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FM AND TELEVISION

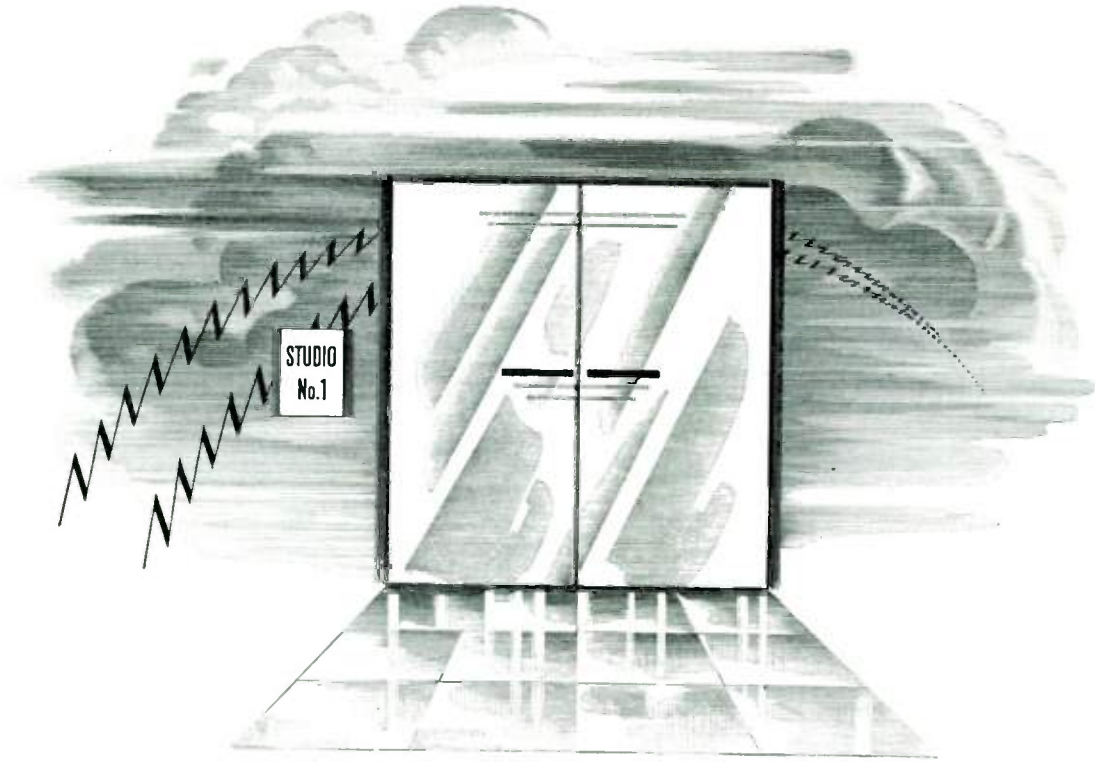
MAY 1944

DEAN OF THE FM BROADCASTING ENGINEERS

Directory of Manufacturers

★ ★ Edited by Milton B. Sleeper ★ ★

YOUR NEW "STUDIO ONE"



. . . something to think about, now that you're on the threshold of full-scale commercial television

No top-flight broadcasting station will be without one . . . a year after victory.

The big question *now* is "How soon can a television studio be operated profitably?" The DuMont organization can help you answer that one . . . through a new service which makes DuMont's extensive telecasting background yours to command.

DuMont has pioneered in designing and equipping three television stations . . . has operated its own station—W2XWV, New York—for more than three years.

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"Planning Your Television Station" tells you how to have a low-cost telecast operation . . . describes the compact equipment units that make it possible for you to expand without replacement losses.

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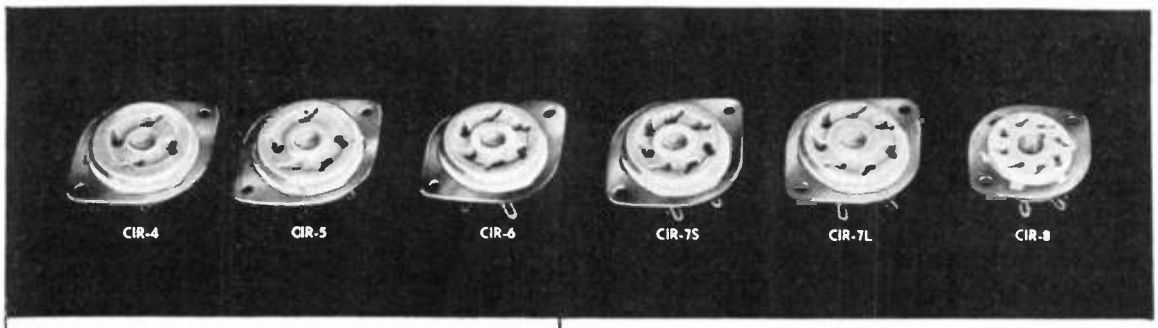
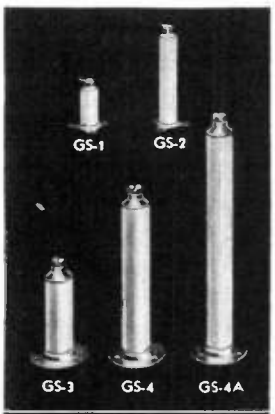
NATIONAL LOW-LOSS SOCKETS AND INSULATORS



CIR Series Sockets

Any Type **List $ .45**

Type CIR Sockets feature low-loss isolantite or steatite insulation, a contact that grips the tube prong for its entire length, and ring for six position mou... supplied with two meta...



GS...

GS-...

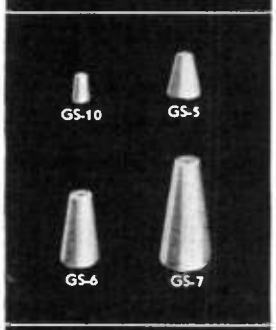
GS-3...

GS-4,...

GS-4A...

Cylindri... standoff ... plated cap...

GSJ, (not i... A special ... top threade... diameter insu... & GS-4A.



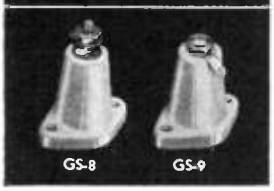
GS-5, 1¼" **List, each $ .40**

GS-6, 2" **List, each $ .70**

GS-7, 3" **List, each $ 1.25**

GS-10, ¾", package of 10 **List $ .12**

These cone type standoff insulators are of low-loss steatite. They have a tapped hole at each end for mounting.



GS-8, with terminal **List $ .90**

GS-9, with Jack **List $ 1.25**

These low-loss steatite standoff insulators are also useful as lead-through bushings.

AA-3 **List $ .60**

A low-loss steatite spreader for 6 inch line spacing. (600 ohms impedance with No. 12 wire.)

List $ .50

...teatite aircraft-...lator.

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...ose strain in-...ss steatite.

...t, each $· .20**

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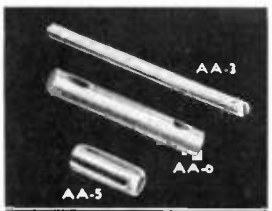
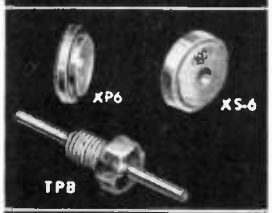
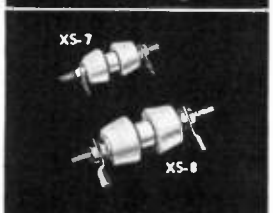
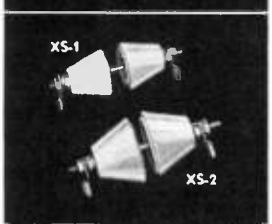








XS-1, (1" Hole) **List $ 1.20**

XS-2, (1½" Hole) **List $ 1.35**

Prices listed are per pair, including metal fittings. Insulation steatite.

XS-3, (2¾" Hole) **List $ 6.00**

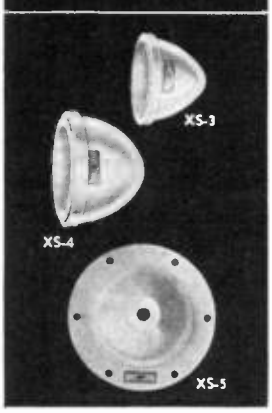
XS-4, (3¾" Hole) **List $ 7.25**

Prices are per pair, including metal fittings. These low-loss steatite bowls are ideal for lead-in purposes at high voltages.

XS-5, Without Fittings **List, each $ 8.25**

XS-5F, With Fittings **List, per pair $17.00**

These big low-loss bowls have an extremely long leakage path and a 5¼" flange for bolting in place. Insulation steatite.



GROUP SUBSCRIPTIONS

FM COMPANY,
240 Madison Ave., New York 16, N. Y.

Please enter the following subscriptions, for which remittance is enclosed:

- ☐ One 1-year subscription $3.00
- ☐ Two 1-year subscriptions $5.00
- ☐ Three 1-year subscriptions $6.00
- ☐ Four 1-year subscriptions $7.00
- ☐ Five 1-year subscriptions $8.00

NOTE: Groups of 6 subscriptions or more will be accepted at the rate of $1.60 each for one year.

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Three Important ANNOUNCEMENTS

1

The series of articles on facsimile, starting on page 11 of this issue, is of the utmost importance to every engineer or executive now formulating postwar radio plans.

Facsimile instruments for home reception can be put into quantity production as soon as materials are released by WPB. Any FM station can transmit sound and facsimile simultaneously. Both services can be received simultaneously on any FM set with a facsimile attachment.

The second article of this series will appear in June, and will be followed by others in succeeding issues.

2

We have been asked repeatedly to publish Major Armstrong's original paper on FM which he delivered before the I.R.E. on November 6, 1935. No copies of this paper are available now. Accordingly, by permission of the Institute we shall publish the complete text in our June issue.

Written in simple terms, without the use of mathematics, and accompanied by 37 drawings and photographs of the original equipment, it is an engineering classic which every man in the industry should read.

3

Our semi-annual Directory of Emergency Radio Stations will appear in the July issue. Its value will be greatly enhanced because permission has been granted to include station calls. Over 1,700 police, marine fire, forestry, and public utility stations will be listed. Subscription orders to include this issue should be placed now. We cannot promise to supply extra single copies.

Each issue of FM and TELEVISION will help you to get a clearer picture of things to come, and to plan your postwar activities more effectively. Subscribe TODAY!

FM AND TELEVISION

FORMERLY: FM RADIO-ELECTRONICS

VOL. 4 MAY, 1944 NO. 5

CONTENTS

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MILTON B. SLEEPER, *Editor and Publisher*

WILLIAM T. MOHRMAN, *Advertising Manager*

GORDON CROTHERS, *Circulation Manager*

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FM Magazine is issued on the 30th of each month. Single copies 25c — Yearly subscription in the U. S. A. $3.00; foreign $4.00. Subscriptions should be sent to FM Company, 240 Madison Avenue, New York City.

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

Commander Paul A. de Mars, former vice president of the Yankee Network in charge of engineering, was the first broadcast engineer to recognize the capabilities of Major Armstrong's FM system for eliminating static, and to take an aggressively active part in the preliminaries which resulted in establishing the present FM broadcast band.

He is generally credited with having brought about the wide use of FM by the U. S. Navy which, with traditional conservatism, clung to AM during the first year after Pearl Harbor. His unusually broad experience has won him some exceedingly interesting assignments. After the War, Commander de Mars will conduct a consulting practice from offices in Boston and Washington.

WHAT'S NEW THIS MONTH

1. Second important event in the Frequency Modulation's 1944 program of expansion was the American Newspaper Publisher's Association convention, held in New York City during the last week of April. More than 900 publishers devoted the fourth day of the convention to a symposium on FM broadcasting. Major Armstrong, GE's Dr. Baker, and Walter Damm, President of FMBI and general manager of Milwaukee stations WMFM and WTMJ, were the speakers.

To the publishers who must now decide whether to fight the competition of broadcasting or take the enemy into their own camps, Major Armstrong said: "You now have a second opportunity to enter the radio field and to furnish (radio) service in communities which could never hope to have a station in the standard broadcast band. In addition, you have the opportunity to enter the field on the basis of a system which is recognized by the public as better than the AM system." He took this opportunity to emphasize a point that is not even understood clearly by many radio men who think that FM transmission is generally limited to direct line-of-sight: "Today we know FM is working up to three or four horizons and, given suitable elevation, will outwork the standard 50-kw. stations in most instances."

Dr. Baker touched on a very tender spot when he reminded the publishers that the gross revenue of all broadcasting stations exceeded a quarter-billion dollars in 1943 — a substantial part of which represents a loss of income to the newspapers.

Pointing out that "FM stations can build an audience and deliver it to advertisers day in and day out, regardless of weather or other conditions that frequently affect standard broadcast stations," and that "FM provides a uniform service both day and night," Dr. Baker told the publisher: "Because of the efficient local coverage possible with FM, the comparatively low cost of construction and maintenance of an FM station, and in view of the tremendous future of FM networks, the newspapers are certainly missing an opportunity which Frequency Modulation offers them tomorrow if they do not investigate the possibilities of FM today."

(CONTINUED ON PAGE 59)

TEAM BEHIND THE BOMBER TEAM

• Just as seven men fight as a team in a bomber, seven girls work as a team at a Sylvania Radio Tube assembly bench.

Thousands of fine precision radio tube parts are assembled into a finished product that must pass rigorous tests for ruggedness and sensitivity.

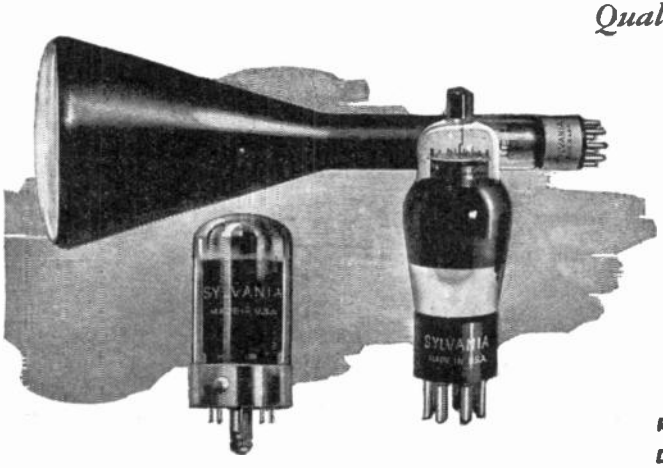
This is work that calls for the feminine touch, patience and sense of detail. Each girl "plays the position" on the team best suited to her ability.

Sylvania assembly teams compete with each other. But the champion in accuracy always takes precedence over the champion in speed.

This teamwork is just another example of how Sylvania maintains radio tube production at the highest standard of quality anywhere known.

You can sell Sylvania Radio Tubes with complete confidence.

Quality That Serves the War Shall Serve the Peace



RADIO DIVISION EMPORIUM, PENNSYLVANIA

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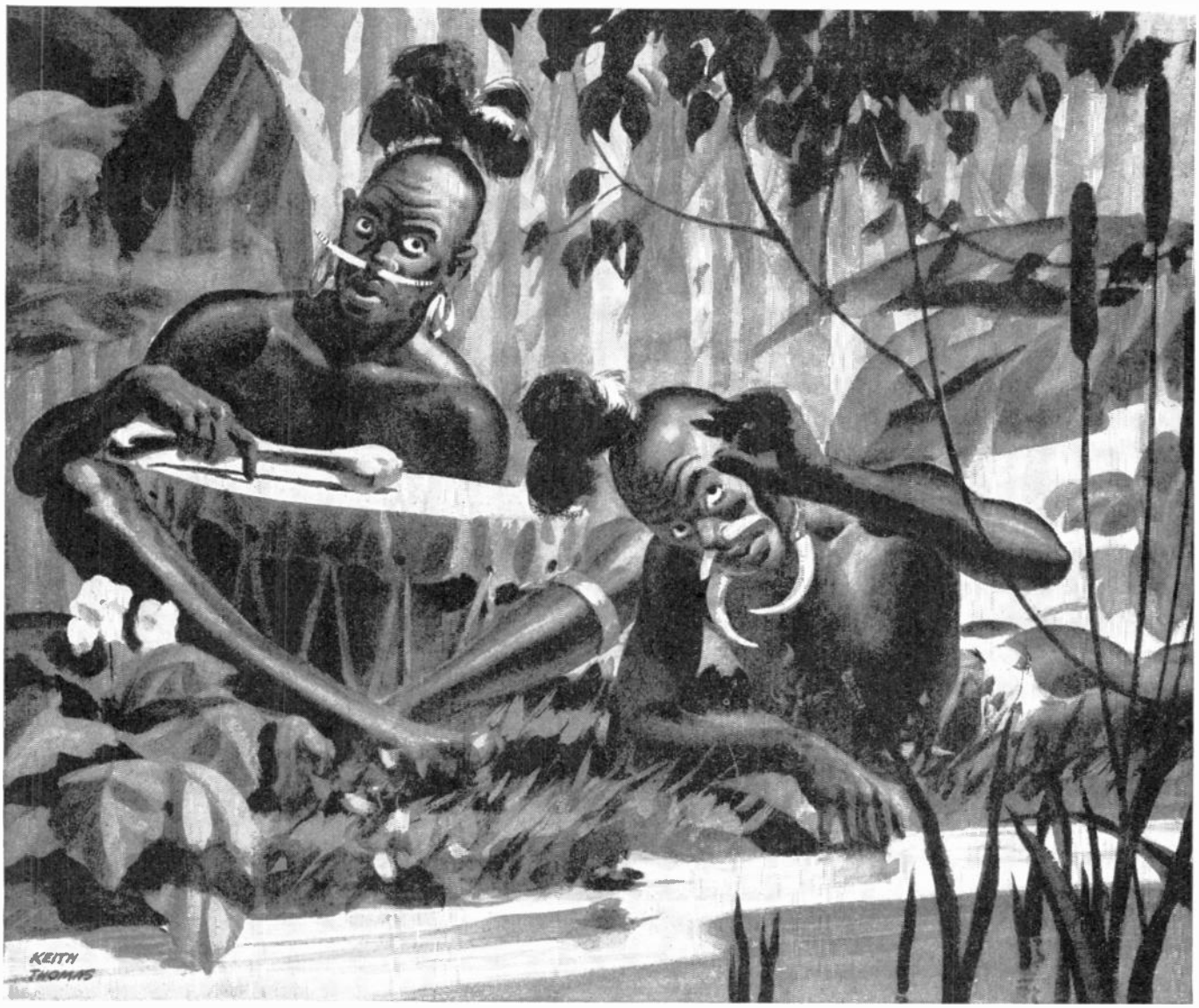
ELECTRIC PRODUCTS INC.

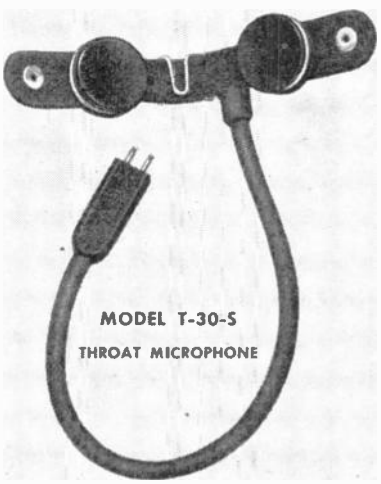
RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVICES, INCANDESCENT LAMPS, FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES

ADVERTISERS INDEX



History of Communications Number Three of a Series

PRIMITIVE COMMUNICATIONS



An early communications instrument was the Tom-Tom—to prove its efficiency, it is still used by the natives of Africa. Tom-Tom signals are "Beat out" along jungle lined rivers, but even then distance is a handicap, and "repeater" stations are many.

Like all means of communications, other than voice communication, translation of coded signals must take place in which additional skill is required, and another chance of error is presented. As in the case of the Tom-Tom beater: knowledge of the Tom-Tom code was restricted to a special family within the tribe, and was handed down from generation to generation.

Today, Universal Microphones in the hands of the fighting men of the Allied Armed Forces are performing a simple but vital need in electronic voice communications where their quality and efficiency are bringing us one step closer to victory.

< Model T-30-S, illustrated at left, is but one of several military type microphones now available to priority users through local radio jobbers.

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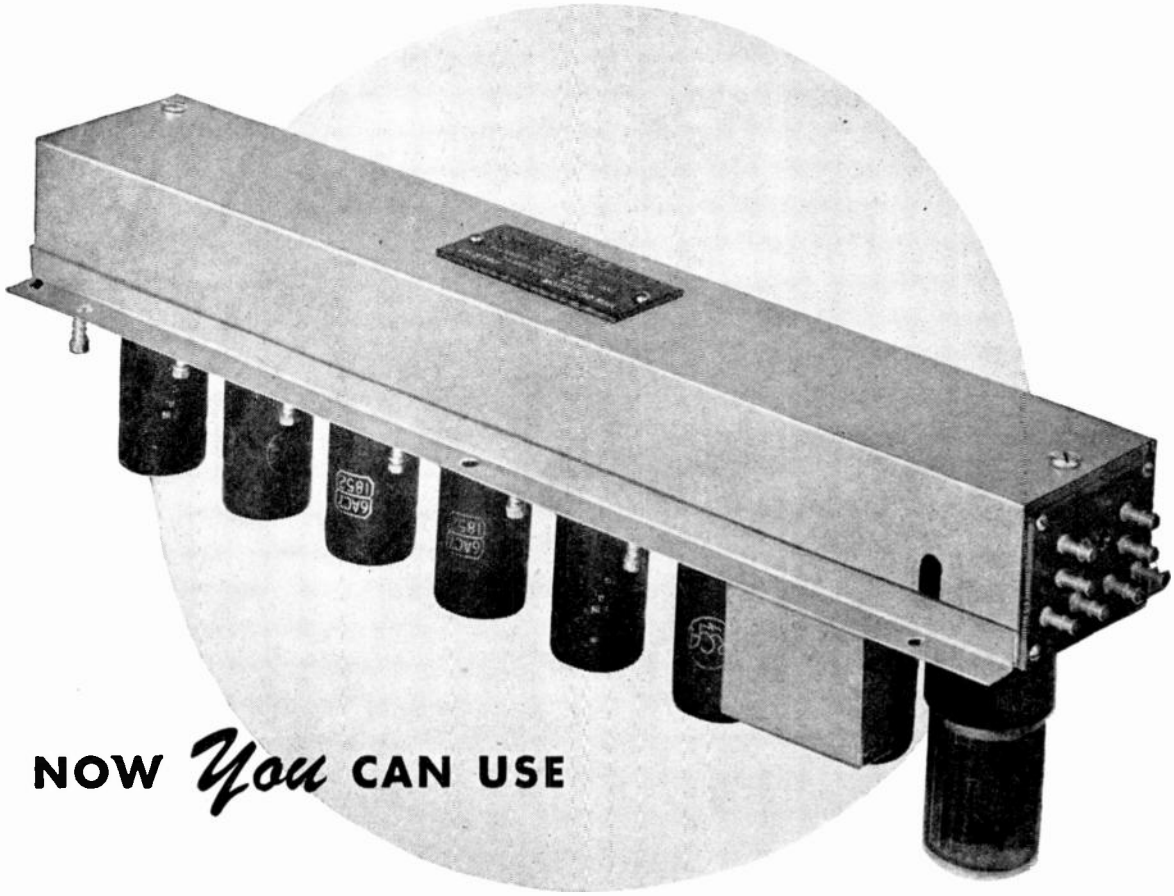

NOW *You* CAN USE

THE HARVEY "AMPLI-STRIP"

This I-F and AUDIO amplifying unit has proved itself on many applications of vital importance. It is now available with electrical characteristics to suit your requirements.

The *Harvey Ampli-Strip* is representative of Harvey design and production facilities that have been painstakingly built up over years of specialization in radio and electronics engineering exclusively. The electronics knowledge, precision manufacturing and testing resources responsible for equipment such as this may prove of great practical value to you now or in the critical re-conversion period ahead.

Your inquiries will be given prompt and careful attention.

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106 PA REGULATED POWER SUPPLY

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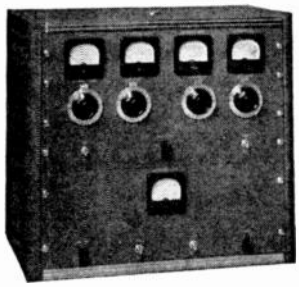
Write for new bulletin



HARVEY 100-T TRANSMITTER

Compact • Dependable
Easy to Operate

A 100 WATT TRANSMITTER—TELEPHONE AND TELEGRAPH

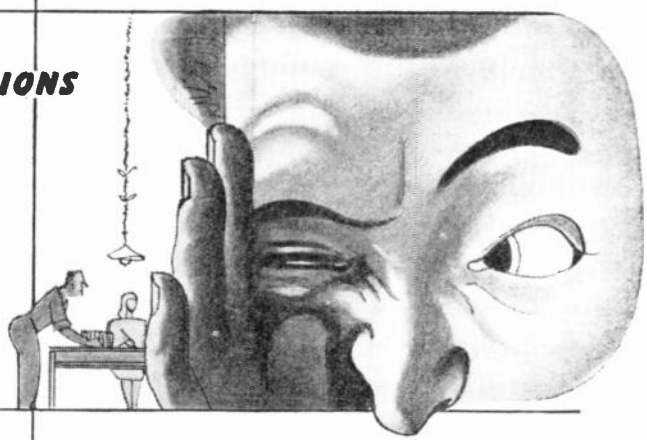
Three attitudes that hamper war production

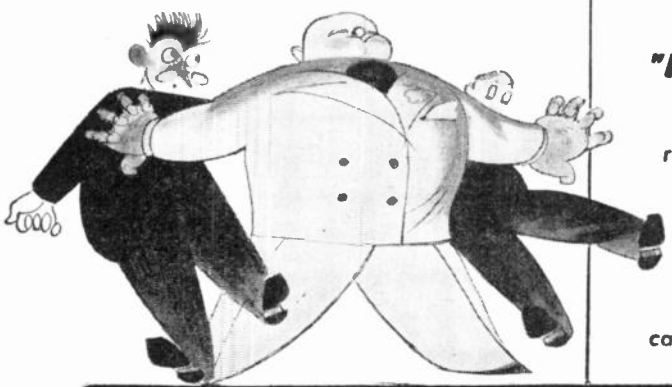
KEEPING LABOR ON LABOR'S SIDE OF THE FENCE

Ignoring successful examples of many progressive plants, some executives still choose to utilize the craftsmanship but not the wholehearted cooperation of labor. Labor appears to be non-essential around the conference table.

ONE EYE SHUT TO WORKING CONDITIONS

A healthy and contented worker is a good worker — but, unfortunately, some men close one eye to this well-established fact. Provisions for maintaining general comfort and morale on the production line are shrugged aside, and then there's wonderment if output lags.





"I'M BETTER THAN HE IS"

While boys of different colors and races and religions fight and die side-by-side, here at home there are those who practice an un-American form of discrimination. Overlooked is the actuality that harmonious relationships of all peoples can, and must, be achieved.

THERE IS NO PLACE IN THIS COUNTRY FOR SUCH ATTITUDES

At ECA, even as in your plant, we have questioned these three attitudes . . . experimented . . . eliminated them. Carrying the fundamental principles of the American dream into our organization, management and labor function as a single democratic unit. Periodic meetings have been established . . . ideas of benefit to both groups are exchanged. Here we gather suggestions for economy and efficiency. Here originate recreational facilities, group insurance and medicine plans, our extensive home front activities. Here developments are born whose value to the country have been effectively demonstrated. Here our policy of assigning jobs on the basis of merit rather than heritage is reaffirmed. *Has our plan worked?* Efficiency steadily increases and production, for example, today is six times greater than it was twelve months ago. This record gives added support to our proposition that, regardless of color or creed, to advance is the common birthright of all men . . . and that mutual cooperation between the man-in-the-front-office and the man-who-puts-things-together is not only highly desirable but highly essential.

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ELECTRONIC CORP. OF AMERICA

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SHAPPE-WILKES INC.

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.

hallicrafters RADIO

BUY A WAR BOND TODAY!

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

SIMULTANEOUS FM SOUND AND FACSIMILE BROADCASTING

Military Developments Assure Simultaneous Home Facsimile and Sound Broadcast Reception Originally Projected When FM Channels Were Set at 200 Kc.

BY MILTON B. SLEEPER

SO GREAT has been the pressure of effort toward new goals of achievement in the service of our Armed Forces that some of the significant events and accomplishments of the past have been temporarily overlooked.

This probably accounts for the fact that, in all the discussions of postwar FM broadcasting, little or nothing has been said about facsimile transmission for home reception. Yet one of the features of FM originally disclosed by Major Armstrong, and widely discussed at that time, was the simultaneous transmission and reception of sound broadcasting and facsimile.

Major Armstrong demonstrated the practicability of duplexing sound and printed news, illustrations, and advertising as early as 1934. This is strikingly illustrated in the accompanying actual-size reproduction of a section of *The New York Times*. The pencilled notes he made on the bottom of the same facsimile paper are reproduced here also. The original copy is now in Major Armstrong's possession.

In 1940, the Yankee Network operated such equipment so successfully that Boston newspapers featured the possibilities of this service in special sections.

FCC Rules Cover Duplexing ★ At the FCC's famous May, 1940 hearing on Frequency Modulation, the plan to duplex sound programs and facsimile was given official recognition. The FM channel width of 200 kc., with a frequency swing of 75 kc. for 100% modulation, leaves room within any channel for facsimile transmission.

The *FCC Rules Governing High Frequency Broadcast Stations*,[1] released on June 22, 1940, provide for such service. The first reference is:

> *Sec. 3.210. Multiplex Transmission:* The term "multiplex transmission" means the simultaneous transmission of two or more signals by means of a common carrier wave. (Multiplex transmission as applied to high frequency broadcast stations means the transmission of facsimile or other aural signals in addition to the regular broadcast signals.)

The word "aural" would probably be replaced with "supersonic" if this section were to be rewritten, for the latter has since come into common use in referring to signals or sounds at frequencies above the audible range. Past practice has been to use a 25,000-cycle carrier for the facsimile signals, which is far enough above the range of audibility to preclude interference with sound broadcasting. The FCC Rules further provide:

> *Sec. 3.226. Facsimile Broadcasting and Multiplex Transmission:* The Commission may grant authority for the multiplex transmission of facsimile and aural broadcast programs — provided the facsimile transmission is incidental to the aural broadcast and does not either reduce the quality of or the frequency swing required for the transmission of the aural program. The frequency swing for the modulation of the aural program should be maintained at 75 kc. and the facsimile signal added thereto. No transmission outside the authorized band of 200 kc. shall result from such multiplex operation nor shall interference be caused to other stations operating on adjacent channels. The transmission of multiplex signals may also be authorized on an experimental basis in accordance with Section 3.32, sub-part A.[2]

Copyright 1944 FM and Television

POSTWAR SUPER-MAN

At the time all station construction and radio set manufacture was stopped, the practicability of home facsimile reception had been definitely established, but plans for duplex FM sound and facsimile broadcasting and for marketing of the machines were, necessarily, postponed for the duration of the war.

Consequently, very little consideration has been given to this subject since Pearl Harbor. This year, with so much attention focused on new plans for FM sound broadcasting, it is not surprising that the additional facilities afforded by facsimile have been overlooked for the moment.

Postwar Facsimile ★ However, both the use and the further development of facsimile have been far from dormant. Like FM, it is performing highly

[1] The full text of the Rules was published in *FM Magazine*, Nov. 1940.

[2] The complete text of the FCC Rules can be obtained on application to the Federal Communications Committee, Washington, D. C. — EDITOR'S NOTE.

valuable service for our Armed Forces.

Today, there are two types of direct-printing facsimile machines available. One is for transmitting black-and-white copy only. The other is capable of transmitting both photographs and black-and-white copy. The latter provides half-tone reproduction that is definitely superior to newspaper illustrations. Type smaller than that used for the text on this page is perfectly legible. Both types print on a roll of paper 6 to 8 ins. wide. The printing is permanent, and requires no chemical processing of any kind.

Such machines are already commercially perfect, and modified designs, suitable for attachment to home radios now in use, can be put into quantity production as soon as WPB turns on the green light. The machines are simple, automatic, and require no manipulation except the occasional insertion of a new roll of paper.

The retail price for a complete unit, ready to operate from any FM receiver, will be less than $100. Some estimates put the price as low as $50.

One very important feature of home facsimile reception that is not generally appreciated is the use of automatic switching. That is, if the FM receiver is turned on and tuned to a station equipped for duplex sound and facsimile broadcasting, signals can be broadcast which will start and stop all the facsimile machines. This is important because sound broadcasting is continuous. Facsimile transmission, on the other hand, would be confined to specified periods. It would not be good practice to keep the motor drive for the facsimile machine running constantly in order to catch the facsimile signals.

By transmitting special supersonic signals from the broadcast station, every motor can be turned on when facsimile transmission starts, and turned off when it is finished, provided, of course, the radio receiver is switched on. This assures reception during all facsimile periods without any personal attention to the machine.

Since facsimile is independent of sound reception, the loudspeaker volume can be cut to zero, and yet the facsimile machine can operate in its normal manner. There will be many applications, such as use in business offices, where facsimile would be used to the exclusion of sound.

The transmitting machines are comparable in their dependability of operation to other broadcasting equipment. They are somewhat more expensive than the receiving devices, but their installation at any FM transmitter involves no complications. Because facsimile signals are at supersonic frequencies (above 15,000 cycles) it would probably be necessary to locate the transmitting machine right at the station itself, unless an FM studio-transmitter link is available. This would carry the supersonic signals, while land wires would not.

Purpose of Facsimile ★ There, in brief, is a description of the apparatus involved. But what services can it perform that will justify the sale of facsimile transmission, and the purchase of receiving machines? And what, if any, particular types of broadcasting stations are in the best position to handle facsimile transmission?

A short answer to the first question answers the second: Anything that is printed in a newspaper is worth transmitting by facsimile.

Proponents of facsimile believe that it can provide every service that a newspaper can offer, plus the convenience of the instantaneous delivery into the living room of every reader.

Some go so far as to say that the saving in plant, machinery, payroll, production, and distribution is so great that a facsimile newspaper publisher could well afford to furnish receiving machines on a rental basis to homes within range of his station, and charge only as much as the cost of an annual newspaper subscription.

The most significant feature of facsimile, as compared to sound or television, is that neither the attention nor even the presence of the family is required during the actual reception.

It seems likely that facsimile networks will be developed to serve two purposes. The first would be to provide national news, pictures and comics as well as national advertising to broadcast stations which are not affiliated with newspapers. Such stations would augment this material with local news, pictures, weather, crop, and market reports, and local advertising. The second purpose of network facsimile would be to furnish the same service to FM broadcast stations operated by local newspapers.

The degree of competition between fac-

(CONCLUDED ON PAGE 17)

BELOW: PENCIL NOTATIONS MADE ON THE SAMPLE OF FACSIMILE RECEPTION REPRODUCED ON THE OPPOSITE PAGE. THIS WAS SIGNED BY MAJOR ARMSTRONG AND HARRY SADENWATER

OPPOSITE: FACSIMILE RECEPTION, USING AN RCA MACHINE, OPERATED TEN YEARS AGO, MULTIPLEXED WITH SOUND AND A TELEGRAPH CHANNEL. SEE THE NOTES REPRODUCED BELOW

Nov. 24, 1934

Four Channel Operation

(1) Music from chain

(2) Synchronizing channel

(3) Facsimile signal

(4) Telegraph channel.

Empire State & Haddonfield N. J. W2XDG on 41 megacycles operating on 61 megacycle antenna.

Experimental demonstration Nov. 24, 1934 Harry Sadenwater Nov 24, 1934

New York Times.

Copyright, 1934, by The New York Times Company.

NEW YORK, SATURDAY, NOVEMBER 24, 1934. TWO CENTS In New

VANDERBILT WRIT CALLS ON CAREW TO DEFEND RULING

Definite Decision Is Sought on Habeas Corpus Action to Pave Way for Appeal.

GUARDIAN FIGHT RESUMED

Reply to Mother's Plea Asserts She Is Not Qualified to Fill Such a Position.

Mrs. Gloria Morgan Vanderbilt carried her efforts to obtain custody of her 10-year-old daughter, Gloria, to the Appellate Division yesterday, obtaining from Presiding Justice Edward R. Finch a show cause order in mandamus proceedings against Supreme Court Justice John F. Carew.

At the same time, Justice Carew's decision earlier this week, placing Gloria in custody of her aunt, Mrs. Harry Payne Whitney, for five days a week, was followed in Surrogate's Court by action bearing on the child's $2,300,000 estate. George W. Wickersham and Thomas B. Gilchrist, as co-guardians, opposed the plea of Mrs. Vanderbilt that she be made a guardian, also, of the estate.

After the show cause order had been signed by Presiding Justice Finch it was served upon Justice Carew in his chambers by Louis D. Frohlich, associate of Nathan Burkan, Mrs. Vanderbilt's counsel. The order directed the justice to show cause on Nov. 30 why he should not be required either to sustain or dismiss the writ of habeas corpus sought by Mrs. Vanderbilt in the Supreme Court case.

Clear Way for Appeal.

This was done, it was explained, to clear the way for an appeal from

SOVIET ARMY TO AID FRANCE IF INVADED, DEPUTIES ARE TOLD

Reporter of Budget Declares Russia Would Help Repel Any German Attack.

MILITARY FUNDS APPROVED

French War Minister Announces Term of Conscript Service Will Not Be Raised.

By P. J. PHILIP.
Wireless to THE NEW YORK TIMES.

PARIS, Nov. 23.—An understanding by which Soviet Russia has offered her army to aid France in case of attack by Germany was reported in the Chamber of Deputies today by Leon Archimbaud, Reporter of the Budget.

In the course of the debate on the army appropriations, Deputy Archimbaud declared that he puts his hopes for the preservation of peace in a union of strength between France and Russia.

"Only that union," he said, "can stabilize Europe and peace. Russia has a solid, well-equipped army which she offers us in case of conflict with Germany. It may be regrettable that twenty years after the war we should come back to the old policy of a balance of power, but it is not our fault.

"It cannot be denied that an understanding exists between the two countries."

After the debate, it was declared in government circles that the Deputy was not speaking for the Cabinet, but was only expressing his idea of what Russia would be likely to do in case of German aggression against France. It was M. Archimbaud who, in his report of

U. S. AND BRITA AS NAVY TALKS JAPAN TO DEN

PACT ASSAILED BY SAITO

Ambassador Says Tokyo Will End It No Matter What Occurs at London.

HOLDS HONOR IS AT STAKE

Tells Philadelphia Audience Ratios Show Japan Is Looked Down On as 'Spoiled Child.'

OPPOSES BUILDING RACE

Declares Tokyo Is Willing to Enter an Agreement to Guard Philippine Independence.

Text of the address by Ambassador Saito, Page 6.

Special to THE NEW YORK TIMES.

PHILADELPHIA, Nov. 23.—So long as a navy retains its character as a "fighting unit" instead of becoming merely a "policing force," Japan cannot give up her claim for equality in naval strength, Ambassador Hiroshi Saito of Japan said here tonight in an address before the American Academy of Political

Japan's Warn... In a Long C...

By The Asso...

TOKYO, Nov. 2... of the budget" w... army and navy o... teen-hour session ... Cabinet.

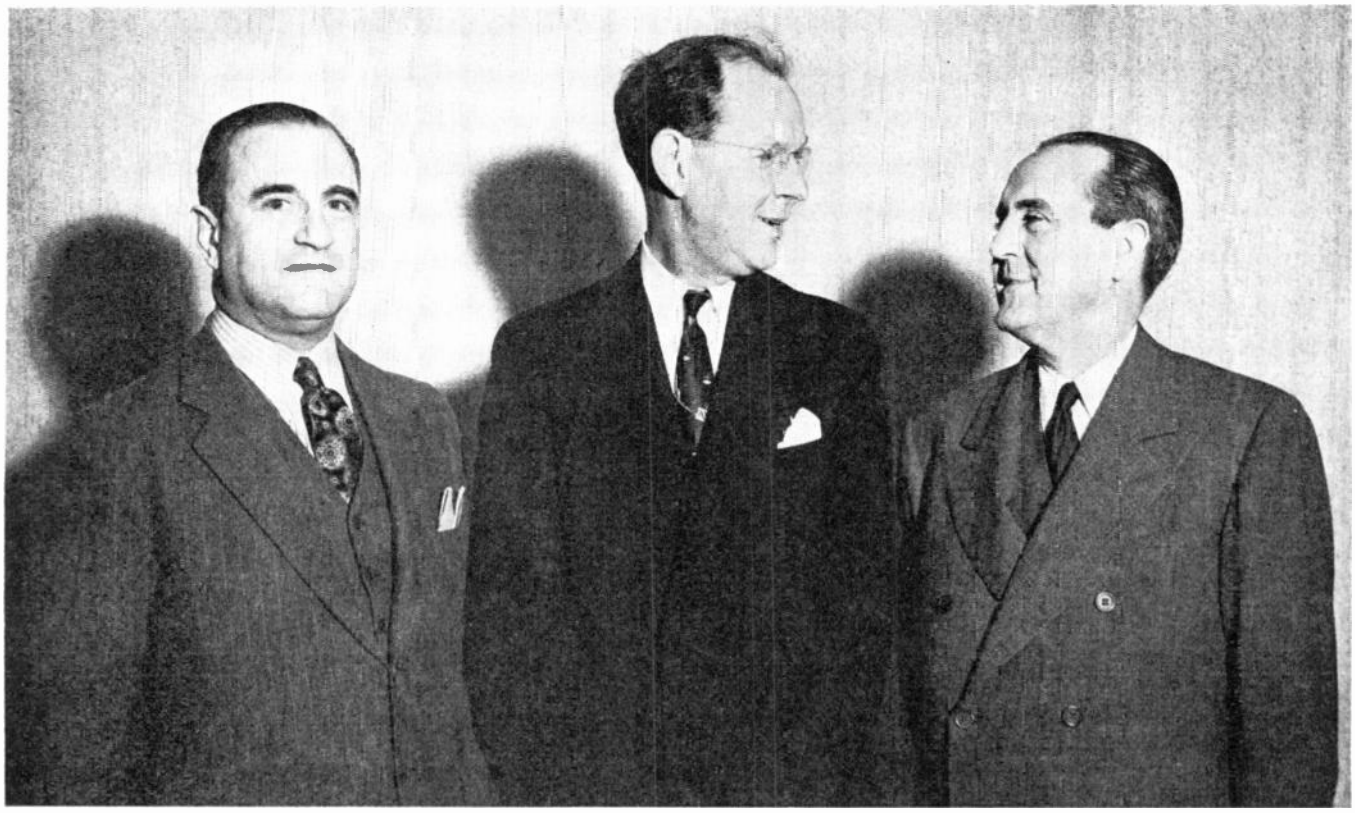
Before the gover... to give these dep... than one billion ... General Sanjuro Ha... of War, had threa... if his demands we... and Admiral Mine... ter of the Navy, t... "the internationa... be considered."

In the end the ... resistance of Se... Minister of Fin... tempted in vain ... fense appropriati... limits of the curr...

Details of the de... were not revealed. ... demanded 171,000,... ships, 78,000,000 ... tenance; 44,000,000 ... tion of warships; ... expansion and ... the air force and ... for new weapons.

Major army req... 900,000 yen for ne... munitions and 70... pansion of the air...

HULL ENCO... UNITY WITH...



THE THREE SPEAKERS AT THE FIRST SESSION OF THE TELEVISION SEMINAR AT NEW YORK, SPONSORED BY THE RADIO EXECUTIVES CLUB. LEFT TO RIGHT THEY ARE: DR. ALFRED N. GOLDSMITH, V.P. OF RTPB; FCC CHAIRMAN JAMES LAWRENCE FLY; NBC PRESIDENT NILES TRAMMELL

PLANS FOR TELEVISION'S PROGRESS

Three Addresses Delivered at the Opening Session of the Television Seminar at New York

EDITOR'S NOTE. — *The Radio Executives Club has organized a Television Seminar of 16 Thursday night sessions. The three addresses which follow were delivered at the first meeting, on May 18th. The attendance numbered over 500 members and their guests. Inquiries concerning the Seminar should be addressed to Murray Grabhorn, Blue Network Company, Inc., 30 Rockefeller Plaza, New York City.*

NILES TRAMMELL[1]

ON BEHALF of the National Broadcasting Company, it gives me a great deal of pleasure to welcome you here tonight, and to the weekly meetings of the Television Seminar which will be held in this studio during the next three months.

Of all the subjects in the field of post-war planning which the Radio Executives Club might have occasion to study or consider, there is none more significant than television. There is no subject concerning which it will be more worth your while in the future to have a working knowledge. And television itself needs the best brains in the radio and advertising professions to go to work on many of its problems right now, so that after the war the new industry can be launched with a minimum of waste motion and render a maximum of public service.

I therefore want to congratulate the officers and members of this club on the constructive forward step they have taken in setting up this Seminar on Television.

Television is a subject in which the National Broadcasting Company has been actively interested since the earliest days of the Company. On April 4, 1928 — less than a year and a half after the company was organized — NBC received from the old Federal Radio Commission its first television station construction permit. Our equipment at that time consisted of a 48-line mechanical scanning system, with a 250-watt transmitter and several mechanical scanning type receivers. By 1930 we had increased the number of scanning lines to 60, but it was obvious that many more lines per picture were required if television were ever going to render a public service.

RCA and NBC engineers built a new television plant in the tower of the Empire State Building, which was put in operation in January 1932. Experiments were conducted with the very high frequencies, improved mechanical scanning of 120 lines was used, and a cathode ray receiving tube replaced the mechanical scanning receiver. This was the first step toward an electronic system.

Meanwhile, Dr. Zworykin, of the RCA Laboratories, had been developing the Iconoscope — the electronic eye of the television camera. Mechanical scanning, which had been the bottle-neck of television progress, was done away with, and we were able to proceed with experiments in an all-electronic television system.

In 1936 the new system was ready for field tests, which commenced on June 29th. For the first time we were able to transmit comparatively high-definition pictures of 343 lines, at the rate of 30 pictures per second. NBC had built two television studios in this building, one for live talent and one for motion picture transmission, and the studios were connected

[1] President, National Broadcasting Company, Radio City, New York, N. Y.

with the new transmitter in the Empire State tower by coaxial cable.

Field tests and experimentation were continuous for the next three years. Picture definition was stepped up to 441 lines. On April 30, 1939, on the opening day of the World's Fair, NBC inaugurated the first regular television program service in the United States. We have been on the air steadily ever since, with the exception of a brief period required in 1941 to adapt our transmitter to a new frequency assigned by the FCC. On July 1, 1941, NBC commenced operating on a commercial basis, with 525 line pictures, under the first commercial television license granted by the Commission.

RCA and NBC poured millions of dollars into those years of experiment and development, and we expect to spend many more millions before television can be self-supporting. I have given you this bit of back history to prove to you that we have always been firm believers in the future greatness of television, and we are stronger believers today than we ever were. (*Mr. Trammell then reviewed some of the NBC television productions which have been broadcast — from April 1939 to April 1940.*)

Mr. Grabhorn (retiring president of the Radio Executives Club) suggested that I should express to you my views on — and I quote — "Why it is important for advertising and radio executives to keep abreast of the television situation." I like his suggestion, and I am tempted to change only one word in it, and make it read: "Why it is important for advertising and radio executives to keep *ahead* of the television situation."

There are a good many reasons why. Since self-preservation is the first law of mankind, perhaps the first reason is that if a radio or advertising executive chooses to remain ignorant about television, the chances are, in a few more years, he is not going to be a radio or advertising executive any more. He might as well begin now to hunt for some more congenial occupation.

For television is going to be the greatest thing in radio since broadcasting was invented; and it is going to be the greatest medium for advertising since the invention of the printing press.

Those are my personal beliefs, and they both stem from the same source: the fact that television will provide the most effective means for mass communication ever created. No other medium combines so many features that will attract and hold a mass audience. (*Mr. Trammell then reviewed the possibilities of television entertainment.*)

After the war, however, television should rank at the top of the new industries that will create jobs for men and women and capital. This will be all the more true because television, unlike many other new post-war products and services that have been talked about, does not come under the head of a technological improvement. It is not just a better form of product or a better way of doing a thing that has been done before. It is something totally new and unique and original. It will not displace or replace anything else. It will grow on new soil where nothing ever grew before.

In other words, as an avenue of employment, television will create new jobs and will not abolish any old ones. It will add to employment without subtracting from it.

Television will be ready for immediate introduction, right across the United States, the instant that the all-important object of winning the war is achieved, and men and materials become available. I consider it a very good omen for the new industry of sight-and-sound broadcasting that the man-power and brain-power represented in this room is preparing now to share in the great responsibilities and opportunities that lie ahead.

HON. JAMES LAWRENCE FLY[2]

SUBSTANTIALLY, there is no clear-cut issue, in the sense that a definitive conclusion concerning television can be reached on any basic issue and put into operation at this time.

I think we ought to take a brief look at the various governmental agencies that have some significant influence or control in this field. The Communications Commission, of course, has the licensing power, certain regulatory authority, statutory duties to encourage research and the development of new uses for radio, and to establish engineering standards for the various radio services. It must allocate and assign frequencies to that end.

At this time, an important governmental influence is the military influence because, to a great extent, they have control of the research and, today, pretty much hold the key to improvements. The War Production Board is significant. It is the wartime controller of all critical materials. The question of construction and expansion hinges right here more than upon any other governmental factor.

It is important to bear in mind, at the outset, that commercial television has been fully authorized by the Commission. There is no question that the Commission will continue to maintain a steady green light. No question should be raised as to the stopping of the expansion of television services. Here, the industry has the permanent authority to move forward, and will have the continuing authority and encouragement of the Commission. License power will be exercised to that end.

Of course, the engineering standards will be fixed from time to time to maintain the most efficacious basis for the operation of television. The Commission has a statutory duty to encourage research and experimentation, and to aid the development of new uses for radio. This will be done in every possible way and in full coöperation with the industry. In the ability of the industry's engineers lies our confident hope for a vastly improved, permanent, and successful form of television. As improvements develop, engineering standards will be lifted accordingly.

Wartime research is wrapped in the cloak of military secrecy. We have ground for believing that we have made more progress in this field in the past two years than in the five years preceding. We may assume that much is being developed in research, such as on cathode-ray tubes, radar, timing, cameras, synchronization, propagation characteristics, and the ultra-high frequencies and micro waves. The industry itself is progressing on radio relays as a basis for network operations, and this is awfully important as a very essential development.

We think we may find that the problem of developing tube power in the higher frequencies may be compensated by the greater propagation capabilities at higher frequencies as compared to the lower. There, you have the possibility that the results will be the reverse of that which we have in the standard broadcast band, where the propagation is better in lower brackets.

As the war develops, research information may be declassified and made available by the military from time to time. Our one greatest determination must be to keep right on top of this research and, at the earliest feasible date, to put these developments into engineering standards for a permanent television system.

Another currently effective limiting factor on commercial expansion is the lack of critical materials. There are minimum time limits and there are no determinable outside limits. Today, we do not have enough radio materials to immediately meet all military needs and supply any substantial demands from the public. Fortunately materials are available and will continue to be available for research and experimentation.

This again gives us a great opportunity to move forward scientifically, while we are commercially stalemated by the war. During this very time is our easiest and best opportunity to advance the art.

[2] Chairman, Federal Communications Commission, Washington, D. C.

We may conjecture that some radio materials will be available to meet the accumulated demands, say, in the course of a year. If you meet urgent public demands possibly by that time you may have minor-scale construction. What then? When will television launch forward across the continent on a widespread expansion basis? Who knows? When will the European war end? When will the Japanese phase of the war end? At what stage of either war will large-scale expansion and the large-scale use of materials be possible?

Hence, why talk today about freezing television at its present level of efficiency, or at any point below the level of the information which is available in limited circumstances today, and will be available to the industry tomorrow and from time to time? Why talk about withholding construction and expansion until two years after the war?

One line of advocacy is based on the fallacious assumption that materials will be available for widespread construction. That is by no means clear. We shall have materials for both research and experimentation, and there will be a gradual release of secret information within a year or two, but with a lack of materials for commercial expansion.

Why blow our brains out with a flood of hot air? I think we have been doing too much talking on this subject. Stop talking and get back to the research laboratories and experimental stations! Let us do our damndest to develop a better system of television; both we, and the industry, and the public will be the beneficiaries for all time to come.

Now, the Radio Technical Planning Board, under the guidance of Dr. Baker and his associates, have been doing a great job and I think the entire industry and the government should be indebted to this group of men. Some of you here, including Dr. Goldsmith, are contributors to that great work. Now, here is another pretty essential job and another influence, if not a controlling factor:

I understand that two recommendations are in the making from that board. One, a somewhat improved system of television for black and white, to operate on 6 mc. I see no reason why these minor changes cannot be incorporated in the Commission's engineering standards and the commercial authority maintained to move forward on those standards.

Second, there is a possibility of a further recommendation on long-range effects. It is the feeling of the Panel that provisions should be made now for the continuation of experimentation and the development of an improved system. Nearly all committees are concerned with one or more phases of this problem. It has been the collective recommendation of several committees and the Panel that the following provisions should be made at this time:

The allocation of 30 channels, 20 mc. in width, between 600 and 2,000 mc. It is contemplated that experimentation and development will be carried out on these channels looking forward to improved television service, which may include color, higher definition, and other features that can be developed. No standards may be assigned, however. It is anticipated that when a suitable service is perfected, standards will be established and constantly developed. These channels will be allocated subsequently on the basis of commercial standards of improved television service. There are other suggestions that are roughly along these lines.

In their general contour, I have no doubt that both of these proposals are highly meritorious. The important consideration remaining is that no one, today or tomorrow, erect any legal, commercial, or artificial barrier that may retard television's advance from status one to status two, where it will almost inevitably and ultimately land.

First, it may be that with the passing of time, and perhaps during the war, further information will be released. Indeed, it is being developed in our own laboratories. Second, with reserve materials made available and, third, with the lack of volume materials for broad scale commercial expansion, we might actually have a golden opportunity to make the initial broad sweep to commercial operations with a vastly superior, broad-band, larger screen, and possibly full color television, in the upper range of frequencies.

Many factors are uncertain. I will not say this can be done. I challenge anyone to say that the possibility should be foreclosed today. No amount of sales and promotional propaganda will settle questions of that character now. Why should they be settled now? Work and sweat and time alone will tell.

We should bear in mind that television standards present a problem essentially engineering in character. A careful lay observer is, of course, equipped to judge the quality of the end product, and to judge the comparative qualities of the end product under various conditions. The policy in administration must be represented by the informed judgment of administrators. These judgments must be founded, in part, on the best technical advice available.

Just as the administrator should not supplant the engineer, the engineer should not put out policy conclusions under the cloak of technical observations. It is interesting to observe the great crop of experts in, or on the fringes of, the industry. Mr. Trammell has wisely stated that there are too many amateurs talking about this subject, and I think this is true. However, the really great task is to find the man who will admit that he is an amateur. (*Laughter.*)

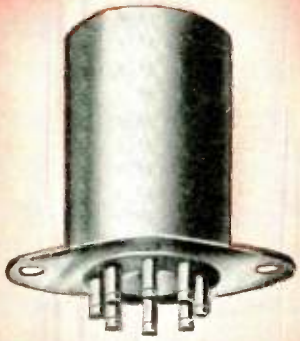
The newspapers have been expounding on the technical effect of linage and band widths and the potential technical deficiencies in certain radio frequency bands. One editorial writer claims that he knows at what frequencies ghosts appear, and he knows that no one can ever lay a ghost. I should imagine it is difficult enough for editors to keep up with the current witching hour, when real ghosts are abroad, what with twenty-four hour operations, and swing-shifts, and everything getting all balled up.

Bearing in mind that television is fully authorized by the Commission to move forward commercially, and omitting the other current governmental influences and limitations, to a great extent and over a long stretch the question of speed and degree of the movement is one to be controlled by the companies themselves. Radio Corporation of America with its patents, large manufacturing capacity, and great broadcasting subsidiaries is equipped to create demand and spread the market for equipment.

RCA and NBC are in the best position to set the pace and for that matter to project the outcome. And that, indeed, is a grave responsibility.

I intended to make a speech to you about the great future of television and what it means to you. I planned to tell you about the great opportunities it offered in post-war employment, and of television's great and lasting service. Seriously I do want to be considered as having made that speech. Mr. Trammell got a hold of a portion of my speech while we were seated at the table and that is already gone. (*Laughter.*)

I do think that the long range interest of the manufacturer, if not the short range interest, must ultimately conform to that of broadcaster. The welfare of the whole group here is pretty well tied together. Because, if we make the false start of bringing in a heavy investment to the injury of the public and the injury of the industry, it can only be a boomerang to us. I am rather regretful to see editorials talking about the necessity of freezing television at the old pre-war standards because there were 7,000 receivers in the market and in the hands of consumers. Now, that ought to be a warning to us. If we are going to have that cry with 7,000 receivers, we will never change basically a system of television when the quantity of receivers may run into millions and the public investment, let us say, is in billions. (*Applause.*)



UTC OUNCER

NOW AVAILABLE HERMETICALLY SEALED

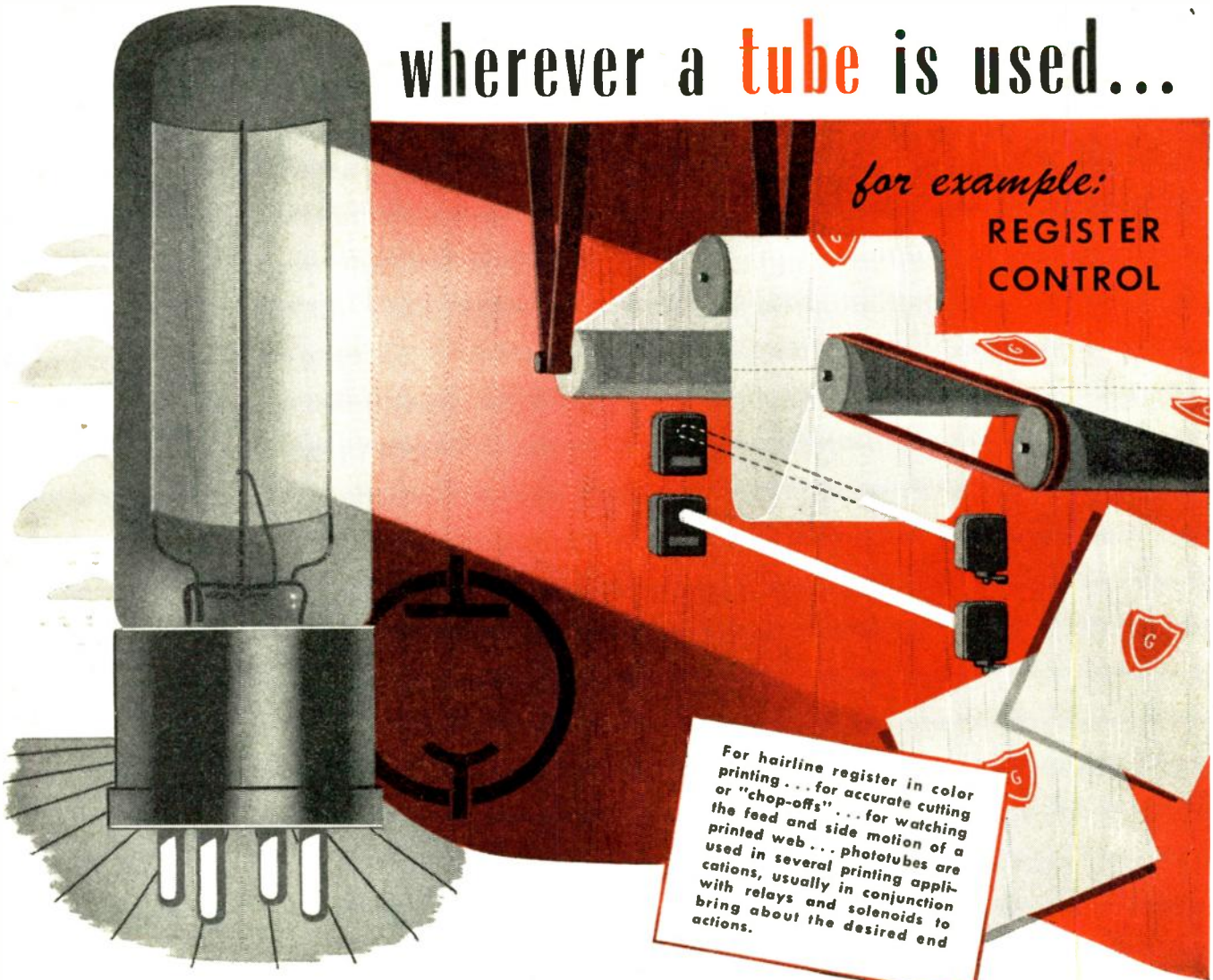
The UTC Ouncer type transformer is one of the most popular units in military equipment at the present time.

UTC glass-metal seals have been production proven for over a year. Additional developments have now made it possible to employ this type of sealing in the miniature Ouncer unit . . . 7/8" diameter.

Should you have limited space requirements, this transformer (the smallest hermetically sealed unit now available) can be supplied to specifications.

United Transformer Co.
150 VARICK STREET • NEW YORK 13, N. Y.
EXPORT DIVISION: 13 EAST 40th STREET, NEW YORK 16, N. Y., CABLES: "ARLAB"

wherever a tube is used...



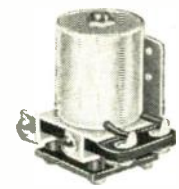
THERE'S A JOB FOR

Relays BY GUARDIAN

In the electronic circuit there is usually a sensitive relay similar to Guardian Series 5, to control a heavier current in response to the weaker "signal" of the phototube. In some applications, however, the current to be handled may be greater than the contact capacity of the sensitive relay. In this case a power relay or solenoid contactor is controlled by the sensitive relay. Guardian series SC-5 is typical of this type of contactor.

Consult Guardian wherever a tube is used—*however*—Relays by Guardian are NOT limited to tube applications but may be used wherever automatic control is desired for making, breaking, or changing the characteristics of electrical circuits.

SERIES 5 D. C. RELAY. Maximum switch capacity—two normally open, two normally closed, or DPDT contacts. Resistance range .01 up to 15,000 ohms. Send for bulletin 14.



SERIES SC-5 SOLENOID CONTACTOR. Contacts rated at 75 amps. continuous, 300 amps. surge. Contact combination—single pole single or double throw. Coil operates on 18-28 volts D. C. and consumes 7 watts at 24 volts D.C. continuous. Send for bulletin SC-5.

GUARDIAN ELECTRIC

1637-F W. WALNUT STREET CHICAGO 12, ILLINOIS

A COMPLETE LINE OF RELAYS SERVING AMERICAN WAR INDUSTRY

WRH

I do think that in no way should anyone delay television and its great service to the public. I don't think any of us would wilfully do anything that might, even for momentary advantage, ultimately impede the advance of television. It is too all-fired important. I doubt if any modern development will be of greater significance to the country. Let us hope that work and sweat and time will erase all such questions. Now, television is here to stay. There must be no faltering, no artificial barriers, and no lack of confidence. We must move in only one direction.

DR. ALFRED N. GOLDSMITH[3]

UNDOUBTEDLY television existed as a hope and a dream in the minds of a myriad of men long before advances in technology made its realization possible. To look far beyond the horizon, to scan remote events, to ride in effect upon the wings of light — this was indeed a noble ideal. And so men sought through the ages for some means of extending human vision to the end that happenings in even the most remote places might be viewed as clearly and readily as those in their direct vicinity. This dream at last approaches realization.

And yet, in its earlier stages, television was a halting and feeble thing. Unsteady, flickering, and crude pictures offered but a trivial substitute for distant vision. Tiny pictures produced by noisy mechanical contraptions were discouragingly far from the ideal to which the televisionaries aspired. And yet they served to whet the appetite and stimulate even more determined effort to produce the modern clear, steady, and highly detailed all-electronic television picture. (*Dr. Goldsmith then reviewed the possible expansion of television broadcasting and possible types of programs.*)

The full fruition and success of television cannot come without a good measure of understanding and coöperation between the many groups which are involved in its operations. Television is not a one-man show. It is rather a coöperative effort of major complexity and magnitude.

Involved in television is of course the public which forms that audience whose judgment is final. Willingness on the part of the public to support television and to applaud its steadily improving capabilities through the years will act as a strong incentive and encouragement to those upon whom rests the responsibility for its operations. The broadcasters themselves, both as originators and distributors of programs, must assume a major role in television development. There will be a group of collaborating industries, such as the motion-picture producers who may be called upon to provide transcribed programs on film or perhaps even "packaged shows" utilizing live talent. A vast industrial group will be active in the manufacture of television transmitters and receivers, thus bringing to life a host of television stations spread wide over the land and millions of television receivers in the homes of our people. The wise planning of these manufacturers will contribute greatly to the advancement of the television art. Among those energizing the television programs will, of course, be the advertisers who sponsor them and the agencies which, in turn, represent the advertiser. Their knowledge of television and their support of its activities will advance its advent and expand its appeal. And last, but far from least, the Government of our country will, through its appropriate agency, study the needs and practices of television, will promulgate the governing regulations, and will doubtless endeavor to guide broadly certain of the trends of television broadcasting operations.

It is indeed fortunate that the interest of the public in television will be so keen that all involved in its activities should have little trouble in learning what is in the public interest. As the years pass by, our knowledge of the means whereby we may best make television a great social agency will grow steadily. As our knowledge grows, so our capabilities will grow.

[3] Consulting engineer and vice president of RTPB, 597 Fifth Avenue, New York 17, N. Y.

FM SOUND AND FACSIMILE BROADCASTING

(CONTINUED FROM PAGE 12)

simile and printed newspapers is a matter for the future to determine. In the beginning, facsimile news would probably be in the form of bulletins, sent out at regular periods, accompanied by illustrated advertising. Special flashes could be transmitted when received. One of the first special features will undoubtedly be new comic strips, corresponding to radio serials now on the air. Of course, any information that radio listeners must write down can be transmitted more effectively by facsimile. This covers a range from market prices to recipes, and from names of products to mailing addresses.

Trademarks and pictures of products will be widely used because they can be reproduced even more clearly than in newspapers, and many uses will be found for coupons.

All these possibilities are of such significance to newspaper publishers that it is not surprising that those who are already acquainted with this third medium of broadcasting are of the opinion that it is of greater interest to them than television, particularly because it can be done over an FM sound broadcasting station. And facsimile offers the operators of present and projected stations the opportunity of augmenting substantially their revenue from sound programs with a relatively small investment in facsimile station equipment.

Experimental attempts to introduce this service have been made in the past, notably by station WOR, using AM transmission. Tests over a considerable period of time showed that:

1. The mechanism employed for reception did not provide that certainty of operation necessary for general home use.

2. Any processing that called for moistening the paper and subsequent drying was not acceptable for home facsimile.

3. Nothing inferior to the degree of definition and clarity of newspaper printing would be of commercial value.

4. Home facsimile equipment operated by AM transmission is made uncertain in its operation not only by static interference but by the heavy background noise present at a fair distance from an AM station, but still within a radius that it would be desirable to cover with facsimile service.

Of course, these tests could be carried on only after normal broadcasting hours, since facsimile and sound cannot be transmitted simultaneously on AM. Many listeners objected to the sounds caused by AM facsimile broadcasting. Thus it became apparent, in the end, that AM stations could not stop sound broadcasting during regular hours to transmit facsimile, nor would it be profitable to do so. Neither was there any demand for facsimile reception during normally quiet hours that would warrant keeping the station on the air.

Perfected facsimile machines and FM broadcasting, making possible simultaneous sound and facsimile transmission, and the use of inaudible facsimile signals have now overcome all those objections.

EDITOR'S NOTE. — *This article will be followed by a series covering all the various aspects of facsimile broadcasting and the different types of transmitting and recording devices which will be available for postwar use. In the June issue, Lester Nafzger, chief engineer of the Columbus, Ohio, FM station WELD, will present complete, illustrated information on facsimile service now being operated at that station.*

212 FM STATIONS NOW OPERATING OR PROJECTED

5 New States, 38 New Cities Represented by 54 Stations Added to List Published Two Months Ago

ALABAMA

Montgomery

	Sq. Mi.	Mc.	Call
Montgomery Bcstg. Co., Inc.	17,299	43.5	
G. W. Covington	4,761	45.5	

CALIFORNIA

Fresno

J. E. Rodman	24,752	44.1	

Hollywood

Columbia Bcstg. Sys., Inc.	34,000	43.1	

Los Angeles

Univ. of Southern Calif.	.....	42.9	
Earle C. Anthony, Inc.	34,000	43.7	
National Bcstg. Co.	.....	44.1	
Don Lee Bcstg. Sys.	.....	44.5	KHJ-FM
Standard Broadcasting Co.	7,000	45.3	
MGM Studios, Inc.	.....	46.1	

Oakland

Tribune Bldg. Co.	1,216	46.5	

Riverside

Bcstg. Corp. of Amer.	48,000	43.5	

San Bernadino

Sun Co. of San Bernadino	17,101	44.1	

San Francisco

Board of Education	.....	42.1	KALW
Assoc. Broadcasters, Inc.	.....	43.1	
Don Lee Bcstg. Sys.	18,050	43.5	
National Bcstg. Co.	.....	43.9	

Stockton

E. F. Peffer	19,696	45.9	

COLORADO

Denver

Kiz Broadcasting Co.	31,400	43.5	
National Bcstg. Co.	.....	43.9	

CONNECTICUT

Hartford

Travelers Bcstg. Service	.....	45.3	WTIC-FM
WDRC, Inc.	.....	46.5	WDRC-FM

DELAWARE

Wilmington

WDEL, Inc.	6,400	44.5	

DISTRICT OF COLUMBIA

Washington

Jansky & Bailey (Experimental)	.....	43.2	W3XO
National Broadcasting Co.	.....	44.3	
Capital Broadcasting Co.	.....	46.7	
Evening Star Bcstg. Co.	5,600	47.1	

FLORIDA

Tampa

Tribune Co.	.....	....	

GEORGIA

Atlanta

Board of Education	.....	....	
Constitution Pub. Co.	7,380	45.3	

ILLINOIS

Chicago

Board of Education	.....	42.5	WBEZ
WJJD, Inc.	10,800	44.7	
Zenith Radio Corp.	.....	45.1	WWZR
WGN, Inc.	.....	45.9	WGNB
National Bcstg. Co., Inc.	10,800	46.3	
Columbia Bcstg. System	.....	46.7	WBBM-FM
Moody Bible Institute	.....	47.5	WDLM
Chicago Fed. of Labor	10,800	47.9	
Oak Park Realty & Am. Co.	10,800	47.9	
WHFC, Inc.	.....	48.3	
Drovers Journal Pub. Co.	10,800	48.7	
Blue Network Co., Inc.	11,000	48.7	

Decatur

Commodore Bcstg. Co.	8,050	46.9	

Evanston

Board of Education	.....	....	

Quincy

Illinois Bcstg. Co.	15,400	44.1	

Rockford

	Sq. Mi.	Mc.	Call
Rockford Broadcasters Inc.	6,000	45.1	

Rock Island

Rock Island Bcstg. Co.	3,000	44.5	

Springfield

Commodore Bcstg. Inc.	8,050	46.9	

Urbana

Board of Education	.....	42.9	WIUC

INDIANA

Bloomington

Indiana University	.....	42.9	

Evansville

Evansville on the Air	.....	44.5	WMLL

Fort Wayne

Westinghouse Radio Stations, Inc.	.....	44.9	WOWO-FM

Indianapolis

Indianapolis Bcstg., Inc.	13,640	45.3	
Assoc. Broadcasters, Inc.	.....	47.3	
WFBM, Inc.	.....	47.7	
Capitol Broadcasting Corp.	14,120	48.7	

South Bend

South Bend Tribune	.....	47.1	WSBF

IOWA

Cedar Rapids

The Gazette Co.	7,400	44.7	

Davenport

Tri-City Bcstg. Co.	10,600	46.3	

Des Moines

Central Bcstg. Co.	18,200	46.1	

Dubuque

Telegraph Herald	8,060	46.5	

Waterloo

Josh Higgins Bcstg. Co.	26,943	44.3	

KENTUCKY

Ashland

Ashland Bcstg. Co.	4,160	46.1	WBKY

Beattyville

University of Kentucky	.....	....	WBKY

Lexington

Amer. Bcstg. Corp. of Ky.	6,300	45.1	

Louisville

Courier-Journal & Louisville Times Co.	13,200	45.7	

LOUISIANA

Baton Rouge

Baton Rouge Bcstg. Co.	.....	44.5	WBRL

New Orleans

Loyala University	8,478	44.9	

MAINE

Portland

Portland Bcstg. Sys., Inc.	3,980	47.1	

MARYLAND

Baltimore

Baltimore Radio Show, Inc.	5,500	45.9	
A. S. Abell Co.	6,040	46.3	
Monumental Radio Co.	4,520	47.9	
Maryland Bcstg. Co.	2,904	48.9	

Olney

FM Devel. Foundation	18,844	43.9	

Salisbury

Peninsular Bcstg. Co.	6,000	48.9	

MASSACHUSETTS

Boston

Columbia Bcstg. Sys., Inc.	20,200	43.5	
Yankee Network	.....	44.3	WGTR
Westinghouse Radio Stations, Inc.	.....	46.7	WBZ-FM
Matheson Radio Co., Inc.	3,600	47.7	

Holyoke

	Sq. Mi.	Mc.	Call
Hampden-Hampshire Corp.	14,340	44.1	

Lawrence

Hildreth & Rogers Co.	2,970	44.9	

New Bedford

E. Anthony & Sons, Inc.	1,787	45.7	

Pittsfield

Monroe B. England (WBRK)	18,100	45.7	

Springfield

Westinghouse Radio Stations, Inc.	.....	48.1	WBZA-FM

Worcester

Worcester Telegram Pub. Co.	.....	46.1	WTAG-FM

MICHIGAN

Battle Creek

Federated Publications, Inc.	4,100	48.1	

Dearborn

Herman Radner	.....	49.5	

Detroit

Board of Education	.....	42.7	
Evening News Association	.....	44.5	WENA
John Lord Booth	.....	44.9	WLOU
WJR, The Goodwill Station	6,800	45.3	
James F. Hopkins, Inc.	6,790	46.5	
King-Trendle Bcstg. Corp.	6,570	47.3	

Grand Rapids

King-Trendle Bcstg. Corp.	5,300	46.9	

Jackson

Board of Education	.....	....	
WIBM, Inc.	.....	49.5	

Kalamazoo

West. Mich. College of Ed.	.....	42.5	

Lansing

WJIM, Inc.	3,800	47.7	

Mt. Pleasant

Board of Education	.....	....	

Muskegon

Ashbacker Radio Corp.	2,290	45.7	

Port Huron

Times Herald Co.	5,600	47.7	

Saginaw

Saginaw Bcstg. Co.	2,100	45.5	

MISSOURI

Kansas City

School Dist. of K.C.	.....	....	
Commercial Radio Equip. Co.	.....	44.9	KOZY
Midland Bcstg. Co.	.....	....	W9XER

St. Joseph

KFEQ, Inc.	.....	46.9	

St. Louis

St. Louis University	13,500	44.3	
Globe-Democrat Pub. Co.	13,083	44.7	
Star-Times Pub. Co.	12,480	44.7	
Pulitzer Pub. Co.	13,391	45.5	
Columbia Bcstg. Sys., Inc.	13,400	45.9	

NEBRASKA

Omaha

World Publishing Co.	11,660	45.4	

NEW HAMPSHIRE

Manchester

Radio Voice of N. H., Inc.	31,630	43.5	

Mt. Washington

Yankee Network	.....	43.9	WMTW

NEW JERSEY

Newark

Board of Education	.....	42.5	
New Jersey Bcstg. Corp.	6,200	49.1	

Paterson

North Jersey Bcstg. Co., Inc.	4,928	49.9	

Trenton

Mercer Bcstg. Co.	3,200	49.9	

NEW YORK

Albany

WOKO, Inc.	7,164	45.1	

Binghamton

Wylie B. Jones Advt. Agency	.....	44.9	WNBF-FM

Buffalo

Board of Education	.....	42.9	

Brooklyn

Frequency Bcstg. Corp.	14,400	43.7	

Ithaca

Cornell University	15,000	43.3	

New York

Board of Education	.....	42.1	WNYE
Edwin H. Armstrong (Exp.)	.....	43.1	W2XMN
Municipal Bcstg. Sys.	.....	43.9	WNYC-FM
Musak Corporation	.....	44.7	WGYN
Natl. Bcstg. Co., Inc.	.....	45.1	W2XWG
W. G. H. Finch	.....	45.5	
Interstate Bcstg. Co.	.....	45.9	WQWQ
Marcus Loew Booking Agency	.....	46.3	WHNF
Columbia Bcstg. Sys.	.....	46.7	WABC-FM
Bamberger Bcstg. Service	.....	47.1	WBAM
Metropolitan Television, Inc.	.....	47.5	WABF
American Network, Inc.	8,840	47.9	
Blue Network, Inc.	8,950	47.9	
News Syndicate Co., Inc.	8,500	47.9	
WBNX Bcstg. Co., Inc.	8,730	48.3	
WMCA, Inc.	8,550	48.3	
Debs Mem. Radio Fund, Inc.	8,600	48.7	
Greater N. Y. Bcstg. Corp.	8,500	48.7	

Ogdensburg

St. Lawrence Bcstg. Corp.	.....	....	

Rochester

WHEC, Inc.	.....	44.7	WHEF
Stromberg-Carlson Tel. Co.	.....	45.1	WHFM

Schenectady

Capitol Broadcasting Co.	.....	44.7	WBCA
General Electric Co.	.....	48.5	WGFM

Syracuse

Onondaga Radio Bcstg. Corp.	6,745	45.9	
Central N. Y. Bcstg. Corp.	6,800	46.3	

Utica

WIBX, Inc.	10,290	45.7	

Watertown

Brockway Co.	4,145	47.3	

White Plains

Westchester Bcstg. Co.	435	49.9	

NORTH CAROLINA

Durham

Durham Radio Corp.	.....	....	

Raleigh

WPTF Radio Co.	23,343	43.3	

Winston-Salem

Gordon Gray	.....	44.1	WMIT
Piedmont Pub. Co.	4,600	46.7	

OHIO

Akron

Summit Radio Corp.	.....	46.5	

Ashtabula

WICA, Inc.	4,116	48.9	

Cincinnati

Crosley Corp. (Exp.)	13,700	45.5	W8XFM

Cleveland

Board of Education	.....	42.5	WBOE
National Bcstg. Co.	.....	43.7	
WGAR Bcstg. Co.	8,500	45.5	
United Bcstg. Co.	8,420	48.5	

Columbus

WBNS, Inc.	.....	44.5	WELD

Steubenville

Valley Bcstg. Co.	.....	....	

Toledo

Toledo Blade Co.	8,400	44.5	

Youngstown

WFMJ Bcstg. Co.	15,610	44.1	

OKLAHOMA

Oklahoma City

WKY Radiophone Co.	21,000	44.5	
Plaza Court Bcstg. Co.	15,394	....	

OREGON

Portland

Broadcasters Oregon, Ltd.	5,826	48.5	

PENNSYLVANIA

Easton

Associated Bcsters. Inc.	2,800	48.5	

Harrisburg

Keystone Bcstg. Corp.	4,000	44.7	

Lancaster

WGAL, Inc.	1,200	45.4	

Philadelphia

Pennsylvania Bcstg. Co.	.....	44.9	WIP-FM
WFIL Bcstg. Co.	.....	45.3	WFIL-FM
Westinghouse Radio Stations, Inc.	.....	45.7	KYW-FM
Gibraltar Service Corp.	9,318	46.1	
WCAU Bcstg. Co.	.....	46.9	WCAU-FM
William Penn Bcstg. Co.	.....	47.3	WPEN-FM
WDAS Bcstg. Station, Inc.	9,300	47.7	

Pittsburgh

Walker-Downing Corp.	.....	44.7	WTNT
Pittsburgh Radio Supply House	8,400	46.5	
Westinghouse Radio Stations, Inc.	.....	47.5	KDKA-FM
Liberty Bcstg. Co.	.....	....	

Reading

Hawley Bcstg. Co.	4,275	46.5	

Sharon

Sharon Herald Bcstg. Co.	11,030	45.9	

Wilkes-Barre

Louis G. Baltimore (WBRE)	.....	....	

York

Susquehanna Bcstg. Co.	3,060	44.5	
York Bcstg. Co.	1,550	45.1	

RHODE ISLAND

Providence

Cherry & Webb Bcstg. Co.	6,207	47.5	
Outlet Co.	7,520	48.5	
A. A. Schechter	.....	....	

SOUTH CAROLINA

Charleston

Atlantic Coast Bcstg. Co.	6,400	47.7	

Spartanburg

Spartanburg Advt. Co.	26,600	43.5	

TENNESSEE

Nashville

National Life & Accident Ins. Co.	.....	44.7	WSM-FM
Nashville Radio Corp.	16,000	46.5	

TEXAS

Amarillo

Amarillo Bcstg. Corp.	5,600	45.1	

Beaumont

Kric, Inc.	6,650	43.1	

Houston

Houston Ptg. Corp.	10,500	46.5	

San Antonio

Southland Industries, Inc.	16,500	44.5	

Wichita Falls

Rhea Howard	12,800	46.5	

UTAH

Salt Lake City

Intermountain Bcstg. Corp.	.....	43.5	
Radioserv. Corp. of Utah.	.....	44.7	

VIRGINIA

Norfolk

WTAR Radio Corp.	5,702	46.5	

Richmond

Havens & Martin, Inc.	12,130	46.1	

WASHINGTON

Spokane

Louis Wasmer, Inc.	12,609	45.7	

WEST VIRGINIA

Beckley

Beckley Newspapers Corp.	8,500	....	

Charleston

Charleston Bcstg. Co.	.....	....	

WISCONSIN

Green Bay

Green Bay Newspaper Co.	.....	....	

Milwaukee

The Journal Co.	.....	45.4	WMFM

Oshkosh

Oshkosh Bcstg. Co.	3,810	44.5	

Wausau

Record-Herald Co.	.....	46.5	

Superior

Head of the Lakes Bcstg. Co. (Exp.)	.....	....	W9XYH

Forecast of Progress ★ At the offices of *FM* AND TELEVISION we have a bird's-eye view of what is ahead in FM broadcasting which forecasts the activity evident in the filing of applications with the FCC. We have a preview of the picture from subscriptions.

Since January of this year, the first special activity we noticed was in the number of new subscribers among the AM broadcasters. There were very few subscriptions from newspapers then, but later it appeared from our records as if that group was slowly coming to life. Then, orders began to come in from publishers and general managers of newspapers in all parts of the country.

Concurrently, by mail, telephone, and personal visits, we have been asked every manner of question about FM broadcasting, ranging from the address of FM Broadcasters, Inc. (which, incidentally is: Colorado Building, Washington, D. C.), to the advisability of buying an AM station now, and adding an FM transmitter when the equipment is available.

It appears, and we can make a reasonably accurate estimate from our own information, that if the manufacture of FM broadcasting equipment is released by January, 1945, that there will be accumulated orders for considerably more than $30,000,000 in FM installations. A substantial part of this will be represented by equipment reservation orders. However, orders for antennas, microphones, measuring and test equipment, and the great quantities of supplies and components will not be placed until restrictions are lifted. Then, a veritable flood of new FM broadcast station business will be released.

SPOT NEWS NOTES

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

New FMBI Members: Admitted since those listed on this page last month:

Louis Wasmer, Inc., Spokane, Wash.
WEBR, Inc., Buffalo, N. Y.
Chicago Board of Education, Chicago, Ill.
FM Development Foundation, Wash., D. C.
Rock Island Bestg Co., Rock Island, Ill.
WEAL, Inc., Lancaster, Pa.
Washington Post, Washington, D. C.

Commissioner T. A. M. Craven: Whose term as a member of the FCC expires on June 30, 1944, has requested the President not to reappoint him. He plans to join the Cowles interests, broadcast station operators and publishers of newspapers in Des Moines and Minneapolis, and Look Magazine, in a technical capacity.

In reply to Commissioner Craven's letter, President Roosevelt wrote: "The reasons you cite leave me no alternative. I shall, therefore, comply with the request you make and I sincerely hope that your reëntry in the field of private business will bring to you rewards that will more than recompense for the years of sacrifice and labor you have given your Government."

FM Radio Worked: When this Missouri State Police car was overturned, the driver was pinned in the wreckage. Accident occurred 40 miles from police barracks, and immediate assistance was needed by the injured driver. Although the Motorola FM equipment had been torn from its mounting, and the antenna was bent back almost flat against the side of the car, the trooper was still able to get a message to his home station. Another car was promptly dispatched to rescue him. Picture shows the wreck when it was towed back to headquarters.

Raymond C. Bierman: Newly appointed chief engineer of Permoflux Corporation, Chicago. In this capacity, he will be in charge of the development of various types of acoustic transducers, and of testing equipment for maintaining quality standards. He received his E.E. degree at Purdue in 1932, and was associated for seven years with the NBC Blue Network as studio field engineer. Off the job, he is an enthusiastic amateur pilot.

Chairman Fly: Disclosed at the first session of the Television Seminar, sponsored by the Radio Executives Club, that just as the propagation characteristics of the lower frequencies are favorable to sound broadcasting, so the characteristics of frequencies in the range from 600 to 2,000 mc. are favorable to television broadcasting. This has been known for some time to many engineers engaged in military research, but the source of their information has deterred them from making any more definite statements than such remarks as Major Armstrong's comment that "television in the present frequencies is an engineering misfit."

M. L. Muhleman: Editor and publisher of *Radio* has retired from the publishing business, and has joined Erwin, Wasey & Co. in an executive capacity in their electronics division, where he will handle advertising and market research for North American Philips.

Multiple Television Ownership: FCC has increased from 3 to 5 the number of television stations to be operated under one ownership or control. It will consider a greater number "as constituting a concentration of control of television broadcasting facilities in a manner inconsistent with public interest, convenience, or necessity."

John F. Dryer, Jr.: Has joined the engineering staff of Amperex Electronic Products, Inc., Brooklyn, N. Y. Previously he was chief of the electrical research department, Duramold Division of Fairchild, working on the development and design of high-frequency heating equipment. He received his M.E. degree at Stevens Institute of Technology in 1921.

St. Paul: About 2,000 new jobs will be available when Western Electric starts operations at the latest factory opened as an adjunct to the Hawthorne plant. The Company has taken a 3-year lease on 290,000 sq. ft. in downtown St. Paul. It is the Gordon Ferguson building, of 8 stories, fronting on Sibley Street. Full capacity production will be reached this fall. Principal items of manufacture will be telephone sets.

Ricardo Muniz: Former chief engineer of Radio Navigational Instrument Corporation has joined Espey Mfg. Company, New York City, as director of engineering. A graduate of Brooklyn Polytechnique Institute, 1930, he taught Radar classes there and directed radio classes at Hunter College. His new book *Radio Maintenance and Repair* will be published shortly by D. Van Nostrand.

(CONTINUED ON PAGE 22)

FROM THIS OVERTURNED WRECK A MISSOURI STATE TROOPER WAS STILL ABLE TO CALL HIS BARRACKS ON THE FM TRANSMITTER AND SUMMON AID

Official U.S. Navy Photo

NEWS PICTURE

IN THE conduct of every amphibious invasion attack, FM communication has played a vital part. Col. Grant A. Williams, Chief Signal Officer of the 1st Army, is authority for the statement that FM equipment is the best obtainable for this type of service, and has consistently outperformed AM both as to operating range and dependability. Yet Frequency Modulation had to win its spurs by demonstrable superiority, for not so long ago the Signal Corps as well as the Navy believed that AM, operated on FM frequencies, could deliver the same results.

(CONTINUED FROM PAGE 20)

Comdr. Paul A. de Mars: Will open offices in Boston and Washington, D. C., to conduct a consulting engineering practice after the war. He will handle the business of clients engaged in broadcasting and in the electronics and electrical engineering fields.

FM Construction Permit: Granted to State University of Iowa, Iowa City, to operate with 2 kw. on 42.7 mc., unlimited time.

Walter Goat: This month marked the 15th anniversary of Goat Metal Stampings, Inc., 320 Dean Street, Brooklyn, N.Y. This is an affiliate of Fred Goat Company, Inc., founded by Mr. Goat's father in 1893. The latter Company produces a wide variety of special production machinery, while the former, under the management of Edward F. Staver, specializes in light stampings of materials from .002 to 1/8 in. thick. In addition to tube shields, for which the Company is widely known, and an innumerable variety of small metal parts for radio equipment, Goat produces plates, grids, and other tube parts for nearly every tube manufacturer.

Robert Charles Gunther: Born May 3rd, 8¼ pounds, second son of Frank A. Gunther, vice president in charge of engineering at Radio Engineering Laboratories. Both Mr. and Mrs. Gunther are CAP pilots.

Television Program Service: To aid advertising agencies in developing new television techniques, Du Mont television station W2XWV now offers an Agency Programming Service under the direction of Eleanor Balz, formerly of Schenectady station WRGB.

Dr. George R. Town: Named manager of research and engineering for Stromberg-Carlson Company. Prior to joining the Stromberg organization in 1936, he was with Leeds & Northrup as research and development engineer. He is a graduate of Rensselaer Polytechnic Institute, and received his doctorate there in 1929. This announcement was made by F. C. Young, Vice President in charge of Research and Engineering.

Profits: First quarter profits of Philco Corporation are 69¢ per share, up from 51¢ in the corresponding quarter of 1943. Net income, after deduction of estimated taxes and renegotiation adjustments, was $946,326 for the first quarter.

Name Changed: Sprague Electric Company is now the official name of Sprague Specialties Company, North Adams, Mass., manufacturers of condensers, resistors, and other radio and electrical components. President R. C. Sprague explains that the change is for the purpose of more accurately describing the Company's business. No change in ownership or management is involved.

RTPB Actions: The inadvisability of publishing reports on RTPB Panel Committee deliberations is indicated by the fact that some of the decisions which leaked out via the grapevine have been reversed already!

Leon Adelman: Former jobber sales manager of Cornell-Dubilier, has resigned to establish himself as an independent manufacturers' representative. Among other lines, he will represent Solar Capacitor Sales Corporation, serving distributors in Metropolitan New York.

SYLVAN WOLIN, LEFT, SOLAR JOBBER MANAGER, AND REP. LEON ADELMAN

I.M.S.A. Convention: The 49th Annual Meeting of the International Municipal Signal Association will be held at Hotel Statler, Boston, on October 2nd to 5th. Theme of the discussions will be "Today's work — tomorrow's planning." All those interested in municipal signal work, whether they are Association members or not, are invited. Inquiries should be addressed to the Association's office at 8 East 41st Street, New York 17, New York.

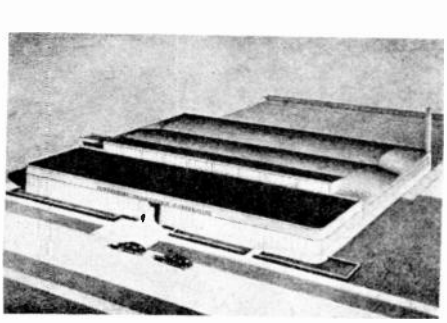
New Radio Line: In 1928, Westinghouse discontinued the manufacture of home radio sets, but this Company will re-enter the field as soon as war conditions permit. This news, from Walter Evans, vice president in charge of the Westinghouse Radio Division, Baltimore, Md., was accompanied by the statement that "When peace comes again, instead of closing down our greatly expanded facilities, with resulting unemployment, we shall turn to the building of home radio receivers. We shall, therefore, manufacture standard and Frequency Modulation receiving sets, including automatic phonograph combinations, and, as soon as possible, home television equipment. They will be distributed to retailers through the Company's national distributing channels."

Garet W. Denise: New general manager of the Littlefuse Chicago plant at 4757 Ravenswood Avenue. He resigned recently from Republic Aviation, where he distinguished himself in his efforts to step up the production of Thunderbolts. He received his degree in electrical engineering from Millikin University.

Procedure for Terminations: War Department has released official regulations covering contract terminations. Known as Procurement Regulation No. 15, this book is for use of contractors and Government personnel in effecting settlements of war contracts. It can be ordered from Superintendent of Documents, Government Printing Office, Washington, D. C., at $1.00, which includes the next 12 amendments.

Harry Sadenwater: Former manager of services for RCA Laboratories at Princeton, N. J., has been appointed broadcast equipment sales manager of RCA in the eastern region. He will make his headquarters at the RCA sales offices, 411 Fifth Avenue, New York. One-time U. S. Radio Inspector, and a lieutenant in the Navy during World War 1, he was radio officer on the flying boat NC1, on her famous flight in 1919.

Condenser Plant: Under construction for Industrial Condenser Corporation, Chicago, of 75,000 square feet, will house a million-volt research laboratory, according to H. Lee Sklar, President. This is the Company's eighth plant for production of electrolytic, paper, and oil condensers.



ARCHITECT'S DRAWING OF NEW PLANT FOR INDUSTRIAL CONDENSER CORP., CHICAGO

NEW FREQUENCIES FOR FIRE STATIONS

Cities of 150,000 Population May Now Use Special System for Fire Communications

UP TO the present time, police radio systems have handled message traffic for the fire departments of most all cities.

Effective 45 days after May 9th, however, new FCC rules will go into effect which make available for use of municipal fire stations one medium frequency and two VHF channels which are now allocated for the use of marine fire stations.[1]

Because of the limited number of frequencies available for emergency service, it was not deemed practical, from an engineering standpoint, to provide separate frequencies, as distinguished from police frequencies, for fire departments of all municipalities in the United States. Normally, only cities whose fire departments service a population of 150,000 or more will be eligible under the new rules for special municipal fire department radio stations, unless some unusual circumstances are shown which would warrant the grant.

The purpose of the new rules is to make it possible for larger cities to use designated frequencies for their fire departments independent of police communications, since it has been found that in emergencies the peak message traffic on municipal frequencies of the larger cities is of such proportions that service cannot be rendered effectively by police departments to the fire departments.

In smaller communities, however, the police systems will be expected to cooperate with the fire departments in handling their needs.

The FCC defines "Municipal Fire station" as a radio station licensed in the Emergency Radio Services, operated by a municipality, and used for emergency communications related directly to official fire department activities.

Applications must be signed on behalf of a municipality by the chief executive of the applicant — that is, the mayor, city manager, first selectman, chairman of the town council, or chairman of the board of county commissioners. No other person is empowered to sign such applications unless he has been expressly authorized in writing to do so by the actual applicant, or its chief executive, in which case express written authorization must be filed with the FCC.

Frequencies ★ The frequencies available for municipal fire communications are:

1,630 kc.
35,580 kc.
37,740 kc.
117,550 kc. (assigned for experimental use only)

On 1,630 kc., emission A-1, A-2, and A-3 may be authorized. On 35,580 and 37,740 kc., emission A-1, A-2, A-3, A-4, and special emission for Frequency Modulation may be authorized.

Only one VHF channel will normally be assigned to a municipality. Requests for additional frequencies must be supported by a satisfactory showing of need which must include a statement specifying and describing the area to be served, the number of mobile radio units to be served, peak message-traffic load, and such other facts and circumstances as show the need for additional frequencies.

Power ★ Only such transmitter power will be authorized as is required for satisfactory technical operation commensurate with the size of the area to be served, and the local conditions which affect radio transmission and reception. Normally, this will not exceed 250 watts.

Requests for authorization of power in excess of 250 watts must be supported by a satisfactory showing of the need. This must include a map showing the size of the area to be served, the proposed distribution of associated radio stations, and local conditions which indicate the need for the higher power requested.

Use of Stations ★ Municipal fire stations are authorized to:

1. Intercommunicate with other licensed municipal fire stations of the same licensee.
2. Transmit messages to mobile units used for emergency purposes in coordination with the official activities of the fire department.
3. Intercommunicate with other licensed stations in the emergency radio service, or communicate with fixed receiving points only in those instances where emergency and temporary cooperation or coordination is necessary for the performance of the official duties of the fire department of the station licensee.

Intercommunication between land stations or transmission of messages from any municipal fire station to radio receivers at fixed locations, as provided above, is permitted only when:

1. Other means of communication are impractical or temporarily unavailable.
2. Interference is not caused to any mobile radio service.
3. The points of communication are not within the same local telephone exchange area, unless the messages transmitted are of immediate importance to mobile units, or wire communication facilities between the local points involved are not immediately available.
4. The points of communication are within the reliable daytime communication range of the transmitting stations involved.

This new ruling by the FCC makes no specific reference to the use of handy-talkies for communication between fire apparatus and fire chiefs who enter the scene of a fire. However, the specification of 117.55 mc. for experimental use would cover such equipment.

Future Possibilities ★ Another device to which consideration will be given one of these days is the automatic radio fire alarm call. Various unattended FM transmitters have demonstrated the complete practicability of such equipment. The FCC might be opposed to the replacement of wire-operated fire alarm systems with automatic radio alarm boxes in city limits, on the theory that wire lines should be used wherever they are available.

In suburban and rural areas the telephone is available, but it does not provide the protection of direct communication with fire headquarters, nor does it permit the actual recording of alarms on tape, as when fire alarm boxes are used. The weakness of the telephone call is that information as to the location of the fire is often given incorrectly or is not possible to obtain from a person who is excited by the emergency conditions. Calls coming from private homes cannot be identified on party lines.

On the other hand, small towns could not afford to furnish radio alarms to individual homes, and such alarms, even though located as little as one-fourth mile apart would be of little value.

Accordingly, it is quite possible that automatic radio alarms, priced very moderately, will be manufactured and sold to municipalities which will, in turn, install

(CONCLUDED ON PAGE 59)

[1] The Directory of Emergency Radio Stations, published in our January, 1944 issue, shows marine fire systems only in New Orleans, Boston, Portland, Me., Detroit, New York City, and Seattle.

THE CBS REPORT ON TELEVISION STANDARDS

The Full Text of the Statement Made on April 27th Concerning Prewar and Postwar Standards

BY PAUL W. KESTEN*

EDITOR'S NOTE: *Mr. Kesten's statement which follows was made at a Press Luncheon in New York City, in connection with the release of the CBS illustrated television report.*

I WANT to thank you all for taking the time to be with us today. I believe I can appreciate the demands upon your time during these days when we are all concentrating our efforts on matters directly connected with the war. That does not excuse us, however, for closing our eyes to the problems which will face us in the immediate postwar period — especially certain problems which must be decided during the war if we are to cope with them responsibly after war.

Television has been very much in the news recently, and is a subject in which I believe you are all very much interested.

By the time we discontinued our live television broadcasting in 1941, in order to enlist our engineering personnel and facilities directly in military projects, we had blazed several new trails on several fronts of television programming. Since that time, however, we have been conspicuously absent in the many public announcements and prophecies concerning television. Today Columbia breaks its long and thoughtful silence on the subject of postwar television.

I would like to sketch something of the opportunity which postwar television presents, and something of the problem which faces it, by a little parable.

Prewar Standards ★ Once upon a time — but as a matter of fact, I mean as recently as 1941 — there was a beautiful maiden. She pledged her hand shortly before the war to a young man of rather doubtful quality. She had no father to guide her. But she had an uncle who was very fond of her. This uncle viewed the match with a slightly worried look, but held his peace.

He was worried for several reasons. For one thing, the young man was a painter of pictures, and not a very good painter — and the uncle knew that he would have to support the young couple for an indefinite number of years; for another, he doubted very much whether his niece was really in love with the painter. The trouble was, his name was more romantic than his paintings. His name, I should explain, was "Prewar Television." His paintings, in fact, were pretty badly blurred. He could paint a fair likeness of a large and simple subject, but he was no good at painting detail. And he didn't know how to use color, so everything was done in washed-out grays.

Well, along came the war and the painter hung around, holding hands with his fiancée, but getting nowhere fast. She seemed to grow tired of him and a little bored with his daubings. She, of course, is "Miss American Public." All this time the painter had concealed from the young lady the fact that he had a younger brother who had gone off to the wars. He too was a painter of pictures, but a brilliant one. He could draw or paint in black-and-white with beautiful precision. He was also very talented in color, and had a flare for brilliant hues as well as delicate tones.

Now the worried uncle knew about this youngster, who made his older brother seem like an amateur if not a fraud. And since he, the uncle, was concerned both with his niece's happiness, for which he felt he would be held responsible, and with his own financial resources, he decided at long last, in the third year of the war, to tell the innocent girl's friends and guardians his misgivings.

I have already identified two of the characters in this rather lengthy parable. The young lady — "Miss American Public." Her prewar fiance, who paints pictures but doesn't paint them very well — "Prewar Television." We intend to present to you today the third character — the precocious younger brother of the faded suitor, the one who has gone off to the wars. He represents, of course, "Postwar Television" — a kind of television which can have all the brilliance and beauty, the color and detail, which prewar television lacked.

The troubled uncle, as you can well imagine, represents the broadcasters. For it is they who must provide the daily support of the young couple until the artist's pictures can be sold — in this case to American sponsors.

No rôle is, of course, less popular than the rôle of a trouble-maker at a wedding who waits until the fateful moment when the preacher asks, "If any man can show just cause why these two should not be joined in holy wedlock, let him now speak or else hereafter hold his peace."

Postwar Television ★ And that, ladies and gentlemen, is the reason for this meeting. We, the Columbia Broadcasting System, playing today the rôle of troubled television uncle, have asked you ladies and gentlemen of the press, whom we look upon as friends and guardians of the public, to counsel with us, before it is too late. We are not waiting until the knot is tied to state our fears, or to express our choice between television as it was before the war and a vastly better kind of television after the war.

Now let me get down to the sober facts behind this so-called parable and then go on to the vital issue they present.

The first fact is this: prewar television standards were fixed by the Federal Communications Commission in June 1941 and have not been changed since. These standards were set as high as 1941 engineering developments permitted them to go. They called for a picture containing about a quarter of a million little "picture elements," roughly comparable, though not exactly, to the little halftone dots with which photographs are printed in the press. If you had a prewar television set with a 10-inch picture, this television screen was a little coarser than the average newspaper halftone screen. If you were to enlarge this picture to 18 or 20 inches, it would become about twice as coarse, that is, only half as fine as a newspaper halftone.

The second fact is this: it might have taken 10 or 20 years of ordinary engineering progress to lift television standards radically higher. But since December 7, 1941, extraordinary things have happened. A decade of development has been compressed into little more than two years. Almost total military secrecy surrounds the story of electronic progress in the war. But the effect of this progress on U. S. postwar television — if the television industry will seize it — is well known to nearly every engineer who has worked, often around the clock, on the deadly electrons of war. Enough has already been done — developed, tested, proved, and put to work — to strike off the technical shackles that held prewar television to a relatively coarse-screen picture. I am

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speaking now, not loosely or vaguely about some unspecified degree of improvement in television pictures, but about definite new standards which lie today at the very finger-tips of engineers, once they are free to focus the progress of war upon the products of peace. I am talking about black-and-white television pictures with more than twice as many tiny picture elements in the mosaic which composes them. Black-and-white pictures containing more than half a million of these little picture elements. Color television pictures containing over 900,000 multicolor picture elements.

The third fact is this: to realize these possibilities, three forces must see eye to eye and work side by side: the United States Government, the television broadcasters, and the manufacturers of transmitting and receiving equipment. And the public must be told what they are doing. For the road is not clear. It leads to a postwar predicament to which the public is a party — perhaps the major party. But every broadcaster and manufacturer is a party to it, too.

CBS Illustrated Report ★ Now just as no printed text of a radio script by Norman Corwin can truly represent the effect of the spoken words on the ear, no talk about television pictures can mean much without pictures to look at. We have therefore, after careful tests and patient experimentation, reduced to visual and printed form the basic question, "Shall the public have coarse-screen pictures or fine-screen pictures after the war?" We have been able to visualize, not exactly but with scientific approximation, the difference between pictures on the prewar standards and pictures on the postwar standards we propose. We have presented these in a report which we shall place in your hands in a moment or two. You will be the first to see it in unfinished form and as additional copies come off the press, in a rather limited printing, copies will be sent to important leaders in education, in science, and in public life, to key executives in business and advertising, and to each CBS affiliated station. Its purpose, as the report explains, is

a. "To state and describe and approximately to visualize the tremendous *opportunity* which the war has given postwar television, and
b. "To state and describe the *problems* which lie in its path."

It has been prepared by the Columbia Broadcasting System for three reasons:

1. "To bring into the open discussion which has largely gone on behind closed doors;
2. "To make clear to the layman what has hitherto been almost wholly the inside knowledge of engineers;
3. "To inform the purveyors of television programs (the broadcasters) and the users of television programs (the advertisers) *how much that is vital* is at stake."

(At this point, Dr. Peter Goldmark, CBS Chief Television Engineer, discussed the printed report that was distributed at this meeting. If copies of the report are still available, they can be obtained by writing Columbia Broadcasting System, 485 Madison Avenue, New York City. Mr. Kesten then continued:)

COMMENTS ON THE CBS REPORT

THE CBS statement on television, made at a time when the RTPB Television Panel was still deliberating postwar plans, gave rise to much comment on the part of broadcasters and manufacturers. It was originally planned to include in this issue a symposium of opinions concerning the CBS report.

However, when executives were asked for a restatement of their views, the general feeling was that the matter of television standards is under consideration by the RTPB and that, as they are responsible for expressing the best-informed opinions of the industry, further comment should be withheld until the final recommendations are submitted to the FCC.

Dr. W. R. G. Baker, Chairman of RTPB, commented briefly in these words: "The Radio Technical Planning Board has not yet made any formal recommendations with respect to the location of television in the frequency spectrum because the work of the Television Panel of the Board has not yet been completed. When the Television Panel and its six committees have completed their work, the Board will issue a statement. Any statements issued prior to completion of this work would be premature."

Meanwhile The New York Times went off the deep end in editorial pronouncements and conjured up a non-existent wrangle between Chairman Fly and Commissioner Jett when, actually, there was no essential differences in their view.

In accordance with its long-established editorial policy, FM AND TELEVISION offers no opinion in this controversy. However, additional information is given on page 26, in a discussion of the CBS report.

Effects of Delay ★ I spoke of a problem or a predicament which lies in the path. It is a different problem, or perhaps a different set of problems, for each of four important groups: The United States Government, the manufacturers of equipment, the broadcasters, and the public. But their various problems stem from one single, central problem: the problem of delay. Because (and this is the gist of it) delay in improving television standards may in itself be fatal. *Delay may be doom* to better television pictures instead of merely delay.

Bear in mind that you cannot receive the improved television standards on sets designed for the lower standards. This has been called the lock-and-key relationship in which, once the technical standards of television are locked in a certain combination, the television set must be built as a key to fit the lock.

If the new standards we propose are decided on during and introduced as quickly as possible after the war, some 7,000 television sets which the public has bought would be made useless. But, ladies and gentlemen, if the new standards are not introduced until say *five years* after the war, perhaps 5,000,000 television sets would be made useless. If they were built and sold on prewar standards, 5,000,000 sets might easily represent a billion dollars of public investment. It would take great courage on the part of any government body to annihilate that much public interest as measured in consumer dollars. It would take great courage on the part of any large set manufacturer to repudiate his product overnight — on so enormous a scale. And, I might add, it would take great courage on the part of any broadcaster whose programs had, after all, been the real inducement to home owners to buy the sets which they bought — it would take great courage for that broadcaster to obliterate his audience overnight by changing to higher standards of transmission which those sets could not receive — and start in all over again to build a new audience in the face of bitter reproach from the old audience.

In view of all this, the question must naturally arise in all your minds: Well, what's holding it back? Who wants delay? What reasons, if any, are there against this striking step-up in the quality of television pictures?

Let me answer these questions as honestly as I can. The most important force working against these far better television standards is the powerful force of INERTIA. The force reflected in the phrase — "Oh, good enough is good enough." Change is always troublesome — especially change is so complex an equation between Government and business — between science and art — as television. And let me add this:

Adapting wartime discoveries to peacetime television would involve some postwar lag. Optimistic engineers say, "Yes, a year or perhaps two." Pessimistic engineers say, "Five." Note well that no engineer — at least none we have met — doubts the certainty of improved television pictures. Their only disagreement is on the question of time.

(CONTINUED ON PAGE 57)

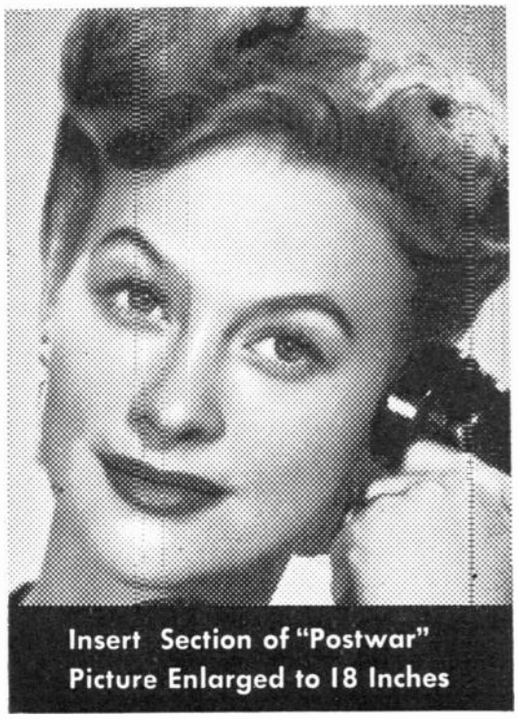


FIG. 1. THIS HALFTONE HAS 35,875 ELEMENTS, AND IS A SECTION OF A PICTURE 13.5 BY 18 INS. WHICH WOULD CONTAIN THE TOTAL OF 585,000 ELEMENTS SPECIFIED BY CBS

FIG. 2. THIS HALFTONE HAS 15,142 ELEMENTS, AND IS A SECTION OF A PICTURE 13.5 by 18 INS. WHICH WOULD CONTAIN THE TOTAL OF 250,000 ELEMENTS OF PREWAR TELEVISION

DISCUSSION OF THE CBS TELEVISION REPORT

Concerning Certain Fallacies in What Has Proved To Be a Very Constructive Effort

THE CBS report on television, introduced on April 27th by Paul Kesten, is the first effort to bring into focus the all-important subject of the quality of television reception. Capacity audiences have been greeting speakers who discuss every other phase of television, from the technique of video advertising to plans for nation-wide relay or coaxial cable networks. Still, until CBS brought the matter into the open, no one has had anything to say about the end result of television broadcasting — the quality or definition of the received images.

Or, to put it in another way, we have been using words to deal with a subject that primarily concerns the eyes! CBS, on the other hand, furnished its executive vice president with pictures to distribute among his listeners, so that they could associate his talk with something they could at least relate to television images. Some of these illustrations are reproduced here, and will be considered later in this discussion.

The CBS Position ★ The CBS position in postwar television planning is stated in the printed report in these words:

"Almost total military secrecy surrounds the surging story of electronic progress in the war. But the *effect* of this progress on U. S. postwar television — if the television industry will seize it — is well known to nearly every engineer who has worked, often around-the-clock, on the deadly electrons of war.

"Enough has already been done — developed, tested, proved, and put to work — to strike off the technical shackles that held prewar television to a relatively coarse-screen picture. Enough to free television from the strait-jacket of narrow-band, black-and-white transmission. Enough to promise pictures twice as large and twice as rich in detail, as well as pictures in full and brilliant color. Enough, in sum, to make the 'good-enough' pictures of prewar vintage seem not good enough in terms of postwar possibilities.

"To realize these possibilities, three forces must see eye to eye and work side by side: the United States Government, the television broadcasters, and the manufacturers of transmitting and receiving equipment. And the public must be told what they are doing. For the road is not clear. It leads to a postwar predicament to which the public is a party — perhaps the major party. But every broadcaster and manufacturer is a party to it, too."

In short, CBS questions the advisability of making definite plans now for postwar television based on the prewar standards already set by the FCC. They reason that current military developments, applied to home television after the war, will make better reception possible. The time required to apply these developments to home television, therefore, would be well spent.

Opposing Views ★ A storm of protest met the CBS report. Principal objections were that employment of returned soldiers

FIG. 3. THIS ENLARGEMENT OF FIG. 2 HAS THE SAME NUMBER OF ELEMENTS (15,142), AND SHOWS JUST AS MUCH DETAIL, WHEN VIEWED AT 20 TO 25 FT., AS FIG. 2 WHEN IT IS VIEWED AT A DISTANCE OF 10 FT.

would be delayed unnecessarily, since the FCC standards now in effect, calling for 525-line transmission on a total channel width of 6 mc. are adequate. Further, the use of broader channels would mean going up above 200 mc., and no suitable transmitting equipment is available for operation at such frequencies. Finally, such a change would obsolete the 7,000 television sets now in use.

Even such a conservative newspaper as *The New York Times* stepped into the situation, and laid its editorial pages open to Chairman Fly's very pointed remarks about the publication of reports as far back as 1929 which claimed that television was ready to go ahead on a commercial basis.

The one group not represented or mentioned in the discussion was the public. No one asserted that reception on television sets now in use, and built to present FCC standards, is good enough to assure an audience sufficiently large to justify the purchase of television time by advertisers.

Commissioner E. K. Jett made the diplomatic proposal that programs could be transmitted in accordance with the old standards and the postwar standards simultaneously, as sound programs are now put out on both AM and FM. However, Commissioner Jett would not have

offered that idea as a serious proposal, for he knows from his long and intimate experience with radio that people would not buy sets to receive old-standard images when new-standard transmission was on the air.

It has been proposed that sets be marketed with circuits that could be changed to suit future requirements. Dr. Alfred N. Goldsmith, commenting on this suggestion, drew from the industry's past experience when he said that this was not good engineering design practice. There can hardly be any difference of opinion on this point among those familiar with the design of radio equipment in general and television apparatus in particular.

Such a hybrid receiver would be complicated with circuits not essential to reception of present transmission nor best suited to future use. As Dr. Goldsmith said, if we knew enough now about what will come next, we wouldn't have any reason to provide for the standards in current use.

Another Angle ★ A careful study of the CBS report discloses certain fallacies in reasoning because the points discussed are not related to the illustrations. These illustrations, it must be observed, were printed from conventional halftone plates and are, therefore, produced in a very different manner from that employed in building up television images. A careful study of those CBS illustrations, two of which are reproduced here in Figs. 1 and 2, and Fig. 3, which is an enlargement of Fig. 2, disclose some very interesting information. This becomes clear if we restate the questions raised by CBS in this manner:

Does the performance of prewar television transmitting and receiving equipment represent the best that can be obtained within the limitations of the prevailing standards, or can the apparatus be improved to the point where television images of 525 lines and 250,000 elements will approach the detail and clarity of printed pictures having the same number of elements? If that is possible, how much time will be required to complete the development work, and to start the improved instruments in production?

Or, if that is not possible, how many lines and elements are required to equal the detail and clarity of printed pictures composed of 250,000 elements? And how much time will be required to carry television development up to that point, and to start such equipment in production?

CBS Pictures ★ The CBS report makes an important contribution to the discussion of television standards because it employs specific examples of picture detail. Fig. 1 is a section of a 13½ by 18-in. image composed of the 585,000 elements. This amount of detail, according to CBS, can and should be provided by postwar television.

Fig. 2 is a section of a 13½ by 18-in. image composed of the 250,000 elements required by the prewar standards, while Fig. 3 shows the same section as it would appear if the whole picture were enlarged to 45 by 60 ins.

Specifically these sections have:

Fig. 1: 175 × 205 elements = 35,875 elements.

THOSE TEST PATTERNS

AS Jack Gould pointed out recently (FM and TELEVISION, April, 1944) so many of the technical aspects of television which are of great significance to engineers mean absolutely nothing to those whom this art is intended to entertain and instruct.

Not until television has become established on a commercial basis will the public be interested in the details of progress now being achieved by the never-flagging loyalty and devotion of the technicians who are carrying on this work, nor in the continuous outpouring of capital which makes their work possible.

Yet engineers must be ever mindful that their efforts can succeed only to the extent that they attract and please an indifferent and unsympathetic public. It might be a worthwhile public relations gesture to use some kind of a cartoon or a drawing with overall detail of a familiar trademark or product during at least part of the television test periods. The standard test patterns are meaningless and tiresome to families who have to look at them every time they tune in for television entertainment. And it would be a reminder to the engineers that the transmission of a good test pattern is not the end, but only the beginning, of their task.

Meanwhile, can't we have Mickey Mouse back again, perhaps with some little mice or some lettering in the corners of the image? — Or anything to give relief from the stiff impersonality of those circles and the radial lines.

(Entire image would have 585,000 elements.)

Fig. 2: 113 × 134 elements = 15,142 elements.

(Entire image would have 250,000 elements.)

Fig. 3: Same as Fig. 2.

Now, the question which Mr. and Mrs. John Q. Public must answer — and this is television's $64 question — is this:

How sharp must the images be in order to convey adequate pictorial detail and to make television thoroughly enjoyable?

A fairly definite opinion can be reached from a careful consideration of these illustrations. Looking at the three sections at arm's length, you will probably feel that you would want as much sharpness as you see in Fig. 1.

But you must remember that you wouldn't want to sit that close to the television screen, particularly since this is only a section from the entire image 13½ × 19 ins. That is an area nearly 4 times as great as the printed area on this page. Other people would want to see the television reception, too, so you wouldn't be near enough to touch the screen. You'd want to sit back at least 10 ft.

Now, from a distance of 10 ft., look at Figs. 1 and 2. You probably won't be able to see any difference between them. At least, you won't see *enough* difference to justify a much higher price for a television set. However, at 10 ft., Fig. 3 has a decidedly coarse-grain effect.

Still, you wouldn't look at Fig. 3 from a distance of 10 ft., because it is only a section of an image 3¾ by 5 ft. in size. To view such an image, you'd want to be 20 to 30 ft. away. Viewed from that distance, Fig. 3 seems to have ample detail, and it is as sharp as Figs. 1 or 2 when viewed from 10 ft.

Images Aren't Halftones ★ On the basis of this simple "picture test," it is reasonable to ask: "What's wrong with the prewar standard of 250,000 picture elements? Surely if the pictures can be enlarged to 3¾ by 5 ft., and show as much detail all over as the section in Fig. 3, when viewed from 20 to 25 ft., there isn't much need for raising the television standards!"

Well, let's go back a bit. The CBS report asks the question: "Do halftone plates (such as Figs. 1 and 2) flatter television pictures?" Then he report gives this reply: "In the competent judgement of informed observers, halftone plates, as such, do flatter *poor* television pictures — pictures, for instance, transmitted by faulty equipment or received on inferior sets, or both. On the other hand, halftone plates *deprecate* the quality of the best black-and-white television pictures with comparable fineness of screen. This is true because tiny areas of white paper exist between the dots of a printed halftone, while no such empty space 'dilutes' an ideal television picture."

If that is true, then there is reason to doubt the wisdom or necessity for improvement beyond the prewar standards which, according to CBS, are represented by Figs. 2 and 3.

But if it is true that television equipment has ever been designed that gives definition comparable to Figs. 2 and 3, it has been kept very secret. Certainly none of the sets manufactured before Pearl Harbor could compare with these two printed examples.

Furthermore, expressing now the opinion of one thoroughly versed in the art of printing, there is reason to question the CBS statement that "halftone plates

deprecate the quality of the best black-and-white television pictures with comparable fineness of screen . . . because tiny areas of white paper exist between the dots of a printed halftone, while no empty space 'dilutes' an ideal television picture."

An examination of Fig. 3 shows that the picture is produced by using varying amounts of black to introduce shadows. It is the shadows which form all pictures. That is what the eye sees when viewing an object directly. The halftone screen makes perfect pictures possible because, as Fig. 3 shows, it provides a continuous range from solid black through black with pinpoints of white to 50% light (black and white squares) to white with tiny black dots.

The accuracy of halftone reproduction lies in the fact that the halftone process breaks up the picture into individual squares of precise dimensions, and evaluates the degree of shadow in each square, or picture element.

The television camera approximates this method, but does not equal the precision of the halftone, which is formed by photographing through an actual "screen" of fine lines scribed on glass.

How and How Much Time? ★ No, it is very difficult to believe, judging from the performance of equipment that has been demonstrated publicly, that television transmission and reception has been perfected to the point where it can equal the definition and amount of detail provided by a halftone picture of 250,000 elements, the number specified by prewar, 525-line standards.

That may even be impossible with any methods now in use. Perhaps it is necessary to go to new standards requiring 585,000 elements on 20-mc. channels, as CBS suggests, instead of the present 250,000 elements on 6-mc. channels, in order to approach or equal the definition of a 250,000-element halftone.

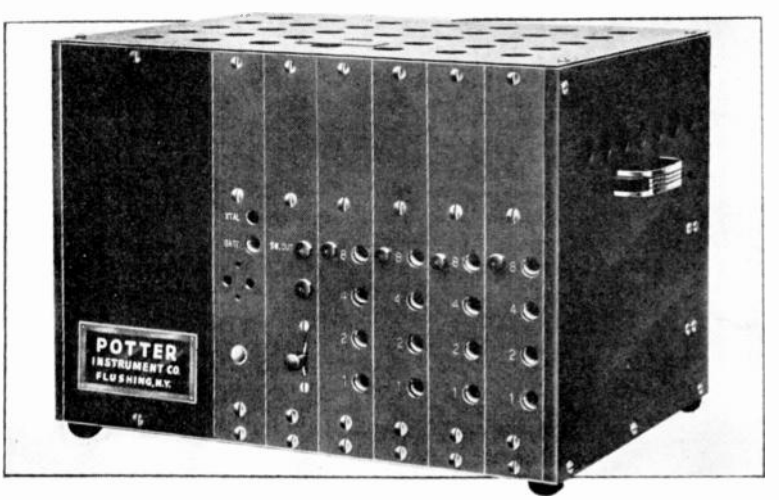
Thus, while the CBS report goes farther than others in being both frank and specific about television reception that will be acceptable to the public, there is no claim in the report that images produced so far deliver the definition of Figs. 2 and 3, or whether, with a 20-mc. channel, images will equal the definition of *either* Fig. 1 or Figs. 2 and 3.

There may be other reasons for going up to the 200-mc. part of the spectrum, as CBS recommends, or the 600- to 2,000-mc. region referred to by FCC Chairman Fly. Such frequencies require direct line-of-sight reception, and within that range, relatively low power is adequate. It is quite possible that television broadcasters, in case they go to a band somewhere between 200 and 2,000 mc., will abandon the idea of covering a large area from a single high-power station and will, instead, use several low-power stations at strategic topographical points within that area, fed by relays from a central installation. This arrangement might reduce the investment in transmitting equipment considerably. It should be emphasized that this is offered as pure speculation, which only television engineers can settle. That may be the answer to the ghost problem, which is the great headache at frequencies now being used for television.

But to the lay reader of the CBS report, although it seems clear that considerable time may be required before the definition and size of television images will merit public acceptance on a commercial scale, the reason or need for going to much higher frequencies is not explained fully or specifically because the printed examples of prewar definition, Figs. 2 and 3 are not related in the text to present-day reality, and the difference between these and Fig. 1, as an example of possible "postwar" definition, is not impressive when compared at normal viewing distance.

Nevertheless, CBS has started something that the television engineers should take up and carry forward until the whole story is told in words and picture examples that everyone can understand, including the people whom we expected to constitute the television audience. — *M. B. Sleeper.*

PRECISION ELECTRONIC INDICATING TIMER



LIGHT INDICATORS SHOW INTERVAL OF TIME TO PLUS OR MINUS .00001 SECOND

A DEGREE of accuracy hitherto impossible to attain has been achieved in a new direct-reading interval counter developed by the Potter Instrument Company, 136-56 Roosevelt Avenue, Flushing, N. Y. It is called a counter chronograph interval timer, and is illustrated above.

Using electronic counters in the timer, with a 100-kc. crystal controlled oscillator to generate the initial counting rate, an electronic switch or "gate" is first actuated by a pulse upon the initiation of the time interval. The 100-kc. frequency is divided by four decades, down to an output of 0.1 second.

The pulse generated by the termination of the time interval turns the electronic gate off, leaving a count on the panel indicators. The resulting count is the number of cycles of the 100-kc. source that have elapsed during the time interval. So accurate is this reading that it gives fractions of a second of + 0 and − 1 cycle of the 100-kc. source, or 0.00001 second for any reading. The full capacity reading of the panel is 0.09999 sec. In addition, the counter can run over this reading if desired.

The electronic counter decades are unique in that only four tubes are used for counting and indicating a scale of ten. The answers are indicated for each decade on four neon lamps designated 1–2–4–8. Combinations of these lamps indicate 0 to 9. Thus, 1 = 1, 2 = 2, 2 + 1 = 3, 4 = 4, 4 + 1 = 5, 4 + 2 = 6, 4 + 2 + 1 = 7, 8 = 8, 8 + 1 = 9.

The instrument operates from a line voltage of 100 to 125 volts, 60 cycles. Altogether, 27 tubes are used. The dimensions of the instruments are 15 ins. by 10 ins. by 10 ins., and the weight, approximately 30 pounds.

118-MC. FM FOR EMERGENCY SERVICES

Although Its Use Has Not Been Publicized, 118-Mc. FM Has Proved Highly Successful in Emergency Service

BY FREDERICK T. BUDELMAN*

THE history of radio communication is one of continued efforts to extend the practical use of the RF spectrum to higher and higher frequencies. This continuous migration is encouraged by the ever increasing need for more radio communication circuits on one hand, and by curious scientists and radio amateurs on the other.

About ten years ago, the widespread practical use of two-way radio by police departments began. Channels in the 30- to 42-mc. band were assigned by the FCC. Development was rapid. Police and many other communication services in this band passed quickly beyond the experimental stage. A complete rearrangement of this band was accomplished by the FCC in order to utilize effectively every possible channel for the rapidly growing demands for new radio uses.

When the advantages of Frequency Modulation were made available to the emergency radio field in 1939, additional demands for radio service came to light. The increased reliability and range available with the Frequency Modulation equipment made practical for the first time complete two-way coverage of entire states. The first such system to be installed was the Connecticut State Police radio system.[1] Its immediate success had several far-reaching consequences. It sounded the eventual death knell for AM equipment in the same class of service. It started a rush of state police radio projects that had been blocked for years by lack of adequate performance in mobile units. The success of the Connecticut State system is credited with being the first convincing demonstration to Army officials of the superiority of FM radio for short range and mobile communications.

The great demand for channels in the 30- to 42-mc. band made it obvious years ago that it would only be a question of time before the mobile and emergency communication services would have to seek additional channels. The only practical frequency assignments available were in the neighborhood of 116 mc. Soon after the initial development of FM equipment for emergency communication in the 30- to 42-mc. band, FM equipment on 116 mc. was put into service for radio links to give reliable point-to-point communication where telephone lines were impractical, uneconomical, or unreliable. One of the first installations of this type was at Mt. Diablo,[2] Contra Costa County,

* Chief Engineer, F. M. Link, 125 W. 17th Street, New York City.

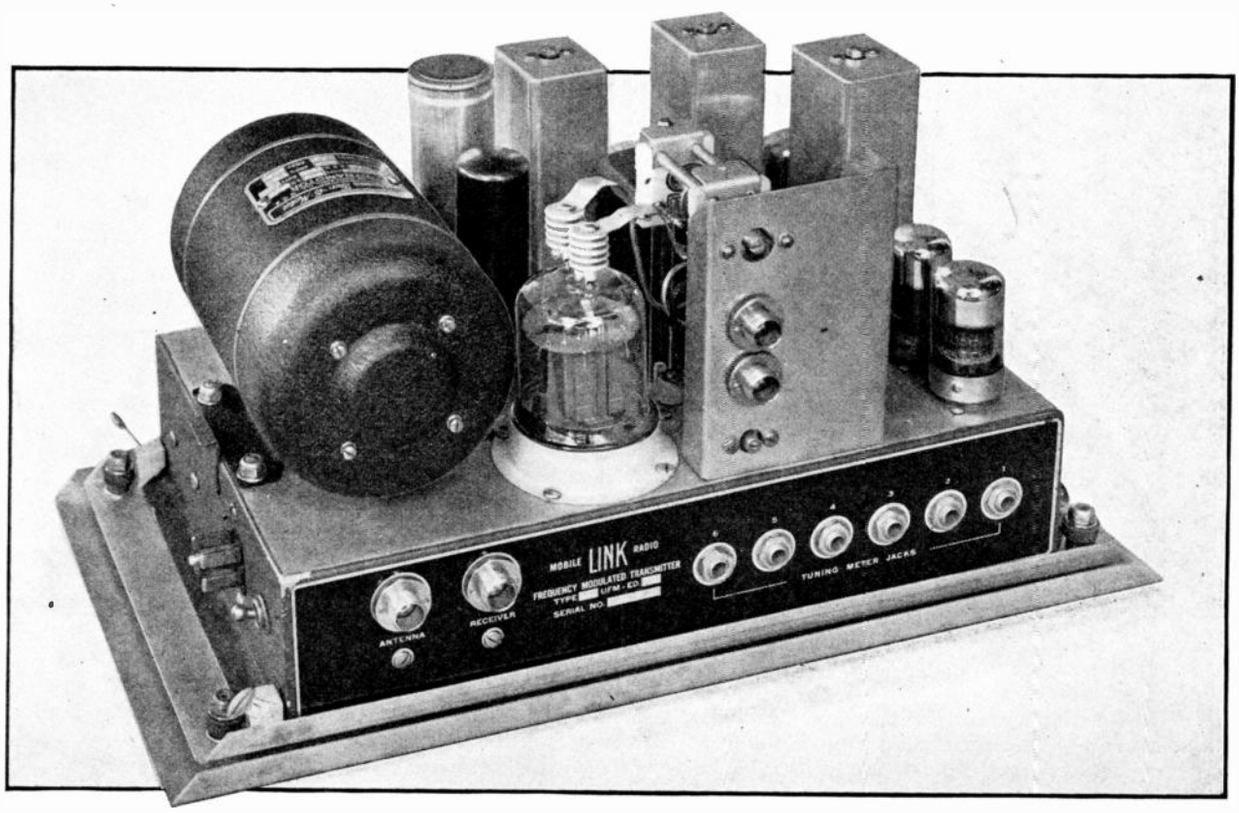


FIG. 1. IN SIZE AND GENERAL APPEARANCE, THERE IS LITTLE TO DISTINGUISH THIS TRANSMITTER FROM THE STANDARD LINK UNIT

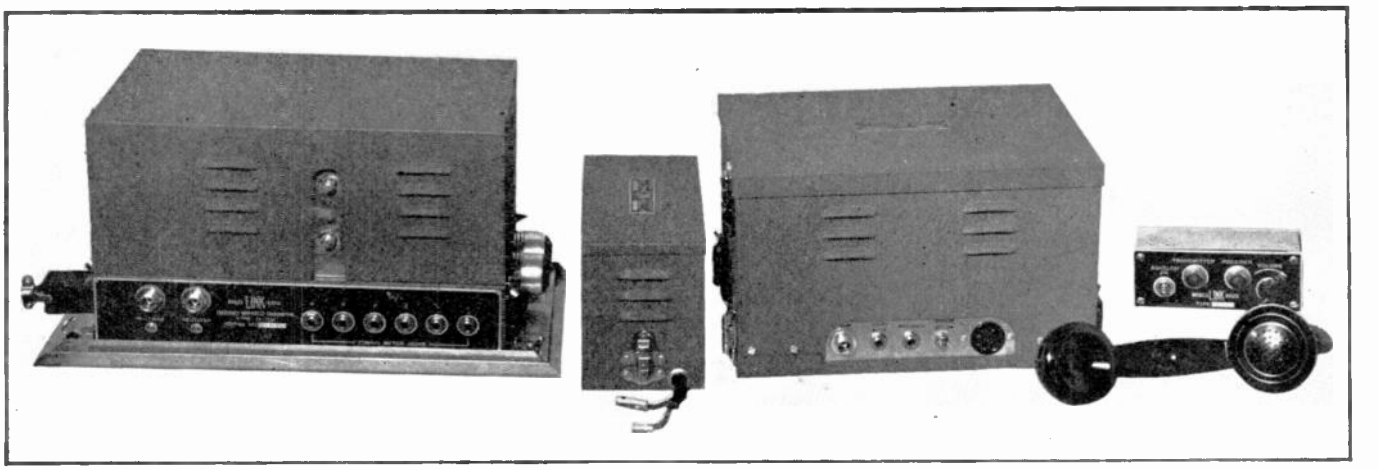


FIG. 2. COMPLETE MOBILE EQUIPMENT FOR THE HIGHER-FREQUENCY SERVICE IS INTERCHANGEABLE WITH 30- TO 40-MC. CAR UNITS

Calif., not far from San Francisco. The success of this and other similar installations led to the development of mobile equipment to operate in the same frequency range.

[1] See the following articles in *FM* RADIO-ELECTRONICS: January, 1941, *State-Wide Two-Way FM System*, by Commissioner Edward J. Hickey, and *Two-Way Police FM Performance*, by Sydney E. Warner. June, 1941, *2-Way Link FM Equipment Data, Part 1*, by Frederick T. Budelman. July, 1941, *2-Way Link FM Equipment Data, Part 2*, by Frederick T. Budelman. September, 1941, *Emergency Truck for State-Wide FM System*, by Sydney E. Warner. April, 1942, *Mobile FM for Portable Service*, by Sydney E. Warner. January, 1944, *Service Record of Police FM Performance*, by Sydney E. Warner.

[2] *FM* RADIO-ELECTRONICS, August, 1942, *Mountain-Top FM Relay*, by Donald G Beachler.

Mobile equipment was designed and made available for test during the summer of 1941. The mechanical and electrical design followed closely that of the Link FMTR mobile equipment which had proven so effective in the 30- to 42-mc. band. The 116-mc. transmitter and receiver, Figs. 1, 2, and 3, are directly interchangeable with the similar units of the FMTR mobile equipment. The use of an appropriate antenna length (¼ wave at 116 mc. is about 2 ft. long) is the only other change needed in a standard FMTR mobile installation. The Link Type 13-WF VHF receiver, Fig. 3, replaces the standard Type 11-UF unit, and the Link Type 15-WFM VHF transmitter, Fig. 1, replaces the standard Type 25-UFM chassis.

The first field test made with the VHF FM mobile equipment was carried out in September of 1941 by Sydney E. Warner, Supervisor of the Connecticut State Police radio system. The tests were made on 118.550 mc. under an experimental license granted by the FCC. The mobile transmitter utilized a quarter-wave whip antenna, about 2-ft. long, shunt-fed from a 70-ohm transmission line. The antenna was mounted on the

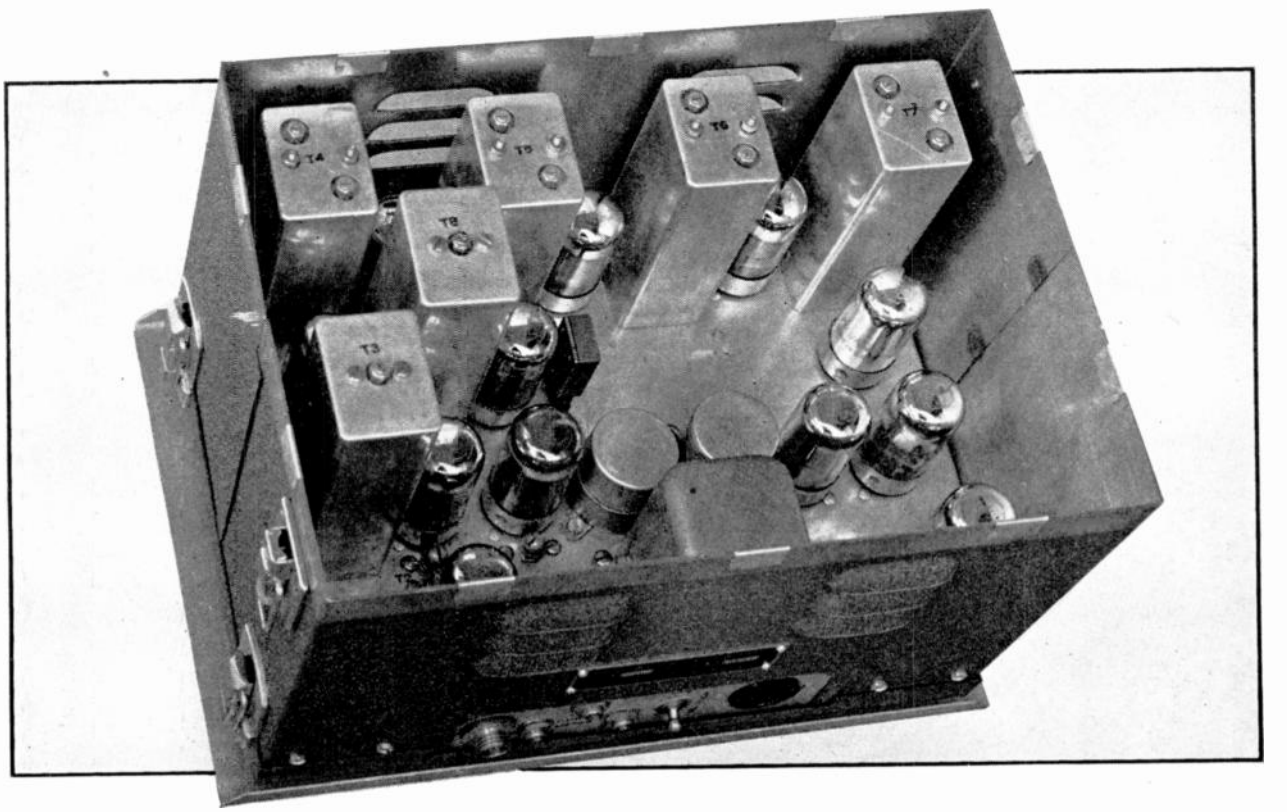


FIG. 3. INTERIOR OF RECEIVER AT THE LEFT OF FIG. 2. NO COMPLICATIONS ARE INTRODUCED BY GOING TO HIGHER FREQUENCIES

IN FM BROADCASTING

RCA has been and will continue to be an active leader in FM development.

A considerable number of FM Transmitters designed, built and installed by RCA are in service...including five 10 KW's, one of which is shown at the right.

RCA engineers have had more experience in building (and operating) radio transmitters than any other group.

And the truth is that FM Transmitters do not differ very greatly from other transmitter installations, particularly Television.

RCA has always pioneered in development of high-frequency antennas ...and is now building many different models for the armed services.

RCA will continue to offer top-rank transmitting equipment for every broadcast need... in AM. in FM, in Short Wave, and in Television.

BUY MORE WAR BONDS

RCA

RCA BROADCAST EQUIPMENT

RADIO CORPORATION OF AMERICA

FM TRANSMITTERS BUILT LIKE DE LUXE AM TRANSMITTERS

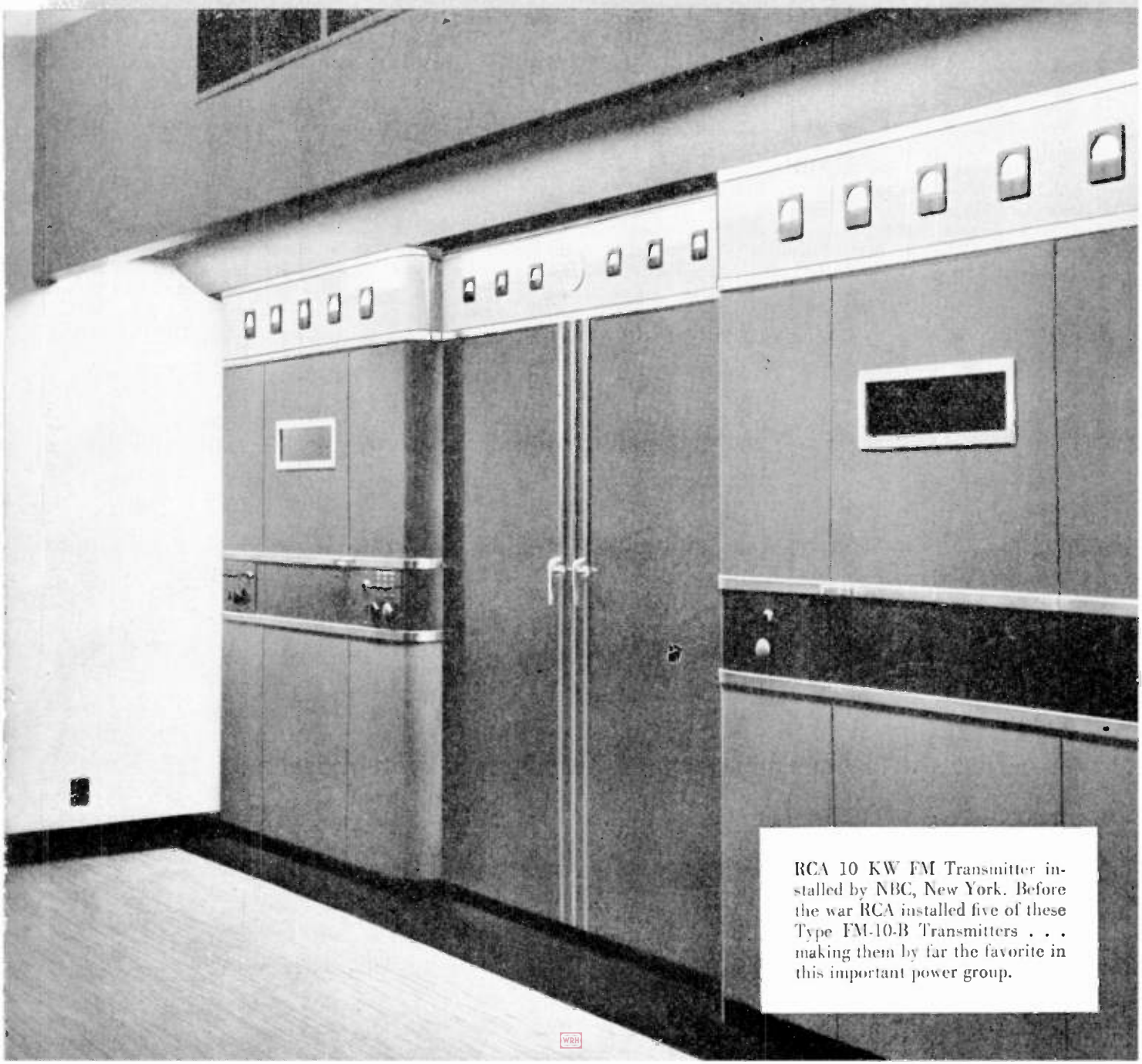
The 10 KW FM Transmitter shown below looks like a de luxe broadcast transmitter.

It should.

Like all RCA FM Transmitters, it is built to the high standards of the best AM Transmitters...RCA quality standards which broadcast engineers know and appreciate.

It is built the way broadcast engineers want it built.

It incorporates such proven RCA features as front access doors, vertical chassis construction, and stylized design.



RCA 10 KW FM Transmitter installed by NBC, New York. Before the war RCA installed five of these Type FM-10-B Transmitters . . . making them by far the favorite in this important power group.

roof of a Ford sedan. The fixed receiver used for the talk-back tests was an AC-operated model, and was installed in the existing Link 250-UFS main station transmitter-receiver unit, without modification. The antenna in use was a coaxial type, tuned to 39.5-mc. and mounted on a 100-ft. pole. The actual received frequency of 118.550 mc. was on approximately the third harmonic of the antenna resonant frequency.

The fixed-station location was approximately 7 miles from the city of Hartford, Connecticut. Particular attention was placed on the operating conditions among the tall buildings of that city. Complete coverage was obtained from all locations. The general conclusions reported by Mr. Warner were that the equipment covered the Hartford area normally required of the mobile units operating in that part of the state, but that the 39.5-mc. circuit gave an appreciably greater maximum operating range. This conclusion, is of course, inevitable for the following reasons.

1. The power generated by the VHF mobile transmitter was approximately one-half that produced by the regular 39.5-mc. unit. The practical limit of power that can be used in a car depends to a large extent on the battery and generator capacity of the car's electrical system. Due to the lower efficiency of the output and multiplying stages in the VHF transmitter, less output can be obtained for the same number of amperes battery drain.

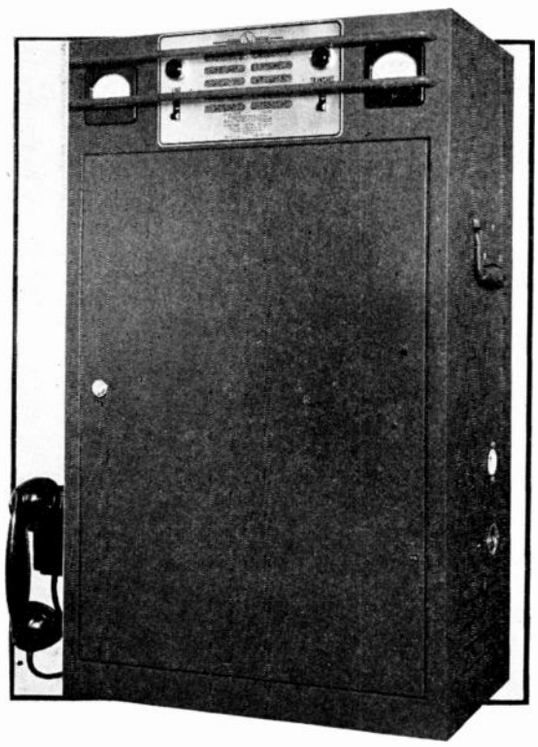


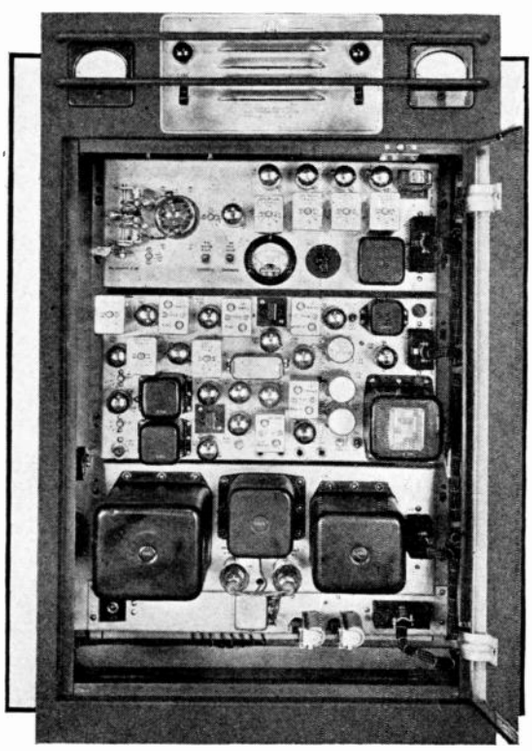
FIG. 4. EXTERIOR OF THE 50-W. EQUIPMENT

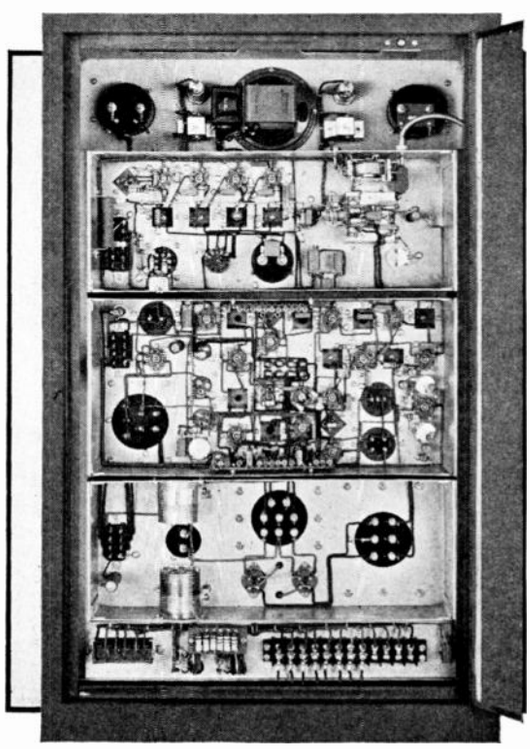
The first test model transmitter on 118.550 mc. had an output power of 15 watts, as compared to the normal output of 25 or 30 watts on the 39.5-mc. transmitters. This statement refers only to the test model and does not infer that higher powers cannot be attained. In fact, later tube and circuit developments have made powers of as much as 50 watts available in the same size unit. In general, however, less output power can be generated for the same battery drain when working on the higher frequency band.

2. It is very difficult to achieve the same receiver efficiency at 118 mc. as at 30- to 42-mc., due to the lower stage gains obtained at the higher frequencies.

3. The basic quieting signal required for the 118-mc. receiver was higher due to the fact that a bandwidth of 75 kc. (± 37.5-kc. swing) was used instead of the 30-kc. (±15-kc. swing) bandwidth used on the 30- to 42-mc. equipment.

The increased bandwidth has both advantages and disadvantages, but is a practical necessity because of the frequency stability problem. It is considered excellent engineering practice at the present time to be able to hold mobile communication equipment within ±.01% of its assigned frequency under all conditions of operation. This represents a possible difference of .02% between





FIGS. 5 AND 6. FRONT AND REAR, RESPECTIVELY, OF THE 50-W. TRANSMITTER AND RECEIVER, USING CRYSTAL FREQUENCY CONTROL

transmitter and receiver resonant frequencies. At 118 mc., .02% represents 23.6 kc., or practically the entire channel width of the 30- to 42-mc. equipment. It is obvious that for very basic practical reasons the swing and bandwidth should be increased in proportion to the operating frequency. The channels assigned by the FCC at 118 mc. are 100 kc. in width, so a swing of ±37.5 kc. was chosen to allow a suitable guard band on each side of the channel.

The disadvantage in using the greater swing lies in the fact that because of the greater receiver RF bandwidth, a higher peak noise level appears at the limiter, and a greater received signal is required to cause quieting of the FM receiver, thus reducing the maximum operating range of the VHF units.

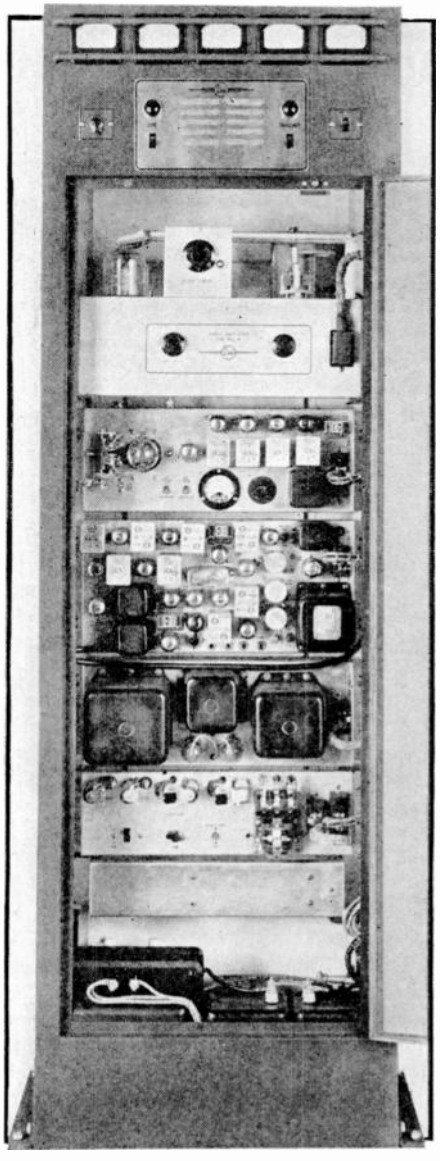


FIG. 8. FRONT VIEW OF THE COMPLETE FM TRANSMITTER AND RECEIVER

The advantage in using the greater swing lies in the fact that because of the greater deviation ratio, the signal-to-noise ratio of the receiver, once quieting is established, is better, and the receiver will provide more efficient reception under high noise level conditions as long as it is within its operating range.

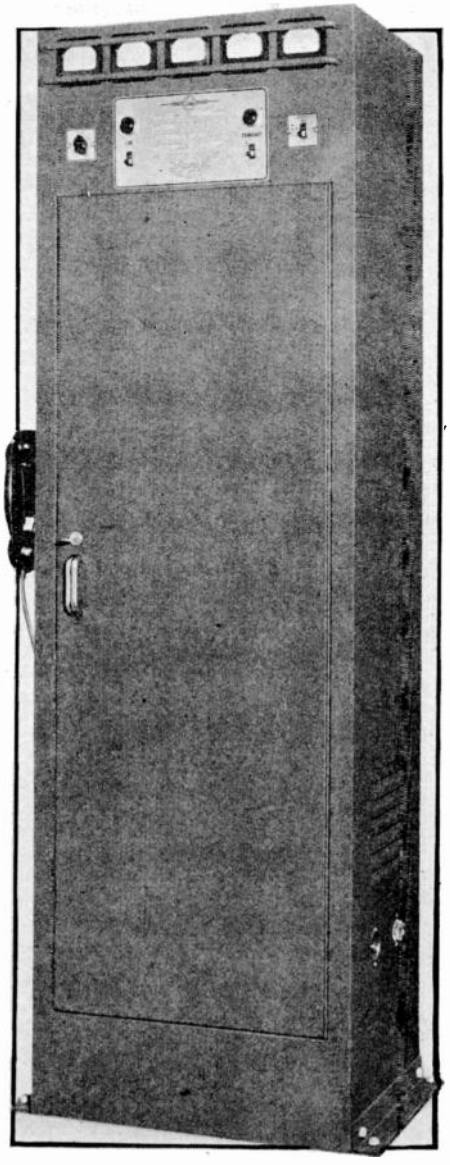


FIG. 7. EXTERIOR OF THE 250-W. UNIT

4. The shorter (9-ft.) quarter wave antenna possible on the higher frequencies, even though affording many mechanical advantages, provides less effective height and consequently less signal pick up than the 6- or 7-ft. antenna used on the 30-to 42-mc. band.

The results of the initial tests reported above indicated that equipment in the 100-mc. region was entirely practical, and that it would fill a definite need of providing good communication on a great number of additional channels. Furthermore, due to the greater tendency of the higher frequencies to follow straight line transmission, frequency assignments can be repeated much more often than on the 30-to 42-mc. band, thus allowing many more stations to use the same frequency without interference.

Development of suitable equipment has continued steadily. The pictures on these pages represent some of the present production models with output ratings of 15, 50, and 250 watts. Thousands of the units illustrated are in actual service at the present time. A great deal of field data and experience has been recorded and stored up against the time when the emergency services are forced to expand into higher frequency channels. The time for this expansion has not yet come, but

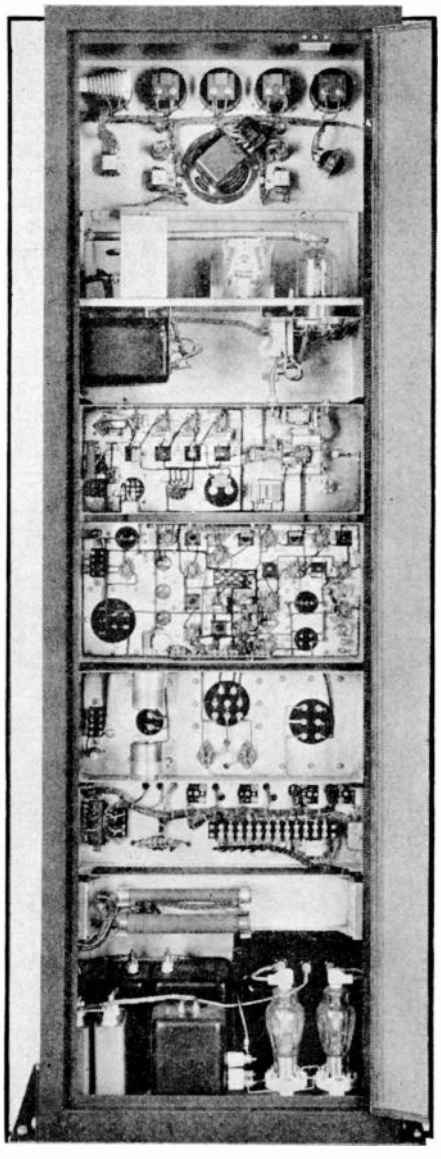


FIG. 9. THIS REAR VIEW SHOWS THE SIMPLE MECHANICAL AND ELECTRICAL DESIGN

will probably be an immediate postwar necessity when substantial new construction for these services is again permitted. In the interim, technical progress has continued, and fully proven equipment will be available when it is required.

It is felt that the use of the higher frequencies for emergency and mobile communication will supplement rather than supplant the present assignments in the 30- to 42-mc. range. The greater range capabilities of the lower frequency equipment will still be needed where the maximum possible two-way range is an economic essential, as in most state police installations. On the other hand, the greater noise reducing capabilities of the higher frequency equipment will be advantageous in most municipal and city applications where the required range is not great but the noise level is high.

The engineer, in planning an emergency radio communication system, should bear in mind the relative advantages and disadvantages to be found in the two frequency ranges. These factors are briefly reviewed here:

1. Radio equipment for use on frequencies in the region of 118 mc. is perfectly practical, as evidenced by several years' experience with thousands of such units.

2. Equipment for the higher frequency ranges, although using more tubes, is no more complicated from the service standpoint than the more conventional 30- to 42-mc. FM equipment. In fact some models are directly interchangeable with their lower frequency counterparts.

3. 118-mc. equipment provides shorter maximum operating ranges due to: a) lower transmitter output per ampere of battery drain, b) lower receiver efficiency due to higher operating frequencies, c) greater receiver bandwidth and higher required quieting signals, and d) less pickup in the shorter quarter-wave antenna.

4. Improved signal-to-noise ratio is found (within its service range) in the higher frequency equipment due to the greater swing or deviation ratio. This represents an advantage under conditions of high peak noise and moderate operating ranges as found in most municipal installations.

5. More sharply defined service areas result from the use of equipment operating at frequencies above 100 mc. Skip and long-distance transmissions are extremely rare, making it possible to repeat channel assignments at much closer distances, and to permit more stations to operate on fewer radio channels.

The success of FM at these higher frequencies indicates still wider use in the emergency services as soon as the equipment can be made available.

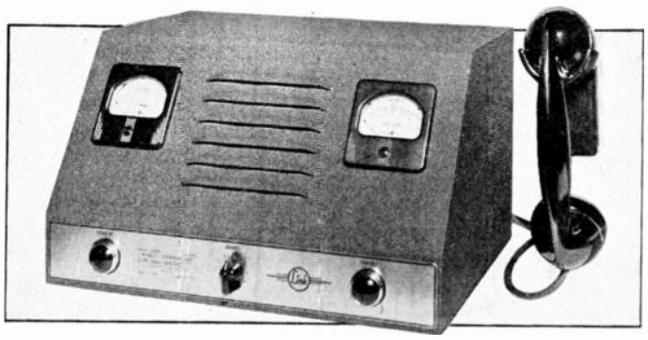


FIG. 10. DESK UNIT CONTROLS EITHER THE 50-W. OR THE 250-W. FIXED INSTALLATIONS

PREVIEW OF WARTIME RADIO JOBS

CONVINCED that his type of war work was not only well-paid but that it was strangely fascinating, Jerry Kahn, President of the Standard Transformer Corporation, set up an assembly line and an employment office in a store not far from the main plant. In three weeks' time the windows brought in enough applications to mark his idea a success, proving that people are just as much interested in the kind of work they do as in the hourly pay.

LOOKING AT THE EMPLOYMENT OFFICE DISPLAY WHICH IS EFFECTIVELY ATTRACTING APPLICANTS FOR JOBS IN THE STANDARD TRANSFORMER FACTORY

The windows showed a complete work bench and typical employees working on Signal Corps walkie talkies and other types of field communication equipment. Both men and women operators of all ages were shrewdly distributed throughout the set-up to impress upon the window shopper that anyone could do this war work, and that it was easy and pleasant. Murals of the main factory illustrated the magnitude of the Company's war work, and posters of all kinds described such advantages as rest periods, change-offs, and spirit of good will among the employees.

This solution of a labor shortage situation is especially noteworthy because the display was not on a busy or popular thoroughfare, but on a secondary artery. However, the news of this job preview got around, and many of those who came to look from curiosity stepped inside to sign up.

In fact, the experience gained from this successful experiment indicates that there are many potential workers, and particularly women who have never been employed before, who are reluctant to seek work in radio plants simply because they have no idea what it involves. This is one way to show them.

RADIO DESIGNERS' ITEMS

Notes on Methods and Products of Importance to Design Engineers

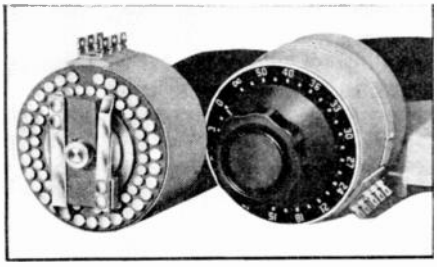


FIG. 1. ATTENUATORS OF NEW DESIGN

Attenuators: A new line of attenuators, Fig. 1, featuring improvements in design details, has been announced by The Daven Company, 191 Central Avenue, Newark 4, N. J. The detent gear now provides a more positive and accurate action as well as longer operating life. Need for cleaning or lubricating the contacts has been eliminated by the use of tarnish-proof silver alloy.

A steel cover provides magnetic shielding, and forms an integral part of the attenuator assembly, protecting the resistors. A snap-on cap gives access to the switch blades and contacts. These units meet requirements of both the Signal Corps and Bureau of Ships.

Rhombic Antenna Transformer: To couple an unbalanced 70-ohm coaxial cable transmission line to the 700-ohm terminals of a rhombic receiving antenna, introduced by the Andrew Company, 363 E. 75th Street, Chicago 19. This unit, Fig. 2, is also suitable for connecting to any antenna terminal stub of 700 ohms impedance. Losses

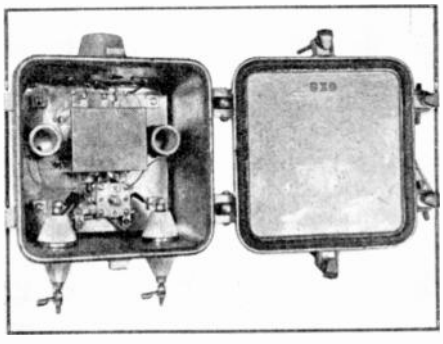


FIG. 2. RHOMBIC ANTENNA TRANSFORMER

are less than 1 db over a range from 4 to 22 mc.

The transformer is intended for outdoors installation, as close to the antenna terminals as possible. The housing is weatherproof, and the cover provides a water-tight seal. Circuit design affords the advantage of simple DC continuity checking throughout the length of the antenna from the coaxial cable input terminal, facilitating inspection and maintenance. Broad frequency response is attained by close coupling and the use of powdered iron transformer cones of high permeability.

Tropical Treatment: To protect radio and electrical equipment against moisture and

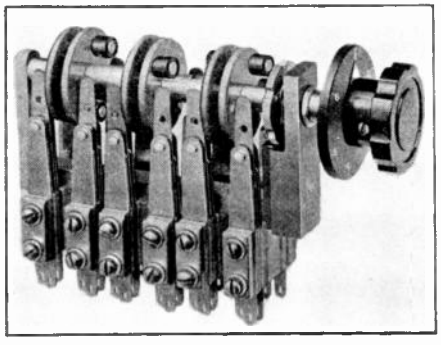


FIG. 3. SWITCH FOR AS MANY AS 12 POSITIONS

the growth of fungus in the tropics, Maas & Waldstein Company, 437 Riverside Avenue, Newark, N. J., have developed a lacquer that is moisture-resistant, retards fungus growth, and provides a high dielectric strength.

The anti-fungus feature is related to moisture-proofing because fungus growth, which springs up and spreads in the most amazing fashion over the interior construction of radio apparatus, absorbs and holds water like blotting paper. Resulting loss of efficiency is so great that equipment now held in Government warehouses is being uncrated to give it the tropical treatment before shipment to Pacific areas.

The Maas & Waldstein product, known as Dulac Fungus-Resistant Lacquer No. 86, complies with Signal Corps Specification 71–2202–A. It is clear in color, quick-drying, and can be applied by spraying, brushing, or dipping. The development of this protection will be of great value in the treatment of civilian sets, after the war, particularly for export service and in U. S. areas such as Florida, where salt-water dampness has greatly reduced the normal life of home radios.

Multi-Socket Wrench: Three different sizes of nuts, up to 5/16 in. across the flats, can be handled automatically by the Tesco wrench, manufactured by Eastern Specialty Company, 3618 North 8th Street, Philadelphia. The molded, insulated handle carries a hardened steel casing, at the end of which are nested hexagonal bushings. When the wrench is pressed onto a nut, the proper size bushing is selected automatically. Clearance through the handle takes studs up to 5½ ins. in length.

Designed for production use, this wrench speeds the work on assemblies which employ nuts of different sizes, since it is unnecessary for the operator to put one wrench down and select another. Both the handle and barrel are given a 1-minute test at 5,000 volts R.M.S. to assure adequate protection to the operator.

Rotary Cam Switch: Rated at 10 amps., 125 volts A.C. is being furnished for military equipment by General Control Company, 1200 Soldiers Field Road, Boston 34. As shown in Fig. 3, combinations of leaf spring contact assemblies in any combination can be used for the six positions. Almost any number of circuits can be closed or opened in sequence or repeated with the convenience of a single knob control. Up to 12 switch positions can be used.

The frame is cast aluminum, rollers and cams are Bakelite, and springs are nickel-plated phosphor bronze with solid silver

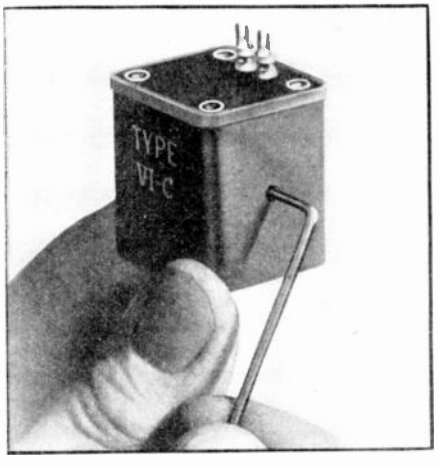


FIG. 4. VARIABLE IRON-CORE INDUCTOR

contacts. The spring build-ups are assembled under pressure to assure permanence under changes of temperature and humidity.

Miniature Air Inductors: Are being produced to specification by Barker and Williamson, Upper Darby, Pa. Used for many purposes in RF circuits, they are regularly supplied in diameters from ½ in. to 1¼ ins. Turns are cemented to strips of

low-loss insulating material. This construction, with a minimum amount of dielectric in the electrical field, produces maximum Q characteristics.

Any type of mounting can be supplied, and the coils can be equipped with internal or external coupling links of fixed or adjustable design. There are 5 standard diameters for windings of 4 to 44 turns per inch using almost any type of wire of 14 to 28 gauge. These coils are particularly suited to high-frequency band switching assemblies. Literature is available to engineers, and samples will be sent on request to Government contractors.

Small Meters: Including voltmeters, ammeters, milliammeters, and microammeters in standard AWS case construction are available from Dale Instruments, 2055 Harney Street, Omaha, Nebr. This Company, set up to produce meters for use in military equipment, occupies an air-conditioned factory designed for meter manufacture under ideal operating conditions. Facilities and engineering talent are available for the design and manufacture of special instruments.

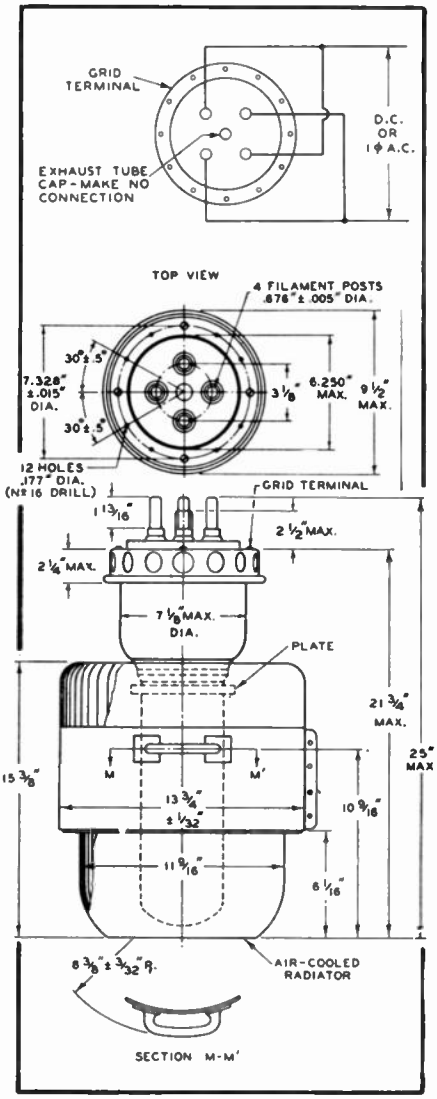
Variable Iron-Core Inductors: Sealed in a die cast case 1¼ by 17/16 by 17/16 ins. have been developed by United Transformer Company, 150 Varick Street, New York 13. The purpose of these inductors is to provide high Q characteristics with a variation of −50% to +90% from the rated value. Adjustment is provided by an 8–32 screw on the side of the case, turned with an Allen wrench, as shown in Fig. 4.

There are 19 standard inductance ratings, ranging from .0085 henry to 33 henries. A 30% tap can be furnished, on special order, for Hartley oscillator circuits. Many uses are being found for these variable inductors in audio oscillators, tuned impedance amplifiers, equalizers, and filter circuits, made possible by the high Q of these units. Weight is approximately 5 oz.

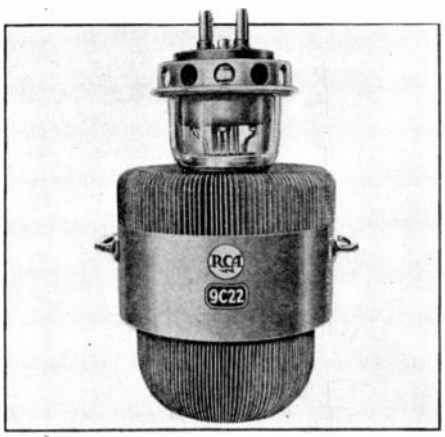
Kelvin-Wheatstone Bridge: Providing resistance measurements from .0001 ohm to 11.11 megohms in a small, portable unit, has been brought out by Shalleross Manufacturing Company, Collingdale, Pa.

Used as a Wheatstone bridge for measurements between 1 ohm and 1 megohm, normal accuracy is .3% or better. Kelvin measurements, utilizing current and potential terminals to eliminate lead and contact resistance, are accurate within 3% below .1 ohm. Rheostat is variable in steps of 1 ohm for Wheatstone, or 1 microohm for Kelvin bridge operation.

Separate keys are provided for the battery and galvanometer circuit. Resistors are accurate to .1% except those of 1 ohm which are .25%. The built-in galvanometer has a sensitivity of .25 microampere per millimeter deflection. This instrument is designed for laboratory use, production testing, maintenance, and field investigations.



FIGS. 5 & 6. DETAILS OF HIGH-POWER AIR-COOLED TRANSMITTER TUBE



Transmitter Tube: Type 9C22 is a new transmitter tube announced by RCA. Designed for forced-air cooling, it is recommended for the class B modulator stage and the plate-modulated class C final amplifier stage of high-power transmitters. Details of this tube are shown in Figs. 5 and 6. A similar tube, type 9C21, is designed for water cooling.

A feature of this tube is the entrant metal header which provides short internal connections between the filament and filament terminals. The grid is also mounted directly on the header, with the flange serving as the grid terminal. This results in an extremely short heavy-current, low-inductance path to the grid, an important factor of operation at higher frequencies. Either the 9C21 or the 9C22 can be used at maximum ratings up to 5 mc., and with reduced ratings up to 25 mc. Following are specifications in brief:

Filament voltage, AC or DC	19.5 volts
Filament Current	415 amps.
Amplification factor	38
Grid-to-plate capacity	48 mmf.
Grid-to-filament capacity	95 mmf.
Plate-to-filament capacity	1.8 mmf.

As an AF power amplifier and modulator, Class B:

DC plate voltage, max.	15,000 volts
Signal DC plate current, max.	6 amps.
Signal plate input, max.	60 kw.
Plate dissipation, max.	20 kw.

As a plate-modulated RF power amplifier, Class C telephony.

DC plate voltage, max.	12,500 volts
DC grid voltage, max.	−2,000 volts
DC plate current, max.	4 amps.
DC grid current, max.	1 amp.
Plate input, max.	50 kw.
Plate dissipation, max.	14 kw.

As an RF power amplifier and oscillator, class C telegraph, under key-down conditions.

DC plate voltage, max.	17,000 volts
DC grid voltage, max.	−2,000 volts
DC plate current, max.	8 amps.
DC grid current, max.	1 amp.
Plate input, max.	100 kw.
Plate dissipation, max.	20 kw.

The 9C22 requires an upward air blast of at least 1,800 cubic ft. per minute, while the 9C21 requires a water flow, under normal conditions, of 15 to 20 gals. per minute.

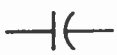
Coördination of Symbols: A great deal of confusion has been experienced in wiring diagrams for military electrical equipment associated with radio installations because the same symbols were used for different components. This situation has been cleared up by the American Standards Association, through the establish-

(CONTINUED ON PAGE 53)

Coordination of Electrical Graphical Symbols

1. Capacitor

1.1 Fixed



2.1 Variable or Adjustable

NOTE: Where it is necessary to identify the capacitor electrodes, the curved element shall represent the outside electrode in fixed paper-dielectric and ceramic-dielectric capacitors, the negative electrode in electrolytic capacitors, and the movable element in variable and adjustable capacitors. When it is desired especially to distinguish trimmer capacitors, the letter T should appear adjacent to the symbol.

2. Contact

2.1 Simple

Open   Closed

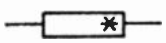
NOTE: The line representing contacts shall be approximately equal to 1¼ times the width of the gap between the lines.

2.2 Simple or Sequence

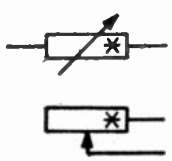
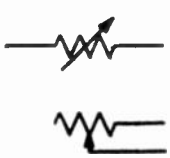
NOTE: The symbol for sequence contact may also be used for a simple contact in order to maintain uniformity and avoid confusion on drawings.

3. Resistor (Including Rheostat and Voltage Divider)

3.1 Fixed

Simple:  OR  Detailed:

3.2 Variable or Adjustable

 OR 

* This symbol must always be used with an identifying legend within or adjacent to the rectangle.

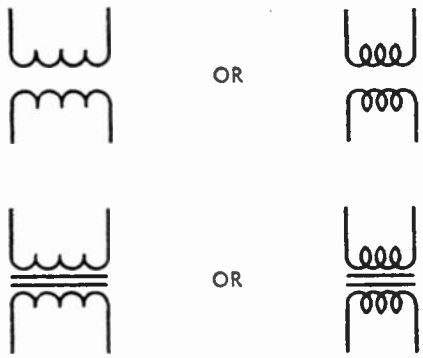
4. Inductor

4.1 Fixed

4.2 Variable or Adjustable

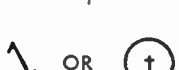
NOTE:When it is desired especially to distinguish magnetic core inductors, a line or lines parallel to the axis of the loops should be used, as in accompanying diagram.

5. Transformer



NOTE: When it is desired especially to distinguish magnetic core transformers a line or lines parallel to the axis of the loops should be used, as in accompanying diagram.

6. Operating Coil

Simple:  Detailed: 

† This symbol must always be used with an identifying legend within or adjacent to the circle.

NOTE: This symbol is customarily used with sequence contacts.

FM AND TELEVISION

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DIRECTORY OF MANUFACTURERS

General Managers and Chief Engineers of Companies Manufacturing FM and Television Equipment, Laboratory Apparatus, Components, Materials, Supplies, Molded Parts, and Production Machinery

MANUFACTURERS

THIS is the most complete Directory of Manufacturers and Engineers ever published. Names are omitted only because they were not furnished after two requests. This Directory will be published again in November, 1944, with revisions and additions, to keep it up-to-date.

Following are the abbreviations used to indicate the official titles of the Engineers:

CAF—Chief Engineer in Charge of Transformers
CC—Carrier Current Engineer
CCP—Chief Engineer, Communications Products
CE—Chief Engineer
CEA—Chief Acoustical Engineer
CED—Chief Development Engineer
CEE—Chief Electrical Engineer
CEL—Chief Electronics Engineer
CEM—Chief Mechanical Engineer
CEP—Chief Products Engineer
CER—Chief Radio Engineer
CES—Chief Design Engineer
CEX—Chief Experimental Engineer
CQ—Chief Engineer is Charge of Quartz Crystals
CR—Chief Engineer, Receivers
CRE—Chief Research Engineer
CRF—Chief Engineer, RF Division
CT—Chief Engineer, Transmitter
DE—Director of Engineering
EC—Condenser Engineer
EE—Engineer in Charge of Electrolytic Condensers
GM—General Manager
IE—Microwave Engineer
ME—Engineer is Charge of Mica Condensers
PE—Engineer in Charge of Paper Condensers
RA—Radio Engineer
RD—In Charge of Research and Development
RE—Receiver Engineer
RES—Research Engineer
SE—Senior Electrical Engineer
SP—In Charge of Special Products
TD—Technical Director
TE—Transmitter Engineer
TO—In Charge of Towers
VE—Engineer in Charge of High-Voltage Condensers
XE—Experimental Engineer

— A —

Abbott Inst. Co., 8 W. 18 St., N. Y. C. 3.
Acadia Synthetic Products, 4031 Ogden Ave., Chicago, Ill.
Accurate Spring Mfg. Co., 3817 W. Lake St., Chicago, Ill.
Ace Mfg. Corp., Erie Ave. & K St., Phila. 24, Pa. G. M. Jones (GM), F. G. Schatz (CE)
Acme Elec. & Mfg. Co., Cuba, N. Y.
Acme Elec. Heating Co., Boston, Mass.
Acme Wire Co., New Haven, Conn.
Adams & Westlake Co., Elkhart, Ind.
Advance Elec. Co., 1260-A W. 2 St., Los Angeles, Calif. F. W. Falck (CE)
Advance Recording Prods. Co., Long Island City, N. Y.
Aero Electric Corp., Los Angeles, Calif.
Aerovox Corp., New Bedford, Mass. Louis Kahn (CER), S. Heyman (ME), A. G. Kalstein (PE), G. B. Gardner (VE), J. L. Collins (EE)
Airadio, Inc., Stamford, Conn.
Air Associates, Inc., Airport and Century Blvds., Los Angeles 43, Calif. John A. Rhoads, Jr. (CE)
Aircraft Accessories Corp., Fairfax and Funston Rds., Kansas City, Kans. C. N. Kimball (CE)
Aircraft Accessories Corp., 9 Rockefeller Plaza, N. Y. C.
Aircraft-Marine Products, Inc., 1523 N. 4 St., Harrisburg, Pa. V. E. Carlson (CEX), J. O. Johnson (CEP), J. H. Thompson (CES)
Air Communications, Inc., 2233 Grant Ave., Kansas City, Mo.
Aircraft Radio Corp., Boonton, N. J.
Aircraft Radio Equip. Corp., 6244 Lex. Ave., Hollywood, Calif.
Air King Products Co., 1523 63rd St., Brooklyn, N. Y. A. D. Sobel (CE)
Airplane & Marine Inst. Inc., Clearfield, Pa. G. E. Pray (CE), W. F. Diehl (GM)
AirWay Elec. Appl. Corp., 2101 Auburn Ave., Toledo, O. C. A. Lindberg (CE)
Air-Way Mfg. Co., Toledo, O.
Akron Porcelain Co., Akron, O.
Alden Products Co., 117 N. Main St., Brockton 64, Mass. Warren Kunz (CE), Milton Alden (GM)
Aladdin Radio Industries, 501 W. 35th St., Chicago, Ill.
Allen-Bradley Co., Milwaukee, Wis.
Allen Mfg. Co., Hartford, Conn.
Alliance Mfg. Co., Alliance, O. R. F. Doyle (GM), E. V. Schneider (CE)
Allied Control Company, Inc., 2 East End Ave., New York 21, N. Y.
Allied Radio Corp., 833 W. Jackson Blvd., Chicago, Ill. L. M. Dezettel (CE)
All-American Tool & Mfg. Co., 1014 Fullerton Ave., Chicago, Ill.
Alrose Chemical Co., Providence, R. I.
Aluminum Co. of America, Pittsburgh, Pa.
American Automatic Elec. Sales Co., 1033 W. Van Buren St., Chicago, Ill.
American Brass Co., Waterbury, Conn.
American Coils Co., 26 Lexington St., Newark, N. Y.
American Communications Corp., 306 Broadway, N. Y. C.
American Condenser Corp., 2508 S. Michigan Ave., Chicago, Ill.
American Cyanamid Co., 30 Rockefeller Plaza, N. Y. C.
Amer. Elec. Heater Co., 6110 Cass Ave., Detroit, Mich.
American Felt Company, Glenville, Conn.
Amer. Hardware Co., 476 Broadway, N. Y. C.
American Instrument Co., 8030-805 Georgia Ave., Silver Spring, Md. W. H. Reynolds (CE)
Amer. Insulator Corp., New Freedom, Pa.
American Lava Corp., Chattanooga, Tenn. F. J. Stevens (CE)
American Microphone Co., 1015 S. Western Ave., Los Angeles, Calif.
American Molded Products Co., 1644 N. Honore St., Chicago, Ill. K. A. Bevington (CE)
American Phenolic Corp., 1830 S. 54th Ave., Chicago, Ill.
American Radio Hardware Co., 476 Broadway, N. Y. C.
Amer. Rolling Mill Co., Middletown, Conn.
American Screw Co., Providence, R. I.
American Spring & Mfg. Corp., Holly, Mich
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
American Steel Package Co., Defiance, O.
Amer. Telev. & Radio Co., St. Paul, Minn.
American Transformer Co., 178 Emmet St., Newark, N. J. Walter Garlick, Jr. (TD), J. F. Harris (SE)
Amperex Electronic Prods., 79 Washington St., Brooklyn, N. Y.
Amperite Co., 561 Broadway, N. Y. C.
Amplifier Co. of America, 398 Broadway, New York 13, N. Y. N. M. Haynes (CE)
Amplex Engineering, Inc., New Castle, Ind.
Amy, Aceves & King, 11 West 42nd Street, N.Y.C. E. V. Amy (GM)
Anaconda Wire & Cable Co., 25 Broadway, N. Y. C.
Andrea Radio Corp., 43-20 34th St., L. I. City, N. Y. Harry Heindel (CE)
Andrew Co., Victor J., 363 E. 75th St., Chicago, Ill. C. R. Cox (CE)
Ansonia Elec. Co., Ansonia, Conn.
Arkwright Finishing Co., Providence, R. I.
Arnessen Elec. Co., 116 Broad St., N. Y. C.
Arnold Engineering Co., 147 E. Ontario St., Chicago, Ill.
Art Radio Corp., 115 Liberty, N. Y. C.
Astatic Corporation, Youngstown, O.
Atlair Machinery Corp., 55 Van Dam, N. Y. C.
Atlas Condenser Products Co., 548 Westchester Ave., N. Y. C.
Atlas Resistor Co., 423 Broome St., N. Y. C.
Atlas Sound Corp., 1442 39th St., Brooklyn, N. Y.
Auburn Button Works, 48 Canoga, Auburn, N. Y. John Lawler (CE)
Audio Devel. Co., North Minneapolis, Minn.
Audio Devices, Inc., 1600 Broadway, N. Y. C.
Ault & Wiborg Corp., 75 Varick St., N. Y. C.
Austin Mfg. Co., 3911 S. Michigan Ave., Chicago, Ill.
Autocall Co., Shelby, O.
Automatic Electric Co., 1033 Van Buren St., Chicago, Ill. K. W. Graybill (CE)
Automatic Radio Mfg. Co., 122 Brookline Ave., Boston, Mass.
Automatic Winding Co., Inc., E. Newark, N. J. J. R. Mazzola (CE)
Avery Adhesives, 451 E. 3 St., Los Angeles, Calif. R. S. Avery (GM)
Avia Prods. Co., 737 N. Highland Ave., Los Angeles, Calif.

— B —

Baker & Co., 113 Astor, Newark, N. J.
Ballantine Labs., Boonton, N. J. Edmund Osterland (CE)
Barber-Colman Co., Rockford, Ill.
Barker and Williamson, 234 Fairfield Ave., Upper Darby, Pa. R. C. Weise (CE)
Barnes Co., Wallace, Bristol, Conn.
Bassett, Inc., Rex, 500 S. E. Second, Ft. Lauderdale, Fla. Rex Earl Bassett, Jr. (GM), Elmer T. Jones (CT), Chas. Knapp (CR), Edw. L. Minnich (CQ)
Bausch & Lomb Optical Co., Rochester, N. Y. Carl L. Bausch (CE)
Bakelite Corp., 30 E. 42nd St., N. Y. C.
Barker & Williamson, Ardmore, Pa.
Belden Mfg. Co., 4673 W. Van Buren St., Chicago, Ill.
Bendix Radio Div., Bendix Aviation Corp., Baltimore, Md. Wilbur L. Webb (CE), R. B. Moon (RE), W. H. Sims, Jr. (TE), A. E. Abel (IE)
Bendix Radio, Div. of Bendix Aviation Corp., Morford Pl., Red Bank, N. J. C. S. Townsend (CE)
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Benwood Linze Co., 1815 Locust St., St. Louis, Mo. Carl E. Peters (CE)
The Thomas & Betts Co., 36 Butler St., Elizabeth, N. J. C. A. Badeau (CE)
Biddle, James G., 1211 Arch St., Philadelphia
Bird, Richard H., Waltham, Mass.
Birnback Radio Co., 145 Hudson St., N. Y. C.
Blitcher Corp., 5087 Huntington Dr., Los Angeles 32, Calif.
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Blake Radio Equip. Co., Gt. Barrington, Mass. L. S. Thomas (CE)
Blaw-Knox Company, Pittsburgh, Pa.
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Bodine Elec. Co., 2254 W. Ohio St., Chicago, Ill. C. A. Rall (CE)
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Boots Aircraft Nut Corp., New Canaan, Conn.
Borg-Gibbs Lab., The George W. Borg Corp., Delavan, Wis. M. E. Brown (CEL)
Boston Insulated Wire & Cable Co., Boston, Mass.
Boston Insulated Wire & Cable Co., Dorchester, Mass.
Brach Mfg. Corp., 55 Dickerson St., Newark, N. J. W. A. Robinson (GM)
Brainin Co., 233 Spring St., New York 13, N. Y. C. S. Brainin (CE)
Brand & Co., Wm., 276 Fourth Ave., N. Y. C.
Brandywine Fibre Prods. Co., Wilmington, Del.
Breeze Mfg. Corp., Newark, N. J.
Brilhart Co., Arnold, Great Neck, N. Y.
The Bristol Co., Waterbury, Conn. L. G. Bean (CE), J. W. Peckham (RD), J. R. Waldelich (SP)
Arthur Brown & Bro., 67 W. 44th St., N. Y. C.
Browning Labs., Inc., 751 Main St., Winchester, Mass. Glenn H. Browning (CE) C. H. Day (GM)
Brush Development Co., Cleveland, O.
Bud Radio, Cleveland, O.
Bunnell, J. H. & Co., 81 Prospect St., Brooklyn 1, N. Y. F. D. Webster (CE)
Bunting Brass & Bronze Co., Toledo, O.
Burke Electric Co., Erie, Pa.
Burndy Engineering Co., Inc., 107 Eastern Blvd., New York 54, N. Y. Marvin Lee (CE), S. D. Bergman (LE)
Burnett Radio Lab. 4814 Idaho St., San Diego, Calif.
Burstein-Applebee Co., Kansas City, Mo.
Burton-Rogers Co., 857 Boylston St., Boston, Mass. V. S. Church (CE)

— C —

Callite Tungsten Corp., 540 39th St., Union City, N. J. Rudolf Lowit (CE)
Cambridge Inst. Co., Grand Central Terminal, N. Y. C.
Cambridge Thermionic Corp., Concord Ave., Cambridge, Mass.
Camburn Products Co., 490 Broome St., N. Y. C. Robert Lahn (CE)
Camfield Mfg. Co., 718 N. Seventh St., Grand Haven, Mich. Robert Harry Lillyblad (CE)
Camloc Fastener Co., 420 Lexington Ave., N. Y. C.
Cannon Co., C. F., Springwater, N. Y.
Cannon Elec. Devel. Co., 3209 Humboldt, Los Angeles, Calif.
Carbide & Carbon Chemicals Corp., 30 E. 42nd St., N. Y. C.
The Carborundum Co., Globar Div., Niagara Falls, N. Y. Ben A. Bovee (CE)
Cardwell Mfg. Corp., Allen D., Brooklyn, N. Y.
Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Carrier Microphone Co., Inglewood, Calif.
Carron Mfg. Co., 415 S. Aberdeen St., Chicago, Ill. C. S. Linell (CE) Herbert Widiger (GM)
Carter Motor Co., 1608 Milwaukee Ave., Chicago 47, Ill. Robert W. Carter (CE)
Catalin Corp., 1 Park Ave., N. Y. C.
Celanese Corp., 180 Madison Ave., New York 16, N. Y. W. R. Donaldson (CE)
Centralab Div. of Globe-Union, Inc., 900 E. Keefe Ave., Milwaukee, Wis. H. W. Rubinstein (CE)
Central Screw Co., 3519 Shields Ave., Chicago, Ill.
W. M. Chace Co., 1600 Beard Ave., Detroit, Mich. Stanley R. Hood (CE)
Champion Radio Works, Danvers, Mass.
Chandler Prods. Corp., Cleveland, O.
Chicago Molded Prods. Corp., 1025 N. Kolmar, Chicago, Ill.
Chicago Telephone Supply Co., W. Beardsley Ave., Elkhart, Ind. N. C. Schellenger (CE)
Chicago Transformer Corp., 3501 Addison St., Chicago, Ill. Donald Schwennesen (CE)
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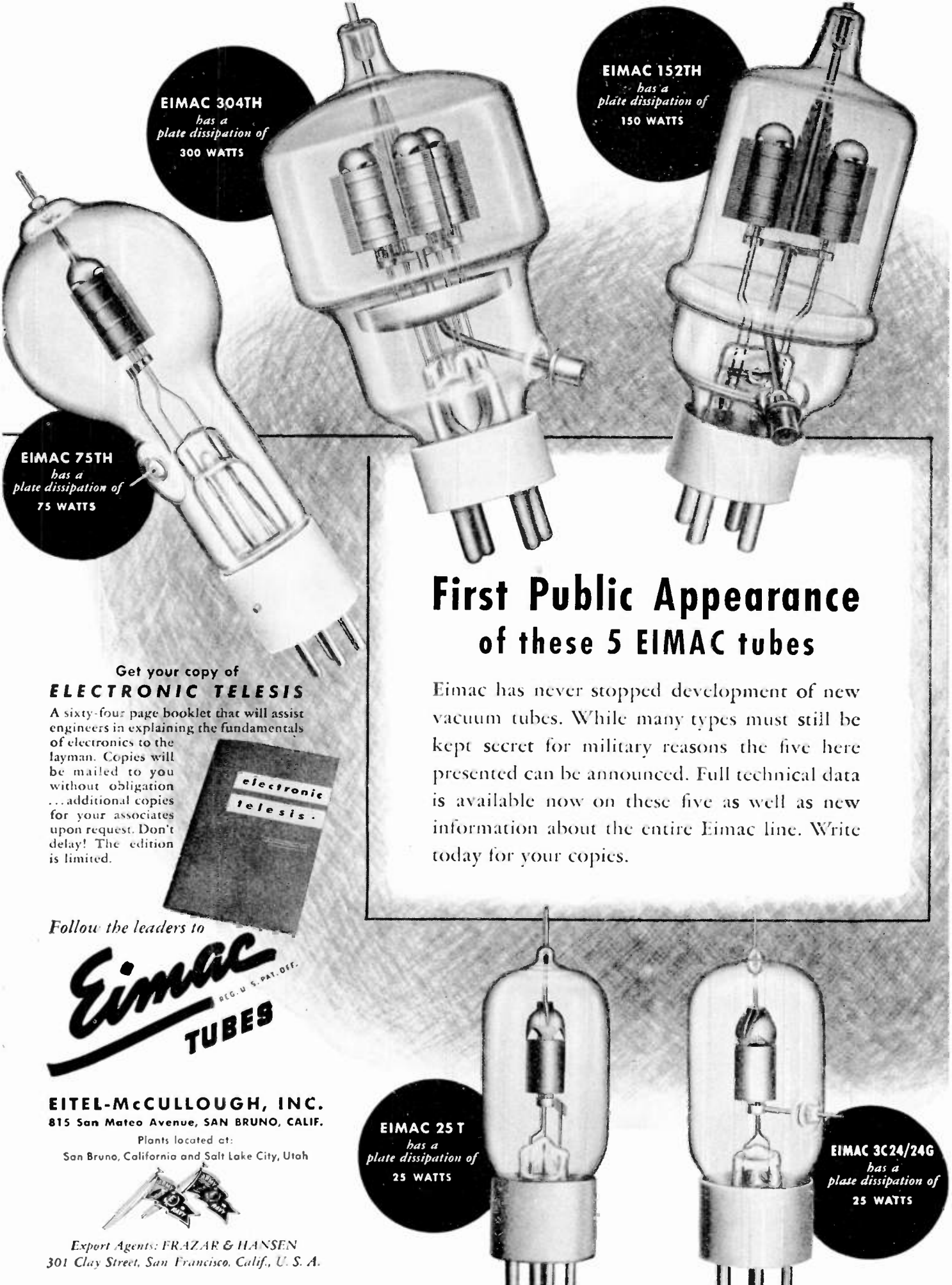
Cinaudagraph Speakers, Inc., 3911 S. Michigan Ave, Chicago, Ill.
Cinch Mfg. Co., 2335 W. Van Buren St., Chicago, Ill.
Cinema Eng. Co., Burbank, Calif.
Clare & Co., C. P., 4719 W. Sunnyside Ave., Chicago, Ill.
Clarostat Mfg. Co., Inc., 130 Clinton St., Brooklyn, N. Y. George J. Mucher (CE)
Clements Mfg. Co., Chicago, Ill.
Collins Radio Co., 855 35th St., N. E., Cedar Rapids, Ia. L. Morgan Craft (CE), Arthur A. Collins (GM)
Collyer Ins. Wire Co., Pawtucket, R. I.
Colonial Kolonite Co., 2212 W. Armitage Ave., Chicago, Ill.
Colonial Radio Corp., Buffalo 7, N. Y. J. C. Ryan (GM) E. C. Forbes (CE)
Communication Equip. & Eng. Co., 504 N. Parkside Ave., Chicago, Ill. R. A. Clark, Jr. (CE)
Communication Products Co., Jersey City, N. J. G. E. Smith (GM)
Communications Co., Inc., Coral Gables, Fla.
Communications Equip. Corp., 134 W. Colorado St., Pasadena, Calif. E. Mattson (CE) Raymond Kimball (GM)
Communication Measurements Lab., 120 Greenwich St., New York 6, N. Y. Joseph L. Roemisch (DE)
Condenser Corporation of America, South Plainfield, N. J.
Condenser Products Co., 1375 N. Branch, Chicago, Ill. M. H. Levenberg (CE)



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Cook Electric Co., 2700 Southport Ave., Chicago
Copperweld Steel Co., Glassport, Pa.
Corbin Screw Corp., New Britain, Conn. J. P. Baldwin (GM)
Cornell-Dubilier Elec. Corp., 1000 Hamilton Blvd., S. Plainfield, N. J. William M. Bailey (CE)
Corning Glass Works, Corning, N. Y.
Cornish Wire Co., Inc., 15 Park Row, N. Y. C. M. T. Mallard (CE)
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Coto-Coil Co., Providence, R. I.
Cover Dual Signal Systems, Inc., 5215 Ravenswood Ave., Chicago, Ill. W. M. Tiffany (CE), W. R. Schum (CER)
Creative Plastics Corp., 963 Kent Ave., Brooklyn, N. Y.
Crescent Industries, Inc., 4140 W. Belmont Ave., Chicago, Ill. Valoran Russell (CE)
Crescent Ins. Wire & Cable Co., Trenton, N. J.
Crosley Corp., Arlington St., Cincinnati, O. Lewis M. Clement (RD) R. C. Cosgrove (GM)
Crowe Nameplate Co., 3701 Ravenswood Ave., Chicago, Ill.
Crowley & Co., Henry L., West Orange, N. J.
Crystal Prod. Co., 1519 McGee St., Kansas City, Mo. L. A. Elbi (CE)
Crystal Research Labs., 23 Allyn St., Hartford, Conn. Richard K. Blackburn (CE), N. L. Chalfin (CRE), R. B. Wolcott (CEM)
Curtis Devel. & Mfg. Co., N. Crawford Ave., Chicago, Ill.
Cutler-Hammer, Inc., Milwaukee, Wis.
Cuyahoga Spring Co., Cleveland, O.

— D —

Daven Company, 191 Central Ave., Newark, N. J. J. P. Smith, Jr. (CE)
Dante Elec. Mfg. Co., Bantam, Conn. J. J. Dante (CE)
de Forest Labs., Lee, 5106 Wilshire Blvd., Los Angeles, Calif.
DeJur-Amsco Corp., 6 Bridge St., Shelton, Conn. F. Moore (CE)
Delco Appliance, Rochester, N. Y. Howard C. Jones (CE)
Delco Radio Div., General Motors Corp., 303 N. Buckeye, Kokomo, Ind. B. A. Schwarz (CE) B. W. Cooper (GM)
Detroit Power Screwdriver Co., 2801 West Fort St., Detroit 16, Mich. John M. Small (CE)
Detrola Corp., 1501 Beard, Detroit, Mich. R. M. Daugherty (CE)
Deutschmann Corp., Tobe, Canton, Mass.
De Vry, Herman A., 1111 W. Center, Chicago, Ill.
DeWald Radio Corp., 440 Lafayette St., N. Y. C. Mark Glaser (CE)
Dial Light Co. of America, 90 West St., N. Y. C.
Dictaphone Corp., 375 Howard Ave., Bridgeport, Conn. L. D. Norton (RD)
Diehl Mfg. Co., Finderne Plant, Somerville, N. J. Philip H. Trickey (CE)
Dilon Coil Co., Caledonia, N. Y. R. T. Bozak (CER), L. Armstrong (CEE)
Dixon Crucible Co., Jersey City, N. J.
John C. Dolph, Newark, N. J.
Dongan Elec. Co., 74 Trinity Pl., N. Y. C.
Doolittle Radio, Inc., 7421 S. Loomis Blvd., Chicago, Ill. Dudley Gray (CE), Harry J. Kayner (CED)
Dormeyer C., Chicago, Ill.
Dow Chemical Co., Midland, Mich. Dr. Willard H. Dow (GM)
Drake Mfg. Co., 1713 W. Hubbard St., Chicago, Ill. Ken Foute (CE)
Driver-Harris Co., Harrison, N. J.
Dumont Elec. Co., 34 Hubert St., N. Y. C. J. Katzman (CE)
Allen B. Du Mont Labs., Inc., 2 Main Ave., Passaic, N. J. Dr. P. S. Christaldi (CE) Paul Ware (GM)
Du Pont De Nemours & Co., E. I., Arlington, N. J.
Dunn, Inc., Struthers, 1321 Cherry St., Philadelphia, Pa.
Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y. R. M. Crawford (GM)
D-X Radio Prods. Co., 1575 Milwaukee, Chicago, Ill.

— E —

Eagle Electric Mfg. Co., 23-10 Bridge Plaza S., Long Island City, N. Y. George I. Hamondi (CE)
Eagle Metals Co., Seattle, Wash.
Eastman Kodak Co., Development Dept., 343 State St., Rochester, N. Y. A. W. Tyler (PH)
Eby, Inc., Hugh H., 18-A W. Chelton Ave., Philadelphia, Pa.
Echophone Radio Co., 201 E. 26 St., Chicago
Eckstein Radio & Television Co., Inc., 1400 Harmon Pl., Minneapolis, Minn. E. A. Eckstein (CE)
Eclipse Aviation, Bendix, N. J.
Elcor, Inc., 1501 W. Congress, Chicago 7, Ill. J. Nader (DE)
Elsler Eng. Co., 7518 13th St., Newark, N. J.
Eitel-McCullough, Inc., San Bruno, Calif. G. T. Howes (CE), Harold E. Sorg (RD)
Elastic Stop Nut Corp., Union, N. J.
Electra Voice Corp. 5215 Ravenswood Ave., Chicago, W. R. Schum (CE)
Electric Auto-lite Co., The, Port Huron, Mich.
Electronic Enterprises, Inc., 65 Sixth Ave., N. Y. C.
Elec. Ind. Mfg. Co., Red Bank, N. J.
Electric Indicator Co., Stamford, Conn.
Electrical Prod. Corp., 950 30th St., Oakland 8, Calif. G. W. Thunen (CE)
Electrical Prod. Supply Co., 1140 Venice Blvd., Los Angeles 15, Calif.
Electrical Research Labs., Inc., 2020 Ridge Ave., Evanston, Ill. Wm. J. Schnell (CE)
Electric Motors Corp., Racine, Wis.
Electric Soldering Iron Co., Deep River, Conn.
Electric Specialty Co., Stamford, Conn.
Electronic Communications Co., 36 N. W. B'way, Portland, Ore.
Electronic Labs., Inc., 122 W. New York St., Indianapolis, Ind. R. H. Frye (CE)
Electronic Mechanics, Inc., Paterson, N. J.
Electronic Specialty Co., Glendale, Calif.
Electronic Transformer Co., 515 W. 29th St., N. Y. C. Samuel Goldberg (GM) Albert Cezar (CE)
Electro Tech. Prod., Inc., Nutley, N. J.
Electrolux Corp., Old Greenwich, Conn.

— F —

Fada Radio & Elec. Co., 30-20 Thomson Ave., Long Island City, N. Y. Albert H. Carr (CE) Geo. H. Wilso (GM)
Fansteel Metallurgical Corp., North Chicago, Ill. Robert J. Aitchison (GM)
Farnsworth Telev. & Radio Co., 3701 E. Pontiac St., Fort Wayne 1, Ind. B. Ray Cummings (CE)
John E. Fast & Co., 3109 N. Crawford Ave., Chicago, Ill. Wm. S. Franklin (CE) Louis Kopinski (GM)
Federal Engineering Co., 37 Murray St., N. Y. C.
Federal Mfg. & Eng. Corp., 199-217 Steuben St., Brooklyn 5, N. Y. M. Kaplowitz (CE) D. H. Engelson (GM)
Federal Recorder Co., Elkhart, Ind.
Federal Screw Prods. Co., 224 W. Huron St. Chicago, Ill. J. M. Levine (GM)
Federal Telephone & Radio Co., 200 Mt. Pleasant Ave., Newark, N. J. E. G. Ports (CE)
Felker Mfg. Co., Torrance, Calif. M. N. Felker (GM) M. W. Hinshaw (CE)
Fenwal, Inc., Ashland, Mass.
Ferranti Elec., Inc., 30 Rockefeller Plaza, N. Y. C.
Ferris Instrument Co., Boonton, N. J.
Ferrocart Corp. of Amer., Hastings on Hudson, N. Y.
Finch Telecommunications, Inc., Passaic, N. J.
Fisher Research Laboratory, 1961 University Ave., Palo Alto, Calif. C. J. Soderquist (CE)
Follansbee Steel Corp., Pittsburgh, Pa.
Ford Radio & Mica Corp., 538 63rd St., Brooklyn, N. Y.
Formica Insulation Co., Cincinnati, O.
Franklin Mfg. Corp., 175 Varick St., N. Y. C. Albert W. Franklin (GM)
Freed Radio Corp., 200 Hudson St., N. Y. C. Murray Weinstein (CE) Arthur Freed (GM).
Freed Transformer Co., 72 Spring St., N. Y. C. E. M. Holder (GM) H. Freed (CE)

— G —

Galvin Mfg. Corp., 4545 W. Augusta Blvd., Chicago, Ill. D. H. Mitchell (CE) F. J. O'Brien (GM)
Garden City Laboratory, 2744 W. 37th Pl., Chicago, Ill.
Gardiner Metal Co., S. Campbell Ave., Chicago, Ill.
Gardner Elec. Mfg. Co., Specialty Div., Oakland, Calif. W. W. Wahlgren (GM)
Fred E. Garner Co., 43 E. Ohio St., Chicago, Ill.
Garod Radio Corp., 70 Washington St., Brooklyn, N. Y. Barnet S. Trott (CE)
Gates Radio Co., 220 Hampshire, Quincy, Ill. Parker Gates (CE)
Gavitt Mfg. Co., Inc., Brookfield, Mass. P. G. Ridley (SP)
Gear Specialties, Inc., 2650 W. Medill, Chicago, Ill.
General Aniline Works, 435 Hudson St., New York 14, N. Y. H. Roger Coleman (SP)
General Armature Corp., Lock Haven, Pa. J. F. Cullin (CE)
General Cable Corp., 420 Lexington Ave., N. Y. C.
General Ceramics & Steatite Corp., Keasbey, N. J.
General Communication Co., 681 Beacon St., Boston, Mass. Carl H. Whittier (CE)
General Control Co., 1200 Soldiers Field Blvd., Cambridge, Mass. E. B. Farmer (CE)
General Electric Co., Engineering Receiver Div., Electronics Dept., 1285 Boston Ave., Bridgeport, Conn. Wm. M. Angus (CE) I. J. Karr (GM)
General Electric Co., Lamp Dept., Hoboken, N. J.
General Elec. Co., Pittsfield, Mass.
General Electric Co., Schenectady, N. Y.
General Electronics, Inc., Paterson, N. J.
General Industries Co., Olive and Taylor Sts., Elyria, O. D. L. Boyd (CE)
General Inst. Corp., 829 Newark Ave., Elizabeth, N. J. Harold M. Detrick (CE)
General Insulated Wire Corp., 53 Park Pl., N. Y. C.
General Radio Co., 30 State St., Cambridge, Mass. Melville Eastham (CE) H. B. Richmond (GM)
General Scientific Corp., 4829 S. Kedzie Ave., Chicago, Ill.
General Television, 1240 N. Homan Ave., Chicago, Ill. James Ricko (CE)
General Transformer Co., 1250 W. Van Buren St., Chicago, Ill. C. E. Dellorn (CE)
General Winding Co., 420 W. 45th St., N. Y. C. William A. Barlow (CE)
Gentleman Prod. Div., Henney Motor Co., 1702 Cuming, Omaha, Nebr. A. E. Bennett (CE)
Gibbs & Co., Thos. B., Div. of Borg Corp., Delavan, Wis., M. E. Brown (CE)
Gibson Company Wm. D., 1800 Clybourn Ave., Chicago, Ill.
Gibson Elec. Co., 8350 Frankstown Ave., Pittsburgh, Pa.
Gilfillan Bros., Inc., 1815 Venice Blvd., Los Angeles, Calif. C. Frederick Wolcott (CE)
Girard-Hopkins, 1000 40th Ave., Oakland 1, Calif. Charles Lasswell (CE) J. C. Hopkins & A. R. Stack (GM)
Girdler Corp., Thermex Div., Louisville, Ky. Paul D. Zottu (CE)
Gits Molding Corp., 4600 Huron St., Chicago, Ill.
G-M Laboratories, Inc., 4300 N. Knox Ave., Chicago, Ill. A. J. McMaster (GM)
Globar Div., Carborundum Co., Niagara Falls, N. Y.
Goat Metal Stampings, Inc., 314 Dean St., Brooklyn, N. Y. E. F. Staver (GM)
Gothard Mfg. Co., Springfield, Ill.
Gould-Moody Co., 395 Broadway, N. Y. C.
Granite City Steel Co., Granite City, Ill.
Graybar Elect. Co., 420 Lexington Ave., N. Y. C. J. W. LaMarque (GM)
Gray Mfg. Co., Hartford, Conn.
Gray Radio Co., West Palm Beach, Fla. F. E. Gray (CE)
Green Elect. Co., Inc., 130 Cedar St., N. Y. C.
Grenby Mfg. Co., 97 Whiting St., Plainville, Conn. McMurdo Silver (CE)
Greyhound Equip. Co, 1720 Church Ave., Brooklyn, N. Y.
Guardian Elec. Mfg. Co., 1627 W. Walnut, Chicago, Ill.
Guided Radio Corp., 161 6th Ave., N. Y. C.
Guthman & Co., Edwin I., 15 S. Throop St., Chicago, Ill.

— H —

Hadley Co., R. M., 707 E. 61 St., Los Angeles
Halldorsen Co., 4500 Ravenswood Ave., Chicago, Ill.
Hallicrafters Co., 2611 Indiana Ave., Chicago, Ill. R. E. Samuelson (CE) W. J. Halligan (GM)
Halstead Traffic Communications Corp., 155 E. 44th St., N. Y. C. Benjamin C. Lord (CE) W. S. Halstead (GM)
Hamilton Radio Corp., 510 6th Ave., N. Y. C.
Hammarlund Mfg. Co., Inc., 460 W. 34 St., N. Y. C. J. Kelley Johnson (CE)
Harco Steel Co., 1180 E. Broad St., Elizabeth, N. J. Harold Cohen (CE)
Hardwick, Hindle, Inc., Newark, N. J.
Harper Co., H. M., 2609 Fletcher, Chicago, Ill.
Harrison Radio Corp., 12 W. Broadway, N. Y. C.
Harvey Radio Labs., Inc., 447 Concord Ave., Cambridge 38, Mass. Frank Lyman, Jr. (CE)
Harvey Wells Communications, Inc., Southbridge, Mass. C. A. Harvey (CE)
Haskelite Mfg. Corp., 208 W. Washington St., Chicago, Ill.
Hartman Corp. of America, 6417 Dale Ave., St. Louis, Mo. L. H. Matthey, Jr. (CE)
Harwood Co., 747 N. Highland Ave., Los Angeles, Calif.
Haydon Mfg. Co., Forestville, Conn. R. M. Pearce (CE) R. A. Conover (GM)
Hazard Ins. Wire Works, Wilkes-Barre, Pa.
Hazeltine Electronics Corp., 58-25 Little Neck Pkwy., Little Neck, N. Y. Daniel E. Harnett (CE)
H-B Electric Co., 6122 N. 21st St., Philadelphia 38, Pa. W. E. Girard (GM)
Heintz & Kaufman, Ltd., South San Francisco, Calif. Winfield G. Wagener (CE)
Herbach & Rademan Co., 522 Market St., Phil.
Herzog Miniature Lamp Works, 12-19 Jackson Ave., Long Island City, N. Y.
Hewlett Packard Co., 395 Page Mill Rd., Palo Alto, Calif. David Packard (CE), Brunton Bauer (CER)
Hexacon Elec. Co., Roselle Park, N. J.
Hickok Elec. Inst. Co., 10514 Dupont Ave., Cleveland, O. Walter A. Weiss (CEL)
Higgins Industries, Santa Monica, Calif.
Hilo Varnish Co., Brooklyn, N. Y.
Hilton Engineering Labs., Redwood City, Calif.
Hipower Crystal Co., 2035 W. Charleston, Chicago, Ill.
Hoffstatter's Sons, Inc., 42-53 24th St., Long Island City, N. Y. Wallace Schler (GM)
Hollywood Electronics Co., 800 Sunset Blvd., Los Angeles
Holyoke Wire & Cable Corp., Holyoke, Mass.
Hopp Press, Inc., 460 W. 34th St., N. Y. C.
Howard Radio Co., 1731 Belmont Ave., Chicago
Hoyt Elec. Instrument Works, Boston, Mass.
H. R. S. Products, 5707 W. Lake St., Chicago, Ill. Dan Zmuda (CE)
Hubbard Spring Co., M. D., Pontiac, Mich.
Hudson American Corp., 25 W. 43rd St., N. Y. C. A. L. Rubenstein (CE) E. L. Wayman (GM)
Hudson Wire Co., Winsted, Conn.
Hunt & Sons, G. C., Carlisle, Pa.
Hunter-Hartman Corp., St. Louis, Mo.
Hunter Pressed Steel Co., Lansdale, Pa.
Hygrade Sylvania Corp., Salem, Mass.
Hytron Corp. & Hytronic Labs., Salem, Mass.

— I —

Ideal Commutator Dresser Co., Sycamore, Ill. Ivan D. Applegate (CE)
Illinois Condenser Co., 1160 N. Howe St., Chicago. Joseph J. Kurland (GM)
Ilsco Copper Tube & Prods., Inc., Station M, Cincinnati, O.
Imperial Molded Prods. Co., 2921 W. Harrison St., Chicago, Ill.
Indiana Steel Prod. Co., 6 N. Michigan Ave., Chicago, Ill.
Induction Heating Corp., 389 Lafayette St., N. Y. C. W. C. Rudd (CE)
Industrial & Com. Electronics, Belmont, Calif. R. C. Shermund (GM)
Industrial Condenser Corp., 1725 W. North Ave., Chicago, Ill.
Industrial Filter & Pump Mfg. Co., W. 1621 W. Carroll Ave., Chicago, Ill. J. W. MacAllister (CE)
Industrial Instruments, Inc., 17 Pollock Ave., Jersey City, N. J. Nathan Schnoll (CE)
Industrial Molded Prods. Co., 2035 Charleston, Chicago, Ill.
Industrial Synthetics Corp., 60 Woolsey St., Irvington, N. J. Albert A. Kaufman (CE)
Industrial Timer Corp., 115 Edison Pl., Newark, N. J.
Instrument Resistors Co., Little Falls, N. J.
Instrument Specialties Co., Inc., 244 Bergen Blvd., Little Falls, N. J. F. S. Stickney (CE)
Insulation Manufacturers Corp., 565 W. Washington Blvd., Chicago 6, Ill.
Insuline Corp. of America, 36-02 35th Ave., Long Island City, N. Y. John R. Carpenter (CE)

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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.

DURABILITY

The relationship between pachyderms and JENSEN speakers is, of course, obscure. It will take another hundred thirty-five years or so to determine positively whether JENSEN speakers actually have the ruggedness and the longevity of an elephant, but we do know of many JENSEN speakers in use fifteen years and more that still are operating more than adequately. JENSEN engineers have never designed a speaker that didn't have durability as one of its major qualifications.

Jensen

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International Screw Co., Detroit, Mich.
International Tel. & Radio Mfg. Corp., East Newark, N. J.
Irvington Varnish & Insulating Co., Irvington, N. J.
Isolantite, Inc., Belleville, N. J.

— J —

Jackson Electrical Inst. Co., Dayton, O.
Janette Mfg. Co., 558 W. Monroe, Chicago, Ill.
Jefferson Elec. Co., Bellwood, Ill.
Jefferson-Travis Radio Mfg. Corp., 245 E. 23 St., N. Y. C. W. B. Wilkens (CE)
Jelliff Mfg. Corp., Southport, Conn.
Jensen Radio Mfg. Co., 6601 S. Laramie Ave., Chicago, Ill. Hugh S. Knowles (CE)
J-B-T Instruments, Inc., 441 Chapel St., New Haven, Conn. Donald E. Anderson (CE)
E. F. Johnson Co., Waseca, Minn. Lloyd W. Clander (CE) E. F. Johnson (GM)
Jones, Howard B., 2300 Wabansia, Chicago, Ill.

— K —

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Karadio Corp., 1400 Harmon Pl., Minneapolis, Minn.
Kato Engineering Co., Mankato, Minn.
Kemlite Labs., 1809 N. Ashland Ave., Chicago
Kellogg Switchb'd & Supply Co., 6650 Cicero, Chicago, Ill. Robert M. Kalb (CE)
Ken-Rad Tube & Lamp Corp., Owensboro, Ky. G. W. Bain (CE)
Kenyon Transformer Co., Inc., 840 Barry St., N. Y. C. Richard B. Shimer (CE)
Kester Solder Co., 4209 Wrightwood Ave., Chicago, Ill.
Keuffel & Esser, Hoboken, N. J.
Kirkland Co., H. R., Morristown, N. J. H. R. Kirkland (GM)
Knapp-Monarch, St. Louis, Mo.
Knights, James Co., Sandwich, Ill. Leon A. Faber (CE) L. E. Faber (GM)
Kold-Hold Mfg. Co., 446 N. Grand Ave., Lansing, Mich.
Kollsman Instrument Div., Elmhurst, Long Island City, N. Y.
Krueger & Hudepohl, Third and Vine, Cincinnati, O.
Kurtz Kasch, Inc., 1421 S. B'way Dayton, O. M. H. Kasch (CE)
Kux Machine Co., 3930 W. Harrison St., Chicago, Ill.

— L —

Lafayette Radio Corp., 901 W. Jackson Blvd., Chicago, Ill. D. Muir (CE), S. W. Berk (GM)
Lamson & Sessions Co., Cleveland, O.
Lapp Insulator Co., Leroy, N. Y.
Lavoie Laboratories, Morganville, N. J. A. M. Schmeling (CE)
Lear, Inc., 1480 Buchanan Ave., S. W., Grand Rapids, Mich. Michael T. Harges (CE)
Lectrohm, Inc., 5125 W. 25th St., Cicero, Ill. L. J. Lastovicka (CE) J. J. Cernif (GM)
Leeds & Northrup Co., Philadelphia, Pa.
Lehigh Structural Steel Co., 17 Battery Pl., N. Y. C. John F. Neary (TE)
Leland Elec. Co., Dayton, O. W. F. Lisman (GM)
Lenz Electrical Mfg. Co., 1751 N. Western Ave., Chicago, Ill.
Lepel Laboratories, 39 W. 60th St., N. Y. C. Henry Peterson (CE), S. L. Teitler (GM)
Lewis Electronics, Los Gatos, Calif., Mason Shaw (GM) G. L. Lewis (CE)
Lewyt Corp., 60 B'way, Bklyn, N. Y.
Lingo & Son, John E., Camden, N. J.
Link Radio Corp., 125 W. 17th St., N. Y. C. F. T. Budelman (CE), F. M. Link (GM)
L-R Mfg. Co., Torrington, Conn.
Littlefuse, Inc., 4753 Ravenswood Ave., Chicago, Ill.
Locke Insulator Co., Baltimore, Md.
Lord Mfg. Co., Erie, Pa.
Louthan Mfg. Co., East Liverpool, O. C. W. Gerster (CE) H. S. Russell (GM)

— M —

Maas & Waldstein Co., Newark, N. J.
Macallen Co., Boston, Mass.
Magnavox Co., Fort Wayne, Ind. R. H. Dreisbach (CE)
Magner Mfg. Co., Inc., 444 Madison Ave., New York 22, N. Y.
Magnetic Windings Co., 16 and Butler Sts., Easton, Pa. Alvah Rittenhouse (CE)
Majestic Radio & Television Corp., 2600 W. 50th St., Chicago, Ill. Fred Pacholke (CE)
P. R. Mallory & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind. Glenn W. Carpenter (CE), J. E. Cain (GM)
Mall Tool Co., 7708 S. Chicago Ave., Chicago, Ill.
Mangold Radio Parts & St'p'g Co., 6300 Shelbourne St., Phila. Fred Strobel (CE)
Marken Machine Co., Keene, N. H.
McClintock Co., O. B., Minneapolis, Minn.
McElroy Mfg. Corp., Brookline Ave., Boston
Measurements Corp., Boonton, N. J. Jerry B. Minter (CE), H. W. Houck (GM)
Meck Industries, John, Liberty at Penn., Plymouth, Ind. E. W. Applebaum (CE), J. S. Meck (GM)
Megard Corp., 381 W. 38 St., Los Angeles
Meissner Mfg. Co., Mt. Carmel, Ill. G. W. Rockey (GM), E. J. Stanmyre (CE)
Mercoid Corp., 4217 Belmont, Chicago, Ill.
Metals & Controls Corp., Attleboro, Mass.
Metaplast Corp., 205 W. 19th St., N. Y. C. Harold Weller (CEL)
Merit Coil & Transformer, 311 N. Desplaines St., Chicago, Ill. H. Jones (CE), C. C. Koch (GM)
Mica Insulator Co., 196 Varick St., N. Y. C.
Micamold Radio Corp., 1087 Flushing Ave., N. Y. C. Aniello DiGiacomo (CE)
Micarta Fabricators, Inc., 4619 Ravenswood Ave., Chicago, Ill.
Micro Switch Corp., Freeport, Ill.
Midwest Radio Corp., Cincinnati, O.
Millen Mfg. Co., Malden, Mass. James Millen (GM)
J. W. Miller Co., 5917 S. Main St., Los Angeles, Calif. Paul O'Connor (CE)
Minneapolis-Honeywell Regulator, Minneapolis, Minn.
Minn. Mining Co., 155 Sixth Ave., N. Y. C.
Mobile Refrigeration, Inc., 38-32 54th St., Woodside, L. I., N. Y.
Molded Insulation Co., 335 E. Price St., Philadelphia, Pa. Arno Zilliger (CE)
Monitor Piezo Prod. Co., Pasadena, Calif.
Monsanto Chemical Co., Springfield, Mass.
Donald P. Mossman, Inc., 6133 N. Northwest Highway, Chicago, Ill.
Muehlhausen Spring Corp., Logansport, Ind. J. R. Gustofson (CE)
Mueller Electric Co., 1583 E. 31st St., Cleveland, O. E. H. DeConingh (CE), Scott Mueller (GM)
Murdock Mfg. Co., Chelsea, Mass.
Muter Co., 1255 S. Michigan Ave., Chicago, Ill. K. E. Rollefson (CE)
Mycalex Corp. of Amer., Clifton, N. J. Wm. Gruen (GM), A. J. Monack (CE)

— N —

National Co., Inc., 61 Sherman St., Malden, Mass. Dana H. Bacon (CEE), Wm. J. Larkin (CEM), W. A. Ready (GM)
National Electronic Mfg. Co., 22-78 Steinway St., Long Island City, N. Y. John R. Carpenter (CE)
Nat'l Fabricated Prods., W. Belden Ave., Chicago, Ill.
National Screw & Mfg. Co., Cleveland, O.
National Union Radio Corp., 15 Wash. St., Newark, N. J. L. J. Woods (GM)
Ntl. Varnished Prod. Corp., Woodbridge, N. J.
National Vulcanized Fibre Co., Wilmington, Del. J. K. Johnston (GM)
New England Mica Co., Waltham, Mass.
New England Screw Co., Keene, N. H.
Newport Rolling Mill Co., Newport, Ky.
Newark Transformer Co., 17 Frelinghuysen Ave., Newark, N. J. O. A. Keefe (CE)
New Wrinkle, Inc., Dayton, O.
New York Transformer Co., 26 Waverly Pl., N. Y. C. Z. Burzyoki (CE)
Noblitt-Sparks Ind., Columbus, Ind. B. H. Irwin (CE)
Noma Elec. Corp., 55 W. 13th St., N. Y. C. J. E. Funk (CE)
No. American Philips Co., 145 Palisade St., Dobbs Ferry, N. Y. H. G. Boyle (CE), E. J. Kelly (GM)
Northern Engineering Labs., 50 Church St., N. Y. C. John Zaleski (CE)
Northern Industrial Chemical Co., Boston, Mass.
Northam Warren Corp., Stamford, Conn.
Norwalk Transformer Corp., South Norwalk, Conn.
Nothelfer Winding Labs., Trenton, N. J.

— O —

Oak Mfg. Co., 1260 Clybourn Ave., Chicago, E. J. Mastney (CE)
Ohio Carbon Co., Cleveland, O.
Ohio Electric Co., 74 Trinity Pl., N. Y. C.
The Ohio Nut & Bolt Co., 600 Front St., Berea, O. Robert A. Reich, Jr. (CE)
Ohmite Mfg. Co., 4835 W. Flournoy St., Chicago, Ill. Herbert Levy (CE)
D. W. Onan & Sons, 43 Royalston Ave., Minneapolis, Minn. J. C. Holby (CE)
Operadio Mfg. Co., St. Charles, Ill. J. F. McCraigh (CE)
Owens-Corning Fiberglas Corp., Toledo, O.
Oxford-Tartak Radio Corp., 3911 S. Michigan Ave., Chicago. George Rusher (CE)

— P —

Pacific Metals Co., Ltd., San Francisco, Calif.
Packard Bell Co., 1115 S. Hope St., Los Angeles 15, Calif. A. R. Ellsworth (CE)
Painut Co., Inc., Irvington, N. J.
Panoramic Radio Corp., 245 W. 55 St. N. Y. C. 19
Parisian Novelty Co., 3510 S. Western Ave., Chicago, Ill. Louis J. Komorous (CE)
Parker Co., Charles, Meriden, Conn.
Parker-Kalon Co., 198 Varick St., N. Y. C.
Par-Metal Prod. Corp., Long Island City, N. Y.
Patton MacGuyer Co., Providence, R. I.
Pawtucket Screw Co., Pawtucket, R. I.
Peck Spring Co., Plainville, Conn.
Peerless Electrical Prod. Co., 6920 McKinley Ave., Los Angeles, Calif. John Jauch (CE)
Perkins Machine & Gear Co., Springfield, Mass.
Permoflux Corp., 4916 W. Grand Ave. Chicago, Ill. W. E. Gilman (CE)
Peterson Radio, Council Bluffs, Iowa
Pheoll Mfg. Co., Chicago, Ill.
Philharmonic Radio Corp., 528 E. 72 St., N. Y. C. 21. Victor Brociner (CE), A. R. Fisher (GM)
Philmore Mfg. Co., Inc., 113 University Pl., N. Y. C. Reginald Burke (CE)
Phosphor Bronze Smelting Co., Philadelphia, Pa.
Photobell Corp., 116 Nassau St., N. Y. C. A. Edelman (CE)
Pierce-Roberts Co., Trenton, N. J.
Pilot Radio Corp., 37-06 36 St., L. I. City 1, N. Y.
Pioneer Gen-E-Motor, 5841 W. Dickens Ave., Chicago, Ill.
Pitman Pub. Corp., 2 W. 45th St., N. Y. C.
Plax Corp., Hartford, Conn.

Polymet Condenser Co., 701 E. 135th St., N. Y. C. Sidney Fishberg (CE)
Potter & Brumfield Co., Princeton, Ind.
Potter Co., 1950 Sheridan Rd., N. Chicago, Ill.
Powers Electronic & Comm. Co., New St., Glen Cove, N. Y. A. J. Sanial (GM)
Precision Fabricators, Inc., Rochester, N. Y.
Premier Crystal Labs, 63 Park Row, N. Y. C.
Precision Piezo Serv., 427 Mayflower St., Baton Rouge, La. C. E. Pearce (CE)
Precision Tube Co., 3824 Terrace St., Phila. 28. Eugene Turney (CE)
Premax Products Division, Chisholm-Ryder Co., Inc., Niagara Falls, N. Y. G. O. Benson (CE)
Premier Metal Etching Co., 21-03 44th Ave., Long Island City, N. Y.
Press Wireless, Inc., Hicksville, N. Y. P. D. Zurian (CE)
Presto Elec. Co., New York Ave., Union City, N. J.
Presto Recording Corp., 242 W. 55th St., N. Y. C.
Printloid Inc., 93 Mercer St., N. Y. C. Jerry Margolish (CE)
Pyroferric Co., 175 Varick St., N. Y. C.

— Q —

Quaker City Gear Works, Inc., N. Front St., Philadelphia, Pa.
Quam-Nichols Co., 33rd Pl., Chicago, 16
Quartz Laboratories, 1512 Oak St., Kansas City, Kan.

— R —

Racon Electric Co., Inc., 52 E. 19th St., N. Y. C. A. I. Abrahams (CE)
Radell Corp., Guilford Ave., Indianapolis, Ind.
Radex Corp., 1322 Elston Ave., Chicago. John Snow (CE) A. C. Johnson (GM)
Radiart Corp., W. 62nd St., Cleveland, O. Ralph Blauvelt (CE)
Radio City Products Co., 127 W. 26th St., N. Y. C. Morris Lieblich (CE), Milton Reiner (GM)
Radio Condenser Co., Camden, N. J.
Radio Corp. of Amer., RCA Victor Div., Camden 2, N. J. Dr. C. B. Jolliffe (CE)
Radio Craftsman, 1340 S. Mich. Ave., Chicago
Radio Engineering Labs., Inc., Long Island City, N. Y. Frank A. Gunther (CE) Charles Srebroff (GM)
Radio Frequency Labs., Boonton, N. J.
Radio Mfg. Engineers, Inc., 306 First Ave., Peoria, Ill. R. M. Planck (CE)
Radiomarine Corp. of America, 75 Varick St., N. Y. C. I. F. Byrnes (CE)
Radio Receptor Co., Inc., 251 W. 19th St., N. Y. C. Everett D. Gibbs (CE), Hugo Cohn (GM)
Radio Speakers, Inc., 221 E. Cullerton, Chicago, Ill.
Radio Transceiver Labs., 86-27 115 St., Richmond Hill, N. Y.
Rauland Corp., 4245 N. Knox Ave., Chicago, Ill. J. J. O'Callaghan (CE)
Raymond Mfg. Co., Corry, Pa.
Raytheon Mfg. Co., Waltham, Mass. P. L. Spencer (GM), H. T. Pekin (CE)
RCA Victor Division, Radio Corp. of America, Camden, N. J. Dr. C. E. Jolliffe (CE)
Readrite Meter Works, Bluffton, O.
Rea Magnet Wire Co., E. Pontiac St., Extd., Ft. Wayne, Ind. Edward I. Snyder (CE)
Rec Mfg. Co., Holliston, Mass.
Redmond Co., A. G. Owosso, Mich. P. H. Maurer (CE)
Reeves Sound Labs., 62 W. 47th St., N. Y. C. Hazard E. Reeves (CE)
Rehtron Corp., 2159 Magnolia Ave., Chicago, Ll.
Reliance Die & St'p'ng Co., 1260 Clybourn Ave., Chicago, Ill.
Reliance Instr. Co., 1135 W. Van Buren St., Chicago, Ill.
Remler Co., Ltd., 2101 Bryant St., San Francisco 10, Calif. H. A. Greene, Jr. (CE)
Republic Steel Corp., Cleveland, O.
Revere Copper & Brass, 230 Park Ave., N. Y. C.
Richardson Allen Corp., 15 W. 20th St., N. Y. C. F. F. Sylvester (CE)
Richardson Company, Melrose Park, Ill.
John F. Rider Laboratories, 404 Fourth Ave., N. Y. C. John M. Borst (CE)
Rockbestos Products Corp., New Haven, Conn. Harold S. Moore (CE)
Roebling's Sons Co., John, Trenton, N. J.
Rogan Bros., 2001 S. Michigan Ave., Chicago, Ill.
Rohm & Haas Co., Washington Sq., Philadelphia, Pa.
The Rola Company, Inc., 2530 Superior Ave., Cleveland, O. J. Q. Tiedje (CE)
Roller-Smith Co., 1766 W. Market St., Bethlehem, Pa. R. M. Smith (CE)
Ronald Press Co., 15 E. 26th St., N. Y. C.
Rosen Co., Raymond, 32nd and Walnut Sts., Philadelphia, Pa. D. N. Lapp (CE), L. P. Clark (GM)
Rothard Mfg. Co., N. 9th Ave., Springfield, Ill.
Rowe Industries, Inc., Toledo, O.
Royal Engineering Co., Whippany Post Office, East Hanover, N. J. C. Kenneth Rose (CE)
The Ruby Chemical Co., 68-70 McDowell St., Columbus, O. G. C. Baker (CE)
Runzel Cord & Wire Co., 4723 Montrose Ave., Chicago, Ill.
Russel, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Russell Co., Chicago, Ill.
Ryerson & Son, Inc., Jos. T., Chicago, Ill.

— S —

Sanborn Co., 39 Osborne St., Cambridge, Mass. Arthur Miller (CE), J. L. Jenks, Jr. (GM)
Sangamon Elec. Co., Springfield, Ill.
Schott Co., W. L., 9306 Santa Monica Blvd., Beverly Hills, Calif.
Scientific Radio Products Co., 738 West Broadway, Council Bluffs, Ia. E. M. Shideler (CE)
Scientific Radio Service, 4301 Sheridan, University Park, Md. H. D. Eisenhauer (CE)
Scott Radio Labs, Inc., 4450 Ravenswood Ave., Chicago
Scovill Mfg. Co., 99 Mill St., Waterbury, Conn. N. A. Cornell (CE)
Security Steel Equipment Corp., Avenel, N. J. Oscar A. Wilkerson, Jr. (RE)
Seeburg Corp., J. P., 1510 Dayton St., Chicago, Ill. M. W. Kenney (CE)
Selectar Mfg. Co., 21-10 49th Ave., Long Island City, N. Y. W. A. Johnson (GM), J. T. Powers (CE)
Selenium Corp. of America, 1719 W. Pico Blvd., Los Angeles, Calif. Eric Lidow (CE), M. Burlin (GM)
Sensitive Research Instr. Co., 9 Elm Ave., Mt. Vernon, N. Y. Vincent P. Cronin (CE)
Sentinel Radio Corp., Evanston, Ill.
Setchell-Carlson, Inc., 2233 University Ave., St. Paul, Minn.
Seymour Mfg. Co., Seymour, Conn.
Shakeproof, Inc., 2501 N. Keeler Ave., Chicago 39, Ill. W. M. Hanneman (CE)
Shallcross Mfg. Co., 10 Jackson Ave., Collingdale, Pa. Frederic D. V. Mitchell (CE)
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Sherron Metallic Corp., Flushing Ave., Brooklyn, N. Y.
Shure Bros., 225 W. Huron, Chicago, Ill. S. N. Shure (GM), B. B. Bauer (CE)
Sickles Co., F. W., 165 Front St., Chicopee, Mass. Howard J. Benner (CE)
Sigma Instruments, Inc., 70 Celon St., Boston. H. N. L. Boyle, Jr. (GM), R. T. Fisher (CE)
Signal Electric Mfg. Co., Menominee, Mich.
Signal Indicator Corp., 140 Cedar St., N. Y. C.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge, Mass. E. W. Davis (CEE)
Simpson Elec. Co., 5218 W. Kinzie, Chicago, Ill.
Slater Electric & Mfg., Co., Brooklyn, N. Y.
Small Motors, Inc., 1308-22 N. Elston Ave., Chicago, Ill. J. A. Snow (CE)
Snyder Mfg. Co., 22nd & Ontario Sts., Phila.
Sola Elec. Co., 2525 Clybourn Ave., Chicago 14. M. A. Tennyson (CE)
Solar Mfg. Corp., 23 St. and Ave. A, Bayonne, N. J. James I. Cornell (CE)
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— T —

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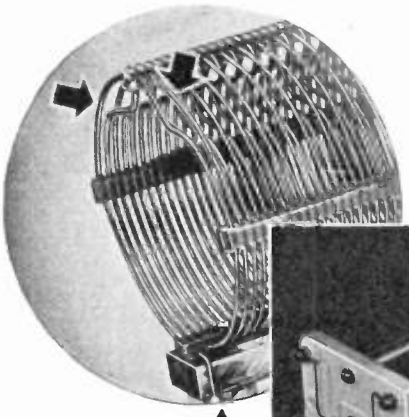

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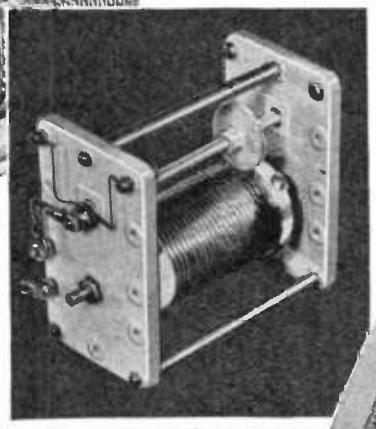

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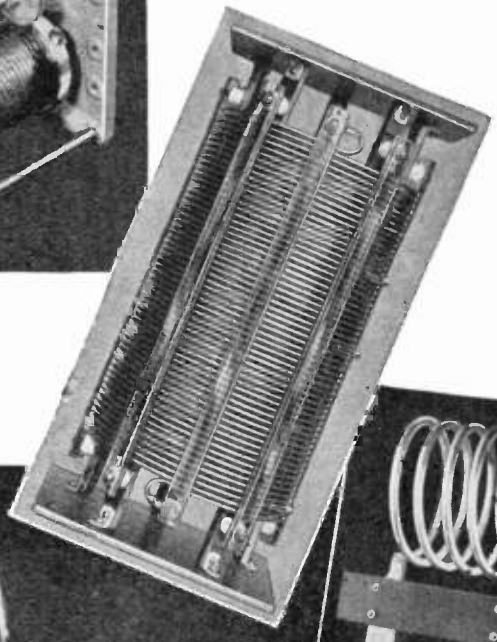

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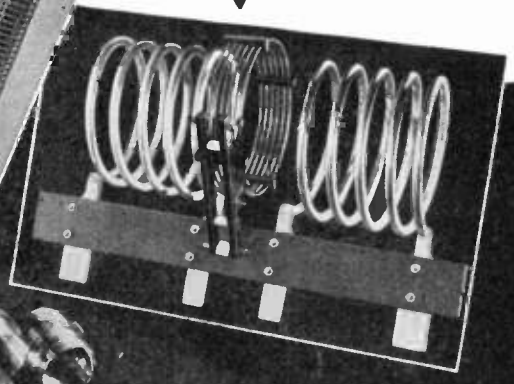

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Varflex Corp., 305 N. Jay St., Rome, N. Y. G. L. Wolfe (SP)
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Wheelco Instruments Co., 847 Harrison St., Chicago, Ill. Theodore A. Cohen (CE), P. A. Blandford (GM)
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Whitehead Metal Prods. Co., 303 W. 10th St., N. Y. C.
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Wick Organ Co., Highland, Ill.
Williams & Company, Inc., Pittsburgh, Pa.
Willor Mfg. Corp., 794 E. 140th St., New York 54, N. Y.
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Wilson Co., H. A., 105 Chestnut, Newark, N. J.
Wincharger Corp., East 7th and Division, Sioux City, Ia. V. C. Miron (CE), M. M. Lasensky (GM)
Winslow Co., Inc., Liberty St., Newark, N. J.
Wirt Co., 5221 Greene St., Phila. 44. P. H. Stuckey (GM)
Worner Prod. Corp., 1019 W. Lake St., Chicago, Ill.

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Zenith Radio Corp., 6001 Dickens Ave., Chicago, Ill. G. E. Gustafson (CE)
Zierick Mfg. Co., 385 Girard Ave., Bronx, N. Y.
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Abrahams, A. I. (CE), Racon Electric Co., Inc.
Aitchison, Robt. J. (GM), Fansteel Metallurgical Corp.
Alden, Milton (GM), Alden Prods. Co.
Allen, W. Russell, III (CE), The Radiart Corp.
Amy, Ernest (CE), Amy, Aceves & King, Inc.
Anderson, Donald E. (CE), J-B-T Instruments, Inc.
Angus, Wm. M. (CE), Gen. Elec. Co., Engineering, Receiver Div., Electronics Dept., Bridgeport, Conn.
Applebaum, E. W. (CE), John Meck Industries
Applegate, Ivan D. (CE), Ideal Commutator Dresser Co.
Armstrong, I. (CEE), Dinion Coil Co.
Avery, R. S. (GM), Avery Adhesives

— B —

Babcock, Stuart K. (CE), Electronic Specialty Co.
Bacon, Dana H. (CE), National Co., Inc.
Badeau, C. A. (CE), The Thomas & Betts Co.
Bailey, William M. (CE), Cornell-Dubilier Elect. Corp.
Bain, G. W. (CE), Ken Rad Tube & Lamp Co.
Baker, G. C. (CE), The Ruby Chemical Co.
Balcom, M. F. (GM), Sylvania Elec. Prods. Inc.
Baldwin, J. P. (GM), Corbin Screw Corp.
Barlow, William A. (CE), General Winding Co.
Bassett, Rex Earl, Jr. (GM), Rex Bassett, Inc.
Bauer, B. B. (CE), Shure Bros.
Bauer, Brunton (CER), Hewlett-Packard Co.
Bausch, Carl L. (CE), Bausch & Lomb Opt. Co.
Bean, L. G. (CE), The Bristol Co.
Benner, Howard J. (CE), F. W. Sickles Co.
Bennett, A. E. (CE), Gentleman Prods. Div.
Benson, G. O. (CE), Premax Products Div., Chisholm-Ryder Co., Inc.
Bergman, S. D. (LE), Burndy Engineering Co., Inc.
Berk, S. W. (GM), Lafayette Radio Corp.
Bevington, K. A. (CE), American Molded Products Co.
Bjorndal, Magnus (CE), Tech. Laboratories
Blackburn, Richard K. (CE), Crystal Research Labs.
Blandford, Paul A. (GM), Wheelco Inst. Co.
Blauvelt, Ralph (CE), Radiart Corp.
Billey, F. D. (GM), Billey Elec. Co.
Blumenfeld, Arthur (CE), University Labs.
Bolesky, John D. (CE), Spencer Thermostat
Borst, John M. (CE), John F. Rider Laboratories
Bovee, Ben A. (CE), The Carborundum Co., Globar Div.
Boyd, D. L. (CE), The General Industries Co.
Boyle, H. G. (CE), No. American Philips Co.
Boyle, H. N. L. (GM), Sigma Instrument, Inc.
Bozak, R. T. (CER), Dinion Coil Co.
Brainin, C. S. (GM), C. S. Brainin Co.
Brociner, Victor (CE), Philharmonic Radio Corp.
Brown, Harold J. (RE), Electronic Laboratories, Inc.
Brown, M. E. (CE), Borg-Gibbs Lab., The Geo. W. Borg Corp.
Browning, Glenn H. (CE), Browning Labs., Inc.
Budelman, F. T. (CE), Link Radio Corp.
Burke, Reginald (CE), Philmore Mfg. Co., Inc.
Burlin, M. (GM), Selenium Corp. of America
Burnside, C. J. (GM), Westinghouse Elec. & Mfg. Co. Radio Div.
Burroughs, Louis R. (CE), Electro-Voice Mfg. Co., Inc.
Burzycki, Z. (CE), New York Transformer Co.
Byrnes, I. F. (CE), Radiomarine Corp. of America

— C —

Caln, J. E. (GM), P. R. Mallory & Co., Inc.
Carlson, V. E. (CEX), Aircraft-Marine Products, Inc.
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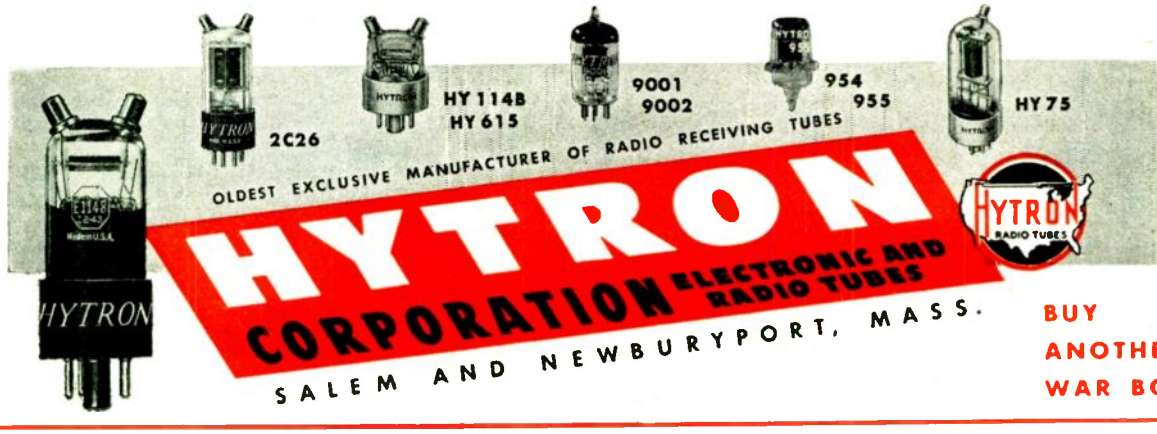
Hytron, especially, owes much to the radio amateur. When he entered the Services and war plants, he took with him a knowledge of Hytron tubes—particularly v-h-f types—and an admiration for them. Through his enthusiasm, these tubes became vital parts of war equipment. When the time comes to speak out for the return of his precious frequencies, Hytron will not forget him.



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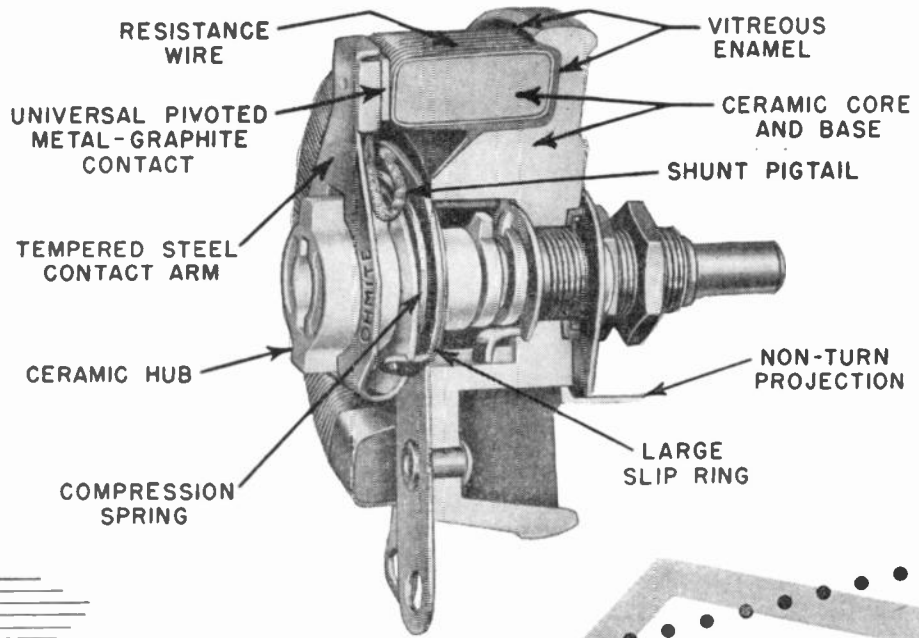

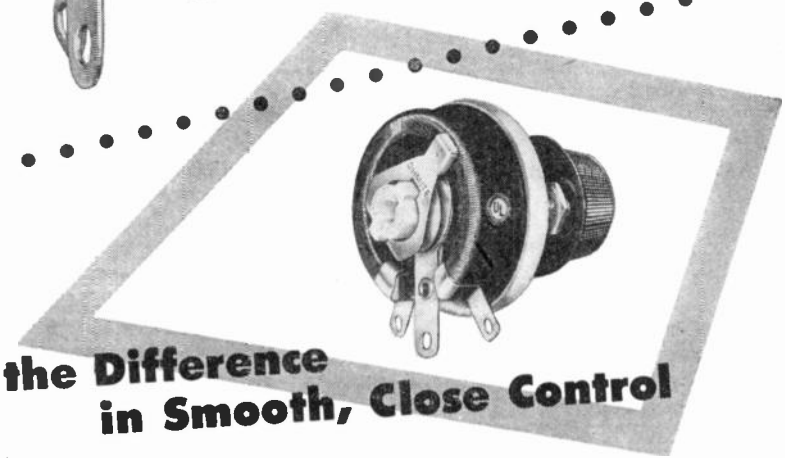

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Collins, J. L. (EE), Aerovox Corp.
Comstock, J. A. (CE), Acme Electric & Mfg. Co. Clyde Plant
Conover, R. A. (GM), Haydon Mfg. Co.
Conrad, H. S. (GM), Stackpole Carbon Co.
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Cooper, B. W. (GM), Delco Radio Div.
Cornell, James L. (CE), Solar Mfg. Corp.
Cornell, N. A. (CE), Scovill Mfg. Co.
Cosgrove, R. C. (GM), The Crosley Corp.
Cotter, Wm. F. (CER), Stromberg-Carlson Co.
Cox, C. Russell (GM), Victor J. Andrew Co.
Craft, L. Morgan (CE), Collins Radio Co.
Cranston, W. E. Jr. (GM), Thermador Elec. Mfg. Co.
Crawford, R. M. (GM), Durez plastics Chemicals, Inc.
Cronin, Vincent P. (CE), Sensitive Research Instr. Co.
Cullin, J. F. (CE), General Armature Corp.
Cummings, B. Ray (CE), Farnsworth Television & Radio Corp.
Curtiss, W. R. (CE), Conn. Tel. & Elec. Div., Great American Ind.

— D —

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Dante, J. J. (CE), Dante Elec. Mfg. Co.
Daugherty, R. M. (CE), The Detrola Corp.
Davis, F. M. (RD), Collins Radio Co.
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DeHorn, Conrad E. (GE) Gen. Transformer Corp.
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Dow, Dr. W. H. (GM), The Dow Chemical Co.
Drebsbach, R. H. (CE), The Magnavox Co.

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Eastham, Melville (CE), General Radio Co.
Eckstein, E. A. (CE), Eckstein Radio & Television Co., Inc.
Edelman, A. (CE), Photobell Corp.
Eibl, L. A. (CE) Crystal Prods. Co.
Eisenhauer, H. D. (CE), Scientific Radio Service
Ellsworth, A. R. (CE), Packard Bell Co.
Engelson, David H. (GM), Federal Mfg. & Eng. Corp.

— F —

Faber, Leon A. (CE), The James Knights Co.
Falck, F. W. (CE), Advance Elec. & Relay Co.
Farmer, E. B. (CE), Gen. Control Co.
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Fidler, R. H. (DE), Tungsol Lamp Works, Inc.
Fishberg, Sidney (CE), Polymet Mfg. Co.
Fisher, Avery R. (GM), Philharmonic Radio Corp.
Fisher, R. T. (CE), Sigma Inst. Corp.
Foute, Ken (CE), Drake Mfg. Co.
Franklin, A. W. (GM), A. W. Franklin Mfg. Co.
Franklin, Wm. S. (CE), John E. Fast & Co.
Freed, Arthur (GM), Freed Radio Corp.
Freed, L. (CE), Freed Trans. Co.
French, Sherwood P. (CT), Kaar Engineering Co.
Frische, Dr. Carl A. (CER), Sperry Gyroscope Co., Inc., Garden City
Frye, Raul H. (CE), Electronic Laboratories, Inc.
Funk, J. E. (CE), Noma Elec. Corp.

— G —

Gabel, R. H. (CE), Superior Tube Co.
Gardner, B. G. (VE), Aerovox Corp.
Garlick, Walter, Jr. (TD), American Transformer Co.
Gates, Howard A. (DE), Warwick Mfg. Corp.
Gates, Parker (CE), Gates Radio Co.
Gerster, C. W. (CE), Louthan Mfg. Co.
Gibbs, Everett D. (CE), Radio Receptor Co., Inc.
Gilman, W. E. (CE), Permoflux Corp.
Girard, W. E. (CE), H-B Electric Co.
Glaser, Mark (CE), DeWald Radio Corp.
Goldberg, Samuel (GM), Electronic Transformer
Goldberg, Simon (CRE), Super Electric Products Corp.
Goode, J. E. (CE), Telegraph Apparatus Co.
Goodwin, W. N., Jr., (CER), Weston Elec. Instr. Corp.
Gratz, Frank W. (CE), Treitel-Gratz Co., Inc.
Gray, Dudley (CE), Doolittle Radio Inc.
Gray, F. E. (CE), Gray Radio Co.
Graybill, K. W. (CE), Automatic Electric Co.
Greene, H. A., Jr. (CE), Remler Co., Ltd.
Gruen, Wm. (GM), Mycalex Corp. of America
Gunther, Frank A. (CE), Radio Engineering Labs., Inc.
Gustafson, G. E. (CE), Zenith Radio Corp.
Gustofson, J. R. (CE), Muehlhausen Spring Corp.

— H —

Halligan, W. J. (GM), The Hallicrafters Co.
Halstead, W. S. (CE), Halstead Corp.
Hamond, George I. (CE), Eagle Electric Mfg. Co.
Hanneman, W. M. (CE), Shakeproof, Inc.
Harges, Michael T. (CE), Lear Inc.
Harnett, Daniel E. (CE), Hazeltine Electronics Corp.
Harnson, R. N. (CER), Westinghouse Elec. & Mfg. Co., Baltimore, Md.
Harris, J. F. (SE), American Transformer Co.
Harvey, Clifford A. (CE), Harvey Wells Communications, Inc.
Haynes, N. M. (CE), Amplifier Co. of America
Helwig, Norman C. (CR), Kaar Engineering Co.
Heppner, E. A. (CE), Consolidated Radio Prod. Co.
Heyman, S. (ME), Aerovox Corp.
Hinshaw, M. W. (CE), Felker Mfg. Co.
Holby, J. C. (CE), D. W. Onan & Sons
Holder, E. M. (GM), Freed Transformer Co.
Hood, Stanley R. (CE), W. M. Chace Co.
Hopkins, James C. (GM), Girard-Hopkins
Houck, H. W. (GM), Measurements Corp.
Howes, G. T. (CE), Eltel-McCullough, Inc.
Hutchings, J. H. (CE), Continental Elec. Co.

— I —

Irwin, B. H. (CE), Noblitt-Sparks, Inc.
Israel, Dorman D. (CE), Emerson Radio & Phonograph Corp.

— J —

Jauch, John (CE), Peerless Electrica Prod. Co.
Jenks, James L. (GM), Sanborn Co.
Johnson, A. C. (GM), Radex Corp.
Johnson, E. F. (GM), E. F. Johnson Co.
Johnson, J. Kelly (CE), Hammerlund Mfg. Co., Inc.
Johnson, J. O. (CEP), Aircraft-Marine Products, Inc.
Johnson, Wm. A. (GM), Selectar Mfg. Corp.
Johnston, J. K. (GM), National Vulc. Fibre Co.
Jolliffe, Dr. C. B. (CE), RCA Victor Division, Radio Corp. of America, Camden, N. J.
Jones, Elmer T. (CT), Rex Bassett, Inc.
Jones, George M. (GM), Ace Mfg. Co.
Jones, H. (CE), Merit Coil & Transformer
Jones, Howard C. (CE), Delco Appliance Div.

— K —

Kahn, Louis (CER), Aerovox Corp.
Kahn, M. B. (GM), Transmitter Equip. Mfg. Corp. Inc.
Kalb, Robert M. (CE), Kellogg Switchboard & Supply Co.
Kalstein, A. G. (PE), Aerovox Corp.
M. Kaplowitz (CE), Federal Mfg. & Eng. Corp.
Karr, L. J. (GM), G. E. Electronics Dept. Receiver Div.
Kasch, Martin H. (CE), Kurz-Kasch, Inc.
Katzman, J. (CE), Dumont Elec. Co.
Kaufman, Albert A. (CE), Industrial Synthetics Corp.
Kayner, Harry J. (CED), Doolittle Radio Inc.
Keefe, O. A. (CE), Newark Transformer Co.
Kelth, W. S. (EC), Hammarlund Mfg. Co., Inc.
Kelly, E. J. (GM), North American Phillips Co., Inc.
Kenney, M. W. (CE), J. P. Seeburg Corp.
Kent, Earle L. (CER), C. G. Conn, Ltd.
Kimball, C. N. (CE), Aircraft Accessories Corp.
Kimball, Raymond (GM), Communications Equip. Corp.
Kirkland, H. R. (GM), H. R. Kirkland Co.
Knapp, Chas. (CR), Rex Bassett, Inc.
Knowles, Hugh S. (CE), Jensen Radio Mfg. Co.
Koch, Chas. C. (GM), Merit Coil & Transformer Corp.
Komorous, Louis J. (CE), Parisian Novelty Co.
Kopinski, Louis (GM), John E. Fast & Co.
Krefft, H. H. (CE), Std. Transformer Corp.
Kunz, Warren (CE), Alden Products Co.
Kurland, Joseph J. (CE), Illinois Condenser Co.

— L —

Lahn, Robert (CE), Camburn Products Co.
LaMarque, J. W. (GM), Graybar Elec. Co., Inc.
Lapp, D. N. (CE), Raymond Rosen Co.
Larkin, Wm. J. (CEM), National Co., Inc.
Lasensky, M. M. (GM), Wincharger Corp.
Lasswell, Charles (CE), Girard-Hopkins
Lastovicka, L. J. (CE), Lectrohm, Inc.
Lawler, John (CE), Auburn Button Works
Lee, Marvin (CE), Burndy Engineering Co., Inc.
Levenberg, M. H. (CE), Condenser Products Co.
Levine, J. M. (GM), Federal Screw Prods. Co.

What We Mean by LEADERSHIP

No Other Radio Publication Has Shown Such Results

JULY, 1943 HERE is an example of what we mean when we refer to the position of leadership achieved by FM and TELEVISION among "the men who set the pace the industry follows":

In our July, 1943 issue, we published the first article to appear in any radio paper on the application of Frequency Modulation to railway communications. At that time, railroad officials commented that the information presented was interesting but not significant.

SEPTEMBER, 1943 ON September 6th, just before our second article on FM railway communications appeared, the Pennsylvania's Congressional Limited was wrecked, killing nearly 100 persons.

Subsequent testimony showed that the equipment described in our second article could have averted that wreck. Still railroad officials discounted the use of radio as a safety measure.

JANUARY, 1944 On December 16th, 79 soldiers and civilians were killed in another wreck. At that time, two more articles on railroad FM were ready for our January issue, one by our Editor, and one by William Halstead. Immediately after our January issue appeared, both authors were called to Washington to testify before the Kilgore Senate Committee, investigating railway radio.

As a result of their testimony in support of the articles in this Magazine, official opposition to the use of radio as a public safety measure was overcome.

APRIL, 1944 * SO great, in fact, was the influence of these articles, that by April of this year, 22 railroads had applied for construction permits to make initial radio installations, and 6 radio manufacturers had launched railway radio development projects.

The FCC will shortly announce a hearing on this subject, so that radio communication can be used by the railroads without delay. C. J. Burnside of Westinghouse recently predicted that "this will be one of the greatest post-war radio developments."

* During all this period not one article on this subject was published by any other radio or electronics magazine.

This is just one example of the influence exerted by FM and TELEVISION, because it commands the attention and respect of:

"the men who set the pace the industry follows"

Levy, Herbert (CE), Ohmite Mfg. Co.
Levy, M. L. (SP), Emerson Radio & Phonograph Corp.
Lewis, Garrett (CE), Lewis Enterprises
Lidow, Eric (CE), Selenium Corp. of America
Lieblich, Morris (CE), Radio City Products Co.
Lilyblad, Robert Harry (CE), Camfield Mfg. Co.
Lindberg, C. A. (CE), Air Way Elec. Appl. Corp.
Linell, C. S. (CE), Carron Mfg. Co.
Lingel, Fred J. (CE), The Triplett Electrical Instrument Co.
Link, Fred W. (GM), Link Radio Corp.
Lisman, W. F. (GM), Leland Elec. Co.
Lorant, Lionel (CAF), Super Electric Products Corp.
Lord, Benjamin C. (CE), Halstead Traffic Communications Corp.
Loughnane, M. H. (RA), Tech. Laboratories
Lowit, Rudolf (CE), Callite Tungsten Corp.
Ludwig, Sidney (CE), Ward Prods.
Lyman, Frank, Jr. (CE), Harvey Radio Labs., Inc.

— M —

MacAllister, J. W., Jr. (CE), Industrial Filter Co.
MacDougall, Donald (CE), Valpey Crystal Corp.
MacGregor, D. (GM), Webster Prods.
Mallard, M. T. (CE), Cornish Wire Co., Inc.
Malpass, Donald (CE), Technical Appliance Corp.
Manson, Dr. Ray H. (GM), Stromberg-Carlson Co.
Margolish, Jerry (CE), Printloid, Inc.
Marsten, Jesse (CE), International Resistance Co.
Mastney, E. J. (CE), Oak Mfg. Co.
Matthey, L. H., Jr. (CE), Hartman Corp. of America
Mattson, Ebert (CE), Communications Equip. Corp.
Maurer, Paul H. (CE), A. G. Redmond Co.
Mayer, Rollins H. (CE), The Turner Co.
Maxon, John (RE), The Triplett Electrical Instrument Co.
Mazzola, J. R. (CE), Automatic Winding Co., Inc.
McCune, M. (CE), Teleradio Corp.
McCraigh, J. F. (CE), Operadio Mfg. Co.
McIlvaine, H. A. (GM), Continental Electric Co.
McMains, C. J. (GM), Aluminum Co. of America
McMaster, A. J. (GM), G. M. Labs, Inc.
Meck, John S. (GM), John Meck Industries
Meyer, Edwin M. (CE), Victor Insulators, Inc.
Miller, Arthur (CE), Sanborn Co.
Miller, E. A. (CE), Acme Electric & Mfg. Co., Cuba Pkt.
Minnich, Edw. L. (CQ), Rex Bassett, Inc.
Minnium, Byron B. (CE), Erie Resistor Corp.
Minter, Jerry B. (CE), Measurements Corp., Boonton, N. J.
Miron, V. C. (CE), Wincharger Corp.
Mitchell, D. H. (CE), Galvin Mfg. Corp.
Mitchell, Frederic D. V. (CE), Shallcross Mfg. Co.
Moon, R. B. (RE), Bendix Radio Div., Bendix Aviation Corp.
Moore, F. (CE), DeJur-Amsco Corp.
Moore, Harold S. (CE), Rockbestos Products Corp.
Mucher, George J. (CE), Clarostat Mfg. Co., Inc.
Mueller, Scott (GM), Mueller Elec. Co.
Muir, D. (CE), Lafayette Radio Corp.
Myers, Jos. R. (CE), Wm. T. Wallace Mfg. Co.

— N —

Nader, J. (DE), Elcor, Inc.
Neary, John F. (TE), Lehigh Structural Steel Co.
Nielse, Harold V. (CE), Sparks Withington Co., Radio Div.
Norton, L. D. (RD), Dictaphone Corp.

— O —

O'Brien, F. J. (GM), Galvin Mfg. Corp.
O'Brien, Richard J. (CE), Trav-Ler Karenola Radio & Telev. Corp.
O'Callaghan, J. J. (CE), The Rauland Corp.
O'Connor, Paul (CE), J. W. Miller Co.
Olander, Lloyd W. (CE), E. F. Johnson Co.
Oram, D. K. (RE), Hammarlund Mfg. Co., Inc.
Osterland, Edmund (CE), Ballantine Labs.

— P —

Pachalke, Fred (CE), Majestic Radio & Tel. Corp.
Packard, David (CE), Hewlett-Packard Co.
Pearce, C. E. (CE), Precision Piezo Serv.
Pearce, R. M. (CE), Haydon Mfg. Co.
Peek, Walter E. (RA), Electronic Laboratories, Inc.
Peckham, J. W. (RD), The Bristol Co.
Pekin, Harry T. (CE), Raytheon Mfg. Co.
Peters, Carl E. (CE), The Benwood Linze Co.
Peterson, Henry (CE), Lepel Laboratories
Planck, R. M. (CE), Radio Mfg. Engineers, Inc.
Ports, E. G. (CE), Federal Tel. & Radio Corp.
Powers, John T. (CE), Selectar Mfg. Corp.
Pray, G. E. (CE), Airplane & Marine Instruments, Inc.

— R —

Rall, C. A. (CE), Bodine Elec. Co.
Reader, F. E. (GM), Standard Piezo Co.
Ready, W. A. (GM), National Co.
Reeves, Hazard E. (CE), Reeves Sound Labs.
Reich, Robert A., Jr. (CE), The Ohio Nut & Bolt Co.
Reiner, Milton (GM) Radio City Prods., Inc.
Reynolds, W. H. (CE), American Instrument Co.
Rhoads, John A., Jr. (CER), Air Associates, Inc.
Richmond, H. B. (GM), Gen. Radio Co.
Ricko, James (CE), General Television Co.
Ridley, P. G. (SP), Gavitt Mfg. Co.
Rittenhouse, Alvah (CE), Magnetic Windings Co.
Robbin, Leon (CE), P. R. Mallory & Co. Inc.
Robinson, Wm. A. (GM), L. S. Brach Mfg. Co.
Rockey, G. V. (GM), Meissner Mfg. Co.
Roemisch, Joseph L. (DE), Communication Measurements Lab.
Rollefson, K. E. (CE), The Muter Co.
Rose, Kenneth (CE), Royal Engineering Co.
Rosenbaum, Jack (CE), Espey Mfg. Co.
Rubenstein, A. L. (CE), Hudson American Corp.
Rubinstein, H. W. (CE), Centralab Div. of Globe-Union, Inc.
Rudd, W. C. (CE), Induction Heating Corp.
Rusher, Geo. (CE), Oxford-Tartak Radio Corp.
Russell, H. S. (GM), The Louthan Mfg. Co.
Russell, Valoran (CE), Crescent Industries, Inc.
Ruth, Edward (CE), Erco Radio Labs., Inc.
Ryan, J. C. (GM), Colonial Radio Corp.

— S —

Sack, S. I., (CE), Transmitter Equipment Mfg. Co., Inc.
Samuelson, R. E. (CE), The Hallicrafters Co.
Sanial, A. J. (CE), Powers Electronic & Comm. Co.
Saunders, A. (GM), Zophar Mills, Inc.
Schellenger, N. C. (CE), Chicago Telephone Supply Co.
Schier, Wallace (GM), Hofstatter's Sons, Inc.
Schmeling, A. M. (CE), Lavoie Labs.
Schneider, E. V. (CE), Alliance Mfg. Co.
Schnell, Wm. J. (CE), Electrical Research Labs., Inc.
Schnoll, Nathan (CE), Industrial Instruments, Inc.
Schum, W. R. (CER), Electra Voice Corp.
Schutz, F. G. (CE), Ace Mfg. Corp.
Schwartz, S. (GM), Sun Radio & Electronics Co.
Schwarz, B. A. (CE), Delco Radio Div. General Motors C.
Schwennesen, Donald (CE), Chicago Transformer Corp.
Seble, A. D. (CE), Air King Products Co.
Shaw, Mason (GM), Lewis Electronics
Shermund, R. C. (GM), Industrial & Commercial Electronics
Shideler, E. M. (CE), Scientific Radio Products Co.
Shimer, Richard B. (CE), Kenyon Transformer Co., Inc.
Shure, S. N. (GM), Shure Bros.
Silver, McMurdo (CE), Grenby Mfg. Co.
Sims, W. H., Jr. (TE), Bendix Radio Div., Bendix Aviation Corp.
Small, John M. (CE), Detroit Power Screwdriver Co.
Smith, G. E. (GM), Communications Co.
Smith, J. P., Jr. (CE), The Daven Co.
Smith, R. M. (CE), Roller-Smith Co.
Smith, Wm. (GM), Southington Hdwe. Mfg. Co.
Snow, John (CE), Radex Corp.
Snow, J. A. (CE), Small Motors, Inc.
Snyder, Edward I. (CE), Rea Magnet Wire Co.
Soderquist, C. J. (CE), Fisher Research Lab.
Sorg, Harold E. (RD), Eitel-McCullough, Inc.
Sparling, E. C. (CE), Sperry Gyroscope Co., Inc., Brooklyn
Spencer, P. L. (GM), Raytheon Mfg. Co.
Srebroff, Chas. (GM), Radio Engineering Labs.
Stack, Alton R. (GM), Girard Hopkins
Stanmyre, E. J. (CE), Meissner Mfg. Co.
Staver, Edward F. (GM), Goat Metal Stampings, Inc.
Steiger, B. F. (CE), United Electronics Co.
Stengel, J. Frank (GM), Telephonics Corp.
Stevens, Frank J. (CE), American Lava Corp.
Stickney, F. S. (CE), Instrument Specialties Co., Inc.
Strobel, Fred (CE), Mangold Radio Parts & Stamping Co.
Stuckey, P. H. (GM), Wirt Co.
Sullivan, Mortimer (CE), Sullivan Varnish Co.
Sylvester, F. F. (CE), Richardson Allen Corp.

— T —

Tarr, Lester W. (GM), Ucinite Co.
Teitler, S. L. (GM), Lepel High Frequency Labs., Inc.
Tennyson, M. A. (CE), Sola Elec. Co.
Thompson, J. H. (CES), Aircraft-Marine Products, Inc.
Thunen, Geo. W. (CE), Electrical Prods. Corp.
Tieje, J. O. (CE), The Rola Co., Inc.
Tiffany, W. M. (CE), Cover Dual Signal Systems, Inc.
Tillotson, James Jr. (GM), Tillotson Furn. Corp.
Townsend, C. S. (CE), Bendix Radio, Div. of Bendix Aviation Corp.
Trickey, Philip H. (CE), Diehl Mfg. Co., Finderne Plant
Trott, Barnet S. (CE), Garod Radio Corp.
Turney, Eugene (CE), Precision Tube Co.
Tyler, A. W. (PH), Eastman Kodak Co.

— W —

Wagener, Winfield G. (CE), Heintz & Kaufman, Ltd.
Wahlgren, Wallace (GM), Gardner Elec. Mfg. Co.
Waldelich, J. R. (SP), The Bristol Co.
Wallace, Wm. T. (GM), Wm. T. Wallace Mfg. Co.
Wardell, John W. (CAF), Thermador Elec. Mfg. Co.
Ware, Paul (GM), Allen B. DuMont Labs.
Wayman, E. L. (GM), Hudson American Corp.
Webb, Wilbur L. (CE), Bendix Radio Div., Bendix Aviation Corp.
Webster, Fullerton D. (CE), J. H. Bunnell & Co.
Weiler, Harold (CEL), Metaplast Corp.
Weinstein, Murray (CE), Freed Radio Corp.
Weise, R. C. (CE), Barker & Williamson
Weiss, Walter A. (CEL), Hickok Elec. Inst. Co.
Whitaker, James (TE), Hammerlund Mfg. Co., Inc.
Whittier, Carl H. (CE), General Communication Co.
Widiger, Herbert (GM), Carbon Mfg. Co.
Wilkens, Wm. B. (CE), Jefferson-Travis Radio Mfg. Co.
Wilkerson, Oscar A., Jr. (RE), Security Steel Equip. Corp.
Willyard, Les (CE), Universal Microphone Co.
Wilso, Geo. H. (GM), Fada Radio & Elec. Co.
Wise, Roger M. (CE), Sylvania Electric Products, Inc.
Wolcott, C. Frederick (CE), Gilfillan Bros., Inc.
Wolcott, R. B. (CEM), Crystal Research Labs.
Wolfe, G. L. (SP), Varflex Corp.
Wolfskill, J. M. (CE), Billey Electric Co.
Woods, L. J. (GM), National Union Radio Corp.
Wright, A. K. (CE), Tungsol Lamp Works, Inc.

— Y —

Young, Frederic C. (CE), Stromberg-Carlson Co.

— Z —

Zaleski, John (CE), Northern Engineering Labs.
Zettu, Paul D. (CE), Girdler Corp., Thermex Div.
Zilliger, Arno (CE), Molded Insulation Co.
Zmuda, Dan (CE), H.R.S. Products
Zurian, P. D. (CE), Press Wireless, Inc.

(CONTINUED FROM PAGE 38)

ment of the coördinated standards shown on the opposite page by permission of the ASA.

This standard for the coördination of fundamental electrical graphical symbols has for its object the coördination and simplification of basic electrical symbols now in use in the American Standard Graphical Symbols for Power, Control and Measurement, Z32.3–1043, and the American Standard Symbols for Telephone, Telegraph and Radio Use, Z32.5–1942, and is to be applied in conjunction with these standards.

At the time of the issuance of Z32.3 and Z32.5, the long-standing conflicts in electrical graphical symbols between the fields of electrical communications, power, control, and measurement were not considered serious because the fields of application rarely overlapped. The war has accelerated the overlapping of these fields and the resulting confusion, notably in the aircraft industry and in industrial electronics, has become serious for the industries affected.

Consequently, after study of the problem, a representative group headed by the chairman of the Sectional Committee on Standardization of Graphical Symbols and Abbreviations for Use on Drawings, Z32, requested that steps be taken under the ASA War Procedure to coördinate the differences in symbols, and submitted a proposal to this end.

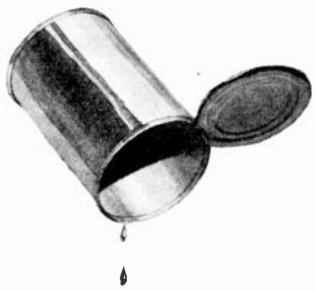
Upon authorization of the project, a conference was held in New York on January 22, 1944, to which representatives of technical societies, trade associations, the War and Navy Departments, the Aeronautical Board, the National Aircraft Standards Committee and of certain other industrial organizations concerned were invited. At this conference, a draft of a proposed standard was agreed upon and circulated for formal approval to the interested organizations. As the result of the circulation, certain objections and suggested changes were received. These were considered at a second conference in New York on March 10, 1944, to which were also invited the objectors and members of the subgroups on Communications, Power and Control Symbols of sectional committee Z32.

After consideration of all points concerned, the symbols shown on page 39 were unanimously recommended for use on electrical diagrams. It was the opinion of the conference that this American War Standard, Coördination of Electrical Graphical Symbols, offers a practical solution to a perplexing and long-standing problem which has caused much confusion within both industry and the Armed Forces in the design, manufacture, and maintenance of electrical equipment.

EDITOR'S NOTE. — *At the time of going*

(CONTINUED ON PAGE 55)

Use it up . . .



That's the thing to do in wartime. Eat every bite of food, save every scrap of soap, make a patriotic habit of stretching all the supplies in the house so they go further, last longer.

Wear it out . . .

This year old coats, old shoes, are a badge of honor. They show you're sensible enough to know that one way to help win the war, to keep prices down, is to wear your old things out!

Make it do . . .

Before you spend a penny in wartime, ask yourself, "Do I really need this? Or do I have something now that will do?" As you patch and darn and turn, you're keeping prices down.

or do without!

When you put your money in War Bonds, savings, taxes, insurance—you're putting your money to work fighting the war and building a sound, stable nation for the peace to come.

It's your money you're saving when you help keep prices down. For it's buying too much when there's too little to buy that sends prices up. And when prices go up—and keep going up—your savings, your future, are in danger.

How can you help keep prices down?

By never spending a thin dime you could turn into a War Stamp. By thinking twice—and thinking "No"—at every urge to open your purse.

By wearing old things out, making makeshifts do. Remember, it's the things you *don't* buy that keep prices down!

See that prices go no higher . . . Be a saver—not a Buyer!

HELP US KEEP PRICES DOWN

A United States war message prepared by the War Advertising Council; approved by the Office of War Information; and contributed by this magazine in cooperation with the Magazine Publishers of America.

RADIO DESIGNERS' ITEMS

(CONTINUED FROM PAGE 53)

to press, information on additional symbols was received. These will be shown next month in Radio Designers' Items.

Interference Suppression: Success in suppressing ignition interference on military cars, trucks, and jeeps has been simplified to a point which warrants enactment of legislation requiring use of this development on all civilian motor vehicles, according to Delman G. Roos, vice president in charge of engineering for Willys-Overland Motors, Inc., Toledo, O.

DC Power Supply: The portable unit illustrated in Fig. 7, manufactured by P. R. Mallory & Co., Inc., Indianapolis, Ind.,

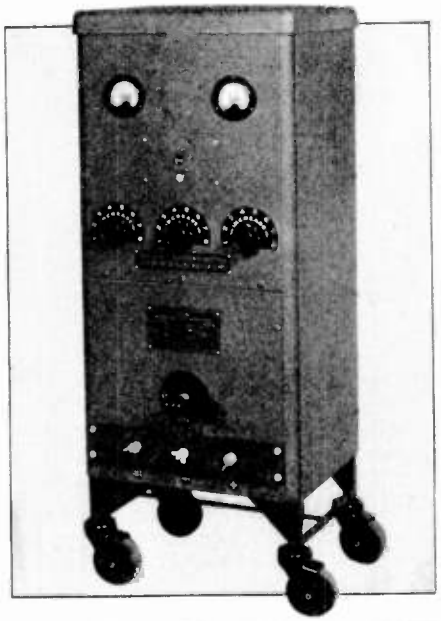


FIG. 7. DC POWER SUPPLY TO OPERATE AND TEST 12- & 24-V. EQUIPMENT

is designed for use on assembly lines, in laboratories and maintenance departments.

It provides a source of portable DC power for manufacturing, testing and operating all electrical and electronic equipment for aircraft, and other units employing 12- or 24-volt systems. The power supply can also be used to taper-charge batteries or battery carts of similar voltages.

The unit is designed to operate from 3-phase AC lines of 208 and 230 volts. Three models are offered: No. VA1500, with DC output of 10 to 16 volts at 100 amperes or 20 to 32 volts at 50 amperes; No. VA3000, with DC output of 10 to 16 volts at 200 amperes or 20 to 32 volts at 100 amperes; No. VA4500, with DC output of 10 to 16 volts at 300 amperes or 20 to 32 volts at 150 amperes. Models with similar DC output, but for operation on 460 volts AC, are also available.

Silent, motionless rectification is provided by magnesium-copper sulphide dry disc rectifiers.

(CONTINUED ON PAGE 56)

RADIO DESIGNERS' ITEMS

(CONTINUED FROM PAGE 55)

Small Soldering Iron: A lightweight iron, Fig. 8, designed for fast, precision work on small parts has been introduced by Harry A. Ungar, Inc., 616 Duncommun

FIG. 8. THIS LIGHTWEIGHT IRON HAS REPLACEABLE HEATING ELEMENT

Street, Los Angeles 12. The weight of the iron is only 3.6 oz., and the length 7 ins. overall.

Despite its small size, it is intended as a production tool. An important feature in this connection is the quick-removable heating element, which can be replaced, if necessary, at small expense. It comes up to full heat in 90 seconds, and draws only 17 watts. Immediately delivery is promised on priority orders.

Precision Resistors: Wound with the flexible ceramic-insulated wire developed for Kool-ohm resistors have been developed by Sprague Specialties Company, North Adams, Mass. These are bobbin-type resistors, 13/16 in. in diameter. Standard resistance tolerance is 15% for full wattage ratings. Maximum rating is 2.5 watts, and maximum resistance is 250,000 ohms in a section 5/8 in. wide. The maximum recommended operating temperature (ambient plus rise) is 150°C.

Bobbins are molded of high-temperature plastic material, fitted with terminal lugs molded integrally with the forms. Finished resistors are varnish-impregnated for protection against tropical conditions.

These units are intended for use as meter multipliers, instrument resistors, resistance elements in RC oscillators, and as power resistors of medium wattage ratings up to ½ megohm where a high degree of stability is required. The windings are treated by a current and temperature ageing process.

CBS REPORT ON TELEVISION

(CONTINUED FROM PAGE 24)

CBS says: Both groups of engineers are right. If the major forces of the industry are indifferent to swift improvement — if they want to let well enough alone — or if they all pull at cross purposes — improvement could no doubt be stalled for an indefinite number of years. But we have found few engineers who doubt that a year of concentrated work — in a dozen laboratories — (work that remains fiercely competitive but is aimed at a single objective) — would easily accomplish what five years of "take it easy" would accomplish. And the difference between one year and five years is just what we are talking about.

You will find a detailed discussion of the problems of the FCC, as we see them, the problems of the manufacturers, and the problem which faces the public, in the report itself.

CBS Point of View ★ Let me, however, state more fully the problem which faces the broadcasters, since this is the one area in which we can speak with considerable authority.

The broadcasters' interests are crystal clear. But their dilemma can be grave —

As broadcasters, they have no sets to sell. They are buyers rather than sellers of transmitters, cameras, studio and mobile equipment. They know they face a period of many years of cumulative deficit. Theirs is the job of producing and broadcasting costly television programs through the lean years of television ownership — long before sufficient homes have sets to provide a profitable audience.

Anything which *shortens* this period — anything which induces more *people* to buy more *sets* and view more television *programs* — reduces the broadcasters' problem. No single thing could quicken and stimulate television *broadcasting* more surely, on a nation-wide scale, than a vastly *better television image* in the home — one which could be viewed longer without eye strain; one which would rival home movies in detail and richness; one which would spread the ownership of television sets through 10,000,000 homes in half the time a mediocre picture would require.

More, even, than that. A truly finer picture may make the difference, in television broadcasting, between eventual success and failure. Mediocre pictures might *never* sell enough sets to provide an economic base for broadcasting. Or if they sold enough sets, mediocre pictures might never create enough *hours of viewing* to lift television *broadcasting* to a sound plane of operations. (There was some evidence, before the war, that families who bought television sets used them less and less after the first novelty began to wear off.)

Nor is the future sponsor of television programs indifferent to all of this. The

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CBS REPORT ON TELEVISION

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basic question any advertiser must ask in planning television for his product is "How good will it look — will it do justice to my merchandise?"

Thus the question, "Are prewar pictures good enough?" sounds academic, if not alarming, to the broadcaster. His central, overwhelming need is *a better television* image on receiving sets. A picture which will reproduce, at its *best*, the *best* he can put into programs. Any compromise with this ideal betrays his interests, threatens his position.

What we as broadcasters propose to do in the interim is also stated clearly in the report. For fear there may be any misunderstanding, let me quote this much of it. We propose, at least for CBS, that we continue broadcasting on the low standards until the high standards are ready, that we close down the old transmitters when we open up the new, that families which can afford receiving sets which may be useless in a year or two be encouraged to buy, with full knowledge of the probable impending change.

This is the hard road for present television broadcasters, but the road of good faith with the public. To broadcasters, it may mean millions of dollars of interim broadcasting to provide continued program service to a handful of prewar sets. It also means scrapping several million dollars' worth of transmitter and studio equipment.

But to manufacturers, such frankness should pay handsome dividends. The higher standards, once achieved, should compress into 3 or 4 years set-buying which might otherwise lag over 5 to 10 years.

Conclusions ★ Let me conclude this talk with the final conclusion from the report itself.

This much seems sure — a single year of concentrated effort should *prove* the case for better television pictures, or else *disprove* it. Hundreds of American engineers have done ten times as much, in two taut years of war, as remains to be done in one full year of peace. They have done the impossible. This is not the impossible. This is the mathematically probable.

We have implicit faith in the technical know-how of these engineers, once they turn their skills to peace-time television. The real problems lie, we believe, not in the laboratories where engineering is done, but in the offices where policy is made.

Frank H. McIntosh, recently resigned as chief of the Domestic and Foreign Branch of the WPB Radio and Radar Division, will enter private consulting practice. His place will be taken by his former assistant, John Creutz, who was chief of the Transmitter Section.

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them in private homes or outlying factories, charging the individual taxpayers for this special protection. It would only be necessary to install a receiver and a recorder at fire headquarters. The time required to clear a busy party telephone line and get coherent instructions to headquarters has often made the difference between a small fire and a total loss.

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Concerning the dual functions of an FM station in producing revenue and building good-will, Dr. Baker said: "Some champions of newspaper ownership of radio stations even go so far as to suggest that newspaper publishers embrace Frequency Modulation broadcasting as a source of first-class institutional promotion among their local readers, without any thought of the additional revenues such a service would make available to the newspaper and its clients. That, however, is a matter of individual opinion, and depends upon the newspaper's own economic problems."

Walter Damm, who opened the FM meeting, addressed the publishers on common ground because of his long association with *The Milwaukee Journal*. At the same time, he spoke with the authority of a pioneer in AM and FM broadcasting when he said: "FM opens the door of stations ownership to thousands of individuals and corporations who have long ago realized the possibilities of radio, but who have been unable to find space in the spectrum."

He took up an important question about which there is now much discussion: "Whether FM develops as a service independent of the present AM system, or as an adjunct of it is a matter which is not clear at this time. Some feel that their FM operation should not compete with their AM operation and, therefore, propose to program their FM stations with the same programs broadcast by their AM stations. This view is being urged by the national networks.

"Other FM operators feel that their FM operation should be independent of their AM operation. The former procedure will perpetuate all the faults of programs for which present day networks are criticised. The latter will promote the improvements and changes which many of us feel are needed. Furthermore, duplicate operation might well be considered unfair competition by those FM station owners who do not own or are not affiliated with an AM station."

2. Walter Damm answered a series of questions which bring out much interesting information, and so many important points are covered that the questions and answers are well worth reporting here:

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To what, if any, extent is FM *apt to replace standard broadcasting?*

Frequency Modulation, in my opinion, will replace Amplitude Modulation as the system for sound broadcasting. How long the transition period will last is anyone's guess. Mine is that it will be from 8 to 10 years after the time that transmitters and sets become available.

How many FM *receiving sets are now in use, and how are they distributed?*

The latest figures compiled by FM Broadcasters, Inc. show approximately 500,000 receivers in use in the United States. As might be expected, most of these are concentrated in areas where Frequency Modulation has been available to listeners. Our figures show approximately in New York, 120,000; Philadelphia, 20,000; Chicago, 80,000; Boston, 35,000; Milwaukee, 21,000; Detroit, 25,000.

Is FM *equally practical for small and large cities?*

Yes. More so, in fact, because with FM and its non-interference between stations on the same frequency, it will be possible to assign stations on the same frequency much closer together than in the case of AM. Therefore, many more smaller cities may be able to have a broadcasting station than is now possible.

Can FM *coverage be controlled by directional antenna systems?*

Yes. But with FM, there is no need for directional antenna, because it is unnecessary to create artificially, by means of a directional antenna, protection between stations on the same frequency. It might, of course, seem desirable in some instances where stations are located near the Atlantic or Pacific Oceans or on the edge of a large body of water like Lake Michigan, to build a directional antenna arrangement which would concentrate the power over the land areas. But again, because of the inherent technical advantages of FM, there is really no need for this.

What, if any, restrictions are there on the sale of time on an FM *station?*

None. The operator of an FM station may sell time from the moment the station first goes on the air, provided, of course, that he can convince the advertiser that the station has an audience. In Milwaukee, we have been very successful in this respect.

How soon after the war may FM *be reasonably expected to be a commercial success?*

If by this question is meant how soon can a station make a profit, I would say that it is dependent upon the diligence

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with which the operator goes about rendering a service to his community which will justify the buying of sets that will pick up FM signals. We have heard estimates to the effect that within one year after the war, there will be 5,000,000 FM sets sold, and that within four years, we may expect 20,000,000 sets in the hands of listeners. Frankly, it is my opinion that in view of the pent-up purchasing power, this is a very conservative estimation. I have not kept secret the fact that our FM station's operation in Milwaukee by the end of this year, its second full year of commercial operation, will practically be self-sustaining.

How is the FCC now handling FM *applications filed by newspapers?*

All applications for FM stations, as a matter of fact, for any kind of station, are treated on the same basis. There is no discrimination between newspaper and non-newspaper ownership. All applications, at present, are placed in a pending file, awaiting servicing by the Commission's engineering and legal departments. No new construction is being authorized, except in accordance with an announcement of the Commission dated January 26, 1944, which says, "The Commission will give consideration to the issuance of conditional grants upon applications where it is shown:

1. That the grant will serve an outstanding public need or national interest.
2. That the operation proposed is consistent with the provisions of the rules and regulations of the Commission, and the conditions and standards prescribed in the Act.
3. That after due consideration of the policies and orders of the WPB and the facts with respect to the existence of availability of necessary materials, there is reasonable prospect that the proposed operation in the vicinity in question can be provided for without substantial delay."

And then the Commission's release goes on to say, "This statement is not to be construed as an invitation for the filing of applications. The policy set forth is intended only to permit grants that will serve an outstanding public need, or national interest, as indicated in this statement."

How much does it cost to put an FM *application on file?*

The filing of an FM application involves a certain amount of engineering work, necessary to determine a proper site location, and to determine the antenna height and efficiency and the transmitter power necessary to generate a signal of sufficient strength to comply with the Commission's

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regulations. Such engineering, I would estimate, could be secured for somewhere between $2,000 and $2,500. The FCC forms necessary can be filled out by any corporation accountant.

Is there any advantage in placing an application on file now, rather than waiting until the FCC is seriously considering FM *applications?*

Before directly answering this question, I would like to say a few words with respect to that part of the question which reads: "until the FCC is seriously considering FM applications." I don't think that the FCC has been doing anything else but seriously considering FM from the day that applications for FM stations were filed with it. The Commission devoted several weeks of its time to a hearing on the subject early in 1940, and announced a very serious decision on May 20, 1940 when, after reviewing the evidence presented at the hearing, it determined that FM had arrived at the point where it justified full commercial operation. As for that part of the question concerning the advantage of filing an application now: there is always an advantage in being in on the ground floor. The first and most important reason for doing it now is that the most ideal sites for FM transmitter locations are not going to last forever.

In Los Angeles, for instance, there are 17 applications for the best site to cover that area. In Chicago, practically every important site already has been leased. In addition to this fact, it would be much better to get the engineering work out of the way now, than wait until the gold rush starts. If you are going to get into FM at all, why wait?

Is it better for a newspaper to file alone, or in association with persons not connected with the industry?

There is no rule or regulation on the books of the FCC which differentiates between newspaper and non-newspaper applicants. There are many of those who believe that this question is still in the minds of the Commission, but we can only be guided by formally adopted regulations. I see no reason why, under present conditions, there should be any advantage one way or the other.

What will be the chance of success of a newspaper applicant as against a conflicting application from (a) a person who is now identified with a local standard broadcast station, or (b) a person who is connected with other than a local station, or (c) a person who has no connection with radio?

I believe I have just answered this question.

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Are there any special FCC requirements regarding FM programs?

As released on May 20, 1940, the Commission's rules and regulations pertaining to FM operation required a minimum of three hours of operation before 6:00 P.M., and three hours after 6:00 P.M., with one of these hours in each category to be of such transmission as to fully comply with the fidelity and noise level advantages of FM. This rule has been suspended for the duration. However, I, for one, hope that when the war is over, the Commission will not only reinstate this regulation, but insist that all FM programs meet the standards of which FM is capable.

What, if any, tie-up is there between FM and television?

None. Sound broadcasting, as we know it today, will live forever, whether it is by means of Amplitude Modulation or Frequency Modulation. Television can never supply the sound broadcasting entertainment needs of the American public. The sound channel on television can of course be either amplitude or frequency-modulated, and it would seem obvious that if FM is the ideal means in use in a sound broadcasting system, then it ought to also be the best means for modulating the sound channel in television.

Other than this, I know of no other tie-up between the two. Television is a new entertainment medium. Even before its introduction to the public on a general scale, there are those who feel that the ultimate television will be "color television" and that the black-and-white television which is being talked about now is only a stop gap.

Are any FM network programs now contemplated?

Last January, two of the national networks announced their plans for network FM programs. Their thinking is in the direction of duplicating present AM programs on their affiliates' FM stations, and giving the FM audience to the advertiser as a bonus. As I said in my opening remarks, there was organized in 1941 an organization to develop an FM network. This organization is now nearing its organizational finale, and there is no question but that when equipment and station connecting facilities become available, this network will blossom out in full glory.

In addition to placing an application on file, how much will it cost to have it finally granted?

Once the application is on file, there should be no further costs involved in having the Commission act on it. I, for one, believe that a Washington legal contact is a very desirable thing for every radio station owner.

FM STATION WMFM

OPERATED BY "THE MILWAUKEE JOURNAL"

FREQUENCY: 45.5 MEGACYCLES
INPUT TO FINAL AMPLIFIER: 60.5 KW.
ANTENNA OUTPUT: 41.5 KW.
TOTAL HOURS OPERATION TO DATE: 11,000
PERCENT OPERATING TIME TO OUTAGES: 99.969%
TYPE OF TRANSMITTER: REL NO. 521DL
TYPE OF ANTENNA: REL 2-BAY TURNSTILE

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Only REL has built FM transmitters in this high-power class. Yet the performance record of WMFM compares favorably with even the low-power installations of other makes.

REL

Station WMFM is under the management of Walter J. Damm, one of the pioneers of FM broadcasting. This transmitter operates in conjunction with *The Milwaukee Journal's* Radio City which ranks among the finest radio installations in this country.

The demonstrated dependability and efficiency of WMFM and many other REL transmitters definitely establishes the superiority of the Armstrong Phase Shift method of frequency modulation employed in REL transmitters of all power ratings.

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Home of Henry J. Kaiser's shipbuilding center, the largest in the world, employing 90,000 workers and making records daily only to break them. The Richmond population has increased from 23,000 to 100,000 since Pearl Harbor, presenting many new problems to the Police Department.

Richmond city officials selected Link FM Radio Communications equipment and were the pioneers in FM radio operation for police communications on the west coast. The Richmond Police Radio System (KRLW) employs a Link 250-UFS main station and 22 Link FMTR mobile units on 24 hour duty.

Chief of Police L. E. Jones stated, "It is impossible to describe in words what this radio system has meant to my department during these abnormal times in Richmond. Without it, we would have been lost."

Mr. Herbert Watson, radio engineer for the city, installed the Link FM radio system in September 1941, and has been in charge of maintenance ever since then. The system requires a minimum of attention and Mr. Watson has devoted most of his recent time to radio engineering for the U. S. Navy in addition to being co-author on a well known radio textbook used extensively in training radio men for the war effort.

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