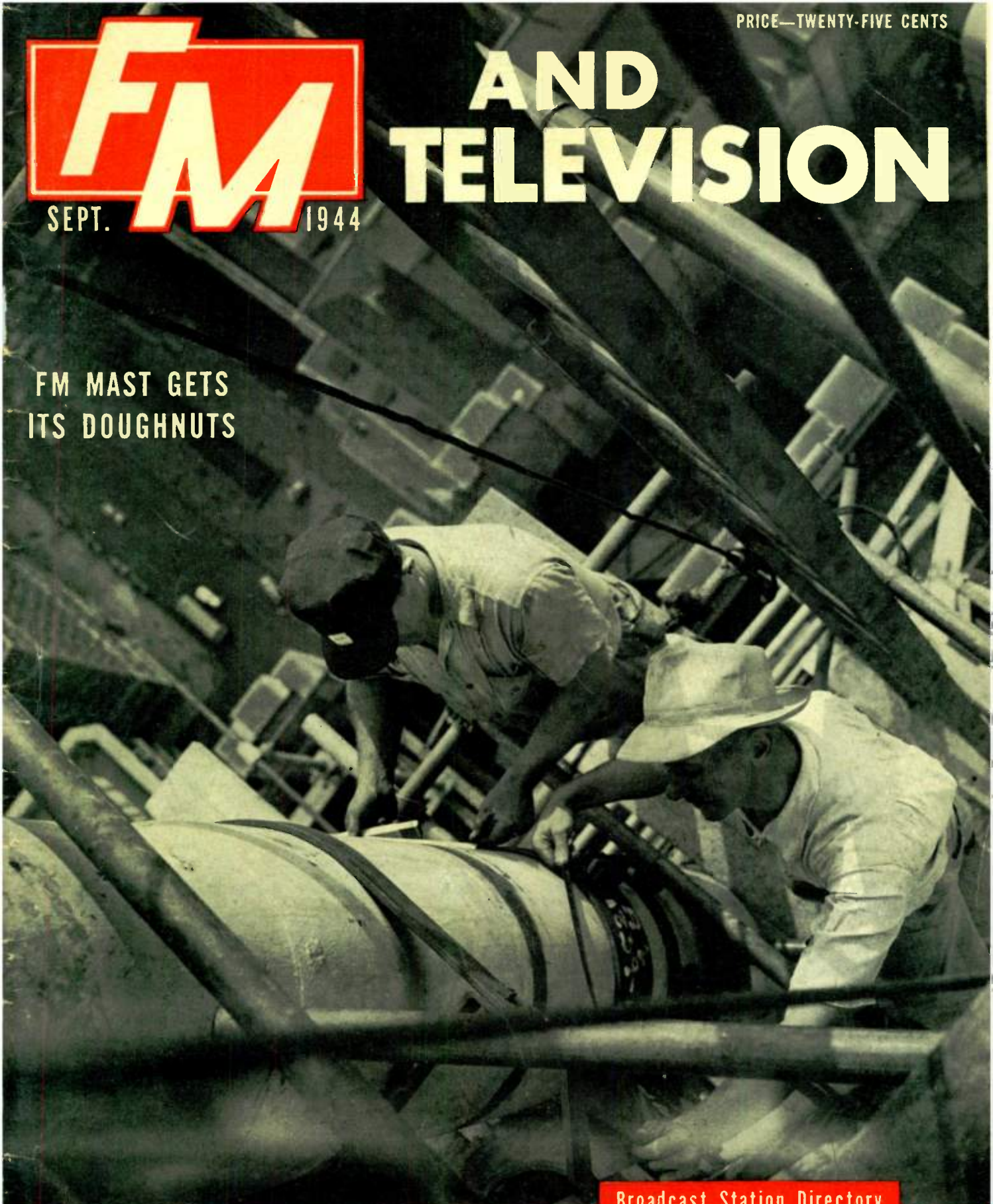
PRICE—TWENTY-FIVE CENTS

# FM AND TELEVISION

SEPT. 1944



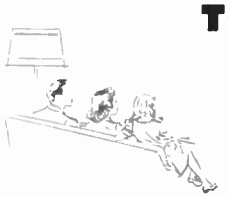
## FM MAST GETS ITS DOUGHNUTS

Broadcast Station Directory

★ ★ Edited by Milton B. Sleeper ★ ★


*Reserve your seat for*

## TELEVISION—THE GREATEST SHOW ON EARTH!



Television promises you the most magnificent show on earth—the thrills, the glamour, the pageantry of our century! Television will transform your favorite easy chair into a choice orchestra seat at the theatre's biggest hits at curtain time ...into the finest box on the third base line when the umpires shout: "Play Ball!" Television will make you an honor guest at every important event, provide entree at exclusive functions, slip you through police lines at parades, steamship piers and movie premieres.

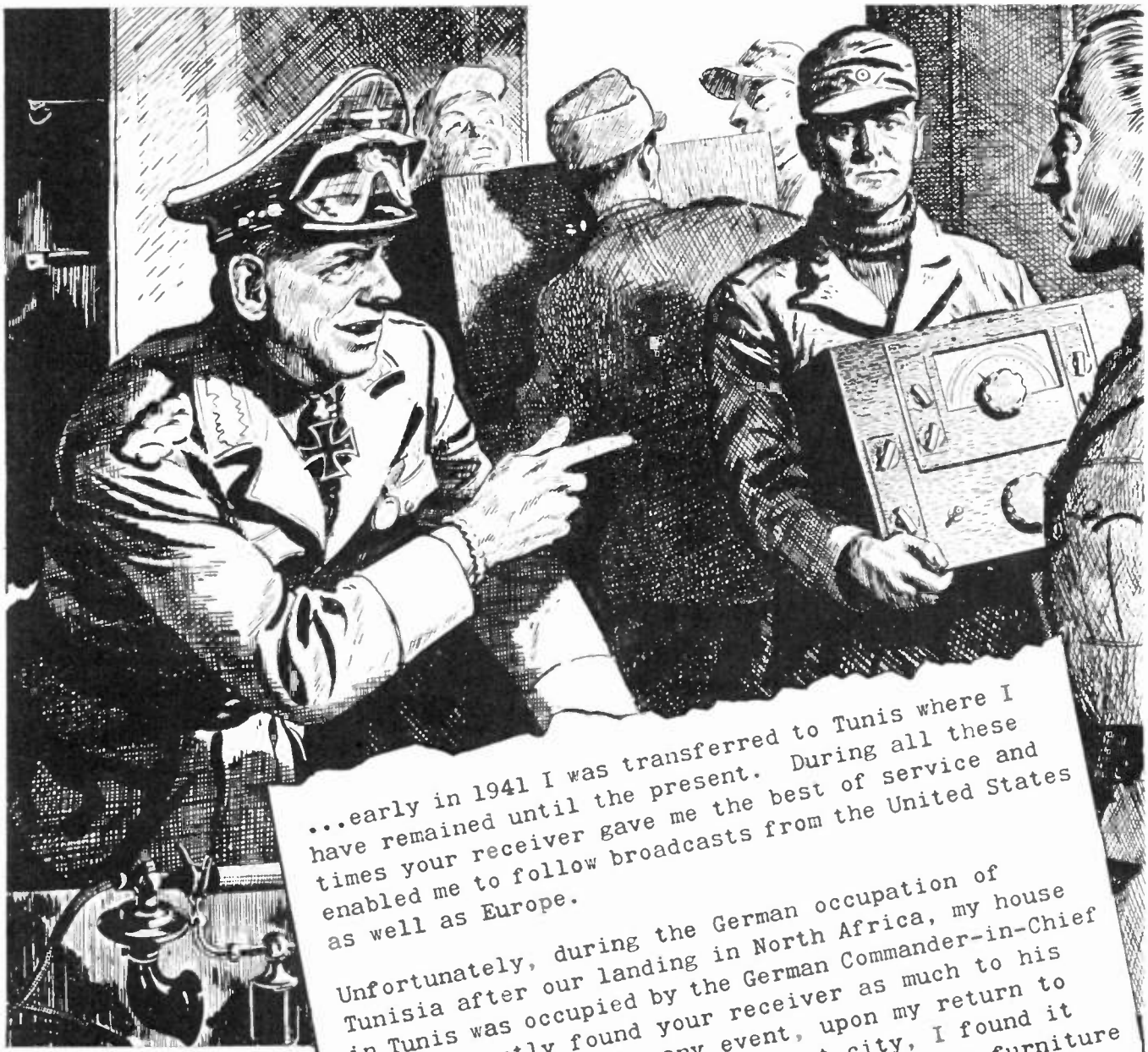
Television is comedy, drama, music, sports, news...seen and heard as it happens! And your "season pass" for this exciting round of pleasure will be a fine DuMont Television-Radio Receiver, the ultimate in electronic engineering and beauty. Since DuMont pioneering gave television its first really *clear* picture reception with the creation of the DuMont Cathode-ray Tube, DuMont has built to an ideal, never to a price. That ideal will reach its final realization when DuMont presents to you in your home...the greatest show on earth!



DUMONT *Precision Electronics and Television*

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

# THANKS FOR THE PLUG, ROMMEL



...early in 1941 I was transferred to Tunis where I have remained until the present. During all these times your receiver gave me the best of service and enabled me to follow broadcasts from the United States as well as Europe.

Unfortunately, during the German occupation of Tunisia after our landing in North Africa, my house in Tunis was occupied by the German Commander-in-Chief who apparently found your receiver as much to his liking as I had. In any event, upon my return to Tunis after the recapture of that city, I found it missing together with the greater part of my furniture and household effects.

It would be appreciated if you would again provide me with the present equivalent of the set which I possessed.

(Excerpt from a letter we received from a member of the State Department)

## NATIONAL COMPANY, INC.

MALDEN MASS, U. S. A.

NATIONAL RECEIVERS ARE IN SERVICE THROUGHOUT THE WORLD

# FM Radio by Western Electric helped revolutionize tank tactics


## 10 channel set—with 80 voices —has push button control

IN 1940 the Signal Corps brought one of its toughest radio assignments to Bell Telephone Laboratories and Western Electric. A rugged multi-frequency set was wanted for the Armored Forces—in effect, a radio switchboard to interconnect tanks, scout cars, command cars, artillery units, anti-tank vehicles.

A model was submitted in one-quarter of the time normally required to design and build such a complex set—an FM transmitter and receiver having 80 crystal controlled frequencies. Any 10 crystals could be quickly plugged in—and push buttons provided instant switching. The set was tested—accepted—ordered in quantity.

Among the most difficult of the many production problems tackled by Western Electric engineers, were those of crystal manufacture. Millions of these tiny quartz wafers would be needed—each lapped to dimensions, metal-plated in a vacuum, mounted on wires so small they must be soldered in place under a microscope. Amazing new machines and methods were devised—crystals poured out on time.

Today huge numbers of units have been made by Western Electric and its sub-contractors. They are providing the instant communications that enable our Armored Forces to travel farther, faster and to hit harder.

Knowledge and experience gained and new techniques developed on this FM tank radio project will find application in finer equipment for users of FM radio.

*Buy all the War Bonds you can — and keep all you buy!*

75TH ANNIVERSARY

**Western Electric**

ARSENAL OF COMMUNICATIONS EQUIPMENT

ARMY E NAVY

FM AND TELEVISION

FORMERLY: FM RADIO-ELECTRONICS

VOL. 4 SEPTEMBER, 1944 NO. 9



# CONTENTS





★ ★ ★ ★ ★ ★

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


## THIS MONTH'S COVER

EVER since Pearl Harbor, the uncompleted antenna of WABC-FM, at Fifth Avenue and 42nd Street, New York, has stood as a gaunt reminder of the interrupted progress of FM broadcasting. Meanwhile, using a temporary rig for an antenna, this CBS station has been on the air with a regular program schedule.

Now, the scaffolding is up around the mast again, and workmen are mounting the doughnut radiators. The storm of September 14th twisted the scaffolding into a spiral, but no serious damage was done. When the antenna is completed, CBS will have the first FM station in New York City to cover its assigned area.

# WHAT'S NEW THIS MONTH

1. Radio's New Problem
2. A Source of Information
3. No Mikes for Soap Boxes

1. A serious unemployment situation will face the radio industry when, at the end of the European war, some 40% of the contracts for military radio equipment are cancelled. This condition will become progressively worse, for there will be a further, continued reduction in military requirements as we move forward in the Pacific war.

Fortunately, this is no insurmountable problem for manufacturers who are willing to undertake its solution. In fact, it can be made a coöperative project, serving the best interests of both the potential unemployed and their present employers.

The plan can be set forth in a single sentence: While they are still employed, prepare them to be servicemen or dealers.

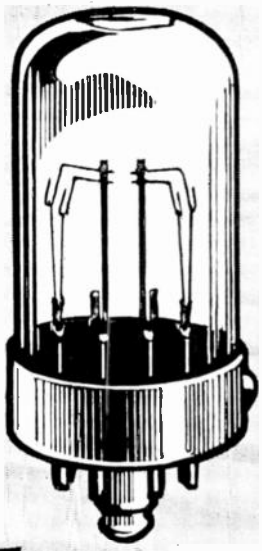
Here, actually, is an opportunity for each radio manufacturer to reënter civilian radio business with a strong force of loyal, enthusiastic dealers to sell his postwar products, and well-trained servicemen to install and maintain them. Never before have manufacturers had an opportunity to establish such close contacts with a group of men who can do so much for them.

In every plant, there are many men who would like to open radio shops or go into service work if they could only get the right start. Many can finance themselves or can get the capital required. Others would be able to find employment easily with established dealers or department stores if they could supplement their factory experience with the kind of instruction that could be given readily by company executives.

What an opportunity this would be to teach a group of potential dealers, with no bad thinking-habits to overcome, the right way to merchandise a new line of radio sets — or a group of potential servicemen, with no self-taught misconceptions, how to make service calls build good will.

Such a plan is sound in theory as well as in practice. Studies of employment related to the expansion of mass production show that the growth of any industry creates "service employment" as an essential counterpart to handle distribution, sales, installation, and maintenance. However, such growth can be limited by failure to develop adequate service employment.

(CONTINUED ON PAGE 60)



SYLVANIA
POWER MEASUREMENT TUBE

# MEASURING RADIO FREQUENCY POWER MORE ACCURATELY

New Sylvania Power Measurement Lamps provide a simple and more accurate means of measuring radio frequency power.

At present there are six "lamps" in the Sylvania PM series. Resistances range from 40 to 310 ohms over the useful ranges of the curves.

A PM Lamp, used with a meter readily available to most radio experimenters, eliminates much of the guesswork that prevailed with old methods. Sylvania PM Lamps, which are no longer restricted to military use, should be useful to radio experimenters.

The research and development of the PM series is just another example of how Sylvania engineering succeeds in solving radio problems. Like Sylvania Radio Tubes, criterions of quality, the new Power Measurement Lamps are manufactured to one standard — the highest anywhere known

**OTHER SYLVANIA RADIO TUBE FIRSTS**

Sylvania was first to introduce a line of 6.3-volt radio tubes and to propose their universal use in not only automobile but home receivers. This contribution standardized radio tube voltage, simplified service and stocking, and eliminated transformers in AC-DC sets.

Sylvania was first to introduce a line of 1.4-volt tubes, which made the portable camera-type radio possible. This radio tube halved portable radio battery weight — a boon in war and in the peace to come.

*Quality that serves the war shall serve the peace*

RADIO DIVISION EMPORIUM, PENNSYLVANIA

# SYLVANIA

## ELECTRIC PRODUCTS INC.

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

# ADVERTISERS INDEX


# MONITOR with PANORAMIC

## See a wide band- all at once

In the typical monitoring station—up to the present time—each received signal has required the active attendance of an operator and a receiver—the operator turning the dials ceaselessly and recording the signals on the air. With the aid of PANORAMIC RECEPTION, however, just one piece of equipment can do the work of many. Because PANORAMIC RECEPTION SHOWS ALL SIGNALS ON A GIVEN BAND OF THE RADIO FREQUENCY SPECTRUM SIMULTANEOUSLY, one operator can cover wider bands of the spectrum with more accuracy and less operator fatigue. Without dial manipulation, he can see immediately open channels and intermittent signals. Moreover, the patterns on the screen tell him the frequencies of the stations; their stability; their signal strength as they reach him; whether the station is AM, FM, or CW; and the type and extent of interference.

In monitoring, as in direction finding, navigation, production, and laboratory procedure, PANORAMIC RECEPTION is becoming an indispensable timesaver. Its unique capabilities will offer new solutions to your industrial and laboratory problems. Allow one of our engineers to explain how PANORAMIC RECEPTION may be used to your best advantage.

*New and interesting booklet "From One Ham to Another." Available on request. Fully illustrated.*

**PANORAMIC RADIO CORPORATION**

242-250 WEST 55TH ST., New York 19, N. Y.

# ENGINEERING SALES

**Epema:** The following officers were elected at the August meeting of the Electronic Products and Equipment Manufacturers Association in Chicago:

Chairman: E. G. Shalkhauser, Radio Manufacturing Engineers, Inc., Peoria, Ill.

Vice chairman: J. A. Berman, Shure Brothers, Chicago.

Treasurer: H. A. Staniland, Quam-Nichols Company, Chicago.

Executive secretary pro tem: J. Arthur Kealy, attorney. Correspondence should be addressed to the Office of the Secretary, Kenneth C. Prince, 77 Washington Street, Chicago.

**Electro-Voice:** President Albert R. Kahn, together with vice president R. E. Seikman and production Manager R. W. Augustine are now at work on dealer helps, catalogs, and advertising plans for postwar sales promotion, following a tour of key cities in the east, where they called on parts jobbers.

**D. W. May:** Planner of prewar dealer cruises, introduced his postwar lines to dealers during a party at Hotel Commodore, New York. Fifteen hundred dealers from metropolitan New York, northern Jersey, and Fairfield County, Conn., came to hear Ernest Vogel of Farnsworth, Larry O'Brien of Kenrad, Warren Hasemier of Wilcox-Gay, and executives of several appliance manufacturers whose products Winnie May will handle also. Sales plans announced call for handling all these lines under New York fair trade laws.

**Philco:** New and very modern service facilities in Mexico City have been opened by Philco, S.A., the exclusive Philco distributor for the Federal District of Mexico, and several adjoining states. The parts department will carry 1,400 different replacement items. President of Philco, S.A. is Ralph E. Chaplin.

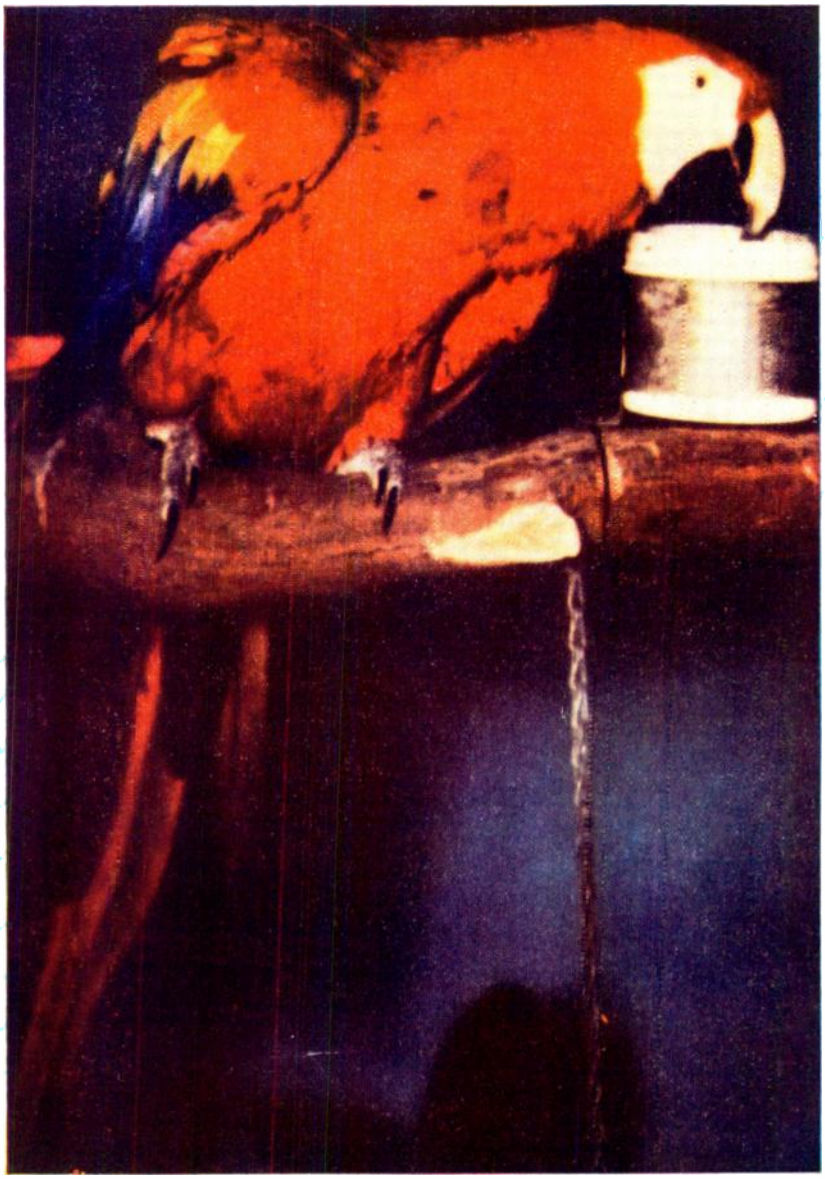
**The Reps:** New members of Chicagoland Chapter, accepted at the August meeting, are: John W. Clarke, Fred R. Ellinger, W. H. Ellinger, Leroy Eschner, Theodore E. Felleisen, Jr., and Royal J. Higgins.

**Clarostat:** Has appointed Leon L. Adelman as advisory sales manager. In addition, he will represent Clarostat in metropolitan New York, serving the jobbers in this area.

(CONTINUED ON PAGE 74)

# COLOR NEGATIVES TRANSMITTED BY WIRE

## *for industrial purposes*



AS MUCH as seven years ago, Finch Facsimile introduced the transmission of color negatives by wire or radio for certain industrial purposes—a feat not duplicated by any other communication system to this day. The negatives here reproduced (by permission) were transmitted from New York to Chicago over ordinary long-distance telephone via Finch equipment, and printed by Editor and Publisher in their issue of June 5, 1937.

We take this means of reminding broadcasters that Finch pioneering and basic patents have long since established Finch leadership in Facsimile and promise a most interesting future for Finch licensees.

FINCH TELECOMMUNICATIONS INC., PASSAIC, N. J.

*Automatically synchronizing*

# finch facsimile

WRH


## *Featuring*

# *The New* HARVEY Regulated Power Supply 206 PA

## RANGE 500 to 1000 VOLTS

This new Harvey development is bound to be a star, because it fills the need for a Regulated Power Supply in upper voltages. It may be operated in two ranges, 500–700 at ¼ of an ampere and 700 to 1000 at .2 of an ampere. Both ranges have accurate regulation to *one per cent or less*.

The new HARVEY Regulated Power Supply 206 PA is a model of efficiency and operating convenience. All parts are readily accessible to the operator. It is equipped with spare fuses, a 6 ft. heavy duty Tyrex cord with a handy two prong plug.

The HARVEY 206 PA is fused on the primary side and has both an overload relay and time delay relay. Two interlocks on the chassis afford the operator complete protection. A black, crackle-finish panel and copper plated chassis make the 206 PA an instrument of beauty as well as precision.

Although the HARVEY 206 PA is too new to picture publicly, it has been thoroughly tested and proved and is now in production. Made by the makers of the HARVEY 106 PA that is providing fine, dependable performance in the 200 to 300 volt range, the HARVEY 206 PA will provide equally fine performance in the higher voltages.

*Now* is the time to get the complete story on this important new contribution to the radio-electronics field. Write, phone or wire

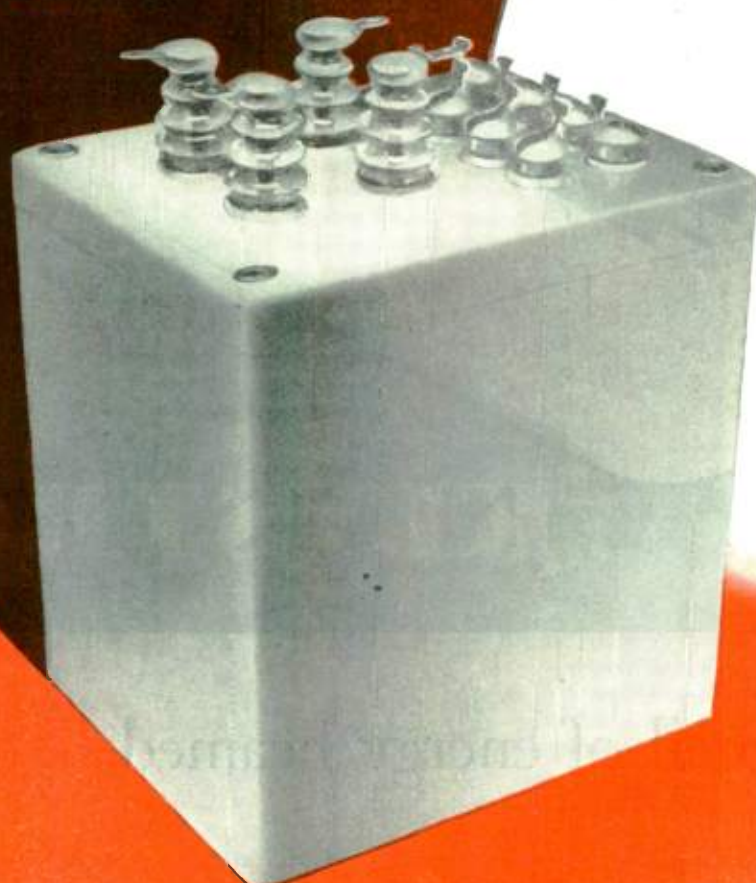
HARVEY
OF CAMBRIDGE

## HARVEY RADIO LABORATORIES, INC.

443 CONCORD AVENUE • CAMBRIDGE 38, MASSACHUSETTS

# POWER SUPPLY COMPONENTS FOR WAR

UTC



The complex power supplies of war apparatus require components of maximum dependability. The unit illustrated is a typical power transformer for cathode ray application. In addition to the tapped primary, this unit provides a low voltage filament winding . . . a 5,000 volt anode supply winding . . . and a filament winding insulated for 15,000 volts peak inverse.

For hermetic sealing this unit employs an all metal enclosure . . . glass seal terminals . . . sealing compound which neither cracks nor flows from −55°C to + 130°C.

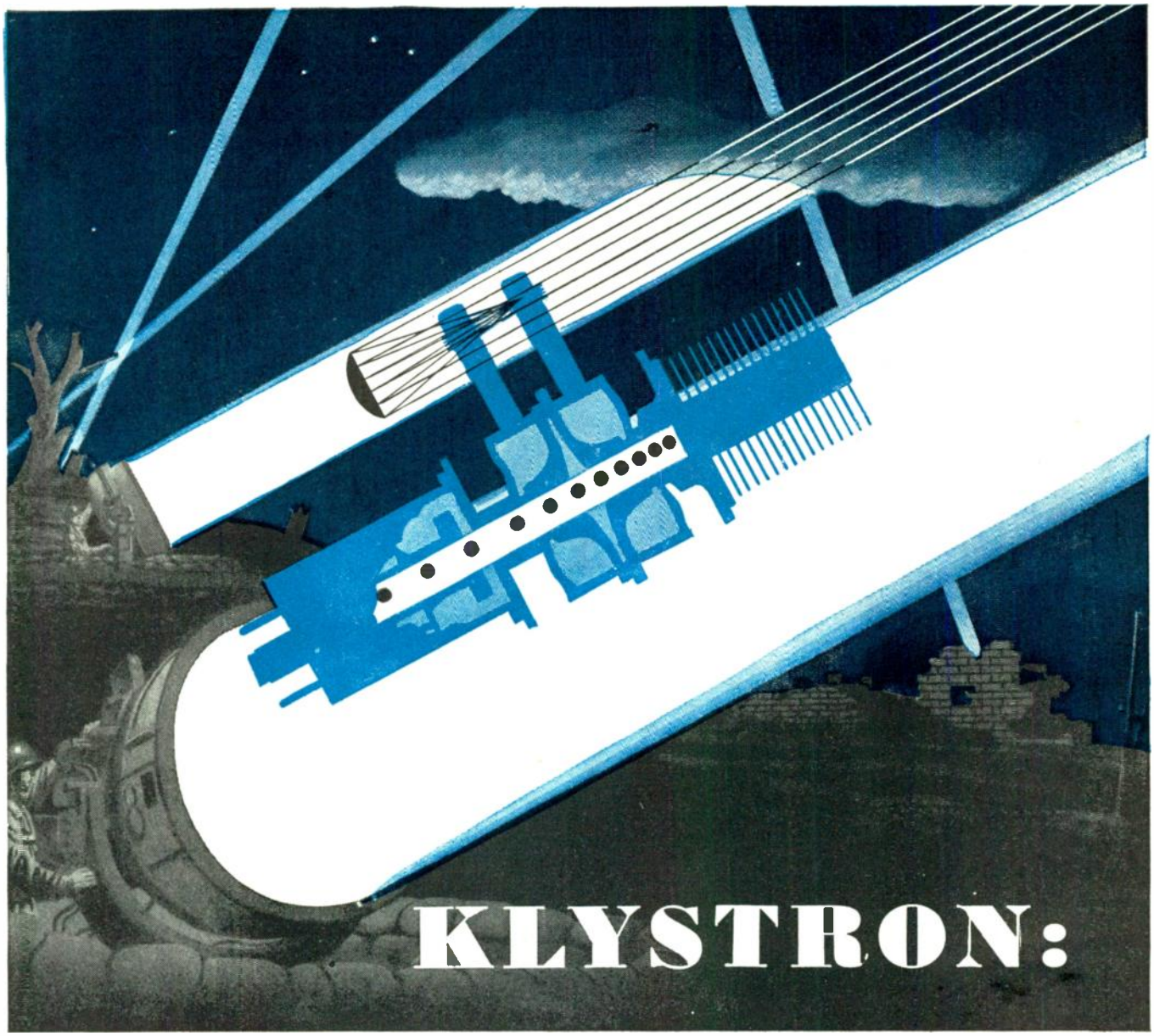
*May we cooperate with you on design savings for your applications...war or postwar?*

United Transformer Co.

150 VARICK STREET NEW YORK 13, N. Y.

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

WRH




# A pencil of energy beamed like light

IF YOU'LL imagine an *invisible* searchlight beam, you'll have a good picture of how Klystron-generated radio waves can be directed into a narrow "pencil" of energy.

▶ This direction is accomplished by suitable reflectors. The beam of ultra-high-frequency waves travels in a straight line, and it can pierce fog, smoke, and clouds which would stop a light beam.

Sperry-developed Klystron tubes are used in many equipments now serving our Armed Forces. Later, *Klystronics* will open the door to the development of many ingenious peacetime devices.

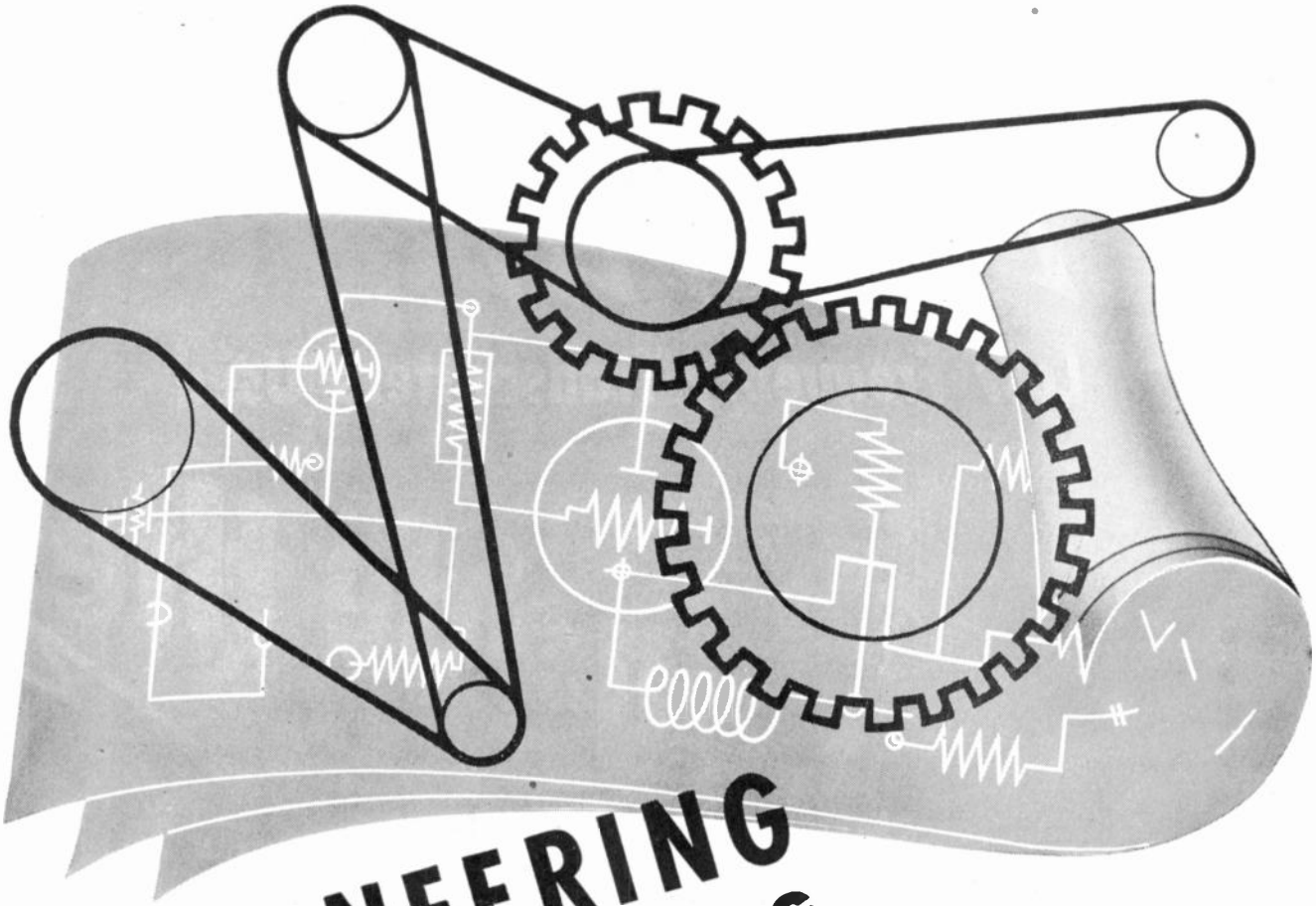
**▶ Klystrons are now being produced in quantities, and certain types are available.**

The name "KLYSTRON" is a registered trade-mark of the Sperry Gyroscope Company, Inc. Like many other Sperry devices, Klystrons are also being made during the emergency by other companies.

## Sperry Gyroscope Company INC.

GREAT NECK, N. Y. • DIVISION OF THE SPERRY CORPORATION

GYROSCOPICS • ELECTRONICS • AUTOMATIC COMPUTATION • SERVO-MECHANISMS



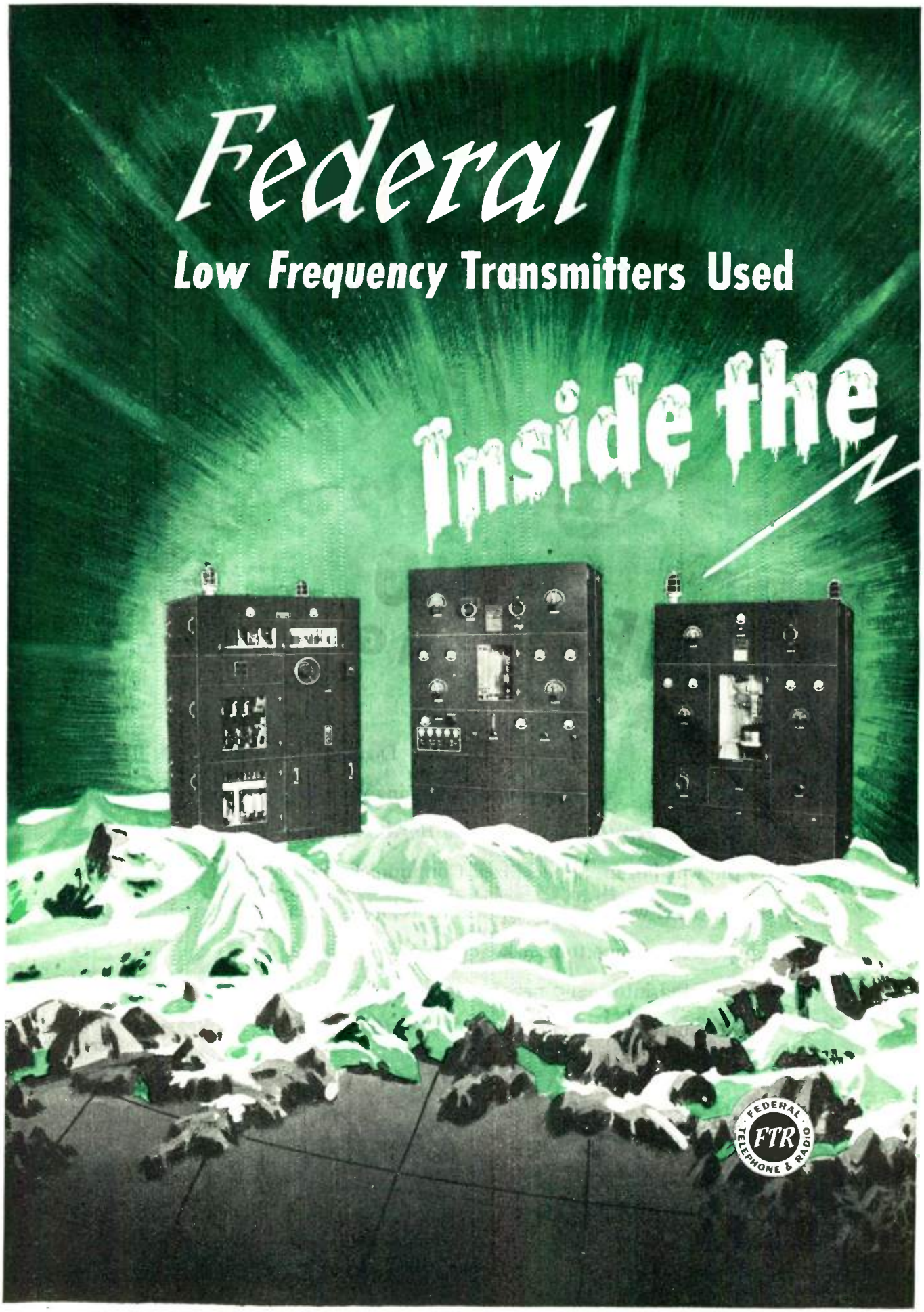
# ENGINEERING AND PRODUCING

Doolittle Engineers are still designing and producing radio equipment for the *Naval Aircraft Factory* and the *Bureau of Aeronautics*. . . . Before the war began, "Specialized Communications Equipment" by DOOLITTLE was a consistent aid to aviation, broadcast and police radio engineers . . . Come tomorrow, our pre-war and war-born experience will be translated into many new benefits for a world of peacetime communications . . . *Look Ahead with DOOLITTLE!*

BACK THE ATTACK
*Buy More War Bonds*

**Doolittle RADIO, INC.**

*Builders of Precision Radio Communications Equipment*
**7421 South Loomis Boulevard, Chicago 36, Illinois**


Federal
Low Frequency Transmitters Used
Inside the
FEDERAL TELEPHONE & RADIO
FTR

# *Insulators*

## BY ENGINEERS

ANTENNAS

CONDENSERS

TUBE SOCKETS

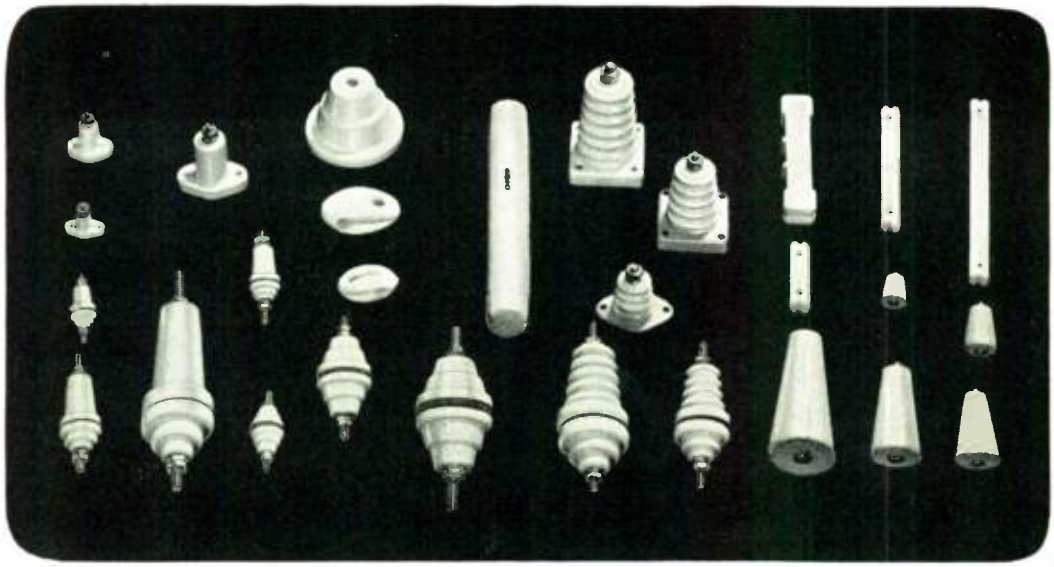
PLUGS & JACKS

INSULATORS

INDUCTORS

BROADCAST EQUIPMENT

CONCENTRIC LINE



Johnson Radio Engineers have been specialists in insulator design for radio frequencies for almost a quarter of a century. Shapes to provide strength for strains and stresses—reinforced mounting holes and carefully designed mountings—high internal resistance to radio frequency voltage—long leakage path—careful treatment to present a surface that will not collect dirt and foreign matter—quality hardware, not punched nuts and poorly formed parts—materials selected for their radio frequency characteristics, not the "flower pot" variety of ceramics.

To Johnson Engineers an insulator is a piece of radio apparatus and given the same careful attention in design and production. As a result you can't buy a better insulator than Johnson. Send your next insulator problem to Johnson for recommendations and quotations. No obligation.

Ask for Catalog 968T.


# JOHNSON

*a famous name in Radio*

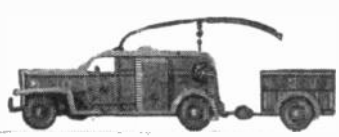
E. F. JOHNSON CO.
Waseca, Minnesota

# How the HT-4 took it at 134° in the shade . . .


*The following is quoted from a letter marked Somewhere in "Libya" which bore the signature of an officer in an AACS Group, USAAF:*
"The writer just spent a year in Persia. Most of the time along the Persian Gulf where it really gets HOT! We operated one of your HT-4-B Transmitters near a place called Abadan. The transmitter performed very satisfactorily under the most unfavorable conditions. I doubt that your engineers ever dreamed that one of your rigs would be called upon to perform in a place where for 5 days and nights the temperature never dropped below 117 degrees and in fact it got up to 134 degrees during the daytime, that is "in the shade" temperature, the humidity was high and the air salty. Actually the transmitter got much hotter than that as it was installed in a brick building and no air conditioning, not even an exhaust fan. The HT-4-B was used on voice and gave very little trouble. One day the piece of bakelite under the phone/cw switch caught on fire but this was easily repaired. During the so called winter season, the temperature actually got as low as 36 degrees one day, we had a little trouble with mice crawling under the rig, which was set up on two 4x4 wooden sleepers. It seems the mice liked the heat and they would crawl up under the transmitter and get lodged in between the rectifier sockets and the frame when the operator switched on the transmitter the mice would fry, usually a fuse would blow but no other damage was done We never did figure why the mice liked the Hallicrafters best. There were several other transmitters in the room but they always seemed to pick the HT-4-B; guess they were pretty smart mice!"

*Just one of hundreds of real life experiences of Hallicrafters equipment. Out of this valuable experience will come your peace time short wave radio.*

★BUY A WAR BOND TODAY!



ARMY E NAVY

**hallicrafters RADIO**

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


THIS ILLUSTRATION, REDRAWN FROM A DON LEE ADVERTISEMENT, APTLY DEPICTS THE NEGATIVE ATTITUDE OF SOME OF OUR RADIO ENGINEERS WHO WOULD DELAY FM BROADCASTING OR DEBASE ITS SERVICE TO LISTENERS

# COMMENTS OF AN FM LISTENER

## A Frank Discussion of the Harm That Can Come from a Negative Engineering Attitude Toward FM

BY M. B. SLEEPER

AS A listener who is now dependent upon FM broadcasting for home radio reception, I am not impressed by the engineers and executives who devote themselves so assiduously to conjuring up contingencies which conceivably could but certainly won't make FM service fail to meet all reasonable expectations.

I find it difficult to sympathize with those who want to tamper with the established width of the FM broadcasting channel, or would like to change the present position of the FM band or who want to postpone any decision on these and other points, saying that they are embarrassed at not knowing whether information available indicates potential future difficulties or not.

Instead, I am reminded of a remark addressed by Chairman C. M. Jansky, Jr. to his fellow members on the RTPB FM Panel: "It is my understanding that engineers are always in that embarrassing position. I have been in it ever since I started engineering. . . . Recognizing our possible absence of knowledge in the light of what we have available, if we want to we can comb the highways and byways of Great Britain and the United States and get still further information, but at some date we have to make up our minds. It is up to the Panel to decide when that point has been reached."

After reading and listening to statements from some of the engineers who wish to influence or delay decisions on postwar FM standards, I realize that I do not qualify for the privilege of expressing an engineering opinion on Frequency Modulation.

I used to think I knew quite a lot about this subject, but more recently I have come to understand that, to be an expert, it is necessary to know all about bursts, multipath distortion, sporadic "E's", the relative penetration of the lower frequencies, refraction in the lower atmosphere, "F-layer" transmission, and the sun-spot cycle.

You can judge the limited extent of my knowledge, therefore, when I confess that I have never heard any bursts. Neither have I listened to distortion which, even by stretching my imagination,

I could associate with multipath distortion. As for those other phenomena, I haven't the faintest idea why some engineers spend so much time talking about them because I have never heard them expressed in terms of interference with FM reception.

Yet I do claim to have done a great deal of FM listening during the last five years. I would say without hesitation that I have done much more listening, for example, than William Lodge of CBS, Raymond Guy and O. B. Hanson of NBC, or S. C. Spielman of Philco.

During the first of those five years, I traveled all over the New England and central states, giving demonstrations of FM reception. Wherever I could reasonably expect to pick up FM signals, I was able to demonstrate perfect reception, limited only by the quality of the program source. In many locations that I was sure were out of bounds for FM, I not only got perfect FM reception but substantially better reception than from the nearest AM stations.

During the first four of those five years, my home was in the Murray Hill section of New York City, right in the shadow of the Empire State Building, with the Muzak FM station to the south, the WABC, WOR, and WQXR FM stations to the north, and Alpine to the northwest. Only W2XWG, on the Empire State Building, was in line of sight with the 10-ft. inside wire that I used for an antenna at my third-floor apartment. All around me bristled the tall buildings of the Grand Central zone, and much of the truck traffic from the Queensborough Tunnel thundered through my west-bound street. I was fortunate enough to have AC, but on all sides were DC installations operating elevators, electrical machinery, and home appliances.

I had local reception of such 50-kw. AM stations as WABC, WOR, WEAF, and WJZ, together with the background of noise that made it unpleasant to turn the tone control up to full audio response. Yet there was not the slightest trace of noise on FM with the tone control in that position — not even from passing trucks.

I always listened to NBC, CBS, and Mutual programs on FM because reception was definitely better than on their AM stations. This applied to network programs as well as local originations, for none of these three was making full use of FM quality, even from their local studios.

Nor is any of these FM transmitters working at full power. Right now, NBC's W2XWG probably doesn't radiate 1 kw. CBS has its mast up a long time, but is still using a temporary rig for an FM antenna that is barely above the roof at 500 Fifth Avenue. WOR is transmitting from a vertical radiator which utilizes only a fraction of the transmitter output.

Still, located in a section of New York that is the despair of television engineers because of ghosts created by the tall buildings, I was unable to hear anything that I could, by any stretch of my imagination, call multipath distortion on FM.

For the latter part of the past five years, I have been living in Great Barrington, Mass. This is in the southwestern corner of the State, approximately 100 miles air-line from downtown New York. Although the elevation of my particular spot is 1,300 ft. it is deep in the radio shadows of much higher ranges on the east, south, and west, 5 to 10 miles distant. Moreover, Great Barrington is in the heart of the Berkshire Mountains, one of the worst sections for radio reception in all the New England States area where, as broadcast engineers know, the ground-conductivity is probably the lowest in the United States.

One of these days, I'm going to put up a proper antenna, but so far I have only a single wire running over the roof in a southerly direction to a chimney 24 ft. above the ground. It may be better than what most city residents use, but it's hardly adequate for FM reception where the nearest transmitter is 33 miles away. Yet under this handicap, here is the score of reception on my Freed-Eiseman receiver. On AM:

WEAF, New York, about 95 miles — No signal

WABC, New York, about 110 miles — No signal

WJZ, New York, about 110 miles — Reception spoiled by heavy background noise.

WOR, New York, about 115 miles — Can be heard through background in daytime. At night, fades in and out with another station.

WGY, Schenectady, about 55 miles — No signal

WBZA, Springfield, about 33 miles — No signal

WTIC, Hartford, about 33 miles — Barely audible above background noise.

Other stations can be heard dimly through the steady roar of background noise, if there is no natural static.

Summer static heard on AM is severe here, ranging from intermittent crackles to a nearly continuous roar, during thunderstorms, that sometimes promises to tear the cone out of the speaker. Then, our water pipes become so heavily charged that I have been severely shocked by touching them.

To summarize our AM reception: There is not one AM station that gives us signals of even fair entertainment quality. Our neighbors use their AM sets for news only.

By way of contrast, here is the score on FM:

WGTR, Paxton (near Worcester) about 66 miles — This is our strongest FM station. It is entirely free of background noise and natural static except for an occasional rasp during a thunderstorm in our immediate neighborhood.

W2XMN, Alpine, about 90 miles — Nearly as strong as WGTR with an equal freedom from static.

WDRC-FM, Meriden Mountain, about 50 miles — Weaker than W2XMN, but with ample volume to operate limiter. Occasionally we hear a little noise from approaching thunderstorms.

WTIC-FM, Hartford, about 45 miles — This low-power station comes in without any background noise, but we can hear the threat of approaching storms. Such static is not severe enough to interfere with musical programs. It is at the threshold of acceptable performance.

W2XWG, New York City, about 105 miles — This is the only New York City FM station we can pick up. Signals are not strong enough to operate the limiter. It can always be heard when it is on the air, but it usually has a slow fade from an adequately strong signal down to bare audibility. Reception is not of entertainment value.

In other words, we have all the benefits claimed for FM from three stations 66, 90, and 50 miles distant, and acceptable reception from a fourth. Considering the very low power output of W2XWG at present, I expect that, when power is stepped up to the intended level, it will give us a signal equal to WDRC-FM. Perhaps WABC-FM will do as well when the antenna originally planned for this station is completed.

When I say "all the benefits claimed for FM" I mean that literally. My neighbors, accustomed to making the best of the miserable AM reception here, are amazed and charmed by the faultless quality of FM. More than that, guests from other sections where AM conditions are much better have gone home with their minds made up that, come peace, they are going to have FM radios. Meanwhile, encouraged to become more critical, I am looking forward to owning a still better set, since mine is a moderately-priced model.

Perhaps I shouldn't be disturbed by William Lodge's comments in *Broadcasting Magazine*, August 14, 1944, about possible future conditions that may upset FM broadcasting which he summarizes with the statement that: "It is unfortu-

nate more is not known at present about the likelihood of long-distance interference in the present 42- to 50-mc. FM band. There are, however, at least four types of transmission which, for an unknown percentage of time, invalidate the classical assumption that FM stations cannot produce interference beyond the horizon." Then he lists 1) tropospheric transmission, 2) bursts, 3) E-layer transmission, and 4) F-layer transmission.

However, he is acting director of engineering for CBS and, as such, carries considerable persuasion. He does not say that he has ever heard a burst, or any other of the phenomena that he thinks "would be very distressing to both broadcasters and listeners." He doesn't even say that he is qualified by experience to have a mere listener's knowledge of FM reception. But, as the responsible head of CBS engineering he stigmatizes the system and sounds an alarm to prospective FM station operators, some of whom are less informed than he, with the statement: "Undoubtedly, the complete story as to how serious distant interference may yet prove to be in FM will not be known until there has been operation throughout one entire sunspot cycle."

Of course, the man who takes a negative attitude toward any new development is quite safe, and can usually call a lot of attention to himself. If he proves to be right, he can then say, "It's too bad you didn't listen to me from the beginning!" If he is found to be wrong, he can crawl out by saying graciously, "I'm delighted to find that I was mistaken!"

All of which may be good politics, but it's not good engineering — particularly when the same man, speaking to broadcasters at the recent NAB convention, implied that satisfactory color television is a reality when he said, "And since television must go to higher frequencies, I can see no engineering reason for not incorporating at the same time higher definition pictures and color." He does not say that he has ever seen acceptable color television, nor that he has any knowledge of such a development. Certainly the mechanical color system which has been demonstrated by CBS, giving to objects moving across the camera the effect of badly off-register printing, is no companion to high-definition television.

There is no intention to single out the remarks of William Lodge in this discussion. His attitude is shared by others. Here, for example, is a discussion reported in the minutes of RTPB Panel 5:

THE CHAIRMAN: Who knows when the next sun spot cycle will appear?

MR. LODGE: About 1948. So we will start having our trouble around 1947, 1948, and 1949, just about the time FM gets thoroughly on its feet.

MR. DAVID: Does that mean we have to wait until 1948 to decide this question? (Of the FM frequency band)

MR. GUY: No, sir. It means that if you decide now, you may be very sorry in 1948.

MR. DAVID: Are you saying this band (40 to 50 mc.) is not good for any type of radio, then?

MR. GUY: I didn't mean to say anything of the sort, Mr. David. I only want to point out what I consider is a dangerous situation which may, and I hope does not, result in a decision to locate FM in a portion of the spectrum in which you may have interfering signals coming in from points 1,000 miles away, with intensities of 1,000 microvolts per meter.

**THIS article has been in course of preparation for nearly five years — ever since the time when I started out to introduce FM receivers to radio dealers by giving demonstrations in their stores and at dealer meetings.**

**I know the deadly effectiveness of the negative attitude because, after giving the most perfect demonstrations of FM reception that should have resulted in substantial orders for sets, I have seen all my efforts wiped out by a third-rate wise-cracker who, first moving his chewing gum to the other cheek, said merely: "That stuff is the bunk. If it was any good don't you suppose my company would be making those sets too?"**

**Human nature being what it is, one such remark was enough to put the dealer on the defensive, and to make him say: "Well, I guess I'll wait a while and see what happens. I'll pass up FM for the present." Gone were his thoughts of greater profits from sets that would give his customers better service and greater enjoyment. Gone, in twenty seconds, was an hour's time spent in trying to implant constructive, progressive ideas in that dealer's mind.**

**My own belief is that FM must be far better than its most enthusiastic proponents have ever realized themselves. Only by having intrinsic worth as public service far beyond the limitations of AM could it have so successfully survived the attacks of negative-minded men who, for various selfish reasons of their own, have hoped to hold back the progress and expansion of FM.**

This solicitude for FM sounds almost convincingly sincere until it is recalled that the RTPB Television Panel has consistently asked for frequencies from 40 mc. upward for television broadcasting. Interference between television stations operating on the same frequency would be far more serious than on FM, because it is highly susceptible to such interference while FM has better than a two-to-one ratio of protection.

Fortunately, the question as to the suitability of the present FM band was settled by referring the matter to Dr. J. H. Dellinger, Chief of the Radio Section, Bureau of Standards. He replied that the fear of sporadic-E transmission and other interfering phenomena associated with the sun spot cycle "is not well founded." He added: "It may also be stated that no radio frequencies are free from transmission vagaries."

Unfortunately, that is only one angle from which FM is being attacked. Equally serious are the efforts to debase the quality of service which FM can provide. These are attempts 1) to narrow the present 200-kc. FM channel and 2) to reduce the established audio fidelity of 15,000 cycles.

Among those who would reduce the noise-free service which FM can deliver to radio listeners is S. C. Spielman, of Philco. After the RTPB FM Panel had settled on a 75-kc. swing and a channel width of 200 kc., Mr. Spielman undertook to reopen this matter, submitting both a letter and an engineering report from Philco in which he set forth reasons for a 50% reduction in the frequency swing and channel width.

To justify this reduction, he referred to field tests conducted by NBC which showed that under practical conditions, the 100-kc. channel will give much better performance on weak but usable signals than the present 200-kc. channel and, therefore, will extend the service area.

The dangerous thing about this statement, as Mr. Spielman used it, is that it is absolutely true! But it is only a half-truth.

The whole truth is that the service area would be still further increased by cutting the swing to 40 kc. However, the result would be to reduce the noise-eliminating feature of FM to the point where it would be no better than AM!

On the other hand, the maximum service area that can be covered with a received signal equal to the quality of that sent out by the transmitter would be attained with a swing of 125 kc., which would require a 300-kc. channel. Thus the present 75-kc. swing and 200-kc. FM channel does not deliver the optimum service to listeners, but represents an intelligent compromise between service and the practical utilization of the frequency band available for FM broadcasting.

Why should Mr. Spielman, representing the largest manufacturer of home radio receivers, want to reduce the quality of FM reception to a point where it is hardly better than AM, arguing that it should be

(CONTINUED ON PAGE 73)

# PREVIEW OF FUTURE BROADCASTING

## An Address Before the National Association of Broadcasters Conference, Chicago, August 30th, 1944

BY JAMES LAWRENCE FLY*

THE history of radio broadcasting since its static-ridden, squeaky-voiced beginnings in 1920 has been one of uninterrupted improvement and uninterrupted expansion. Revenues and profits have grown year after year; technical improvements have been introduced in a continuous procession; and, subject perhaps to a few minor qualifications, program quality has kept step with the onward and upward progress of the art. The question, therefore, which now faces broadcasters is this: Can that march of progress continue unabated through the years of readjustment which lie ahead? I should like, in brief digest form, to suggest some answers to that question on all three levels — commercially, technically, and with respect to programs.

**Progress of Broadcasting** ★ First, the commercial aspects. Two years ago, many broadcasters faced the future with fear and foreboding. The war, rationing, full employment, overtime, night shifts, a sellers' market, censorship restrictions, and the wholly unwarranted bogeyman of government operation — which was never even dreamed of by anyone in authority — these and other fears and forebodings were widespread in the industry.

We all know the sequel. The year 1942 was the most prosperous in the history of broadcasting; and 1943, as shown by figures just compiled by the FCC, topped even 1942 by a tremendous margin.

In 1942, for example, the standard broadcast stations and networks reporting to the Federal Communications Commission had net time sales of about $164,000,000. In 1943 these revenues had increased to nearly $196,000,000 — an increase of approximately 20 per cent.

This increase in revenues resulted in an even greater increase in profits. Net income from broadcasting in 1942, after all expenses but before Federal income tax, amounted to about $45,000,000. In 1943 net income expanded by almost 50 per cent, to the all-time high of $66,000,000.

The networks, of course, accounted for a considerable portion of this increase, but even excluding the networks and their owned and operated stations, the 1943 picture was phenomenal. Indeed, it appears that the smaller the station, the greater the percentage of improvement. Thus the net income from broadcasting of the 50,000-watt clear-channel stations increased in 1943 by about 22 per cent over 1942; the 5,000- to 25,000-watt stations increased by 56 per cent; the regional stations by 51 per cent; and the local unlimited-time stations by 188 per cent.

Last year, I devoted considerable time to a discussion of those stations which showed a net operating loss for the year. In 1942 there were 194 such stations, and it was feared that many of them would go off the air altogether. I am glad to report that not even a handful have actually ceased broadcasting; indeed, the mortality rate among broadcasting stations is phenomenally low. And the number of "losers" declined from 194 to 94, a further sign of commercial health.

The number of stations affiliated with the major networks in 1942 totalled 572. This increased to 604 during 1943, perhaps in part as a result of the reduction in telephone line charges initiated by the Commission, and to some degree as a result of the Chain Broadcasting Regulations and the separation of the NBC and Blue networks. Thus more than two-thirds of the nation's standard broadcast stations are now affiliated with the nationwide networks. It remains true, however, that the networks do not yet serve the entire country, and that some unaffiliated stations serve areas not presently served by one or more of the four networks. There is thus room for a further expansion of network coverage, and a further affiliation of independent stations.

**Postwar Forecast** ★ But what of the future? Several of the factors which made broadcasting so profitable in 1943 and so far in 1944 will not last forever — the newsprint shortage, for example, and the present tax ratio. Will these changes result in a setback for broadcasting?

I venture to doubt it. For at the precise moment when war-engendered revenues are withdrawn, new factors will arise to take their place. Countless manufacturers will have to re-educate the entire public to the use of their products, and they will inevitably turn to radio. Not only will products long withdrawn from consumers because of the war be back, but new products will be marketed, with the resulting necessity for advertising them.

Much depends, of course, upon the direction taken by our entire economy. If industry, government, and labor cannot get together to engineer a smooth transition from war to peacetime production and distribution, if full production and full employment cannot be achieved throughout our economy, if segments of our society are to battle with one another rather than work together in harness towards the common goal, then difficulties may lie ahead. But the experience of the war years has certainly shown that there is no need for such internal strife. We can all pull together; and if we do, all will benefit. A decade of full production and full employment would certainly open up to the American people a great future — not merely in terms of a perpetually rising standard of living, but also in terms of a successful solution to the social strife which characterizes periods of depression.

Broadcasting is in a peculiarly favorable position to contribute its share to this postwar goal of full production and employment because, at the very moment when returning soldiers are coming back for jobs and manufacturers are turning from war to peace production, broadcasting will be launching vast new projects for public service. FM and television, the two great ventures which lie ahead, ensure that broadcasting will do its share to see that the postwar era is one of expansion and prosperity rather than contraction and depression.

**FM Planning** ★ With respect to FM, the future seems assured. Manufacturers are estimating that 5,000,000 FM receivers will be marketed a year during the four years immediately following resumption of civilian production. The average radio receiver today must be at least five or six years old — ready and eager for replacement, and it seems likely that a large proportion of radio owners will replace their prewar sets with receivers which provide for FM as well as AM reception.

The marketability of FM receivers is already well established. It takes no great memory to recall that during 1941 the only limit to the number of FM receivers which could be sold was the number that could be manufactured — and that was true despite the fact that FM program transmission was barely under way. With several hundred FM transmitters ready to

* Chairman, Federal Commission, Washington, D. C.

go on the air as soon as the "freeze" is off, and additional hundreds well along in the planning stage, the receiver market will move right along in step. To take a more pessimistic view would be to fly in the face of common sense and of the actual experience of 1941.

Technically, there are still a few FM problems to be solved. One has to do with "bursts," or sudden program interruptions, which may last a fraction of a second or longer — just long enough to be a nuisance. A second is the increasing evidence of secondary FM service, so that stations in Wisconsin and Massachusetts, for example, are audible for hours at a time in Kentucky. But those are obviously the mere growing pains of an important new venture; and engineers are already at work to get the right answers.

**FM Research by FCC** ★ So that the Commission may be as informed as possible, the Commission has drawn and still is drawing on all available resources for the latest and most accurate information. To complement other sources the Commission, through the coöperation of its Field, Technical Information, and other Divisions has long been engaged in the collection of extensive field data; propagation characteristics have been observed particularly in the critical 40-odd-megacycle band. FM and television stations here, as elsewhere, have coöperated wholeheartedly.

Within a few days our engineers will begin experimental operation in the Washington area with a small FM transmitter in the 40-megacycle band in order to gain first-hand information with respect to the same and adjacent channel interference, and other practical operating characteristics for several values of frequency swing.

With the continued coöperation of the industry, we should approach the important September 28th hearings with much useful data.

**Utilizing Full Capabilities of FM** ★ The Commission, as you know, is concerned that the growth of network broadcasting on FM shall be along sound lines. The appearance of network operations in the FM field point to a rapid growth of FM network broadcasting. Sound forethought is especially needed to prevent FM from becoming a mere replica of AM, thus sacrificing FM's inherent advantages and improved program structure. This does not mean that the simultaneous broadcasting of programs over FM and AM is always or necessarily an evil; but it does mean, and the FCC rules so provide, that stations must be on the alert to provide programs specially suited to FM's wider capabilities and AM programs of established merit.

After all, broadcasting has here an opportunity to build from scratch. Any errors which have through the years become imbedded in the program structure can be eliminated from the new FM structure without a major operation. On our end, the Commission and its engineers are endeavoring to avoid the pitfalls of AM in the composition and distribution of the traffic. You yourselves can make comparable improvements in the quality of programs. Reducing the long agonizing hours of the drip, drip, dripping of the suds seems to be beyond the courage of the AM industry. But low quality and major program unbalance need never arise in the FM band.

At still another point the public interest requires that certain minimum standards be established and adhered to lest the benefits inherent in better broadcasting be lost — that is, in the design of receivers. This is neither my job nor yours — but it is one which the manufacturers should face collectively.

**The Coming of Television** ★ Side by side with FM we have the coming of television, which affords unlimited potentialities for postwar expansion. As you know, the Commission has already licensed nine commercial television stations; 60 applications are pending, and many more are in the planning stage. The major task now is to complete the basic research projects which were left incomplete at the outbreak of the war, and to assimilate the vast technical progress which has been made during the war. I am confident that as soon as the practical applications of wartime advances have been worked out in television, it will be ready to move ahead on a tremendous scale.

Much will depend upon the *timing* of television advance. After all, it would have been possible to erect television transmitters and to sell television receivers at high prices as far back as 1929. In the stage of the art then reached, however, the public reaction would almost certainly have been negative, and the investment of the industry and of the public alike would have been wiped out. Again in 1939, there was the danger of freezing television progress at the level then reached. Today, the television outlook is clearer and more hopeful than ever before in history. The opening up of the new very high frequencies points the way to a place on the air for television where a moving image technically far superior to any known before will be possible, and where there will be plenty of room for competitive expansion. By harnessing this new knowledge to television immediately, it may be really possible to live up to the slogan of the future: "You're *there* with a television receiver."

**Television Standards** ★ One application already filed with the Commission calls for a television image far clearer than any heretofore known, and it is contemplated to put it on the air within a matter of months after the freeze is off.

In a recent report, the British Institution of Radio Engineers makes this observation:

> "It is suggested that the immediate postwar television standard will, in fact, be permanent; it is, therefore, desirable that these standards should not be frozen at a level that is below the technical and economic limits of the present time."

Where improvement is so needed, and where respectable engineering opinion indicates its attainability, it is obviously of the utmost importance that the fullest possible experimentation be undertaken as rapidly as possible, in order to get the right answers and to get them promptly. Neither the broadcasting industry nor the public can afford a false start. The Commission is prepared to encourage such experimentation on the higher frequencies to the fullest extent possible, in order that the final decision on postwar television standards can be made in the light of all the facts at the earliest feasible date.

**Television above 500 Mc.** ★ The war has produced something in the nature of a beneficent stalemate; television has not been locked down to the pre-war standards. From the war-time research laboratories have come many developments which soon can be applied to the improvement of television. It is reasonable to expect that the military restrictions on much of this information will be lifted at an early date. Meanwhile, leading research engineers of the industry think that it may be feasible to develop tubes to broadcast in the frequency range above 500 megacycles; that the propagation characteristics here give promise of affording a better plan of allocation than can be achieved in the present television bands below 100 megacycles; and that the ghosts, or reflections, which were so greatly feared heretofore can be slain by scientific methods.

What can be achieved in the very high frequencies? Primarily, the spectrum will be less crowded in that region and there will be room to spread out and do an effective job. The bandwidth may be easily three times that of the pre-war standard. A comparably greater number of scanning lines may be utilized and a thoroughly satisfactory picture with great clarity and much detail can be delivered to a larger screen in the receiver at home. This is the minimum which we require if we are to have the wholly successful and enduring system. Color television will give marked improvement. It is in the making now and at some reasonably early date color tele-

(CONTINUED ON PAGE 64)

# AN ENGINEER'S OPINION OF FM RADIO FOR RAILROADS

## FM Is Suffering from Comparisons with Previous and Unsuccessful Efforts to Use AM for Railway Radio. Many Railroad Officials Fail to Understand That FM Can Succeed Where AM Could Not

BY JOHN DRANEY*

**WE present here the opinions of John Draney who, in his 59 years of railroading, has piloted both steam and diesel-electric locomotives. By his experience, he is qualified to speak with authority on the subject of radio as a supplement to signalling and safety equipment already in use. Widely known in railroad circles, he is particularly famous for his record-breaking run, still unequalled, of 6 hours and 45 minutes from Hoboken to Buffalo, when he took Dr. Janeway to the bedside of President McKinley, after the President had been shot by an assassin.**

THE elapsed time from Marconi's first successful wireless transmission, up to Dr. Armstrong's present day FM application, somewhat parallels the railroads' quest for better and safer signaling and communication devices.

As early as 1850, railway engineers toyed with the possibilities of duplicating right-of-way signals within the locomotive cab. An external contacting device was patented in England in that year. In 1872, Forest and Lartigue, two engineers of the *French Northern*, invented a cab indicator and by 1880 the double track lines of that road had been equipped with the apparatus. The open circuit principle was used. It turned out to be a fair weather gadget, however, as storms and bad electrical grounds left much to be desired in the way of foolproof action.

In 1906, the *Great Western* of England adopted a similar system which worked on the closed circuit principle. An annunciator bell supplemented the visual signal-in-cab, probably inaugurating the first attempt to utilize the engineman's sense of hearing as well as sight, within the locomotive.

Turning to our own country in 1920, an Interstate Commerce law was enacted (sec. 26) which stated: "That the Commission may, after investigation, order any carrier by railroad subject to this act, within a time specified in the order, to install automatic train stop or train control devices, or other safety devices, which comply with specifications and requirements prescribed by the Commission upon the whole or any part of its railroad, such order to be issued and published at least two years before the date specified for its fulfillment."

On January 10, 1922 the Commission ordered 49 railroads to install automatic stops or train controls by July 1, 1924, but gave the railroads until March 15, 1922 to contest the order. On June 13, 1922, order number 13413 was issued requiring the 49 railroads to install, on or before January 1, 1925: "An automatic stop or train control device or devices applicable to or operated in connection with the road engines running on or over at least one full passenger locomotive division included in the part of each such company's main line between points hereinafter designated." These points were thereafter designated by the Commission.

The Pennsylvania Railroad volunteered to comply with the Commission's preliminary order, choosing to go ahead on its own initiative before the official order was entered. The P.R.R. had an enviable record on progressive ventures. Along with the devices specified, Pennsylvania went a step farther and supplemented them with the signal-in-cab system as we know it today.

Anyone who has reviewed the painstaking analysis of railroad collisions which have occurred on standard signal divisions could not sanely assert that FM radios or *any other instruments* would be 100 per cent insurance against rail disasters. The greatest number of rail accidents can be traced to human failure, such as a) misreading signals, b) reading signals on an adjoining track, c) running under approach signals at unreasonable speed — *assuming* a change before the signal is reached, d) missing the approach signal under adverse conditions of visibility due to smoke or the elements, or e) engineman being ill, incapacitated, negligent, or asleep.

The modern visual and aural signal-in-cab system eliminates many of these gambles which occur outside of the locomotive. However, scientists and engineers, in the never-ending search to close the gap between present day developments and infinity, systematically discover new methods which continually improve on the old. From the beginning of the railroad industry until 1941, direct two-way voice communication between a central point and moving locomotives had never been accomplished successfully. That is, it had never been proven practical for railroad use. Amplitude modulated radio equipment offered too many stumbling blocks in the way of high background noise-to-signal-ratio, and interference from internal and external electrical sources, both natural and man-made.

Frequency Modulation radio, as developed for emergency services, has something tangible to offer to the railroad industry. Military requirements for radio equipment have opened up avenues of research that would have been financially impossible to undertake under ordinary circumstances. In 1941, Link Radio Cor-

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poration manufactured FM radio systems that proved both practical and economical for use in the country's largest Army ordnance plants. These installations were on the diesel type locomotives, and tests over a long period of time indicated that the following possibilities for railroads existed:

1. Radio communication circuits with all the safeguards against failure and false operation that are now so carefully made a part of railroad signaling and indicator circuits.

2. Block signals or other signals duplicated in locomotive cabs.

3. Three-way train-to-dispatcher, train-to-train, and dispatcher-to-train voice communication.

4. Two-way, engine-to-caboose voice communication.

In addition to serving the ends of safe operation, there are many ways in which radio can speed the movement of trains by avoiding delays due to the fact that there is no means of continuous communication between dispatchers and engineers. To take just one typical example:

Two trains are proceeding toward the meeting point under an order 31. Train A is maintaining its proper time schedule, but train B has developed trouble and is losing speed. Under these circumstances, train A will possibly lose 15 to 30 minutes waiting for train B to arrive at the meeting point, there being no means for communication to the divisional dispatcher to have train B's order 31 superseded. The use of FM radio will overcome one of the railroad's most common deficiencies: not maintaining schedules due to unforeseen failures, and having no instantaneous communications to rectify such situations.

The economical feature is that any or all of these proven possibilities can be built on one initial FM radio communication system. Only one transmitter-receiver unit is required at each mobile point entering into the radio network. The number of separate communication channels required for operations would determine the number of receivers at main stations or relay stations along the right-of-way.

Further military developments have opened up schools of thought on other applications still on the initial system as installed. For further economy to roads with limited appropriations, another lesson can be put to practice as used in the Armed Forces. FM equipment can be designed in portable units to be assigned to train crews as they are ready to move off on schedule. They would take their own units, slip them into place, and lock them there for the round trip. After the run, these units would be turned over to other crews going on duty. Thus, engines or other rolling stock in the shops for repair would have no idle radio equipment aboard.

It still remains for the country's railroad executives and engineers to view the situation on a long range basis, planning for the foundation of FM radio to *supplement* the present day methods of signaling and communications for the time being, but with an eye to future developments. Such plans should be a must on blueprints of postwar railroad equipment. Perhaps some enterprising road will come to the forefront, as the Pennsylvania did in 1922, and pioneer the FM radio path.

When police departments and other organizations with a need for emergency radio communications first entertained the idea of FM, there were those people on the sidelines who looked on doubtfully and shook their heads. Yet today, the field has expanded so rapidly that new ventures on the horizon have put the legitimate emergency services on their toes, to see that they have the proper channels and enough of them after the war.

Much abuse has been heaped on the railroads for unavoidable disasters during this period of war emergency. The railroad industry, like all others, has suffered greatly due to manpower shortage. Current indications are that some of the railroads will foster radio experiments in spite of shortages of any kind. For this they are to be commended highly.

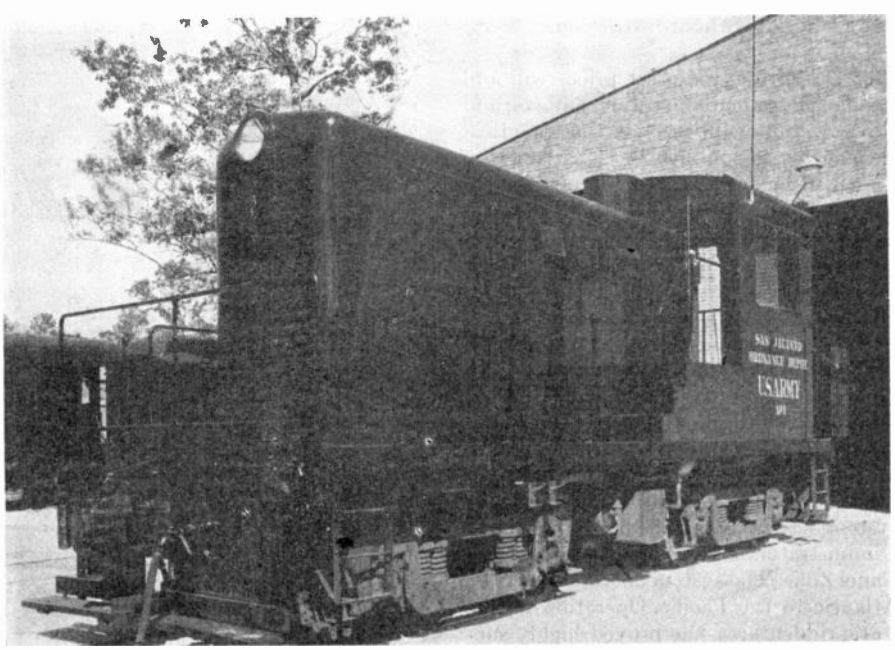
The licensed FM manufacturers who have devoted so much time and talent toward the successful conclusion of the war can only hope that the railroads will profit by the experience gained in the widespread use of FM by our Armed Forces. Two- and three-way voice communication, such as afforded by these present FM instruments, working in conjunction with standard railroad signaling and communication devices, can perform an exceedingly useful service on any railroad. It would be difficult for even the most skeptical person to deny that direct, interference-free FM voice communication has more advantages than any other method now on test or in use by the railroads.

## POSTSCRIPT

JUST when this article had been set in type, newspaper headlines announced another railroad tragedy, this time on a single-track stretch of the Chicago and Eastern Illinois lines. Twenty-nine were killed, sixty-five injured in a head-on collision. Except for the fact that one train carried only express and mail, the toll might have been doubled.

The wreck occurred 3 miles from the nearest siding, at 2:20 A.M., in a very heavy fog. No explanation of the possible cause of the wreck was made public. However, it is obvious that if the locomotives had been equipped with radio, each engineer would have had knowledge of the train approaching on the same track, long before time to apply the brakes to prevent this collision!

On the same day this wreck occurred, the Pennsylvania Railroad announced the construction of a new type of locomotive capable of hauling 125 freight cars at 50 miles per hour. Might it not be well to delay plans to further increase the speed-up of railway traffic until such time as safety means and communications methods have been brought up-to-date?




2-WAY FM HAS PROVED HIGHLY SATISFACTORY IN U. S. ARSENAL FREIGHT YARDS

# SPOT NEWS NOTES

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

DIRECTORS OF TELEVISION BROADCASTERS ASSOCIATION MEET AT SCHENECTADY

**Civilian Radio:** Unless further changes at WPB alter present planning, manufacture of home radio sets and broadcast station equipment may be resumed without limitations at the end of October. Military radio-radar production will then be cut about 40% below present volume, making ample manpower and materials available for initial civilian needs.

Tentative plans to ration production at the start have been abandonned. Obvious reason is that manufacturers could not agree on basis of production allotments for established radio concerns nor on provisions for newcomers. The only plan fair to all is to wait until the whole industry can go ahead without restrictions.

**Price Ceilings:** On radio set prices will add headaches for manufacturers, jobbers, and dealers, but will provide no practical benefit to the public. Most satisfactory plan will be to permit manufacturers to set their own list prices. Then OPA can protect the public by limiting retail prices to manufacturers' list FOB factory. Dealers should be allowed an installation charge if they do the installation.

**FM Broadcast Transmitters:** Of all ratings up to 50-kw. or higher, if required, will be manufactured by Federal Telephone and Radio Corporation, Newark, N. J.

**FM at Canal Zone:** A 2-way FM radiophone system has been installed for the public administrators and police of the Panama Canel Zone. The system operates from the Atlantic to the Pacific. Operation in this static-ridden area has proved highly successful. This is a Motorola installation.

**T.B.A. Directors:** Meeting at Schenectady, directors of Television Broadcasters Association were given first hand information on the lighthouse tube for television broadcast and relay transmitters by G.E.'s B. W. Cruger. In the picture here, left to right, are Paul Raibourn, Paramount; F. J. Bingley, Philco; R. L. Gibson, G.E.; Allen B. Du Mont, Du Mont Laboratories; Worthington Miner, CBS; B. W. Cruger, G.E.; John Poppele, Mutual; and William Bellin, secretary and treasurer of T.B.A.

**Dissolved:** Stockholders of The American Network, Inc. voted on August 31st to dissolve this corporation. In a brief announcement, no reason was given for this action.

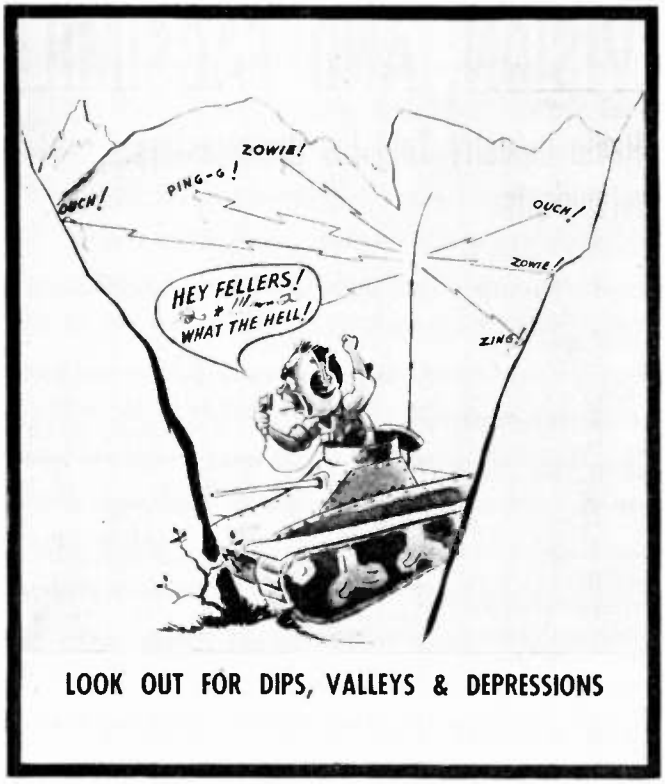
**FM Movie:** Yankee Network is using frequent spot announcements to invite listeners to see *The Story of FM*, shown three times daily in one of the Yankee studios. It is G.E.'s remarkable animation of FM circuit functions, coupled with a simple story of improved radio entertainment. Result is high y effective promotion for FM sets.

**Television Applications:** CBS, after announcing that it will not operate television transmitters below 100 mc., except for the present New York Station WCBW, has applied for construction permits to erect stations in Boston, Chicago, Los Angeles, and St. Louis on frequencies in the neighborhood of 500 mc.

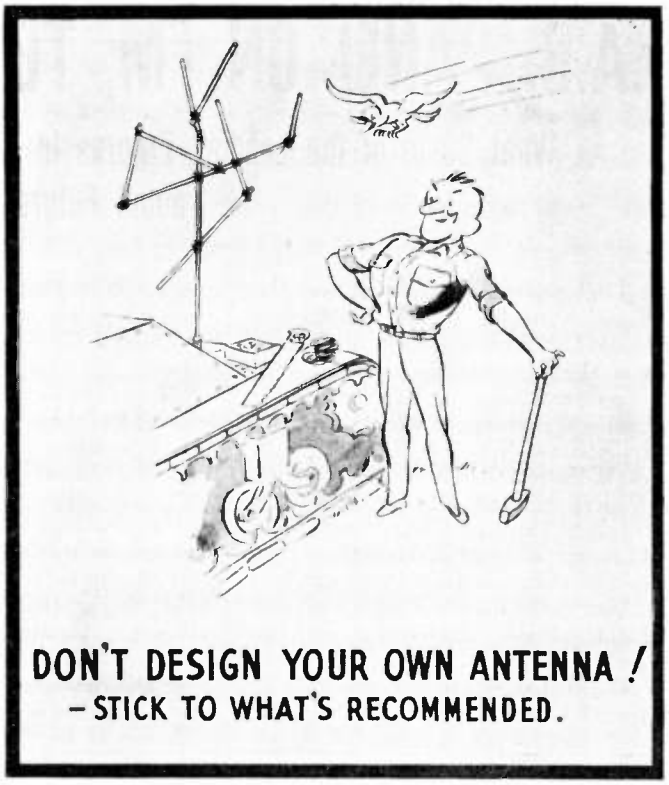
**Super Salesgirls:** Employees of Freed Radio Corporation more than tripled its Bond quota in the 5th War Loan Drive. In a contest organized by vice president Arthur Freed, three girls pictured below won top honors and bond prizes offered by the Company. From left to right they are Hope Correale, Florence Barashick (sales $56,200) and Genevieve Zeiss. These girls are all experts on FM set production, for Freed Radio is rated as the largest producer of special-purpose FM military equipment.

(CONTINUED ON PAGE 71)


ARTHUR FREED WITH HIS PRIZE-WINNING CREW OF SUPER BOND SALESGIRLS




LOOK OUT FOR DIPS, VALLEYS & DEPRESSIONS



DON'T DESIGN YOUR OWN ANTENNA!
– STICK TO WHAT'S RECOMMENDED.

CHEW THE FAT AT THE MESS
—*NOT* AT THE MIKE!


# NEWS PICTURE

THE Army has been illustrating its instruction manuals that put into dull type and diagrams some highly effective meaning, purpose, and action. Illustrations such as these have done more to sell the Army, for example, on the proper use of the Western Electric SCR-508 and 608 FM tank equipment than any words, written or spoken, could possibly do. Manufacturers can use this same idea, with equal effectiveness, to sell the correct installation and operation of their new home radio receivers.

# N.A.B. PANEL ON FM, TELEVISION, AND FACSIMILE

## What Some of the Leading Figures in the Radio Industry Told the Broadcasters about Future Developments

OF THE various meetings at the National Association of Broadcasters Chicago Conference, largest attendance was at the technical discussion of FM, television, and facsimile. The speakers, in the order of their appearance, were: Paul Chamberlain of G.E., Thomas F. Joyce of RCA, William B. Lodge of CBS, William S. Hedges of NBC, Major Edwin H. Armstrong, Paul F. Godley, and John V. L. Hogan of WQXR, WQXQ.

Opinions expressed by these speakers were that 1) FM broadcasting will expand on a national scale immediately upon the release of equipment, and ample production of FM-AM sets will be available, 2) commercial facsimile broadcasting and home recorders can be expected in advance of television, and 3) television broadcasting and home receivers have reached a state of commercial perfection, and will be available within a reasonable time after frequency allocations have been settled and engineering talent is free to concentrate on the final design details.

### PAUL CHAMBERLAIN

**General Electric Company**

Pointing out that FM provides the only means for the improvement and expansion of broadcasting, Paul Chamberlain said: "Within a short time following the war FM Stations will be built in most cities now having AM Stations. FM is also expected to prove economically sound in cities which have not previously supported a Broadcasting Station. FM is the solution to the problems of fading, interference, and static that have hampered low power AM stations. 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 AM reception. To the listener, FM means virtually static-and-interference-free reception plus music that far surpasses any reproduction by conventional radio.

"FM is of particular advantage to the lower power stations. As an example, based on average ground conductivity a 1400 kc. 250-watt AM station with a 331-ft. vertical antenna has a daytime range of 13 miles and a nighttime range of 4.8 miles. A 250-watt FM transmitter with an antenna of the same height will deliver consistent day and night coverage over a radius of 29 miles and will neither cause interference with other stations or be affected by interference from other stations.

"Most broadcasters could do a better job with FM than they are now doing with AM, especially those on the crowded regional and local channels. In such cases, FM offers better coverage of the same area at less cost, or better coverage of more area at the same cost. . . .

"FM transmitters before the war were slightly higher than AM transmitters for ratings up through 3 kilowatts. Above that, the FM transmitters were priced lower than corresponding AM transmitters. The prices of low-power FM transmitters may be more in line with AM transmitters post-war.

"It is logical to locate the studio for operating convenience. It could well be placed in a downtown location in the average city. The transmitter should be where it will have maximum coverage, a nearby hilltop or mountaintop or the top of a tall building. The gap between studio and transmitter could be bridged by wire lines. However, in many locations it is more economical and satisfactory to use a high-frequency low-power radio link. Such links are giving extremely satisfactory results up to 110 miles.

"What about networks for FM? Networks probably will operate by means of wire lines, on coaxial lines, and point-to-point high-frequency radio relay. Recent announcements by A.T. and T. and I.B.M. point to the establishment of adequate network facilities.

"Now a brief discussion of the FCC Allocation Plan for FM stations. FMBI and RTPB are studying the present plan with the objective of recommending certain changes. Briefly — the contemplated changes are:

1. An increase in the present band width now allocated for FM broadcasting.
2. A complete elimination of classes of stations — or at least a reduction in the number of classes.
3. A separation of the present rigid coupling between trading areas and service areas of the FM stations.
4. A modification of the present rules to permit FM applicants to start with less power than their ultimate plans call for — or in other words — not require all FM broadcasters in a given area to install facilities for the same coverage.

"If these changes are put into effect, the establishment of FM stations will be governed mostly by economics and the spheres of influence which the applicants can justify in the eyes of the commission. . . .

"As to General Electric's future plans: FM will dominate our product design and merchandising and advertising program. Tentative plans call for FM receivers in all but the lower priced brackets. Omitting the AC-DC sets from the picture, we expect our post-war line to consist of FM sets to the extent of 80 to 90 per cent.

"We believe the industry will produce 5 million FM receivers in the first full year of unrestricted post-war production and in the following four or five years this total will grow to about twenty millions. . . .

"We will continue to back up our confidence in FM in our advertising. For eight months our consumer magazine advertising and many of the commercial messages on our network news program, "The World Today", have been devoted to FM. . . .

"It seems reasonable that FM will eventually supplant all local, most regional, and some high power stations. The present AM band would be cleared up — making more clear channels available for high-power and possibly super-power AM stations. Such a transition would be generally beneficial as it would give the public FM reception plus better AM reception.

"Let us turn to television. Nine commercial television transmitters today serve an area in which twenty-two million people live. Interest in television has grown rapidly in recent months and many forward-thinking broadcasters, department stores, newspapers and merchandising organizations are making plans to enter the field of television broadcasting. Representatives of these industries are coming to Schenectady to see the facilities at WRGB. The 40-kw. visual transmitter is the world's most powerful. The studio is one of the best equipped — with mobile cameras — motion picture projectors — control and monitoring equipment and picture and sound studio-to-transmitter radio relay transmitters. . . .

"One major economic problem facing television is reaching larger audiences — thus increasing the circulation and reducing the programming cost-per-listener.

"The first step involves the construction of master television stations in larger cities. These stations would have studio facilities and staffs capable of originating programs such as musical comedies and plays. . . .

"One of the first ultra-high frequency radio relay circuits will be installed between Schenectady and New York City by the International Business Machines Corporation — subject to FCC approval — just as soon as conditions permit. This system will be a multi-channel two-way circuit operating above 2000 mc. The apparatus will be designed and built by General Electric. A second radio relay will connect New York City with Washington, D. C., and intermediate points and extension to other cities is contemplated. Such facilities will make programs from master television stations available to other stations on the network. There are about 80 television stations scheduled for construction based upon licenses granted or applied for. These stations will serve areas with a population of more than 30 million. . . .

"We fully realize the necessity of providing the public with high quality television receivers at popular prices. And when we say popular prices we do not mean four-, five-, or six-hundred-dollar merchandise exclusively.

"Lower cost receivers will undoubtedly be of the direct-view type. Our line will consist of both direct view and projection models. The direct-view models employing, for example, a 12-inch tube will be relatively inexpensive. We anticipate such a design because it will insure excellent picture contrast and definition. If a larger picture were provided in the lower price receivers we would have to sacrifice picture quality to some extent over that obtainable with a direct-view tube.

"The higher priced television sets will be designed with a projection tube that will provide an excellent picture up to 18 by 24 inches. Satisfactory projection type television sets are inherently more expensive to produce than direct-view types."

### THOMAS F. JOYCE

**Radio Corporation of America**

Using slides and phonograph recordings, Tom Joyce discussed the post-war markets for television receivers. Always an interesting speaker, it seemed to this writer his talk was more entertaining than convincing.

As an indication of the general interest he quoted figures from the Franklin Square Bank where 22% of the depositors who have opened accounts earmarked for postwar purchases are saving up to buy $400 television sets; the *Newsweek* poll which, in a 14% return, showed that 32.4% of the people replying want to buy television sets, putting this item second only to automobiles; and *McCall's* survey of postwar plans to which 67% of the women taking part said they "like and may get" television receivers, and 16.5% said they "must have" them.

The element lacking in this data is a check on the percentage of these people who have actually seen television. The probability is that most of them are asking for what they *think* television to be, rather than what it is in its prewar state. On the other hand, if people throughout the nation had seen such television as is being promised postwar, the figures might have been even higher.

Similarly, data quoted on television station coverage related to population, wired homes, and buying power, as indicating the number of television sets to be purchased 1, 2, 3, 4, and 5 years after the end of the war, were not conclusive. Conclusions drawn from this data source have been known to be altogether misleading.

The final evidence offered was a recording of answers to telephone offers to repurchase 36 of the television receivers in the New York City area. Only one owner was willing to part with his set. On the basis of this result, Joyce concluded that: "If the present owners of television receivers, in these times of severely limited broadcasting conditions and meager program fare, place such a high valuation on the pre-war instruments they possess, how much more eager will they be, and how much more eager will be the great public they represent, under the vastly more favorable conditions that will soon prevail. It is expressions of this kind, added to our own knowledge and convictions, that give us infinite faith in a television ready to surge forward as soon as practicable after the last shot has been fired."

### WILLIAM B. LODGE

**Columbia Broadcasting System**

To those who think of CBS as a progressive and aggressive organization, William Lodge's talk was something of a disappointment. He opened his talk with the statement that: "In my brief remarks I will attempt to avoid the conservative stand which says there will be no change, and equally to avoid the over-imaginative flights of fancy which have no basis in fact."

Then, admitting that, "It is quite evident to all who are engaged in the broadcasting business that radio is faced with a period of many changes," he seemed to deplore this new state of affairs, and to look with apprehension on the future when the existing AM setup will be beset with competition from FM and television. In this connection he said: "The questions raised by FM and television will undoubtedly slow the expansion in the AM field and cause AM station operators to question the advisability of proceeding with plans for power and frequency changes which do not give a substantial increase in coverage. It must not be forgotten, however, that the backbone of the broadcasting industry today is standard band AM broadcasting and that what it offers, namely, circulation, must also be offered by FM and television before they become effective competitors. It seems safe to predict that the standard band will remain the broadcaster's breadwinner and chief source of income for a considerable number of years. Furthermore, it is doubtful if the high-powered clear channel AM station will be replaced within the foreseeable future as a means of providing widespread rural service."

Conceding that "the basic conclusions of the supporters of FM are correct," and that "it is in many ways a superior method of sound transmission" by which "a large percentage of existing broadcasting stations could give an improved service to a larger area if they changed to FM," he disagreed with FCC chairman Fly about the need of separate FM programming to make full use of FM's capabilities. Of this he said: "There will undoubtedly be a substantial number of new operators entering the broadcasting business via FM without ever having operated an AM station. It is to be hoped, moreover, that the Federal Communications Commission will not impede the transfer to FM by requiring separate programming of AM and FM stations. Such a course could only result in a longer and more confused transition period in which the public would have less incentive to buy FM receivers if their present favorite AM programs are not on FM."

Perhaps it would be too much to expect William Lodge to point out that entirely new program techniques will be employed by FM stations which do not have AM affiliations. Such programs will have such a quality of realism as to transport the listener to the scene of action. Heard over AM, however, the effects would be spoiled entirely, because the limited audio range and the necessity of leveling the output for AM transmission would make programs designed for FM sound inferior to present standard broadcasting. On the other hand, many programs designed for AM transmission sound inferior on FM because FM discloses their lack of audio

fidelity and dynamic range. This is particularly true when average recordings are transmitted on FM. In spite of that, Mr. Lodge feels that public interest will be served best by debasing the quality of FM through limiting it to AM levels.

On the other hand, he believes that television should make no compromise with the ultimate in service and picture quality. He said: "I believe all of the parties interested in the future of television are now agreed that approximately 25 or 30 television channels are required to permit the growth of a comprehensive, competitive nationwide television system. This point is generally missed. In other words, regardless of the picture definition or whether postwar television is to be black and white or in color, a sufficient number of channels must be provided and it appears at the present time that the needs of various government agencies and safety-of-life services which cannot be shifted in frequency severely limit the number of channels which can be assigned below 300 mc.

Most of you know that the government's Interdepartmental Radio Advisory Committee found it possible to assign only 9 channels between 54 and 108 mc. and 6 scattered channels at higher frequencies for the present type of television transmission. This simply means that whether television is transmitted on 6-mc. channels or 16-mc. channels (or any other band width you care to name) it will have to go up to frequencies where it can find sufficient space not likely to be preëmpted by other services. And since television must go to higher frequencies, I can see no engineering reason for not incorporating at the same time higher definition pictures and color.

As you know, CBS has vigorously supported improved pictures not only for the above reason, but because, its interest being solely that of a broadcaster, it believes a better picture would improve the chances of making television broadcasting a successful business. Eventual success or failure may well depend on whether the television pictures offered to the public are good enough. . . .

"Television will have a financial load to carry many times that of radio broadcasting per unit of circulation. Television receivers will certainly be many times as expensive as the low priced radio receivers; the cost of connecting stations for network operation — whether by coaxial cable or radio relaying — will be much greater than the present network sound circuits; program costs are much greater in television; and we do not yet know how many hours of viewing per day can reasonably be expected, compared with the present 4½ hours per day of radio listening.

"In view of these considerations the hourly rate of a coast-to-coast television network might be considerably higher than a corresponding sound network and might deliver less circulation. This is not an alarmist's view, and naturally is subject to constant reëvaluation. But we would be deluding ourselves if we assume that television will necessarily roll merrily along on the same road as a sound broadcasting. . . .

"Television, in order to succeed, must avoid any unnecessary handicaps — and the greatest handicap would, I think, be the establishment of the service on the present 6-mc. channels.

"It is therefore my opinion that there will be only limited utilization of the present television channels. Columbia has already decided to build no additional stations on the lower frequencies with 6-mc. band width, and is devoting its entire energy to the development of television in the region of 500 to 1000 mc. We are sufficiently sure of our ground so that we will confine our immediate television broadcasting to New York on our existing station, WCBW, which, we believe, will give us the necessary experience in the production of television programs. . . .

"Columbia has a huge stake in television — certainly the largest stake of any broadcaster who is not affiliated with manufacturing activities. As broadcasters we believe that the period of red ink in television will be substantially shortened and its ultimate fruits substantially increased if we give the American people the best possible picture — as quickly as possible. . . . Certainly television accomplishes a miracle that is offered by no other medium. I think we are wise enough to free television from the unnecessary shackles of prewar standards. If we are, we will be able to accomplish two things: first, we will avoid digging pits which we ourselves may fall into and, second, we will have done our part in making it possible for this infant industry to grow into what may be a giant, dwarfing anything we have known in radio."

## WILLIAM S. HEDGES

**National Broadcasting Company**

Looking upon FM and television as a challenge to the broadcasting industry to make the most of these facilities in the service of the American public, William Hedges said: "The postwar commercial development and expansion of FM and television confront American broadcasters with immediate problems more serious than any they have ever encountered since they went into business.

"For the present — but for the present only — the broadcasting industry has an inside track in the race to establish these new services. But no broadcaster should comfort himself with the idea that he can maintain a position of watchful waiting indefinitely and can step into a place of leadership in FM and television whenever he gets good and ready.

"We cannot afford to take the fable of the hare and the tortoise too seriously. 'Slow but sure' is a good slogan for many situations, but no turtle is going to win this race.

"There are various interests and groups and individuals who see in FM an opportunity at comparatively modest expense to make their first entrance into the field of broadcasting. As a matter of fact, we welcome them to our ranks and look to them to make valuable fresh contributions to the art and industry. FM provides more elbow room in the radio spectrum than has been available since the earliest days of broadcasting. It offers places for many new broadcasters.

"The broadcaster who is firmly established in the field of AM will be well advised not to take these new competitors too lightly. Some of them may prove to be rabbits with no great staying power; but plenty of them will have both speed and stamina. They will have money and ideas and initiative. They will be in the market for an audience for advertising and for network connections. It is axiomatic that the importance of the aggressive FM broadcaster to both advertisers and networks will keep pace with the growth of the FM audience.

"Television presents a far more difficult problem to the broadcaster than FM. It is not just a technological change in his present business. In many respects it is a new business. It calls for a capital outlay of serious proportions. It demands new skills and techniques of engineering and program production.

"A great deal about the future of television is still a closed book, but one thing is certain: television is here and it is here to stay. Television has powerful friends and backers outside the radio field who would like nothing better than to take over television by default — lock, stock and barrel. It is too significant and fascinating a service to the public to stop moving forward. The public wants it, and what the public wants it is sure to get.

"Television is the greatest challenge ever presented to American broadcasters. It is a challenge which, as an industry, we have accepted. But to accept it is one thing, and to put our acceptance into active effect is another. It will take an unending supply of courage and patience to follow through. Inspiring though the broad social and economic aspects of television may be, the risks and toil of getting it under way will not be a matter of inspiration but of perspiration.

"Above all, the establishment of the new services of broadcasting — particularly television — on a firm social and economic basis will call for the highest degree of understanding and coöperation between Government and the broadcasting industry. I am confident that this understanding and coöperation can be achieved and maintained. Government and the industry have the same boss — the public. Consequently, we both must measure the problems of broadcasting by a single standard — the yardstick of public service. . . .

"In the field of sound broadcasting, obviously the most important technical development will be the expansion of FM. The radio manufacturing industry, for the most part, is planning to incorporate FM along with AM in practically all except the cheapest models.

"There is every reason to expect that the establishment of FM broadcasting stations will more than keep pace with the sale of FM receivers. Within a few years after the war there should be FM program service available in a hundred cities."

In this estimate of FM service, Mr. Hedges probably erred on the conservative side, for there are over 170 cities represented already in the list of stations on the air and applications pending for construction permits. Continuing on the subject of FM expansion, he brought out a piece of information that most of us have forgotten about the status of the AM audience at the time NBC was organized: "This estimate of the early postwar growth of FM is necessarily the roughest kind of an approximation. It is just guesswork. But if it is a good guess, it will be a remarkable showing. When the National Broadcasting Company was formed in 1926, there were only 5,000,000 receiving sets in the entire United States. There may be more than that number of FM receivers in use after little more than a year of full post-war production."

On one point, Mr. Hedges expressed a misconception of "FM set owners" which is shared by many others among the broadcasters and manufacturers. Actually, there is no such thing as an FM set owner. There are AM set owners, because there are sets that tune only to AM, but all sets equipped for FM reception are also capable of AM reception.

However, there are two kinds of "FM listeners," and their tastes are distinctly different. One is the listener of average taste who prefers to hear all his programs on FM because it gives him better reception than AM. The other, whose tastes are distinctly more discriminating and critical, listens only to programs of superior quality, and prefers the superior quality of FM reproduction. This group is already of substantial proportions, and will grow greatly in numbers under the encouragement of better programs transmitted by FM. The latter group was not considered when Mr. Hedges said: "Up to the present time there has been reason to think of the owner of an FM receiver as quite a different sort of person than the average radio listener. The estimated half-million people who have bought FM sets up to now include a high proportion of lovers of fine music. Their listening habits probably register a pretty low rating for serial dramas and comedy programs.

"But as FM receivers begin to be sold in quantity, this picture is going to change rapidly. The typical owner of an FM set will come more and more closely to resemble the run-of-the-mill listener, until the time comes when the two are indistinguishable. The bigger and more widespread the sales of FM receivers, the more the program likes and dislikes of the average FM set owner will become identical with those of the entire national radio audience.

"This is the same thing as saying that a program which is good for the postwar AM audience will be good for the FM audience, and vice versa. A well-balanced program structure will continue to be as important in national network broadcasting as it has always been, regardless of what type receivers the public uses. . . .

"FM can be seen as an important technical improvement added to sound broadcasting — one that will help increase the total size of the listening audience. When we come to study the place of television in postwar broadcasting, however, the story is altogether a different one.

"Television is not just an improvement over something else. It is a new and unique and original medium of mass communication. It will exist and grow where nothing ever existed or grew before.

"Twenty-three years ago sound broadcasting itself began to grow where nothing ever grew before. It competed with the theatre and motion pictures, with newspapers and magazines, and with the phonograph. It did not replace any of them.

"Television will not replace them either; and it is as illogical to say that television will replace sound broadcasting as to say that the airplane will replace the railroad or the automobile.

"Sound broadcasting was never a parasite industry, deriving its nourishment from sucking the blood of older forms of enterprise. To a great extent it created a special audience of its own. By rendering an advertising service that had never been rendered before, it obtained a revenue largely comprised of advertising dollars that had never been budgeted before.

"Similarly, the success of television will not be contingent upon cancelling out the services and revenues of older industries. The net effect of television will be a tremendous addition to the social and economic life of the nation.

"It is not necessary to emphasize again at this time the importance and popular appeal of television as a vehicle for information and entertainment. It is going to be the most effective medium of mass communication ever created. The combined qualities of visualization, sound, motion and immediacy that attract and hold a television audience are what will give television unequalled effectiveness as a medium for advertising.

"Television is going to attract many new sponsors who feel they need a visual presentation of their merchandise, and who for that reason have never been large users of sound radio. It will appeal strongly to department stores, chain stores, and retail outlets of many different kinds. This will not be network business. It will be local business. The coverage of a television station is practically identical with the retail trading area of the average city.

"Many manufacturers will find in television an ideal means for displaying and demonstrating their products. Package designs will be restudied and restyled. The genuine virtues of an advertised product — like the honest sincerity of a political candidate — will show up on the television screen to greater advantage than through any other form of communication. An ounce of merit will be worth a ton of ballyhoo.

"The prospective value of television to the nation amounts to far more than the benefit of opening a new avenue of intelligence and recreation into the American home. Its economic importance far exceeds that of supplying new employment for millions of capital and thousands of men and women in radio manufacturing plants and broadcasting studios.

"For television is going to be a vital new arm of distribution of the country's manufactured goods. It will be a new girder in our economic structure at a point where fresh support is most needed.

"In all the mass of statistics and the reams of opinion that have been published about our postwar economy, there is complete unanimity on one point. That is the nation's capacity to produce. No one questions the ability of American manufacturers to supply enough of everything — both consumer merchandise and durable goods — that the people of the United States can use. The marvelous record of the nation's war production leaves no room for doubt on that score. If postwar prosperity depended simply

on our productive ability, there would not be a cloud the size of a man's hand on the economic horizon.

"How to keep that enormous production machine profitably employed — that is the heart of our economic problem. And that is the problem of distribution.

"The mass production methods of American industry — in other words, high output per worker — have often been pointed to as the basis for the American standard of living: the reason why there are more automobiles, radios, bathtubs, refrigerators and a hundred other conveniences per capita in the United States than anywhere else in the world.

"That is putting the cart before the horse. We have no corner on mass production technique. There is nothing secret about it. Manufacturers in other countries know how to use the same methods. We have mass production only to the extent that we have mass demand. No demand, no production. Little demand, little production. Big demand, big production.

"The outstanding factor in American business that has created demands for new products, and has turned little demands into big demands, is advertising. Advertising is the pump-primer of industry. It is advertising, by creating new and greater markets, that has increased payrolls and reduced both manufacturing and distribution costs. Consequently, the advent of a new advertising medium of the potential stature of television is an economic milestone of profound importance.

"Television is going to help American industry prime its own pump and keep it pumping. It is altogether likely that for every new job which television creates on its own account — in the building of apparatus and the production of programs — television advertising may create ten jobs in American factories and the stories which distribute their output."

Although he made no direct reference to the choice between the 6-mc. and 20-mc. television channels, it appears from his concluding remarks that Mr. Hedges expects NBC to go ahead in the immediate future with "four-cylinder" 6-mc. television, without waiting for the development of an "eight-cylinder" 20-mc. system: "I can sum up briefly: As for FM any technical advantages it possesses should be made available to the public by present broadcasters who, to a large extent, make the highly popular programs currently available only to the standard band listeners, likewise available to the FM listeners. As for television, NBC is prepared to establish a television service as soon as men and materials are available on the best possible practical standards as authorized by the FCC. We believe that experimentation should continue with the end in view of supplying the public with constantly improved television service. We do not believe in the principle of withholding a practical four-cylinder automobile from the public because a theoretical eight-cylinder engine is about to be developed."

## MAJOR EDWIN H. ARMSTRONG

I have been invited to present factual data about FM broadcasting which may be of particular interest to broadcasting station executives. The limited time available precludes any presentation of the facts themselves, but does afford opportunity to point out where they may be found, and to review briefly the conclusions drawn from them at the time they were first presented. It is the conclusions which are of primary importance, not the facts themselves, as the history of the FM development shows.

A little over ten years ago, on the morning of June 9th, 1934, signals were transmitted from the Empire State Building in New York City to Westhampton Beach, seventy miles away. By an odd coincidence, a reproduction of the original log of the first test of FM appears in this month's issue of *FM* Magazine. There is recorded therein a comparison of the FM system with amplitude modulation on the same ultra high frequency, with the conclusion "hundreds or thousands of times more noise on amplitude." The final paragraph in the log contains the words "all tests performed exactly according to Hoyle. . . . An era as new and distinct in the radio art as that of Regeneration is now upon us."

After nearly a year's tests under all conceivable conditions the results were announced in the press on April 26th, 1935, with the prediction that static-free and fading-free service would be possible up to at least a hundred miles. A new era in broadcasting and relaying was forecasted.

Here I would like to illustrate what I mean by the statement that it is the conclusion drawn from the facts, not the facts themselves, which is the important thing.

The following day a man described in the press as a famous radio engineer, who had witnessed the tests, stated that in his opinion static would be eliminated from the standard broadcast system before it ever was by the new FM system. Contrarywise, the editors of *Electronics Magazine*, without benefit of a demonstration or instruction from me, correctly ascertained the facts and reported them in their June issue of that year.

In November, 1935, the system was described to the Institute of Radio Engineers, and the paper was published in the May, 1936, *Proceedings*. This paper is now out of print, but at the instance of the Editor of *FM* Magazine it has been reproduced in the June, July and August issues of this year. The final paragraph is the following:

> "The conclusion is inescapable that it is technically possible to furnish a broadcast service over the primary areas of the stations of the present broadcast system that is very greatly superior to that now rendered by these stations."

In June, 1936, opportunity was afforded to present before the Federal Communications Commission and the broadcasting and manufacturing industry a sound recording taken during a thunderstorm, showing a comparison between a 50-kilowatt AM station — WEAF — and a 2-kilowatt FM station at a distance of 85 miles. The difference in noise level was of the order of tens of thousands of times. The record contains the following statement:

> "The conclusion must not be drawn that the difference between these two recordings is due entirely to Frequency Modulation. Part of it is due to the frequency of transmission, since natural static is decidedly less on the higher frequencies. The recording does, however, show what broadcasting might be.
>
> "Now, if the art draws the same conclusion from these recordings that I do, it will visualize the ultrahigh frequencies playing not a subsidiary, but the leading role in the aural broadcast field."

A very few broadcasters, manufacturers and engineers drew the same conclusion. The major part of the industry did not.

The facts, however, were made available to everyone in the broadcasting or manufacturing industries who asked for them, this including a demonstration from W2AG, an amateur station fitted up to transmit FM.

By 1940, the original small group of pioneers had been joined by enough converts to the new art to warrant the prediction in an article by me in *Electrical Engineering* of December of that year that "the conclusion is inescapable that within the next five years the existing broadcast system will be largely superseded." That prediction, eliminating the delay due to the war, will, I believe, be fulfilled.

In the course of this development many "facts" were presented which precluded the coming to pass of what has in fact come to pass. There was the "fact" that the ultra-high frequencies could only go to the horizon. Numerous high power stations are now steadily giving service over three or four horizons.

There was the prediction that ignition noise would prevent FM competing with the standard system, but it more than competes.

There was the "fact" that FM receivers required 57 or 75 tubes, and so were quite impractical. However, my prediction to the Commission in 1940, that there would be a set for every pocketbook, will shortly be borne out.

There was the "fact" that the public did not like high fidelity — because of the way it used the tone control to get rid of AM distortion — but the sale of sets and the surveys show that they do like it; that is, whatever it may be called, the public obviously likes natural reproduction.

The investigation of the phenomenon of "bursts," which was, I believe, first studied by deMars, Pickard and myself in 1940, has disclosed that our conclusions in this respect were correct — that it is not a serious detriment to FM.

The much publicized "multiple-path distortion" bugaboo — recently trotted out — has now been shown to be a matter of no importance — to FM. It was investigated by me and that conclusion reached in 1938. What is of importance, however, is that it was recently presented to the art in a manner obviously designed to mislead it — and constrict the FM band.

The more recently expressed fears of possible evil results of future sun-spot activity are based on a phenomenon which is annoying and which we would rather did not exist. The period of time so far indicated when trouble from the sporadic-E may be expected over any appreciable area of a station's coverage appears negligible. The best opinion on the subject is that the disturbance will not be serious. It is important to keep in mind the fact that there is no perfect wavelength. Whatever the annoyance factor may be, the FM system is the one best able to combat it.

Those of you who look back through the records which I have referred to will find that the facts are there, and that nothing has been withheld or misrepresented to you. The promise that you would be able to render a better service has been kept.

But quite aside from the mere supplanting of existing stations by an FM service, there has emerged a circumstance that completely overshadows all other considerations. It has now become possible for every community, however small, to have a voice on the air, provided it can support it. Economic conditions, rather than shortage of technical facilities, now limit the number of stations. Problems which have defied solution by Congress, the Federal Communications Commission and the industry alike now disappear as this new art advances.

And now in closing I want to leave with you one question. Ask yourselves this: Wouldn't both this country and the broadcasters in general have been better off if more attention had been paid to what engineers like deMars, Jansky and Bailey and Hogan, and broadcasters like Sheppard, Dolittle and Damm were doing, rather than that council of a course of action which could only result in a continuing shortage of channel facilities? A free radio does not lie in that direction.

## PAUL F. GODLEY

**Consulting Radio Engineer**

After listening to Paul Godley's talk and rereading the text, it is not clear that he intended to do more than remark upon the conflicting views which have been held by various individuals during the course of the last twenty years.

At one point he may have intended to reasure AM broadcasters when he said: "I take it that today's discussions were arranged with a view toward helping broadcasters in their thinking about postwar technical policies.

"And let me put it plainly — for a long period we have had discussions of, and aggressive sales promotion on new broadcasting services which, to speak figuratively, are to be turned loose on V-day, plus one, — and these discussions have in many quarters created the impression that our present system might become obsolete as of that time.

"I have never found it possible to agree with any such idea; and I feel that confusions which have grown out of impressions such as these, are unfortunate."

He brought out one point of significance to radio set manufacturers when he referred to AM frequencies of 520, 530, and 540 kc. These are not covered by most AM receivers, but should be included in the tuning range of new models.

"Present AM services are amenable to considerable further profitable extension and magnification in the instant public interest; and, perhaps it needs to be added, in the interest of the new services. I believe it now in order to add needed outlets wherever feasible, and to include the 540, 530 and 520 KC channels within the band for the benefit, principally, of numerous small city, town and rural communities heretofore without, but now able to support their own services."

Mr. Godley does not seem to have much confidence in the sincerity of those who have applied for FM construction permits. If he is right, the files of the FCC are being cluttered with a lot of waste paper in the form of applications, and some action should be taken by the Commission to discourage the filing of applications by those who will not proceed with FM stations when their C.Ps. are issued. On this point he said: "Taking the objective view, I have not been concerned about the relative importance of FM stations and receivers now extant; nor am I greatly impressed by the argument that the considerable number of applications for new FM stations is an evidence of an industry-wide desire to immediately exploit FM as originally allocated. As anyone may quickly learn, these applications develop not as the result of comprehensive study and comparison of engineering, service, or economic factors, — but rather from a desire on the part of 'lay-minded' and somewhat confused broadcasters to take out quick and cheap insurance against an uncertain future; or by would-be broadcasters who, mayhap, slept through the Maiden Trip of the radio Show Boat."

As for television, he dismissed the subject with the statement that: "Time bars my discussion of the opportunities wrapped up in facsimile, — or of television. But I wish to say this of television: it greatly broadens the horizons of broadcasting, and, it seems to me, is the desirable, ultimate, medium. However, I have no expectation that it will, within the foreseeable future, spell quietus for sound broadcasting."

## JOHN V. L. HOGAN

**WQXR and (FM) WQXQ**

The text of John Hogan's address on the subject of facsimile was not made available. That was unfortunate because it was extremely interesting, and presented with the background of extensive experience in the development and operation of facsimile equipment.

Referring to facsimile as the home printing press, he explained that the perfection of this service had advanced so far, during the war, that the relatively minor prewar accomplishments must be forgotten. Potentially, he said, facsimile can deliver by radio a printed magazine, handsomely illustrated with pictures and advertising, to every home in the nation. He pointed out that a number of newspaper-broadcasters have already investigated the possibilities of modern facsimile equipment, and are now planning to provide FM-facsimile broadcasting as soon as the scanning machines and home recorders can be manufactured.

Furthermore, he stated that he is in agreement with those who believe that within five years facsimile will be a more important service, and more soundly established economically than television.

As to the question of choice between multiplexing facsimile and sound programs on FM stations, or using separate transmitters and receivers operating within the FM band, Mr. Hogan declined to express an opinion. It is better, he said, to leave this point to be determined by further experience, rather than to settle on either method at this time.

FIG. 1. REPRODUCED FROM FACSIMILE RECEPTION ON FILM AT 96 LINES PER INCH. NOTE THE EXCELLENT CONTRAST


FIG. 2. REPRODUCED FROM FACSIMILE RECORDING ON ALFAX NO. 66 PAPER. ORIGINAL WAS A FAMILIAR ADVERTISEMENT

# SUITING FACSIMILE DESIGNS TO SERVICE NEEDS

## A Review of the Special-Purpose Facsimile Equipment Manufactured by Alden Products Company

BY MILTON ALDEN*

I HAVE just picked up an old Webster's Dictionary published in 1890, the year I was born; I have turned to *Facsimile* and find *facsimile*, also *Facsimile telegraph*, defined as "a telegraph apparatus reproducing messages in autograph."

Before me is a book of about 300 pages published in 1938 entitled *Facsimile*. Beside me on the floor are a portion of over 3,200 patents that have a bearing on at least some of the phases of facsimile problems. One of these patents shows a date nearly a hundred years ago, 1846, and one by a man calling himself "I. Ludvoic Charles Adrien Joseph Guyot D'Arlincourt of Paris, in the French Empire, gentleman," dated 1871 which shows a grasp of nearly all the problems of facsimile, and in principle indicates means of solving them that are paralleled by today's best practices. Interspersed are also some early patents of Edison's on electrolytic paper.

Yet when I tell someone that we are making facsimile equipment, the word is meaningless. Why? Well, to a large extent most of the patents and the equipment shown in the book mentioned above have not met the acid test of actual operation. In other words, none of the equipment described attained sufficiently widespread commercial or other usage to become known to the general public. To reach that goal, equipment must not only work as an engineering experiment, but must justify itself economically.

For illustration, we are licensed to make and use what, insofar as we know, is the first black and white paper, capable of recording at high speed, which does not smudge, deteriorate, or fade, and is inexpensive enough to manufacture for home use.

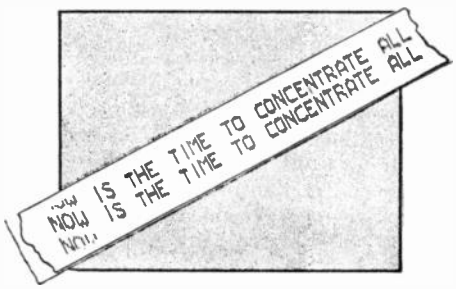



FIG. 3 FACSIMILE TAPE RECORDING

As set forth, all the principles used in "faxs" have been known for a long time but, like radar for instance, it has taken the war and its necessities to provide the testing grounds.

At Alden Products Company, we have been particularly fortunate in having contracts for the production of "faxs" equipment covering the whole gamut of requirements.

For example, our company has supplied continuous page recorders used and proved by extensive service on press circuits, the day-in-and-day-out kind of service that eliminates the bugs and takes the equipment out of the experimental or strictly engineering field. We are now duplicating this equipment for operation on radio circuits in China.

For the poorer circuits, radio or wire, we have produced tape recorders by taking the better features of existing machines and building into them great ruggedness and simple interchangeability of parts. Doughboys can adjust them with their fingers, and use a dime as a screwdriver. All gears are enclosed, running in baths of oil, and the construction is such that desert storms or tropical fungus does not prevent their functioning. These tape recorders operate without synchronization. A special design feature is the spreading of the recording during interference, fading, or weak signals, for easier reading.

In the picture recording (photographic) fields, the equipment we have made has been compact, portable, of high quality, and capable of work with all kinds of power supplies operated under adverse conditions.

Out of this experience we are developing an organization and techniques for the manufacture of equipment covering facsimile and the entire field of impulse recording.

It is very evident that there is no one universal system or any one recording

* Alden Products Company, 117 North Main Street, Brockton 64, Mass.


FIG. 4. RIGHT: ORIGINAL FINGER-PRINT RECORD. ABOVE: ACTUAL SIZE OF FACSIMILE RECORDING ON ALFAX PAPER. NOTE THE DEGREE OF ENLARGEMENT

medium that meets all needs. For illustration, we are working with the most precise and compact equipment for high-resolution transmission of photographs or film. Although this apparatus has its uses, the number of hours a day any such equipment is required is very limited. Today's newspaper pictures of the invasion are credited to this same equipment. When the Graf Spee was sunk in Rio de Janeiro, Associated Press picture circuits were kept busy with these photos, only to lapse into idleness until the next unusual interest event. Therefore, despite its value for certain purposes, the photographic picture transmission field is limited. The transmission is relatively slow and requires some photographic skill or training on the part of the operator. Because of these limitations, this equipment is not suited for home use or volume business communications.

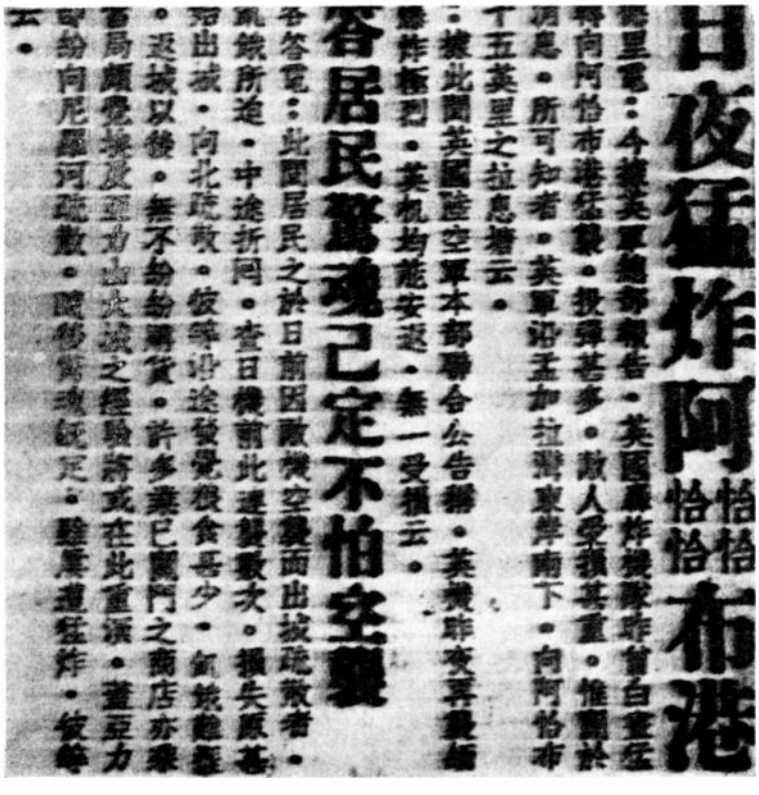



FIG. 5. FACSIMILE TRANSMISSION IS IDEAL FOR HANDLING MESSAGES IN CHINESE

A very simple technique for certain types of messages is possible using Teledeltos paper, manufactured by Western Union for their own use, but available to others. This is a black conducting paper, faced or coated with a light-color compound. The current discharge from a fine needle electrode produces a miniature arc and destroys the coating, thus producing a gray to black recording. Where single and intermittent messages are to be sent and no great speed is required, the equipment can be simple. It does not lend itself very readily to continuous recording, and requires electrode replacement. This is a fairly delicate adjustment. Like carbon paper recording, it has a tendency to smudge. The light coating comes off from abrasion if not carefully handled. The

recording current produces slight smoke or fumes and, at times, when too much current has been applied, the paper has been known to catch on fire. As it is a coated paper, it depends on 100 per cent perfect coating. This means unusual care in its manufacture.

Although there are situations where the use of Teledeltos paper would be more satisfactory than any other readily available recording medium, it could not be considered a universal paper. By this we mean it would not be the ideal for home recording. For such use, the paper must lend itself to continuous recording. That is, the paper must be in a roll instead of individual sheets that have to be inserted one at a time. We say *paper*, instead of *medium*, because film would not be suited for the home, and cost must be reasonable for wide home use.

Alfax paper fills the bill for home use. It is an electro-sensitive paper, with a controlled moisture content which is easily maintained until use by packing in sealed tin cans. It is removed from the can, placed in the humidor compartment of the recorder and, as the moisture content is greater than would be the result from ab-

FIG. 6, ABOVE: PAGE RECORDER FOR ELECTROLYTIC RECORDING, USED ON INTERNATIONAL PRESS CIRCUITS. FIGS. 6 AND 7, BELOW: RECORDINGS ON ALFAX NO. M620. SMALL TYPE WAS RECORDED AT RATE OF 400 WORDS PER MINUTE


"Buck's a bit upset! The cannibal natives around here have nick-named him 'hors d'oeuvres'!"

**Holbrook**

**SCHOOL ENDS; WELL ATTENDED**

*Legion Fund Total Soars to $1368.84*

The fund for matching suits and other gifts for the Brockton Legion Junior baseball team.


"My wife's away, so I bring these down to her sister's house for washing!"

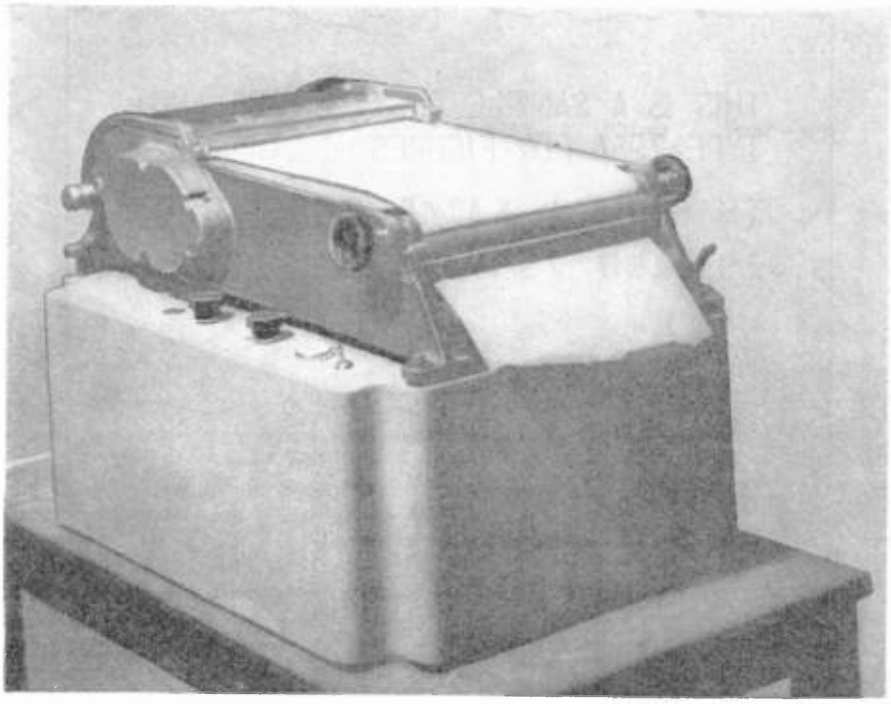


FIG. 8. RECORDERS ARE DESIGNED FOR SIMPLICITY, ADAPTABILITY, AND VISIBILITY

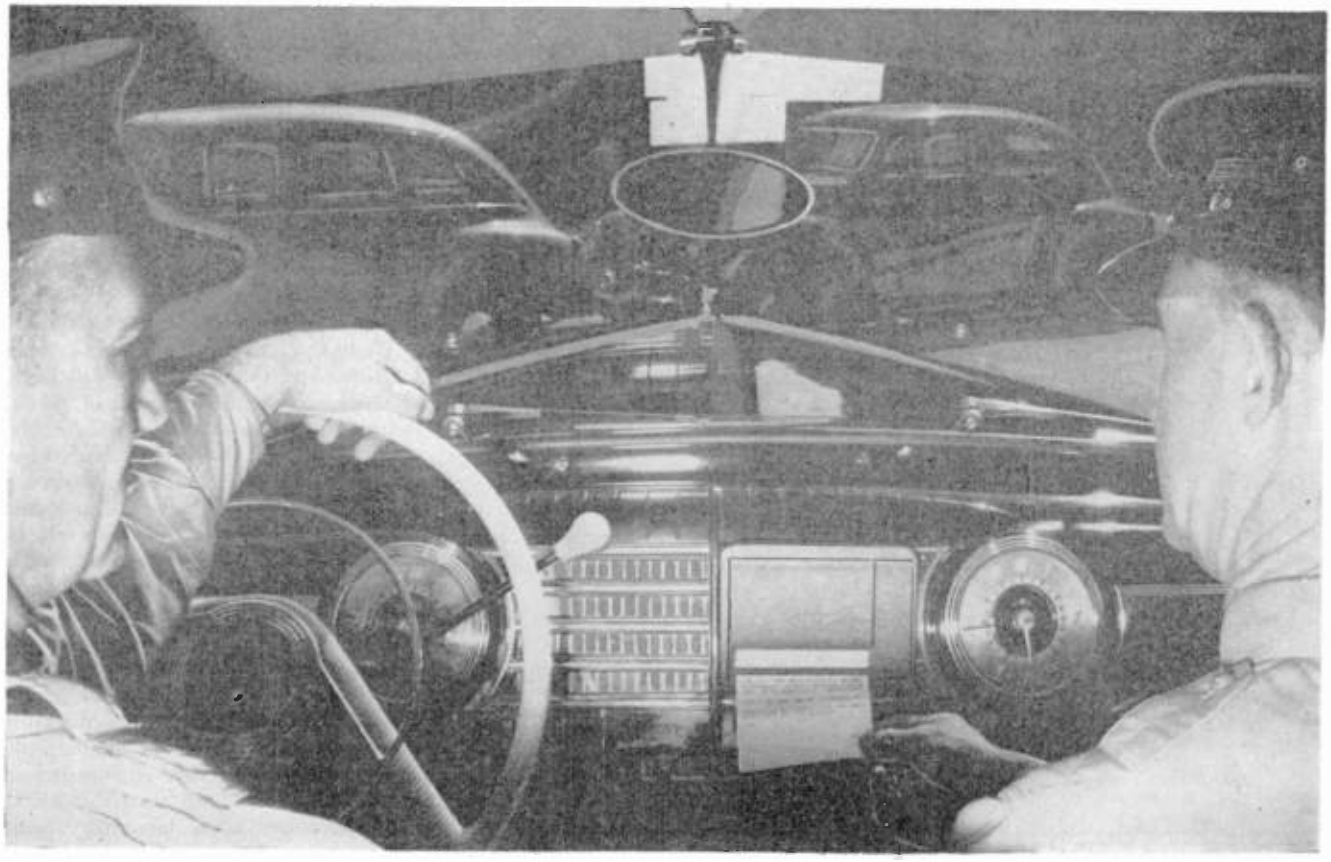
sorption at the highest humidities encountered, it works equally well during high humidity as low, with the paper always having the optimum conducting value.

Since the recorded mark penetrates clear through the Alfax recording paper, it is very useful for getting additional copies. The paper can be treated with a preparation that makes the base paper translucent. Thus, the recordings can be used as a tracing in a blueprint, Ozalid, or similar apparatus for obtaining any quantity of duplicate prints. In weather map work, recordings may be overlapped with previous recordings or master maps for comparison.

Alfax paper differs essentially from coated paper in that it can be made uniformly, for it is simply an immersion process in which the paper is run through an electrolyte. Edison and others were issued patents on electro-chemical paper, but the chemistry of their day did not provide them with a paper that was high speed and black, that did not fade, and was inexpensive enough to apply to sizeable sheets. As a matter of fact, some of their chemical conclusions as to what was happening were incorrectly interpreted. That which is suited to the home, where simplicity is a first, is that which is generally well-suited for some commercial applications.

Thus, in one of the police communication problems, the ideal equipment does not involve photography and yet provides for permanent records. When a supposed criminal is held, his keep costs money. Prompt identification calls for immediate transmission of fingerprints and their interpretation. In transmitting fingerprints, the white lines or spacing between the markings is the important part. The lines or the whorls converge to zero and for interpretation must indicate widths of spacing as narrow as .003 of an inch. We have

FIG. 9. A 4-IN. PAGE RECORDER, OPERATING AT 200 WORDS PER MINUTE, CAN BE OPERATED BY STANDARD POLICE RADIO



produced ideal equipment, using Alfax paper, for this purpose. Other systems, in their experimental designs, have photographically enlarged the fingerprints and then transmitted them. What we do is to transmit them directly as taken, with extra fine special scanning. Then we record them directly in double their original size on Alfax paper, without delay and without photography. The result is an enlarged print on which it is easier to count the lines and analyze them than in the original. The same equipment transmits the subject's photographs and record. These photographs are of newspaper quality and, with the fingerprints and record

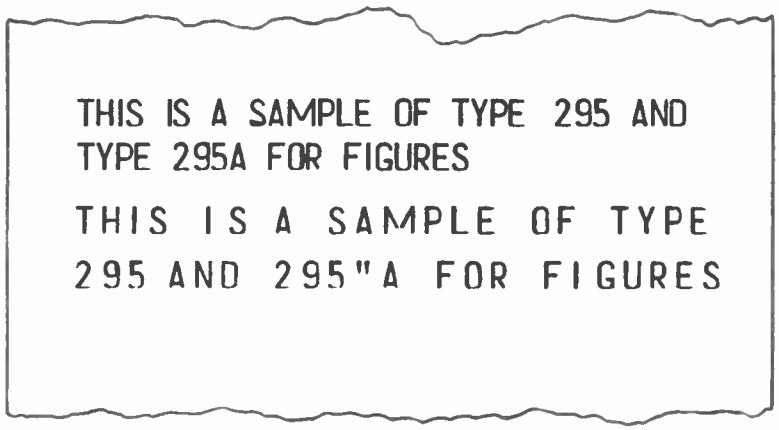
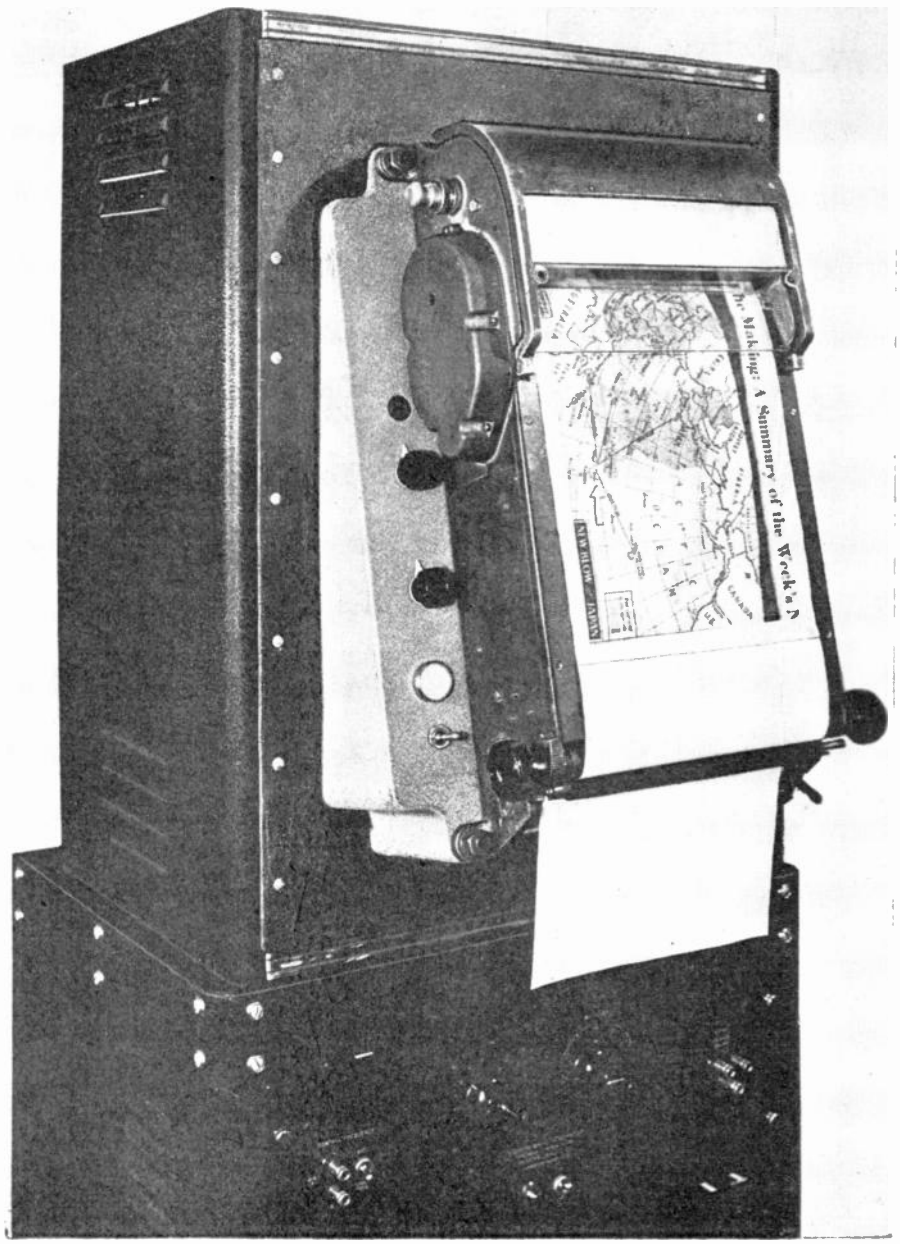



FIG. 10, ABOVE: SAMPLE OF TYPE USED FOR TRANSMITTING DISPATCHES TO POLICE CARS BY FACSIMILE. FIG. 11, BELOW: 8-IN. CONTINUOUS RECORDER USED FOR TRANSMISSION OF MAPS. SIMILAR MODELS HAVE RECORDING AREA 18 INS. WIDE



information, are a definite aid in the prompt identification of a suspect or criminal.

We have chosen to consider all impulse-recording as facsimile. By covering this field, our engineers have delved into many closely related problems and we now have standard designs for all the various mechanical, optical, frequency control, motor, photoelectric and other units for many different purposes. For instance, there have been many methods of synchronizing, and we are licensed under a number that are unique. However, in practice we are finding that the same synchronizing and driving means used in film or photographic transmission is also best suited for our continuous recording equipment using Alfax paper.

Thus the compact oscillator, controlled by a compensated, compact electro-driven tuning fork, driving a synchronous motor comprise three units which solve, in a most practical way, this phase of much equipment.

Likewise in tape recording, our interchangeable-parts printer is suited for the poorer non-synchronized circuits by recording two sets of characters simultaneously, yet it and its drive mechanism are available for other circuit requirements.

We have had considerable to say about high-speed recording because we had available somewhat standardized, or perhaps better called basic-unit designs for high-speed recording. We were presented by a government department with a slow recording problem. Here again the Alfax paper was best suited, not by itself, but because the recording equipment had no inertia or lag, no pens to fill, ribbons or carbon paper to contend with, needles to replace, etc. However, as no one machine or system meets all needs, we find that no one electrolytic paper meets all requirements any more than one photographic paper fills all the needs of photography. Thus a whole new line of engineering and development has been started with the *use-applications* as a laboratory which

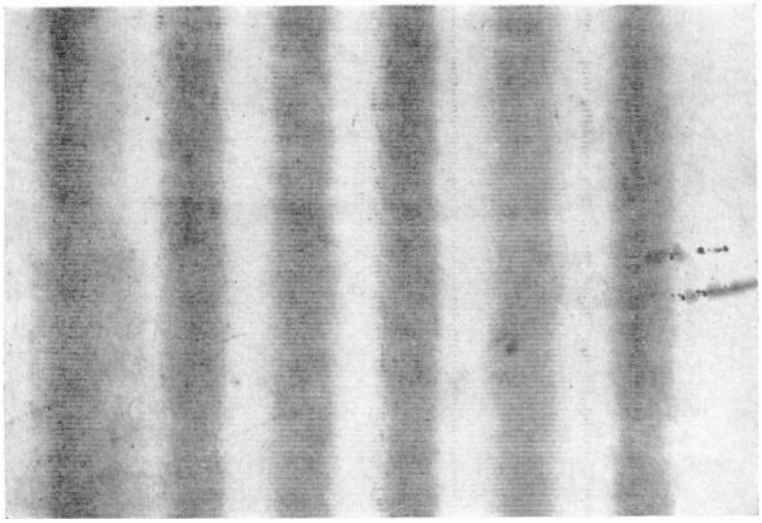


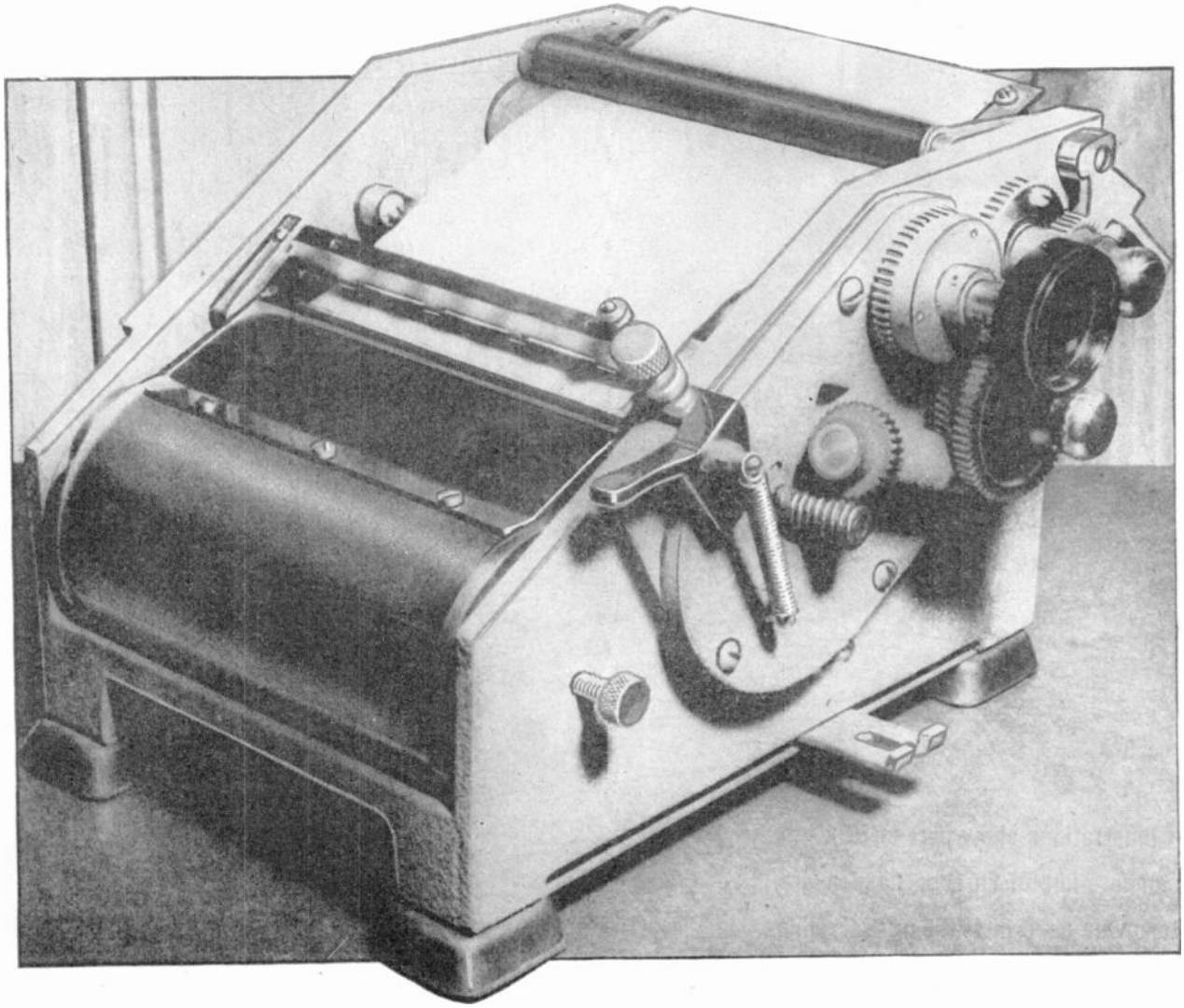
FIG. 12. ALFAX RECORDING OF 60-CYCLE CURRENT, AT 80 LINE-INS. PER SECOND

speeds up the search for practical answers.

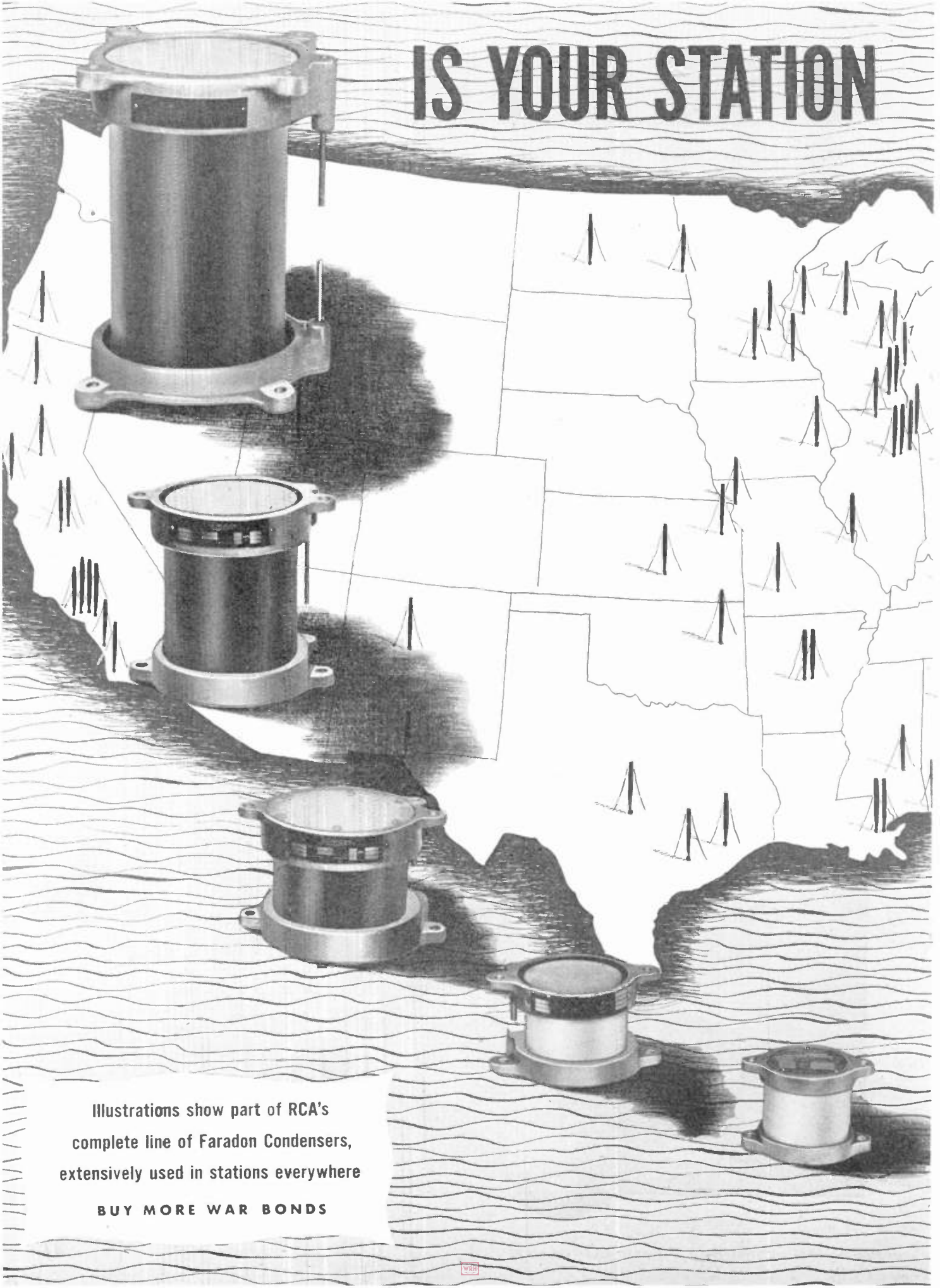
When we speak of recording without inertia, we think comparatively, with many other types of recorders in mind. That is, there are recorders with the recording means mounted at the end of arms. When the action is sudden, the arms swing further than they should. In cases where the action is uniform, it must reverse itself. Thus it cannot operate at high speeds. Again, if the recording is on a drum, with paper held around the drum and a needle or electrode follows the turning paper, there is the problem of bounce at the paper's edge. Other recorders have magnetically driven printing bars which introduce inertia, frequency response, and bounce problems. However, where the paper is fed continuously, with a helix electrode on one side of the paper and a floating electrode on the other, all impulses are recorded the exact instant in which they occur. Further, as the helix is round, it can be perfectly balanced and run at any speed without introducing oscillation or vibration.

In certain of our equipment, the marking is due to the electrochemical action between the electrode and the paper, and the passage of the current has the effect of dyeing the paper. The electrode is a spiral helix wire with quick-fastening terminals, so that if it ever needs to be replaced, that can be done easily and quickly, even by the uninitiated. The other electrode is, in one instance, a thin blade that slips into position, and is as easy to replace as a safety razor blade. Another modification is a simple stamping which, in practice, we

FIG. 13. THIS 4-IN. RECORDER IS A VERSATILE MACHINE, MAKING SHARP PICTURES AT SPEEDS UP TO 36 INS. PER MINUTE



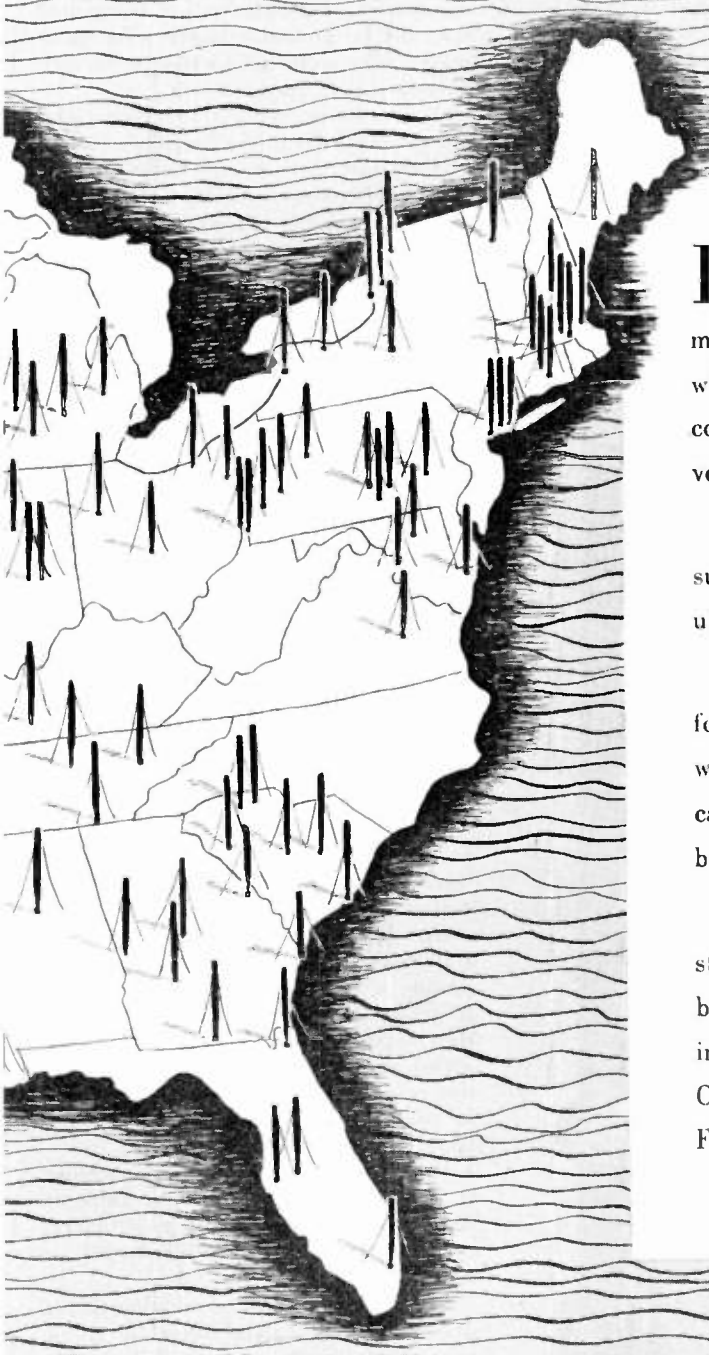
# IS YOUR STATION



Illustrations show part of RCA's complete line of Faradon Condensers, extensively used in stations everywhere

BUY MORE WAR BONDS

# ON THIS MAP?



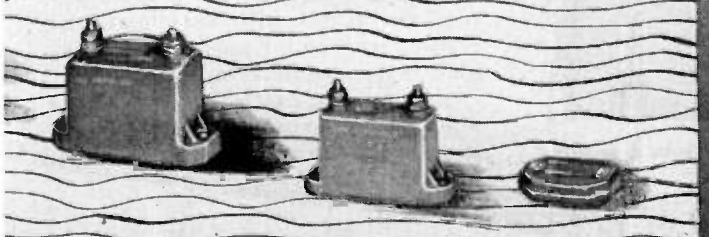
IF so, it is one of the stations to which we have shipped Faradon Condensers during the past two years. RCA is mighty proud of the record number of these wartime orders which have been handled. It's a record made at a time when condensers of the type used by broadcast stations have been very hard to get for other than direct military use.

How was this record accomplished? By rebuilding units, by substituting condenser sizes and types. By rearranging schedules and by exhausting every possible stock of spare units.

Why did we do this? Because we had a peacetime reputation for helping our broadcast customers—a reputation RCA wanted to keep. We knew we wouldn't be able to fill broadcasters' orders for the shiny new things they would like to buy. But we could "keep them on the air"—and we have!

RCA Faradon Condensers have a reputation for durability, stamina and continuous service. Here is a quality product by *pre*war standards. Craftsmen, long experienced in the intricacies of condenser manufacture, supervise Faradon Condenser production. Postwar, a complete line of RCA Faradon Condensers will be available for every purpose.

**RCA BROADCAST EQUIPMENT SECTION**



RCA

**RADIO CORPORATION OF AMERICA**

RCA VICTOR DIVISION • CAMDEN, N. J.

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

have never worn out, but which can be replaced, if damaged, by simply pressing it into its holder.

We have talked about quality and high resolution, fast recording, slow recording, continuous recording. Now let's conclude by covering fast recording a little more specifically, talking about sizes of records and applications of what might be called coarse recording.

In high speed recording, we have the equipment and recording paper that operates as high as 42 ins. per minute with copy 4 ins. wide, making 168 square inches per minute, or 80 linear inches of recorded line per second. A recording is shown in fig. 12 of a 60 cycle signal. Note the peaks recorded 120 of a second apart.

The high speed recording on Alfax paper is of special interest to those having the problem of recording low frequency phenomena such as encountered in the fields of seismography, geophysics, vibration, fatigue, electro-medicine, and in fact any aperiodic or irregular pulse for analytical study and future reference. Any imaginative engineer can think of many such applications. Although the highly specialized, single-application equipment may not be profitable business for us, it adds to the scope of our experience and, therefore, is of interest to us.

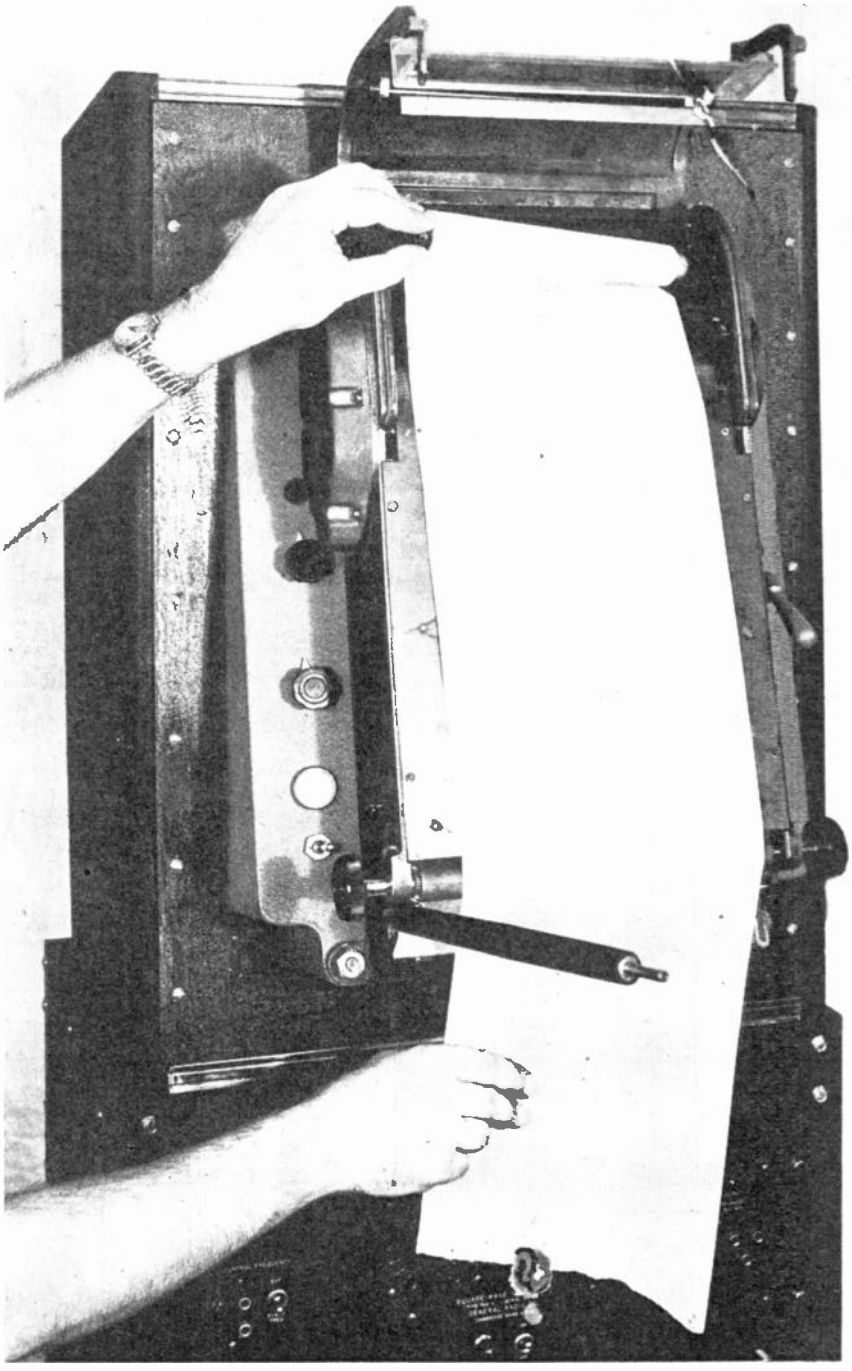


FIG. 14. INSERTING NEW ROLL OF ALFAX PAPER REQUIRES LESS THAN A MINUTE

As you know, terminal equipment and speeds are tied into the frequencies available in the circuits or radio links. Thus, on circuits where speed in getting through the messages is a must, resolution or detail may have to be sacrificed because the necessary frequencies are not available for transmission. Consequently, the equipment we are bringing through for service in police cars calls for a message of about 200 words in one minute in boldface type, about ¼ in. high, as shown in Fig. 10. Thus, either the driver or his companion can be given, in one minute, the confirmation of car numbers or any instructions that have been transmitted orally. Since the width of the paper is 4 ins., a minimum of dashboard space is used. To load the recorder, cover is opened, a paper roll is inserted, the cover closed, and the machine is ready to operate. No adjustments or fussing of any kind are required.

The same equipment is applicable to the locomotives, tugboats, trucks or other transportation facilities to which instructions and orders are given. This equipment is also designed so that a duplicate message is recorded in a locked chamber, avoiding all dispute as to the receipt and contents of the messages. In accident investigation, this can be invaluable.

Now about size: for FM multiplex sound and facsimile broadcasting, we are presenting a chairside set using four inch recording. We have no qualms in making this equipment simple, efficient, well-styled, and low in cost. If and when the industry is ready to use it, it will be available in production. We propose to use Alfax paper for this machine.

We manufacture two types of machines with a recording width of 8 ins. Table or bench models and models for mounting on standard relay racks are illustrated in Figs. 8 and 10.

For the transmission of weather maps, drawings, plans, or the format of a full page of newspaper, we are making an 18-in. continuous recorder, Fig. 10. In this equipment the recording is instantly visible as it is recorded.

Thus we are covering all sizes, speeds, resolution, circuit requirements, and recording mediums, so as to meet any requirement, not with some particular system, but with the equipment and medium best suited to do each specific job.

Editors Note: *This is the fifth of a series of articles on facsimile equipment, its present use and future possibilities.*

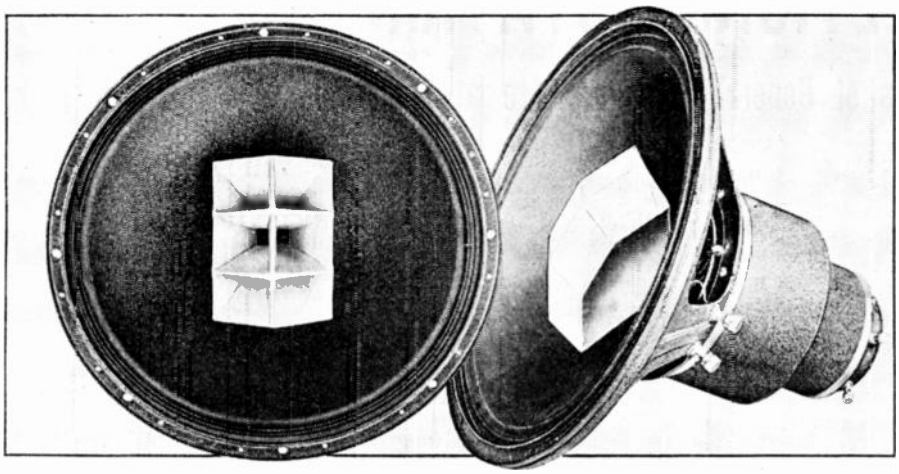


FIG. 1. THE TWEETER IS MOUNTED CONCENTRIC WITH THE LOW-FREQUENCY CONE IN THIS ALTEC-LANSING HIGH-FIDELITY LOUDSPEAKER

# RADIO DESIGNERS' ITEMS

## Notes on Methods and Products of Importance to Design Engineers

**Multi-Cellular Speaker:** An interesting type of loudspeaker is being produced by Altec Lansing Corporation, 1210 Taft Building, Hollywood 28, Calif. As rated by the manufacturer, this speaker, Fig. 1, has a 60° area of horizontal distribution and 40° vertical area. The high-frequency unit is assembled concentric with the low-frequency cone. The former, using an aluminum alloy diaphragm and voice coil of rectangular aluminum wire, is designed to operate as a piston up to frequencies beyond the limit of audibility. Power for the HF unit is supplied through the pole piece of the LF unit.

The voice coil of the LF unit is assembled on a 15-in., stiff paper cone, resonant at 38 cycles. Impedance of the duplex unit is 20 ohms. The dividing network cross-over point is 1,200 cycles. When mounted in a suitable cabinet, the low-frequency cutoff is rated at 60 cycles, and the high-frequency cutoff above audibility.

Cabinets are supplied for floor, ceiling, and wall mounting. A compact amplifier, giving 60 db gain with 15 watts output, is available. The speaker is 15 3/16 ins. in diameter and 10 ins. in depth.

**Seagoing Dynamotor:** A series of dynamotors for input voltage of 6 to 115 volts DC and output ratings up to 600 volts at .25 amp., designed for marine use, has been announced by Carter Motor Company.

Mechanical design, as shown in Fig. 2, affords protection against salt-water atmosphere. Metal parts are verdigris-repellant. Bearings are packed with preworked marine grease. The largest dynamotor of this series is 7 1/8 ins. long, 4 1/8 ins. wide, and 3 1/2 ins. high. Without the filter, which is available on order, weight is 9 lbs.

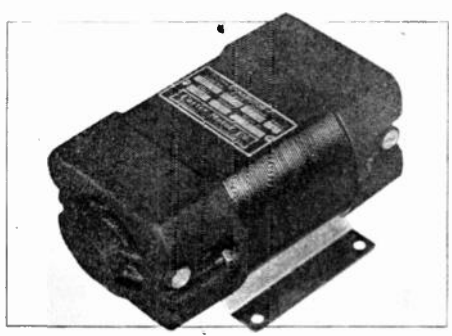


FIG. 2. CARTER DYNAMOTOR DESIGNED FOR MARINE RADIO TRANSMITTERS

These units have been in use on marine installations for some time, although this is the first announcement of their availability.

**Variable Resistors:** Centralab has resumed manufacture of prewar designs of variable resistors. Shafts will be of aluminum again, once more extending 3 ins. from a 3/8-in. bushing. Universal fluted mills now simplify filing, and allow for all types of knots. No substitute materials will be used in Centralab types.

**Coaxial Plugs & Jacks:** To make soldered joints in coaxial cable quick, easy, and positive, the Andrew Company has designed the plug and jack arrangement shown in Fig. 3. Built in sliding sections, the plug and jack are readily disassembled, and the conductors to be soldered are exposed when one screw is removed and the sections are slid apart. No special tools are required.

The parts are machined from bar stock. Inner conductor contacts are silver-plated. Insulation is mycalex.

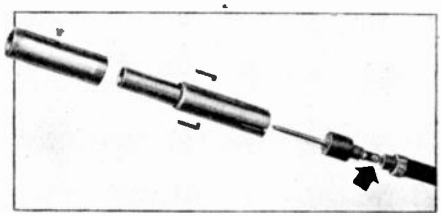


FIG. 3. ANDREW CONNECTOR FOR JOINING COAXIAL TRANSMISSION LINES

**803:** This tube, Fig. 4, manufactured by Taylor Tubes, Inc., is announced as the first large pentode to be manufactured under RCA license in quantity production. Measuring 9 3/8 ins. in overall length, and 2 9/16 ins. in diameter, it is fitted with a giant mycalex base. Following are the essential operating characteristics:

| | |
|---|---|
| Filament voltage, AC or DC | 10 volts |
| Filament Current | 5 amps. |

For use as an RF amplifier and oscillator:

| | |
|---|---|
| DC plate voltage | 2,000 volts |
| Suppressor voltage | 500 volts |
| Screen voltage | 600 volts |
| Grid voltage | −500 volts |
| DC plate current | 175 milliamps. |
| DC grid current | 50 milliamps. |
| Plate input, max. | 350 watts |
| Suppressor input, max. | 10 watts |
| Screen input, max. | 30 watts |
| Plate dissipation, max. | 125 watts |
| Driving power, approx. | 2 watts |
| Power output, approx. | 210 watts |

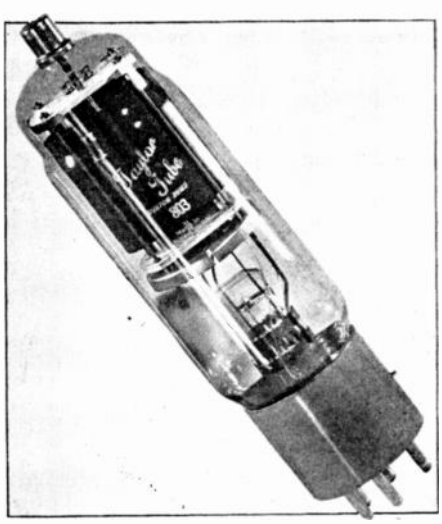


FIG. 4. TAYLOR 803 PENTODE TUBE

The maximum frequency at which full output can be obtained is 20 mc. Vertical mounting is required, with base at top or bottom. At this time, the 803 is available only for military equipment.

# FM, AM & TELEVISION STATION DIRECTORY

## Under Station Call Letters, Names of General Managers Are at Left, Chief Engineers at Right

### U. S. Television Stations

WABD New York N Y — S H Cuff — S Patremio
WBKB Chicago Ill — A H Brolly
WCBW New York N Y — W Miner — P Goldmark
WMJT Milwaukee Wis — W J Damm — D W Gellerup
WNBT New York N Y — J F Royal — O B Hanson
WPTZ Philadelphia Pa — W W Merkle
WRGB Schenectady N Y — R B Stone — R L Smith
WTZR Chicago Ill
W2XMT New York N Y — L L Thompson — T B Grenier
W6XAO Los Angeles Calif — L A Weiss — F M Kennedy
W6XLA Los Angeles Calif — K Landsberg — K Landsberg
W6XYZ Hollywood Calif — K Landsberg — K Landsberg

### U. S. FM Broadcasting Stations

— K —

KDKA-FM Pittsburgh Pa — J E Baudino — T C Kenney
KHJ-FM Hollywood Calif — L A Weiss — F Kennedy
KLAW San Francisco Calif
KMBC-FM Kansas City Mo — A B Church — A R Moler
KOZY Kansas City Mo — E L Dillard — M W Woodward
KSL-FM Salt Lake City Utah — I Sharp — C R Evans
KYW-FM Philadelphia Pa — L W Joy — E H Gager

— W —

WAAW Newark N J — I R Rosenhaus — F V Bremer
WABC-FM New York N Y — A H Hayes — W Lodge
WABF New York N Y — L L Thompson — T B Grenier
WBAM New York N Y — T C Streibert — J R Poppele
WBBM-FM Chicago Ill — J L VanVolkenburg — J J Beloungy
WBCA Schenectady N Y — L L Asch — D S Hoag
WBEZ Chicago Ill — G Jennings — E H Andresen
WBKY Beattyville Ky
WBOE Cleveland O — W B Levenson — N Neal
WBRL-FM Baton Rouge — R Dabadie — D K Allen
WBZ-FM Boston Mass — C S Young — W H Hauser
WBZA-FM Springfield Mass — C S Young — H E Randol
WCAU-FM Philadelphia Pa — N West — G Lewis
WDLM Chicago Ill — H C Crowell — A P Frye
WDRC-FM Hartford Conn — F Doolittle — I Martino
WDUL Duluth Minn — W C Bridges — W H Lounsberry
WELD Columbus O — L H Nafzger — L H Nafzger
WENA Detroit Mich — E K Wheeler — C H Wesser
WEW St Louis Mo — N Pacilara — G E Rueppel
WFIL-FM Philadelphia Pa — R W Clipp — L E Littlejohn
WGFM Schenectady N Y — E Markham — W J Purcell
WGNB Chicago Ill — F P Schreiber — G W Lang
WGTR Boston Mass — J Shepard — I B Robinson
WGYN New York N Y — C J Schaefer — H Anhalt
WHEF Rochester N Y — G O Wilg — B C O'Brien
WHFM Rochester N Y — W Fay — K J Gardner
WHNF New York N Y — H L Pettey — P Fuelling
WIP-FM Philadelphia Pa — B Gimbel — J M Tisdale
WIUC Urbana Ill — J F Wright — A J Ebel
WLBG Philadelphia Pa — E D Clery — J H Henninger
WLOU Detroit Mich — H M Gray — E H Clark
WMFM Milwaukee Wis — W J Damm — D W Gellerup
WMIT Winston-Salem N C — H Essex — P Dillon
WMLL Evansville Ind — C Leich — J B Caraway
WMTW Gorham N H — J Shepard — I Robinson
WNBF-FM Binghamton N Y — C D Mastin — L Gilbert
WNYC-FM New York N Y — M S Novik — B Arnow
WOWO-FM Fort Wayne Ind — J B Conley — B H Ratts
WPEN-FM Philadelphia Pa — A Simon — C Burtis
WQXQ New York N Y — E M Sanger — R D Valentine
WSBF South Bend Ind — F D Schurz — H G Cole
WSM-FM Nashville Tenn — H Stone — G Reynolds
WTAG-FM Worcester Mass — E E Hill — E A Browning
WTIC-FM Hartford Conn — P W Morency — H D Taylor
WTNT Pittsburgh Pa — F R Smith — J R Harlow
WWZR Chicago Ill — E H Herrmann — R Utter
WYNE Brooklyn N Y — J F Macandrew — H O Haverkamp
W2XMN Alpine N J — E H Armstrong — P H Osborn
W2XWG New York N Y — F Mullen — O B Hanson
W8XFM Cincinnati O — J D Shouse
W9XEK Louisville Ky — W L Coulson — D C Summerford

### U. S. AM Broadcasting Stations

— KA —

KABC San Antonio Tex — B Michaels — P Wolf
KABR Aberdeen S D — A A Fahy — D T Hunt
KADA Ada Okla — H W Stamps — H Walker
KALB Alexandria La — E R Cappellini — J Sexton
KAND Corsicana Tex — A H Escoe — E R Hellums
KANS Wichita Kans — J Todd — C C Lucy
KARK Little Rock Ark — G E Zimmerman — D L Winn
KARM Fresno Calif — C F Coombs — R M Dorothy
KASA Elk City Okla
KAST Astoria Ore — L E Parsons — J Titus
KATE Albert Lea Minn — E L Hayek — L Lawson
KAVE Carlsbad N M — C C Cook

— KB —

KBIX Muskogee Okla — J Barry — G Barnett
KBIZ Ottumwa Ia — J J Conroy — A P Johnson
KBKR Baker Ore — L Jacobs — S Williams
KBND Bend Ore — F H Loggon — W Guthrie
KBON Omaha Neb — P Fry — R Wina
KBPS Portland Ore — M E Gilmore — C Weagant
KBST Big Spring Tex — L O Seibert — A M Jones
KBTM Jonesboro Ark — J P Beard — J E Douglas
KBUR Burlington Ia — G B McDermott — R Busch
KBWD Brownwood Tex — W Mayes — A W Stewart

— KC —

KCKN Kansas City Kans — B Ludy — M Williams
KCMC Texarkana Tex — F O Myers — P McCaslin
KCRC Enid Okla — M B Garber — W B Teitzel
KCRJ Jerome Ariz

— KD —

KDAL Duluth Minn — D LeMasurier — R A Dettman
KDB Santa Barbara Calif — F Hollinger — W C Buckley
KDFN Casper Wyo
KDKA Pittsburgh Pa — J E Baudino
KDLR Devils Lake N D
KDNT Denton Tex — HV Shepard — H V Shepard
KDON Monterey Calif — H V Walters — E C Duty
KDRO Sedalia Mo — P E Trout — H Young
KDTH Dubuque Ia — K S Gordon — C M Cain
KDYL Salt Lake City Utah — S S Fox — J M Baldwin

— KE —

KECA Los Angeles Calif — W B Ryan
KEEW Brownsville Tex — E E Wilson — G McIntosh
KELA Centralia-Chehalis Wash — J Chytil — E Lippencott
KELD El Dorado Ark — L M Sipes — A W Hearin
KELO Sioux Falls S D — M Henkin — M Staley
KENO Las Vegas Nev
KERN Bakersfield Calif — L Shatto
KEUB Price Utah
KEVE Everett Wash — B Sims — R H Hilgers
KEVR Seattle Wash — A Schultz
KEX Portland Ore — A X Pangborn
KEYS Corpus Christi Tex — B Hughes — E C Dunn

— KF —

KFAB Lincoln Neb — H M Feltis — M W Bullock
KFAC Los Angeles Calif
KFAM St Cloud Minn — F Schilplin — R B Witschen
KFAR Fairbanks Alaska — A O Bramstedt — A G Heibert
KFBB Great Falls Mont — J P Wilkins — W L Myhre
KFBC Cheyenne Wyo — W C Grove — E G Barnett
KFBI Wichita Kans — R K Lindsley — K W Pyle
KFBK Sacramento Calif
KFDA Amarillo Tex — H P Roberson — J R Thomas
KFDM Beaumont Tex — C B Locke — L M Sanders
KFEL Denver Colo — G O'Fallon — T Atherstone
KFEQ St Joseph Mo
KFFA Helena Ark — J Q Floyd — J C Warren
KFGQ Boone Ia
KFH Wichita Kans — P S Clark — A C Dadisman
KFI Los Angeles Calif — W B Ryan — C Mason
KFIO Spokane Wash — R G McBroom — H L Blatterman
KFIZ Fond du Lac Wis — L A Fairbanks — D Waymire
KFJB Marshalltown Ia — E N Peak — W S Meyers
KFJI Klamath Falls Ore — E Peak
KFJM Grand Forks N D
KFJZ Ft Worth Tex — G L Cagle — T Kimzey
KFKA Greeley Colo — F Price — K H Cooper
KFKU Lawrence Kans
KFMB San Diego Calif — J O Gross — C C Frisk
KFNF Shenandoah Ia — T F Stubbs — R N Barkman
KFOR Lincoln Neb — M Drake — C Winkler
KFOX Long Beach Calif — H G Nicols — L W McDowell
KFPW Ft Smith Ark — J A England — J M VanHorn
KFPY Spokane Wash — A L Bright — G E Langford
KFQD Anchorage Alaska
KFRC San Francisco Calif — D J Donnelly — J J McArdle
KFSG Fresno Calif — P R Bartlett — S W Anderson
KFRO Longview Tex — J R Curtis — J R Curtis
KFRU Columbia Mo — F H Brown — R H Haigh
KFSD San Diego Calif — T E Sharp — G Durham
KFSG Los Angeles Calif — J Carmaine — M E Kluge
KFUN Las Vegas Nev
KFUO Clayton Mo — H H Hohenstein
KFVD Los Angeles Calif — J F Burke — W Gass
KFVS Cape Girardeau Mo — O C Hirsch — O C Hirsch
KFWB Hollywood Calif — H Maillish — H Myers
KFXD Nampa Idaho — F E Hurt — F Hurt
KFXJ Grand Junction Colo
KFXM San Bernardino Calif — M A Vroman — G Ewing
KFYO Lubbock Tex — C L Jaren — L C Erickson
KFYR Bismarck N D — F E Fitzsimonds — I Nelson

— KG —

KGA Spokane Wash — H Wixon — C W Evans
KGB San Diego Calif — F D Ide — W G Collins
KGBS Harlingen Tex — T McDaniel — S Spencer
KGBX Springfield Mo — J G Wardell — D White
KGCU Mandan N D — M J Reichert — L Gunderson
KGCX Sidney Mont — E E Krebsbach — F A Toomey
KGDE Fergus Falls Minn
KGDM Stockton Calif — E F Peffer — B Greene
KGEK Sterling Colo — E G Beehler — E G Beehler
KGER Long Beach Calif — M Dobyns — R Oakley
KGEZ Kalispell Mont
KGFF Shawnee Okla — M Eddy — S Ricciotti
KGFJ Los Angeles Calif — T Kirchner — H Obuchon
KGFL Roswell N M — W E Whitmore
KGFW Kearney Neb — E A Thomas — J Lewis
KGFX Pierre S D — I A McNeil — R H Dye
KGGF Coffeyville Kans — H J Powell
KGGM Albuquerque N M
KGHF Pueblo Colo — P Gundy
KGHI Little Rock Ark — A L Chilton — V O VanDusen
KGHL Billings Mont — F Yocum — J Kilchil
KGIR Butte Mont — E B Craney — J Provis
KGIW Alamosa Colo — E L Allen — R Lewis
KGKB Tyler Tex — J G Ulmer — J B Sheppard
KGKL San Angelo Tex — L O Seibert — F Jones
KGKO Ft Worth Tex
KGKY Scottsbluff Neb
KGLO Mason City Ia — F C Eighmey — R Sawyer
KGLU Safford Ariz — M P Merrill — H Hartman
KGMB Honolulu T H
KGNC Amarillo Tex — R Hollingsworth — W Torrey
KGNO Dodge City Kans — N C Petersen — R Hickman
KGO San Francisco Calif — D Searle — T B Palmer
KGU Honolulu T H — M A Mulrony — M A Mulrony
KGVO Missoula Mont — A J Mosby — F Womble
KGW Portland Ore — A X Pangborn — H Singleton
KGY Olympia Wash — T Olsen — C A Roark

— KH —

KHAS Hastings Neb — D L Watts — H Hardy
KHBC Hilo T H
KHBG Okmulgee Okla — P Buford — C Ludwick
KHJ Los Angeles Calif — L A Weiss — F M Kennedy
KHMO Hannibal Mo — W W Cribb — T M Schenke
KHQ Spokane Wash — H Wixson — C W Evans
KHSL Chico Calif — E P Milburn
KHUB Watsonville Calif — R R Hunt — H Degering

— KI —

KICD Spencer Ia — L W Andrews — H D Grotewohl
KID Idaho Falls Idaho — R Bullen — C N Layne
KIDO Boise Idaho — W E Wagstaff — J Johntz
KIEM Eureka Calif — W B Smullin — A E Olson
KIEV Glendale Calif — L W Peters — L Gustafson
KILO Grand Forks N D — D LeMasurier — A Petrich
KINY Juneau Alaska
KIRO Seattle Wash — H J Quilliam — J B Hatfield
KIT Yakima Wash — J A Murphy — H B Murphy
KIUL Garden City Kans — A Pyatt — W Pash
KIUN Pecos Tex — J W Hawkins — C C Cook
KIUP Durango Colo — R M Beckner — J L Antle

— KJ —

KJBS San Francisco Calif — E P Franklin — C Dutton
KJR Seattle Wash — B F Fisher — F J Brott

— KL —

KLBM LaGrande Ore — G Capps — M M Durham
KLCN Blytheville Ark — H Sudbury — B Conner
KLO Ogden Utah — G B Morgan — W D Cozzens
KLPM Minot N D — J B Cooley — C W Baker
KLRA Little Rock Ark — S C Vinsonhaler — K F Tracey
KLS Oakland Calif — S W Warner — F W Morse
KLUF Galveston Tex — L Clough — L Clough
KLX Oakland Calif — G Shaw — R S Smith
KLZ Denver Colo — H B Terry — H Wehrman
KMA Shenandoah Ia — J C Rapp — R J Schroeder
KMAC San Antonio Tex — C F Harris
KMBC Kansas City Mo — A B Church — A R Moler
KMED Medford Ore — W J Virgin — D H Rees
KMJ Fresno Calif — K B Collins — W N Wallace
KMLB Monroe La
KMMJ Grand Island Neb — W Heath — D Swanson
KMO Tacoma Wash — J A Murphy — J D Kolesar
KMOX St Louis Mo — M S Jones — H Harvey
KMPC Los Angeles Calif — R O Reynolds — L Sigman
KMTR Hollywood Calif — K O Tinkham — P Wilson
KMYC Marysville Calif — J D Carroll — J D Carroll
KMYR Denver Colo — A G Meyer — G James

— KN —

KNEL Brady Tex — G L Burns — A D Patton
KNET Palestine Tex — B Laurie — B Laurie
KNOW Austin Tex — H C Harvey — J E Lewis
KNX Los Angeles Calif — D W Thornburgh — L H Bowman

— KO —

KOA Denver Colo — J R MacPherson — R H Owen
KOAC Corvallis Ore — A Miller — G S Felkert
KOAM Pittsburg Kans — R E Wade — L S Stafford
KOB Albuquerque N M — G S Johnson
KOBH Rapid City S D — R J Dean — A E Griffiths
KOCA Kilgore Tex — H A Degner — A Mason

## U. S. AM Stations, Cont.

KOCY Oklahoma City Okla — H Durham
M H Bonebrake
KODL The Dalles Ore
KODY North Platte Neb — B Eaves
J Alexander
KOH Reno Nev — T Boland
R L Stoddard
KOIL Omaha Neb — C Winkler
G Gray
KOIN Portland Ore — L S Bookwalter
C W Myers
KOKO La Junta Colo
KOL Seattle Wash — P C Lind
A Taft
KOLR Devils Lake N D — R Moritz
B Wick
KOMA Oklahoma City Okla — M W Thomas
K Brown
KOME Tulsa Okla — R Brown
H Grimes
KOMO Seattle Wash — F J Brott
B F Fisher
KONO San Antonio Tex — G Ing
J M Brown
KOOS Marshfield Ore — H Shade
B E Stone
KORE Eugene Ore — S Miller
L W Trommlitz
KORN Fremont Neb — H G Alexander
L Urban
KOTN Pine Bluff Ark — B J Parrish
B J Parrish
KOVC Valley City N D — C J Sjostrom
R E Ingstad
KOVO Provo Utah — J Petersen
C A Tolboe
KOWH Omaha Neb — O E Weimer
B C Corrigan
KOY Phoenix Ariz — P Zeigler
A Johnson

### — KP —

KPAB Laredo Tex — H Smith
R S Dougharty
KPAC Port Arthur Tex — K Hyman
C Vaughan
KPAS Pasadena Calif — J Fredericks
L K King
KPDN Pampa Tex — J R Thomas
J Hanna
KPFA Helena Mont
KPHO Phoenix Ariz — R E Griffith
T Chauncey
KPLC Lake Charles La
KPLT Paris Tex — M C Secrest
P McDonald
KPMC Bakersfield Calif
KPO San Francisco Calif — G Greaves
J W Elwood
KPOF Denver Colo — P H Schissler
A K White
KPOW Powell Wyo — D Brandt
M V Ernst
KPPC Pasadena Calif — V Parsons
L Hall
KPQ Wenatchee Wash — R B Sutton
R Jones
KPRC Houston Tex — H Wheeler
K Tips
KPRO Riverside Calif
W L Gleeson

### — KQ —

KQV Pittsburgh Pa
KQW San Jose Calif

### — KR —

KRBA Lufkin Tex — G Perry
D E Yates
KRBC Abilene Tex — J B Casey
H Barrett
KRBM Bozeman Mont — J J Provis
E A Neath
KRE Berkeley Calif — P McKernan
A Westlund
KRGV Weslaco Tex — L Hartwig
A J Taylor
KRIC Beaumont Tex — B Hughes
J Nell
KRIS Corpus Christi Tex — R S Bush
KRJF Miles City Mont — I A Elliot
W F Flinn
KRKD Los Angeles Calif — W O Freitag
N Connor
KRKO Everett Wash — R C Towne
W R Taft
KRLC Lewiston Idaho — M L MacLafferty
D A Wike
KRLD Dallas Tex — R M Flynn
C W Rembert
KRLH Midland Tex — J Cecil
J M McDonald
KRMD Shreveport La — R M Dean
T B Lanford
KRNR Roseburg Ore — H J Chandler
M H Pengra
KRNT Des Moines Ia — D E Burrichter
P Hoffman
KROC Rochester Minn — F C Clarke
G Wing
KROD El Paso Tex — E P Talbott
V Lawrence
KROS Clinton Ia
KROW Oakland Calif — C E Downey
P G Lasky
KROY Sacramento Calif
KRRV Sherman Tex — T John
L L Hendrick
KRSC Seattle Wash — G A Freeman
R E Priebe

### — KS —

KSAC Manhattan Kans — V B P Holbert
H Umberger
KSAL Salina Kans — N E Vance
O H Balch
KSAM Huntsville Tex
KSAN San Francisco Calif — N J Patterson
J Akers
KSCJ Sioux City Ia — A H Smith
E T Flaherty
KSD St Louis Mo — C R Yarger
G M Burbach
KSEI Pocatello Idaho — H H Fletcher
H H Fletcher
KSFO San Francisco Calif — R V Howard
L Dellar
KSJB Jamestown N D — L R Amoo
L R Amoo
KSKY Dallas Tex — M M Ming
A L Chilton
KSL Salt Lake City Utah — C R Evans
I Sharp
KSO Des Moines Ia — F E Bartlett
G Higgins
KSOO Sioux Falls S D — M Staley
M Henkin
KSRO Santa Rosa Calif
H McCauley
KSTP St Paul Minn — B R Hilker
S E Hubbard
KSUB Cedar City Utah — H Urie
H Urie
KSUN Lowell Ariz
KSWO Lawton Okla — W E Billington
B Ross

### — KT —

KTAR Phoenix Ariz — J H Haughawout
KTBC Austin Tex — M W Jeffus
P Adelman
KTBI Tacoma Wash — G Cole
B W Ormsby
KTBS Shreveport La
J C McCormack
KTEM Temple Tex — P Shaw
F W Mayborn
KTFI Twin Falls Idaho — F V Cox
F M Gardner
KTHS Hot Springs Ark — C L Suitt
K K Kellam
KTKC Visalia Calif — B Williamson
C P Scott
KTKN Ketchikan Alaska
KTMS Santa Barbara Calif — W McHardie
L F Kroeck
KTNM Tucumcari N M
KTOH Lihue T H
KTOK Oklahoma City Okla — C Easum
R D Enoch
KTRB Modesto Calif — W H Bates
W H Bates
KTRH Houston Tex — K H Robinson
B F Orr — T Hiner
KTRI Sioux City Ia — R Beck
D Dirks
KTSA San Antonio Tex — W G Egerton
G W Johnson
KTSM El Paso Tex — E L Gemoets
K O Wyler
KTSW Emporia Kans — H C Davis
J N Rupard
KTTS Springfield Mo — W F Curry
J P Ward
KTUC Tucson Ariz — C A Livingston
L Little
KTUL Tulsa Okla — R Snider
J Esau
KTW Seattle Wash

### — KU —

KUIN Grants Pass Ore — E A Malone
E Hanson
KUJ Walla Walla Wash — M L MacLafferty
H E Studebaker
KUOA Siloam Springs Ark — K Maxwell
S Whaley
KUSD Vermillion S D — S J Graf
H Aarnes
KUTA Salt Lake City Utah — L O Wahlquist
F C Carman

### — KV —

KVAK Atchison Kans — B G Parker
J Akers
KVAN Vancouver Wash — S W McReady
B E Stone
KVCV Redding Calif — R D Will
R Bryan
KVEC San Luis Obispo Calif — E Travis
L Hacker
KVFD Fort Dodge Ia — D Sinclair
E Breen
KVGB Great Bend Kans — L Legleiter
C Morgan
KVI Tacoma Wash — R Griese
V Irwin
KVIC Victoria Tex — R McCown
J Fisher
KVNU Logan Utah — C N Layne
R Bullen
KVOA Tucson Ariz — R Holsclaw
R B Williams
KVOD Denver Colo — W D Pyle
W D Pyle
KVOE Santa Ana Calif — W S Wiggins
E L Spencer
KVOL Lafayette La — B H Bailey
G H Thomas
KVOO Tulsa Okla — L W Stinson
W B Way
KVOP Plainview Tex — J Simms
F LeMieux
KVOR Colorado Spgs Colo — H C Strang
E Shupe
KVOS Bellingham Wash
R Jones
KVOX Moorhead Minn — H E Vose
M M Marget
KVRS Rock Springs Wyo — A W Buchanan
H L McCracken
KVSF Santa Fe N M
KVSO Ardmore Okla — C M Milner
A Riese
KVWC Vernon Tex — H F Ridgway

### — KW —

KWAL Wallace Idaho — A Haapanen
R G Binyon
KWAT Watertown S D — F Alwin
F L Bramble
KWBU Corpus Christi Tex — N Cuesta
C P Collins
KWBW Hutchinson Kans — M H Clary
KWEW Hobbs N M — R Evans
KWFC Hot Springs Ark — E H Butler
W E Ware
KWFT Wichita Falls Tex — J Adams
C E Clough
KWG Stockton Calif
G Ross
KWIL Albany Ore — H Davidson
C Wheeler
KWJB Globe Ariz — H Hartman
P Merrill
KWJJ Portland Ore
KWK St Louis Mo — N J Zehr
R Dady
KWKH Shreveport La — W E Antony
J C McCormack

KWKW Pasadena Calif — P W Spargo
H L Tullis
KWLC Decorah Ia — O Elttreim
M M Roberts
KWLK Longview Wash — R H Mietzke
C O Chatterton
KWLM Willmar Minn — L Stenberg
H W Linder
KWNO Winona Minn
L L McCurnin
KWOC Poplar Bluff Mo — D Lidenton
P H Cunningham
KWON Bartlesville Okla — D DeGrafenreid
J F Case
KWOS Jefferson City Mo — H White
R L Rose
KWRC Pendleton Ore
KWSC Pullman Wash — R Baird
G Jones
KWTO Springfield Mo. — F Bauer
R D Foster
KWYO Sheridan Wyo — B Crosthwait
J Carroll

### — KX —

KXA Seattle Wash — J N Dubuque
F Wallace
KXEL Waterloo Ia — D Kassner
J DuMond
KXL Portland Ore — L K Ballinger
H S Jacobson
KXO El Centro Calif — J Coin
K Thornton — L Bellwood
KXOK St Louis Mo — A Rekart
C L Thomas
KXOX Sweetwater Tex — G W Dotson
J H Hubbard
KXRO Aberdeen Wash — K Grinde
H R Spence
KXYZ Houston Tex — J R Chinski
T F Smith

### — KY —

KYA San Francisco Calif — P Schulz
D Fedderson
KYCA Prescott Ariz
KYOS Merced Calif
KYSM Mankato Minn — J Houts
J F Meagher
KYUM Yuma Ariz — L Wheeler
R C Smucker
KYW Philadelphia Pa — E H Gager
L W Joy

### — WA —

WAAB Worcester Mass
WAAC Ft Myers Fla
WAAF Chicago Ill — C W Ulrich
B R Eldmann
WAAT Newark N J — F V Bremer
I R Rosenhaus
WABC New York N Y — W Lodge
A H Hayes
WABI Bangor Me — W Dickson
F B Simpson
WABY Albany N Y
WACO Waco Tex — L H Appleman
R E Glasgaw
WADC Akron O — L P Hennigan
A T Simmons
WAGA Atlanta Ga — A L Jones
C A Smithgall
WAGE Syracuse N Y — C W Brannen
WAGF Dothan Ala — J T Hubbard
J C Smith
WAGM Presque Isle Me — L E Hughes
H D Glidden
WAIM Anderson S C — W R Davidson
J D McCoy
WAIR Winston-Salem N C — L C King
G D Walker
WAIT Chicago Ill — E Jacker
G T Dyer
WAJR Morgantown W Va
H B McNaughton
WAKR Akron O — G Paul
S B Berk
WALA Mobile Ala — R Killough
H K Martin
WALB Albany Ga — D Layton
A M Israel
WALL Middleton N Y
M Karig — E Warnock
WAML Laurel Miss — G Dennis
B Dennis
WAOV Vincennes Ind — G M Nutty
V H Lund
WAPI Birmingham Ala — N S Hurley
T Holt
WAPO Chattanooga Tenn — B B Barnes
R G Patterson
WARM Scranton Pa — A W Oschmann
M F Memolo
WARW Clarksdale Miss
WASK Lafayette Ind — H C Garba
J Spring
WATL Atlanta Ga — R W Minton
J A Davenport
WATN Watertown N Y
G H Righter
WATR Waterbury Conn — R Jensen
H Thomas
WATW Ashland Wis — H Dahlbacka
J W Huss
WAVE Louisville Ky — W Hudson
N Lord — N Wilson
WAWZ Zarephath N J
WAYS Charlotte N C — J C Price
G O Shepherd
WAYX Waycross Ga — J J Tobola
J J Tobola — J H Mathiot
WAZL Hazelton Pa

### — WB —

WBAA W Lafayette Ind
J W Ditamore
WBAB Atlantic City N J — E Godfrey
M L Mendelsohn
WBAL Baltimore Md — G W Cooke
H C Burke
WBAP Ft Worth Tex — R C Stinson
G Cranston
WBAX Wilkes-Barre Pa — J H Stenger
J H Stenger
WBBB Burlington N C — B Tysor
E Z Jones
WBBL Richmond Va — R W Raabe
M A Sitton
WBBM Chicago Ill — J J Beloungy
J L Van Volkenburg
WBBR Brooklyn N Y — R H Leffler
M A Howlett
WBBZ Ponca Okla — L E Brown
A L Carrell
WBCM Bay City Mich — R H Carpenter
H A Giesel
WBEN Buffalo N Y — R J Kingsley
A H Kirchhofer
WBHP Huntsville Ala — J Garrison
W H Pollard
WBIG Greensboro N C — E Allison
E Ridge
WBIR Knoxville Tenn — J R Horton
J P Hart
WBLJ Dalton Ga — W C Roberts
W V Williams
WBLK Clarksburg W Va — J Wright
G C Blackwell
WBML Macon Ga — H S Goodrich
C W Pittman
WBNS Columbus O — L H Nafzger
WBNX New York N Y — A L Solbrig
W I Moore
WBNY Buffalo N Y — T L Venes
R L Albertson
WBOC Salisbury Md — P A Alfonsi
WBOW Terre Haute Ind — D Aldrich
G Jackson
WBRC Birmingham Ala — G P Hamann
J Bell
WBRE Wilkes Barre Pa — C Sakoski
A C Baltimore
WBRK Pittsfield Mass
WBRW Welch W Va — J H Metz
J H Metz
WBRY Waterbury Conn — F B Hales
E J Frey
WBT Charlotte N C — M J Minor
A D Willard
WBTA Batavia N Y — H Cochran
C R Switendick
WBTH Williamson W Va — R W Bullio
A Shein
WBTM Danville Va — H W Spencer
R S Guyer
WBYN Brooklyn N Y — P Testan
W Norin
WBZ Boston Mass — W H Hauser
C S Young
WBZA Springfield Mass — H E Randol
C S Young

### — WC —

WCAE Pittsburgh Pa — J Schultz
L Kapner
WCAL Northfield Minn — O Haldorsen
D Johnson
WCAM Camden N J — C E Onens
W H Markward
WCAO Baltimore Md — M L Jones
L W Milbourne
WCAP Asbury Pk N J
WCAR Pontiac Mich — W N Cook
H Y Levinson
WCAT Rapid City S D — G Lewis
WCAU Philadelphia Pa — J C Quill
L Levy
WCAX Burlington Vt — J V Jones
C P Hasbrook
WCAZ Carthage Ill — A E Eckels
WCBI Columbus Miss — H L Dewing
B McRaney
WCBM Baltimore Md — C Meares
G H Roeder
WCBS Springfield Ill — H S McCartney
C Neeld
WCBT Roanoke Rapids N C — V Stahl
S E Crew
WCCO Minneapolis Minn — R B Pappin
A E Joscelyn
WCED DuBois Pa
J S Gray
WCFL Chicago Ill
H T Keegan

## U. S. AM Stations, Cont.

WCHS Charleston W Va
H L Chernoff — O E Robinson
WCHV Charlottesville Va
C Barham — W Gray
WCKY Cincinnati O
L B Wilson — A D Gillette
WCLO Janesville Wis
S H Bliss — W Clay
WCLS Joliet Ill
R M Holt — L DeCosta
WCMI Ashland Ky — C W Weaver
WCNC Elizabeth City N C
J E Aydlett — J J Behonis
WCOA Pensacola Fla
WCOC Meridian Miss
D W Gavin — D W Gavin
WCOL Columbus O
L Pixley — J E Lowe
WCOP Boston Mass
A N Armstrong — R Hale
WCOS Columbia S C
W C Bochman — H L Clippard
WCOU Lewiston Me
O J Norman — J T Duty
WCOV Montgomery Ala
G W Covington — J C Hughes
WCPO Cincinnati O
M C Watters
WCRS Greenwood S C
D Crosland — E C Niemann
WCRW Chicago Ill
J A White — C R White
WCSC Charleston S C
J M Rivers — W R Albee
WCSH Portland Me
W H Rines — G F Crandon

### — WD —

WDAE Tampa Fla
L S Mitchell — W P Moore
WDAF Kansas City Mo
D Fitzer — J A Flaherty
WDAK Columbus Ga
L J Duncan — D Pulley
WDAN Danville Ill
E C Hewes — T G Magin
WDAS Philadelphia Pa
P J Stanton — F Unterberger
WDAY Fargo N Dak
J Dunn — S J Savold
WDBC Escanaba Mich
WDPJ Roanoke Va
R P Jordan — J W Robertson
WDBO Orlando Fla
W G McBride — J E Yarbrough
WDEF Chattanooga Tenn
F S Lane — B C Baker
WDEL Wilmington Del
J E Mathiot
WDEV Waterbury Vt
L E Squier — H Grout
WDGY Minneapolis Minn
G W Young — G W Young
WDLP Panama City Fla
R Hayford — E Scott
WDMJ Marquette Mich
WDNC Durham N C
J F Jarmon — W S Hill
WDOD Chattanooga Tenn
E W Winger — J C Vessels
WDRC Hartford Conn
F M Doolittle — I Martino
WDSM Superior Wis
A C Robinson — J M Laskey
WDSU New Orleans La
F Weber — C Whitney
WDWS Champaign Ill
J A McDermott — J R Baum
WDZ Tuscola Ill
W C Schafer — T A Giles

### — WE —

WEAF New York N Y
F Mullen — O B Hanson
WEAN Providence R I
J Lopez — H Tilley
WEAU Eau Claire Wis
W C Pridgen — T O Jorgenson
WEBC Duluth Minn
W C Pridgen — W H Lounsberry
WEPQ Harrisburg Ill
I M Taylor — J R Tate
WEPR Buffalo N Y
C King — R Lamy
WEDC Chicago Ill
F J Kettnour — C Lewicki
WEED Rocky Mount N C
WEEI Boston Mass
WEEU Reading Pa
C M Chafey — H O Landis
WEGO Concord N C
W M Nelson — W M Nelson
WEIM Fitchburg Mass
E C Clement — T Kalin
WELI New Haven Conn
H H Lone — F King
WELL Battle Creek Mich
D E Jayne — E J Stone
WEMP Milwaukee Wis
C J Lanphier — R Jost
WENR Chicago Ill
E R Borroff — E C Horstman
WENY Elmira N Y
D Taylor — T A Greene
WEOA Evansville Ind
C Leich — E Schoeny
WERC Erie Pa
C E Denny — T Phillips
WEST Easton Pa
E Anderson — J E Mathiot
WESX Martinhead Mass
WEVD New York N Y
H Greenfield — C W Brown
WEW St Louis Mo
N Pacillara — G E Rueppel
WEXL Royal Oak Mich
E C Thompson — J Steadley

### — WF —

WFAA Dallas Tex
M Campbell — T Collins
WFAB White Plains N Y
F A Seitz — F A Seitz
WFBC Greenville S C
B Whitmire — W C Etheridge
WFBG Altoona Pa
R F Thompson — G R Burgoon
WFBL Syracuse N Y
S Woodworth — A R Marcy
WFBM Indianapolis Ind
F O Sharp — H S Holland
WFBR Baltimore Md
H H Barroll — W Q Ranft
WFCI Pawtucket R I
W A Walker — G Johnson
WFDF Flint Mich
H M Loeb — F D Fallain
WFEA Manchester N H
A Owens — R Schow
WFHR Wisconsin Rapids
G T Frechette — G N Bowker
WFIG Sumter S C — E W Roman
WFIL Philadelphia Pa
R W Clipp — L E Littlejohn
WFIN Findlay O
F R Hover — E C Smith
WFLA Tampa Fla
W W Tison — J H Mitchell
WFMD Frederick Md
WFMJ Youngstown O
W F Maag — F A Dieringer
WFNC Fayetteville N C
C J Ewing — B K Thron
WFOR Hattiesburg Miss
C J Wright — D E Hardison
WFOY St Augustine Fla
WFPG Atlantic City N J
E E Kohn — E Sanders
WFTC Kinston N C
J Welland — F R Clark
WFTL Ft Lauderdale Fla
S Smithgall — P Whitney
WFVA Fredericksburg Va

### — WG —

WGAA Cedartown Ga
WGAC Augusta Ga
J B Fuqua — J Lyon
WGAL Lancaster Pa
W O Miller — J E Mathiot
WGAN Portland Me
C E Gatchell — R W Hodgkins
WGAR Cleveland O
J F Patt — R M Pierce
WGAU Athens Ga
M C Gorman — M C Gorman
WGBB Freeport N Y
H H Carman — H H Carman
WGBF Evansville Ind
C Leich — F Gehres
WGBG Greensboro N C
R M Lambeth — J H Warlick
WGBI Scranton Pa
G D Coleman — K R Cooke
WGER Goldsboro N C
H G Bright — D B Trueblood
WGCM Gulfport Miss
H O Jones — D Murphy
WGES Chicago Ill
WGGA Gainesville Ga
H R Holt — E Sampatt
WGH Newport News Va
E E Bishop — W P Grether
WGIL Galesburg Ill — E I King
WGKV Charleston W Va
J B Matthews — M Swizzinger
WGL Ft Wayne Ind
J B Conley — B H Ratts
WGN Chicago Ill
F P Schreiber — G W Lang
WGNC Gastonia N C
P McSwain — W C Groves
WGNY Newburgh N Y
H W Cassill — M S Selmes
WGOV Valdosta Ga
E D Rivers
WGPC Albany Ga
M U Kinnett — C M Kinnett
WGR Buffalo N Y
I R Lounsberry — K B Hoffman
WGRC Louisville Ky
C L Harris — P Esten
WGRM Greenwood Miss
WGST Atlanta Ga
F Gaither — B Akerman
J Fulton
WGTC Greenville N C
M J Laughinghouse — H Tribley
WGTM Wilson N C
A Wannamaker — W Wooten
WGY Schenectady N Y
K Hager — W J Purcell

### — WH —

WHA Madison Wis
WHAI Greenfield Mass
H W Nichols — L F Wheeler
WHAM Rochester N Y
J H Lee — K J Gardner
WHAS Louisville Ky
W L Coulson — D C Summerford
WHAT Philadelphia Pa
WHAZ Troy N Y
W J Williams — W C Stoker
WHB Kansas City Mo
WHBB Selma Ala
J Smith — T F Kelly
WHBC Canton O
F Hinkle — K L Sliker
WHBF Rock Island Ill
L C Johnson — R J Sinnett
WHBI Newark N J
WHBL Sheboygan Wis
H H Born — H J Mayer
WHBQ Memphis Tenn
E A Alburty — S D Wooten
WHBU Anderson Ind
J R Atkinson — L F Podhaski
WHBY Appleton Wis — G E Merkl
WHCU Ithaca N Y
M R Hanna — T McLean
WHDF Calumet Mich
J W Rice — G L Burgan
WHDH Boston Mass
R G Matheson — R G Matheson
WHDL Olean N Y
T L Brown — T J Gill
WHEB Portsmouth N H
B Georges — P G Lindsay
WHEC Rochester N Y
G O Wilg
WHFC Cicero Ill
WHIO Dayton O
R H Moody — E Adams
WHIS Bluefield W Va
H I Shott — P T Flanagan
WHIT New Pern N C — G Neuville
WHIZ Zanesville O
A Haid — W Hunt
WHJB Greensburg Pa
G J Podeyn — W McCoy
WHK Cleveland O
K K Hackathorn — R H DeLany
WHKC Columbus O
WHKK Cleveland O
R W Richmond — J S Hill
WHKY Hickory N C
E S Long — E S Long
WHLB Virginia Minn
O H Peterson — E Jokinen
WHLD Niagara Falls N Y
E C Hull — R J Wilson
WHLN Harlan Ky
R B Helms — J F Fox
WHLS Port Huron Mich
H L Stevens — L C Conant
WHMA Anniston Ala
J W Buttram — J Hudson
WHN New York N Y
WHO Des Moines Ia
J O Maland — P A Loyet
WHOM Jersey City N J
J Lang — T Gempp
WHOP Hopkinsville Ky
F E Lackey — C W Stratton
WHP Harrisburg Pa
A K Redmond — R S Duncan
WHUB Cookeville Tenn
M L Medley — H Beasley
WHYN Holyoke Mass
P J Montague — T R Humphrey

### — WI —

WIBA Madison Wis
E C Allen — N Hahan
WIBC Indianapolis Ind
C A McLaughlin — H E Adams
WIBG Philadelphia Pa
E D Clery — J H Henninger
WIBM Jackson Mich
W Cizek — C W Wirtanen
WIBU Poynette Wis
W Forrest — L Doese
WIBW Topeka Kans
B Ludy — K G Marquardt
WIBX Utica N Y
M P Bowen — J T Dowdell
WICA Ashtabula O
R B Rowley — G E Gautney
WICC Bridgeport Conn
J T Lopez — G P Ketch
WIGM Medford Wis
I Meyer — R Bohnert
WIL Louis Mo
C W Benson — C Stoup
WILL Urbana Ill
J F Wright — A J Ebel
WILM Wilmington Del — J E Mathiot
WINC Winchester Va — P Whitney
WIND Gary Ind — V H Voss
WING Dayton O
J P Williams — S Beck
WINK Ft Myers Fla
R B Woodyard — H Ritchey
WINN Louisville Ky
H McTigue — V Nunn
WINS New York N Y
C G Cosby
WINX Washington D C
L J Heller — R E Cannon
WIOD Miami Fla
J M Legate — W Chiles
WIP Philadelphia Pa
B Gimbel — J M Tisdale
WIRE Indianapolis Ind
R Schepp — E E Alden
WIS Columbia S C
G R Shafto — S Helt
WISE Asheville N C
H H Thoms — M Hollerith
WISH Indianapolis Ind
C B McConnell — W S Gresham
WISN Milwaukee Wis
G W Grignon — N J Richard
WISR Butler Pa
D H Rosenblum — P Rex
WITH Baltimore Md
T G Tinsley — J S Duff
WIZE Springfield O — A F Martin

### — WJ —

WJAC Johnstown Pa
J C Tully — N L Straub
WJAG Norfolk Neb
A Thomas — F Wiedenbach
WJAR Providence R I
J J Boyle — T C J Prior
WJAS Pittsburg Pa
H J Brennen — W W McCoy
WJAX Jacksonville Fla
WJBC Bloomington Ill
G M McGregor — J Hamm
WJBK Detroit Mich
J Hopkins
WJBO Baton Rouge La
R Dabadie — D K Allan
WJBW New Orleans La
WJBY Gadsden Ala
WJDX Jackson Miss
W P Hafris — P G Root
WJEJ Hagerstown Md
G C Crilley — G McIntire
WJHL Johnson City Tenn
W Lancaster — O K Garland
WJHO Opelika Ala
F M Hyatt — F M Hyatt
WJHP Jacksonville Fla
T Chapeau — B Hayford
WJIM Detroit Mich
H M Gray — E H Clark
WJJD Chicago Ill
A F Harre — W F Meyers
WJLB Detroit Mich — E H Clark
WJLD Bessemer Ala
H Falter — C M Callicott
WJLS Beckley W Va
V N Cooper — A J Ginkel
WJMC Rice Lake Wis
L G Anderson — C W LaBonte
WJMS Ironwood Mich
J W Huss — A Dahlbacka
WJNO W Palm Beach Fla
WJOB Hammond Ind
O E Richardson — S Strasburg
WJPA Washington Pa
J M Croft — J M Troesch
WJPF Herrin Ill
C R Cook — M F Sawyer
WJPR Greenville Miss
E H McMurry — G W Wilson
WJR Detroit Mich
L Fitzpatrick — M R Mitchell
WJRD Tuscaloosa Ala
J R Doss — J W Arendale
WJTN Jamestown N Y
D S Wilkins — H Krotzert
WJW Cleveland O
W M O'Neil — G Roberts
WJZ New York N Y
J H McNeil — G Milne
WJZM Clarksville Tenn
W E Williams — W B Thurman

### — WK —

WKAR E Lansing Mich
R J Coleman — N E Grover
WKAT Miami Beach Fla
J I Prosser — A Smith
T Magee
WKBB Dubuque Ia
J D DCarpenter — L T Carlson
WKBH LaCrosse Wis
H Dahl — A Leeman
WKBN Youngstown
W P Williamson — W P Williamson
WKBO Harrisburg Pa
C G Moss — J E Mathiot
WKBV Richmond Ind
G F Albright — G Walker
WKBW Buffalo N Y
I R Lounsberry — K B Hoffman
WKBZ Muskegon Mich
G F Ashbacker — G Krivitzky
WKEU Griffin Ga
WKEY Covington Va
E M Key
WKIP Poughkeepsie N Y
R E Coon — J P Burke
WKMO Kokomo Ind
J C Jeffrey — G Palmer
WKNE Keene N H
D Carpenter — E Batchelder
WKNY Kingston N Y
L Steketee — J M Troesch
WKOK Sunbury Pa
M Lahr — H Bower
WKPA Kingsport Tenn
J Swicegood — G W Upchurch
WKRC Cincinnati O
K Church — G A Wilson
WKST New Castle Pa
A W Graham — R Emch
WKWK Wheeling W Va
J B Reynolds — F Baker
WKY Oklahoma City Okla
G V Grubb — H J Lovell
WKZO Kalamazoo Mich
J E Fetzer — C E Lee

### — WL —

WLAC Nashville Tenn
F C Sowell — F D Binns
WLAG La Grange Ga
E Mullinax — J M McKay
WLAK Lakeland Fla
S O Ward — W P Lee
WALP Lexington Ky
J E Willis — S Helt
WLAV Grand Rapids Mich
H M Steed — R Plank
WLAW Lawrence Mass
I E Rogers — G A Hinckley
WLAY Muscle Shoals Ala
E J Sperry — J W Smith
WLB Minneapolis Minn
E W Ziebarth — Berton Holmberg
WLBC Muncie Ind
D A Burton — M M Crain
WLBJ Bowling Green Ky
K D Given — J Hight
WLBL Stevens Point Wis
F R Calvert — W Ninneman
WLBZ Bangor Me
WLDS Jacksonville Ill
WLEU Erie Pa
V H Weir — C Baker
WLIB Brooklyn N Y
E I Godofsky — A Faske
WLLH Lowell Mass
R Donahue — R Newton
WLNH Laconia N H
M B Avery — L C Steady
WLOF Orlando Fla
WLOG Logan W Va
J C McGowan — L C Beckworth
WLOK Lima O
R Elvin — R Gartner
WLOL Minneapolis Minn
E S Mittendorf — G Brautigam
WLPM Suffolk Va
F L Hart
WLS Chicago Ill
G Snyder — T L Rowe
WLVA Lynchburg Va
P P Allen — J Orth
WLW Cincinnati O
J D Shouse — R J Rockwell

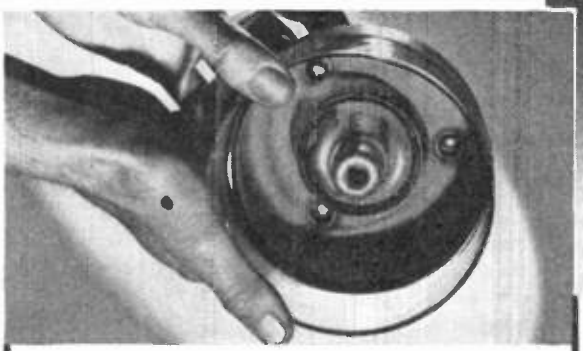
### — WM —

WMAL Washington D C
K H Berkeley — D Hunter
WMAM Marinette Wis
J D Mackin — M R Lund
WMAN Mansfield O
J M O'Hara — W E Morrison
WMAQ Chicago Ill
H Kopf — H C Luttgens
WMAS Springfield Mass
W Greenwood — E Hewinson
WMAZ Macon Ga
W E Cobb — G P Rankin
WMBD Peoria Ill
E L Bill — T A Giles
WMBG Richmond Va
W M Havens — W H Wood
WMBH Joplin Mo
D J Poyner — R Meek
WMBI Chicago Ill
WMBO Auburn N Y
F L Keesee
WMBR Jacksonville Fla
F King
G Marshall — E Vordermark
WMBS Uniontown Pa
J C Burwell — W Henzly
WMC Memphis Tenn
H W Slavick — E C Frase
WMCA New York N Y
C Stark — F Marx
WMEX Boston Mass
WMFD Wilmington N C
R A Dunlea — E I Herring
WMFF Plattsburg N Y
G F Bissell — J Nazak
WNFG Hibbing Minn — W H Lounsberry
WMFR High Point N C
H M Lambeth — R P Boyd
WMGA Moultrie Ga
J Pidcock — J M Wilder
WMIN St Paul Minn
E Hoffman
WMIS Natchez Miss — T W Patterson

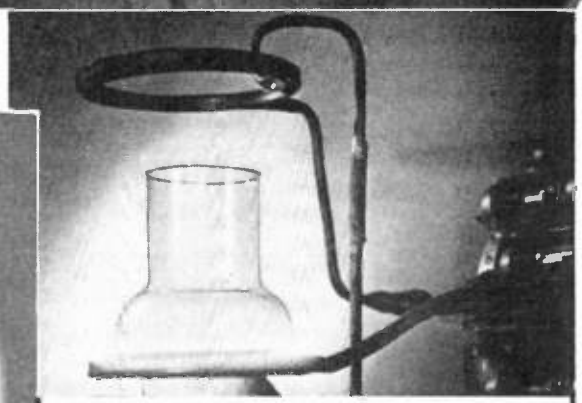
# Many complex glass structures go into a modern vacuum tube

*Forming special quartz part at 1800° Centigrade*

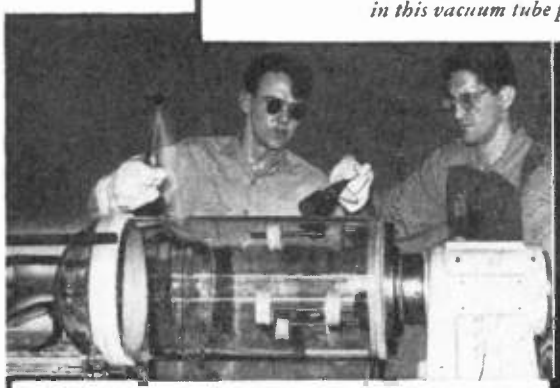
In vacuum tubes many complicated shapes, large and small, must be made within very close tolerances. Eimac's know-how of handling glass is just one reason why electronic engineers throughout the world submit their special problems to Eimac with complete confidence in Eimac's ability to do a superior job.



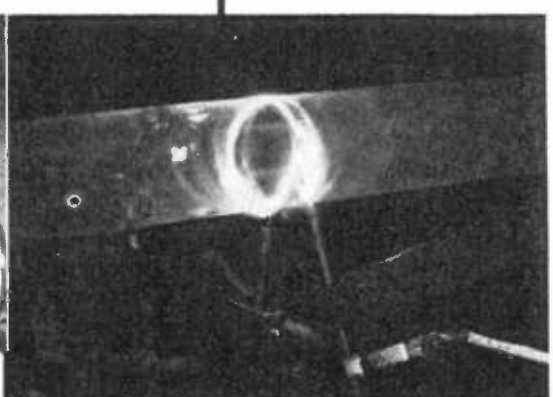
*There are four complicated glass to metal seals in this vacuum tube part*



*The use of R. F. heat in making glass to metal seals simplifies and speeds many such sealing operations*



*Making very large glass seals requires expert handling. Two 17" glass cylinders are being joined*



*Heavy glass tubing is accurately and rapidly sealed with a Radio Frequency Arc*

Electronic Telesis—a sixty-four page, completely illustrated handbook has been designed especially to assist you in explaining the fundamentals of Electronics to laymen. Send for your copy today.

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873

## U. S. AM Stations, Cont.

WMJM Cordele Ga — J S Rivers — H Harrell
WMMN Fairmont W Va — S P Kettler — R Hough
WMOB Mobile Ala — S B Quigley — T W Greenwood
AMOG Brunswick Ga — K E White — K E White
WMPC Lapeer Mich
WMPS Memphis Tenn — H R Krebstein — J G Deaderick
WMRC Greenville S C — W E Bray — G D Tate
WMRF Lewiston Pa
WMRN Marion O — R T Mason — S R Morrison
WMRO Aurora Ill — V G Cofey
WMSL Decatur Ala — M Hutson — G G Sandlin
WMT Cedar Rapids Ia — W B Quarton — C Quintin
WMUR Manchester N H — H Carter — V H Chandler
WMVA Martinsville Va — J W Shultz — D W Muse

### — WN —

WNAB Bridgeport Conn — L Thomas — V DeLaurentis
WNAC Boston Mass — I B Robinson
WNAD Norman Okla — J W Dunn — C L Farrar
WNAX Yankton S D — D E Inman — C M Todd
WNBC Hartford Conn — R B Holt
WNBF Binghamton N Y — C D Mastin — L Gilbert
WNBH New Bedford Mass — H R Norman — E T Parker
WNBZ Saranac Lake N Y — J F Grimes — H B Williams
WNEW New York N Y — B Judis — M J Weiner
WNLC New London Conn — G J Morey — G J Morey
WNOE New Orleans La
WNOX Knoxville Tenn — H LeBrun — J Cole
WNYC New York N Y — M S Novik — B Arnow

### — WO —

WOAI San Antonio Tex — H A L Halff — F Sterling
WOC Davenport Ia — J B Lottridge — P A Arvidson
WOI Ames Ia — W I Griffith — L L Lewis
WOKO Albany N Y
WOL Washington D C — W B Dolph — H H Lyon
WOLF Syracuse N Y — T S Marshall — D F Foote
WOLS Florence S C — N L Royster — H L Hanks
WOMI Owensboro Ky — H O Potter — L R Goodaker
WOMT Manitowoc Wis — F M Kadow — W F Duben
WOR New York N Y — T C Streibert — J R Poppele
WORC Worcester Mass — M P Stanton
WORD Spartanburg S C — W J Brown — C J Burdette
WORK York Pa — J E Mathiot
WORL Boston Mass — G Lasker — J W Parker
WOSH Oshkosh Wis — B A Laird — N Williams
WOSU Columbus O — R C Higgy — C A Boehnker
WOV New York N Y — H Meyer
WOW Omaha Neb — J J Gillin — W J Kotera
WOWO Ft Wayne Ind — J B Conley — B H Ratts

### — WP —

WPAD Paducah Ky — P E Lackey — V C Morris
WPAR Parkersburg W Va — G H Clinton — C Knowles
WPAT Paterson N J — S J Flamm — E Lucas
WPAX Thomasville Ga — H Wimpy — J W Poole
WPAY Portsmouth O — P Wagner — M L Myers
WPDQ Jacksonville Fla — R R Feagin — J Donovon
WPEN Philadelphia Pa — A Simon — C Burtis
WPIC Sharon Pa — J Fahnline — A C Heck
WPRO Providence R I — F R Ripley — J Ferri
WPTF Raleigh N C — R H Mason — H Hulock
WPTZ Philadelphia Pa — P Knight — F J Bingley

### — WQ —

WQAM Miami Fla — F W Borton — W E Davenport
WQAN Scranton Pa — E J Lynett
WQBC Vicksburg Miss — O W Jones — C E Drake
WQXR New York N Y — E M Sanger — R D Valentine

### — WR —

WRAK Williamsport Pa — G E Joy — L N Persio
WRAL Raleigh N C — F Fletcher — S Brown
WRAW Reading Pa — R A Gaul — H O Landis
WRBL Columbus Ga — W Herrin
WRC Washington D C — C D Smith — D Cooper
WRDO Augusta Me — Q Crandall — H Dinsmore
WRDW Augusta Ga — W R Ringson — H Aderhold
WREC Memphis Tenn
WREN Lawrence Kans — V Bratton — C Bliesner
WRGA Rome Ga — H Quarles — D Williams
WRJN Racine Wis — H R LePoidevin — F L Dechant
WRLC Toccoa Ga — V E Craig — E Church
WRNL Richmond Va — E S Whitlock — W R Selden
WROK Rockford Ill — R Weaver — C Hicks
WROL Knoxville Tenn — J N Gilbert
WROX Clarksdale Miss — C B Jordan — D J Tucker
WRRF Washington N C — W R Roberson — G P Martin
WRRN Warren O — E J Pryor — C J Hurton
WRUF Gainesville Fla — G Powell — P Craig
WRVA Richmond Va — C T Luch — D C Woods

### — WS —

WSAI Cincinnati O — J D Shouse — R J Rockwell
WSAJ Grove City Pa — V T Seaman
WSAM Saginaw Mich — B B Musselman — R H Musselman
WSAN Allentown Pa — T W Aydlett — E M Cronk
WSAP Portsmouth Va — W T Welch
WSAR Fall River Mass — W T Welch
WSAU Wausau Wis — B F Hovel — R R Richardt
WSAV Savannah Ga — H Daniel — M E Thompson
WSAY Rochester N Y — G P Brown — G P Brown
WSAZ Huntington W Va — F J Evans — L Kilpatrick
WSB Atlanta Ga — J M Outler — C F Daugherty
WSBA York Pa — L Vyner — W N Weaver
WSBC Chicago Ill
WSFA Montgomery Ala — H E Pill — C Shelkofsky
WSGN Birmingham Ala — G F Bishop
WSIX Nashville Tenn — J M Draughon — B E Porter
WSJS Winston-Salem N C — H Essex — P Hedrick
WSKB McComb Miss
WSLB Ogdensburg N Y
WSLI Jackson Miss — L M Sepaugh — C A Perkins
WSLS Roanoke Va — J H Moore — J P Briggs
WSM Nashville Tenn — H Stone — G Reynolds
WSMB New Orleans La — H Wheelahan — H G Nebe
WSNJ Bridgeton N J — P Alger — F Fekel
WSNY Schenectady N Y — G R Nelson — I P Beck
WSOC Charlotte N C — E J Gluck — L L Caudle
WSON Henderson Ky — H S Lackey
WSOO Sault Ste Marie Mich — S R Pratt — E T Kaari
WSOY Decatur Ill — E E Lindsay — P A Wnorowski
WSPA Spartanburg S C — S J Brown — H R Beckholt
WSPB Sarasota Fla — J B Browning — J E Grant
WSPD Toledo O — E Y Flannigan — W Stringfellow
WSPR Springfield Mass — Q A Brackett — L A Reilly
WSRR Stamford Conn — H H Meyer — E L Markman
WSTP Salisbury N C — B P Beard — C Watson
WSTV Steubenville O — J Laux — J Troesch
WSUI Iowa City Ia — C H Menzer — C H Menzer
WSUN St Petersburg Fla — N E Brown — L J Link
WSVA Harrisonburg Va — F L Allman — D A Nichols
WSYB Rutland Vt — J H Weiss — N Ransom
WSYR Syracuse N Y — H C Nlider — A G Belle Isle

### — WT —

WTAD Quincy Ill — C A Flfer — F Wentura
WTAG Worcester Mass — E E Hill — E A Browning
WTAL Tallahassee Fla — T M Meyer — W A Snowden
WTAM Cleveland O — V H Pribble — S E Leonard
WTAQ Green Bay Wis — W J Stangel
WTAR Norfolk Va — C Arnoux — J L Grether
WTAW College Station Tex — T Hills — H C Dillingham
WTAX Springfield Ill — J A Johnson — E C Swaringen
WTBO Cumberland Md — A S Becker — D Jefferies
WTCM Traverse City Mich — L Biederman — L Biederman
WTCN Minneapolis Minn — C T Hagman — M Fleming
WTEL Philadelphia Pa — H N Cocker — E D Hibbs
WTHT Hartford Conn — C G DeLaney — C S Masini
WTIC Hartford Conn — P W Morency — H D Taylor
WTJS Jackson Tenn — A A Stone — C Brummel
WTMA Charleston S C — R E Bradham — D M Bradham
WTMC Ocala Fla — T S Gilchrist — B Hayford
WTMJ Milwaukee Wis — W J Damm — D W Gellerup
WTMV E St Louis Ill
WTNJ Trenton N J — F J Wolff — E P Knowles
WTOC Savannah Ga — W T Knight — C M Gray
WTOL Toledo O — A Shawd — J Sheehan
WTOP Washington D C — C J Burkland — C M Hunt
WTRC Elkhart Ind — R R Baker — L M Zellmer
WTRY Troy N Y — W A Riple — W P Whitman
WTSP St Petersburg Fla — L L D Herron — W D Mangold
WTTM Trenton N J — P Alger — T P Kilmer

### — WW —

WWDC Washington D C — G B Larson — R H Beville
WWJ Detroit Mich — H Bannister — H F Tank
WWL New Orleans La — W H Summerville — J D Bloom
WWNC Asheville N C — D S Elias — C B Hoskins
WWNY Watertown N Y — T E Martin — M B Davis
WWPG Palm Beach Fla — D S Greenlef — P McGinty
WWRL New York N Y — W H Reuman — W H Reuman
WWSR St Albans Vt — W L Blake — T Boisvert
WWSW Pittsburgh Pa — F R Smith
WWVA Wheeling W Va — G W Smith — E L Kelm

### — WX —

WXYZ Detroit Mich — H A Campbell — C Kocher

## Canadian AM Stations

### — CB —

CBA Sackville N B
CBF Montreal Que — O Renaud — E D Roberts
CBJ Chicoutimi Que — V Fortin — J E Roberts
CBK Watrous Sask — A Grignon — J L Marshall
CBL Toronto Ont
CBM Montreal Que — O Renaud — E D Roberts
CBO Ottawa Ont — C P Wright — M W Gilbert
CBR Vancouver B C — I Dilworth — N R Olding
CBV Quebec Que — M Valiquette — C Frenette

### — CF —

CFAC Calgary Alta
CFAR Flin Flon Man — G B Quinney — H Beckman
CFBR Brockville Ont — J C Whitby — G W Anderson
CFCF Montreal Que — R M Brophy — J Gettenby
CFCH North Bay Ont
CFCN Calgary Alta — H G Love — B Lamb
CFCO Chatham Ont — J Beardall — G Brooks
CFCY Charlottebown PEI — K S Rogers — R F Large
CFGP Grande Prairie Alta — C L Berry — G Sadler
CFJC Kamloops B C — I Clark — R Tate
CFNB Fredericton N B
CFOS Owen Sound Ont — B Hawkins — B Vallins
CFPA Port Arthur Ont — R H Parker — R H Parker
CFPL London Ont — C Thomas — J Warder
CFPR Prince Rupert B C — C H Insulander — C H Insulander
CFQC Saskatoon Sask — A A Murphy
CFRB Toronto Ont — H Sedgwick — J Sharpe
CFRC Kingston Ont
CFRN Edmonton Alberta — F R A Rice — F Makepeace

### — CH —

CHAB Moose Jaw Sask — H C Buchanan — A E Jacobson
CHAD Amos Que — H Cooke — A E Crump
CHEX Peterborough Ont
CHGB St Anne de la Pocatiere Que — G T Desjardins
CHGS Summerside PEI — R L Mollison — A McKie
CHLN Trois-Rivieres Que — L Trepanier — L Trepanier
CHLP Montreal Que — M Lefebvre — A Cloutier
CHLT Sherbrooke Que — A Gauthier — R Paquette
CHML Hamilton Ont — C Howde — W Crawford
CHNC New Carslisle Que — C Howde — J R McGough
CHNS Halifax N S — W C Barrett — A W Greig
CHOV Pembroke Ont
CHPS Parry Sound Ont — G E Smith — L A Croutel
CHRC Quebec Que — J N Thivierge — A Nadeau
CHSJ St John N B — L C Rudoff — J G Bishop

### — CJ —

CJAT Trail B C — W Dales — E C Aylen
CJBC Toronto Ont
CJBR Rimouski Que — G A Lavole — F C Coak
CJCA Edmonton Alta — G S Henry — G Shillabeer
CJCB Sydney N S — N Nathanson — A Vernon
CJCJ Calgary Alta
CJCS Stratford Ont — S E Tapley — G Hildebrand
CJCX Sydney N S — N Nathanson — A Vernon
CJFX Antigonish N S — J C Nunn — G MacDougall
CJGX Yorkton Sask — A Mills
CJIC Sault Ste Marie Ont
CJKL Kirkland Lake Ont — T G Watson
CJLS Yarmouth N S
CJMH Medicine Hat Alta — J H Yuill — S R Sadler
CJOC Lethbridge Alta — N Botterill — J C Stewart
CJOR Vancouver B C — A H Chanlder
CHRL Kenora Ont — H Clark — G Sands
CJVI Victoria B C — M V Chestnut — J Sommers

### — CK —

CKAC Montreal Que — P Lalonde — L Spencer
CKBI Prince Albert Sask — L Moffatt — T Van Ness
CKCH Hull Que — L Amyot — M Gebhardt
CKCK Regina Sask — H Crittenden — E A Strong
CKCL Toronto Ont — E O Swan
CKCO Ottawa Ont — G M Geldert — W McLellan
CKCR Kitchener Ont — W C Mitchell — T Hartman
CKCV Quebec Que — P LePage — M Belanger
CKCW Moncton N B — F A Lynds — A J White
CKEY Toronto Ont — J K Cooke — E W Swan
CKGB Timmins Ont — H Freeman — E D Mott
CKLN Nelson B C — J B Stark — S Irving
CKLW Windsor Ont — J E Campeau — W J Carte
CKMO Vancouver B C — T C Stewart — R L Whiteside
CKNB Campbellton N B — C H Houde — L P Paquet
CKNX Wingham Ont — W T Cruickshank — W T Cruickshank
CKOC Hamilto Ont — W T Cranston — L Horton
CKOV Kelowna B C — J W B Browne — J H B Browne
CKPC Brantford Ont — J D Buchanan — A Teague
CKPR Port Arthur Ont — R H Parker
CKRC Winnipeg Man — G Gaetz — A W Hooper
CKRM Regina Sask — W A Speers — W McDonald
CKSO Sudbury Ont — D McGill — J McRae
CKRB St Catherines Ont — W H Allen
CKUA Edmonton Alta — B M Rce — R Usher
CKVD Val D'or Que — L Godin — G Pope
CKWS Kingston Ont — J M Davidson — C McCurdy
CKWX Vancouver B C — C H Elphicke — G Fairweather
CKX Brandon Man — W F Seller — C E R Collins
CKY Winnipeg Man — W H Backhouse — W Duffield

### — VO —

VONF St Johns Nfd — W F Galgay

## Canadian FM Stations

VE9AK Toronto Ont — H Sedgwick — J Sharpe
VE9CM Montreal Que — R M Brophy — J Gettenby

## U. S. General Managers

### — A —

Aarnes H — KSVD
Aburty E A — WHBQ
Adelman P — KTBC
Akers J — KSAN KVAK
Albright G F — WKBV
Alexander J — KODY
Alger P — WSNJ WTTM
Allen E C — WIBA
Allen E L — KGIW
Allen P P — WLVA
Allman F L — WSVA
Amoo L R — KSJB
Anderson E — WEST
Anderson L G — WJMC
Andrews L W — KICD
Armstrong A N — WCOP
Armstrong E H — W2XMN
Arnoux C — WTAR
Asch L L — WBCA
Ashbacker G F — WKBZ
Atkinson J R — WHBC
Avery M B — WLNH
Aydett J E — WCNC
Aydlett T W — WSAP

### — B —

Baker R R — WTRC
Balch O H — KSAL
Baltimore A C — WBRE
Bannister H — WWJ
Barham C — WCHV
Barrett H — KRBC
Barroll H H — WFBR
Barry J — KBIX
Barnett S W — WOOD
Bates W H — KTRB
Baudino J E — KDAK-FM KDKA
Beard B P — WSTP
Beard Mrs J P — KBTM
Becker A S — WTBO
Bell J C — WBRC
Benson L A — WIL
Berk S B — WAKR
Berkeley K H — WMAL
Biederman L — WTCM
Bill E L — WMBD
Binyon R G — KWAL
Bishop E E — WGH
Bissell G F — WMFF
Blackwell G C — WBLK

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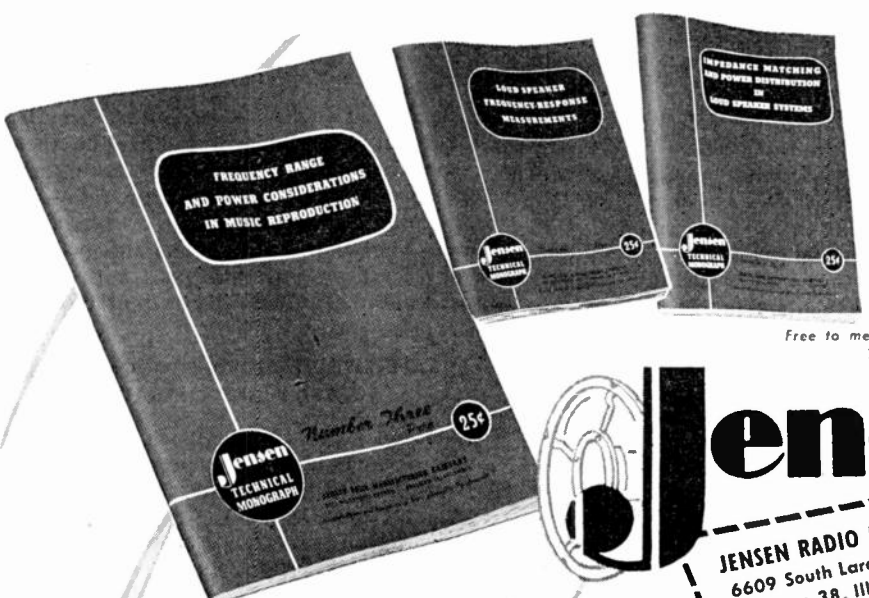


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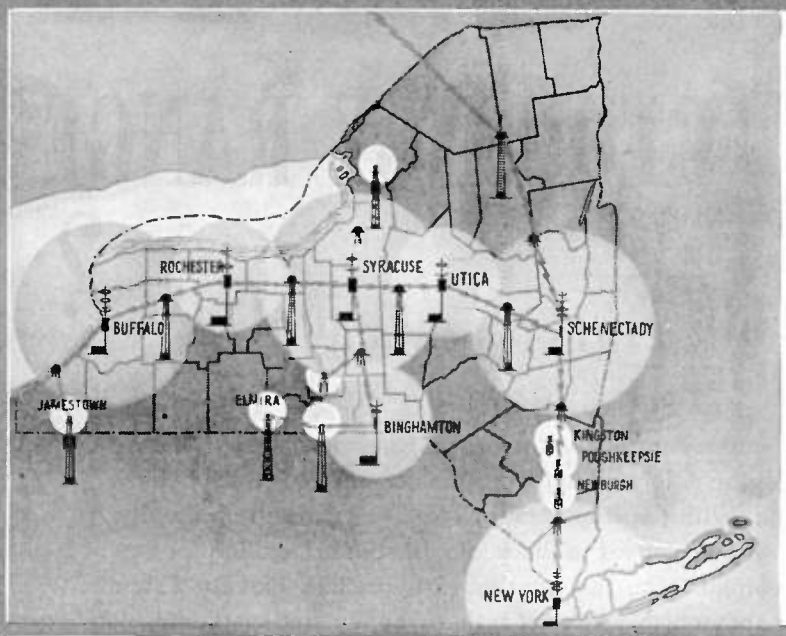



93% of the population of New York State could be covered by this regional network of five master television stations and nine satellite stations.

A television network relay station.

# The G-E Satellite

## will bring 1. Network Television 2. Television Revenue

G-E developments will make it possible to provide television program service in small and intermediate markets as well as large cities.

Master television stations, capable of originating television shows of network calibre, will be located in the larger centers of population. These master stations can be linked together in regional networks by G-E ultra-high frequency radio relay stations. Coast-to-coast hook-ups of regional networks logically will follow.

### SATELLITE STATIONS THE NEXT STEP

From this broad framework will stem still other stations — hundreds! . . . to bring television to the smaller communities — to make it a still more attractive advertising medium for concerns doing a regional or nation-wide business.

Known as satellite stations, these smaller community stations will tie in with their respective regional networks by taking network programs from the nearest relay station, and rebroadcasting them over the local area. The satellite station can also produce and televise its own film programs, under local sponsorship, independently of the networks.

### SATELLITE STATIONS ECONOMICAL TO BUILD AND OPERATE

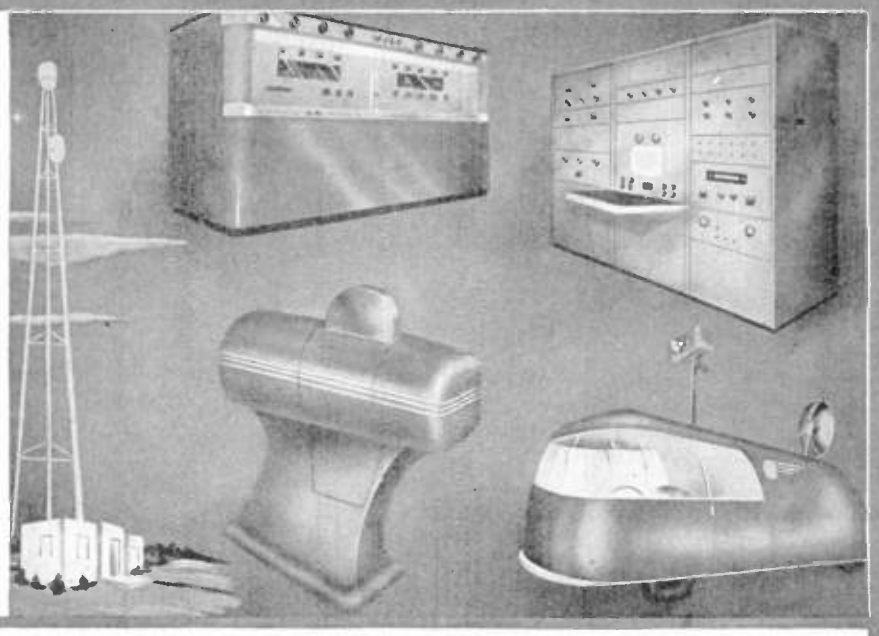
A satellite television station will be relatively inexpensive to install and operate — and will require a minimum of operating personnel.

The illustration at the far right, above, shows equipment required for a satellite television

STATION AND STUDIO EQUIPMENT • TRANSMITTERS

GENERAL ELECTRIC


The G-E disk-seal tube — a development that makes ultra-high frequency relaying possible.



Equipment for a G-E satellite television station. Antenna · 16-mm projector · Transmitter · Receiver-monitor · Mobile pick-up unit

# Television Station

## to small communities

## to local station owners

station of the future. A simple building houses the equipment and a lattice tower supports both the broadcasting antennas and the antenna which picks up the picture and sound signals from the nearest relay station. The small transmitter will have sufficient power to cover the local market area. A receiver-monitor unit, an amplifier unit, and a 16-mm motion picture projector and film pick-up camera complete the essential station equipment.

For local revenue, a 16-mm silent motion picture camera will be used by the satellite station operator to take pictures of products or demonstrations local merchants may wish to advertise. A G-E magnetic wire recorder will add background sound and commentary. Local happenings—parades, fires, dedications, sports, and social events—can be filmed in similar manner to provide other local sponsored programs. For on-the-spot broadcasts of events as they happen, a small truck may be equipped as a mobile unit.

Let General Electric help you with your preliminary plans. Let General Electric provide your complete television broadcasting system. Benefit from G.E.'s experience in operating WRGB — the nation's most powerful television station.

If you are interested in television broadcasting, plan your visit to Schenectady now — Thursdays and Fridays are our "open house" days at WRGB. If you have not received the G-E brochure, "TELEVISION BROADCASTING POST-WAR," write *Electronics Department, General Electric, Schenectady, New York.*

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

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*See G-E for all three!*

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Born H H — WHBL
Borroff E R — WENR
Borton F W — WQAM
Bowen Mrs S H — WIBX
Boyle J J — WJAR
Brackett Q A — WSPR
Bradham R E — WTMA
Bramble F L — KWAT
Bramstedt A O — FAR
Bratton V — WREN
Bray W E — WMBC
Breen E — KVFD
Brennen H J — WJAS
Bridges W C — WEAU WEBC WDUL
Bright A L — KFPY
Bright H G — WGBR
Brown F H — KFRU
Brown F K — KOMA
Brown G P — WSAY
Brown J M — KONO
Brown N E — WSUN
Brown T L — WHDL
Brown W J — WSPA WORD
Browning J B — WSPB
Bryan R — KVCV
Buford P — KHBG
Bullen R — KVNU KID
Burbach G M — KSD
Burke H C — WBAL
Burkland C J — WTOP
Burns G L — KNEL
Burton D A — WLBC
Burwell J C — WMBS
Buttram J W — WHMA

— C —

Cagle G L — KFJZ
Calvert F R — WLBL
Campbell H A — WXYZ
Campbell M — KGKO WFAA
Cappellini E R — KALB
Capps G — KLBM
Carmaine J — KFSG
Carman F C — KUTA
Carman H H — WGBB
Carpenter D — WKNE
Carpenter J D — WKBB
Carrell A L — WBBZ
Carroll J — KWYO
Carroll J — KMYC
Carter H — WMUR
Case J F — KWON
Cassill H W — WCNY
Chafey C W — WEEV
Chapeau T — WJHP
Chatterton C O — KWLK
Chauncey T — KPHO
Chernoff H L — WCHS
Chilton A L — KSKY KGHI
Church A B — KMBC-FM KMBC
Church K — WKRC
Chytil J — KELA
Cizek W — WIBM
Clark P S — KFH
Clement E — WEIM
Clery E D — WLBG WIBG
Clinton G H — WPAR
Clipp R W — WFIL-FM WRIL
Clough C E — KWFT
Clough L — KLUF
Cobb W E — WMAZ
Cocker H N — WTEL
Coleman G D — WJBO
Coleman R J — WKAR
Collins C P — KWBU
Collins K B — KMJ
Conley J B — WGL WOWO-FM WOWO
Connor N — KRKD
Conroy J J — KBIZ
Cook C R — WJPF
Cooley J B — KLPM
Coombs C F — KARM
Coon R E — WKIP
Cooper V N — WJLS
Corrigan B C — KOWH
Cosby C G — WINS
Coulson W L — W9XEK WHAS
Covington G W — WCOV
Craig V E — WRJC
Crandall Q — WROD
Craney E B — KGIR
Cranston G — WBAP
Crew S E — WCBT
Cribb W W — KHMO
Crilley G C — WJEJ
Croft J M — WJPA
Crosland D — WCRS
Crowell H C — WDLM
Cuff S H — WABD
Cunningham P H — KWOC
Curtis J R — KFRO

— D —

Dabadir R — WBRL-FM WJBO
Dady R — KWK
Dahl H — WKBH
Damm W H — WTFM WMJJ WTMJ
Daniel H — WSAY
Davenport J A — WATL
Dean R J — KOBH
Degner H A — KOCA
DeLaney C G — WTHT
Dellar L — KSFO
Denny C E — WERC
Dillard E L — KOZY
Dirks D — KTRI
Ditamore J W — WBAA
Dobyns M — KGER
Dolph W B — WOL
Donahue R — WLLH
Donnelly D J — KFRC
Doolittle F M — WDRC-FM WDRC
Doss J R — WJRD
Dougherty R S — KPAB
Drake M — KPOR
Draughn J M — WSIX
DuMond J — KXEL
DuMont A B — W2XWV
Duncan L J — WDAK
Dunlea R A — WMPD
Dunn J — WDAY
Dunn J W — WNAD
Dyer G T — WAIT

— E —

Eddy M — KGFF
Eidmann B R — WAFF
Eighmey F C — KGLO
Elias D S — WWNC
Elvin R — WLOK
Elwood J W — KPO
England J A — KFPW
Enoch R D — KTOK
Ernst M V — KPOW
Esau J — KTUL
Escoe A H — KAND
Essex H — WSJS WMIT
Evans F J — WSAZ
Ewing W C — WFNC

— F —

Fahnline J — WPIC
Fahy A A — KABR
Fairbanks L A — KFIZ
Falter H — WJLD
Fay W — WHFM
Feagin R — WPDQ
Fedderson D — KYA
Fetzer J E — WKZO
Fifer C A — WTAD
Fisher B F — KOMO KJR
Fisher J — KVIC
Fitzer D — WDAF
Fitzpatrick L — WJR
Fitzsimonds F E — KFYR
Flaherty E T — KSCJ
Flamm S J — WPAT
Fletcher F — WRAL
Fletcher H H — KSEI
Fletis H M — KFAB
Flinn W F — KRJF
Floyd J Q — KFFA
Forrest W C — WIBU
Foster R D — KWTO
Fox S S — KDYL
Franklin E P — KJBS
Frechette G T — WFHR
Frey E J — WBRY
Fry P — KBON
Fultin J — WGST
Fuqua J B — WGAC

— G —

Galther F — WGST
Garber M B — KCRC
Gardner F M — KTFI
Garner J E — KFPW
Gatchell C E — WGAN
Gaul R A — WRAW
Gavin D W — WCOC
Georges B — WHEB
Giesel H A — WBCM
Gilchrist T S — WTMC
Gillin J J — WOW
Gilmore M E — KBPS
Gimbel B — WIP WIP-FM
Given K D — WLEJ
Glasgow R E L — WACO
Gleeson W L — KPRO
Glidden H D — WAGM
Gluck E J — WSOC
Goddard F G — KXRO
Godofsky E I — WLIB
Gordon K S — KDTH
Gorman M C — WGAU
Graham A W — WKST
Gray G — KOIL
Gray H M — WJBL WLOU
Gray J S — WCED
Greenfield H — WEVD
Greenlief D S — WWPG
Greenwood W — WMAS
Griffith W I — WOI
Grignon G W — WISN
Grimes H — KOME
Grimes J F — WNBZ
Gross J O — KFMB
Grossman H — WOOC WOOW
Grove W C — KFBC
Grubb G V — WKY
Guyer R S — WBTM

— H —

Hackathorn K K — WHK
Hacke R L — KVEC
Hager K — WGY
Hagman C T — WTCN
Hahn N H — WIBA
Haid A — WHIZ
Halff H A L — WOAI
Hall L — KPPC
Hanna J — KPDN
Hanna M R — WHCU
Hanson R — KUIN
Harre A F — WJJD
Harris C L — WGRC
Harris W P — WJDX
Hart F L — WLPM
Hart J P — WBIR
Harvey H C — KNOW
Hasbrook C P — WCAX
Havens W M — WMBG
Hawkins J — KIUN
Hayek E L — KATE
Hayes A H — WABC WABC-FM
Hayford B — WDLP
Heath W — KMMJ
Heller L J — WINX
Helms R B — WHLN
Hendrick L L — KRRY
Henkin M — KSOO KELD
Herrin W — WRLB
Herron L L D — WTSP
Herrmann E H — WWZR
Hewes E C — WDAN
Higgins G — KSO
Higgy R C — WOSU
Hill E — WTAG WTAG-FM
Hills T — WTAW
Hinkie F — WHBC
Hirsch O C — KFVS
Hoffman E — WMIN
Hoffman P — KRNT
Hohenstein H H — KFUO
Hollinger F — KDB
Hollingsworth R — KGNC
Holt H R — WGGA
Holt R M — WCLS
Holt T — WAPI
Hopkins J — WJBK
Hovel B F — WSAU
Hover F R — WFIN
Howlett M A — WBBR
Hubbard J H — KXOX
Hubbard S E — KSTP
Hughes B — KEYS
Hull E C — WHLD
Hunt R R — KHUB
Hurt F E — KFXD
Huss J W — WJMS WATW
Hutson M — WMSL
Hyatt F M — WJHO

— I —

Ide F D — KGB
Ingstad R E — KOVC
Inman D E — WNAX
Irwin V I — KVI
Israel A M — WALB

— J —

Jackson G — WBOW
Jacobs L — KBKR
Jacobson H S — KXL
Jaren C L — KGDE
Jarman J F — WDNC
Jayne D E — WELL
Jeffrey J C — WKMO
Jennings G — WBEZ
Johnson A — KOY
Johnson D — WCAL
Johnson G W — KTSA
Johnson L C — WHBF
Johnson J A — WTAX
Johnson K B — WCOL
Johnson G C — WDBO
Jones E Z — WBBB
Jones G — KWSC
Jones H O — WGCM
Jones O W — WQBC
Jones M S — KMOX
Jones R — KPQ KVOS
Jordan C B — WRR
Jordon R P — WDBJ
Joscelyn A E — WCCO
Joy G E — WRAK
Joy L W — KYW-FM
Judis B — WNEW

— K —

Kadow F M — WOMT
Kapner L — WCAE
Karig M — WALL
Keegan H T — WCFL
Keesee F L — WMBO
Kellam K K — KTHS
Kettler S P — WMMM
King C — WEPR
King F — WMFR
King L K — KPAS
Kinnett M U — WGPC
Kirchner T — WGPC
Kmety V — WWZR
Knight P — WPTZ
Knight W T — WTOC
Kohn E E — WFPG
Koph H C — WMAQ
Kotnour F J — WEDC
Krebsbach E E — KGCY
Kreistein H R — WMPS
Kroeck L F — KTMS

— L —

Lackey F E — WHOP
Lackey P E — WPAD
Lackey H S — WSON
Lahr M — WKOK
Laird B A — WOSH
Lambeth H M — WMFR
Lambeth R N — WGBG
Lancaster W H — WJHL
Landis D W — KFYO
Landsberg K — W6XYZ W6XLA
Lane F S — WDEF
Lanford T B — WROX
Lang J — WHOM
Lanphier C J — WEMP
Larson G B — WWDC
Lasker — WORL
Lasky P G — KROW
Laughinghouse M J — WGTC
Laurie B — KNET
Laux J — WSTV
Lawrence C — KSO KRNT
Lawrence V — KROD
LeBrun H — WNOX
Lee J H — WHAM
Legate J M — WIOD
Leich C — WBGF WEOA WMLL
LeMasurier D — KILO KDAL
LeMieux F — KVOP
LePoldevin H R — WRJN
Levenson W B — WBOE
Levinson H Y — WCAR
Levy L — WCAU
Levinson H Y — WCAR
Linder A W — KWLM
Lindsay E E — WSOY
Lindsley R K — KFBI
Little L — KTUC
Locke C B — KFDM
Loeb H M — WFDF
Loggan F H — KBND
Long D H — WELI
Long E S — WHKY
Lopez J — WEAN
Lopez J T — WICC
Lord N — WAVE
Lottridge J B — WOC
Lounsberry I R — WGR WKBW
Lucy C T — WRVA
Ludy B — KCKN WIBW
Lund V H — WAOV
Lynett E J — WQAN

— M —

Maag W F — WFMJ
Macandrew J F — WYNE
Mackin J D — WMAN
MacPherson J R — KOA
Malzlish H — KFWB
Maland J O — WHO
Marget M M — KOVN
Markham E — WGFM
Markward W H — WCAM
Marshall G — WMBR
Marshall T S — WOLF
Martin H K — WALA
Martin T E — WWNY
Mason R H — WPRF
Mason R T — WMRN
Mastin C D — WNBF-FM
Matheston R G — WHDH
Matthews J B — WGKV
Mayborn F W — KTEM
Mayes W — KBWD
McBride W G — WDBO
McBroom R G — KFIO
McConnell C B — WISH
McCormack J C — KTBS KWKH
McCoy J D — WAIM
McCracken H L — KVRS
McCurnin L L — KWNO
McDaniel T — KGBS
McDermott G B — KBUR
McDermott J A — WDWS
McDonald J M — KRLH
McDonald P — KPLT
McGowan J E — WLOG
McGregor G M — WJBC
McLaughlin C A — WIBC
McMurry E H — WJPR
McNaughton H B — WAJR
McNeil I A — KGFX
McNeil J H — WJZ
McRaney B — WCBI
McSwain P — WGNC
McTigue H — WINN
Meagher J F — KYSM
Medley M L — WHUB
Memolo M F — WARM
Mendelshon M L — WBAB
Menzer C H — WSUI WSUI
Merlke W W — WPTZ
Merrill P — KGLU
Metz J H — WBRW
Meyer A G — KMYR
Meyer H H — WSRR
Meyer I — WIGM
Michaels B — KABC
Milbourne L W — WCAO
Miller A — KOAC
Miller W O — WGAL
Miner W — WCHW
Mitchell L S — WDAE
Mittendorf E S — WLOL
Montague P J — WHYN
Moody R H — WHIO
Morency P W — WTIC WTIC-FM
Morey G J — WNLC
MORGAN C — KVGB
Morgan G B — KLO
Mosby A J — KGBO
Moss C G — WKBO
Mullen F — NBC Network
Mullinax E — WLAG
Mulrony M A — KGU
Murdock M M — KFH
Murphy J A — KMO
Murphy J A — KIT
Musselman B B — WSAN
Myers C W — KOIN
Myers F O — KCMC
Myers T M — WTAL

— N —

Nafzger L H — WELD
Neath E A — KBRM
Neeld C W — WCBS
Neil J — KRIC
Nelson G R — WSNY
Nelson W M — WEGO
Nichols H G — KFOX
Nichols H W — WHAI
Norins W — WBYN
Norman H R — WNBH
Normand O J — WCOU
Novik M S — WNYC-FM

— O —

O'Fallon G — KFEL
O'Halloran P — KPOW
O'Hara J M — WMAN
Olsen T — KGY
O'Neil W M — WJW
Ormsby B W — KTBI
Orr B F — KTRH
Outler J M — WSB
Owen E — KBIZ
Owens A — WFEA

— P —

Pagliara N — WEW
Pangborn A X — KGW
Parrish B J — KOTN
Parsons L E — KAST
Patt J F — WGAR
Patterson R G — WAPO
Peak E N — KFJB
Peffer E F — KGDM
Penura M H — KRNR
Peters L W — KIEV
Peterson N C — KGNO
Peterson O H — WHLB
Pettey H L — WHNF
Phillips G — KIDO
Pidcock J F — WMGH
Pill H E — WSFA
Pittman C W — WBML
Pixley L — WCOL
Podeyn G J — WHJB
Pollard W H — WBHP
Potter H O — WOMI
Powell G — WRUF
Powell H J — KGGF
Poynor D J — WMBH
Pratt S R — WSOO
Pribble V H — WTAM
Price F — KFKA
Priebe R E — KRSC
Prosser J I — WKAT
Pryor E J — WRRN
Pyatt A — KUIL
Pyle W D — KVOD

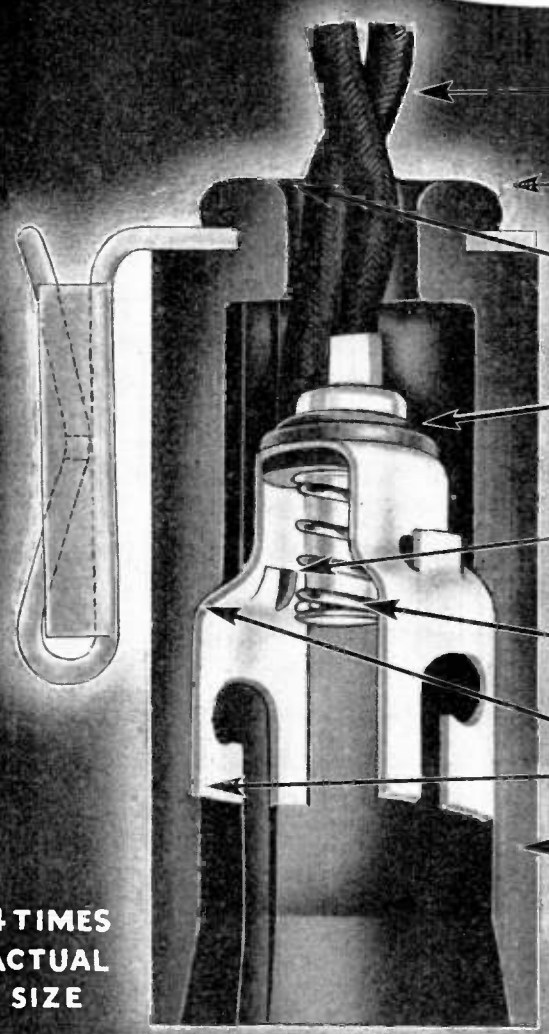
— Q —

Quarels H — WRGA
Quarton W B — WMT
Quigley S B — WMOB
Quilliam H J — KIRO

— R —

Rapp J C — KMA
Redmond A K — WHP
Reichert M J — KCKN
Rembert G W — KRLD
Reuman W H — WWRL
Reynold G A — WSM-FM
Reynolds J B — WKWK
Reynolds R O — KMPC
Rice J W — WHDF
Richardson O E — WJOB
Richmond R W — WHKK
Ridge E — WBIG
Riese A — KVSO
Righter G H — WATN
Rines W H — WCSH
Ringson W R — WRDW
Riple W A — WTRY
Ripley F R — WPRO
Rivers E D — WGOV
Rivers J S — WMJM
Rivers J M — WCSC
Roberson H P — KFDA
Roberson W R — WRRF
Roberts I S — KGBS

# *a New and Superior* DIAL LIGHT SOCKET




Tensile strength of leads and connections far in excess of requirements.

Tough, plastic shell molded around bracket providing a secure bond with mechanical strength far beyond any normal requirement.

Rounded edge will not cut or fray wire insulation.

Voltage Breakdown between contacts—1200 Volts. Voltage Breakdown to ground —5000 Volts.

Lug on contact fits in groove in shell so that contact cannot be turned or twisted when inserting lamp.

Center contact mounted so that it cannot protrude from shell and short on chassis when lamp is removed.

Plastic shell is recessed for contacts, which cannot be pushed or pulled out of position.

Stronger, tougher, heavy walled plastic shell.

A variety of different mounting bracket styles available, suitable for practically any mounting.

## For Your Present and Post-War Production

**40th ANNIVERSARY**
**1904–1944**

This year Lenz celebrates its 40th year of service to the communications industry.

Lenz Dial Light Sockets have always been known for their superior mechanical qualities and electrical characteristics.

Now these sockets are still further improved, with even greater mechanical strength. A stronger, tougher plastic shell is attached to the bracket with a new type of construction that provides a virtually unbreakable bond between shell and bracket. Its excellent electrical characteristics are maintained.

Consider these Lenz Dial Sockets for your present and post war production. Write for sample today.

LENZ

In Business Since 1904

**LENZ ELECTRIC MANUFACTURING CO.**

1751 N. WESTERN AVE. CHICAGO 47, ILLINOIS

ELECTRIC CORDS, WIRES AND CABLES

### U. S. General Managers, Cont.

| | |
|---|---|
| Roberts M M | KWLC |
| Robinson A C | WDSM |
| Roeder G H | WCBM |
| Rogers I E | WLAW |
| Rose R L | KWOS |
| Rosenblum D H | WISR |
| Rosenhaus I R | WAAT WAAW |
| Ross B | KSWO |
| Ross G | KWG |
| Rowley R B | WICA |
| Royal J F | WNBT |
| Royster N L | WOLS |
| Rupard J N | KTSW |
| Ryan J M | WBTA |
| Ryan W B | KFI |
| **— S —** | |
| Sanger E M | WQXR WQXQ |
| Schaefer C J | WGYN |
| Schafer W C | WDZ |
| Schepp R | WIRE |
| Schilpin F | KFAM |
| Schreiber F P | WGN WGNB |
| Schultz J W | WMVA |
| Schurz F D | WSBF |
| Scott C P | KTKC |
| Searle D | KGO |
| Seibert L O | KGKL KBST |
| Seitz F A | WFAS |
| Seapugh L M | WSLI |
| Shafto G R | WIS |
| Sharp F O | WFBM |
| Sharp I | KSL-FM |
| Sharp T E | KFSD |
| Shaw G | KLX |
| Shawd A | WTOL |
| Shein A | WBTH |
| Shepard H V | KDNT |
| Shepard J | WMTW WGTR |
| Shepherd G O | WAYS |
| Shott H I | WHIS |
| Shouse J D | WLW WLWK WSAI W8XFM W8XCT |
| Shupe E | KVOR |
| Simmons A T | WADC |
| Simon A | WPEN WPEN-FM |
| Simpson F B | WABI |
| Sims B | KEVR |
| Sipes L M | KELD |
| Sitton M A | WBBL |
| Smith C D | WRC |
| Smith F R | WTNT |
| Smith H M | WAML |
| Smith J C | WAGF WHBB |
| Smith T F | KXYZ |
| Smithgall C A | WAGA |
| Smithgall C | WFTL |
| Smucker R C | KYUM |
| Smullin W B | KIEM |
| Snyder G | WLS |
| Sowell F C | WLAC |
| Spence H R | KXRO |
| Spencer E L | KVOE |
| Sperry E J | WLAY |
| Spring J | WASK |
| Squier L E | WDEV |
| Stamps H W | KADA |
| Stanton M P | WORC |
| Stanton P J | WDAS |
| Stark C | WMCA |
| Steed H M | WLAV |
| Steketee L | WKNY |
| Stenger J H | WBAX |
| Stevens H L | WHLS |
| Stoddard R L | KOIL |
| Stone A A | WTJS |
| Stone B E | KOOS KVAN |
| Stone H | WSM WSM-FM |
| Stone R B | WRGB |
| Streibert T C | WOR WBAM |
| Stubbs R F | KFNF |
| Studebaker H E | KUJ |
| Sudbury H | KLCN |
| Summerville W J | WWL |
| Swicegood J | WKPT |
| Switendink C R | WBTA |
| **— T —** | |
| Taft A | KOL |
| Taft W R | KRKO |
| Taylor A J | KRGV |
| Taylor D | WENY |
| Taylor I M | WEBQ |
| Terry H B | KLZ |
| Thomas A | WJAG |
| Thomas C L | KXOX |
| Thomas E A | KGFW |
| Thomas G H | KVOL |
| Thomas H | WATR |
| Thomas L | WNAB |
| Thompson E C | WEXL |
| Thompson L L | WABF |
| Thompson R F | WFBG |
| Thoms H H | WISE |
| Thornburgh D W | KNX |
| Thornton K | KXO |
| Tinkham K O | KMTR |
| Tinsley T G | WITH |
| Tips K | KPRC |
| Tison W W | WFLA |
| Tobola J J | WAYX |
| Todd J | Kans |
| Tolboe C A | KOVO |
| Trommlitz L W | KORE |
| Trout P E | KDRO |
| Tullis H L | KWKW |
| Tully J C | WJAC |
| Twambly E H | WBEN |
| **— U —** | |
| Ulmer J G | KGKB |
| Umberger H | KSAC |
| Upton E O | WBKB WGXBK WGXBT |
| Urban L | KORN |
| Urie H | KSUB |
| **— V —** | |
| VanVolkenburg J L | WBBM-FM |
| Vaughn C | KPAC |
| Vinsonhaler S C | KLRA |
| Virgin W J | KMED |
| Vroman M A | KFXM |
| Vyner L | WSBA |
| **— W —** | |
| Wade R E | KOAM |
| Wagner P | WPAY |
| Wagstaff W E | KIDO |
| Walker G D | WAIR |
| Walker W A | WFCI |
| Wallace F | KXA |
| Walters H V | KDON |
| Wannamaker A | WGTM |
| Ward G P | KTTS |
| Ward S O | WLAK |
| Wardell J G | KGBX |
| Ware W E | KWFC |
| Warner S W | KLS |
| Watters M C | WCPO |
| Watts D L | KHAS |
| Way W B | KVOO |
| Weaver R | WROX |
| Weber F | WDSU |
| Welland J | WFTC |
| Weir V H | WLEU |
| Weiss J H | WSYB |
| Weiss L A | KHJ W6XAO |
| Welch W T | WSAR |
| West N | WCAU-FM |
| Westlund A | KRE |
| Whaley S | KUOA |
| Wheelahan H | WSMB |
| Wheeler E K | WFNA |
| Wheeler C | KWIL |
| White A K | KPOF |
| White J A | WCRW |
| White K E | WMOG |
| White R B | WAWZ |
| Whitlock E S | WRNL |
| Whitmire B | WFBC |
| Whitmore W E | KGFL |
| Wick B | KOLR |
| Wiltz G O | WHEF |
| Wike D A | KRLC |
| Wilder H C | WSYR |
| Wilkins D S | WJTN |
| Wilkins J P | KFBB |
| Willard A D | WBT |
| Williams J P | WING |
| Willionis R B | KVOA |
| Williams W E | WJZM |
| Williams W J | WHAZ |
| Williams W V | WBLJ |
| Williamson W P | WKBN |
| Willis J E | WLAP |
| Wilson E E | KEEW |
| Wilson L B | WCKY |
| Wilson N | WAWZ |
| Wilson W A | WOPD |
| Wimpy H | WPAX |
| Winger E W | WDOD |
| Wixon H | KHQ KGA |
| Wolf F J | WTNJ |
| Woodruff H W | WRBL |
| Woodworth S | WFBL |
| Woodyard R B | WINK |
| Wright C J | WFOR |
| Wright J F | WILL WIUC |
| Wyler K O | KTSM |
| **— Y —** | |
| Yates D E | KRBA |
| Yocum E | KGHL |
| Young C S | WBZ WBZ-FM |
| | WBZA |
| Young G W | WDGY |
| **— Z —** | |
| Ziebarth E Q | WLB |
| Zimmerman G E | KARK |

### U. S. Chief Engineers

| | |
|---|---|
| **— A —** | |
| Adams E L | WHIO |
| Adams J | KWFT |
| Adams H E | WIBC |
| Aderhold H J | WRDW |
| Akerman B | WGST |
| Albee W R | WCSC |
| Alden G | WIREAld |
| Aldrich D | WBOW |
| Alexander | KORN |
| Allen D K | WJBO WBRL-FM |
| Alfond P A | WBOC |
| Allison E | WBIG |
| Alwin F | KWAT |
| Amoo L R | KSJB |
| Anderson S W | KFRE |
| Andresen E H | WBEZ |
| Anhalt H | WGYN |
| Antic J L | KIUP |
| Antony W E | KWKH |
| Appleman L H | WACO |
| Arendale J W | WJRD |
| Arvidson P A | WOC |
| Atherstone T | KFEL |
| **— B —** | |
| Bailey B H | KVOL |
| Baird R | KWSC |
| Baker B C | WDEF |
| Baker C | WLEU |
| Baker C W | KLPM |
| Baker F | WKWK |
| Baldwin J M | KDYL |
| Ballinger L K | KXL |
| Barkman R N | KFNF |
| Barnes B B | WAPO |
| Barnett G | KBIX |
| Barrett E G | KFBC |
| Bartlett F E | KSO |
| Batchelder E F | WKNE |
| Bates W H | KTRB |
| Bauer F | KWTO |
| Baum J R | WDWS |
| Beasley H | WHUB |
| Beck I P | WSNY |
| Beck R | KTRI |
| Beck S | WING |
| Beckholt H R | WSPA |
| Beckworth L C | WLOG |
| Bechler E G | KGEK |
| Belle Isle A G | WSYR |
| Bellwood L | KXO |
| Belounzy J J | WBBM-FM |
| Benonis J J | WCNC |
| Beville R H | WWDC |
| Biederman L | WTCM |
| Billington W E | KSWO |
| Pingley F J | WPTZ |
| Binns F D | WLAC |
| Bishop G F | WSGN |
| Bledsoe W S | KFYO |
| Bliesner C | WRENv |
| Bloom J D | WWL |
| Boehnker C A | WOSU |
| Bohnert R | WIGM |
| Boisvert T | WWSR |
| Boland T | KOH |
| Bookwalter L S | KOIN |
| Bower H | WKOK |
| Bowker G N | WFHR |


# . . . in Hearing Aids

A vital component of the Hearing Aid is the Microphone which must be small, light, moisture-proof and possess the frequency response adapted to the Hearing Aid Device. Often the Microphone must be chosen to fit the threshold of hearing of the patient. Shure Research has succeeded so well in controlling the frequency response and output level of small size Hearing Aid Microphones that, today, Shure Brothers produces microphones for practically every major manufacturer of Hearing Aids.

**SHURE BROTHERS, 225 West Huron Street, Chicago**

*Designers and Manufacturers of Microphones and Acoustic Devices*

SHURE MICROPHONES

**U. S. Chief Engineers, Cont.**

| | |
|---|---|
| Bowman L H | KNX |
| Boyd R P | WMFR |
| Bradham D M | WTMA |
| Brandt D | KPOW |
| Brannen C W | WAGE |
| Brautigam G | WLOL |
| Bremer F V | WAAW WAAT |
| Briggs J P | WSLS |
| Brolly A H | WBKB |
| Brott F J | KJR KOMO |
| Brown C W | WEVD |
| Brown G P | WSAY |
| Brown, L E | WBBZ |
| Brown R | KOME |
| Brown S H | WRAL |
| Browning E A | WTAG WTAG-FM |
| Brummel C | WTJS |
| Buchanan A W | KVRS |
| Buckley W C | KDB |
| Bullio R W | WBTH |
| Bullock M W | KFAB |
| Burdette C J | WORD |
| Burgan G L | WHDF |
| Burgoon G R | WFBG |
| Burke J P | WKIP |
| Burrichter D E | KRNT |
| Burtis C W | WPEN |
| Busch R | KBUR |
| Bush R S | KRIS |
| Butler E H | KWFC |

— C —

| | |
|---|---|
| Cain C M | KDTH |
| Callicott C M | WJLD |
| Cannon R E | WINX |
| Caraway J B | WMLL |
| Carlson L T | WKBB |
| Carman H H | WGBB |
| Carpenter H A | WBCM |
| Carroll J D | KMYC |
| Casey J B | KRBC |
| Caudle L L | WSOC |
| Cecil J | KRLH |
| Chandler H J | KRNR |
| Chandler V H | WMUR |
| Chiles W R | WIOD |
| Chinski J R | KXYZ |
| Church E | WRLC |
| Clark E H | WLOU WJLB |
| Clark F R | WFTL |
| Clark F C | KROC |
| Clary M H | KWBW |
| Clay W | WCLO |
| Clough L | KLUF |
| Cochran H D | WBTA |
| Cofey V G | WMRO |
| Coln J | KXO |
| Cole G | KTBI |
| Cole H G | WSBF |
| Cole J | WNOX |
| Collins R | KGKO WFAA |
| Collins W G | KGB |
| Conant L C | WHLS |
| Conner B | KLCN |
| Cook C C | KAVE KUIN |
| Cook W N | WCAR |
| Cooke G W | WBAL |
| Cooke K R | WGBI |
| Cooper D H | WRC |
| Cooper K H | KFKA |
| Cox F V | KTFI |
| Cozzens W D | KLO |
| Craig P | WRUF |
| Crain M M | WLBC |
| Crandon G F | WCSH |
| Cronk E M | WSAP |
| Crosthwait B | KWYO |
| Cuesta N | KWBU |
| Curry W F | KTTS |
| Curtis J R | KFRO |

— D —

| | |
|---|---|
| Dadisman A C | KFH |
| Dahlbacka A | WJMS |
| Cahlbacka H | WATW |
| Daugherty C F | WSB |
| Davenport W E | WQAM |
| Davidson H | KWIL |
| Davidson W R | WAIM |
| Davis H C | KTSW |
| Davis M B | WWNY |
| Deaderick J G | WMPS |
| Dean R M | KRMD |
| Dechant F I | WRJN |
| DeCosta L L | WCLS |
| Degering H | KHUB |
| DeGrafenreid D | KWON |
| DeLany R H | WHK |
| DeLaurentis V | WNAB |
| Dennis G | WAML |
| Dettman R A | KDAL |
| Dewing H L | WCBS |
| Dickson W | WABI |
| Dieringer F A | WFMJ |
| Dillingham H C | WTAW |
| Dillon P | WMIT |
| Dinsmore H | WRDO |
| Ditamore J W | WBAA |
| Doese L | WIBU |
| Donovan J | WPDQ |
| Dorothy R M | KARM |
| Dotson G W | KXOX |
| Douglas J E | KBTM |
| Dowdell J T | WIBX |
| Downey C E | KROW |
| Drake C E | WQBC |
| Duben W F | WOMT |
| Dubuque J N | KXA |
| Duff J | WITH |
| Duncan R S | WHP |
| Dunn E C | KEYS |
| Durham G | KFSD |
| Durham H | KOCY |
| Durham M M | KLBM |
| Dutton C | KJBS |
| Duty C E | KDON |
| Duty J T | WCOU |
| Dye R H | KGFX |

— E —

| | |
|---|---|
| Easum C M | KTOK |
| Eaves B | KODY |
| Ebel A J | WIUC WILL |
| Ebert S J | WSUI |
| Eckels A E | WCBM |
| Egerton W G | KTSA |
| Elttreim O | KWLC |
| Elliot I A | KRJF |
| Emch R | WKST |
| Erickson L C | KGDE |
| Esten P W | WGRC |
| Etheredge W C | WFBC |
| Evans C R | KSL-FM |
| Evans C W | KGA KHQ |
| Evans R | KWEW |
| Ewing G | KFXM |

— F —

| | |
|---|---|
| Fallain F D | WFDF |
| Farrar C L | WMAD |
| Faske A | WLIB |
| Felkert G S | KOAC |
| Fekel F | WSNJ |
| Ferri J | WPRO |
| Flaherty J A | WDAF |
| Flanagan P T | WHIS |
| Fleming M | WTCN |
| Fletcher H H | KSEI |
| Flynn R M | KRLD |
| Foote D F | WOLF |
| Fox J F | WHLN |
| Frase E C | WMC |
| Fredericks J | KPAS |
| Freeman G A | KRSC |
| Freitag W O | KRKD |
| Frisk C C | KFMB |
| Frye A P | WDLM |
| Fuelling P | WHNF |

— G —

| | |
|---|---|
| Gager E H | KYW KWY-FM |
| Garba H C | WASK |
| Gardner K J | WHAM |
| Gardner K J | WHFM |
| Garrison J | WBHP |
| Gartner R | WLOK |
| Gass W | KFVD |
| Gautney G E | WICA |
| Gavin D W | WCOC |
| Gehres F | WGBF |
| Gellerup D Q | WMFM WTMJ WMJJ |
| Gempp T | WHOM |
| Gemoets E L | KTSM |
| Gilbert J N | WROL |
| Gilbert L | WNBF-FM |
| Giles T A | WMBD |
| Giles T | WDZ |
| Gill T J | WHDL |
| Ginkel A J | WJLS |
| Gleeson W L | KARO KPOR KPRO |
| Godfrey E | WBAB |
| Goldmark P | WCBW |
| Goodaker L R | WOMI |
| Goodrich H S | WBML |
| Gorman M C | WGAU |
| Graf S J | KUSD |
| Grant J E | WSPB |
| Gray C M | WTOC |
| Gray W | WCHV |
| Greaves G | KPO |
| Greene T A | WENY |
| Greene B | KGDM |
| Greenwood T L | WMOB |
| Grenier T B | WABF |
| Gresham W S | WISR |
| Grether J L | WTAR |
| Grether W P | WGH |
| Griese R | KVI |
| Griffiths A E | KOBH |
| Griffith R E | KPHO |
| Grinde K | KXRO |
| Grossman H | WOOC WOOW |
| Grotewohl H D | KICD |
| Grout H | WDEV |
| Grover N E | WKAR |
| Groves W C | WGNC |
| Gunderson L | KHCU |
| Gundy P | KGHF |
| Gustafson L | KIEV |
| Guthrie W | KBND |

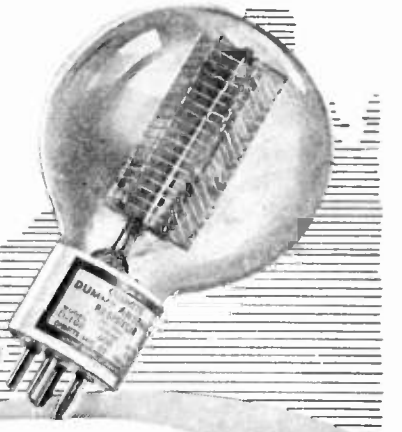
— H —

| | |
|---|---|
| Haapanen A | KWAL |
| Hahn N | WIBA |
| Haigh R H | KFRU |
| Haldorsen O | WCAL |
| Hale R C | WCOP |
| Hales F B | WBRY |
| Hamann G P | WBRC |
| Hamm J | WJBC |
| Hanson O B | NBC Network |
| Hanks H L | WOLS |
| Hardison D E | WFTC |
| Hardy H | KHAS |
| Harlow J R | WTNT |
| Harrell H | WMJM |
| Harris C F | KMAC |
| Hartman H | KGLU KWJB |
| Hartwig L | KRGV |
| Harvey J B | KOMX |
| Hatfield J B | KIRO |
| Hauser W H | WBZ WBZ-FM |
| Haverkamp H O | WYNE |
| Hayford B | WJHP WTMC |
| Hearin A W | KELD |
| Heck A C | WPIC |
| Hedrick P | WSJS |
| Helliums E R | KASD |
| Helt S | WLAP |
| Helt S | WIS |
| Hennigan L P | WADC |
| Henninger J H | WIBG WLBG |
| Henzly W | WMBS |
| Herrin W | WRBL |
| Herring E I | WMFD |
| Hewinson E | WMAS |
| Hibbs E D | WTEL |
| Hickman R | KGNO |
| Hicks C | WROX |
| Hiebert A G | KFAR |
| Hight J A | WLBJ |
| Hilker B R | KSTP |
| Hill J | WHKK |
| Hill W | WDNC |
| Hinckley G A | WLAW |
| Hiner T | KFRI |
| Hirsch O C | KFVS |
| Hoag D S | WBCA |
| Hodgkins R W | WGAN |
| Hoffman K B | WGR WKBW |
| Holbert V B P | KSAC |
| Holland H S | WFBM |
| Hollerith M | WISE |
| Holmberg B | WLB |
| Holselaw R | KVOA |
| Holt R B | WNBC |
| Horstman E C | WENR |
| Horton J R | WBIR |
| Hoskins C B | WWNC |
| Host R | WEMP |
| Hough R | WMMN |
| Houts J | KYSM |
| Howard R V | KSFO |
| Hubbard J T | WAGF |

# OHMITE

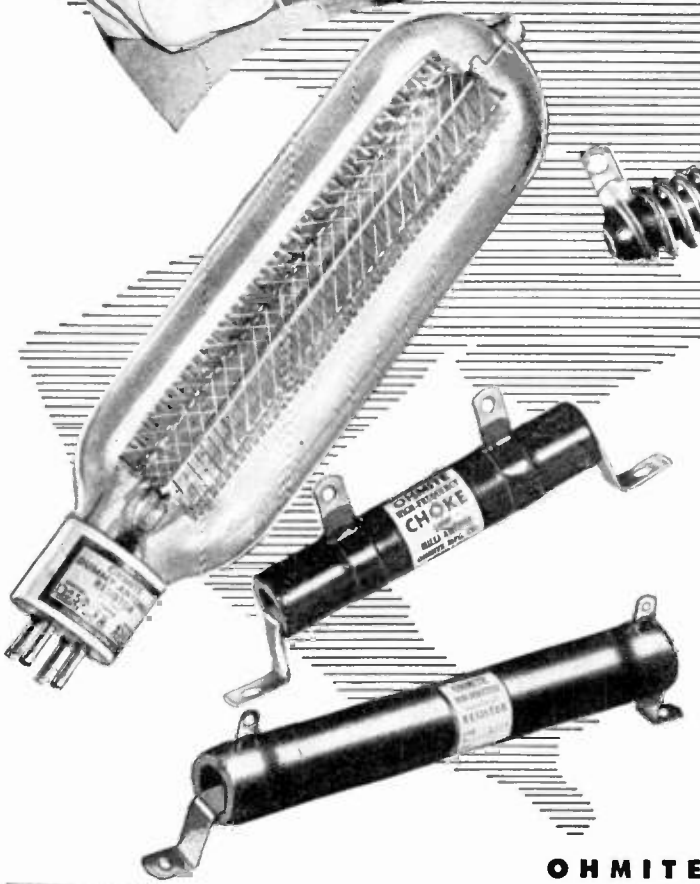
## RESISTORS and CHOKES

*for Radio Frequency Applications*



**Ohmite Dummy Antenna Used in Testing Critical Transmitting Equipment**

Here's what *COLLINS RADIO CO.*, well-known transmitter manufacturer, says: *"Within its power range . . . the most convenient to use, the most stable and the most accurate Dummy Antenna we have encountered . . . Used successfully for testing and measuring power output . . . Gives long life without detectable deterioration."*





Proved by use before war came . . . Ohmite R.F. Units today are performing vital functions in the production and operation of vital war equipment. An interesting example is the use of Ohmite hermetically-sealed, glass-enclosed gas-filled dummy antenna resistors by Collins Radio Company, and other well-known manufacturers for testing and measuring power output.

Other Ohmite Units doing specialized jobs in radio frequency applications are Vitreous Enameled Non-Inductive Power-Size Resistors, Parasitic Suppressor and R.F. Plate Chokes.

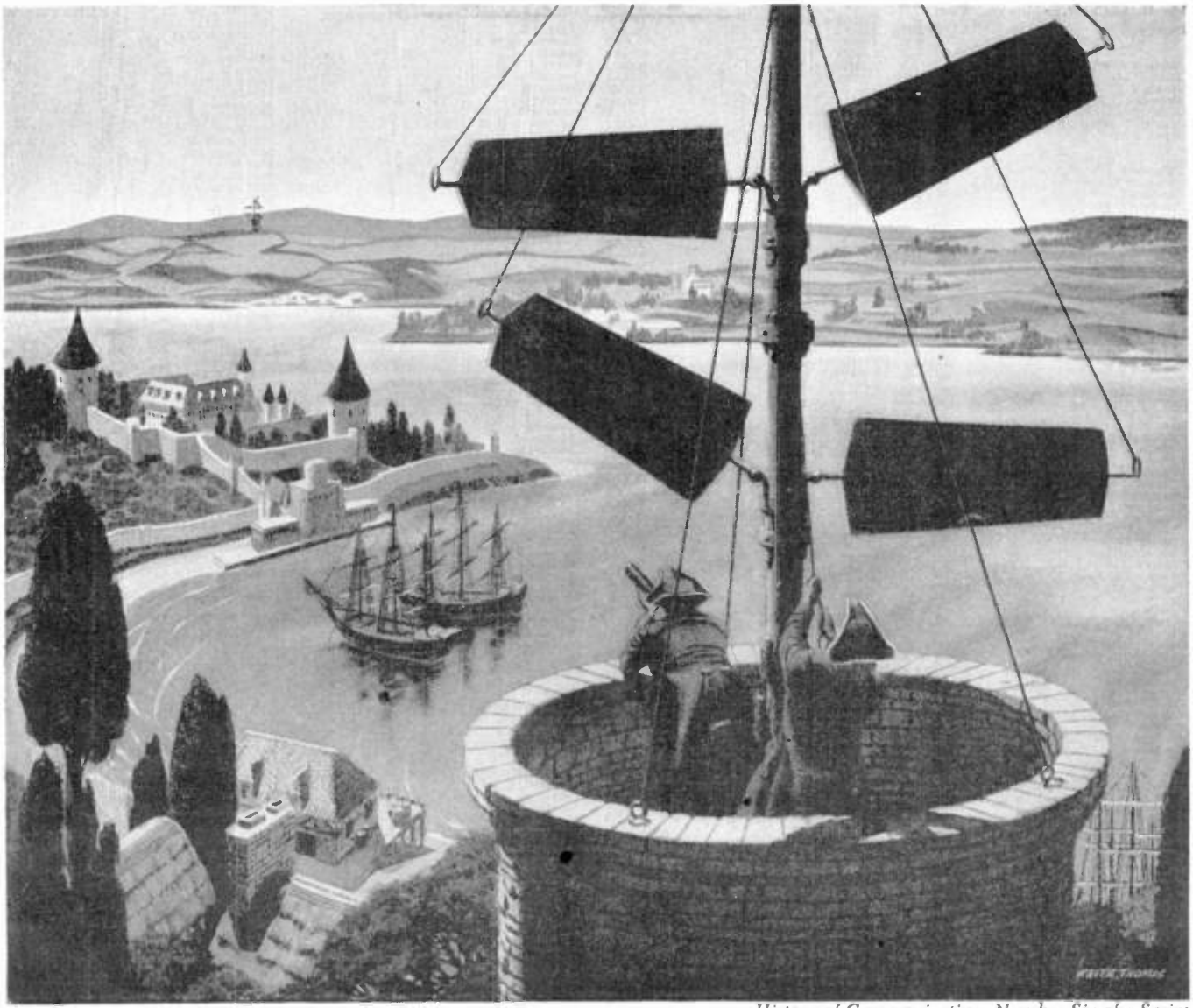
**OHMITE MANUFACTURING COMPANY**
**4853 Flournoy St., Chicago 44, Illinois**
*Foremost Manufacturers of Power Rheostats, Resistors, Tap Switches*


*For complete data, write on company letterhead for helpful Catalog and Engineering Manual No. 40. Address 4853 Flournoy St., Chicago 44, Ill.*

*Be Right with* OHMITE
**RHEOSTATS • RESISTORS • TAP SWITCHES**

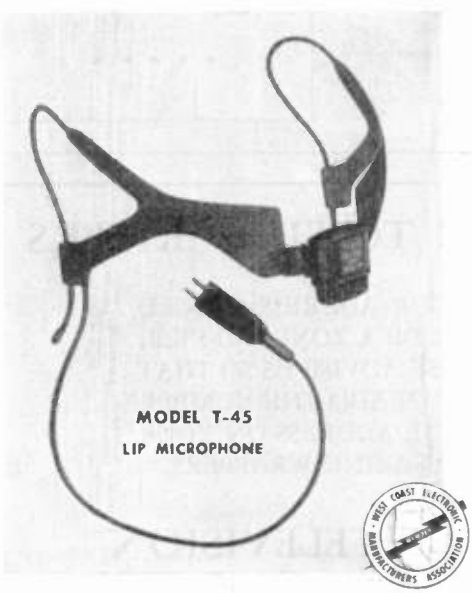
## U. S. Chief Engineers, Cont.

| | |
|---|---|
| Hudson J | WHMA |
| Hudson W | WAVE |
| Hughes B | KRIC |
| Hughes J C | WCOV |
| Hughes L E | WAGM |
| Hullek H | WPTF |
| Humphrey T R | WHYN |
| Hunt C M | WTOP |
| Hunt D T | KABR |
| Hunt W | WHIZ |
| Hunter D | WMAL |
| Hurley N S | WAPI |
| Hurt E | KFXD |
| Hurton C J | WRRN |
| Hyatt F M | WJHO |
| Hyman K | KPAC |
| **— I —** | |
| Ing G | KONO |
| **— J —** | |
| Jacker E | WAIT |
| James G | KMYR |
| Jefferies D | WTBO |
| Jeffus M W | KTBC |
| Jensen R | WATR |
| John T | KRRV |
| Johnson A P | KBIZ |
| Johnson G | WFCI |
| Johnson G S | KOB |
| Johntz J A | KIDO |
| Jokinen E | WHLB |
| Jones A L | WAGA |
| Jones A M | KBST |
| Jones F | KGKL |
| Jones J V | WCBI |
| Jones M L | WCAO |
| Jones R | KVOS |
| Jorgenson T O | WEAU |
| **— K —** | |
| Kaari E T | WSOO |
| Kalin T | WEIM |
| Kassner D E | KXEL |
| Keich G | WICC |
| Keim E L | WWVA |
| Kelly T F | WHBB |
| Kennedy F M | W6XAO KHJ-FM KHJ-LA |
| Kenney T C | KDKA-FM |
| Kilchil J | KGHL |
| Killough R | WALA |
| Kilmer T P | WTTM |
| Kilpatrick L | WSAZ |
| Kimzey T | KFJZ |
| King D I | WGIL |
| King F | WELI |
| King L | WAIR |
| Kingsley R J | WBEN |
| Kinnett C M | WGPR |
| Kluge M E | KFSG |
| Knowles E P | WTNJ |
| Knowles C | WPAR |
| Kocher C | WXYZ |
| Kolesar J D | KMO |
| Kotera W J | WOW |
| Krivitzky G | WKBZ |
| Krotzert H | WJTN |
| **— L —** | |
| La Bonte C W | WJMC |
| Lamy R | WEBR |
| Landis H O | WEEV WRAW |
| Landsberg K | W6XYZ |
| Lang G W | WGNB WGN |
| Langford G E | KFPY |
| Laskey J M | WDSM |
| Laurie B | KNET |
| Lawson L | KATE |
| Layne C N | KID KVNU |
| Layton D | WALB |
| Lee C E | WKZO |
| Lee W P | WLAK |
| Leeman A | WKBH |
| Leffler R H | WBBR |
| Legleiter L | KVGB |
| Leonard S E | WTAM |
| Levy G | WCAU |
| Lewicki C | WEDC |
| Lewis G | WCAU-FM |
| Lewis J | KGWF |
| Lewis J E | KNOW |
| Lewis L L | WOI |
| Lewis R | KGIW |
| Lidenton D | KWOC |
| Lind P C | KOL |
| Lindsay P G | WHEB |
| Link L J | WSUN |
| Lippencott E | KELA |
| Littlejohn L E | WFIL-FM |
| Livingston C | KTUC |
| Lodge W | WABC WABC-FM |
| Long E S | WHKY |
| Lounsberry W H | WEBC WDUL |
| Lovell H J | WKY |
| Lowe J E | WCOL |
| Loyet P A | WHO |
| Lucas E | WPAT |
| Lucy C C | KANS |
| Ludwick C | KHBG |
| Lund M R | WMAM |
| Luttgens H C | WMAQ |
| Lyon H H | WOL |
| Lyon J | WGAC |
| **— M —** | |
| Maddox C H | KTBS |
| MacLafferty M L | KUJ |
| MacLafferty M L | KRLC |
| Magin T G | WDAN |
| Malone E A | KUIN |
| Mangold W D | WTSP |
| Marcy A R | WFBL |
| Markman E L | WSRR |
| Marks F | WMCA |
| Marquardt K G | WIBW |
| Martin A F | WIZE |
| Martin G P | WRR |
| Martino I A | WDRC WDRC-FM |
| Marx F L | WMCA |
| Masini C S | WTHT |
| Mason A | KOCA |
| Mason C | KFI |
| Matheson R G | WHDH |
| Mathiot J E | WKBO WGAL WEST |
| Maxwell K | KUOA |
| Mayer H J | WHBL |
| McArdle J J | KFRC |
| McCartney H S | WCCO |
| McCaslin P | KCMC |
| McCauley H | KSRO |
| McCown R | KVIC |
| McCoy W | WHJB |
| McCoy W W | WJAS |
| McCready S W | KVAN |
| McDowell L W | KFOX |
| McGinty P | WWPG |
| McHardle W | KTMS |
| McIntire G | WJEJ |
| McIntosh G | KEEW |
| McKay J M | WLAG |
| McKernan P | KRE |
| McLean T | WHCU |
| McNaughton H B | WQJR |
| Meares C W | WCHT |
| Meek R | WMBH |
| Menzer C H | W9XUI WSUI |
| Metz J H | WBRW |
| Merki G E | WHBY |
| Meyers W | WJJD |
| Meyers W F | WJJD |
| Meyers W S | KFIZ |
| Mietzke R H | KWLK |
| Milburn E P | KHSL |
| Miller S | KORE |
| Milne G O | WJZ |
| Milner C M | KVSO |
| Ming M M | KSKY |
| Minor M J | WBT |
| Minton B | WATL |
| Mitchell J H | WFLA |
| Mitchell J M | WFLA |
| Mitchell M R | WJR |
| Moler A R | KMBC KMBC-FM |
| Moore W P | WDAE |
| Morey G J | WNCL |
| Moritz R | KOLR |
| Morris V C | WPAD |
| Morrison S R | WMRN |
| Morrison W E | WMAN |
| Morse F W | KLS |
| Mulrony M A | KGU |
| Murphy H B | KIT |
| Murphy D | WGCM |
| Muse D W | WMVA |
| Musselman R H | WSAN |
| Myers H | KFWB |
| Myers M L | WPAY |
| Myhre W L | KFBB |
| **— N —** | |
| Nafzger L H | WELD |
| Nazak J | WMFF |
| Neal N A | WBOE |
| Nebe H G | WSMB |
| Nelson I | KFYR |
| Nelson W M | WEGO |
| Neuville G | WHIT |
| Newton R | WLLH |
| Niemann E C | WCRS |
| Nichols D A | WSVA |
| Ninneman W | WLBL |
| Nunn V | WINN |
| Nutty G M | WAOV |
| **— O —** | |
| Oakley R | KGER |
| O'Brien B C | WHEF |
| Obuchon H | KGFJ |
| Olson A E | KIEM |
| O'Malley A J | WQAN |
| Onens C E | WCAM |
| Orth J | WLVA |
| Osborn P H | W2XMN |
| Oschmann A W | WARM |
| Owen R H | KOA |
| **— P —** | |
| Palmer G E | WKMO |
| Palmer T B | KGO |
| Pappin R B | WCFL |
| Parker B G | KVAK |
| Parker E T | WNBH |
| Parker J W | WORL |
| Parker S | WNBH |
| Parrish B J | KOTN |
| Parsons V | KPPC |
| Pash W | KIUL |
| Patremio | WABD |
| Patterson N J | KSAN |
| Patterson T W | WMIS |
| Patton A D | KNEL |
| Paul G | WAKR |
| Peak E | KFJB |
| Perkins C A | WSLI |
| Perry G | KRBA |
| Persio L N | WRAK |
| Peterson J | KOVO |
| Petrich A | KILO |
| Phillips T | WERC |
| Pierce R M | WGAR |
| Plank R | WLAV |
| Podhaski L F | WHBU |
| Poole J W | WPAX |
| Poppele J R | WOR WBAM |
| Porter B E | WSIX |
| Prior T C J | WJAR |
| Price J C | WAYS |
| Provis J | KGIR KBRM |
| Pulley D | WDAK |
| Purcell W J | WGY WGFM |
| Pyle K W | KFBI |
| Pyle W D | KVOD |
| **— Q —** | |
| Quentin C | WMT |
| Quill J C | WCAX |
| **— R —** | |
| Raabe R W | WBBL |
| Randol H E | WBZA WBZA-FM |
| Ranft W Q | WFBR |
| Rankin G P | WMAZ |
| Ransom N | WSYB |
| Ratts B H | WGL WOWO WOWO-FM |
| Rees D H | KMED |
| Reilly L A | WSPR |
| Rekart A F | KXOK |
| Reuman W H | WWRL |
| Rex P | WISR |
| Reynolds G | WSM-FM |
| Ricciotti S | KGFF |
| Richardt R R | WSAU |
| Richard N J | WISN |
| Richter G H | WATN |
| Ridgway H F | KVWC |
| Ritchey H | WINK |
| Roark C A | KGY |
| Roberts G | WJW |
| Roberts W C | WBLJ |
| Robertson J W | WDBJ |
| Robinson I B | WMTW WGTR |
| Robinson K H | KTRH |
| Robinson O E | WCHS |



*History of Communications Number Six of a Series*

## COMMUNICATION BY SEMAPHORE




The Semaphore, as a means of communication, met first commercial acceptance in France under the authority of Napoleon in 1792. Restricted by "line of sight" and low power eye pieces, excessive numbers of relay stations, as pictured above, were required for "directional broadcasting" over rough terrain. Weather conditions, too, were a handicap. Because of the code used and its necessary translation, delays and errors were continually encountered.

Today, in the era of applied electronics, Universal microphones are being used to expedite messages on every battle front in the service of the Allies. Universal is proud of its contribution in the electronic voice communications and its every effort to our ultimate Victory.

*Model T-45, illustrated at left, is the new Lip Microphone being manufactured by Universal for the U. S. Army Signal Corps. Shortly, these microphones will be available to priority users through local Radio Jobbers.*

**UNIVERSAL MICROPHONE COMPANY**
**INGLEWOOD, CALIFORNIA**

FOREIGN DIVISION: 301 CLAY STREET, SAN FRANCISCO 11, CALIFORNIA ·· CANADIAN DIVISION: 560 KING STREET WEST, TORONTO 1, ONTARIO, CANADA

### U. S. Chief Engineers, Cont.

Rockwell R J — WLW WSAI W8XFR
WLWK WLWL WLWO WLWP
WLWS W8XCT
Roman E W — WFIG
Root P G — WJDX
Rowe T L — WLS
Rueppel G E — WEW
Runkle E G — KCMO
Russell F W — WOOD
Ryan J M — WBTA

— S —

Sakoski C — WBRE
Sampatt E — WGGA
Sanders E — WFOR
Sanders L M — KFDM
Sandlin G G — WMSL
Savold S J — WDAY
Sawyer M F — WJPF
Sawyer R — KGLO
Schenke R M — KHMO
Schissler P H — KPOF
Schoeny E — WEOA
Schow R — WFEA
Schroeder F J — KMA
Schultz J — WCAE
Schultz A — KEVR
Schulz P — KYA
Scott E — WDLP
Seaman V T — WSAM
Secrest M C — KPLT
Selmes M — WGNY
Seltz F A — WFAS
Selden W R — WRNL
Sexton J — KALB
Shade H — KOOS
Shatto L — KERN
Shaw P — KTEM
Sheehan J — WTOL
Shelkofsky C — WSFA
Shepard H V — KDNT
Sheppard J B — KGKB
Sigman L — KMPC
Simms J — KVOP
Sinclair D G — KVFD
Singleton H — KGW
Sinnett R J — WHBF
Sjostrom C J — KOVC
Sliker K L — WHBC
Smith A — WKAT
Smith A H — KSCJ
Smith E C — WFIN
Smith H — KPAB
Smith J W — WLAY
Smith R H — WOPD
Smith R L — WRGB
Smith R S — KLX
Snider R — KTUL
Snowden W A — WTAL
Solbrig A L — WBNX
Sparko P W — KWKW
Spencer H W — WBTM
Spencer S — KGBS
Stafford L S — KOAM
Stahl V — WCED
Staley M — KSOO KELD
Stangel W J — WTAQ
Steadley J — WEXL
Steady L G — WLNH
Stenberg L S — KWLM
Stenger J H — WBAX
Sterling F — WOAI
Stewart A W — KBWD
Stinson L W — KVOO
Stinson R C — WHAP
Stoker W C — WHAZ
Stone E J — WELL
Stoup C — WIL
Strang H C — KVOR
Strasburg S — WJOB
Stratton C W — WHOP
Straub N L — WJAC
Suitt C L — KTHS
Summerford D C — W9XEK WHAS
Summerville W H — WWL
Sutton R B — KPQ
Swanson D — RMMJ
Swaringen E C — WTAX
Swenson S J — W2XWV
Swizzinger M — WGKV

— T —

Talbott E P — KROD
Tank H F — WWJ
Tate G D — WMRC
Tate J R — WEBQ
Taylor H D — WTIC WTIC-FM
Teitzel W M — KCRC
Testan P — WBYN
Thomas J R — KPDN KFDA
Thomas M W — KOMA
Thompson M E — WSAV
Thron B K — WFPG
Thurman W B — WJZM
Tilley H H — WEAN
Tisdale J M — WIP WIP-FM
Titus J — KAST
Tobola J J — WAYX
Todd C M — WNAX
Toomey F A — KGCX
Torrey W — KGNC
Towne R C — KRKO
Tracy K F — KLRA
Travis E — KVEC
Tribley H — WGTC
Troesch J — WKNY WJPA WSTV
Trueblood D B — WGBR
Tucker D J — WRR
Tysor B — WBBB

— U —

Ulrich C W — WAAF
Unterberger F — WDAS
Upchurch G W — WKPT
Urie H — KSUB
Utter R — WWZR

— V —

Valentine R D — WQXR WQXQ
Vance N E — KSAL
VanDusen V O — KGHI
VanHorn J M — KFPW
Venes T L — WBNY
Vessels J C — WDOD
Vordermark E B — WMBR
Vose H E — KVOX
Voss V H — WIND

— W —

Wahlquist L O — KUTA
Walker G — WKBV
Walker H — KADA
Wallace W N — KMJ
Warlick J H — WGBG
Warnock E — WALL
Warren J C — KFFA
Watson C — WSTP
Watters M C — WCPO
Waymire D — KFIO
Weagant C — KBPS
Weaver C W — WCMI
Weaver W N — WSBA
Wehrman H — KLZ
Weimer O E — KOWH
Weiner M J — WNEW
Welch W T — WSAR
Wentura F — WTAD
Wesser C H — WENA
Wheeler H — KPRC
Wheeler L — KYUM
Wheeler L F — WHAI
White C R — WCRW
White D — KGBX
White H — KWOS
White K E — WMOG
Whitman W P — WTRY
Whitney C — WDSU
Whitney P — WNCA WINC
Wiedenbach F — WJAG
Wiggins W S — KVOE
Wilder J M — WMGH
Will R D — KVCV
Williams D — WRGA
Williams H B — WNBZ
Williams M — KCKN
Williams N — WOSH
Williams S — KBKR
Williamson B — KTKC
Williamson W P — WKBN
Wilson G A — WKRC
Wilson G W — WJPR
Wilson N — WAWZ
Wilson P — KMTR
Wilson R — WHLD
Winkler C — KFOR KOIL
Winn D L — KARK
Wirtanen C W — WIBM
Witschen R B — KFAM
Wina R — KBON
Wnorowski P A — WSOY
Wolf P — KABC
Womble F — KGVO
Woodward M W — KOZY
Wood W H — WMBG
Woods D C — WRVA
Wooten S D — WHBQ
Wooten W — WGTM
Wright J — WBLK

— Y —

Yarbrough J E — WDBO
Yarger C R — KSD
Young G W — WDGY
Young H — KDRO

— Z —

Zehr N J — KWK
Zeigler P — KOY
Zellmer L M — WTRC

### Canadian General Managers

Amyot L — CKCH
Backhouse W H — CKY
Beardall J — CKCO
Berry C L — CKGF
Borrett W C — CHNS
Botterill N — CJOC
Brophy R M — VE9CM CFCF
Browne J W B — CKOV
Buchanan H C — CHAB
Buchanan J D — CKPC
Cairns A M — CFAC
Campeau J E — CKLW
Chestnut M V — CJVI
Clark H — CJRL
Clark I — CFJC
Cooke H — CHEX
Cooke J K — CKEY
Cranston W T — CKOC
Crittendon H A — CKCK
Cruickshank W T — CKNX
Dales W — CJAT
Davidson J M — CKWS
Desjardins G T — CHGB
Dilworth I — CBR
Elphicke F H — CKWX
Fortin V — CBJ
Freeman H — CKGB
Frigon A — CBC Network
Gaetz G — CKRO CKRO-X
Galgay W F — VONF
Gardner W R — CKMO
Gauthier A — CHLT
Geldert G M — CKCO
Godin L — CKVD
Hawkins W N — CFOS
Henry G — CJCA
Houde C H — CHNC CKNB
Insulander C H — CFPR
Jean E — CHLN
LaLonde P — CKAC
Lavole G A — CJBR
Lefebvre M — CHLP
LePage P — CKCV
Love H G — CFCN
Lynds F A — CKCW
McGill D — CKSO
Mitchell W C — CKCR
Moffat L — CKBI
Mollison R L — CHGS
Murphy A A — CFQC
Nathanson N — CJCB CJCX
Nunn J C — CJFX
Parker R H — CFPA
Quinney G B — CFAR
Renaud O — CBM CBF
Rice G R A — CFRN
Roe B M — CKUA
Rogers K S — CFCY
Rudoff L C — CHSJ
Sedgwick H — VE9AK CFRB
Seiler W F — CKX
Smith G E — CHPS
Speers W A — CKRM
Stark J B — CKLN
Stewart T C — CKMO
Tapley S E — CJCS
Thivierge J N — CHRC
Thomas C — CFPL
Trepanier L — CHLN
Vallquette M — CHV
Wright C P — CFBO
Yeill J H — CJMH

### Canadian Chief Engineers

Allen W H — CKTB
Anderson G W — CFAR
Arnow B — WNYC-FM
Aylen E C — CJAT
Beckman H — CFAR
Belanger M — CKCV
Bishop J G — CHSJ
Brooks G — CFCO
Browne J H B — CKOV
Carter W J — CKLW
Chandler A H — CJOR
Cloutier A — CHLP
Collins E R — CKX
Connor E C — CFAC
Crawford W — CHML
Crotel L A — CHPS
Cruickshank W T — CKNX
Crump A E — CHEX
Doak F C — CJRR
Duffield W H — CKY
Fairweather G — CKWX
Frenette C — CBV
Gebhardt M — CKCH
Gettenby J — VE9CM CFCF
Gilbert M W — CBO
Grieg A W — CHNS
Hartman T — CKCR
Hildebraud G — CJCS
Hooper A W — CKRO CKRO-X
Horton L — CKOC
Insulander C H — CFPR
Irving S — CKLN
Jacobson A E — CHAB
Lamb B — CFCN
Large R F — CFCY
MacDougall G — CJFX
Makepeace F — CFRN
Marshall J L — CHK
McCurdy G M — CKWS
McDonald W — CKRM
McGough J R — CHNC
McKie A — CHGS
McLellan W — CKCO
McRae J — CKSO
Mills A — CJCX
Mott E D — CKGB
Nadeau A — CHRC
Olding N R — CBR
Olive G — CBC Network
Paquette R — CKNB CHLT
Parker R H — CFPA CKPR
Peters G — CKVD
Roberts E D — CBF CBM
Roberts J E — CBJ
Sadler G — CFGP
Sadler S R — CJMH
Sands G — CJRL
Sharpe J — VE9AK CFRB
Shillabeer G — CJCA
Sommers J — CJVI
Spencer L — CKAC
Stewart J C — CJOC
Strong E A — CKCK
Swan E O — CKEY
Tate R — CFJC
Teague A — CKPC
Trepanier L — CHLN
Usher R — CKUA
Vlalins B — CFOS
Van Ness T — CKBI
Vernon A — CJCX CJCB
Warder J C — CFPL
Watson R G — CJKL
White A J — CKCW
Whiteside R L — CKMO

• • • • •

The names which appear in this Directory were obtained from replies in response to questionnaires mailed to the broadcast stations. Thus the accuracy of this Directory is assured. The next Broadcast Station Directory will appear in the March, 1945 issue

• • • • •

# GREAT NEWS! SUPERIOR'S WELL-KNOWN

## *Model 710*

# VOLT—OHM—MILLIAMMETER

**is now available for shipment within 10 days after receipt of order on priority of AA3 or better.**

*Sensitivity—*

**1,000 OHMS PER VOLT**
ON BOTH A.C. AND D.C.!!

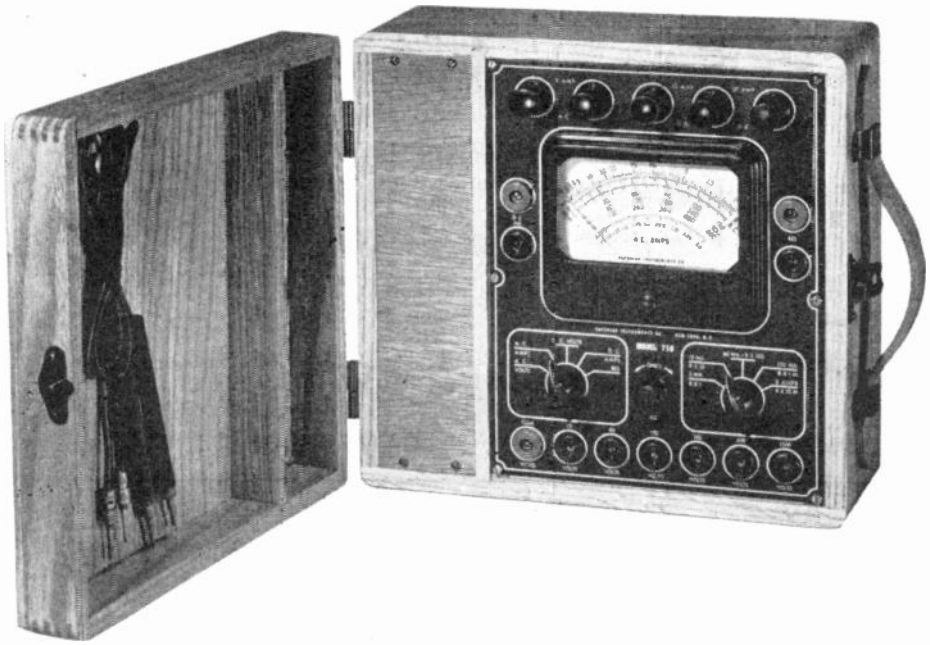
*Measures:—*

A.C. AND D.C. VOLTAGES UP TO—
**1500 VOLTS**

A.C. CURRENT UP TO—
**3 AMPERES**

D.C. CURRENT UP TO—
**30 AMPERES**

RESISTANCE UP TO—
**10 MEGOHMS**



*Features:—*

★ Uses New 4½" Square Rugged 0-400 Microampere Meter.
★ Direct Reading—All Calibrations Printed Directly on Meter Scale in Large Easy-to-Read Type.
★ Housed in Rugged Heavy Duty Portable Oak Cabinet.
★ Completely Self-Contained—No External Source of Current Required.

*Designed and perfected in wartime to meet the exacting requirements of America's War Producers for a dependable volt-ohm-milliammeter, the Model 710 is being used by war plants engaged in the production of planes, ships, tanks, guns, etc.; also by various Army, Navy and other government agencies.*

*Specifications:—*

**6 D.C. VOLTAGE RANGES (1000 OHMS PER VOLT)**
0 to 15/60/150/300/600/1500 Volts.

**6 A.C. VOLTAGE RANGES (1000 OHMS PER VOLT)**
0 to 15/60/150/300/600/1500 Volts.

**7 D.C. CURRENT RANGES:**
0 to 3/15/60/150 Milliamperes 0 to 3/15/30 Amperes.

**A.C. CURRENT RANGE:**
0 to 3 Amperes.

**5 RESISTANCE RANGES:**
0 to 1,000/10,000/100,000 Ohms. 0 to 1 Megohm. 0 to 10 Megohms.

The MODEL 710 comes complete with cover, self-contained batteries, test leads and instructions. Size 6" x 10" x 10". Net weight 11 pounds. Price ..... **$34.50**

## SUPERIOR INSTRUMENTS CO., Dept. F

227 FULTON STREET NEW YORK 7, N. Y.

## WHAT'S NEW THIS MONTH

(CONTINUED FROM PAGE 4)

It is probable that the marked prewar tendency of the radio industry to produce home radios in the form of "packaged merchandise" rather than radio equipment resulted chiefly from the indifference of manufacturers to the necessity of developing a trained service employment group capable of selling and servicing the more elaborate and expensive equipment representing the technical progress of the radio art.

With all radio manufacturers planning to provide FM circuits in their postwar models, they are automatically creating a need for a larger and better-trained service employment group than in the past. This need will be multiplied again as television and facsimile receivers are made available on a nation-wide scale.

Thus it is clear that 1) the radio industry is faced with an existing shortage of men in the service employment group, 2) that men, and perhaps women, now employed in production will soon become available to fill present and future needs of radio sales and service, 3) that this is the ideal time to initiate training classes in sales and service, both for the benefit of the employees and the manufacturers, and 4) that if manufacturers do not take steps to anticipate the need for a radio service employment group, their failure to do so will definitely limit the growth of the industry.

**2.** A very significant source of information for sales executives is the Directory of FM Stations published every other month in *FM* AND TELEVISION. This includes not only the FM stations on the air, but all the stations for which C.Ps. have been requested up to the time the Directory is closed for printing. The next Directory, in our October issue, will list over 250 stations projected for construction as soon as the manufacture of broadcast equipment can be resumed.

The value of this Directory to sales executives of set manufacturing companies lies in the fact that the geographical distribution of new FM stations is a complete guide to markets for FM-AM receivers. It is the most powerful argument to answer any jobbers who are indifferent to or unaware of the potential markets for FM-AM sets. Manufacturers are always welcome to reproduce these Directories for distribution among their jobbers and dealers, provided the usual credit line appears on them.

**3.** Officials of the CIO-Political Action Committee who, in their *Radio Handbook*, called upon union members to demand time on local radio stations might have gained some useful information at the recent N.A.B. Conference. In the course of a most interesting address,

(CONTINUED ON PAGE 62)

As you plan today for tomorrow's business, keep this thought in mind: If you continue in radio,* your market will be in FM and Television. ★ ★ ★ When you plan advertising to reach the FM and Television markets, remember that *FM* AND TELEVISION† Magazine is the only publication that can give you horizontal coverage concentrated in these fields ★ ★ ★

* Practically all the new ultra-high and very-high frequencies the FCC is now preparing to assign will be used for Television and for broadcasting, communications, and relay services employing FM transmission.

† Edited for and read by executives and engineers engaged in radio manufacturing and research, broadcasting, communications, and sales, distribution, and service — in short: "the men who set the pace the industry follows."

## WHAT'S NEW THIS MONTH

(CONTINUED FROM PAGE 60)

Charles Francis Coe said: "We learned long ago in motion pictures that the surest way to empty theatres is to put propaganda on the screen. . . . The universality of radio impels broadcasters always toward better and better shows — better and broader service. The public will turn against radio only when radio ceases to perform in a measure reasonably close to its potential."

It is too bad that the Hillmans and Dubinskys and the Browders can't take time to learn that, unlike their fellow travelers in Europe, the majority of the men and women in the United States are at least third-generation citizens whose forebears came to this Country because they were sufficiently self-reliant and independent-minded to establish here a new way of life.

Today, the majority of our citizens still prefer to leave European doctrines to the Europeans. That Hillman-Dubinsky-Browder et al are not asked to take their alien ideas back from whence they came only attests to American tolerance. If they mistake tolerance for encouragement, it is a grievous error.

These men should know their places and keep to them. No one objects to their use of street-corner soap boxes, or even public halls, but if Sidney Hillman expects to propound over the radio, in American homes, the proposition that "all matters of party policy are to be democratically determined by the vote of the representatives of the participating trade unions based on their per capita tax payments to the party," he must have learned his radio technique where he picked up his political ideology.

Whatever may be said against the radio soap operas, they are as much of an American institution as radio broadcasting itself. We may object to them, and join with Mr. Fly in deploring their presence on the air. However, they do not insult our national ideals and loyalties, as do the foreign-born soap-box democrats who want to use the radio to sell themselves into positions of political leadership.

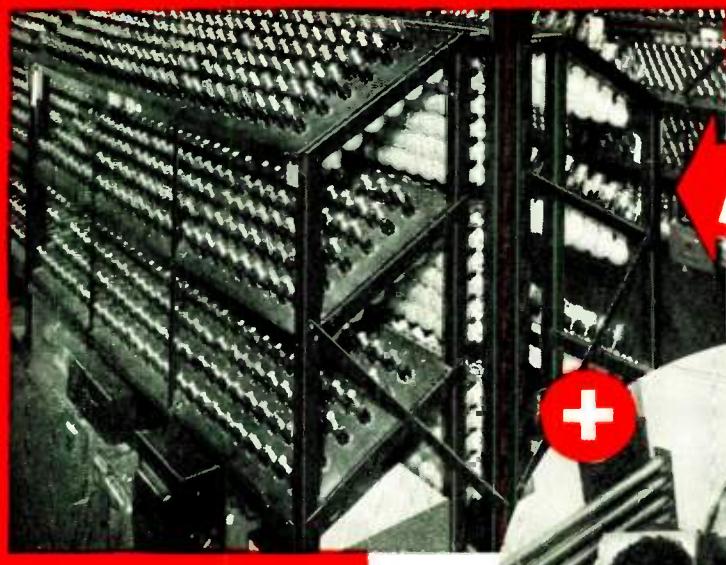
To the people of the United States, now joined with their English-speaking allies in fighting a second European war, the use of the radio by Mr. Hillman and his fellow pressure-politicians in the CIO-PAC would be as great a mistake as their ideas of democratic procedures. Let them have their soap boxes by all means, but not with radio microphones on them!

— *Milton B. Sleeper*

## DIRECTORY OF MANUFACTURERS

The November issue of *FM* and TELEVISION will contain the semi-annual directory of manufacturers of radio equipment, laboratory instruments, components, and materials. In addition, the listings will show the names of the general managers and chief engineers of these concerns.

# A + B = X ★ ★ ★



**A**

**RECEIVING TUBE TECHNIQUE**

Oldest manufacturer specializing on radio receiving tubes — the originator of the now standard BANTAM GT — Hytron has been developing skill in high-speed, soft-glass receiving tube technique since 1921.

**+**

**B**

**SPECIAL PURPOSE ENGINEERING**

Hytron engineers originated BANTAM JR. hearing-aid tubes —popular U-H-F types HY75, HY114B, HY615—instant-heating beam tetrodes HY65, HY67, HY69, HY1269—and numerous other special tubes.

**=X**

## THE ANSWER

**Add A to B, and you have the answer Hytron is able to give the Services when they demand special purpose and transmitting tubes in staggering quantities and at economical prices.**

**1616** Consider a few examples. Substituting soft for hard glass, a mesh for a ribbon filament, Hytron beat the promise by months on requirements for the high-voltage thermionic type 1616 rectifier—through application of mass production methods. Result: The Navy's, "Well done!"

**HY65** Typical of Hytron's instant-heating beam tetrodes for mobile communications, the HY65 combines high-speed techniques with a thoriated tungsten filament and special r.f. design features which gave the Services a rugged, power-conserving, all-purpose beam tetrode. (Cf. JAN-1A spec.)

**OD3/VR-150** Hytron engineering refinements include new starting electrode, lower starting voltage, painstaking processing. Add to these still-increasing high-speed manufacture. Result: "When we think of the OD3/VR-150, we think of Hytron."*

*Quotation from expediter for one of largest electronic equipment manufacturers.

**2C26** Hytron solved a problem for the Services by designing a tube capable of performance and high ratings never before achieved in soft glass. Produced at receiving tube speed and priced at less than a fourth of the cost of tubes replaced, the little 2C26 delivers 2 KW of useful r.f. power under intermittent operating conditions.

***WHAT ABOUT POST-WAR?*** Hytron design, development, and production facilities now serving our fighting men, will be yours to command. The A plus B of Hytron's know-how will supply answers to your special tube problems.

OLDEST EXCLUSIVE MANUFACTURER OF RADIO RECEIVING TUBES

# HYTRON CORPORATION

ELECTRONIC AND RADIO TUBES

SALEM AND NEWBURYPORT, MASS.

HYTRON RADIO TUBES

ARMY-NAVY E

**BUY ANOTHER WAR BOND**

## PREVIEW OF BROADCASTING

(CONTINUED FROM PAGE 21)

vision broadcasting will be feasible. The greater bandwidth will give the needed space for this development.

We thus have the greatest opportunity for the development of an enduring system of television. Research has achieved so much that the interests of all concerned, including those of the manufacturers, the broadcasters, and the public, may best be served by the industry's concentration on research and experimentation. It is desirable that the research men concentrate on this job and that experimental stations be erected at an early date to develop and publicly demonstrate the system. This is an immediate task and it is television's most significant task.

**Television Networks** ★ Another important problem in the offing is to afford the means for the successful operation of television networks. The vision of important events must be carried over the distances. Moreover, the costs of programming will be such that few local stations will be able to do the job effectively without network affiliation.

Here the large motion picture interests may cut across the bow of television network broadcasting. It is wholly feasible to project television pictures on a motion picture screen. Moreover, the record or transcription of the local television station is likely to be a motion picture reel, shipped in from a distance. It is conceivable that this form of local television broadcasting may be quite interesting and, hence, quite successful.

We have proceeded on the assumption, however, that network broadcasting of television programs is to be desired. For example, the important sporting events, the Presidential Inauguration, and many other current news and entertainment events have only one locale. A network can transmit these to the public throughout the country. If efficient means are set up to accomplish this result, then live talent shows of high entertainment quality can likewise be transmitted from the point of origin.

Provision has been made to permit networks to acquire television transmitting stations at all important points of program origin. The Federal Communications Commission is giving extensive consideration to an adequate method of relay transmission. Unlike radio programs, a television program cannot be satisfactorily transmitted along an ordinary telephone line; special coaxial cables are needed to connect television stations into networks by wire and these are both expensive and difficult to construct or install. Serious consideration is therefore being given to an alternative method of providing a radio highway to link television stations into networks. Such radio

(CONTINUED ON PAGE 69)

# FACSIMILE SYSTEMS & IMPULSE RECORDERS *for All Applications*

THE broad experience of the Alden Manufacturing Company in developing and manufacturing facsimile and impulse recording equipment for a wide range of military and industrial services has put this Company in a position to assume leadership in this field as soon as our facilities can be applied to peacetime production.

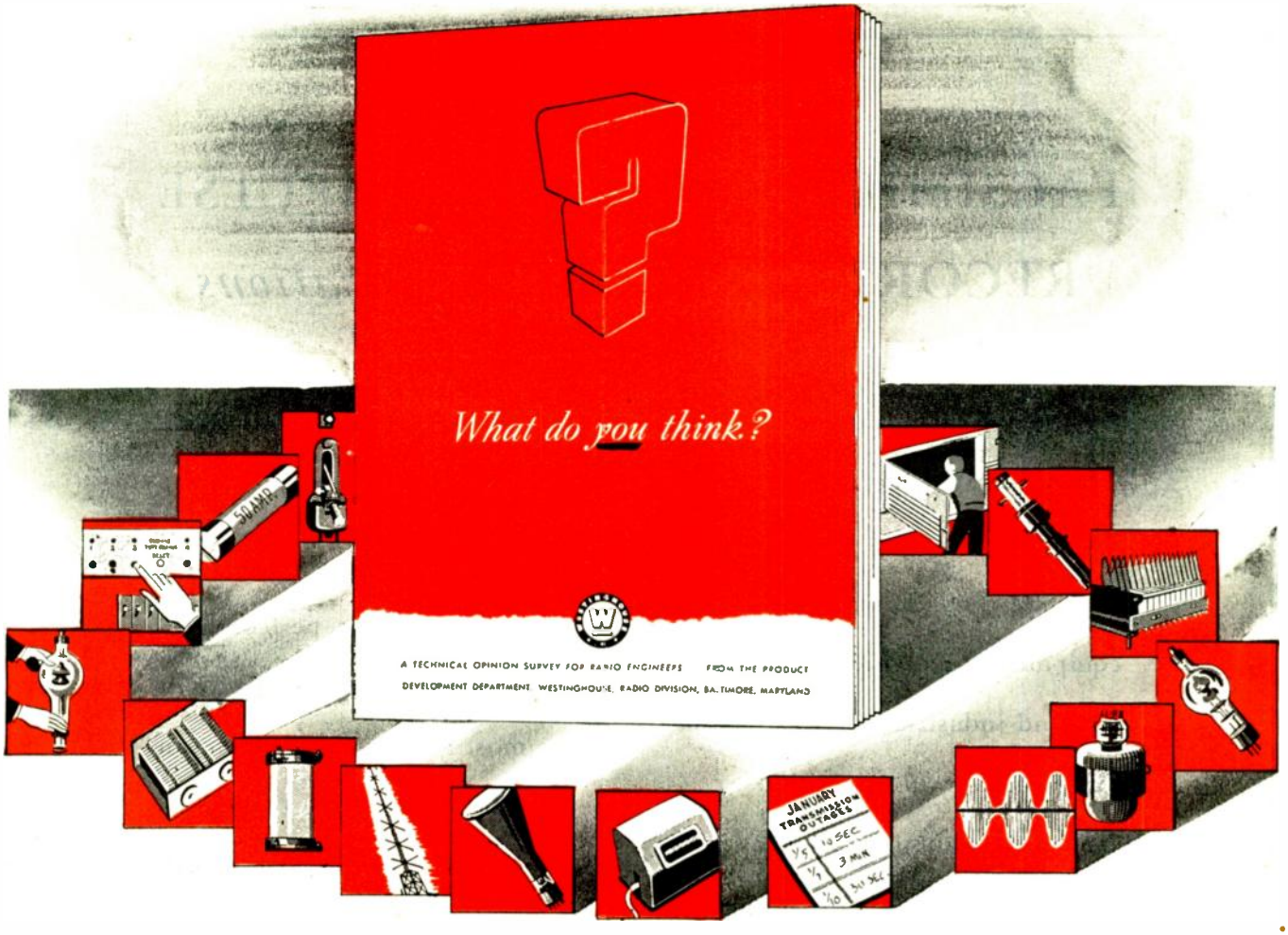
Our experience has not been limited to one type of equipment for some single-purpose use. Rather, it has been with many different kinds of services, calling for the development and manufacture of scanning and recording apparatus suited to each application. In addition, we are producing a variety of impulse recorders for medical, industrial, and other specialized purposes.

As a result, we have perfected designs and components, long-proven in the most rigorous use, which can be adapted readily to meet the needs of any service as to cost, size, speed, recording means, and resolution.

We invite inquiries concerning facsimile equipment for any purpose from operators of communications systems, police departments, broadcast stations, and manufacturers of home radio sets.

*Alden Products Company*

*Department F, Brockton, Mass.*




# CALLING ALL RADIO ENGINEERS!

In the interest of better broadcasting... and as a check on the features we are incorporating in our new transmitter designs... Westinghouse would like to know what radio engineers think about transmission equipment, feature by feature.

There's more than one way to "skin a cat", but there's one *best* way. You men who are responsible for operating the equipment are interested, we believe, in these factors:

**HIGH FIDELITY SIGNALS . . . CONTINUITY OF SERVICE**
**SIMPLICITY OF CONTROL . . . LOW OPERATING COST**
**EASE OF MAINTENANCE**

We will appreciate knowing what you consider the best way to incorporate these advantages in postwar transmitters. To facilitate this, the questionnaire booklet pictured above will be distributed to all stations in the near future. If you do not receive your copy . . . write Westinghouse Electric & Manufacturing Company, Dept. 7-N, East Pittsburgh, Pennsylvania. J-08075

**Westinghouse** RADIO DIVISION

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

**A M • E L E C T R O N I C S • F M**

# AMPHENOL

## Electronic Connectors and Parts

## FLY WITH THE B-29's

● Even counting all the days—and nights—put into planning and preparation by designers, builders and suppliers, B-29 still represents a miracle in achievement—the number of days still seem far too few for the undertaking.

Built to carry loads beyond former limits, at speeds never before considered, and safeguarded as no fighting plane before it, the Super-Fortress history-maker represents a new high in co-ordination between those who plan and those who build.

Leaders among manufacturers—known for quality of products and ability to deliver on schedule the various types of equipment needed, were asked to pledge their co-operation in this twenty-four hour a day job. Amphenol is proud to have been chosen to furnish the electronic connectors and parts for this great weapon.

Engineers in these plants from coast to coast worked simultaneously in designing parts that would meet the requirements set. Each production department set up a time table of the dates on which it would make first and subsequent deliveries. And B-29 progressed by the clock.

The first take off was on schedule. Japan was bombed on schedule. And today, American flyers have a marvelous weapon which gives their talents full play.


● SEND FOR THIS BOOK. Twenty-four illustrated pages of suggestions on dependable wiring—directly from the benches. These are things that other practical men have worked out and by which you or your wiring department can benefit. Send for a copy—you will enjoy reading it.

*Depend upon*

**AMPHENOL**

*Quality*

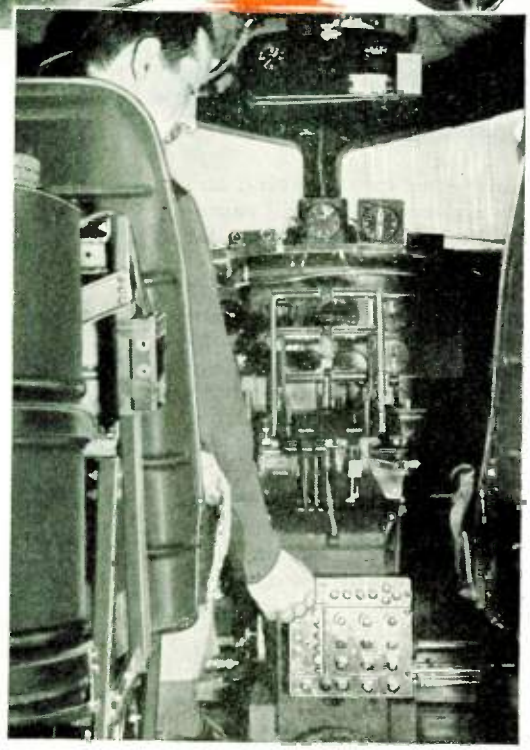
Makers of Connectors (AN, British, UHF), Fittings, Conduit (Flexible Metal and Plastic), Cable Assemblies, UHF (RG) Cable, Radio Parts, Plastics for Industry.

**AMERICAN PHENOLIC CORPORATION**

1830 S. 54th Avenue, Chicago 50, Illinois

IN CANADA · AMPHENOL LIMITED · TORONTO

# THE ELECTRONIC AUTOMATIC PILOT BRINGS THEM THROUGH WITH RAYTHEON TUBES



THE ELECTRONIC AUTOMATIC PILOT, pioneered and developed by Minneapolis-Honeywell, is one of the most significant advances made in aircraft science. Developed to keep bombers on a straight course in their bombing run, the electronic automatic pilot promises safer and more efficient flight for airlines . . . and, because this device must operate with complete reliability at all times, Minneapolis-Honeywell uses thousands of RAYTHEON tubes.

The special wartime experiences of Raytheon Manufacturing Company in devising and producing advanced electronic tubes for the war effort, means that you will be able to offer your customers the best tubes for all applications. Because you have the best tubes, you will have better customer good-will, faster turnover and greater profits.

***Raytheon Manufacturing Company***

RADIO RECEIVING TUBE DIVISION

Newton, Massachusetts • Los Angeles • New York • Chicago • Atlanta

All Four Raytheon Divisions Have Been Awarded Army-Navy "E" Plus Stars

# RAYTHEON

*High Fidelity*

RADIO AND ELECTRONIC TUBES

DEVOTED TO RESEARCH AND MANUFACTURE OF TUBES FOR THE NEW ERA OF ELECTRONICS

(CONTINUED FROM PAGE 64)

highways may be wide enough to be capable of carrying a multiplicity of programs, plus numerous point-to-point telegraph or telephone circuits as well, and may thus become an economic method of long-distance transmission.

There is still another reason why television networks are to be desired. Postwar television need not be limited to a local station, or, for that matter, to any one nation. It is to be hoped that in the course of years it may be feasible to transmit television programs among the continents of the world. Modern industry could make few greater contributions toward a better world than in thus bringing the peoples of nations so closely together by means of international television.

**Political Broadcasts** ★ Let me turn from such long vistas to the immediate future — broadcasting between now and the Tuesday after the first Monday in November. As you know, the Communications Act is quite explicit with respect to broadcasts by candidates for public office. Section 315 of the Act provides:

> "If any licensee shall permit any person who is a legally qualified candidate for any public office to use a broadcasting station, he shall afford equal opportunities to all other such candidates for that office in the use of such broadcasting station, and the Commission shall make rules and regulations to carry this provision into effect: *Provided*, That such licensee shall have no power of censorship over the material broadcast under the provisions of this section. No obligation is hereby imposed upon any licensee to allow the use of its station by any such candidate."

It might be worth your while also to reread the Commission's regulations pursuant to that section of the Act.

So far as broadcasts by actual candidates are concerned, I think the broadcasting industry has a very clear picture of its duties and responsibilities. The disputes arising with respect to broadcasts by candidates in recent years have been few and far between. But I think we would all agree that absolute fairness and scrupulous impartiality in an election year cannot be limited merely to fulfilling the provision with respect to candidates. That is an irreducible minimum of fairness; actually, much more is involved.

For example, there is the matter of programs on behalf of candidates by responsible organizations other than official campaign committees.

Also, there is the treatment of the *issues* which are involved in the campaign. It goes without saying that there is an affirmative duty to practice as rigorous fairness with respect to organizations and

(CONTINUED ON PAGE 70)

## PREVIEW OF BROADCASTING

(CONTINUED FROM PAGE 69)

issues as with respect to candidates themselves.

One feature of the present campaign is the vastly increased prestige, influence, and time on the air of the commentators. Their position has grown tremendously since 1940; and accordingly their role in election campaigns has become increasingly important. News and comment, coming as they do from human sources are peculiarly significant at critical stages in history.

**Freedom of Speech** ★ We must bear in mind that for the first time in history the people's basic right of free speech has a practical working mechanism. Yours the task to see that it is wholly adequate to the needs of a free people. You are the trustees of this powerful mechanism, holding it and guiding its operations in the interest of the public. This is an awe-inspiring responsibility. Basic principles of fairness and adequacy are controlling. So long as you fully and consciously assume this responsibility, you can stand secure against all the ill winds of doctrine and conflict. Radio has been preserved as a free institution. It has done a grand job in most difficult times. Today it has reached a fair degree of maturity and it stands poised to move on to greater things.

**The Dead Hand vs. Live Management** ★ Another evidence of maturity is the appearance of some second generation broadcasters. Some broadcasters have taken steps to guide the future disposition of their interests just in case. I know that some of you may want to be broadcasters in the next world. But you are going to be in a hell of a state if you don't get yourself a new frequency.

Down here we have already seen minor indications of efforts to control by the dead hand. It cannot be done. It should be borne in mind that broadcasting is a highly significant public service; that it is highly personal in character, and that the burden of the public operations devolves upon certain outstanding individuals. Licenses are granted upon the assumption that the individuals involved can assume the attendant responsibilities. The law, of course, explicitly contemplates radio licenses shall not be treated as property. The Commission in certain decisions has already indicated a reluctance to see broadcasting operations move from the hands of competent, specialized personal management into the toils of a legally mechanized impersonal trust estate. It has particularly frowned upon the effort to make the management of a broadcasting station simply another account number in a bank or a trust company. I venture to suggest that it will be wiser

(CONTINUED ON PAGE 71)

## PREVIEW OF BROADCASTING

(CONTINUED FROM PAGE 70)

for the individual broadcasters to see that their radio properties pass both beneficially and legally into the hands of individuals who can be relied upon fully to assume the responsibilities of licenses, and who may have some special competence in that field.

**L'envoi** ★ May I repeat the thought expressed at the San Francisco Convention — the faith I then held I still hold. Wars may come and political campaigns will go. The years like great black oxen will thunder down the trail of unending time. But a free radio must ever stand as a basic cornerstone of our democratic institutions.

## SPOT NEWS NOTES

(CONTINUED FROM PAGE 24)

**New Offices:** General Radio has remodelled a former commercial building to provide space for research, production control, sales, and administrative personnel. Ad-


GENERAL RADIO HAS NEW OFFICES

joining the manufacturing plant, it is connected by passageways on each floor. This addition brings the total plant space to 112,000 sq. ft. New address is 275 Massachusetts Avenue, Cambridge, Mass.

**Baltimore:** Bendix Radio plans to enter the home radio field, and is setting up national consumer advertising to support distribution through jobbers. This development will be watched with great interest, for the Bendix radio plant is set up for the production of precision military and aircraft equipment. W. P. Hilliard, general manager, promises that: "Improvements in quality and performance of components, speakers, and record-playing mechanisms will characterize the complete line of FM-AM home radio and phonograph combinations."

**Allen B. Du Mont:** Received the honorary degree of Doctor of Engineering from Rensselaer Polytechnic Institute, when he delivered the commencement address to the graduating class.

**Our Trouble Department:** Larry Smith, chief radio engineer of the Alabama Department of Public Safety, writes: "I want to order some additional copies of your July

(CONTINUED ON PAGE 72)

## SPOT NEWS NOTES

(CONTINUED FROM PAGE 71)

issue. Mr. Bennett's copy was taken, and the office says mine was received but it was confiscated." We appreciate his frankness. Usually, under those circumstances, our subscribers say: "What's wrong with your mailing department? You didn't send me the last issue."

**Annual FMBI Meeting:** Is tentatively scheduled for week of January 22, 1945, in New York City. Meeting will probably be timed in conjunction with I.R.E. and A.I.E.E. sessions.

**FM Band to 56 Mc.:** With the RTPB television and FM Panels finally in agreement on the advisability of maintaining the present FM band, and extending it still further, it now appears that the FCC will settle on 42 to 56 mc. for educational and commercial broadcasting, with the former at the low end of the band.

**T.B.A. Conference:** First Annual Conference of Television Broadcasters Association will be held at the Commodore Hotel, December 11th and 12th.

**Back Again:** Publication of Western Electric's *Pick-Ups* has been resumed, but under the new title of *The Western Electric Oscillator*. Editor is Will Whitmore, with Vance Hilliard as assistant. Publication office is at 195 Broadway, New York City 7.

**See You at Chicago:** *FM* AND TELEVISION Magazine will have a booth at the Electronic Parts & Equipment Industry Conference, Hotel Stevens, October 19, 20, and 21. We hope to greet there many of our friends we haven't seen since prewar days.

**New Name:** The Lafayette Radio Corporation of Chicago and Atlanta has announced a change of name to Concord Radio Corporation. No reason was given for this, but it was emphasized that there will be no change in the company executives or personnel.

**Low Power FM Transmitters:** Up to 5 kw. output will be offered as soon as conditions permit by F. M. Link, 125 W. 17th Street, New York City. Present plans do not contemplate the manufacture of FM broadcast transmitters in the higher ratings.

**Milwaukee:** As a part of its postwar planning, *The Milwaukee Journal* has appointed Philip Laeser, formerly WMFM transmitter supervisor, to the new post of FM-television engineering supervisor. Alva Van Alstyne, former WMFM transmitter engineer under Laeser, has been named chief transmitting engineer of WMFM.

## COMMENTS OF AN FM LISTENER

(CONTINUED FROM PAGE 19)

done because more people can hear this inferior quality?

As a listener, that puzzles me, just as it is difficult to understand why Philco, which claims to have sold more "FM" receivers than any other manufacturer, put out a set that had no limiter — the very circuit element required to give the static reduction that is the principal feature of FM. In fact, these sets were so inferior in their performance that the Better Business Bureau, believing that there was misrepresentation involved in the advertising of these sets as "FM receivers," was conducting an investigation of this subject at the time of Pearl Harbor.

Concerning the experience of those who bought these sets, I do know that every dealer I have asked concerning their performance has referred to them as "clucks" or "lemons," but has been most enthusiastic about the FM reception delivered by other makes.

Again, as a listener, and on behalf of others who share a reasonable desire for further improvement in the audio quality of radio reception, I object to the efforts of engineers to discount the importance of tone fidelity. Now that FM eliminates the background noise, I want at my home all the high frequencies I would hear if I were listening to original studio programs.

Yet Mr. Hanson, chief engineer of NBC, stated in a pamphlet which he distributed to members of the RTPB FM Panel: "Receivers which at present provide millions of listeners with many hours of enjoyment seem generally adequate for reproducing the intelligence and entertainment contained in the program material. For example, the witticisms of Charlie McCarthy are just as humorous on a receiver whose frequency range is 200 to 3,000 cycles as on a higher fidelity system."

Well, I suppose that people with enough imagination to be amused by a ventriloquist's dummy over the radio can easily supply such missing details as the audio frequencies above and below 200 to 3,000 cycles.

Mr. Hanson continues: "The average radio listener purchases the table model receiver rather than the console. The former type of receiver cannot adequately reproduce bass frequencies, the fundamental reason being lack of sufficient physical size."

That's true, but why? The answer is that reproduction from AM console receivers isn't enough better than from table models to justify the difference in cost. The fidelity of consoles has been limited by AM broadcasting and by static and background noise.

However, the experience of licensed FM set manufacturers, before the freeze, was that so few FM-AM table models

(CONTINUED ON PAGE 74)

## COMMENTS OF AN FM LISTENER

(CONTINUED FROM PAGE 73)

were sold compared to consoles that they were hardly justified in making table models at all! Furthermore, while the average price of 1941 AM radios was about $25, the most popular FM-AM sets were in the $350 class.

Mr. Hanson argues that studio acoustics can be controlled only to 8,000 cycles. Actually, the science of studio acoustics did not exist when broadcasting started. It can and will be developed further if the audio capabilities of transmitters and receivers justify it.

There is no intention, in these remarks, of offending anyone, and if they contain a certain amount of criticism, their purpose is altogether constructive. In the interests of listeners, someone must raise an outcry against negative thinking expressed in statements and policies which will either delay or limit the improved service which FM can provide to radio listeners. This obligation transcends professional courtesy.

If broadcast and radio design engineers combine to get the utmost from FM, there will be no problem to sell time or receivers for this superior broadcasting. That is what FCC Chairman Fly had in mind when he said of broadcasting: "Sound forethought is especially needed to prevent FM from becoming a mere replica of FM, thus sacrificing FM's inherent advantages," and of receiving sets: "Public interest requires that certain minimum standards be established and adhered to lest the benefits inherent in better broadcasting be lost — that is, in the design of receivers."

## ENGINEERING SALES

(CONTINUED FROM PAGE 8)

**Bendix:** Jack C. Wilson, formerly of the Signal Corps production field office, is the new Pacific Coast district manager for Bendix radio sets. With offices in San Francisco, he will cover California, Oregon, Washington, Arizona, Nevada, Utah, Idaho, and Montana.

**Charlie H. McCee:** Has resigned from the Radio and Radar Division of WPB to resume activities as a manufacturers' representative. His offices are at 927 Fifteenth Street, N.W., Washington, D. C.

**National Carbon:** A new sales setup is being installed for handling *Eveready* products. A new office in Atlanta, with J. F. Warnell in charge, will serve the southeast. Another new office has been opened at

(CONTINUED ON PAGE 75)

## ENGINEERING SALES

(CONTINUED FROM PAGE 74)

Dallas, under C. C. Joslyn. A. C. Bryan has taken over the Kansas City office, and R. P. Tolles has succeeded to the direction of the San Francisco organization. Division offices will soon be opened in Chicago, Pittsburgh, and New York City.

**Philco:** New head of industrial radio division is Leslie J. Woods, formerly vice president and general manager of National Union Radio, a Philco subsidiary. Woods joined Philco in 1925. He will make his headquarters at Detroit, where he will serve the automobile and aircraft industries. His assistant manager will be Martin F. Shea who, since 1942, has been in charge of Philco's Washington office.

**Meissner:** Ray R. Hutmacher, formerly with Utah Radio, has joined Meissner as district sales manager at the Chicago office, working under vice president Oden F. Jester, on the sale of the new line of Meissner phonograph combinations.

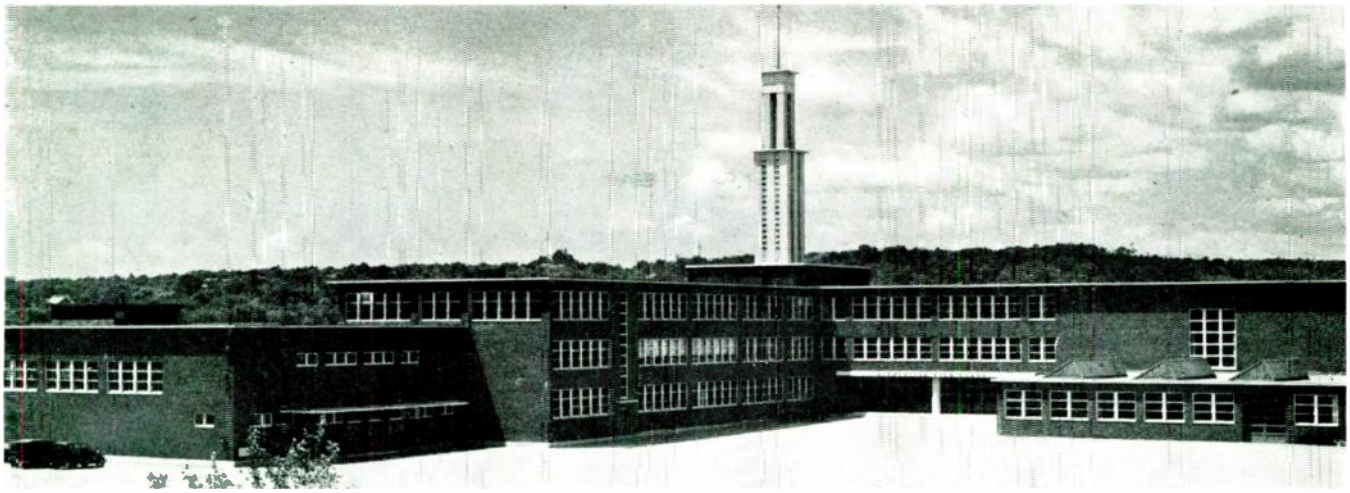
**Admiral:** Newly appointed distributors are Peaslee-Gaulbert Corp., Atlanta, Ga., and Jacksonville, Fla.; Monroe Hardware Co., Monroe and Shreveport, La.; and Kaemper-Barrett of San Francisco and Oakland, Calif.

**Echophone:** Willams Export Associates, headed by T. F. Williams, formerly of Philco, Great Britain, will handle overseas sales of Echophone Radio communications receivers and other electronic products. A heavy foreign demand is expected for sets to pick up U. S. shortwave programs.

**Zenith:** Planning expansion in the automobile radio field, Zenith has appointed Walter H. Dyer as manager of this division. Dyer was previously with RCA.

**Taylor Tubes:** Have announced a plan to distribute their products through jobbers under which industrial sales will be made by the jobbers' salesmen, but the accounts will be carried by the factory.

**C. E. Anderson:** Former sales manager of Audio Devices has resigned to join John O. Olsen, manufacturers' representative in Cleveland, covering West Virginia, Pennsylvania, and Ohio.



# FM goes to school!

## ...but in the role of an Educator!

FM has been chosen as the ideal method for Transmitting Educational Programs. The Federal Communications Commission has assigned special FM Frequencies for the exclusive use of schools and colleges of this country. Boards of Education of large cities have already broadcast, by Frequency Modulation, regularly scheduled educational programs.

REL has been the pioneer in FM Educational Stations, having furnished and equipped WNYE (NYC) and WBOE (Cleveland). This added to our background of numerous successful installations of 1 to 50 KW Commercial FM Stations, has ideally equipped us to serve Educational Groups interested in FM.

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# *Link* RADIO FUNCTIONS FLAWLESSLY DURING YEAR'S GREATEST EMERGENCY

## ★ "KQCE" *Only* MEANS OF COMMUNICATION FOLLOWING PORT CHICAGO EXPLOSION

*MARTINEZ, California.*

The Port Chicago explosion on July 17th took 254 lives and injured about 400 persons. How many lives were saved through the quick action of Sheriff Long's department will never be known.

Port Chicago has no regular police department or radio communication facilities Knowing these circumstances, the Sheriff dispatched a patrol car to the area immediately following the explosion. The concussion from the blast seven miles away knocked the radio operator from her chair in headquarters It shattered windows in the control room and caused other damage but **"All radio equipment continued to function,"** in the words of George K. Burton, Radio Supervisor

Hardly an overhead wire of any description was left intact The full load of essential traffic had to clear through "KQCE" After the patrol car had given the first flash on the tragedy, an urgent plea for medical assistance was made Public Utilities were alerted on shutting down electrical power and cutting off the supply of escaping gas. The many potential fires and secondary explosions were averted by quick thinking

Normal communications in and out of the disaster area were at an absolute standstill. During the next 24 hours there was hardly a break in radio operations for "KQCE" and its mobile units within the blast area. Even after telephone service was restored, "KQCE" continued its excellent work by detailing demolition squads to pick up live ammunition hurled up to 5 miles away from the area.

George Burton made a conservative understatement when he said, **"During this trying period the radio system functioned without any trouble and that is certainly a tribute to Police Radio."** We at Link Radio know that George Burton and the Sherriff he represents have put in many years of hard work, perfecting their radio system for jobs like this. The Contra Costa Sheriff's Office has proven that a progressive organization is always ready for any emergency. They performed flawlessly through the finest emergency communication acid test of this or any year.

Sheriff James N. Long's Contra Costa Radio Station. The Link Type 500-B is housed in this building. The "KQCE" vertical radiator mast is shown against a background of the Southern Pacific's tracks. Abnormal flood waters prevailed at the time photo was taken, with no effect on the system's operation.

★

***Link* FM→ RELAY REPEATER**

"KQCE" pioneered mountain top relay more than five years ago. First, Link AM and then FM as shown.

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