to reproduce the Esterline-Angus recordings in full, as some of them are in excess of 30 ft. in length, sections have been picked out for comment. The recordings and observations made on various trips show a number of interesting effects which had been suspected from the results of the installation of receivers. These may be summarized as follows:

1. From the George Washington Bridge to the Narrows, in the Hudson River,

FIG. 29. CHANNEL NO. 1 TEST PATTERN AS RECEIVED ON PREWAR TELEVISION SET OPERATED AT AVERAGE LOCATION

FIG. 30. CHANNEL NO. 2 TEST PATTERN AS RECEIVED ON PREWAR TELEVISION RECEIVER OPERATED AT AVERAGE LOCATION

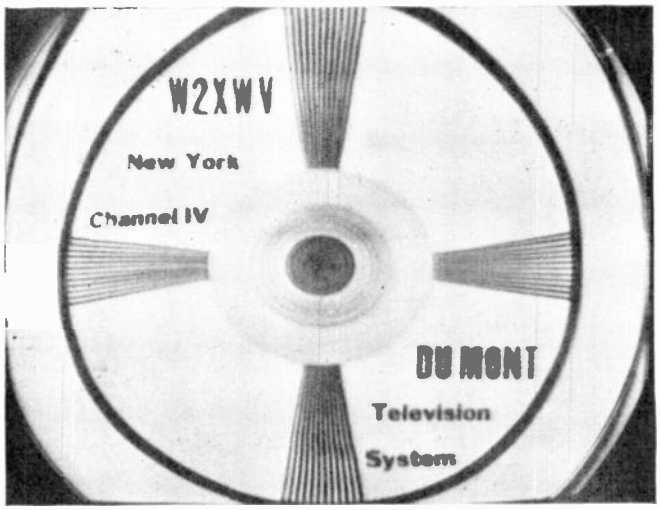


FIG. 31. CHANNEL NO. 4 TEST PATTERN AS RECEIVED ON PREWAR TELEVISION RECEIVER OPERATED AT AVERAGE LOCATION

large variations in signal strength may be expected. These variations in many cases occur within relatively short distances — not over 50 ft. In this section, secondary images of various types are prevalent for most of the distance. The same condition holds true for the entire length of the Harlem River and for the East River from the battery to the Hell Gate Bridge.

2. From the George Washington Bridge to Dobbs Ferry, in the Hudson River, the picture is smeared considerably.

3. From Dobbs Ferry northward, a ghost-free pattern is obtained, and from Hell Gate Bridge eastward out the Long Island Sound the same is true except while passing under the Whitestone Bridge, and a ghost-free pattern is also obtained from the Narrows southward.

4. In runs made to determine the maximum range of the transmitters it was found that with a ratio of 2 to 1 between the video and audio transmitter the best balance between them was obtained.

5. No difficulty was experienced with synchronization at extreme distances even when the video signal could be just observed.

6. Secondary images became progressively worse on the stations operating on the higher frequencies.

In Fig. 22 is shown a typical recording made in the Harlem River on Channel No. 1 and Channel No. 4. It will be observed that variations in signal strength of up to 500% may be experienced in distances not over 100 ft. apart.

Figs. 23 and 24 illustrate the wide variation in quality of received signal in the Harlem River within a relatively short distance. It is apparent from Fig. 22 that, although the variations in signal strength are somewhat worse on the higher frequency Channel No. 4, the effect is quite similar on Channels No. 1 and No. 4. However, when the test patterns are observed, secondary images are considerably worse on Channel No. 4 than Channel No. 1. This is shown best by studies with motion picture film records.

In Fig. 25, a recording is shown of the signal strength variation on Channel No. 1 and Channel No. 4 when passing under the Whitestone Bridge. It will be noticed that the increase in signal strength of the reflected signal is considerably greater for Channel No. 4 than for Channel No. 1. This is also confirmed by noting the test patterns in which the density of the direct and reflected patterns can be observed.

Fig. 26 shows a typical recording obtained where the transmitter is shielded from the receiver, thus providing no direct signal.

In Fig. 27 are recordings taken in Long Island Sound, off Oyster Bay, and in lower New York Bay. The variations are typical of the signal at distances greater than approximately 8 miles from the transmitters in Manhattan.

The field patterns produced by the transmitters on Channels No. 1 and No. 4 have been averaged from the recorded signal strengths. The actual recordings show extreme variations in regions where buildings cause multi-path reception. An average signal drawn through these curves indicates a satisfactory field strength to distances of 35 miles in most directions. Wherever there is a receiving location free of large obstacles and relatively free of local interference, good pictures can be expected. A study of the unobstructed field strength can be obtained best from the recordings taken on the second trip, illustrated in Fig. 6, going from Hell Gate Bridge out in Long Island Sound to Huntington. Measurements were made of the equivalent signal generator microvolts required to give the same recorder deflection as that produced by the antenna shown in Fig. 5, connected to the television receiver.

Fig. 28 shows this average field strength measured out Long Island Sound from Station W2XWV, Channel No. 4, and Station WNBT, Channel No. 1. It is difficult to arrive at a figure of absolute microvolts-per-meter, since the characteristics of the antenna and transmission line are not completely accounted for in this method of field strength measurement. However, the curves indicate very accurately the signal strength available for operation of the average television receiver.

Multipath Effects on FM Sound Channel ★ The quality of the FM sound accompanying the picture transmissions has been studied along with the picture signal strength recordings and photographic picture records. It was found that the sound quality varies tremendously in territories where picture multipath conditions exist. As would be expected, the sound intensity varies over a rather wide range in a relatively short distance of motion of the receiving antenna.

However, a much more serious condition was observed wherein the FM sound quality was found to be permanently degraded for certain fixed locations of a receiving antenna. This degradation of the sound quality is to be expected with frequency modulation transmission when multipath conditions exist. The sound becomes quite distorted as though an over-load condition existed, even at a low sound level.

Let us consider, for example, the condition where a main signal arrives at the antenna over path $P1$ which has a total path length $d1$. When a second path $P2$, having a path distance $d2$, provides con-

FIGS. 32 AND 33. EXAMPLES OF PICTURE QUALITY AVAILABLE ON RECENT TELEVISION PROGRAM TRANSMISSIONS

siderable energy to the receiving antenna, the FM receiver will respond to the summation voltage from these two signals. If $d2 - d1 = \Delta d$, and Δd is of the order of 1,000 meters, then this will be 200 wavelengths of the rest frequency of an FM transmitter whose wavelength is 5 meters or 60 mc.

In this case, both signals will arrive in phase with one another and will reinforce each other to provide a strong receiver signal. However, a slight displacement of the receiving antenna to a new location will cause a change in Δd say of half a wavelength, and the two signals then arrive out of phase and if each is of approximately the same magnitude they can practically cancel each other. Unfortunately where frequency modulation transmission is present the swing in frequency of the transmitter can cause this same effect of successive reinforcement or cancellation as is experienced with a small displacement of the receiving antenna.

This condition becomes most critical when Δd is a number of wavelengths plus a fraction of a wavelength, such that the resulting receiver signal is just above the limiter level. Now when the audio modulation is applied at the transmitter the frequency swing will cause the receiver signal to be reinforced on one phase of its swing and cause the signal to be annulled on the other phase of the swing to such an extent that the limiter momentarily goes out of operation. When this happens a very serious distortion occurs.

In effect, the multipath conditions literally transform the constant-amplitude, variable-frequency radiated signal into a signal which is variable in amplitude and variable in frequency, thus making it impossible for the receiver to take this signal and utilize it for high quality reproduction through its limiters and sloping discriminator. The presence of several multipath signals unfortunately does not offer a smooth discriminator slope in its generation of amplitude modulation upon the carrier.

Multipath conditions are common in which two signals of approximately equal strength arrive at a receiving antenna and therefore this type of distortion with FM sound transmission can be expected to occur frequently.

In a region where multipath conditions exist, it is difficult to find any one location for the receiving antenna where good sound quality is available from several different FM stations.

Since this distortion of FM sound is related to the phase shift between two signals arriving over different paths, then the distortion will prove more serious on shorter wavelength stations such as the higher television channels than on the television Channel No. 1 or the present FM broadcast channels.

The time delay of 5 to 50 microseconds between signal over one path and signal over another path gives very little noticeable distortion to the audio signals as such, since this time interval is quite short in comparison with the period of the highest audio frequencies in use.

In the past several years, transmissions were first made on amplitude modulation and then with modification of standards frequency modulation has been employed on the sound channel. Field tests generally have shown satisfactory sound reception in most cases, but in a number of cases reports from the field indicate that the sound quality is worse with FM transmission than it was previously with the AM transmission. It is therefore worth while to seriously consider the fundamental advantage of amplitude modulation transmission of the sound to regions where multipath conditions abound.

Fortunately amplitude modulation sound transmission is free of some of these distortions. If the receiving antenna receives appreciable energy, then the antenna is not subject to this pseudo-displacement by a fraction of the wavelength in position which is experienced with the FM reception.

Multipath Effects on Color ★ Just before the war started considerable field experimentation was carried on with color television. Only a few complete color receivers were operated in the field though many receivers were provided which could receive these transmissions in black and white. Although a complete study of color reception in multipath receiving locations has not been made, the multiple images in color become even more serious than multiple images in black and white due to the improper blending of colors at the receiver. For example, a green portion of a main pattern may have superposed upon it a red portion of a displaced ghost pattern causing both patterns to be rendered in false colors.

Since multipath problems become more serious at the higher frequencies it is expected that the best color transmissions will be possible on the lower frequency channels.

FM Video Transmissions ★ A few test transmissions have been made using frequency modulation on the video transmitter. Reasonably good reception was experienced where only a crisp direct path signal was received. However in the presence of multi-path received signals the frequency modulation transmission of pictures proved very unsatisfactory. This is to be expected since the much wider frequency shift with pictures augments the difficulties already outlined for sound transmission. Under certain multi-path conditions, a change in level from black to white would cause the receiver detected signal to go through several null voltages

while the transmitter is making a uniform frequency swing over its 4-mc. range.

Obviously, these distorted wave forms cannot reproduce a crisp undistorted picture. The appearance of the ghost patterns produced when frequency modulation of the video is employed shows displaced images of about the same displacement as with amplitude modulation but much more prominent in contrast. For multi-path pictures received by AM that could be considered reasonably satisfactory, the corresponding FM pictures were hopelessly degraded.

Frequency modulation, with its higher transmitter efficiency does prove promising for relay transmission purposes, where both the transmitting and receiving locations can be suitably chosen to have very little multi-path difficulty.

Television Conclusions ★ By way of summary the following points are presented:

1. The primary obstacle to be overcome is the secondary images (ghosts) which become worse with higher frequencies.

2. Diathermy interference is worse on Channel No. 1 than on Channel No. 4. Although generally not serious, a plan should be worked out to gradually eliminate it.

3. Auto ignition is not particularly serious and can usually be corrected by antenna design or location.

4. Natural atmospherics are only noticeable at extreme ranges.

5. Particular attention must be paid to antenna design to cover a wide frequency-band and reduce secondary images.

6. Particular attention must be paid to the type of lead in used, so as not to discriminate against the higher frequency stations.

7. In practice, a power ratio of 2 to 1 of the video transmitted power to the audio power works out satisfactorily.

8. Synchronism difficulties with either type pulse are minor, even at extreme ranges.

9. No interference between stations has been detected.

10. Increased transmitter power will reduce present troubles very materially.

The major portion of this paper may have given certain readers the impression that television is not very practical due to the multipath conditions. However this is far from true since a great many locations in and around New York are excellently suited for the reception of good programs from the three existing New York transmitters. The enthusiastic listener response to the rather extensive programs which were possible before the war and the somewhat curtailed programs of the present time indicate that television is very satisfactory as a medium of entertainment and education. Figs. 29, 30 and 31 illustrate the test pattern reception available from the three New York transmitters as photographed recently from a pre-war receiver in an average location. While still further improvement in quality of reception can be obtained the pictures are quite satisfactory.

Figs. 32 and 33 illustrate the picture quality available via television in recent transmissions.

Television in New York is technically ready to render an excellent service within the present standards, and is awaiting an opportunity to resume its expansion with improved transmitting and receiving equipments and extended programs when war conditions permit it.

FM BROADCASTING NOTES

AT THE Chicago meeting of RTPB Panel 5, considerable progress was made in settling the essential problems of future FM broadcasting. On April 11th, the following resolutions were passed:

1. It was resolved to accept the Committee's recommendation to retain the present FM spectrum position, subject to advice, requested by resolution, from Dr. J. H. Dellinger of the Bureau of Standards as to the spectrum position where the least sun-spot phenomena will occur.

2. The Committee recommendation was adopted to retain the present 200-kc. channel width for FM.

3. The Committee recommendation was adopted for a minimum of 80 to 100 FM broadcasting channels in a continuous band of frequencies.

4. Horizontal polarization was adopted as standard for FM broadcasting station antennas.

5. The frequency of 8.25 mc. was adopted as standard for the IF circuits of FM receivers.

6. A motion was adopted requesting authority to change the Panel name from "VHF Broadcasting" to "FM Broadcasting."

It was decided that the FM broadcasting band should start in the vicinity of 40 mc. unless the report to be submitted by Dr. Dellinger should indicate that this would put FM in a section of the spectrum that might be seriously affected by sun-spot phenomena. The expectation is that his report will not call for a change.

The sun-spot cycle extends over a period of 11 years. During this length of time, there may be interference from that source, but it is not likely that, expressed in percentage of time, it would be any more serious than the existence of thunder storms of sufficient severity to wipe out present AM reception.

The minutes of the meeting brought out a number of very interesting points, and comments were made that would be well worth publishing. However, Dr. W. R. G. Baker was quite definite in saying that no official information is being given out for publication prior to the conclusion of the final reports. The principal reason for this is that, in the course of RTPB deliberations, decisions may be altered, and the release of anything prior to the final reports would result in confusion.

The American Network, Inc., is going to build and operate four FM stations, according to an announcement which followed the directors' meeting on April 21st, in New York City.

American Network directors have approved a lease for space on the roof of the LaSalle-Wacker Building for their Chicago station. In addition, a transmitter site has been purchased for a station in Washington, although the address was not disclosed. These, with stations in New York City and Los Angeles, will be the key points of the net.

Four new operating companies have been elected to ANI membership. These are: WCAE, Inc., operating WCAE in Pittsburgh; WFBM, Inc., operating WFBM in Indianapolis; The Worcester Broadcasting Corporation, operating KFMB in San Diego; and O. L. Taylor, who recently purchased KTOK in Oklahoma City.

The original plans of ANI called for members in 40 principal market areas. At the April meeting, however, it was voted to accept memberships from 11 additional markets. These are:

San Diego, Calif.
Charleston, W. Va.
Duluth, Minn., including Superior
Scranton, Pa., including Wilkes-Barre
Tampa, Fla.
Allentown, Pa., including Bethlehem and Easton
Miami, Fla.
Jacksonville, Fla.
Mobile, Ala.
Salt Lake City, Utah
Syracuse, N. Y.

The American Network is already represented in 25 of the 51 markets in which the net will eventually have member stations. Considerable interest has been shown by operators in areas not included in the 51 principal markets. Accordingly, an affiliation contract is being drawn up to take care of the special situations.

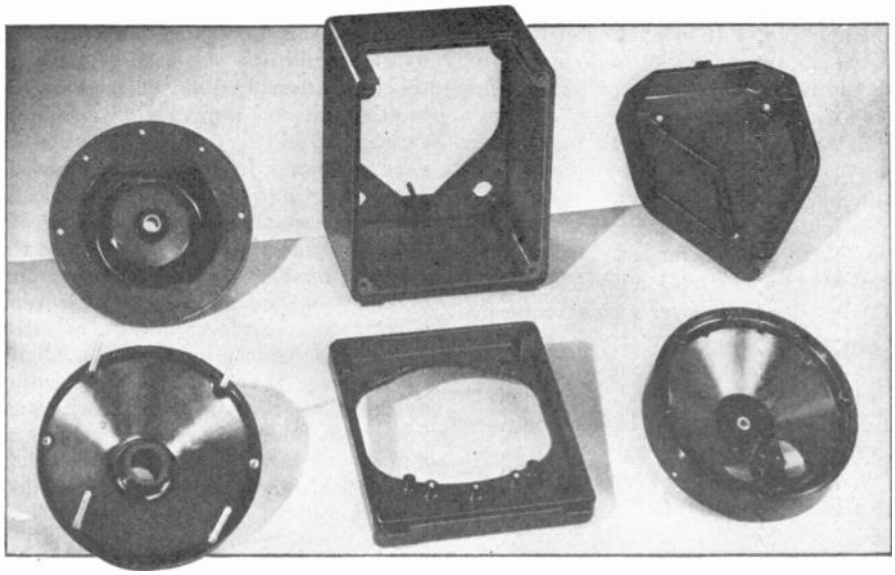


FIG. 2. AN INTERESTING EXAMPLE OF DESIGN FOR A MOLDED INSTRUMENT CASE

RADIO DESIGNERS' ITEMS

Notes on Methods and Products of Importance to Design Engineers

Molded Parts: Two very interesting examples of Bakelite molding are shown in Figs. 1 and 2. The first is a one-piece spherical coil form, approximately 5 ins. in diameter, weighing 1 lb. A study of this piece will reveal the complexity of mold design. At first thought, it would seem as if the side-draws would have been solid pieces between the ribs. Actually, however, each side-draw included one rib and half the space on each side. The parting lines run half-way between the ribs. This gives clean, smooth surfaces to the outer contour of the ribs, where the wire is wound.

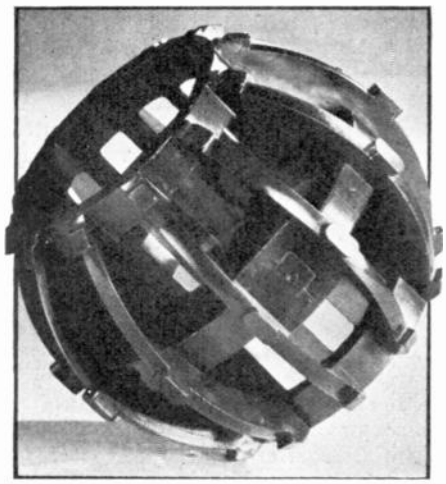


FIG. 1. ONE-PIECE MOLDED COIL FORM

This piece, one of the largest ever molded from Bakelite low-loss phenolic, shows that this material is admirably suited to the most complicated parts. The steel mold employed weighs 700 lbs., and is made up of 12 distinct sections. American Insulator Corporation, New Freedom, Pa., is producing this part.

Elements of a well-designed case, molded of Bakelite impact-resistant phenolic, are illustrated in Fig. 2. Used for James G. Bidde's Megger insulation testers, it is shown here because it suggests various applications of molding to cases for radio and associated apparatus. The parts follow the best design practice in the use of rounded or filleted corners, reinforcements for corner screws, and ribbing for reinforcements which are economical of material. Additional strength is provided by making the round closures conical rather than flat. Note also that mounting feet are molded on the bottom of the case and end plate. The end plate is located on the case by a raised surface which fits into the case, and makes the joint practically dust-proof. These parts are produced by Chicago Molded Products Corporation, 1025 N. Kolmer Street, Chicago.

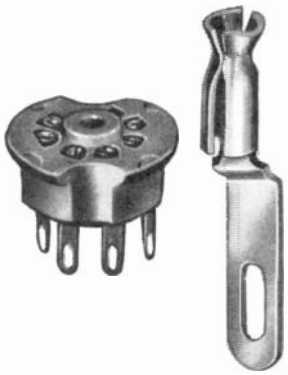


FIG. 3. MINIATURE SOCKET AND ENLARGED DETAIL OF BERYLLIUM COPPER CONTACT

Miniature Socket: Designed and developed at the Ft. Monmouth Signal Corps Laboratories, the miniature socket in Fig. 3 is now being produced by Hugh H. Ely, 18 W. Chilton Avenue, Philadelphia 44. An enlarged view of the "Micro-Processed" beryllium copper contacts shows the construction. Contacts are heavily silver-plated for low contact resistance.

These sockets are made in two types. One employs Navy grade G cast Steatite. Capacity is 1.5 mmf. or less at 10 mc. and loss factor is .016 or less when tested in accordance with specification ASTM D 150-42T. The second type is of mica-filled plastic. It has a capacity of 5 mmf. or less at 10 mc., and a loss factor, under the same test, of .05 or less.

New Condenser Standards: The A.S.A. has completed a standard for fixed ceramic-dielectric condensers of the temperature-compensating type. It covers classification of condensers, material, workmanship, general and detailed requirements, methods of sampling, inspection, and tests. Both the Radio Division, Bureau of Ships, and the Signal Corps have adopted this standard. Copies can be ordered under the title C75.12-1944, price 35 cents, from American Standards Association, 29 W. 39th Street, New York City 18.

Regulated Power Supply: A series of three AC-operated, regulated power supplies has been introduced by the Radio-Television Institute, Inc., 480 Lexington Ave., New York City 17. The model shown in Fig. 4 has a DC output continuously variable from 0 to 300 volts. At the high-voltage end, the drop is only .2 volt with .1 ampere output, and less than .1 volt drop at the low-voltage end with .1 ampere output. Hum is less than .012 volt R.M.S.

FIG. 4. REGULATED DC POWER SUPPLY

Prices drop on these Six Eimac Tubes

Vacuum tubes are now being massed produced on a vast scale at Eimac. The use of new manufacturing techniques has effected great savings which Eimac is passing along to users. The new prices listed below are now in effect.

	Old Price	New Price
304-TH	$ ~~65.00~~	$ 50.00
304-TL	~~65.00~~	50.00
450-TH	~~75.00~~	60.00
450-TL	~~75.00~~	60.00
750-TL	~~175.00~~	135.00
1000-T	~~175.00~~	100.00
1500-T	~~225.00~~	185.00
2000-T	~~300.00~~	225.00

Write today for new price sheet which covers these changes and provides essential data on all Eimac tubes. Remember Eimac tubes are first choice of leading engineers throughout the world . . . first in the new developments in electronics.

EITEL-McCULLOUGH, INC., 801 San Mateo Ave., SAN BRUNO, CALIF.

Plants located at San Bruno, California and Salt Lake City, Utah

Follow the leaders to **Eimac** **TUBES**

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at any output voltage and with full load.

The second model, designed as a filament supply for laboratory or production testing, delivers 1. to 1.5 volts at .5 ampere. Hum content is less than .002 volt.

A third model, about the same size and weight as a standard B battery, delivers a regulated output of .04 ampere at 45 volts.

Miniature Tube: Type 6J4 is a new miniature UHF amplifier triode, of the grounded-grid type, announced by RCA.

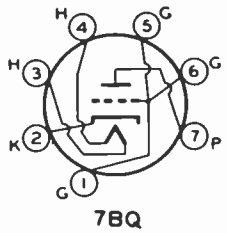

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FIG. 5. TERMINAL ARRANGEMENT OF THE 6J4

It is a heater-cathode type of miniature triode for use primarily as a grounded-grid UHF amplifier at frequencies up to approximately 500 mc. An amplification factor of 55 is combined with an extremely high transconductance of 12,000 micromhos, permitting grounded-grid operation with a high signal-to-noise ratio. The 6J4 can also be used in conventional triode circuits with ungrounded grid.

In grounded-grid service, the grid of the 6J4 functions as a shield between cathode and plate, and the input signal is applied to the cathode. The input circuit, therefore, is between cathode and the grounded grid; and the output circuit is between plate and the grounded grid. To keep the capacitance low between cathode and plate, and thus reduce undesirable feed-back effects, use is made of internal shielding connected to the grid. The grid is provided with three terminals for effective grounding with the minimum of reactance, as shown in Fig. 5.

Following are the general specifications, in brief: AC or DC heater voltage is 6.3 volts, at .4 ampere. Direct interelectrode capacity, with a close-fitting shield connected to the grid:

Plate to cathode and heater
$C'_{p\,(k+h)}$ = .24 mmf. max.
Grid to cathode and heater
$C'_{g\,(k+h)}$ = 5.5 mmf. max.
Grid to plate
C_{gp} = 4. mmf. max.
Heater to cathode
C'_{hk} = 2.8 mmf. max.

Maximum overall length, 2⅛ ins.; seated height, 1⅞ ins.; diameter, ¾ in.; bulb T-5½; base, miniature button 7-pin; can be mounted in any position.

Plate voltage, max.	150 volts
Plate dissipation, max.	2.25 watts
Plate current, max.	20 milliamp.
DC heater-cathode potential, max.	90 volts

Typical operation and characteristics as grounded-grid Class A_1 amplifier:

Plate volts	100	150
Cathode bias resistor, ohms (suitably by-passed)	100	100
Amplification factor	55	55
Plate resistance, ohms	5,000	4,500
Transconductance, micromhos	11,000	12,000
Plate current, milliamps.	10	15

Voltage Regulator Tubes: Types OA3/VR75, OC3/VR105, and OD3/VR150 are new voltage regulators, announced by RCA.

Of the cold-cathode, glow-discharge type, they are intended for use as voltage regulators in applications where it is necessary to maintain constant DC output voltage across a load, independent of load current and moderate line-voltage variations. Like other glow-discharge

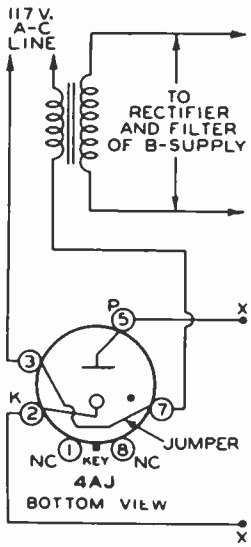

FIG. 6. TERMINALS OF THE REGULATOR TUBES

tubes, they can be used also as relaxation oscillators, and for spark-over protection. The approximate DC operating voltage maintained by the types listed above is, respectively, 75, 105, and 150 volts.

Following are the general specifications, in brief: maximum overall length, 4⅛ ins.; seated height, 3 9/16 ins.; diameter, 1 9/16 ins.; bulb, ST-12; base, small shell 6-pin octal; can be mounted in any position.

These tubes fit standard octal sockets. In each type, base pins No. 3 and No. 7 are connected together by a jumper within the base. This jumper may be connected in series with the primary of the transformer supplying power for the equipment utilizing the voltage-regulator tube, to provide a safety interlock which will open the primary circuit if the tube is removed from its socket, thus preventing the application of abnormal voltages to the regulated tubes in the equipment. Connections are shown in the diagram of the pin connections.

HF Relay: The relay shown in Fig. 7 is insulated with Mycalex so that it can be used to transfer HF circuits. It is intended

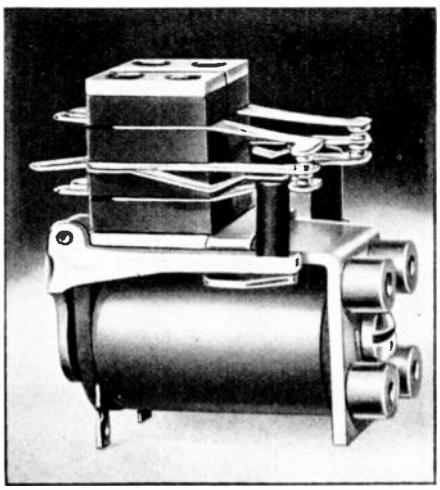

FIG. 7. HF RELAY HAS MYCALEX INSULATION

to withstand the standard salt spray test, and the coil is sealed against moisture with cellulose acetate. Palladium or silver contacts are furnished, according to specification. The construction is designed to withstand shock and vibration up to 10 G. A variety of contact arrangements are available. Without contact pile-ups, the weight is 1½ oz., and the dimensions are 1 7/16 ins. long, 1 5/16 in. wide, 1 1/16 ins. high. The relay is mounted by four tapped studs. Manufactured by Allied Control Company, Inc., 2 East End Avenue, New York City 21.

(CONTINUED ON PAGE 58)

	OA3/VR75	OC3/VR105	OD3/VR150
DC anode supply, volts min. (to assure starting)	105	133	185
DC current, continuous, milliamp.	40 max. / 5 min.	40 max. / 5 min.	40 max. / 5 min.
Ambient temperature, °C.	−55 to 90	−55 to 90	−55 to 90
DC starting voltage, approx., volts	100	115	160
DC operating voltage, approx., volts	75	105	150
Regulation, 5 to 30 milliamp., volts	3	1	2
Regulation, 5 to 40 milliamp., volts	5	2	4

JENSEN RADIO MANUFACTURING COMPANY, 6601 S. LARAMIE AVE., CHICAGO 38, U. S. A.

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The Radio Engineers' & Purchasing Agents' Guide to Essential Materials, Components, and Equipment

★ Indicates advertiser in this issue of FM and TELEVISION

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HARTFORD
Hatry & Young, 203 Ann St.
Scell & Co., 227 Asylum St.
NEW HAVEN, Hatry & Young, 1172 Chapel St.

DISTRICT OF COLUMBIA
WASHINGTON, Southern Wholesalers, Inc., 1519 L St. N. W.

GEORGIA
ATLANTA
★ Lafayette Radio Corp., 265 Peachtree St.
Yancey Co., Inc., W. Peachtree St.
MACON, Specialty Dist. Co.
SAVANNAH, Specialty Dist. Co.

ILLINOIS
CHICAGO
Allied Radio Corp., 833 W. Jackson Blvd.
Chicago Radio App. Co., 4155 S. Dearborn St.
★ Lafayette Radio Corp., 901 W. Jackson Blvd.
Radio Parts Co., 612 W. Randolph St.
Walker-Jimieson, Inc., 311 S. Western Ave.
ELGIN, Fox Elec. Supply Co., 67 N. State St.
PEORIA, Klaus Radio & Elec. Co., Main St.

INDIANA
INDIANAPOLIS, Kiefer-Stewart Co., W. Georgia St.

IOWA
CEDAR RAPIDS, Checker Elec. Supply, Inc., 1st S. E.
DAVENPORT, Midwest-Timmerman Co., Western Ave.

KENTUCKY
LOUISVILLE, Smith Dist. Co., E. B'way

MARYLAND
BALTIMORE, D & H Distributing Co., 202 S. Pulaski St.

MASSACHUSETTS
BOSTON, Radio Wire Television, Inc., 110 Federal St.
CAMBRIDGE, Eastern Co.
SPRINGFIELD, Cushing, T. F.
WORCESTER, Radio Maint. Supply Co.

MICHIGAN
FLINT, Shand Radio Spec., W. Kearsley St.

MISSOURI
★ KANSAS CITY, Burstein Applebee Co., 1012 McGee St.
ST. LOUIS, Interstate Supply Co., 10th & Walnuts Sts.

NEW JERSEY
NEWARK
Radio Wire Television, Inc., 24 Central Ave.
Krich-Radisco, Inc., 422 Elizabeth Ave.
Lippman & Co., Aaron, 246 Central Ave.

NEW YORK
BINGHAMTON, Morris Distributing Co., Inc., 25 Henry St.
GLOVERSVILLE, Fulton County Dist. Co.
ITHACA, Stallman of Ithaca, N. Tioga St.
NEW YORK
Bruno-New York, Inc., 460 W. 34th St.
Com. Radio-Sound Corp., 570 Lexington Ave.
Harrison Radio Corp., 12 W. B'way
Radio Wire Television, Inc., 100 Sixth Ave.
Sanford Electronics Corp., 136 Liberty St.
Sun Radio & Electronics Co., 212 Fulton St.
Terminal Radio Corp., 85 Cortlandt St.
SYRACUSE, Morris Distributing Co., Inc., 412 S. Clinton St.

NORTH CAROLINA
RALEIGH, Southeastern Radio Supply Co., E. Hargett St.

OHIO
CLEVELAND, Goldhamer, Inc., Huron Rd.

PENNSYLVANIA
HARRISBURG, D & H Distributing Co., 3115 Cameron St.
PHILADELPHIA, Radio Elec. Service Co., 7th & Arch Sts.
PITTSBURGH, Cameradio Co., 963 Liberty St.
WILLIAMSPORT, Williamsport Auto Parts Co.

RHODE ISLAND
PROVIDENCE, Edwards Co., W. H., 94 B'way

SOUTH DAKOTA
SIOUX FALLS, Power City Radio Co., S. Main Ave.

TENNESSEE
KNOXVILLE, McClung Co., C. M.
MEMPHIS, Bluff City Dist. Co., Union Ave.
NASHVILLE, Electra Dist. Co., W. End Ave.

TEXAS
HOUSTON, Hall, R. C. & L. F., Caroline St.

UTAH
SALT LAKE CITY, Radio Studios, Inc., E. B'way

VIRGINIA
DANVILLE, Five Forks Battery Station
RICHMOND, Wyatt-Cornick, Inc., Grace St.

WASHINGTON
SEATTLE
Seattle Radio Supply, Inc., 2nd Ave.
Sobrist Co., 2016 Third Ave.

WEST VIRGINIA
CHARLESTON, Chemcity Radio Elec. Co., E. Washington St.
MORGANTOWN, Trenton Radio Co.

WISCONSIN
RACINE, Standard Radio Parts Co., State St.

NEW LISTINGS ADDED THIS MONTH

Company addresses will be found in the Directory listings

We shall be pleased to receive suggestions as to company names and hard-to-find items which should be added to this Directory

NOTE: For the convenience of engineers and purchasing agents, we have added, under the heading "SUPPLY HOUSES," a list of parts jobbers in 48 cities. These houses carry large stocks of components, instruments, and tubes, and are prepared to fill mail or telegraph orders.

CABLES, Preformed
Wallace Mfg. Co., Wm. T.

CABLES, Microphone, Speaker & Battery
Universal Microphone Co.

CONDENSERS, Fixed
Capacitrons, Inc.

RELAYS, Small Switching
Cook Electric Co.

RELAYS, Small Telephone Type
Cook Electric Co.

SCREW MACHINE PARTS
Chicago Aviation Co.

SCREWS, Recessed Head
Manufacturers Screw Products

SCREWS, Self-Tapping
Manufacturers Screw Products

SCREWS, Set & Cap.
Manufacturers Screw Products

SCREWS, Hollow & Socket Head
Manufacturers Screw Products

SPEAKERS, Cabinet Mounting
Quam-Nichols Co.

SPEAKERS, Outdoor Type
Cinaudagraph Speakers, Inc.

TERMINALS (Turret Lugs)
Cambridge Thermionic Corp.
Manufacturers Screw Products
Ucinite Company

AIRPORT RADIO Installations

Aircraft Accessories Corp., Funston Rd., Kansas City, Kans.
Air Associates, Inc., Los Angeles, Calif.
Hendix Radio, Towson, Md.
Communications Equip. Corp., 134 Colorado St., Pasadena, Calif.
Erco Radio Labs. Inc., Hempstead, L. I., N. Y.
Radio Receptor Co., Inc., 251 W. 19 St., N. Y. C.

ANTENNAS, Mobile Whip & Collapsible

Aircraft Accessories Corp., Funston Rd., Kansas City, Kans.
Birnbach Radio Co., 145 Hudson St., N. Y. C.
Brach Mfg. Corp., L. S., Newark, N. J.
Camburn Elec. Co., 484 Broome St., N. Y. C.
★ Galvin Mfg. Corp., Chicago, Ill.
★ Link, F. M., 125 W. 17th St., N. Y. C.
Premax Products, 4214 Highland Ave., Niagara Falls, N. Y.
★ Radio Eng. Labs., Inc., L. I. City, N. Y.
★ Snyder Mfg. Co., Noble & Darien Sts., Phila.
Tech. Appl. Co., 516 W. 34 St., N. Y. C.
Ward Products Corp., 1523 E. 45 St., Cleveland, O.

ANTENNAS, Tower Type

Blaw-Knox Co., Pittsburgh, Pa.
Harco Steel Cons. Co., E. Broad St., Elizabeth, N. J.
Lehigh Structural Steel Co., 17 Battery Pl., N. Y. C.
★ Lingo & Son, John E., Camden, N. J.
Truscon Steel Co., Youngstown, O.
★ Wincharger Corp., Sioux City, Iowa

ATTENUATORS

Cinema Engineering Co., Burbank, Calif.
Daven Co., Summit Ave., Newark, N. J.
General Radio Co., Cambridge, Mass.
International Resistance Co., 429 Broad St., Phila.
Malbry & Co., P. R., Indianapolis, Ind.
Ohmite Mfg. Co., 4835 W. Flournoy St., Chicago
Remler Co., Ltd., 2101 Bryant St., San Francisco
Shallcross Mfg. Co., Collingdale, Pa.
Tech Laboratories, Lincoln St., Jersey City, N. J.
Utah Radio Prod. Co., 842 Orleans St., Chicago

BEADS, Insulating

Amer. Lava Corp., Chattanooga, Tenn.
Corning Glass Works, Corning, N. Y.
Dunn, Inc., Struthers, 1321 Cherry, Phila., Pa.
Star Porcelain Co., Trenton, N. J.
Steward Mfg. Co., Chattanooga, Tenn.

BEARINGS, Glass Instrument

Bird, Richard H., Waltham, Mass.

BINDING POSTS, Plain

Amer. Hdware Co., 476 B'way, N. Y. C.
Franklin Mfg. Corp., 175 Varick St., N. Y. C.
Radex Corp., 1308 Elston Ave., Chicago

BINDING POSTS, Push Type

Amer. Radio Hdware Co., 476 B'way, N. Y. C.
Eby, Inc., H. H., W. Chelten Ave., Phila.

BLOWERS, for Radio Equipment

L-R Mfg. Co., Torrington, Conn.
Trade-Wind Motorfans, Inc., 5725 S. Main St., Los Angeles

BOOKS on Radio & Electronics

Macmillan Co., 60 Fifth Ave., N. Y. C.
Maedel Pub. House, 593AE 38 St., Bklyn, N. Y.
McGraw-Hill Book Co., 330 W. 42 St., N. Y. C.
Pitman Pub. Corp., 2 W. 45 St., N. Y. C.
Radio Tech. Pub. Co., 45 Astor Pl., N. Y. C.
Rider, John F., 404 Fourth Ave., N. Y. C.
Ronald Press Co., 15 E. 26 St., N. Y. C.
Van Nostrand Co., D., 250 Fourth Ave., N. Y. C.
Wiley & Sons, John, 440 Fourth Ave., N. Y. C.

BRIDGES, Percent Limit Resistance

Leeds & Northrup Co., 4901 Stenton Ave., Phila.
★ Radio City Products Co., 127 W. 26 St., N. Y. C.
Shallcross Mfg. Co., Collingdale, Pa.

BRIDGES, Wheatstone

Industrial Instruments, Inc., Culver Ave., Jersey City, N. J.
Leeds & Northrup Co., 4901 Stenton Ave., Phila.
Shallcross Mfg. Co., Collingdale, Pa.

BUSHINGS, Hermetic Sealing

Corning Glass Works, Corning, N. Y.
Westinghouse Elect. & Mfg. Co., E. Pittsburgh, Pa.

BUSHINGS, Terminal Sealing

Corning Glass Works, Corning, N. Y.
Peerless Electrical Prod. Co., 6920 McKinley Ave., Los Angeles 1
Westinghouse Elect. & Mfg. Co., E. Pittsburgh, Pa.

CABINETS, Metal

Par-Metal Prod. Corp., 32-49th St., L. I. City, N. Y.
Insuline Corp. of Amer., Long Island City, N. Y.

CABINETS, Wood, for Home Radios

Churchill Cabinet Co., 2119 Churchill St., Chicago
Tillotson Furniture Co., Jamestown, N. Y.

CABLE, Coaxial

American Phenolic Corp., 1830 S. 54 Av., Chicago
Anaconda Wire & Cable Co., 25 B'way, N. Y. C.
★ Andrew Co., Victor J., 363 E. 75 St., Chicago
Belden Mfg. Co., 4673 W. Van Buren, Chicago
Boston Insulated Wire & Cable Co., Boston
Communications Prods. Co., Jersey City, N. J.
Cornish Wire Co., 15 Park Row, N. Y. C.
Doolittle Radio, Inc., 7521 S. Loomis Blvd., Chicago
General Cable Corp., 420 Lexington, N. Y. C.
General Insulated Wire Corp., 53 Park Pl., N. Y. C.
Johnson Co., E. F., Waseca, Minn.
Lenz Electrical Mfg. Co.
Radex Corp., 1308 Elston Ave., Chicago
Simplex Wire & Cable Corp., Cambridge, Mass.

CABLE, Coaxial, Solid Dielectric

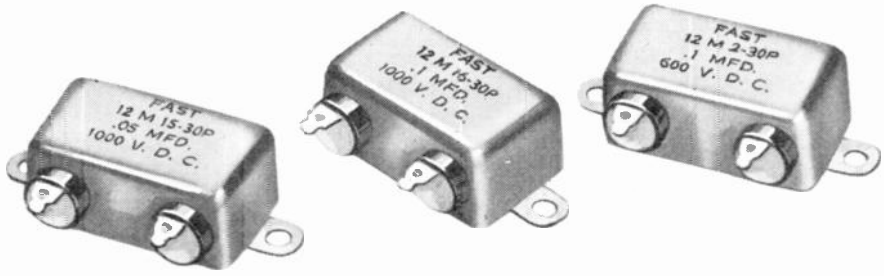
American Phenolic Corp., 1830 S. 54 Ave., Chicago
Federal Tel. & Radio Corp., E. Newark, N. J.
Simplex Wire & Cable Corp., Cambridge, Mass.

CABLE, Microphone, Speaker & Battery

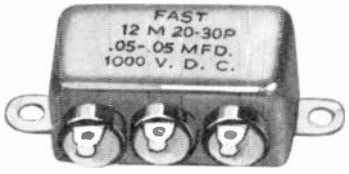
Alden Prods. Co., Brockton, Mass.
Anaconda Wire & Cable Co., 25 Broadway, N. Y. C.
Belden Mfg. Co., 4633 W. Van Buren, Chicago
Boston Insulated Wire & Cable Co., Dorchester, Mass.
Gavett Mfg. Co., Brookfield, Mass.
Holyoke Wire & Cable Corp., Holyoke, Mass.
★ Universal Microphone Co., Inglewood, Calif.

CABLES, Preformed

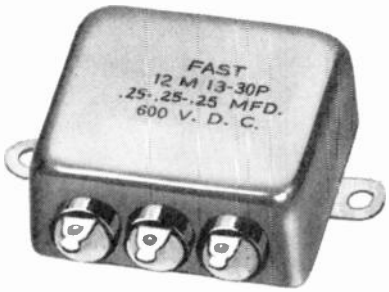
Belden Mfg. Co., 4633 W. Van Buren St., Chicago
Wallace Mfg. Co., Wm. T., Rochester, Ind.

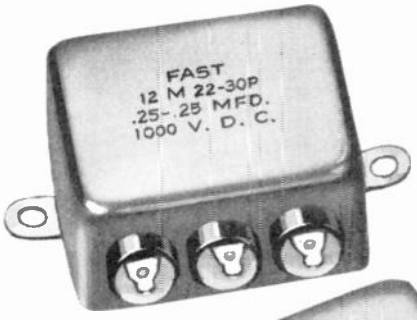


FAST CAPACITORS



FOR WAR ...and POSTWAR





Like others in the industry, we too are confronted with the postwar problem . . . BUT, we are fully conscious that VICTORY must come *first*! The important task of "getting there fustest with the mostest" is far from finished. We are making our contribution with not too much emphasis on postwar planning . . . concentrating on the production of vital parts to help win the war.

Nevertheless, we face the postwar era with confidence . . . secure in the knowledge that no job is too formidable for American ingenuity. The solution of today's problems renders tomorrow's insignificant by comparison.

The Capacitors we manufacture are critical components of numerous Radio and Electronic devices urgently needed now by our Armed Forces. Tomorrow, FAST Capacitors will be ready again for peacetime pursuits and postwar realities. May we suggest you consult us on your future requirements . . . we are certain our Quarter-Century experence will prove helpful.

"When you Think of Capacitors . . . Think FAST"

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FAST Condensers and Capacitors are produced in many types and sizes, in standard and special designs, for a great variety of electronic and electrical applications in industry. Paper Capacitors—Oil or Wax impregnated—Rectangular or Tubular—in sizes from the smallest to the largest. Units specially engineered.

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J. R. Longstaffe, Ltd., 349 Carlaw Avenue, Toronto, for Special Applications

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Tillotson Furniture Co., Jamestown, N. Y.

CASTINGS, Die

Aluminum Co. of Amer., Pittsburgh, Pa.
American Brass Co., Waterbury, Conn.
Dow Chemical Co., Dow Metal Div., Midland, Mich.

CERAMICS, Bushings, Washers, Special Shapes

Akron Porcelain Co., Akron, O.
Amer. Lava Corp., Chattanooga, Tenn.
Centralab, Div. of Globe-Union Inc., Milwaukee, Wis.
Corning Glass Works, Corning, N. Y.
Electronic Mechanics, Inc., Paterson, N. J.
Gen'l Ceramics & Steatite Corp., Keasbey, N. J.
Isolantite, Inc., Belleville, N. J.
Lapp Insulator Co., Leroy, N. Y.
Lenox, Inc., Trenton, N. J.
Louthan Mfg. Co., E. Liverpool, O.
Star Porcelain Co., Trenton, N. J.
Steward Mfg. Co., Chattanooga, Tenn.
Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.
Victor Insulator Co., Victor, N. Y.
Westinghouse Elect. & Mfg. Co., E. Pittsburgh, Pa.

CHASSIS, Metal

See STAMPINGS, Metal

CHOKES, RF

Aladdin Radio Industries, 501 W. 35th, Chicago
Alden Prods. Co., Brockton, Mass.
American Communications Corp., 306 B'way, N. Y. C.
Barker & Williamson, Upper Darby, Pa.
Coto-Coil Co., Providence, R. I.
D-X Radio Prods. Co., 1575 Milwaukee, Chicago
Gen. Winding Co., 420 W. 45 St., N. Y. C.
Guthman & Co., Edwin, 400 S. Peoria, Chicago
★ Hammarlund Mfg. Co., 424 W. 33 St., N. Y. C.
Johnson Co., E. F., Waseca, Minn.
Lectrohm, Inc., Cicero, Ill.
Meissner Mfg. Co., Mt. Carmel, Ill.
Miller Co., J. W., Los Angeles, Cal.
Muter Co., 1255 S. Michigan, Chicago
★ National Co., Malden, Mass.
Ohmite Mfg. Co., 4835 W. Flournoy St., Chicago
Radex Corp., 1328 Elston Av., Chicago
Sickles Co., F. W., Chicopee, Mass.
Teleradio Eng. Corp., 484 Broome St., N. Y. C.
Triumph Mfg. Co. 913 W. Van Buren St., Chicago

CLIPS, Connector

Mueller Electric Co., Cleveland, O.

CLIPS & MOUNTINGS, Fuse

Alden Prods. Co., Brockton, Mass.
Dante Elec. Mfg. Co., Bantam, Conn.
Ilsco Copper Tube & Prods., Inc., Station M., Cincinnati
Jefferson Elec. Co., Bellwood, Ill.
Jones, Howard B., 2300 Wabansia, Chicago
Littlefuse, Inc., 4753 Ravenswood, Chicago
Patton MacGuyer Co., Providence, R. I.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Stewart Stamping Co., 621 E. 216 St., Bronx, N. Y.
Zierick Mfg. Co., 385 Girard Ave., Bronx, N. Y. C.

CLOTH, Insulating

Acme Wire Co., New Haven, Conn.
Brand & Co., Wm., 276-4th Av., N. Y. C.
Endurette Corp. of Amer., Cliffwood, N. J.
Insulation Mfgrs. Corp., 565 W. Wash. Blvd., Chicago
Irvington Varnish & Insulating Co., Irvington, N. J.
Mica Insulator Co., 196 Varick, N. Y. C.

COIL FORMS, Glass

Corning Glass Works, Corning, N. Y.

COIL FORMS, Phenolic, Cast without Molds

Creative Plastics Corp., 963 Kent Ave., B'klyn, N. Y.

COILS, Radio

See Transformers, IF, RF

CONDENSERS, Ceramic Case Mica Transmitting

Aerovox Corp., New Bedford, Mass.
Cornell-Dubilier, S. Plainfield, N. J.
★ RCA Mfg. Co., Inc., Camden, N. J.
Sangamo Electric Co., Springfield, Ill.
Solar Mfg. Corp., Bayonne, N. J.

CONDENSERS, Fixed

Aerovox Corp., New Bedford, Mass.
American Condenser Corp., 2508 S. Michigan, Chicago
Art Radio Corp., 115 Liberty, N. Y. C.
Atlas Condenser Prods. Co., 548 Westchester Ave., N. Y. C.
Automatic Winding Co., E. Newark, N. J.
Bud Radio, Inc., Cleveland, O.
Capacitrons, Inc., 318 W. Schiller St., Chicago
Centralab, Milwaukee, Wis.
Condenser Corp. of America, South Plainfield, N. J.
Condenser Prods. Co., 1375 N. Branch, Chicago
Cornell-Dubilier Elec. Corp., S. Plainfield, N. J.
Cosmic Radio Co., 699 E. 135th St., N. Y. C.
Crowley & Co., Henry, W. Orange, N. J.
Deutschmann Corp., Tobe, Canton, Mass.
Dumont Elec. Co., 34 Hubert St., N. Y. C.
Electro-Motive Mfg. Co., Willimantic, Conn.
Erie Resistor Corp., Erie, Pa.
★ Fast & Co., John E., 3123 N. Crawford, Chicago
General Radio Co., Cambridge, Mass.
Girard-Hopkins, Oakland, Calif.
Guthman & Co., Edwin L., 15 S. Throop St., Chicago
H. R. S. Prods, 5707 W. Lake St., Chicago
Illinois Cond. Co., 1160 Howe St., Chicago
Industrial Cond. Corp., 1725 W. North Av., Chicago
Insuline Corp. of America, Long Island City, N. Y.
Johnson Co., E. F., Waseca, Minn.
Kellogg Switchb'd & Supply Co., 6650 Cicero, Chicago
Magnavox Co., Fort Wayne, Ind.
Mallory & Co., P. R., Indianapolis, Ind.
Micamold Radio Corp., Brooklyn, N. Y.
Muter Co., 1255 S. Michigan, Chicago
Noma Electric Corp., 55 W. 13 St., N. Y. C.
Polymet Condenser Co., 699 E. 139 St., N. Y. C.
Potter Co., 1950 Sheridan Rd., N. Chicago
★ RCA Mfg. Co., Camden, N. J.
Sangamo Elec. Co., Springfield, Ill.
★ National Co., Malden, Mass.
Radio Condenser Co., Camden, N. J.

CONDENSERS, Variable Trimmer

Alden Prods Co., Brockton, Mass.
American Steel Package Co., Defiance, O.
Bud Radio, Inc., Cleveland, O.
Cardwell Mfg. Corp., Brooklyn, N. Y.
Centralab, Milwaukee, Wis.
Fada Radio & Elec. Corp., Long Island City, N. Y.
General Radio Co., Cambridge, Mass.
Guthman, Inc., E. I., 400 S. Peoria, Chicago
★ Hammarlund Mfg. Co., 424 W. 33 St., N. Y. C.
Insuline Corp. of America, Long Island City, N. Y.
Johnson Co., E. F., Waseca, Minn.
Mallory & Co., Inc., P. R. Indianapolis, Ind.
Meissner Mfg. Co., Mt. Carmel, Ill.
Millen Mfg. Co., James, Malden, Mass.
Miller Co., J. W., Los Angeles, Cal.
Muter Co., 1255 S. Michigan Av., Chicago
★ National Co., Malden, Mass.
Potter Co., 1950 Sheridan Rd., N. Chicago
Sickles Co., F. W., Chicopee, Mass.
Solar Mfg. Corp., Bayonne, N. J.
Teleradio Eng. Corp., 484 Broome, N. Y. C.

CONNECTORS, Cable

Aero Electric Corp., Los Angeles, Calif.
Airadio, Inc., Stamford, Conn.
Alden Prods., Brockton, Mass.
Amer. Microphone Co., 1915 S. Western Av., Los Angeles
Amer. Phenolic Corp., 1830 S. 54th St., Chicago

SCHEDULE OF DIRECTORIES

FM & TELEVISION PRODUCTS DIRECTORY
February, April, June, August, October, December

BROADCAST STATIONS
General Managers & Chief Engineers — March, September

POLICE RADIO COMMUNICATIONS OFFICERS
January, July

RADIO MANUFACTURERS
General Managers & Chief Engineers — May, November

Under this schedule, FM and TELEVISION presents up-to-date listings, with complete corrections and additions, which are available in no other publication.

Sickles Co., F. W., Chicopee, Mass.
Solar Mfg. Corp., Bayonne, N. J.
Sprague Specialties Co., N. Adams, Mass.
Teleradio Engineering Corp., 484 Broome St., N. Y. C.
Westinghouse Elect. & Mfg. Co., E. Pittsburgh, Pa.

CONDENSERS, Gas-filled

Lapp Insulator Co., Inc., Leroy, N. Y.

CONDENSERS, High-Voltage Vacuum

Centralab, Milwaukee, Wis.
★ Eitel-McCullough, Inc., San Bruno, Calif.
Erie Resistor Corp., Erie, Pa.
★ General Electric Co., Schenectady, N. Y.
General Electronics, Inc., Paterson, N. J.

CONDENSERS, Small Ceramic Tubular

Centralab; Div. of Globe-Union, Inc., Milwaukee, Wis.
Erie Resistor Corp., Erie, Pa.

CONDENSERS, Variable Receiver Tuning

Alden Prods. Co., Brockton, Mass.
American Steel Package Co., Defiance, Ohio
Barker & Williamson, Ardmore, Pa.
Bud Radio, Inc., Cleveland, O.
Cardwell Mfg. Corp., Allen D., Brooklyn, N. Y.
General Instrument Corp., Elizabeth, N. J.
★ Hammarlund Mfg. Co., 424 W. 34th St., N. Y. C.
Insuline Corp. of Amer., L. I. City, N. Y.
Meissner Mfg. Co., Mt. Carmel, Ill.
Millen Mfg. Co., Malden, Mass.
★ National Co., Malden, Mass.
Oak Mfg. Co., 1267 Clybourn Ave., Chicago
Radio Condenser Co., Camden, N. J.
Rauland Corp., Chicago, Ill.

CONDENSERS, Variable Transmitter Tuning

Barker & Williamson, Upper Darby, Pa.
Bud Radio, Cleveland, O.
Cardwell Mfg. Corp., Allen D., Brooklyn, N. Y.
★ Hammarlund Mfg. Co., 424 W. 33 St., N. Y. C.
Insuline Corp. of Amer., L. I. City, N. Y.
Johnson, E. F., Waseca, Minn.
Millen Mfg. Co., James, Malden, Mass.
American Radio Hardware Co., 476 B'way, N. Y. C.
★ Andrew, Victor J., 363 E. 75 St., Chicago
Astatic Corp., Youngstown, O.
Atlas Sound Corp., 1442 39th St., Brooklyn, N. Y.
Birnbach Radio, 145 Hudson St., N. Y. C.
Breeze Mfg. Corp., Newark, N. J.
Brush Development Co., Cleveland, O.
Bud Radio, Cleveland, Ohio
Cannon Elec. Development, 3209 Humboldt, Los Angeles
Eby, Inc., Hugh H., Philadelphia
Electro Voice Mfg. Co., South Bend, Indiana
Franklin Mfg. Corp., 175 Varick St., N. Y. C.
General Radio Co., Cambridge, Mass.
Harwood Co., 747 N. Highland Ave., Los Angeles
Insuline Corp. of Amer., L. I. City, N. Y.
Jones, Howard B., 2300 Wabansia, Chicago
Kellogg Switchboard & Supply Co., 6650 S. Cicero Ave., Chicago
Mallory & Co., P. R., Indianapolis, Ind.
Monowatt Electric Co., Providence, R. I.
Northam Warren Corp., Stamford, Conn.
★ Radio City Products Co., 127 W. 26 St., N. Y. C.
Remler Co., Ltd., 2101 Bryant St., San Francisco
Schott Co., W. L., 9306 Santa Monica Blvd., Beverly Hills, Calif.
Selectar Mfg. Co., L. I. City, N. Y.
★ Universal Microphone Co., Ltd., Inglewood, Calif.

CONTACT POINTS

Brainin Co., C. S., 233 Spring St., N. Y. C.
Callite Tungsten Corp., Union City, N. J.
Mallory & Co., Inc., P. R., Indianapolis, Ind.

COUPLINGS, flexible

Cardwell Mfg. Corp., Brooklyn, N. Y.
Johnson Co., E. F., Waseca, Minn.
Millen Mfg. Co., James, Malden, Mass.
★ National Co., Inc., Malden, Mass.

CRYSTAL GRINDING EQUIPMENT

Cons. Diamond Saw Blade Corp., Yonkers Ave., Yonkers 2, N. Y.
Felker Mfg. Co., Torrance, Calif.

CRYSTAL HOLDERS

REC Mfg. Co., Holliston, Mass.

CRYSTALS, Quartz

Aircraft Accessories Corp., Funston Rd., Kansas City, Kans.
Bausch & Lomb Optical Co., Rochester, N. Y.
Billey Elec. Co., Erie, Penna.
Collins Radio Co., Cedar Rapids, Iowa
Crystal Prod. Co., 1519 McGee St., Kansas City, Mo.
Crystal Research Labs., Hartford, Conn.
DX Crystal Co., 1200 N. Claremont, Chicago
Electronic Research Corp., 800 W. Washington Blvd., Chicago
Federal Engineering Co., 37 Murray St., N. Y. C.
★ General Electric Co., Schenectady, N. Y.
General Radio Co., Cambridge, Mass.
Harvey-Wells Communications, Southbridge, Mass.
Henney Motor Co., Omaha, Nebr.
Higgins Industries, Santa Monica, Calif.
Hipower Crystal Co., 2035 W. Charleston, Chicago
Hunt & Sons, G. C., Carlisle, Pa.
Jefferson, Inc., Ray, Westport, L. I., N. Y.
Kaar Engineering Co., Palo Alto, Cal.
Knights Co., The James, Sandwich, Ill.
Meck Industries, John, Plymouth, Ind.
Miller, August E., North Bergen, N. J.
Monitor Piezo Prod. Co., S. Pasadena, Calif.
Peterson Radio, Council Bluffs, Iowa
Precision Piezo Service, Baton Rouge, La.
Premier Crystal Labs., 63 Park Row, N. Y. C.
Quartz Laboratories, 1512 Oak St., Kansas City, Kans.
Radell Corp., Guilford Ave., Indianapolis, Ind.
RCA Mfg. Co., Camden, N. J.
Reeves Sound Labs., 62 W. 47 St., N. Y. C.
Scientific Radio Products Co., Council Bluffs, Ia.
Scientific Radio Service, Hyattsville, Md.
Standard Piezo Co., Carlisle, Pa.
Valpey Crystals, Holliston, Mass.
Wallace Mfg. Co., Wm. T., Peru, Ind.
Zeiss, Inc., Carl, 485 Fifth Ave., N. Y. C.

DIAL LIGHTS

See PILOT LIGHTS

DIALS, Instrument

Barker & Williamson, Upper Darby, Pa.
Crowe Name Plate Co., 3701 Ravenswood Ave., Chicago
General Radio Co., Cambridge, Mass.
Gits Molding Corp., 4600 Huron St., Chicago
Mica Insul. Co., 198 Varick St., N. Y. C.
★ National Co., Inc., Malden, Mass.
★ Rogan Bros., 2003 S. Michigan Ave., Chicago

DISCS, Recording

Advance Recording Products Co., Long Island City, N. Y.
Allied Recording Products Co., Long Island City, N. Y.
Audio Devices, Inc., 1600 B'way, N. Y. C.
Federal Recorder Co., Elkhart, Ind.
★ Gould-Moody Co., 395 B'way, N. Y. C.
Presto Recording Corp., 242 W. 55 St., N. Y. C.
★ RCA Mfg. Co., Camden, N. J.

DYNAMOTORS — See Motor-Generators

ENAMELS, Wood & Metal Finish

Sullivan Varnish Co., 410 N. Hart St., Chicago 22

ENGRAVING MACHINES

Auto-Engraver Co., 1776 B'way, N. Y. C.

ETCHING, Metal

Crowe Name Plate & Mfg. Co., 3701 Ravenswood Ave., Chicago
Etched Prod. Corp., 39-01 Queens Blvd., Long Island City, N. Y.
★ Premier Metal Etching Co., 21-03 44th Ave., Long Island City, N. Y.

FACSIMILE EQUIPMENT

Alden Products Co., Inc., Brockton, Mass.

FASTENERS, Separable

Camloc Fastener Co., 420 Lexington Ave., N. Y. C.
Shakeproof, Inc., 2501 N. Keeler Ave., Chicago

FELT

Amer. Felt Co., Inc., Glenville, Conn.
Western Felt Works, 4031 Ogden Ave., Chicago

FIBRE, Vulcanized

Brandywine Fibre Prods. Co., Wilmington, Del.
Continental-Diamond Fibre Co., Newark, Del.
Insulation Mfgrs. Corp., 565 W. Wash. Blvd., Chicago
Mica Insulator Co., 196 Varick, N. Y. C.
Nat'l Vulcanized Fibre Co., Wilmington, Del.
Spaulding Fibre Co., Inc., 233 B'way, N. Y. C.
Taylor Fibre Co., Norristown, Pa.
Wilmington Fibre Specialty Co., Wilmington, Del.

FILTERS, Electrical Noise

Avia Products Co., 737 N. Highland Ave., Los Angeles

Three attitudes that hamper the War Effort

IGNORING NATIONAL DESTINY

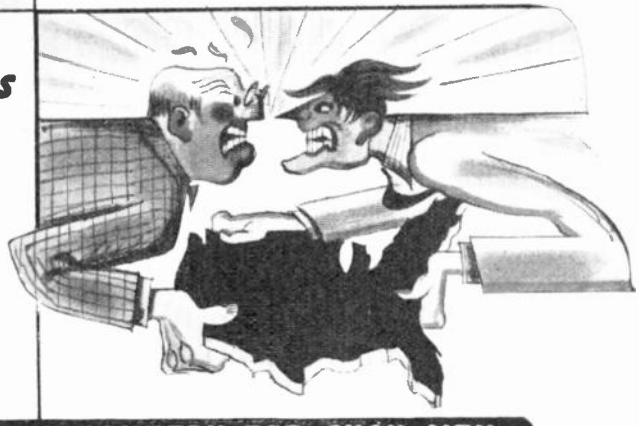
Many men are solving the problems of war as they would ordinary business difficulties. Having solved them, they ignore the most important phase. Their attitude toward the war's meaning and its effect on national destiny is apathetic and disinterested.

USING VITAL ISSUES TO PERSONAL ADVANTAGE

To further their own selfish aims, many men seize upon vital issues to confuse and confound the average citizen. When the times call for statesmanship, America is treated to a sorry spectacle of demagoguery, greed, blocs, distortion, shrewd manipulation of emotions.

PULLING IN DIFFERENT DIRECTIONS

While commands in various war theatres are being consolidated and strengthened, here at home there are men who have forgotten the unity after Pearl Harbor. Each is off on his own particular project, seldom remembering that thousands of other men will die before the conflict is over.



THERE IS NO PLACE IN THE COUNTRY FOR SUCH MEN

We of ECA are working not only to produce the materials of war but, like all good citizens, to help attain the objectives of the war. We know that we must be vigilant... especially so now. Men of evil intent have come out of hiding. In smoke-filled rooms attractive bargains are being arranged — with the "little people" included out. Energy which should be devoted to the support of the Commander-in-Chief, and those under him, is being used to stir up distrust and dissension. What appears to be overlooked is that the ultimate aim of victory is a decent world ... where men of good will live and work together with a full understanding of each other's needs and hopes and aspirations. We have already learned, the hard way, what isolationism and selfishness and disunity can mean. Must history again repeat itself?

eca

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Kellogg Switchboard & Supply Co., 6650 S. Cicero Ave., Chicago
Mallory & Co., Inc., P. R., Indianapolis, Ind.
Miller Co., J. W., 5917 S. Main St., Los Angeles
Tobe Deutschmann Corp., Canton, Mass.

FINISHES, Metal

Alrose Chemical Co., Providence, R. I.
Aluminum Co. of America, Pittsburgh, Pa.
Ault & Wiborg Corp., 75 Varick, N. Y. C.
Hilo Varnish Corp., Brooklyn, N. Y.
Maas & Waldstein Co., Newark, N. J.
New Wrinkle, Inc., Dayton, O.
Sullivan Varnish Co., 410 N. Hart St., Chicago 22

FREQUENCY METERS

Bendix Radio, Towson, Md.
★ Browning Labs., Inc., Winchester, Mass.
General Radio Co., Cambridge, Mass.
Lavoie Laboratories, Long Branch, N. J.
★ Link, F. M., 125 W. 17 St., N. Y. C.
★ Measurements Corp., Boonton, N. J.
North Amer. Philips Co., Inc., 419 Fourth Ave., N. Y. C.

FREQUENCY STANDARDS, Primary

General Radio Co., Cambridge, Mass.

FREQUENCY STANDARDS, Quartz Secondary

Garner Co., Fred E., 43 E. Ohio St., Chicago
Hewlett-Packard Co., Palo Alto, Calif.
Millen Mfg. Co., Inc., Malden, Mass.

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Jefferson Elec. Co., Bellwood, Ill.
Littlefuse, Inc., 4753 Ravenswood Av., Chicago

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Perkins Machine & Gear Co., Springfield, Mass.
Quaker City Gear Wks., Inc., N. Front St., Phila.
Thompson Clock Co., Bristol, Conn.

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Brandywine Fibre Prods. Co., Wilmington, Del.
Formica Insulation Co., Cincinnati, O.
Gear Specialties, Inc., 2650 W. Medill, Chicago
★ General Electric Co., Pittsfield, Mass.
Mica Insulator Co., 196 Varick St., N. Y. C.
National Vulcanized Fibre Co., Wilmington, Del.
Perkins Machine & Gear Co., Springfield, Mass.
Richardson Co., Melrose Park, Ill.
Spaulding Fibre Co., Inc., 233 B'way, N. Y. C.
Synthane Corp., Oaks, Pa.
Taylor Fibre Co., Norristown, Pa.
Wilmington Fibre Specialty Co., Wilmington, Del.

GENERATORS, Electronic AC

Communication Meas. Lab., 118 Greenwich St., N. Y. C.

GENERATORS, Gas Engine Driven

Hunter-Hartman Corp., St. Louis, Mo.
Kato Engineering Co., Mankato, Minn.
Onan & Sons, Royalston Ave., Minneapolis, Minn.
Pioneer Gen-E-Motor, 5841 W. Dickens Ave., Chicago, Ill.

GENERATORS, Hand Driven

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Carter Motor Co., 1608 Milwaukee, Chicago
Chicago Tel. Supply Co., Elkart, Ind.

GENERATORS, Standard Signal

Boonton Radio Corp., Boonton, N. J.
Ferris Instrument Co., Boonton, N. J.
General Radio Co., Cambridge, Mass.
Hewlett-Packard Co., Palo Alto, Calif.
★ Measurements Corp., Boonton, N. J.

GENERATORS, Wind-Driven, Aircraft

General Armature Corp., Lock Haven, Pa.

GLASS, Electrical

Corning Glass Works, Corning, N. Y.

GREASE, for Electrical Contacts & Bearings

Royal Engineering Co. (Royco Grease), East Hanover, N. J.

HEADPHONES

Brush Development Co., Cleveland, O.
Cannon Co., C. F., Springwater, N. Y.
Carron Mfg. Co., 415 S. Aberdeen, Chicago
Connecticut Tel. & Elec. Co., Meriden, Conn.
Consolidated Radio Prod. Co., W. Erie St., Chicago
Elec. Ind. Mfg. Co., Red Bank, N. J.
Kellogg Switchboard & Supply Co., 6650 S. Cicero Ave., Chicago
Murdock Mfg. Co., Chelsea, Mass.
Permoflux Corp., W. Grand Ave., Chicago
Telephonics Corp., 350 W. 31 St., N. Y. C.
Trimm Radio Mfg. Co., 1770 W. Berteau, Chicago
★ Universal Microphone Co., Inglewood, Cal.
Utah Radio Prod. Co., 842 Orleans St., Chicago

HORNS, Outdoor

Graybar Elect. Co., Lexington Ave. at 43 St., N. Y. C.
★ Jensen Radio Mfg. Co., 6601 S. Laramie Ave., Chicago
Operadio Mfg. Co., St. Charles, Ill.
Oxford Tartak Radio Corp., 915 W. Van Buren St., Chicago
Racon Electric Co., 52 E. 19 St., N. Y. C.
★ RCA Mfg. Co., Camden, N. J.
University Laboratories, 225 Varick St., N. Y. C.

INDUCTION HEATING EQUIPMENT

Induction Heating Corp., 389 Lafayette St., N. Y. C.
Lepel High Frequency Labs., 39 W. 60 St., N. Y. C.

INDUCTORS, Transmitter

Barker & Williamson, Upper Darby, Pa.

INDUCTORS, Variable Tuning

Barker & Williamson, Upper Darby, Pa.

INSTRUMENTS, Radio Laboratory

Ballantine Laboratories, Inc., Boonton, N. J.
Boonton Radio Corp., Boonton, N. J.
Ferris Inst. Corp., Boonton, N. J.
★ General Electric Co., Schenectady, N. Y.
General Radio Co., Cambridge, Mass.
Hewlett Packard Co., Palo Alto, Calif.
★ Measurements Corp., Boonton, N. J.

INSULATORS, Ceramic Stand-off, Lead-in, Rod Types

America Lava Corp., Chattanooga, Tenn.
Corning Glass Works, Corning, N. Y.
Electronic Mechanics, Inc., Clifton, N. J.
Isolantite, Inc., Belleville, N. J.
Johnson Co., E. F., Waseca, Minn.
Lapp Insulator Co., Inc., Leroy, N. Y.
Locke Insulator Co., Baltimore, Md.
Millen Mfg. Co., Malden, Mass.
★ National Co., Inc., Malden, Mass.

IRON CORES, Powdered

Aladdin Radio Industries, Inc., 501 W. 35 St., Chicago
Crowley & Co., Henry, W. Orange, N. J.
Ferrocart Corp. of Amer., Hastings-on-Hudson, N. Y.
Genl. Aniline Wks., 435 Hudson St., N. Y. C.
Gibson Elec. Co., Pittsburgh, Pa.
Magner Mfg. Co., Inc., 444 Madison Ave., N. Y. C.
Mallory & Co., P. R., Indianapolis, Ind.
Pyroferric Co., 175 Varick St., N. Y. C.
Stackpole Carbon Co., St. Marys, Pa.
Western Electric Co., 195 Broadway, N. Y. C.
Wilson Co., H. A., Newark, N. J.

IRONS, Soldering

Acme Electric Heating Co., 1217 Washington St., Boston
Amer. Electrical Heater Co., 6110 Cass Ave., Detroit
Drake Elec. Wks., Inc., 3656 Lincoln Ave., Chicago
★ Electric Soldering Iron Co., Deep River, Conn.
★ General Electric Co., Schenectady, N. Y.
Hexacon Elec. Co., Roselle Park, N. J.
Vasco Electrical Mfg. Co., 4116 Avalon Blvd., Los Angeles
Vulcan Electric Co., Lynn, Mass.

JACKS, Telephone

Alden Prods. Co., Brockton, Mass.
Amer. Molded Prods. Co., 1753 N. Honore St., Chicago
Chicago Tel. Supply Co., Elkhart, Ind.
★ Guardian Elec. Mfg. Co., 1627 W. Walnut St., Chicago
Insuline Corp. of Amer., L. I. C., N. Y.
Johnson, E. F., Waseca, Minn.
Jones, Howard B., 2300 Wabansia Ave., Chicago
Mallory & Co., Inc., P. R., Indianapolis, Ind.
Mangold Radio Pts. & Stamping Co., 6300 Shelbourne St., Philadelphia
Molded Insulation Co., Germantown, Pa.
★ Universal Microphone Co., Inglewood, Calif.
Utah Radio Prod. Co., Orleans St., Chicago

KEYS, Telegraph

Amer. Radio Hardware Co., Inc., 476 Broadway, N. Y. C.
Bunnell & Co., J. H., 215 Fulton N. Y. C.
Mossman, Inc., Donald P., 6133 N. Northwest Hy., Chicago
Remler Co., Ltd., 2101 Bryant St., San Francisco
Signal Electric Mfg. Co., Menominee, Mich.
Telegraph App. Co., 325 W. Huron St., Chicago
Telephonics Corp., 350 W. 31 St., N. Y. C.
Winslow Co., Inc., Liberty St., Newark, N. J.

KNOBS, Radio & Instrument

Alden Prods. Co., Brockton, Mass.
American Insulator Corp., New Freedom, Pa.
Chicago Molded Prods. Corp., 1025 N. Kolmar, Chicago
General Radio Co., Cambridge, Mass.
Gits Molding Corp., 4600 Huron St., Chicago
Imperial Molded Prods. Corp., 2921 W. Harrison, Chicago
Kurtz Kasch, Inc., Dayton, O.
Mallory & Co., Inc., P. R., Indianapolis, Ind.
Millen Mfg. Co., James, Malden, Mass.
★ Nat'l Co., Inc., Malden, Mass.
★ Radio City Products Co., 127 W. 26 St., N. Y. C.
★ Rogan Bros., 2001 S. Michigan, Chicago

LABELS, Removable

Avery Adhesives, 451 3rd St., Los Angeles

LABELS, Stick-to-Metal

Ever Ready Label Corp., E. 25th St., N. Y. C.
Tablet & Ticket Co., 1021 W. Adams St., Chicago

LABORATORIES, Electronic

★ Browning Labs., Inc., Winchester, Mass.
★ Electronic Corp. of Amer., 45 W. 18 St., N. Y. C.
Hazeltine Electronics Corp., 1775 B'way, N. Y. C.
Sherron Metallic Corp., Flushing Ave., Brooklyn, N. Y.
Worner Electronic Devices, 848 N. Noble St., Chicago, 22

LACQUERS, Wood & Metal Finish

Sullivan Varnish Co., 410 N. Hart St., Chicago 22

LOCKWASHERS, Spring Type

Natl. Lock Washer Co., Newark, N. J.

LUGS, Soldering

Burndy Engineering Co., 459 E. 133rd St., N. Y. C.
Cinch Mfg. Corp., W. Van Buren St., Chicago
Dante Elec. Mfg. Co., Bantam, Conn.
Ideal Commutator Dresser Co., Sycamore, Ill.
Ilsco Copper Tube & Prods., Inc., Station M, Cincinnati
Krueger & Hudepohl, Third & Vine, Cincinnati, O.
Patton-MacGuyer Co., 17 Virginia Av., Providence, R. I.
Sherman Mfg. Co., Battle Creek, Mich.
Zierick Mfg. Co., 385 Girard Ave., Bronx, N. Y. C.

LUGS, Solderless

Aircraft Marine Prod., Inc., Harrisburg, Pa.
Burndy Eng. Co., 107 Eastern Blvd., N. Y. C.

MACHINES, Impregnating

Stokes Machine Co., F. J., Phila., Pa.

MACHINES, Screwdriving

Detroit Power Screwdriver Co., Detroit, Mich.
Stanley Tool Div. of the Stanley Works, New Britain, Conn.

MAGNETS, Permanent

Arnold Engineering Co., 147 E. Ontario St., Chicago 11
★ General Elec. Co., Schenectady, N. Y.
Indiana Steel Prod. Co., 6 N. Michigan Ave., Chicago, Ill.
Thomas & Skinner Steel Prod. Co., Indianapolis, Ind.

MAIL ORDER SUPPLY HOUSES

See listing at head of Directory

MARKERS, Wire Identification

Brand & Co., Wm., 276 4th Ave., N. Y. C.
Irvington Varnish & Ins. Co., Irvington, N. J.
Minn. Mining Co., 155 Sixth Ave., N. Y. C.
Ntl. Varnished Prod. Corp., Woodbridge, N. J.

MARKING MACHINES, Letters, Numbers

Marken Machine Co., Keene, N. H.

METAL, Thermostatic

Baker & Co., 113 Astor, Newark, N. J.
C. S. Brainin Co., 20 VanDam, N. Y. C.
Callite Tungsten Corp., Union City, N. J.
Chace Co., W. M., Detroit, Mich.
Metals & Controls Corp., Attleboro, Mass.
Wilson Co., H. A., 105 Chestnut, Newark, N. J.

METERS, Ammeters, Voltmeters, Small Panel

Cambridge Inst. Co., Grand Central Terminal, N. Y. C.
De Jur-Amsco Corp., Shelton, Conn.
★ General Electric Co., Bridgeport, Conn.
Hickok Elec. Inst. Co., Cleveland, O.
Hoyt Elec. Inst. Works, Boston, Mass.
McClintock Co., O. B., Minneapolis, Minn.
Readrite Meter Works, Bluffton, O.
Roller-Smith Co., Bethlehem, Pa.
★ Simpson Elec. Co., 5218 W. Kinzie, Chicago
Triplett Elec. Inst. Co., Bluffton, O.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Weston Elec. Inst. Corp., Newark, N. J.
Wheelco Inst. Co., 847 W. Harrison St., Chicago

METERS, Q

Boonton Radio Corp., Boonton, N. J.

METERS, Vacuum Tube Volt

Ballantine Laboratories, Inc., Boonton, N. J.
Ferris Instrument Corp., Boonton, N. J.
General Radio Co., Cambridge, Mass.
Hewlett-Packard Co., Palo Alto, Calif.
★ Measurements Corp., Boonton, N. J.
★ Radio City Products Co., 127 W. 26 St., N. Y. C.

METERS, Vibrating Reed

Biddle, James G., 1211 Arch St., Phila.
J-B-T Instruments, Inc., New Haven 8, Conn.
Triplett Elec. Inst. Co., Bluffton, O.

MICA

Brand & Co., Wm., 276 Fourth Av., N. Y. C.
Ford Radio & Mica Corp., 538 63rd St., Bklyn, N. Y.
Insulation Mfgrs. Corp., 565 W. Wash. Blvd., Chicago
Macallen Co., Boston, Mass.
Mica Insulator Corp., 196 Varick, N. Y. C.
Mitchell-Rand Insulation Co., 51 Murray St., N. Y. C.
New England Mica Co., Waltham, Mass.
Richardson Co., Melrose Park, Ill.

MICROPHONES

Amer. Microphone Co., 1015 Western Av., Los Angeles
Amperite Co., 561 B'way, N. Y. C.
Astatic Corp., Youngstown, O.
Brush Development Co., Cleveland, O.
Electro Voice Mfg. Co., South Bend, Ind.
Kellogg Switchboard & Supply Co., 6650 S. Cicero, Chicago
Radio Speakers, Inc., 221 E. Cullerton, Chicago
Philmore Mfg. Co., 113 University Pl., N. Y. C.
Permoflux Corp., 4916 W. Grand Av., Chicago
Rowe Industries, Inc., Toledo, O.
Shure Bros., 225 W. Huron St., Chicago
Telephonics Corp., 350 W. 31 St., N. Y. C.
Turner Co., Cedar Rapids, Ia.
★ Universal Microphone Co., Inglewood, Cal.

MONITORS, Frequency

★ General Electric Co., Schenectady, N. Y.
General Radio Co., Cambridge, Mass.
★ RCA Mfg. Co., Camden, N. J.

MOTOR-GENERATORS, Dynamotors, Rotary Converters

Alliance Mfg. Co., Alliance, O.
Air-Way Mfg. Co., Toledo, O.
Bendix, Red Bank, N. J.
Black & Decker Mfg. Co., Towson, Md.
Bodine Elec. Co., 2262 W. Ohio, Chicago
Carter Motor Co., 1608 Milwaukee, Chicago
Clements Mfg. Co., Chicago, Ill.
Continental Electric Co., Newark, N. J.
Delco Appliance, Rochester, N. Y.
Diehl Mfg. Co., Elizabethport, N. J.
Dormeyer Co., Chicago, Ill.
Eclipse Aviation, Bendix, N. J.
★ Elcor, Inc., 1060 W. Adams, Chicago

MOTOR-GENERATORS

★ Elcor, Inc., 1060 W. Adams, Chicago
Electric Indicator Co., Stamford, Conn.
Electric Motors Corp., Racine, Wis.
Electric Specialty Co., Stamford, Conn.
Electrolux Corp., Old Greenwich, Conn.
Eureka Vacuum Cleaner, Detroit, Mich.
General Armature Corp., Lock Haven, Pa.
★ General Electric Co., Schenectady, N. Y.
Jannette Mfg. Co., 558 W. Monroe, Chicago
Knapp-Monarch, St. Louis, Mo.
Leland Electric Co., Dayton, O.
Ohio Electric Co., 74 Trinity Pl., N. Y. C.
Pioneer Gen-E-Motor, 5841 W. Dickens Av., Chicago
Redmond Co., A. G., Owosso, Mich.
Russell Co., Chicago, Ill.
Small Motors, Inc., 1308 Elston Ave., Chicago
Webster Co., Chicago, Ill.
Webster Products, 3825 Armitage Ave., Chicago
Westinghouse Elect. Mfg. Co., Lima, O.
★ Wincharger Corp., Sioux City, Iowa

MOTORS, Very Small Types

Kollsman Instrument Div., Elmhurst, Long Island, N. Y.
Utah Radio Prod. Co., 842 Orleans St., Chicago

MOUNTINGS, Shock Absorbing

Lord Mfg. Co., Erie, Pa.
Pierce-Roberts Co., Trenton, N. J.
U. S. Rubber Co., 1230–6th Ave., N. Y. C.

MYCALEX

Colonial Kolonite Co., 2212 W. Armitage Ave., Chicago
★ General Electric Co., Schenectady, N. Y.
Mycalex Corp. of Amer., Clifton, N. J.
Precision Fabricators, Inc., Rochester, N. Y.

NAME PLATES, Etched Metal

See ETCHING, Metal

NAME PLATES, Plastic

Crowe Name Plate & Mfg. Co., 3700 Ravenswood Ave., Chicago
Hopp Press, Inc., 460 W. 34 St., N. Y. C.
Parisian Novelty Co., 3502 S. Western Ave., Chicago

NICKEL, Sheet, Rod, Tubes

Eagle Metals Co., Seattle, Wash.
Pacific Metals Co., Ltd., San Francisco, Calif.
Steel Sales Corp., 129 S. Jefferson St., Chicago
Tull Metal & Supply Co., J. M., Atlanta, Ga.
Whitehead Metal Prod. Co., 303 W. 10th St., N. Y. C.
Williams and Co., Inc., Pittsburgh, Pa.

NUTS, Self-locking

Boots Aircraft Nut Corp., New Canaan, Conn.
Elastic Stop Nut Corp., Union, N. J.
Palnut Co., Inc., Irvington, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

OSCILLATORS, AF

General Radio Co., Cambridge, Mass.
Hewlett-Packard Co., Palo Alto, Calif.
Jackson Electrical Inst. Co., Dayton, O.

OSCILLOSCOPES, Cathode Ray

★ Du Mont Laboratories, Inc., Allen B., Passaic, N. J.
★ General Electric Co., Schenectady, N. Y.
General Radio Co., Cambridge, Mass.
Millen Mfg. Co., Malden, Mass.
Panoramic Radio Corp., 242 W. 55 St., N. Y. C.
Reiner Electronics Co., 152 W. 25 St., N. Y. C.
RCA Mfg. Co., Inc., Camden, N. J.
★ Radio City Products Co., Inc., 127 W. 26 St., N. Y. C.

OVENS, Industrial & Laboratory

★ General Elec. Co., Schenectady, N. Y.
Trent Co., Harold E., Philadelphia

PANELS, Metal Etched
(See Etching, Metal)

PANELS, Phenolic, Cast without Molds

Creative Plastics Corp., 963 Kent Ave., B'klyn, N. Y.
See TUBES, Photo-Electric

PILOT LIGHTS

Alden Prods. Co., Brockton, Mass.
Amer. Radio Hardware Co., Inc., 467 B'way, N. Y. C.
Dial Light Co. of Amer., 90 West, N. Y. C.
Drake Mfg. Co., 1713 W. Hubbard, Chicago
General Control Co., Cambridge, Mass.
Gothard Mfg. Co., Springfield, Ill.
Herzog Miniature Lamp Works, 12–19 Jackson Av., Long Island City, N. Y. C.
Kirkland Co., H. R., Morristown, N. J.
Mallory & Co., P. R., Indianapolis, Ind.
Signal Indicator Corp., 140 Cedar St., N. Y. C.

PHOSPHOR BRONZE

American Brass Co., Waterbury, Conn.
Bunting Brass & Bronze Co., Toledo, O.
Driver-Harris Co., Harrison, N. J.
Phosphor Bronze Smelting Co., Philadelphia
Revere Copper & Brass, 230 Park Av., N. Y. C.
Seymour Mfg. Co., Seymour, Conn.

PLASTICS, Cast without Molds

Creative Plastics Corp., 963 Kent Ave., B'klyn, N. Y.

PLASTICS, Extruded

Bium & Co., Inc., Julius, 532 W. 22 St., N. Y. C.
Brand & Co., Wm., 276 4th Ave., N. Y. C.
Extruded Plastics, Inc., Norwalk, Conn.
Industrial Synthetic Corp., Irvington, N. J.
Irvington Varnish & Insulator Co., Irvington, N. J.

PLASTIC SHEET, for Name Plates

Mica Insulator Co. 200 Varick St., N. Y. C.

PLASTICS, Injection Molded

Remler Co., Ltd., 2101 Bryant St., San Francisco
Tech-Art Plastics, 41–01 36th Ave., Long Island City, N. Y.
Universal Plastics Corp., New Brunswick, N. J.

PLASTICS, Laminated or Molded

Acadia Synthetic Prods., 4031 Ogden Av., Chicago
Alden Prods. Co., Brockton, Mass.
American Cyanamid Co., 30 Rockefeller Plaza, N. Y. C.
American Insulator Corp., New Freedom, Pa.
American Molded Prods. Co., 1753 N. Honore, Chicago
Auburn Button Works, Auburn, N. Y.
Barber-Colman Co., Rockford, Ill.
Brandywine Fibre Prods. Co., Wilmington, Del.
Brilhart Co., Arnold, Great Neck, N. Y.
Catalin Corp., 1 Park Av., N. Y. C.
Celanese Celluloid Corp., 180 Madison Av., N. Y. C.
Chicago Molded Prods. Corp., 1024 N. Kolmar, Chicago
Continental-Diamond Fibre Co., Newark, Del.
Creative Plastics Corp., 963 Kent Ave., B'klyn, N. Y.
Dow Chemical Co., Midland, Mich.
Durez Plastics & Chemicals, Inc., N. Tonawanda, N. Y.
Extruded Plastics, Inc., Norwalk, Conn.
Formica Insulation Co., Cincinnati, O.
★ General Electric Co., Plastics Dept., Pittsfield, Mass.
General Industries Co., Elyria, O.
Gits Molding Corp., 4600 Huron St., Chicago
Imperial Molded Prods. Co., 2921 W. Harrison, Chicago
Industrial Molded Prods. Co., 2035 Charleston, Chicago
Kurz-Kasch, Inc., Dayton, O.
Macallen Co., Boston, Mass.
Mica Insulator Co., 196 Varick, N. Y. C.
Monsanto Chemical Co., Springfield, Mass.
National Vulcanized Fibre Co., Wilmington, Del.
Northern Industrial Chemical Co., Boston, Mass.
Printloid Corp., 93 Mercer St., N. Y. C.
★ Radio City Products Co., 127 W. 26 St., N. Y. C.
Remler Co., Ltd., 2101 Bryant St., San Francisco
Richardson Co., Melrose Park, Ill.
★ Rogan Bros., 2000 S. Michigan Ave., Chicago
Rohm & Haas Co., Philadelphia
Spaulding Fibre Co., Inc., 233 B'way, N. Y. C.
Stokes Rubber Co., Joseph, Trenton, N. J.
Surprenant Elec. Ins. Co., Boston
Synthane Corp., Oaks, Pa.
Taylor Fibre Co., Norristown, Pa.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Wilmington Fibre Specialty Co., Wilmington, Del.

PLASTICS, Materials

Bakelite Corp., 30 E. 42 St., N. Y. C.
Carbide & Carbon Chemicals Corp., 30 E. 42 St., N. Y. C.

PLASTICS, Transparent

Carbide & Carbon Chemicals Corp., 30 E. 42 St., N. Y. C.
Celanese Celluloid Corp., 180 Madison Ave., N. Y. C.
Dow Chemical Co., Midland, Mich.
du Pont de Nemours & Co., E. I., Arlington, N. J.
Plax Corp., Hartford, Conn.
Printloid Corp., 93 Mercer St., N. Y. C.
Rohm & Haas Co., Washington Sq., Philadelphia

PLATING, Metal on Molded Parts

Metaplast Corp., 205 W. 19 St., N. Y. C.

PLUGS (Banana), Spring Type

Amer. Radio H'dw're Co., 476 B'way, N. Y. C.
Birnbach Radio Co., 145 Hudson St., N. Y. C.
Eastman Kodak Co., Rochester, N. Y.
Eby, Inc., Hugh H., Philadelphia, Pa.
Franklin Mfg. Corp., 175 Varick St., N. Y. C.
General Radio Co., Cambridge, Mass.
Johnson Co., E. F., Waseca, Minn.
Mallory & Co., Inc., P. R., Indianapolis, Ind.
Ucinite Co., Newtonville, Mass.

PLUGS, Telephone Type

Alden Prods. Co., Brockton, Mass.
American Molded Prods. Co., 1753 N. Honore, Chicago
Chicago Tel. Supply Co., Elkhart, Ind.
★ Guardian Elec. Mfg. Co., 1400 W. Wash. Blvd. Chicago
Insuline Corp. of Amer., L. I. City, N. Y.
Johnson Co., E. F., Waseca, Minn.
Jones, H. B., 2300 Wabansia, Chicago
Mallory & Co., Inc., P. R., Indianapolis, Ind.
Remler Co., Ltd., Bryant St., San Francisco
Trav-Ler Karenola Corp., 1030 W. Van Buren St., Chicago 7
★ Universal Microphone Co., Ltd., Inglewood, Calif.
Utah Radio Prod., Orleans St., Chicago.

PLYWOOD, Metal Faced

Haskelite Mfg. Corp., 208 W. Washington St., Chicago

RACKS, Standard Aircraft Types

Delco Radio, Kokomo, Ind.

RACKS & PANELS, Metal

See STAMPINGS, Metal

RADIO RECEIVERS & TRANSMITTERS

Abbott Instrument, Inc., 8 W. 18 St., N. Y. C. 3
Aircraft Accessories Corp., Funston Rd., Kansas City, Kans.
Aircraft Radio Corp., Boonton, N. J.
Aircraft Radio Equip. Corp., 6244 Lex. Ave., Hollywood, Calif.
Air Communications, Inc., 2233 Grant Ave., Kansas City, Mo.
Air King Products Co., 1523 63rd Ave., Brooklyn, N. Y.
Airplane & Marine Inst., Inc., Clearfield, Pa.
Andrea Radio Corp., 43–20 34th St., Long Island City, N. Y.
Amplex Engineering, Inc., New Castle, Ind.
Arnessen Electric Co., 116 Broad St., N. Y. C.
Automatic Radio Mfg. Co., 122 Brookline Ave., Boston, Mass.
Bassett, Inc., Rex, Ft. Lauderdale, Fla.
Belmont Radio Corp., 5921 Dickens Ave., Chicago
Bendix Radio, Div. of Bendix Aviation Corp., Baltimore, Md.
Berger Electronics, 109–01 72nd Rd., Forrest Hills, N. Y.
Boes Co., The W. W., Dayton, O.
★ Browning Laboratories, Inc., Winchester, Mass.
Bunnell & Co., J. H., 215 Fulton St., N. Y. C.
Burnett Radio Lab., 4814 Idaho St., San Diego, Calif.
Colonial Radio Corp., Rano St., Buffalo, N. Y.
Communications Co., Inc., Coral Gables, Fla.
Conn. Tel. & Elec. Co., Meriden, Conn.
Continental Radio & Telev. Corp., 3800 W. Cortland St., Chicago
Cover Dual Signal Systems, Inc., 125 W. Hubbard St., Chicago
Crosley Radio Corp., Cincinnati, O.
de Forest Labs, Lee, 5106 Wilshire Blvd., Los Angeles
Delco Radio, Kokomo, Ind.
Detrola Corp., 1501 Beard Ave., Detroit, Mich.
De Wald Radio Mfg. Corp., 436 Lafayette St., N. Y. C.
Dictaphone Corp., 420 Lexington Ave., N. Y. C.
★ DuMont Labs., Inc., Allen B., Passaic, N. J.
Echophone Radio Co., 201 E. 26 St., Chicago
Eckstein Radio & Telev. Co., Inc., 1400 Harmon Pl., Minneapolis, Minn.
Electrical Ind. Mfg. Co., Red Bank, N. J.
Elect. Research Lab., Inc., Evanston, Ill.
Electronic Communications Co., 36 N. W. B'way, Portland, Ore.
★ Electronic Corp. of Amer., 45 W. 18 St., N. Y. C.
Electronic Specialty Co., Glendale, Calif.
Emerson Radio & Phone Corp., 111 8th Ave., N. Y. C.
Erco Radio Labs., Inc., Hempstead, N. Y.
Espey Mfg. Co., Inc., 305 E. 63 St., N. Y. C.
Fada Radio & Elec. Corp. 30–20 Thomson Ave., Long Island City, N. Y.
Federal Electronics Div., 209 Steuben St., B'klyn, N. Y.
Federal Tel. & Radio Corp., Newark, N. J.
Finch Telecommunications, Inc., Passaic, N. J.
Fisher Research Lab., Palo Alto, Calif.
Freed Radio Corp., 200 Hudson St., N. Y. C.
★ Galvin Mfg. Corp., 4545 Augusta Blvd., Chicago
Garod Radio Corp., 70 Washington St., B'klyn, N. Y.
Gates Radio & Supply Co., Quincy, Ill.
General Communication Co., 681 Beacon St., Boston, Mass.
★ General Electric Co., Schenectady, N. Y.
General Telev. & Radio Corp., 1240 N. Homan Ave., Chicago
Gibbs & Co., Thomas B., Delavan, Wis.
Gilfillen Bros., Inc., 1815 Venice Blvd., Los Angeles, Calif.
Girdler Corp., Louisville, Ky.
Gray Mfg. Co., Hartford, Conn.
Gray Radio Co., West Palm Beach, Fla.
Grenby Mfg. Co., Plainville, Conn.
Gulded Radio Corp., 161 6th Ave., N. Y. C.
Hadley Co., R. M., 707 E. 61 St., Los Angeles
★ Hallicrafters Co., 2611 Indiana Ave., Chicago
Halstead Traffic Com. Corp., 155 E. 44 St., N. Y. C.
Hamilton Radio Corp., 510 Sixth Ave., N. Y. C.
★ Hammarlund Mfg. Co., 460 W. 34th St., N. Y. C.
Harrel, D. H., 1527 E. 74 Pl., Chicago
Harvey Machine Co., Inc., 6200 Avalon Blvd., Los Angeles
★ Harvey Radio Labs, Inc., Cambridge, Mass.
Harvey-Wells Com., Inc., Southbridge, Mass.
Hazeltine Electronics Corp., Great Neck, N. Y.
Herbach & Rodeman Co., 522 Market St., Phila.
Hollywood Electronics Co., 800 Sunset Blvd., Los Angeles
Horni Signal Mfg. Co., 310 Hudson St., N. Y. C.
Howard Radio Co., 1731 Belmont Ave., Chicago
Hudson American Corp., 62 W. 47 St., N. Y. C.
Jefferson, Inc., Ray, Freeport, N. Y.
Jefferson-Travis Radio Mfg. Corp., 245 E 23 St., N. Y. C.
Karadio Corp., 1400 Harmon Pl., Minneapolis, Minn.
Kemlite Labs., 1809 N. Ashland Ave., Chicago
Lear Avia, Inc., Piqua, O.
Lewyt Corp., 60 B'way B'klyn, N. Y.
★ Link, F. M., 125 W. 17 St., N. Y. C.
Machlett Labs., Inc., Springdale, Conn.
Magnavox Co., Indianapolis, Ind.
Majestic Radio & Tel. Corp., 2600 W. 50 St., Chicago
McElroy Mfg. Corp., Brookline Ave., Boston
Megard Corp., 381 W. 38 St., Los Angeles, Calif.
Midwest Radio Corp., Cincinnati, O.
Millen Mfg. Co., Inc., Malden, Mass.
★ National Co., Inc., Malden, Mass.
Noblitt-Sparks Ind. Inc., Columbus, Ind.
North Amer. Philips Co., 100 E. 42 St., N. Y. C.
Operadio Mfg. Co., St. Charles, Ill.
Panoramic Radio Corp., 245 W. 55 St., N. Y. C. 19
Philco Corp., Tioga & C Sts., Philadelphia, Pa.
Philharmonic Radio Corp., 216 Williams St., N. Y. C.
Pierson-DeLane, Inc., 2345 W. Washington Blvd., Los Angeles
Pilot Radio Corp., Long Island City, N. Y.
Powers Electronic & Communication Co., Glen Cove, N. Y.
Precision Tube Co., 3828 Terrace St., Phila. 28
Press Wireless, Inc., 1475 B'way, N. Y. C.
★ Radio Corp. of Amer., Camden, N. J.
Radio Craftsmen, 1340 S. Mich. Ave., Chicago
★ Radio Engineering Labs., Long Island City, N. Y.
Radio Frequency Labs., Inc., Boonton, N. J.
Radio Mfg. Engineers, Inc., Peoria, Ill.
Radiomarine Corp. of Amer., 75 Varick St., N. Y. C.
Radio Receptor Co., Inc., 251 W. 17 St., N. Y. C.
Radio Transceiver Labs., 86–27 115th St., Richmond Hill, L. I.
Richardson-Allen Corp., 15 W. 20 St., N. Y. C.
Rosen Co., Raymond, 32 & Walnut Sts., Phila.
Rauland Corp., Chicago, Ill.
Sanborn Co., Cambridge 39, Mass.
Schuttig & Co., 9th & Kearny Sts., Washington, D. C.
Scott Radio Labs, Inc., 4450 Ravenswood Ave., Chicago
Seeburg Corp., J. P., 1500 N. Dayton St., Chicago
Sentinel Radio Corp., Evanston, Ill.
Setchell-Carlson, Inc., 2233 University Ave., St. Paul, Minn.
Smith Co., Maxwell, 1027 N. Highland Ave., Hollywood, Calif.
Sonora Radio & Telev. Corp., 325 N. Hoyne Ave., Chicago
Sparks-Withington Co., Jackson, Mich.
Sperry Gyroscope Co., Garden City, N. Y.
Sperti, Inc., Cincinnati, O.
Stewart-Warner Corp., 1826 Diversey Pkwy., Chicago
Stromberg-Carlson Co., Rochester, N. Y.
Templetone Radio Co., Mystic, Conn.
Transmitter Equip. Mfg. Co., 345 Hudson St., N. Y. C.
Trebor Radio Co., Pasadena, Calif.
Troy Radio & Telev. Co., 1144 S. Olive St., Los Angeles, Calif.
Warwick Mfg. Corp., 4640 W. Harrison St., Chicago
Watterson Radio Mfg. Co., 2608 Ross Ave., Dallas, Tex.
Waugh Laboratories, 420 Lexington Ave., N. Y. C.
Western Electric Co., 195 B'way, N. Y. C.
Westinghouse Elec. & Mfg. Co., Wilkens Ave., Baltimore, Md.
Wilcox Electric Co., 14th & Chestnut Sts., Kansas City, Mo.
Zenith Radio Corp., 6001 Dickens Ave., Chicago, Ill.

RECTIFIERS, Current

Benwood Linze Co., St. Louis, Mo.
Continental Elec. Co., 903 Merchandise Mart, Chicago
Electronics Labs., Indianapolis, Ind.
Fansteel Metallurgical Corp., N. Chicago, Ill.
★ General Electric Co., Bridgeport, Conn.
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Mallory & Co., P. R., Indianapolis, Ind.
Nothelfer Winding Labs., Trenton, N. J.
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United Cinephone Corp., Torrington, Conn.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

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Dunn, Inc., Struthers, 1321 Cherry, Philadelphia
Fenwal Inc., Ashland, Mass.
★ General Electric Co., Schenectady, N. Y.
Mercoid Corp., 4217 Belmont, Chicago
Minneapolis-Honeywell Regulator, Minneapolis, Minn.
Spencer Thermostat Co., Attleboro, Mass.

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Ferranti Elec., Inc., 30 Rockefeller Plaza, N. Y. C.

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Bircher Corp., 5087 Huntington Dr., Los Angeles 32
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Presto Elect. Co., N. Y. Ave., Union City, N. J.
Struthers Dunn, Inc., Arch St., Phila.

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Haydon Mfg. Co., Inc., Forestville, Conn.
H-B Electric Co., 6122 N. 21 St., Phila.
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Sangamo Elec. Co., Springfield, Ill.
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Erie Resistor Corp., Erie, Pa.
Globar Div. Carborundum Co., Niagara Falls, N. Y.
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Centralab, Milwaukee, Wis.
Chicago Tel. Supply Co., Elkhart, Ind.
Cinema Eng. Co., Burbank, Cal.
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Electro Motive Mfg. Co., Willimantic, Conn.
General Radio Co., Cambridge, Mass.
G-M Labs., Inc., Chicago, Ill.
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Intern'l Resistance Co., Philadelphia
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Lamson & Sessions, Cleveland, O.
Manufacturers Screw Prod., 216 W. Hubbard St., Chicago 10
National Screw & Mfg. Co., Cleveland, O.
New England Screw Co., Keene, N. H.
Parker Co., Charles, The, Meriden, Conn.
Parker-Kalon Corp., 198 Varick, N. Y. C.
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Central Screw Co., 3519 Shields Av., Chicago
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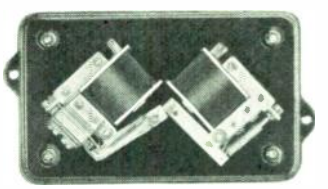

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Eagle Elec. Mfg. Co., Brooklyn, N. Y.
Eby, Inc., H. H., Philadelphia
Federal Screw Prods. Co., 26 S. Jefferson, Chicago
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Jones, Howard B., 2300 Wabansia, Chicago
Micarta Fabricators, Inc., 4619 Ravenswood, Chicago
Millen Mfg. Co., James, Malden, Mass.
Miller Co., J. W., Los Angeles, Cal.
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Crescent Industries, Inc., 4132 W. Belmont Ave., Chicago
Cuyahoga Spring Co., Cleveland, O.
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Instrument Specialties Co., Little Falls, N. Y.
Muehlhausen Spring Corp., Logansport, Ind.
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Raymond Mfg. Co., Corry, Pa.
Security Steel Equip. Corp., Avenel, N. J.
Standard Spring & Mfg. Co., Ind., 236-42 St., Brooklyn, N. Y.
★ Willor Mfg. Corp., 794 E. 104 St., N. Y. C. 54

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★ Goat Metal Stampings, Inc., 314 Dean St., Brooklyn, N. Y.
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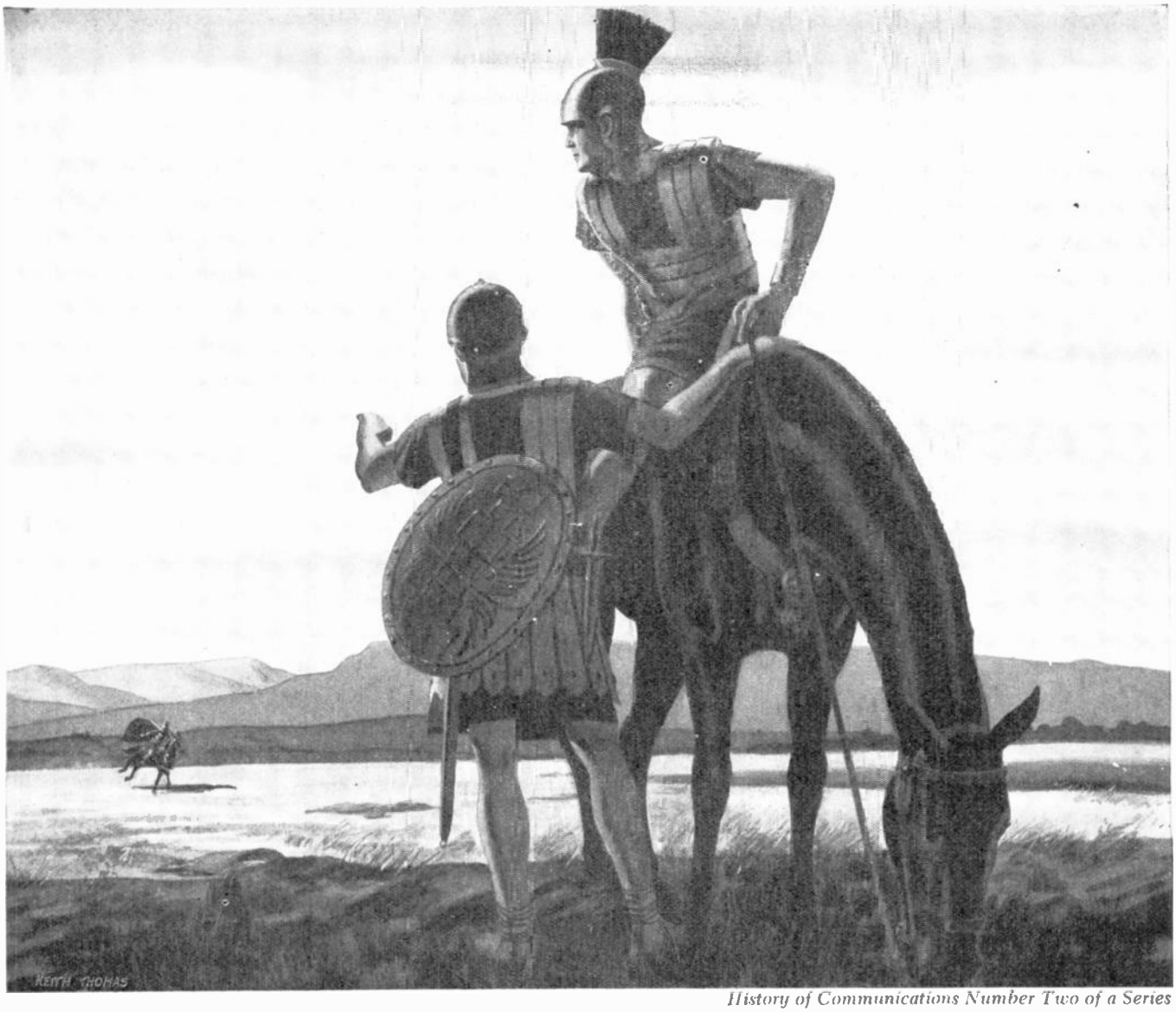

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Thermador Elect. & Mfg. Co., Riverside Dr., Los Angeles
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Farnsworth Tele. & Radio Corp., Ft. Wayne, Ind.
★ General Elec. Co., Schenectady, N. Y.
Ken-Rad Tube & Lamp Corp., Owensboro, Ky.
Nat'l Union Radio Corp., Newark, N. J.
North Amer. Philips Co., Inc., Dobbs Ferry, N. Y.
Rauland Corp., Chicago, Ill.
★ RCA Mfg. Co., Camden, N. J.
★ Sylvania Elect. Prod., Inc., Emporium, Pa.
Westinghouse Elect. & Mfg. Co., E. Pittsburgh, Pa.

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Amperite Co., 561 Broadway, N. Y. C.
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★ Hytron Corp. & Hytronic Labs., Salem, Mass.
★ RCA Mfg. Co., Camden, N. J.
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Weston Elec. Inst. Corp., Newark, N. J.

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Nat'l Union Radio Corp., Newark, N. J.
Raytheon Prod. Corp., 420 Lexington Av., N. Y. C.
★ RCA Mfg. Co., Camden, N. J.
★ Sylvania Elect. Prod., Inc., Emporium, Pa.
Tung-Sol Lamp Works, Newark, N. J.

TUBES, Transmitting

Amperex Electronic Prods., Brooklyn, N. Y.
★ Eitel-McCullough, Inc., San Bruno, Cal.
Electronic Enterprises, Inc., 65-67 Av., Newark, N. J.
★ Federal Telephone & Radio Corp., Newark, N. J.
★ General Elec. Co., Schenectady, N. Y.
Heintz & Kaufman, S. San Francisco, Cal.
★ Hytron Corp., Salem, Mass.
Ken-Rad Tube & Lamp Corp., Owensboro, Ky.
Nat'l Union Radio Corp., Newark, N. J.
North Amer. Philips Co., Inc., Dobbs Ferry, N. Y.
Raytheon Prod. Corp., 420 Lexington Av., N. Y. C.
★ RCA Mfg. Co., Camden, N. J.
Slater Electric & Mfg. Co., Brooklyn, N. Y.
Sperry Gyroscope Co., Inc., Brooklyn, N. Y.
★ Sylvania Elect. Prod., Inc., Emporium, Pa.
Taylor Tubes, Inc., 2341 Wabansia, Chicago
United Electronics Co., Newark, N. J.
Western Elec. Co., 195 B'way, N. Y. C.
Westinghouse Lamp Div., Bloomfield, N. J.

TUBES, Voltage-Regulating

Amperite Co., 561 Broadway, N. Y. C.
Hytron Corp., Salem, Mass.
★ RCA Mfg. Co., Camden, N. J.
★ Sylvania Elec. Prod., Inc., Salem, Mass.

TUBING, Laminated Phenolic

Brandywine Fibre Prods. Co., Wilmington, Del.
Formica Insulation Co., Cincinnati, O.
★ General Electric Co., Pittsfield, Mass.
Insulation Mfgrs. Corp., 565 W. Washington Blvd., Chicago
Mica Insulator Co., 196 Varick, N. Y. C.
Nat'l Vulcanized Fibre Co., Wilmington, Del.
Richardson Co., Melrose Park, Ill.
Spaulding Fibre Co., 233 B'way, N. Y. C.
Synthane Corp., Oaks, Pa.
Taylor Fibre Co., Norristown, Pa.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Wilmington Fibre Specialty Co., Wilmington, Del.

TUBING, Precision Metal

Superior Tube Co., Norristown, Pa.

TUBING & SLEEVING, Varnished Cambric, Glass-Fibre, Spaghetti

Bentley-Harris Mfg. Co., Conshohocken, Pa.
Brand & Co., Wm., 276 Fourth Av., N. Y. C.
Electro Tech. Prod., Inc., Nutley, N. J.
Endurette Corp. of Amer., Cliffwood, N. J.
★ General Elec. Co., Bridgeport, Conn.
Insulation Mfgrs. Corp., 565 W. Washington Blvd., Chicago
Irvington Var. & Ins. Co., Irvington, N. J.
Mica Insul. Co., 196 Varick St., N. Y. C.
Mitchell-Rand Insulation Co., 51 Murray St., N. Y. C.
Varflex Corp., Rome, N. Y.

TURNTABLES, Phonograph

General Industries Co., Elyria, O.
★ R C A Mfg. Co., Camden, N. J.
Western Electric Co., 125 B'way, N. Y. C.

VARNISHES, Insulating, Air-Drying & Baking

John C. Dolph Co., Newark, N. J.
Irvington Var. & Ins. Co., Irvington, N. J.
Mitchell-Rand Insulation Co., 51 Murray St., N. Y. C.
Stille-Young Corp., 2300 N. Ashland Av., Chicago
Zophar Mills, Inc., 112-26 St., Bklyn, N. Y.

SPOT NEWS NOTES

(CONTINUED FROM PAGE 20)

Films for Television: Battle films may be televised within 36 hours after they are delivered to the Navy Department. This service is available to all stations, according to the Navy Office of Public Relations.

Chester A. Cole: Appointed eastern district manager for John Meck Industries. He has set up offices at 500 Fifth Avenue, New York City, which will also serve as a field office for Meck engineers. Jobber and dealer sales for the Atlantic Coast area will be handled from the New York headquarters.

Dispatcher N. Manville: At Oak Park, Ill. station WQFL, handling the usual run of police messages, received a fire alarm call which required the routine dispatching of a car to the scene. He checked for the nearest car, called it, got the acknowledgment, gave the address, and then, with the carrier still on, let out a yell: "Hey, that's my house!" It was not only his house, but his own apartment.

American Television Society: At a round-table discussion held in New York City, participating engineers agreed that the limit of picture definition depends upon the time and money spent on attaining improvement, and that, at some time in the future, 1,500-line definition may be reached by transmitting on frequencies around 1,000 mc.

Norman D. Waters, president of ATS, acted as quiz master for the engineering panel comprised of Dorman Israel of Emerson Radio, William Bohlke of RCA, William B. Still of Jamaica Radio & Television Service, Richard Campbell of Allan B. Du Mont, Milton Walsh of RCA, and Philip Goetz of CBS.

Oden F. Jester: Newly appointed vice president of Meissner ManufacturingCompany, Mt. Carmel, Ill., will be in charge of the new Meissner offices in the Palmolive Building, Chicago. He resigned as vice president in charge of sales at Utah Radio Products to take up this new post.

B. Ray Cummings: Vice president in charge of engineering at Farnsworth Radio & Television Corp., expressed the opinion to the members of the Television Press Club that in postwar television sets the projection tube will replace tubes which are viewed directly or by reflection.

After the war, if your products aren't used for FM and Television you probably won't be in the radio business

Here Are the Facts for Your Consideration

Consider these facts about FM — Equipment manufacturers count on FM production for immediate reconversion, to take up the first facilities made available as war contracts taper off. They can make this move quickly because:

1. Plans are already set to shift broadcasting from AM to FM transmission.

2. Police, public utility, and the projected railway communications will all use FM.

3. Facsimile for home reception will be broadcast by the FM stations.

4. FM radio networks will largely replace the wire lines now in use.

5. The FCC has already specified FM for television sound channel transmission.

Consider these facts about Television — As soon as materials and manpower are released, work will be rushed on the development of final commercial designs for transmitters and home receivers. This will be the second step in taking up the reconverted production facilities of the radio industry because:

1. The public is ready and waiting to buy television sets as soon as perfected models are put on sale.

2. Plans are being laid now for the locations of transmitters and television networks.

3. Advertisers are at work to perfect the technique of television entertainment. The support of sponsors is assured.

4. Capital is ready to finance set manufacture and broadcasting.

Consider These Facts about "*FM* AND TELEVISION"

Now in its fourth year, this publication has consistently appealed to the leaders in all branches of the radio field — to "the men who set the pace the industry follows." These are the men who are setting the stage for the postwar expansion of FM and Television. To reach these men with your advertising, *FM* AND TELEVISION is the logical first choice because:

1. It has won and continues to hold the interest and respect of the leaders of the industry, through its outstanding contribution to the progress of FM in broadcasting, communications, and military applications.

2. This has been accomplished by the presentation of complete information, accurate information, and constructive, well-informed editorial planning.

3. Now, the scope has been broadened to give Television the same editorial treatment and the same constructive support.

4. No other magazine performs an equivalent service.

5. The 5,000 circulation of *FM* AND TELEVISION represents the most highly concentrated circulation among top engineers and executives that can be bought at any price.

6. After the war, to continue in the radio business, you must sell the companies represented by the readership of *FM* AND TELEVISION. The 12-time page rate is $125. Put *FM* AND TELEVISION to work now to pave the way for your postwar sales. Complete information is available on request.

"for the men who set the pace the Industry follows"

RADIO DESIGNERS ITEMS

Oil Condenser: An unusual condenser design is the .01-mfd., 40,000-volt unit, Fig. 8, manufactured by Industrial Specialty Company, 1725 W. North Avenue, Chicago 22. The welded steel case, $4\frac{11}{16}$ ins. by $5\frac{3}{4}$ ins. by 7 ins. high is surmounted by a Westinghouse solder-seal terminal to prevent leakage of oil or the entrance of moisture. This condenser is designed to operate at 80° C., and to withstand total immersion.

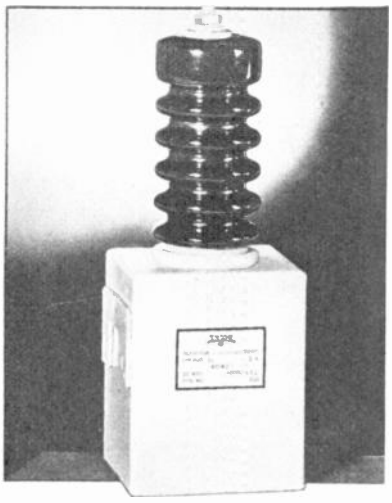

FIG. 8. 40,000-VOLTOIL CONDENSER

Oscillograph: Designed with a range of $\frac{1}{2}$ cycle to 500 kc., the new DuMont type 247 oscillograph permits the examination of transient or recurrent phenomena over a wide range of frequencies. Vertical frequency response is flat within 10 per cent from 2 cycles to 200 kc., and is down 50 per cent at 650 kc. An A-N preferred type 5CP1 tube is furnished, 5 ins. in diameter. A number of improvements and refinements are provided to give improved performance and to broaden the scope of use.

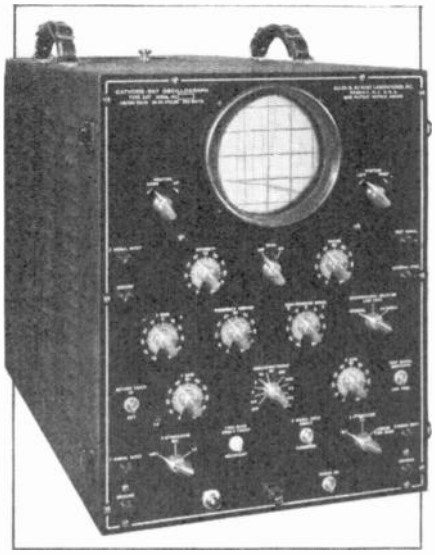

FIG. 9. NEWLY DESIGNED OSCILLOGRAPH

PREMIÈRED BY TELEVISION

(CONTINUED FROM PAGE 13)

With such fancy trappings, it seems no exaggeration to say that NBC and MGM regarded the evening as an event of consequence, with newspaper folk and others invited to judge in its early stages what may be a commonplace occurrence in the future. And yet the conclusion is inescapable that the show was a good deal less than an auspicious occasion, and one that would hardly stimulate interest in the new medium, particularly among those who forsook the edibles at the Ritz for surroundings of an average member of the home television audience. Thus the following report which appeared in *The New York Times* was written from the point of view of the citizens who must support television by buying receivers and patronizing sponsors:

If nothing else, elemental showmanship was lacking. The film, entitled *Patrolling the Ether*, was only a "short" that attempted to tell about the work of the FCC in tracking down espionage transmitters. The cast was non-professional by usual Hollywood standards and there was more silly cops-and-robber stuff than any serious attempt to tell about radio intelligence, which could be a fascinating yarn. Certainly, it would seem MGM and NBC could have found better fare for television's first world premiere of a motion picture. Why not Hedy Lamarr, for instance?

From the television aspect, three individuals who have been paid at one time or another to go to the motion pictures and theatre agreed on these points: Primarily, television in April, 1944, is still hard on the eyes; a maximum degree of concentration is required and, accordingly, the instinct to turn off the receiver is even stronger than with a radio program that is not to a listener's liking. Lastly, the room lighting has to be lowered appreciably for even partial enjoyment, which is going to be rough on other members of the household who want to read books or the evening newspaper.

These complaints are no doubt petty, and probably the engineers already have the answers. But if the layman's expectations are not met at the moment, the fault would seem to lie with television's best friends rather than with the medium itself.

In recent weeks, the manufacturing companies and net works have gone all-out in their promotion. "Television is here," runs the cry, accompanied by a welter of statistics and promises. The experts know whereof they speak, it may be assumed, but what they have in mind are largely improvements that either cannot be shown for military reasons or cannot be built under present material and man-power shortages.

Only the foolish will deny that the video art is truly an n'th wonder of the age, but it is not ready yet to be mentioned in the

(CONTINUED ON PAGE 60)

PUNCH IN HOLES INDICATED — FILE IN YOUR NOTEBOOK

TECHNICAL NOTES

Excerpts from New Home Study Lessons Being Prepared under the Direction of the CREI Director of Engineering Texts

The Iconoscope

Regardless of whether or not television is being employed in the present war, it undoubtedly will be one of the most important post-war enterprises. CREI has been fully aware of this, and has prepared a specialized course on the subject. We borrow, from this source, our material, the technical article appearing in the May issue of the CREI NEWS. The subject is the iconoscope, and Part I presented in the May issue deals with the general aspects of photoelectric and secondary emission phenomena as a preparation for Parts II and III, in which the action of the Iconoscope itself will be analyzed.

The approach is mainly from the physical viewpoint, since to the average engineer, a good qualitative understanding of the action of the iconoscope will stand him in better stead than a theoretical mathematical presentation, which is not of much use practically because of the difficulty in measuring the various quantities involved.

As you probably know by this time, ***the CREI NEWS is offered free*** for the asking to anybody sufficiently interested to write us for it. ***Write today for the May issue, and the article,***

"The Iconoscope."

You incur no obligation in requesting to be put on our mailing list.

★ ★ ★

The subject of "The Iconoscope" is but one of many that are being constantly revised and added to CREI lessons by A. Preisman, Director of Engineering Texts, under the personal supervision of CREI President, E. H. Rietzke. CREI home study courses are of college calibre for the professional engineer and technician who recognizes CREI training as a proven program for personal advancement in the field of Radio-Electronics. Complete details of the home study courses sent on request. . . . *Ask for 36-page booklet.*

CAPITOL RADIO
ENGINEERING INSTITUTE

E. H. RIETZKE, President

Home Study Courses in Practical Radio-Electronics Engineering for Professional Self-Improvement

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WASHINGTON 10, D.C.

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PREMIÈRED BY TELEVISION

(CONTINUED FROM PAGE 59)

same breath with the theatre, radio and motion pictures, so far as the layman's ease of enjoyment is concerned. The technician may regard that as a harsh comparison, but the advertiser who pays the bills and the person asked to lay out $150 or more for a new receiver is not apt to get widely excited about much less.

Television would seem to be building up an unnecessary headache for itself at this stage of the game by overselling its virtues. Theatrical warehouses and radio script bins are filled with good shows that were over-promoted prematurely, and any old-time showman can vouch that the most deadly audience is the one that comes into the theatre saying, "Show me." Reasonable promotion of television is only sound business, but the superman approach might be allowed to wait until the real show opens. The audience will be there if it's good.

WHAT'S NEW THIS MONTH

(CONTINUED FROM PAGE 4)

certainty on which to plan the future of a business dedicated to the service of public interest, convenience, and necessity.

With the radio broadcasters, the Federal Communications Commission, and our legislators burdened with tremendous wartime responsibilities and obligations, we find 1) that the executives of the broadcasting stations are being constantly bedevilled by the FCC because the Commissioners have decided that the industry is sick, and must swallow a dose of reorganization medicine, even if the patient strangles from the effects; 2) that the Commissioners are forced to spend an unconscionable amount of time testifying in defense of their acts at Congressional investigations and hearings; and 3) that our legislators, overtaxed with problems of national security and international peace, are spending time and energy on investigating the legality of FCC actions, and trying to curb the Commissioners by amending the entirely adequate Communications Act of 1934.

No one would claim that our American system of broadcasting is perfect, or that it is not subject to improvement. Still, it is the greatest system of public radio service in the world, and it reached that status even before the 1934 radio laws were enacted, and without benefit of the present FCC administration.

If there is a situation that can be properly compared with a dead mackerel in the moonlight, not only the broadcasters are involved, but the FCC and our legislators as well for, between them, they are spending countless man-hours and millions of taxpayers' dollars with only a continued turmoil in the radio industry to show for their efforts.

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WHAT'S NEW THIS MONTH

(CONTINUED FROM PAGE 60)

By way of contrast are the words of the late ICC chairman, Joseph B. Eastman, when, only a few days before his death, he outlined a credo for administrators of Government agencies, based on his own experience. He said, in part:

"The statutes which the tribunal administers should be well, simply and carefully framed, but the personnel which does the administering is more important than the wording of the statute. Good men can produce better results with a poor law than poor men can produce with a good law. Zealots, evangelists and crusaders have their value before an administrative tribunal, but not on it.

"Other important qualifications are patience, courtesy and a desire to be helpful to the extent that the law permits. There is nothing more important than to curb abuse of power, wherever it may reside, and power is always subject to abuse.

"The importance of sound public regulation cannot be minimized, but it must not be magnified to the exclusion of those factors in financial success upon which ordinary private business must rely."

The occasion for these remarks was a testimonial dinner in honor of his 25 years of service in the Interstate Commerce Commission. During this period, he became one of the most highly respected administrators in Washington.

If the FCC has been right, then Mr. Eastman's policies were entirely wrong. In its efforts to reorganize and reform the broadcasting industry, the FCC has played the part of the zealot, the evangelist, and the crusader. The words of the Commissioners have repeatedly displayed impatience and discourtesy, and their actions have been frequently arbitrary and uncoöperative, lacking the spirit of constructive thinking.

Moreover, during the past three years, the FCC's methods of adding regulation upon regulation have involved hearings which put a financial burden upon the broadcasters amounting to millions of dollars. Legal expense is an item of cost which appears in station rates paid by advertisers, and is a part of distribution costs ultimately paid by the buying public.

The name most often connected with actions by the FCC is that of its Chairman. Actually, he is only one of the seven men who constitute this Commission. If the Chairman is wrong, the majority of the Commissioners is equally to blame.

So much for the unhappy record of the past. Today, the men and women of this Country are engaged in a war against nations whose citizens have countenanced

(CONTINUED ON PAGE 62)

WHAT'S NEW THIS MONTH

(CONTINUED FROM PAGE 61)

arbitrary, presumptuous, and abusive acts by their leaders. And now, these people would reduce us to the same condition of servitude.

We propose to emerge victorious from this great struggle. We are encouraged to fight by the hope for a new era that will come with peace — an era of progress for all to share, in which we shall offset the devastation of war by applying to constructive effort the lessons we are now learning at such great expense.

In the period following the War, radio can have a dual rôle. It can contribute enormously toward reorienting our national philosophy from war to peace. It can also play a leading part in our national economy when our industries are released from military production.

However, this will be possible only if the groundwork of planning is laid now, and is laid soundly, for the future growth of the radio art.

Such planning is as impersonal as the search for truth itself. The burden of this task must be borne by the FCC. It must recognize selfish intent on the part of those who would influence its decisions. To do that, it must first eliminate arrogance on the part of its own membership. It must treat with respect those whom it asks to be self-respecting.

The magnitude of the preparations for peace is being outlined now as the problems come to light in the work of the RTPB. This Board is discovering that postwar radio includes not only the perfection and expansion of services already established before the War. There are, in addition, countless new services to be launched which represent the application of accelerated wartime progress and discovery.

Whether these services will be made available to the public, and whether war workers and returned soldiers will be given employment in production, operation, and maintenance of these services depends upon the wisdom of the FCC in laying the groundwork for them *right now*.

In the end, if this is not accomplished by the FCC, it will be accomplished in spite of the FCC. The present Commissioners, under the existing radio laws, can carry out this undertaking if they have the will to do it. They may not find all the right answers the first time. No one could expect so much. But where the spirit of good will prevails, nothing is impossible of achievement.

The first step toward the accomplishment of this great service to public interest, convenience and necessity, the token act by which the FCC will make its intentions clear to all, will be the burial of that dead mackerel, once and for all, deep in the sands of the moonlit shore where

(CONTINUED ON PAGE 63)

WHAT'S NEW THIS MONTH

(CONTINUED FROM PAGE 62)

it has shone and stunk so long, to the discredit of our Federal Communications Commission.

3. One of the most interesting developments in postwar civilian radio sets will be the FM portable. The specifications have been established already, at least in part, by the extremely successful FM handy-talkie. With this as a starting point, the transmitter can be left out, larger batteries substituted for those now used, and the output increased enough to drive a loudspeaker. The collapsible antenna will probably be retained, for it is superior to any loop arrangement, even for reception from horizontally polarized transmitting antennas. The net result will be a lighter portable radio, giving much increased battery life through the use of miniature tubes.

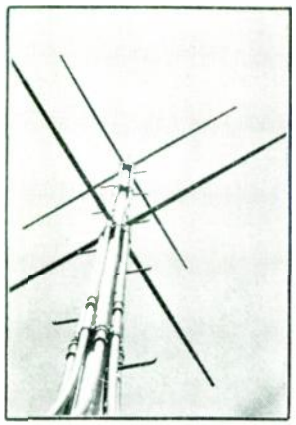
Of greatest importance as a sales feature, however, will be its superior performance. At a majority of the summer places where the portables are most needed, AM receiving conditions are unfavorable. Those who have had personal contact with dealers and servicemen in such localities have heard of the complaints from summer visitors: "Something has happened to my portable. It worked all right when I left the city!" Invariably, the answer is: "There's nothing wrong with it. Portables just don't work well here."

Will FM be different? The answer is emphatically, "Yes." It just happens that there is now FM reception available in two extremely popular summer resort areas where AM reception generally, from both home radios and portables, is notoriously poor. These are central and northern New England, and east central New York. In these areas, FM reception is excellent — entirely free from the erratic behavior of AM.

One of these sections, visited by people from all over the United States, runs from Albany through Schenectady and up to Saratoga and Lake George, where AM reception is worst of all. Now, however, FM stations are putting down adequate and dependable signals that assure satisfaction in that area.

The same thing is true in parts of New Hampshire, Vermont, and Maine. With FM portables, vacation-time reception of enjoyable quality will be assured. This experience will be duplicated in other parts of the Country as soon as construction permits now pending are granted, and the projected transmitters go on the air.

News of better performance travels fast. The news about FM portable sets, tied up with the stories that we'll hear about FM talky-walkies when our men are released from the Service, will bring about a complete change in portable radio designs.



REL

THE FORERUNNER OF POSTWAR

HIGH-POWER FM SKYSCRAPER INSTALLATIONS

THE first high-power FM transmitter to be installed atop a skyscraper is the 50-kw. REL model 521 equipment, completed in October, 1941 for the Evening News Association in the Penobscot Building, Detroit — first FM station in Michigan.

To those who do not have suitable high ground available, and must therefore use a tall building to obtain sufficient antenna height, WENA (formerly W45D) is of special interest.

Primary power equipment is installed in the basement. The 3-kw. REL driver and the 50-kw. REL amplifier, together with the speech and control equipment, are on the 45th floor, where the studios and offices are located. On the 46th floor are the water circulating pumps, filament motor-generator, and gas tanks for the transmission line. Phasing and matching section for the antenna is on the roof. A 2-bay REL turnstile is mounted above the ball at the top of the tower, as the illustrations show.

This is probably the most difficult installation that any manufacturer of radio transmitters has been called upon to make. To REL engineers, it was another opportunity to apply our unequalled background of experience. The highly successful performance of WENA over a period of nearly three years is proof that the job was well done.

Such is the engineering service available to all purchasers of REL Frequency Modulation transmitters and associated equipment.

PIONEER MANUFACTURERS OF FM TRANSMITTERS EMPLOYING ARMSTRONG PHASE-SHIFT MODULATION

RADIO ENGINEERING LABS., INC.

Long Island City, N.Y.

RUMFORD PRESS
CONCORD N H

A "FEATURE" of the Meeting

An outstanding program was presented at the meeting of the New England Section, International Municipal Signal Association and Eastern States Police Radio League at Boston on March 22.

A talk by **Sergeant Donald McFarlane,** Radio Supervisor of the Metropolitan District Police, Boston, and his demonstration illustrated above—of **LINK FM two-way radio communication equipment** used by the Metropolitan Police, was a feature of the program.

Wherever municipal signal engineers and radio technicians gather, Link Radio and Electronic Equipment is foremost in their thoughts and discussions . . . a condition reflected in the number of notable Link installations in cities, counties and states from Border to Border and Coast to Coast.

For the needs of the ARMED SERVICES on all fighting fronts, for American communities qualifying for protection now, for those seeking the finest in radio communication for Today and Tomorrow . . . Link Equipment will continue to be preferred.

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Fred M. Link

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