PRICE—TWENTY-FIVE CENTS

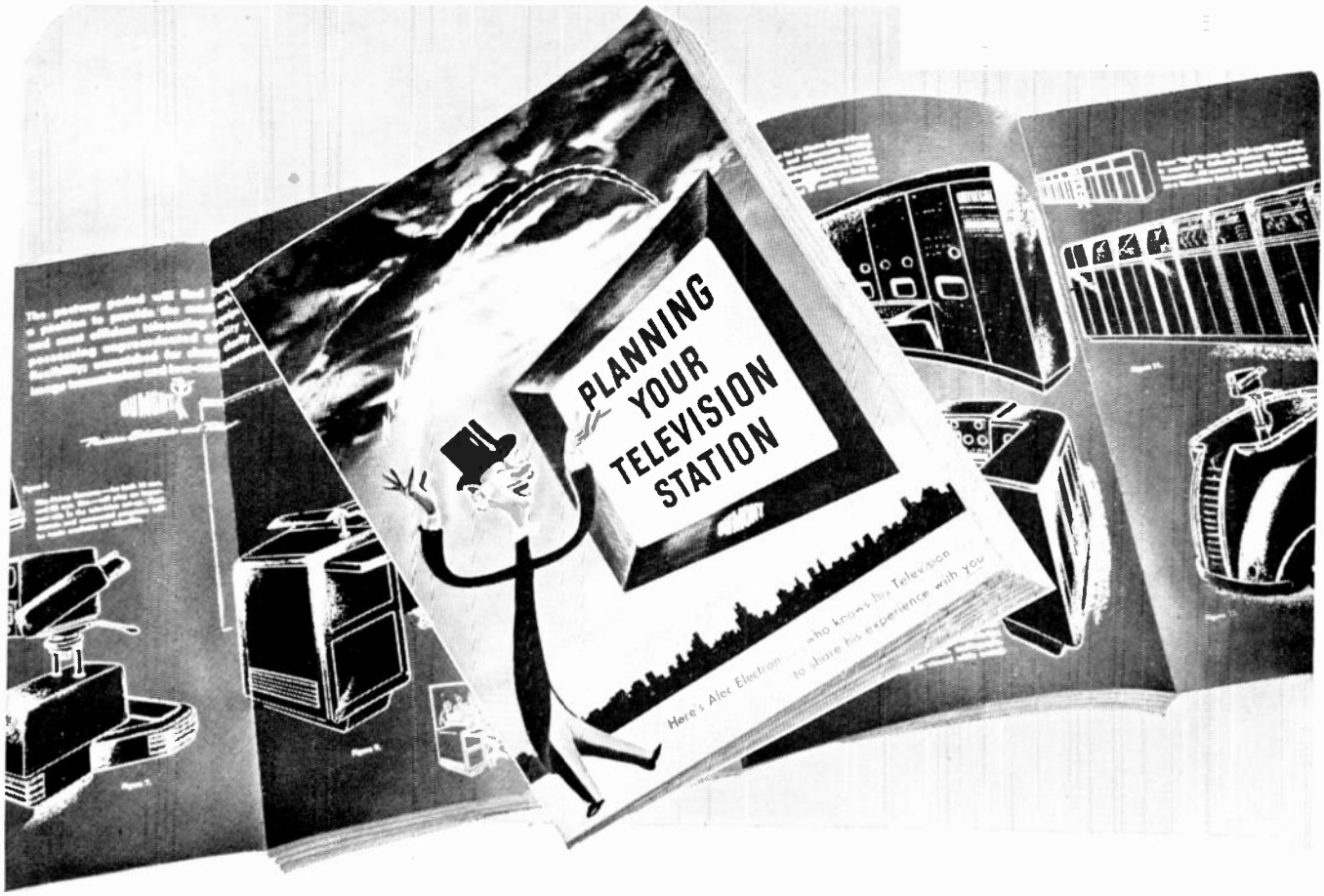
FM AND TELEVISION

JULY 1944

CHECKING VIBRATORS FOR POLICE RECEIVERS

Emergency Radio Stations

★ ★ Edited by Milton B. Sleeper ★ ★



WHAT SHOULD A TELEVISION STATION COST?

Prospective station owners are fast discovering that DuMont has *the answers on television* . . . and willingly shares its "television know how" for the advancement of this magnificent new art. Prospective station operators also are discovering that DuMont telecasting equipment is "tops" in signal transmitting efficiency and effectiveness, and leads in installation and operating economies.

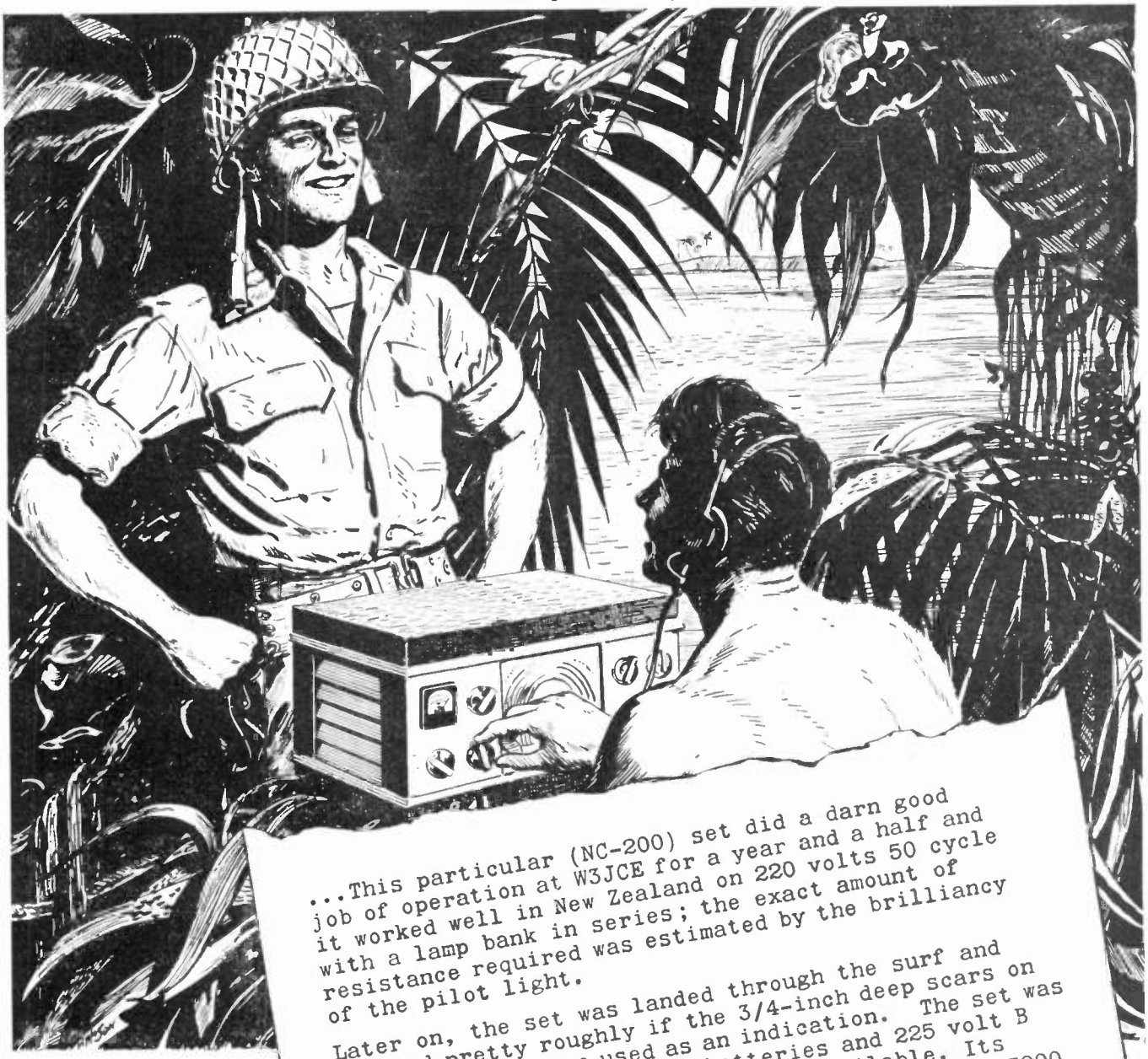
Eloquent evidence of DuMont leadership is provided in the design and construction of 3 of the nation's 9 television stations in service today . . . and in the operation (for more than 3 years) of Television Station WABD, New York. Just as DuMont's development of the DuMont Cathode-ray Tube made television commercially practical, so DuMont pioneering in station design and operation has set a pattern for profitable station management. This pattern is available to you.

"Planning Your Television Station" tells how to insure a low-cost telecast operation . . . outlines your equipment requirements . . . offers you a surprising arrangement for *reserving* equipment now, and for custom-building your telecasting set-up and training your personnel soon after victory. Please request this booklet on your firm letterhead.

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

"RIGHT, MAJOR, IT WON'T TRANSLATE JAPANESE"



...This particular (NC-200) set did a darn good job of operation at W3JCE for a year and a half and it worked well in New Zealand on 220 volts 50 cycle with a lamp bank in series; the exact amount of resistance required was estimated by the brilliancy of the pilot light.

Later on, the set was landed through the surf and handled pretty roughly if the 3/4-inch deep scars on the packing box are used as an indication. The set was operated on 6 volt storage batteries and 225 volt B for several weeks until AC became available. Its reception of broadcast programs from the States 7000 miles away was excellent. In fact, the only thing it wouldn't do was translate Japanese. The NC-200 was by far the best radio on the island except for one 'RAS' and I guess you know who built that.

When I received my orders to come back to this country, it almost broke my heart to part with 'Baby', but I sold it because a good radio means a lot out there.

(Excerpt from a letter from a Major of Marines in the Pacific)

NATIONAL COMPANY

MALDEN  **MASS, U. S. A.**

NATIONAL RECEIVERS ARE IN SERVICE THROUGHOUT THE WORLD

SHARING THE RESPONSIBILITY OF

Security at Sea

• Today and for all tomorrows, ships at sea everywhere and airships, trains, police cars—will be in constant touch with the home port or base. The long wartime strides of electronics' progress have assured this for the world.

Lifeline of this instant constant contact is the high frequency (low-loss) cable. Amphenol R G type is an outstanding example which is serving today on the ships of every sea and flying in every formation.

Amphenol has been closely allied to the development work and pioneered the manufacturing processes of solid dielectric ultra-high-frequency cables. The result is quite naturally a cable of unusual quality built in many sizes and with vinyl or armored outer jacket—a husky, serviceable high frequency cable built to the needs of shipbuilders, and manufacturers of electrical equipment for every type of service. Write for Amphenol Catalog Section D.

Amphenol R.G., U.H.F. Cable, in full range of sizes, solid dielectric, braided metal shield, tough vinyl and armored jacket.

Amphenol, approved design, ultra low-loss connectors.

Depend upon AMPHENOL Quality

Connectors (AN, British, U. H. F.)
Cable Assemblies
Conduit (Flexible)
AN Fittings
UHF Cable
Radio Parts and Equipment
Plastic Products

AMERICAN PHENOLIC CORPORATION
1830 S. 54th AVENUE, CHICAGO 50, ILLINOIS

FM AND TELEVISION

FORMERLY: FM RADIO-ELECTRONICS

VOL. 4 | JULY, 1944 | NO. 7

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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

B SUPPLY vibrators in pleasure-car radios are only called upon for intermittent service, but those in police-car receivers are in almost continuous use. Thus the manufacturers of these components have made substantial investments in research to stabilize their performance, and to extend their life in this special service. Actual results depend not only upon the vibrator design but equally upon the coordination of vibrator characteristics and circuit design. Mismatch may cut down the life of a vibrator to a fraction of its normal rating.

This month's cover shows Robert J. Aust, vibrator engineer at P. R. Mallory, using an oscillograph and Strobotac to observe simultaneously electrical characteristics and mechanical action of an experimental vibrator.

WHAT'S NEW THIS MONTH

1. Correction
2. Robot Bombs
3. Civilian Radio
4. The RTPB
5. Little Caesar

1. On page 12 of our June issue, the statement was made that messages from the German Fleet were picked up on a superheterodyne receiver just prior to the Battle of Jutland. Imagine, then, your editor's embarrassment upon being advised by Major Armstrong that the Battle of Jutland was fought on May 31, 1916, two years before the superheterodyne was invented!

Major Armstrong confirmed the report of the incident which might well have reversed the outcome of the battle, but the messages which indicated the movement of the German Fleet, he said, were received on a regenerative amplifier.

2. About that time, your editor was working at Sperry Gyroscope with the late Morris Titterington, subsequently one of the founders of the Pioneer Instrument Company, on the development of what we would now call a radio controlled "robot bomb." We were using Curtis Jennies which were intended to carry bomb loads instead of pilots. The bomb-carrying plane was to be flown by a Sperry gyropilot, forerunner of the present automatic pilot.

We had a marvelous anti-interference mechanism to keep the enemy from taking away the control of the plane, but the project was not successful, partly due to the limitations of radio apparatus available then, and also because, while the gyropilot was highly perfected even at that time, the planes were so lacking in inherent stability that it was not practical to substitute mechanical means for the delicate technique known as "flying by the seat of one's pants."

The ultimate fate of the project is not known because toward the end of this unsuccessful effort, your editor joined what was then called the British Royal Flying Corps.

3. Every advance in Normandy, Italy, and on the Eastern Front brings nearer the day when radio receivers and transmitters can be manufactured for civilian use. The lack of planning for that time recalls the situation during the days

(CONTINUED ON PAGE 71)

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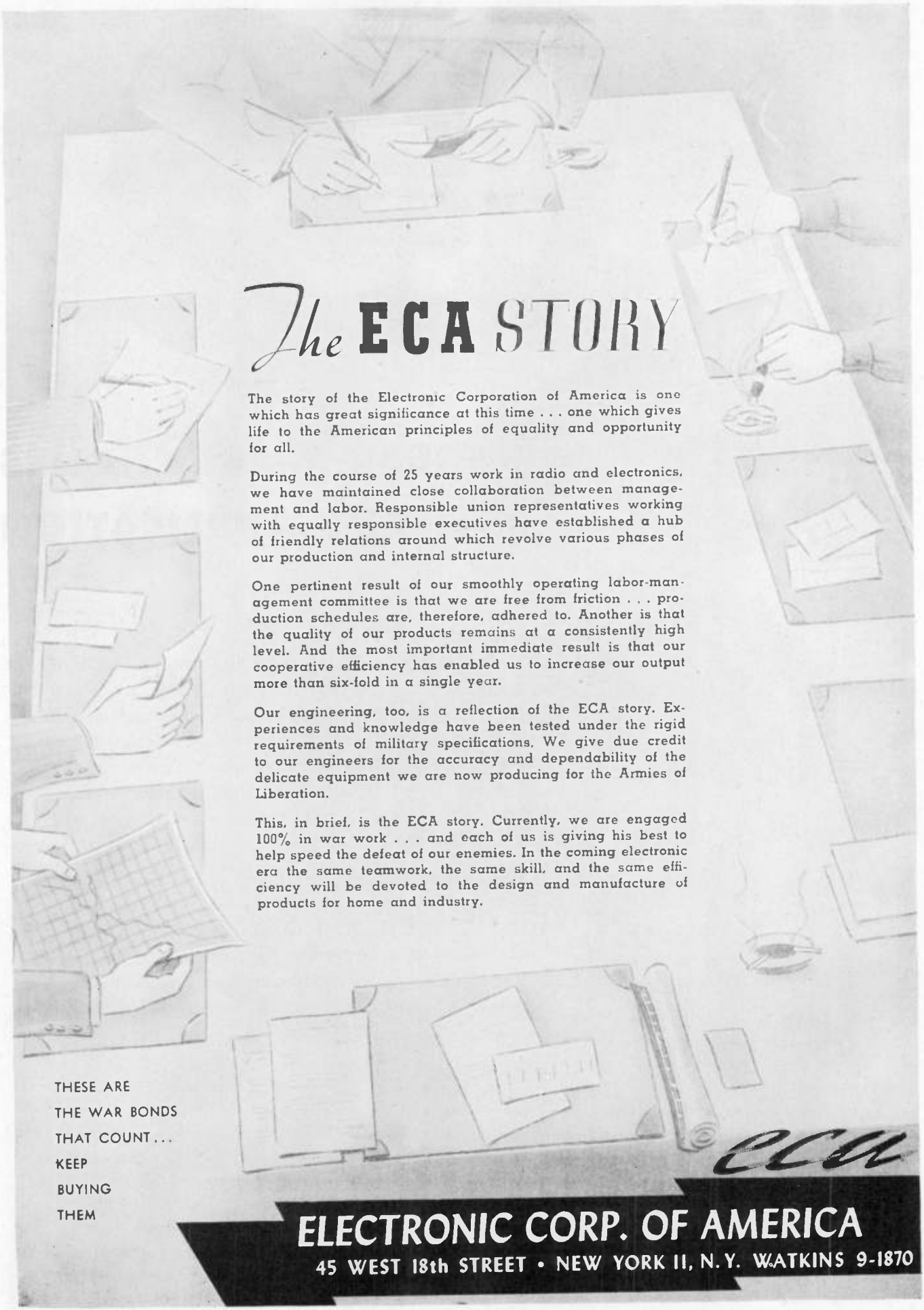


The ECA STORY

The story of the Electronic Corporation of America is one which has great significance at this time . . . one which gives life to the American principles of equality and opportunity for all.

During the course of 25 years work in radio and electronics, we have maintained close collaboration between management and labor. Responsible union representatives working with equally responsible executives have established a hub of friendly relations around which revolve various phases of our production and internal structure.

One pertinent result of our smoothly operating labor-management committee is that we are free from friction . . . production schedules are, therefore, adhered to. Another is that the quality of our products remains at a consistently high level. And the most important immediate result is that our cooperative efficiency has enabled us to increase our output more than six-fold in a single year.

Our engineering, too, is a reflection of the ECA story. Experiences and knowledge have been tested under the rigid requirements of military specifications. We give due credit to our engineers for the accuracy and dependability of the delicate equipment we are now producing for the Armies of Liberation.

This, in brief, is the ECA story. Currently, we are engaged 100% in war work . . . and each of us is giving his best to help speed the defeat of our enemies. In the coming electronic era the same teamwork, the same skill, and the same efficiency will be devoted to the design and manufacture of products for home and industry.

THESE ARE
THE WAR BONDS
THAT COUNT...
KEEP
BUYING
THEM

eca

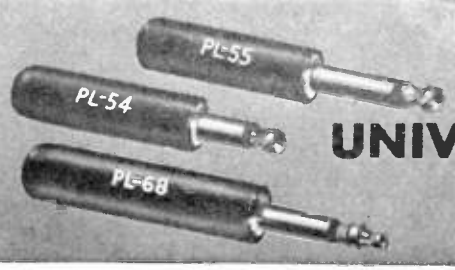
ELECTRONIC CORP. OF AMERICA

45 WEST 18th STREET • NEW YORK 11, N.Y. WATKINS 9-1870

UNIVERSAL MICROPHONES IN MILITARY APPLICATION

Universal takes pride in producing these three types of Microphones at the request of the U. S. Army Signal Corps. These units represent but a small part of the skill and experience which has produced over 250 different types and models made available to our customers. From Submarine Detectors to High Altitude Acoustic units, Universal's Engineering experience has covered World War II.

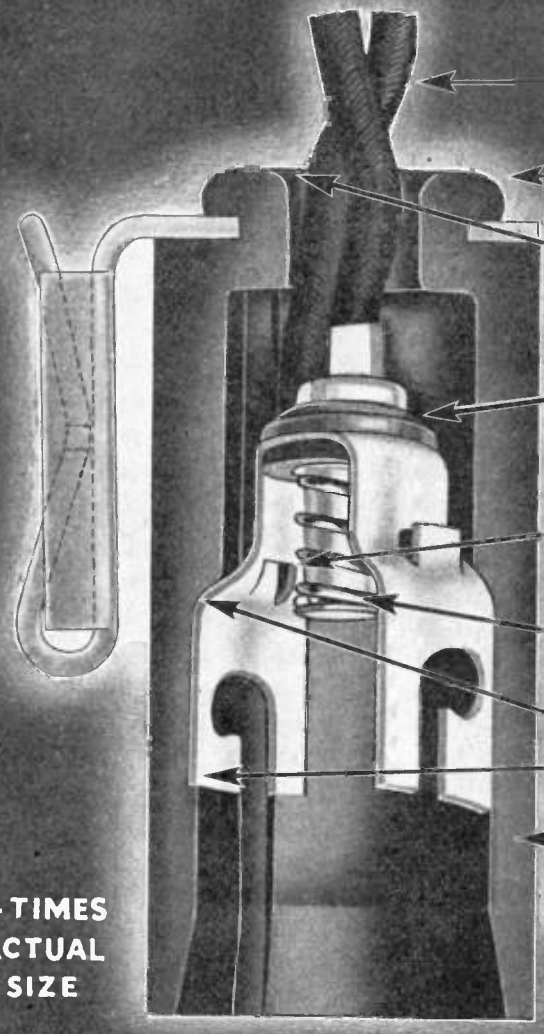
These Microphones built without peace time glamour have every essential of military utility. When peace comes, Universal Microphones, with many innovations of design and accoutrements, will enter upon the post-war scene. Universal includes among its electronic communication components, in addition to microphones: Plugs, Jacks, Switches, and Cord Assemblies.



UNIVERSAL MICROPHONE COMPANY

INGLEWOOD, CALIFORNIA

a New and Superior DIAL LIGHT SOCKET



4 TIMES ACTUAL SIZE

- 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 charcteristics.

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

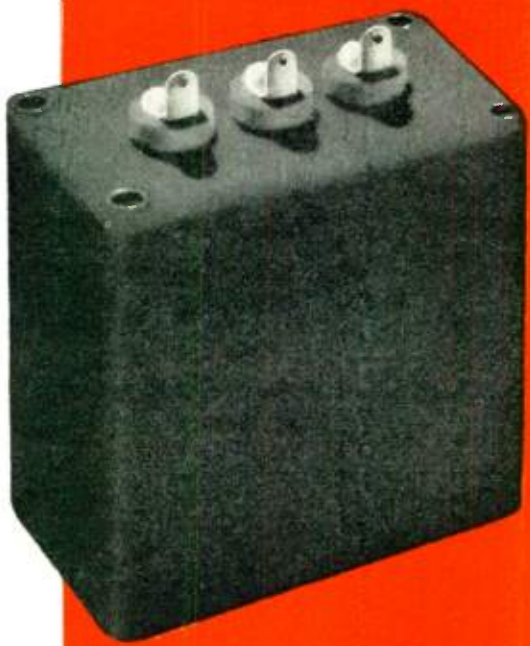
In Business *Since 1904*

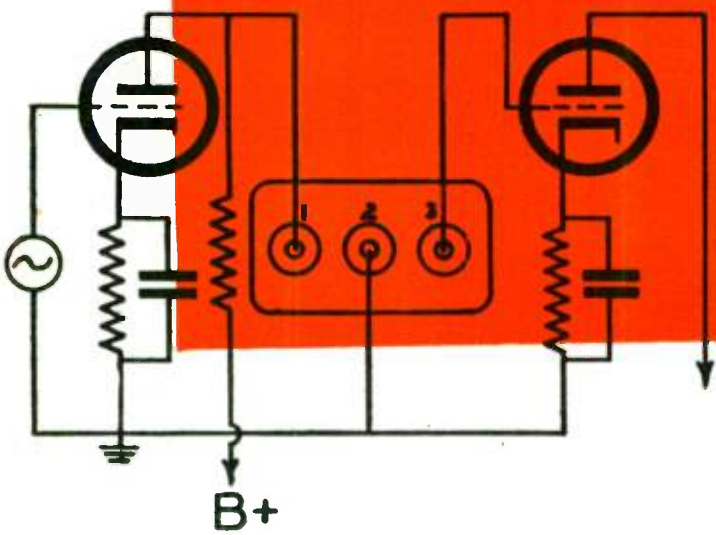
LENZ ELECTRIC MANUFACTURING CO.

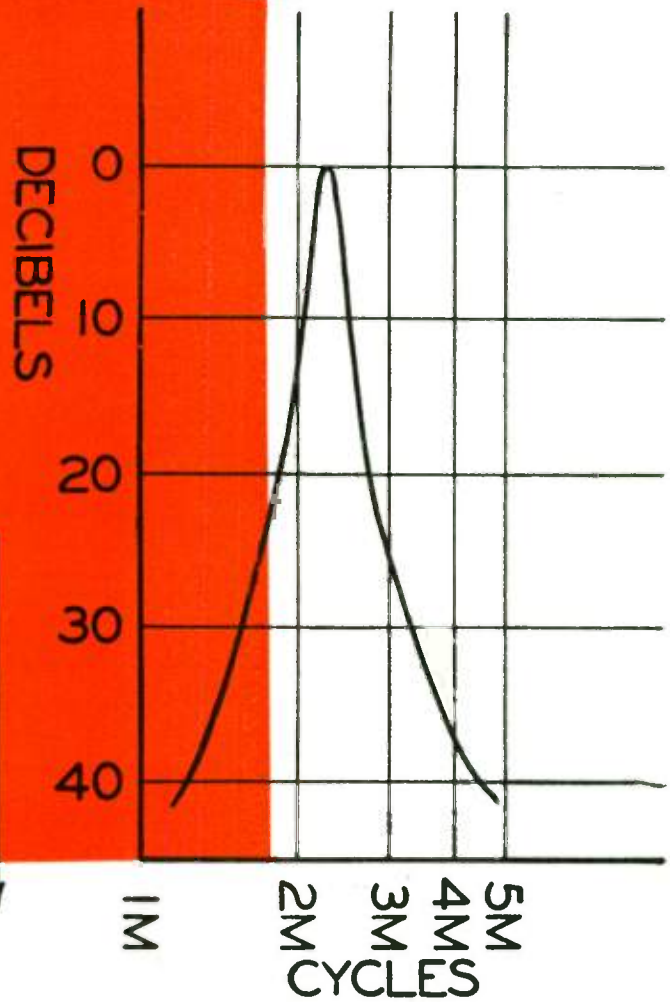
1751 N. WESTERN AVE. CHICAGO 47, ILLINOIS

ELECTRIC CORDS, WIRES AND CABLES

INTERSTAGE FILTERS BY







Interstage filters lend themselves to effecting gain simultaneously with their frequency discrimination. The unit illustrated is a band pass unit which provides a 2:1 step-up ratio, with band pass attenuation of 40 DB per octave. This unit employs a dual alloy magnetic shield which reduces inductive pick-up to 150 Mv. per gauss. The dimensions in its hermetically sealed case are 1½ x 2½ x 2½. Filters of this type can be supplied for any band pass frequency from 200 to 10,000 cycles.

May we cooperate with you on design savings for your application . . . 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"

wherever a tube is used...

for example

THE ELECTRONIC CALIBRATOR

A recently designed automatic calibrator for frequency meters used in conjunction with adding machines largely eliminates tedious hand calibration, saves man hours, reduces element of human error, speeds production.

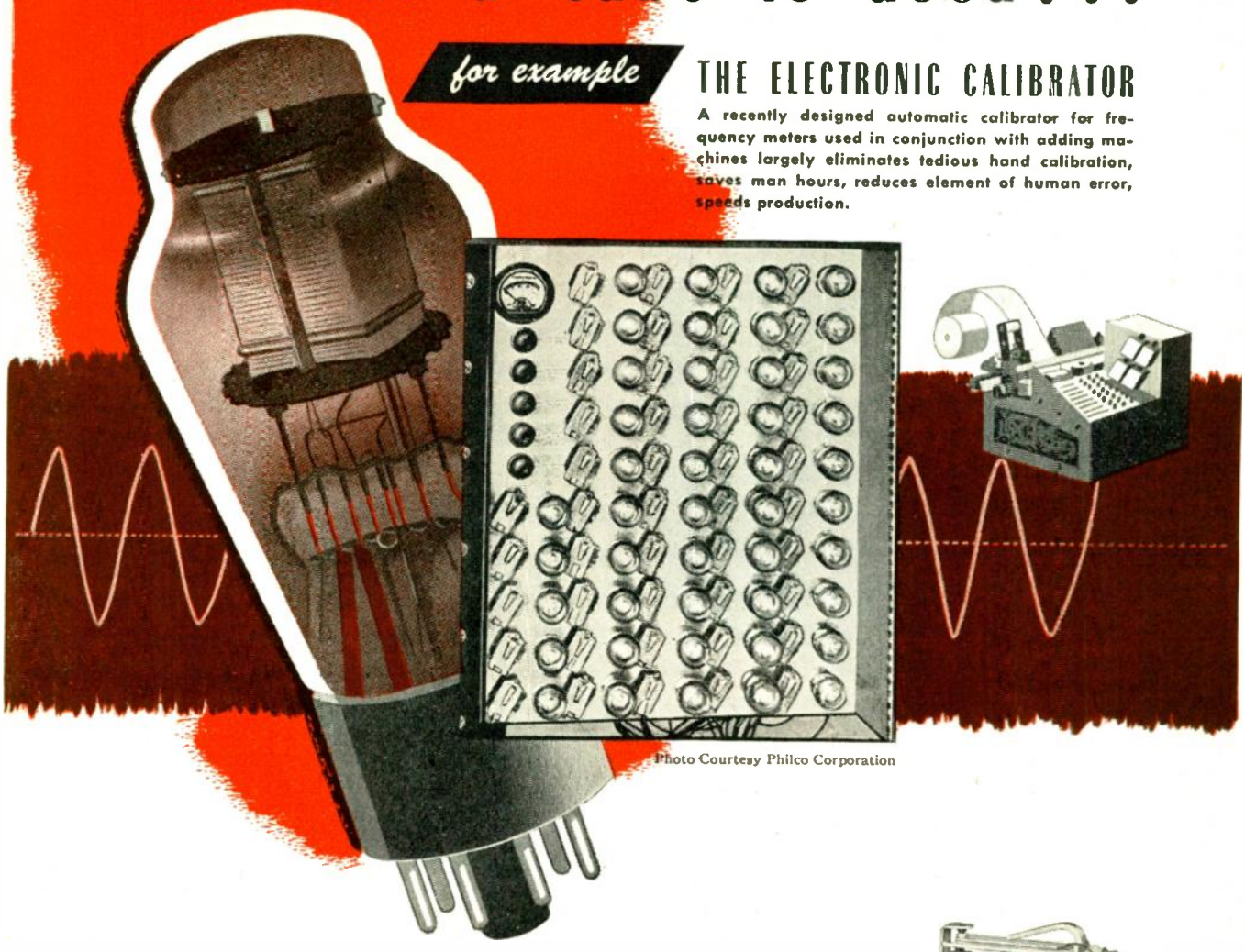


Photo Courtesy Philco Corporation

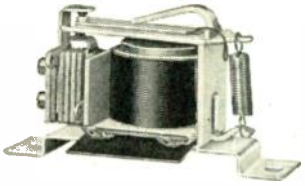
THERE'S A JOB FOR

Relays BY GUARDIAN

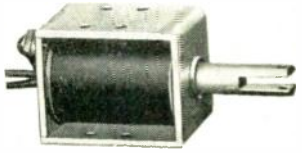
The Philco 126-tube Electronic Calibrator employs a system of fast and slow-acting relays and solenoids to bring about desired end actions. One application is the transferring of readings from the storage bank (shown above) to the keyboard of the adding machine. Operated by the plate current of OA4G tubes the relays on the storage bank energize the adding machine solenoids which press the proper number key of the adding machine.

The Guardian Series 120 relay used in this application is a small, sensitive unit having a minimum power requirement of 0.5 VA and an average of 2 VA. Coils are available in resistances from .01 to 6,000 ohms. Contact combinations up to single pole, double throw with 12.5 amp. points. Send for Bulletin 120.

The solenoid is Guardian Series 4 available for either A.C. or D.C. use. Series 4 A.C. at a maximum stroke of 1" permits a pull of 14 oz. intermittent duty, 3 oz. continuous duty. Series 4 D.C. at a maximum stroke of 1" permits a pull of 6 oz. intermittent duty, 1 oz. continuous duty. Send for information.



Series 120 Relay



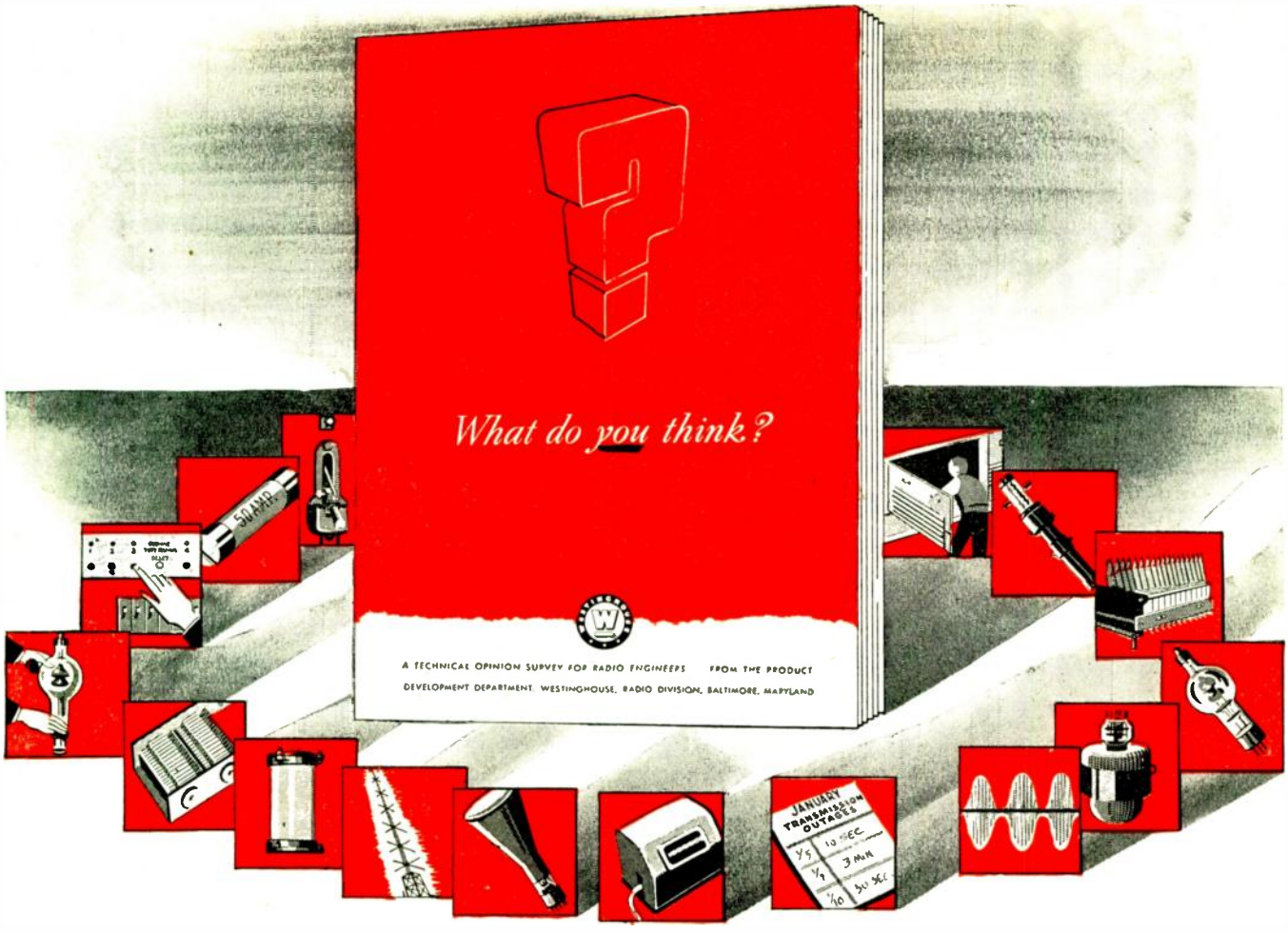
Series 4 Solenoid

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

GUARDIAN ELECTRIC

1637-H W. WALNUT STREET CHICAGO 12, ILLINOIS

A COMPLETE LINE OF RELAYS SERVING AMERICAN WAR INDUSTRY



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

These Solar Capacitors

SERVE THE SERVICES

So you can see what they look like, they stopped to have their pictures taken, before going to war. They will serve with the Signal Corps, the Navy, with Ordnance vehicles and tanks; they will enable the Marines to tell it to each other; they will drop with paratroopers; they will visit every climate on the earth and will climb with the Air Force, above climate; they will win many merits even though they never wear them. Principally, they want you to remember, they will render an assist in the saving of many lives,–through reliable communications.

Their story is told in pictures—including many official color photographs of troops in action . . . in a 40-page book "Solar Capacitors . . . in the War . . . in the Peace." Just fill out and mail the coupon.

SOLAR MANUFACTURING CORP.
285 Madison Avenue, New York 17, N. Y.

Please send me your 40-page booklet
"Solar Capacitors . . . in the War . . . in the Peace"

Name_____

Street_____

City_____ State_____

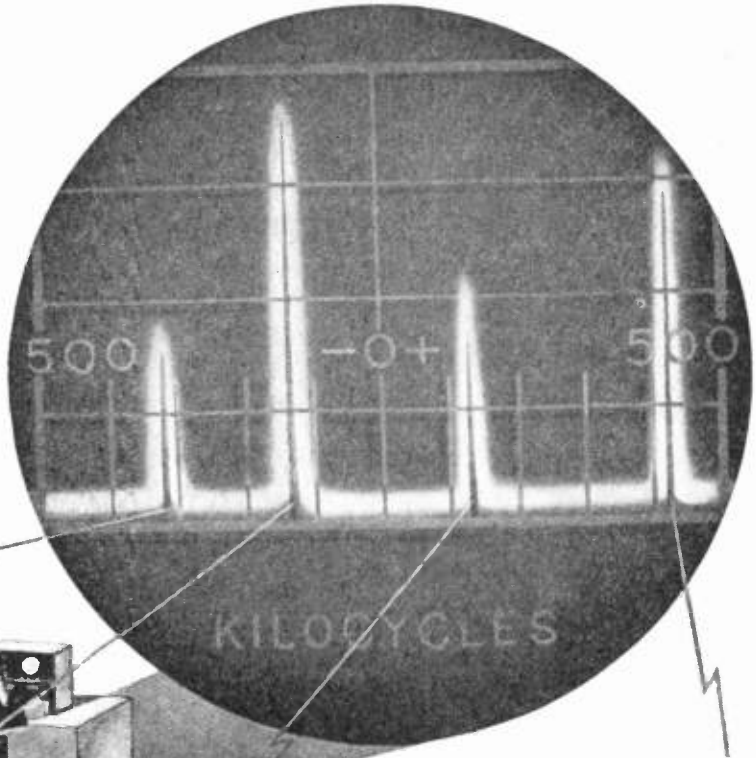
ARMY E NAVY

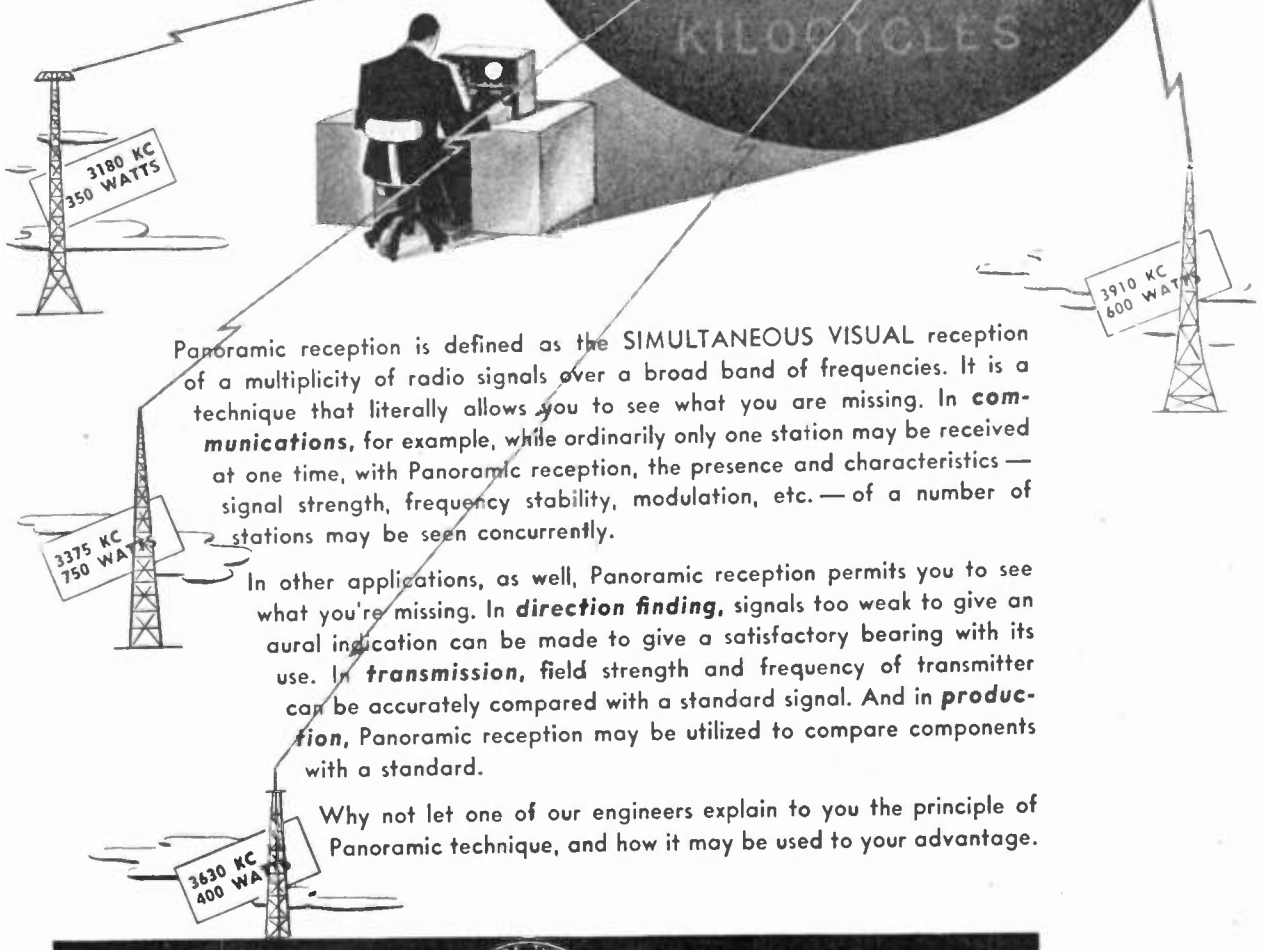
Solar

CAPACITORS & ELIM-O-STATS

PANORAMIC

SHOWS A WIDE BAND OF FREQUENCIES ALL AT ONCE





Panoramic reception is defined as the SIMULTANEOUS VISUAL reception of a multiplicity of radio signals over a broad band of frequencies. It is a technique that literally allows you to see what you are missing. In ***communications,*** for example, while ordinarily only one station may be received at one time, with Panoramic reception, the presence and characteristics — signal strength, frequency stability, modulation, etc. — of a number of stations may be seen concurrently.

In other applications, as well, Panoramic reception permits you to see what you're missing. In ***direction finding,*** signals too weak to give an aural indication can be made to give a satisfactory bearing with its use. In ***transmission,*** field strength and frequency of transmitter can be accurately compared with a standard signal. And in ***production,*** Panoramic reception may be utilized to compare components with a standard.

Why not let one of our engineers explain to you the principle of Panoramic technique, and how it may be used to your advantage.

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

NEW LETTER CONTEST for SERVICEMEN!

ELEVEN 1st PRIZE WINNERS IN 5 MONTHS IN CONTEST No. 1!

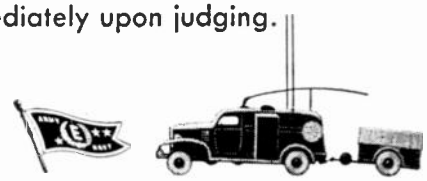
Yes sir, guys, the hundreds of letters received were so swell that *double* first prize winners had to be awarded each of the first four months and there were *triple* first prize winners the fifth and last month . . .

SO—HERE WE GO AGAIN!

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

RULES FOR THE CONTEST

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



BUY A WAR BOND TODAY!

hallicrafters RADIO

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

POSTWAR FUTURE OF EMERGENCY RADIO SERVICES

An Outline of Developments Which Will Require Accommodations in the Radio Spectrum

BY JAMES LAWRENCE FLY*

IT is a commonplace that one of the few good results from war's tragedy and destruction is the tremendous stimulus to technological development. We are bombed out of our old patterns of thinking and forced willy-nilly to explore new ways and new ideas; to leap towards new goals where once we walked.

One of the most striking instances of this war-born impetus is the advance in the art of radio communication, navigation, direction-finding, and remote control of moving objects. Some of these advances are known to even our youngsters who play their war games with "walkie-talkies." Others are merely hinted at by the military authorities or the guardians of laboratory secrets.

Americans have become more radio-minded than ever before. Our men in the services, who have developed or used radio as a weapon of war on land, air, and sea, will be quick to convert it to a tool of peace after the war.

We know that one of the most significant of the wartime advances has been the upward extension of the usable portion of the radio spectrum. Although we do not have full information, enough has been learned to arouse hopes for a greatly-increased supply of frequencies.

To those contemplating the expansion of radio for police work, fire fighting, public utilities, railroads, and aviation, this prospect of new territories in the spectrum has been an exciting incentive to postwar planning.

Before too much of a gold rush fever sets in, a word of caution is advisable — not to dampen anyone's enthusiasm but to set future prospects in proper focus, or as near proper focus as we can foresee at this time.

While it is true that more frequencies will be available, it is also true that the demand will be greater than ever before. How well these elements will balance remains to be seen.

Beside the familiar uses of radio, many new uses are anticipated. Radar will come out of its wartime mystery into peacetime applications.

Many railroads are looking to radio. As an outgrowth of the widespread interest in radio for railroads, the Federal Communications Commission will hold public hearings, beginning September 13, 1944, on the feasibility and necessity of using radio as a safety measure and for other purposes in railroad operations. There is no actual radio system in regular use on any commercial railway in the United States today, but since May 1, 1944, the FCC has received applications for 30 construction permits for radio stations for use at fixed locations and on rolling stock in railroad operations.

In fields where radio is already established, its use will apparently mushroom. It can be taken for granted that this nation will maintain an Army and Navy of considerable size for some time after the war. They will require a generous allotment of frequencies.

C. I. Stanton, administrator of the Civil Aeronautics Administration, has predicted 300,000 civilian airplanes in the United States within three years after the war and 500,000 by 1950. In view of the close relationship between safe flying and the use of radio for communication and navigation, think what a demand for frequencies for both planes and airports such a development will generate!

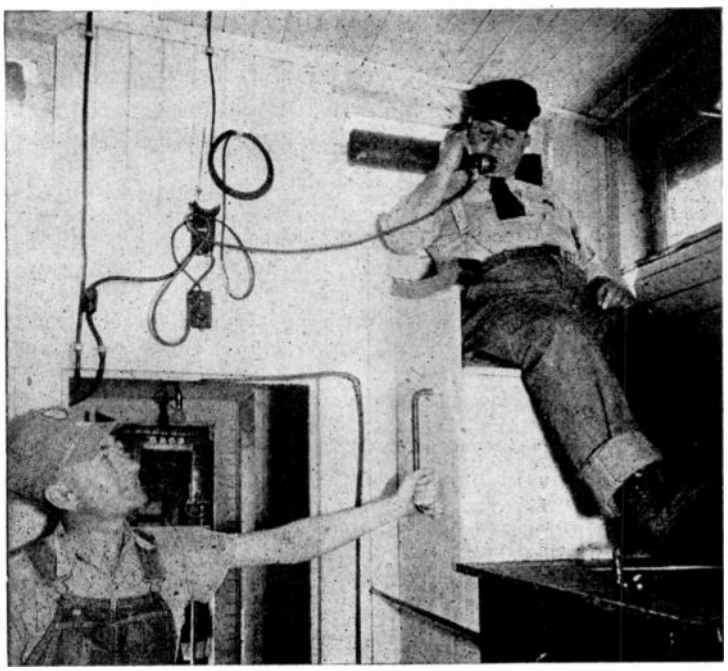
Our huge ocean-going and Great Lakes cargo fleets, the result of one of the greatest miracles of war production, will remain important users of radio communication and navigation facilities. Harbors, yachts, forest services will want radio channels.

Present indications are that FM, television, and facsimile will grow to giants after the war and frequencies for these services will have to be supplied.

In view of all these demands already on the horizon, it is plain that we will still need economical rationing of frequencies after the war and that government and industry must cooperate and plan now to achieve the goal for which we are all striving, namely, sufficient assignments to meet at least the minimum postwar needs of all legitimate radio services.

Satisfactory progress in this planning is now being made. The Federal Communications Commission, which has the responsibility of allocating frequencies for civilian use; the Interdepartment Radio Advisory Committee, which recommends frequency assignments for government departments and agencies to the President in normal times; and the Radio Technical Planning Board, composed of industry representatives, are actively studying these important problems.

As to the relatively high importance of the established emergency services in the radio realm there can be no question. Everyone responsible for planning radio's future realizes the unique and urgent requirements of these services, and will bend every effort to supply enough frequencies that they may attain their maximum effectiveness.



FREIGHT CONDUCTOR M. P. NICHOLSON, OF SEABOARD AIR LINE, TALKS FROM CABOOSE TO LOCOMOTIVE ON BENDIX TEST INSTALLATION

*Chairman, Federal Communications Commission, Washington 25, D.C.

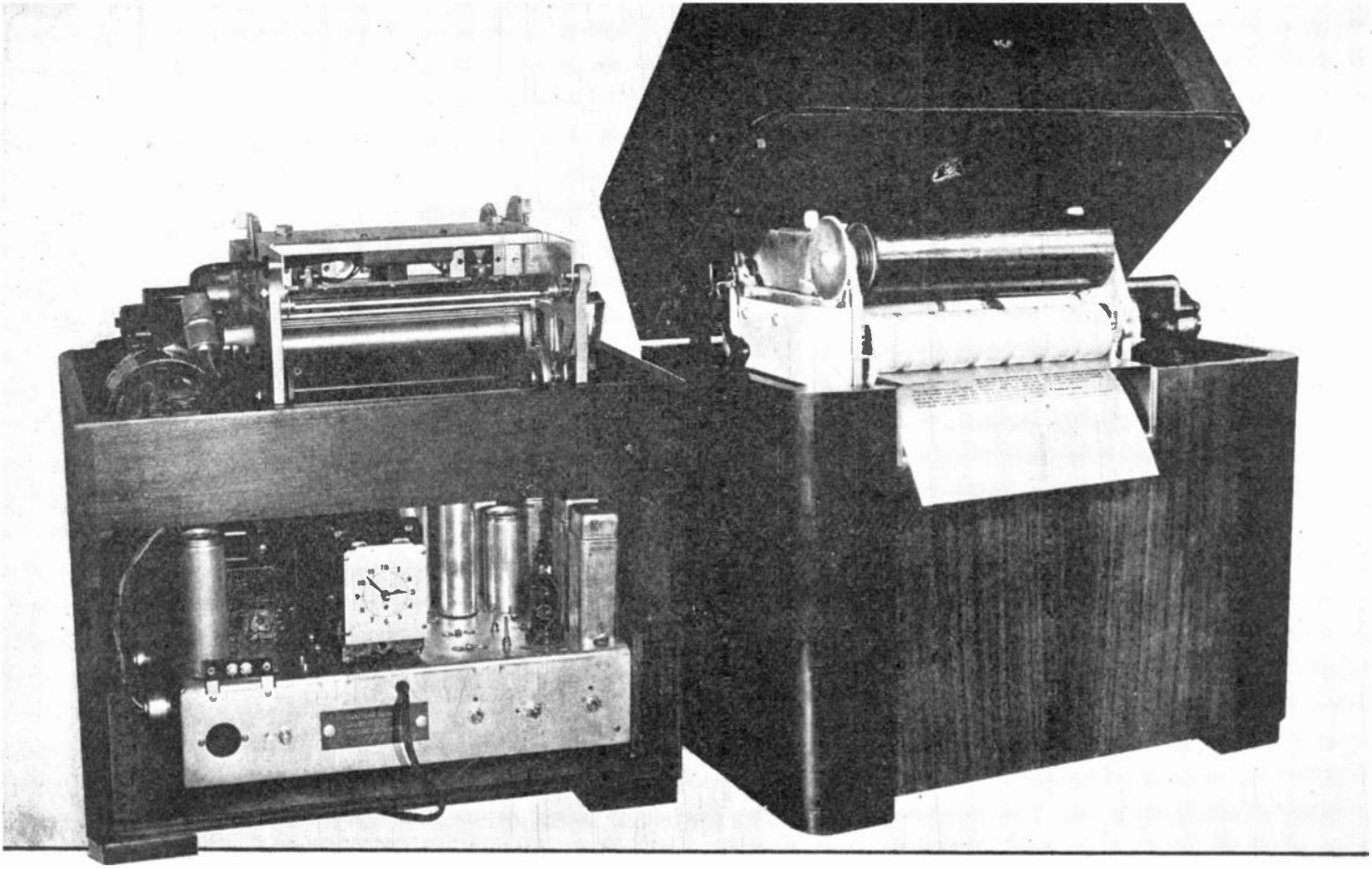


FIG. 1. REAR AND FRONT VIEWS OF THE RCA FACSIMILE RECORDER AND FIXED-TUNED RECEIVER, WITH TIME SWITCH

RCA FACSIMILE EQUIPMENT

Details of the Sub-Carrier Method of Transmission and Reception and 60-Cycle Synchronous Drive

BY F. C. COLLINGS AND C. J. YOUNG*

IN THE RCA organization, direct printing facsimile methods were first developed for broadcast service beginning some 15 years ago. As the work proceeded, other applications were evolved and modified designs were built for map transmission and other forms of communication. Starting even earlier, and continuing during the same period, a parallel development on long distance Radiophoto systems was under way, and the two lines of work benefited each other. One development which soon diverged from the others and became a separate project, was Tape Facsimile, also a direct printing facsimile method operating on the same basic principles as Page Facsimile.

Much thought is being given now to the post-war possibilities of all the radio developments, facsimile among them. It is time to plan ahead, and yet, in a Company devoted to war work, there can be little recent progress to report which does not fall under the restrictions of military secrecy. It is possible, however, to review the accomplishments preceding the war and to indicate therefrom the probable course of growth in the postwar period, and to show some of the likely applications This is the object of this article and, if much of the story reads in the past tense, the reason is that only from the foundation of history can we project ourselves into the future.

The rather extensive development and engineering work done by RCA in the field of broadcast facsimile includes examples of most of the problems encountered in setting up a complete direct-printing page facsimile system. It will provide a good basis for discussion of all parts, from the scanner through the modulators and transmission, to the receiver and finally the recorder. Applications of similar devices to commercial or communication service will be considered later.

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1939 Broadcast Facsimile Equipment ★ The broadcast apparatus manufactured in 1939 by RCA was used for experimental purposes by a number of broadcasting stations, operating both in the standard band and between 25 and 50 mc. A front view of the receiver-recorder, type FAX-2A, is shown in Fig. 1, and a rear view, with all covers removed. The recorder employs the helix and printer-bar principle, with white paper and carbon paper fed from rolls. One loading is sufficient for over 100 hours of recording at a speed of 3 ft. per hour. The chassis, in the base of the cabinet, combines a fixed tuned radio receiver, the printer or recording amplifier, and a clock. The set is tuned at the time of installation by the serviceman, and the clock set to the time chosen for the daily program. Thereafter the user has nothing to do but read the sheet. This emphasizes one point which would seem to be pretty fundamental to facsimile broadcasting: namely, the user should not have to be on hand to receive a news pro-

gram as it comes in and, conversely, that the facsimile receiver should start and run either on a time clock, or under the control of the transmitter.

The studio scanning equipment, type FAX-1A, is shown in Fig. 2. The mechanism itself is of the familiar cylinder type and requires no detailed description. The amplifier circuits are rather special in that means are provided to compensate the amplitude characteristic in such a way as to give faithful half-tone reproduction at the recorder. The output is a 3,000-cycle tone modulated by the picture signals, and can be adjusted to the desired level to feed a wire line. The required frequency band, extending with the modulation frequencies from 2,000 to 4,000 cycles, is easily handled over the usual broadcast circuits and, in at least one case, was sent over more than 100 miles of wire before being put on the air.

In this project, synchronization was handled in the simplest and most reliable way. The scanner and all recorders were driven by synchronous 60-cycle motors connected to a common power line. This is a satisfactory method in many broadcast areas. In places like the New York City area, however, there are two or three unconnected power systems. Therefore service had to be limited to locations on a single system at a time. When necessary, the program was repeated later for receivers on the second power system with the scanner switched over to it. The second part of the synchronising problem is handled in this equipment by an automatic phasing relay in the recorder which jogs the motor out of synchronism until the recording is centered on the sheet.

The chief characteristics of the 1939 broadcast facsimile system are summarized in the first column of Table I.

The performance of this equipment in the hands of the broadcasters was satisfactory as far as technical factors were concerned. The receivers required relatively little service and gave good reproduction of pictures and of print down to 8-point [1] size.

[1] The text type on this page is 9-point size.

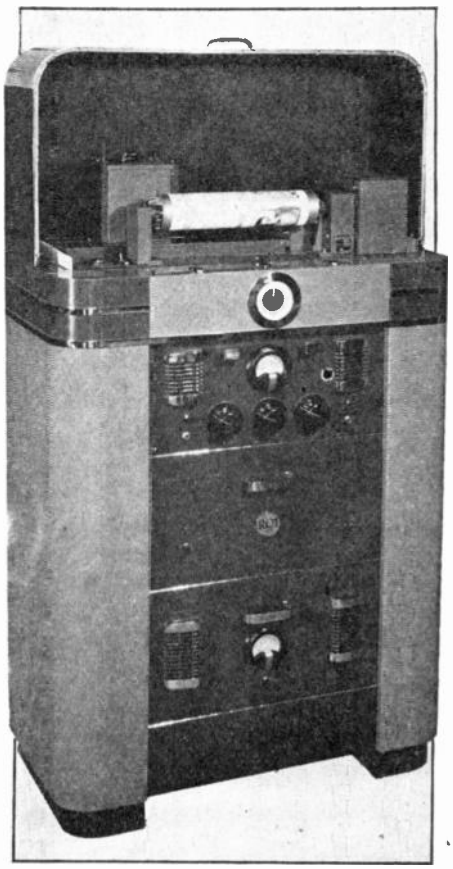


FIG. 2. TRANSMITTING SCANNER AND AMPLIFIER FOR STUDIO OPERATION

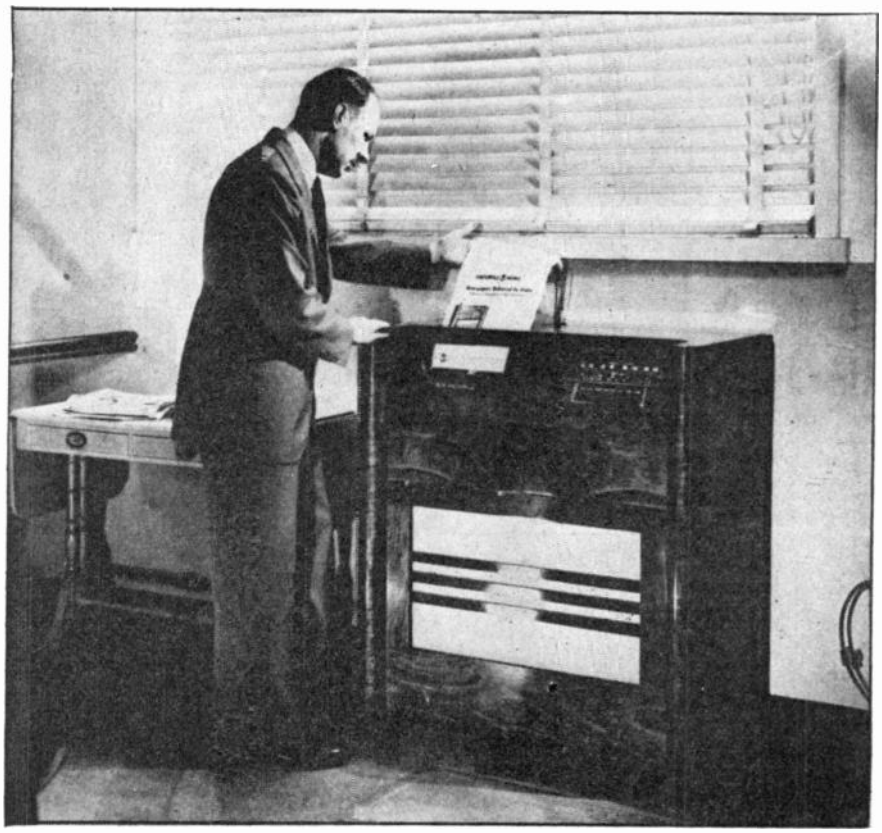


FIG. 3. A SPECIAL RCA MODEL HOME RADIO RECEIVER AND FACSIMILE RECORDER

One station transmitted standard newsprint with good success and found that the speed of transmission was over 100 words per minute. Another has run over 2,500 schedules and states that the recorders require no more service than an ordinary radio receiver.

From the commercial point of view, however, the consensus of opinion was:

a) that the speed was too slow to give enough recorded area for pictures and advertisements,
b) that the units should be self-synchronized so as to work on any power source, and
c) that the receivers should be turned on and off by the transmitter.

Combined Sound and Facsimile Receiver ★ To meet these requirements, RCA built some new models, combining a sound and facsimile receiver, and exhibited them at the New York World's Fair in 1940. One of these is shown in Fig. 3. Many technical improvements were included.

The cabinet housed a good quality sound receiver for standard and short wave bands, and the facsimile recorder and amplifiers. The main selector switch on the panel had three positions: SOUND, FACSIMILE, and OFF. In the Facsimile position, the RF portion of the receiver and a special relay circuit were left on. This circuit was not affected by sound modulation, but would start the facsimile recorder whenever facsimile signals were received providing, of course, the tuning dial had been left set on the facsimile station's frequency. There was no provision in this receiver for duplexing; reception was either facsimile or sound.

The printing mechanism was improved and the speed of recording doubled, becoming 6 instead of 3 ft. per hour. Inasmuch as daytime operation on short waves was then proposed, the arrangement of parts in the recorder was revised to make the copy visible thru a window immediately after printing, after which the strip fed out of the top of the cabinet and to the rear.

The most important improvement incorporated in this design was the change-over of the modulation system from amplitude to SCFM, or sub-carrier frequency modulation. The pioneer work on this method of handling facsimile signals for radio transmission had been done by the RCA group who were concerned with the trans-Atlantic Radiophoto service from New York City. The results which they obtained were outstanding. The speed of handling pictures was increased threefold, and the degradations resulting from noise and multipath effects were greatly reduced. Most radio pictures systems have now adopted this method. Fig. 4 gives a comparison of facsimile modulation by the old amplitude method and the new SCFM method. The application of the new method to the broadcast problem was recommended after a long series of field experiments during which numerous modifications were compared. Only the final choice of signal type need be described here.

The scanner was arranged with a variable frequency oscillator so that the output picture signal was of constant amplitude, but was:

4,000 cycles on black
3,500 " " middle grey
3,000 " " white
2,000 " " on the phasing dash.

There was then superimposed on this wave amplitude modulation at 480 cycles, 4 cycles on and 4 cycles off, thus providing a 60-cycle reference synchronous with the power driving the scanner motor. The complete envelope then contained frequencies extending from 400 to about 4,700 cycles, and was used to amplitude-modulate the radio carrier.

At the receiver, this envelope reappeared at the second detector. The synchronizing reference was taken off by an amplitude detector and used to control the recorder motor. The signal was then passed through a limiter, an audio discriminator, and a rectifier, thus obtaining DC facsimile impulses to operate the printer. At each phase dash, an extra strong pulse was obtained from rectification of the 2,000 cycles, and was separated by a threshold circuit from the printer amplifier, thus providing a reference for the automatic phasing device. The characteristic of the filters and discriminator circuit is shown in Fig. 5, and the over-all characteristics are tabulated in Column 2 of Table I.

The benefits of SCFM were fully realized for the broadcast type of service, in that the effects of fading and noise were much reduced. In addition, the fact that level changes no longer affected the picture was an enormous convenience to operation at studio, transmitter, and receivers. The superimposed synchronizing signal held the recorders in step under poor signal-to-noise conditions down to the point where even the print itself became unreadable. Transmission tests were made over wire lines, and on radio channels from standard broadcast to 70 mc., with both AM and FM modulation of the radio carrier wave.

Sound-Facsimile Duplex on FM ★ The Federal Communications Commission proposed duplex facsimile and aural transmission on FM broadcasting stations by Rule S3.228 which, in brief, specified that the facsimile should be incidental to the sound, that the sound deviation should not be reduced from 75 kc. each side of center, and that no transmission should occur

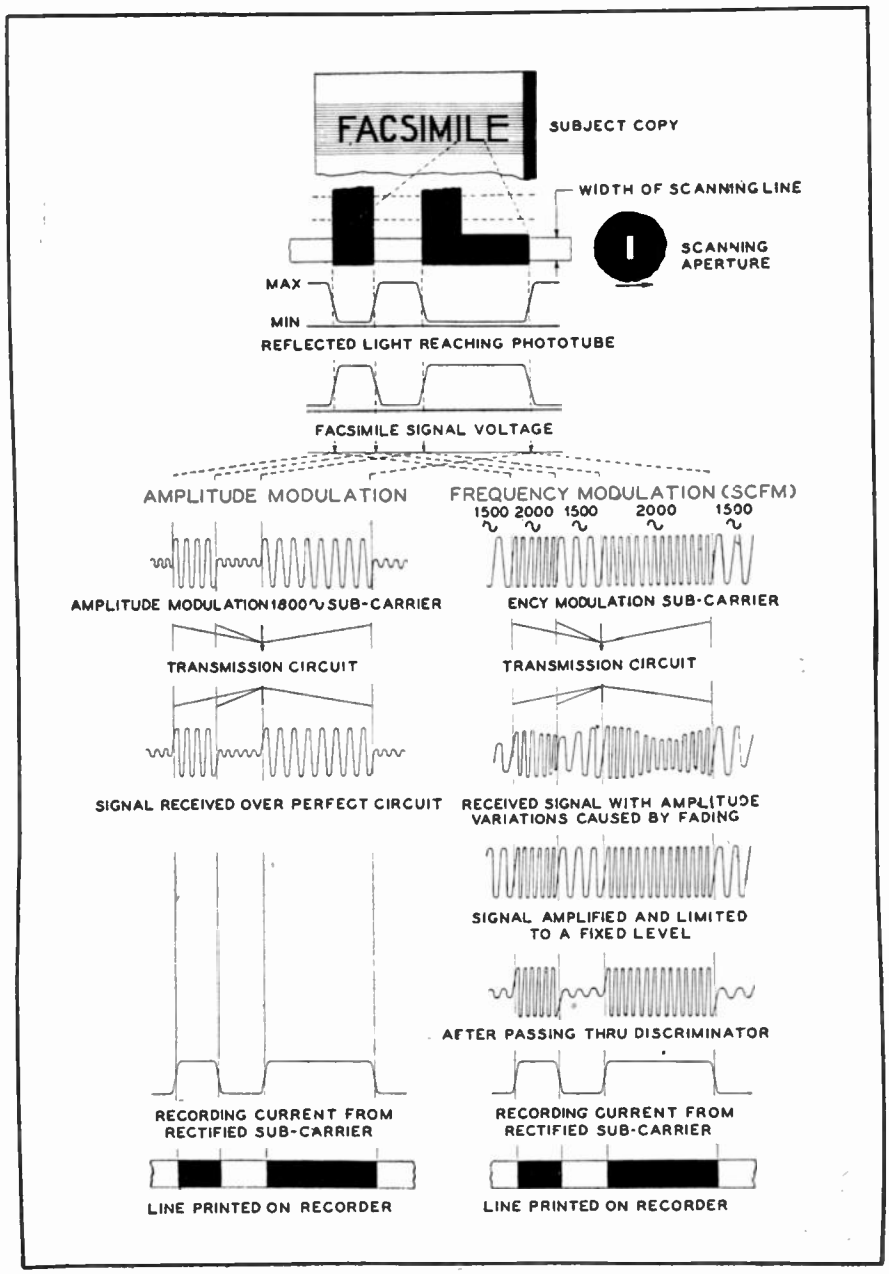


FIG. 4. COMPARISON OF AM AND SUB-CARRIER FM FACSIMILE TRANSMISSION

TABLE I

	1939 Broadcast Equipment	Revised Broadcast Equipment
Drum Speed (lines per minute)	75	150
Length of scanning line, ins.	8.75	9.125
Lines per inch	125	125
Linear paper speed, ins. per minute	0.6	1.2
Width of paper, ins.	8.5	9
Reproduction speed, sq. ins. per minute	4½	9.9
Synchronizing reference	Power Frequency	480–60 Cycles
Type of modulation	AM	SCFM
White frequency, cycles	3,000	3,000
Black frequency, cycles	3,000	4,000
Phase frequency, cycles	3,000	2,000
Lower limit of band, cycles	2,000	400
Upper limit of band, cycles	4,000	4,700

outside the authorized band of 200 kc.

A considerable amount of work was done by RCA, both in the laboratory and on the air, to investigate the possibilities of this type of operation, and a demonstration was made for members of the FCC in January 1941. During this demonstration, the duplex sound and facsimile signals were broadcast from an FM transmitter located on the Empire State Building and operated by the National Broadcasting Company. The facsimile receiver was the combined unit described above, having a speed of approximately 10 square ins. per minute at a drum speed of 150 RPM. However, a separate radio receiver was constructed for this test. It used an intermediate frequency of 8.25 mc., and the IF amplifier was made somewhat wider than normal: 14 db down at 100 kc. each side of center. Special pains were taken to make the detector characteristic linear over a wide range. It deviated only slightly from a straight line for 100 kc. each side of center. An excellent audio amplifier and loudspeaker gave assurance of high fidelity sound reproduction. Fig. 6 gives a block diagram of the complete receiving equipment.

The scanner was modified to produce an SCFM signal as follows:

18	kilocycles	phasing signal
20	"	on white
22	"	middle grey
24	"	on black

In addition, the complete SCFM envelope was amplitude-modulated 30% with 60 cycles to provide a synchronizing reference for the recorder. This superaudible band of signals, extending from about 18 to 25 kc., was then mixed with the sound modulation, and both fed to the reactance tube of the FM transmitter. The levels, during the test, were adjusted so that the aural signals produced a deviation of 60 kc. and the facsimile signals a deviation of 15 kc. Earlier work in the laboratory had shown that it was impossible to have a sound deviation of 75 kc. and a facsimile deviation in addition without exceeding the authorized 200-kc. transmission band.

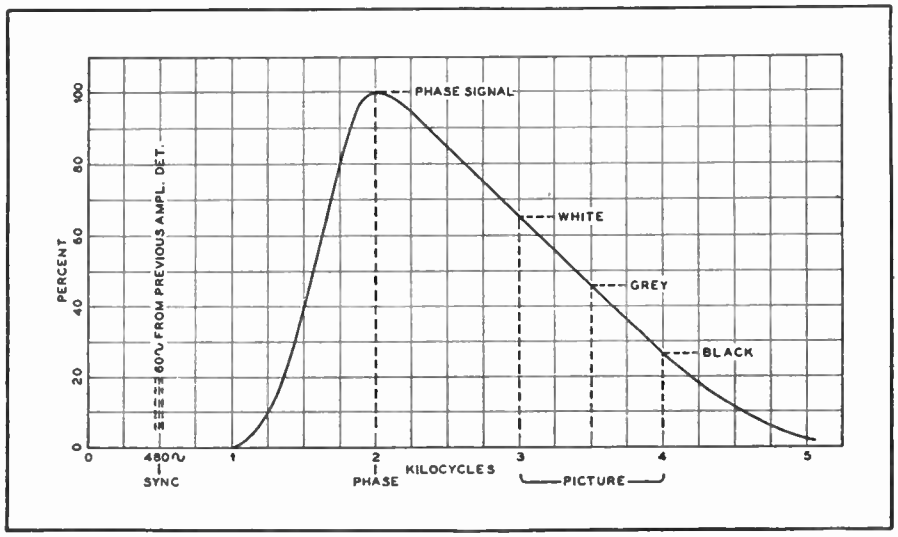


FIG. 5. CHARACTERISTICS OF FILTERS AND DISCRIMINATOR CIRCUITS FOR SCFM

Under these conditions, and with precise tuning of the receiver, there was little interference between the two services. It was observed, however, that a sound program with prominent sibilants produced a short skip or white space in the facsimile copy for each "s" sound, and also that during pauses in the sound program the facsimile signal could be heard in the background. Slight mis-tuning of the receiver made the facsimile signals very evident in the loudspeaker.

Although the demonstration was reasonably satisfactory, the engineers who carried out the work were convinced that this method of duplex operation was not desirable for general use. Their experience showed that with the demonstration equipment great care had to be taken in building the circuits to avoid any intermodulation between the two signals in the receiver. The high-pass and low-pass filters in the receiver can only separate the signals if they have not been previously intermodulated. For this to be true, it is necessary that the entire envelope of FM modulation frequencies up to 100 kc. each side of the carrier be passed through the intermediate amplifier without selective attenuation, and also fall wholly on the straight portion of the discriminator. It would be very difficult to build a practical receiver which would meet this requirement and would also have adequate adjacent channel selectivity. Furthermore, the receiver would need an extremely stable oscillator because the cross-talk increases rapidly as the tuning drifts. It is even questionable that the ordinary user would tune the station with sufficient accuracy.

Recently, further study has been given to this problem with the hope that some other kind of duplexing might be found which would make the combined service practical. Suppose for example, an FM broadcaster considered the facsimile service very important at certain times a day and was willing to sacrifice FM sound quality for the sake of the facsimile, during a news report for example. He might reduce the aural deviation to 20 kc., and use 15 kc. facsimile deviation. Under these conditions it is found that there is still facsimile interference in the sound channel amounting to 1.2 per cent at 1,000 cycles and 8.3 per cent at 9,000

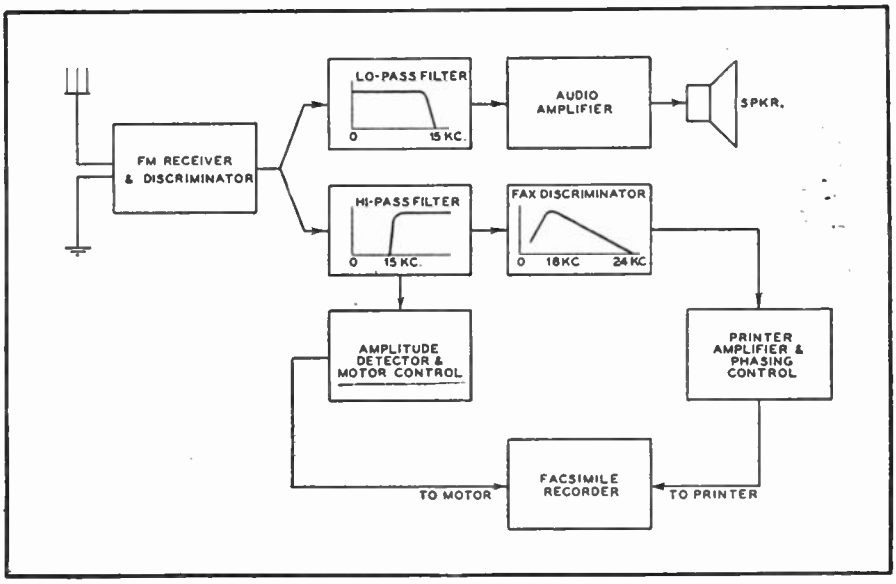


FIG. 6. BLOCK DIAGRAM FOR RCA MULTIPLIED FACSIMILE AND SOUND RECEPTION

cycles. It is unlikely that this degradation of the sound quality would be tolerated. It seems probable that, under practical operating conditions, and with FM receivers at reasonable costs, there will always be some cross-talk.

Finally it must be realized that the stringent requirements on receiver design which were noted above would have to be met by all FM sound receivers, whether they were using the facsimile service or not. It seems entirely unreasonable that all FM receivers should be made more complicated and more costly in order that a relatively small number of the people served might enjoy facsimile reception. Other and separate frequencies assignments are needed for broadcast facsimile.

Broadcast Facsimile Postwar ★ By summarizing the experience which has been accumulated, we can set down the factors which indicate the possibilities for the future of broadcast facsimile. First from the technical side:

1. A recorder has been demonstrated which will print good facsimile copy on paper 8½ ins. wide at a speed of 6 ft. per hour. In terms of text, this speed is well over 150 words per minute.
2. The mechanism is relatively simple and has proven sufficiently reliable in field tests for use by the general public. Loading paper is like loading film in a camera.
3. Synchronization by connection to a common 60-cycle power network is simplest, but where this is impracticable, the recorders can be controlled from a reference frequency transmitted as a part of the signal. Automatic phasing would, of course, be provided.
4. Means are available for starting and stopping all the recorders from the transmitter.
5. The SCFM type of signal has proven to have great advantages both in reducing distortions from the radio transmission, and in simplifying adjustments and operation at transmitter and receiver.
6. The bandwidth required to transmit this signal is no greater than is now used for sound broadcasting. Therefore it can be networked over existing wire lines.
7. It is technically possible to duplex sound and facsimile signals on present FM broadcast systems. However, all FM receivers, whether used for sound or facsimile, would surely be more complicated. Plans should be laid for separate channels for the facsimile service.
8. A combination sound and facsimile receiver can be built, but it is quite probable that a separate facsimile unit, complete with its own radio receiver, would be a better solution, even if it were mounted in the same cabinet with a broadcast sound receiver. The power consumption of the standby circuits could be reduced to a minimum and the automatic starting simplified. Furthermore, the user could count on regular reception of facsimile however the sound set was tuned.

FIG. 8. SCANNER, LEFT, AND RECEIVER FOR INDUSTRIAL FACSIMILE SERVICE

From the commercial point of view, there remain many problems in the exploitation of a broadcast service. The operating speeds mentioned above are more than ample for all the text or news one could wish to have, but they do not afford enough area to handle a large number of pictures or extensive advertising copy. On the other hand, very much higher speeds will feed more paper out of the recorder than one would want in the living room. Also the cost of paper per day might become unreasonably high. It seems unlikely the actual cost per 8½-by 12-in. page will go much below one-half cent.

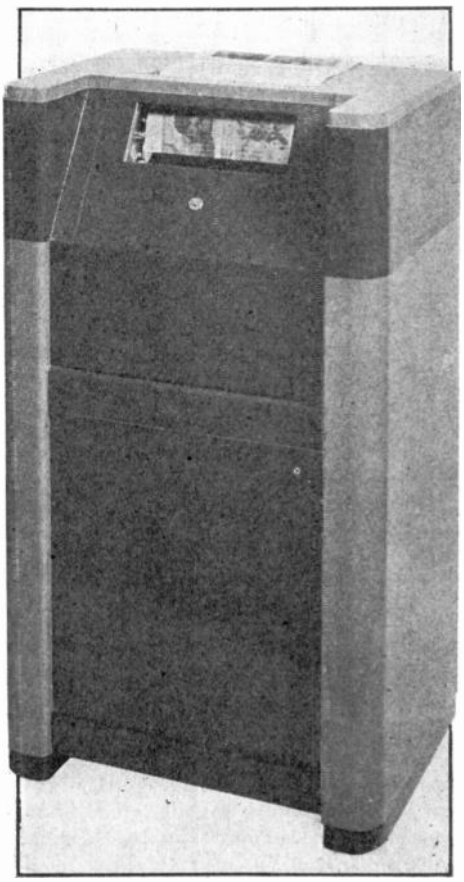


FIG. 7. RECORDER USED FOR THE RECEPTION OF WEATHER MAPS

In spite of the problems involved in its exploitation, many are confident that broadcast facsimile will come to render a real service to the public. It remains for some one with vision to bring together the advertising, news, and broadcasting possibilities, and to set up a system on a sound financial basis.

Applications to Communication Service ★ In communication service there are a number of fields in which page facsimile has unique advantages over other types of apparatus. One of the outstanding ones is in the transmission of weather maps. The nature of these maps is such that other methods of sending them, as for example by coding the data, have not been very successful.

(CONCLUDED ON PAGE 75)

CHEHAW MOUNTAIN STATION IS REMOTELY CONTROLLED FROM ANNISTON, 22 MILES AWAY

HOW ALABAMA USES 2-WAY FM COMMUNICATIONS

A Complete Analysis of the State-Wide System Operated by the Department of Public Safety

BY MILTON B. SLEEPER

WE HAVE had many articles giving technical data on police radio equipment, but none has presented a complete account of operation of a radio system, and the use of the equipment. City officials and state legislators require such information when they are called upon to appropriate funds for radio installations, for the service to citizens must justify the expense. On the other hand, radio engineers, called upon to develop and further improve equipment for police use need a definite idea of the service requirements.

Accordingly, it was a pleasure and a privilege to accept the invitation of Chief Van B. Gilbert, Director of Alabama's Department of Public Safety, to learn at first hand how his state-wide radio system is set up, and how it is operated to increase the effectiveness of his Department.

Alabama is a State of 51,609 square miles and a population of 2,832,000. This area is slightly larger than New York State, and nearly as great as that of all the six New England States. Montgomery, the capital, has a population of 78,000, while the industrial cities of Birmingham and Mobile have 267,000 and 79,000 respectively, according to the 1940 census. However, war industries have brought more than 61,000 workers to this state, and military camps have added an even larger number of soldiers.

Thus wartime conditions put a heavy load of new responsibility on the Department of Public Safety, and at the same time the total personnel was reduced because it was not possible to replace all the men drawn into the Armed Forces.

TABLE I — FIXED TRANSMITTERS

Location	Watts Output	Talk-Back Range, Miles	Talk-Out Range, Miles	Remote, Miles	Antenna Height, Ft.	Altitude at Base, Ft.	Total Height, Ft.
Anniston	250	100	250	22	75	2,405	2,480
Birmingham	250	75	120	13	115	1,085	1,200
Decatur	50	50	50	..	80	350	430
Demopolis	50	50	75	1	195	160	355
Dotham	250	75	120	4	195	345	540
Evergreen	250	75	120	1	94	410	504
Gadsden	50	50	50	..	80	400	480
Huntsville	250	75	120	8	195	1,650	1,845
Mobile	250	75	120	12	195	150	345
Montgomery	250*	75	120	15	380	290	670
Opelika	50	60	100	1¼	195	825	1,020
Selma	50	50	50	1/10	80	120	200
Tuscaloosa	250	75	120	2	195	395	590

*Output is to be increased with a 3-kw. amplifier.

That was the situation facing the Department when, last October, its $100,000 state-wide 2-way FM radio system was put in operation.

Using Motorola FM equipment throughout, this system has 7 fixed stations of 250 watts, 6 auxiliary 50-watt fixed stations located in congested areas, and 90 radio equipped patrol cars. Two frequencies, 37.5 and 37.38 mc., are used, one for the fixed stations, and the other for the car transmitters. In addition, the car transmitters are so designed that they can change to the fixed-station frequency, making it possible for cars to talk directly to each other, or for any car, in case of emergency, to serve as a fixed station.

9 Months' Experience ★ Arriving at Montgomery, the capital city and headquarters of the Department of Public Safety, my first call was on Chief Gilbert. I asked him only one question: "Has your radio system proved successful?" After that, he did the talking. In reply to my question, he said: "This radio system is the stuff. And you can quote me on that!" That was his way of expressing unqualified approval. Then he proceeded with the details.

"Just to give you an idea of the way radio has enabled our men to work more effectively by working faster, here is a list of miscellaneous items recovered by our patrolmen during the month of May." Here is the list:

61 tires, assorted sizes and makes	$ 750
1 table model radio	15
1 set of silverware	50
1 automobile radio	60
1 outboard motor	50
1 electric saw and drill	100
1 set of tools	20
5 fishing rods and reels	60
14 Buick automobile wheels	90
35 Chevrolet automobile wheels	245
1 suit of clothes	65
3 boxes of fishing tackle	50
5 pairs of shoes	40
1 gas mask	40
40 tire tubes	120
	$1655

"But that is just a by-product of our work. Here are some really startling figures. Last year, before our radio system went into operation, the Highway Patrol recovered stolen motor vehicles of an estimated value of $72,000. From October 1st, 1943 to April 30th, 1944, we recovered stolen motor vehicles totalling an estimated value of $118,000. And that's not all. In the month of May, 1944, of 65 cars reported stolen, we recovered 45, valued at $49,855, and made 28 arrests. In other words, the cars recovered in one month for residents of this State amounted to practically one-half the cost of installing the entire radio system.

"And remember, our force has been cut down from 165 men to 108, because we haven't been able to replace all those who have gone into the Service. In spite of that, we have been able to increase our efficiency with our radio system, and we can work single men in some of our cars, where before two men were required in every car.

"Another reason is that we can always reach our men, and we know that we reach them because they can talk back to us. We used to have some 1-way equipment, but then we could only call the cars, repeat the messages several times, and hope they were received. But we never knew for sure. Now I can check any car in the State myself.

"Our 2-way radio has had another result. It has kept the men more active. I can see this for myself because the monthly mileage reports from the cars is away up."

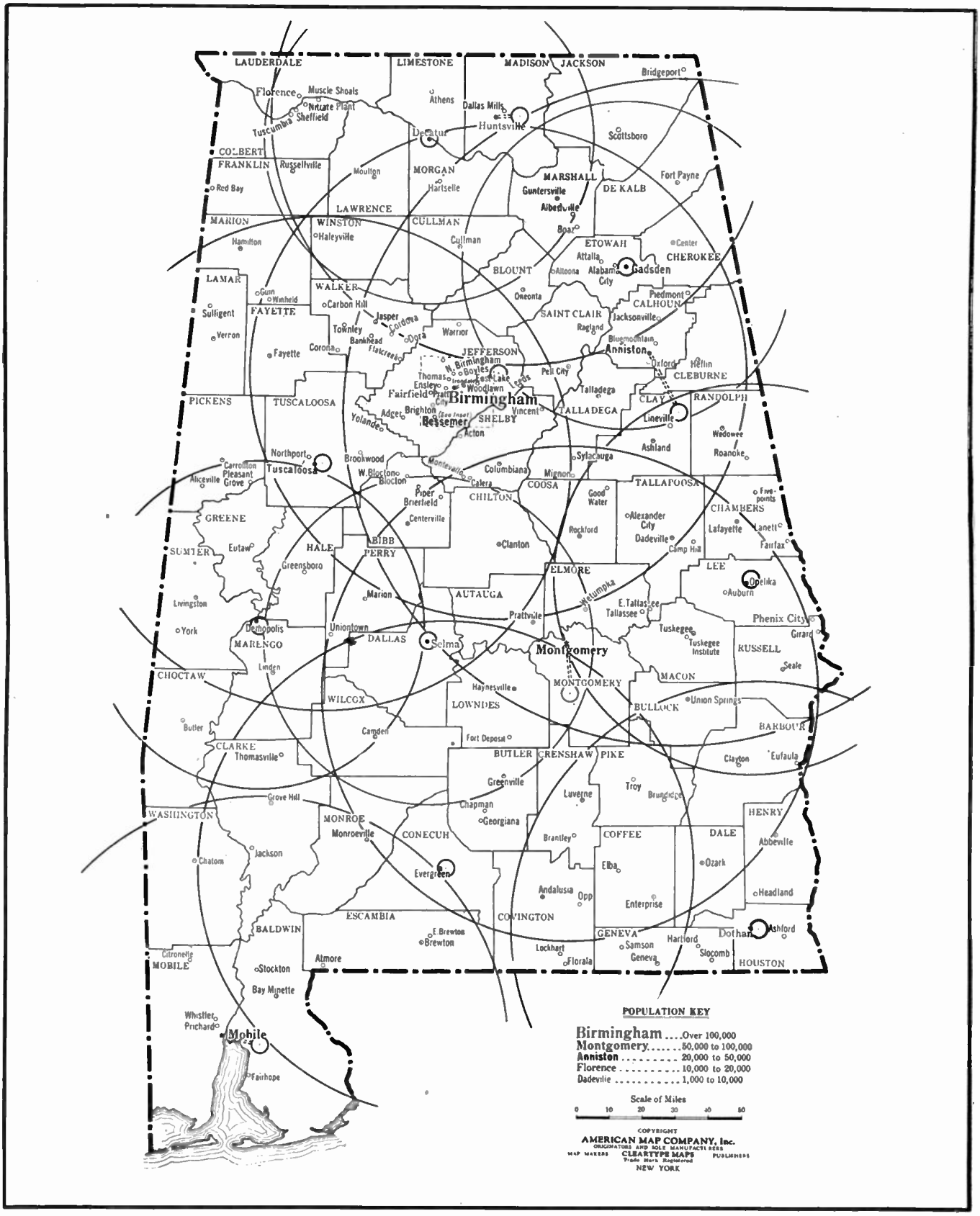
I interrupted Chief Gilbert to ask: "Are the people conscious yet that the efficiency of the Highway Patrol has been increased?"

"Indeed they are," he said. "The convicts at the State prisons have found out. We know that because breaks from the prisons and road camps have dropped to less than one-third the number we used to have. People whose stolen property has been recovered know it, and those who have had accidents on the highways. Why, just the other day, we had a case of labor trouble. Within 5 minutes after the report came in, I had 30 patrolmen on their way to the scene.

"Besides that, we are able to perform all kinds of special services that were impossible before we had 2-way radio. Just to give you one example: A woman in Virginia called the Birmingham station and asked us to stop a Virginia car, heavily laden, with a small flag on the rear. That was about all the description she could give us. The driver's father had died, and she wanted to reach him before he got out of our State. In exactly 44 minutes, the driver had her on the phone.

"Yes, sir, our radio is the stuff! But don't take my word for it alone. Talk to our chief radio engineer and some of the other officials, and get out in the cars, if you like, so you can see the system in operation."

Radio Serves I. & I. Division ★ That's just what I did, and everywhere I went, Chief Gilbert's opinion was reaffirmed. I had met Lawrence J. Smyth, chief engineer of the Radio Division, but before going into the technical details, I wanted to hear more about the operation of the system. Cecil T. Donaldson, chief of the Division of Investigation and Identification, was as enthusiastic about the FM installation as Chief Gilbert. He told me: "Remember this — the purpose of our radio system is not primarily to make the work of the Department easier. It is to make it more effective. That is accomplished by radio



LOCATIONS OF HIGHWAY PATROL STATIONS, WITH CIRCLES TO INDICATE THE DEPENDABLE RANGE OF 2-WAY COMMUNICATION

in many ways, and the most important is by enabling us to work faster."

Two kinds of records are kept by the Division of Investigation and Identification. One has to do with people, and the other with automobiles and other stolen property. Most information on automobiles can be obtained from the dispatcher's office of the Montgomery headquarters

RIGHT, DISPATCHER'S POSITION AT THE MONTGOMERY HEADQUARTERS OF THE HIGHWAY PATROL. WOMEN DISPATCHERS HAVE BEEN TRAINED TO RELIEVE PATROLMEN AT SOME POINTS

LEFT, CHIEF VAN B. GILBERT, DIRECTOR OF PUBLIC SAFETY, AT HIS DESK ADJACENT TO THE CONTROL ROOM SHOWN ABOVE. WHENEVER NECESSARY, CHIEF GILBERT CAN REACH PATROL CARS IN ANY PART OF THE STATE BY MEANS OF THE 2-WAY RADIO

station, where registrations are on file by counties. That is because Alabama plates carry numbers to show from what county each plate was issued.

Accordingly, any car can call Montgomery from any part of the state, either directly or through another station, and get the details of ownership on any Alabama plate within two or three minutes. New numbers, changes of ownership, and similar information are supplied daily by the Drivers' License Division. Thus a car stopped on suspicion can be checked immediately, without being held for investigation. This has proved to be a highly valuable feature of instantaneous two-way communication, since so much of the work of the Highway Patrol has to do with stolen cars and illegal operation.

The second set of records is a cross-indexed file of fingerprints, aliases, and criminal records. These are coördinated from day to day. The record of names and aliases now totals over 135,000 and the daily additions average 350.

Mr. Donaldson told me one thing about the use of radio for obtaining tentative identification by radio that surprised me. If a fingerprint is obtained at the scene of a crime, and the identity of the print is thought to be known, an officer will give the name and the approximate code of the fingerprint by radio. One of the experts at the Investigation and Identification office can check the file and establish a tentative identification at once. He can also furnish any aliases used by that person, or determine the true name of the person if only an alias is known, or has been given. A similar course is frequently followed when a person is held on suspicion. His fingerprints are taken, and the code numbers are reported to headquarters. If they are entirely dissimiliar to the record, the suspect is usually released. Here, again, the file of aliases plays an important role. Sometimes these run to fifteen or twenty names for the same person.

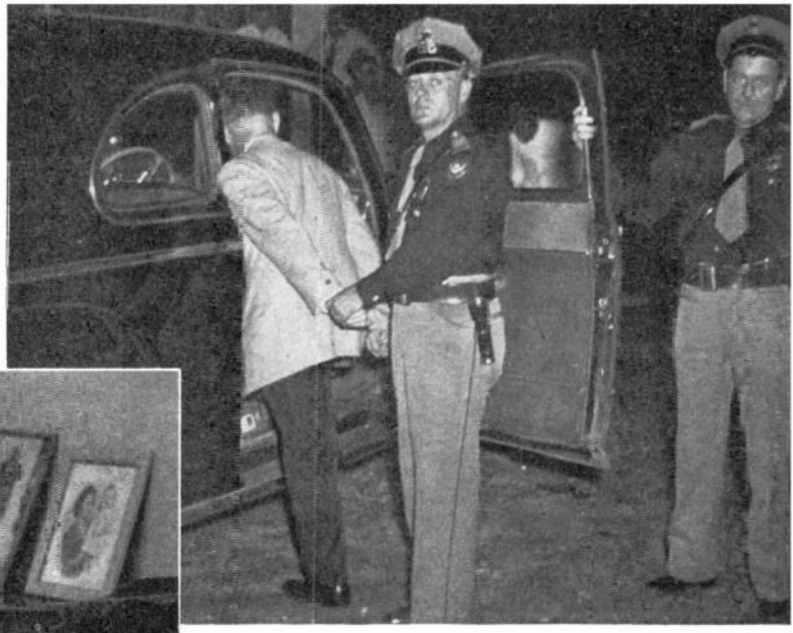
I asked Mr. Donaldson if he made much use of the radio in his own activities. "I certainly do," he said. "I even have a special installation on my car so that no one would know there's a two-way radio in it." But he declined to give me any details for publication. Later, out on the street, I am sure I picked out his car among a number parked in front of the building. It had an antenna similar in appearance to those used by thousands of private cars, but I identified his car by one little detail that I never would have noticed if I hadn't been on guard. I won't go into any further details, because the important thing about its undistinguished appearance is that it can be used to follow criminal suspects, and information can be requested and obtained by radio without attracting the attention of occupants in the car ahead.

FM Performance ★ Next, I went to the Radio Division, to see one of the busiest engineers I have ever met, and yet so generous and coöperative that he spent the better part of three days to help me get a complete picture of the radio system and its operation. That was chief radio engineer Larry Smyth who, with one assistant about to be called into the Army, supervises the state-wide system and maintains the 13 fixed stations and 90 car installations.

He gave me the data for the accompanying coverage map and the information presented in Table I. The number and locations of the fixed stations were planned entirely from a topographical map, and the experience of Motorola representative Lowell White was substituted for an actual coverage survey. Yet so accurately was the performance predetermined that only one change was made from the original plan.

The map and Table I really tell the story of performance. The circles on the

BELOW, CHIEF INSPECTOR C. T. DONALDSON, WHO IS IN CHARGE OF THE DIVISION OF IDENTIFICATION AND INVESTIGATION, CAN BE REACHED AT ALL TIMES THROUGH HIS SPECIAL CAR INSTALLATION



ABOVE, PATROLMEN OTTO (DUCK) DEES, LEFT, AND W. S. (PETE) KENNEDY, KEEP ORDER ON THE HIGHWAYS AND AT THE NIGHT SPOTS OUTSIDE MONTGOMERY. SATURDAY NIGHT WAS TOO MUCH FOR THIS MAN. HE IS EN ROUTE TO COUNTY JAIL

map show the regular 2-way coverage areas. Station-to-car distances are, of course, substantially greater. It should be explained, however, that at the outer limits, there may be spots where a car cannot reach a particular station. On the other hand, there are spots far beyond the distances shown on the map where 2-way communication is still dependable.

Some of these distances I was able to check myself during a 400-mile trip I made with Larry Smyth from Montgomery to Anniston, Birmingham, Tuscaloosa, and back to Montgomery. Recalling the reluctance of many engineers to believe that FM mobile units could cover as much as 25 miles dependably, it was quite a thrill when, as we started out from Montgomery, Larry Smyth called Anniston, nearly 100 miles away, received an immediate acknowledgment, and then said, "We'll be at the transmitter in about two and one-half hours." And this was done with a 50-watt car transmitter and a roof-top antenna.

One of the accompanying illustrations shows the Anniston installation on Chehaw Mountain at 2,480 ft. above sea level. This is remote-controlled from the Anniston Barracks, 22 miles away. Access to the transmitter is over a dirt road through the State Forest. It was an adventure to me to drive it in good weather, but those who know the road make it in the winter and seem to think very little of it.

Current at this station, and at others similarly located on high ground, is brought up from near-by power lines. Although this has proved adequate and dependable, plans have been made to install automatic generating plants driven by gasoline engines, when they are available. A more serious problem has been the maintenance of telephone lines. At first, the wires were strung below those used for the foresters' telephone system. That was all right until an ice storm loaded those lines until they sagged and broke down on the wires running to the radio transmitter. Then the latter were strung on crossarms, to prevent a recurrence of that trouble.

One of these days the wires will probably be eliminated entirely by the use of radio links at those locations which operate over considerable distances. The use of wire lines, however, involves no hazards other than those to which ordinary power and phone services are subjected, namely, storms and ice, and the only breakdown last winter was due to ice on the Anniston-Chehaw Mountain circuit.

Nearly all the Alabama transmitters are remote controlled. The longer distances are: Montgomery 15 miles, Birmingham 13 miles, Mobile 12 miles, Huntsville 8 miles, and Anniston 22 miles. The connections are indicated on the map by dotted lines connecting the cities with the small circles around the transmitter sites.

The problems of servicing the main stations and car installations in a statewide system are of particular interest, and doubly so in this case where maintaining equipment spread over such a large area is practically a one-man job. Moreover, not one man in the highway patrol had any radio experience before the system was installed. The controlling factor in the success of this installation, therefore, was the attitude of the men toward the use of radio. If they had been against it, radio would have been a failure before the first unit was put into operation.

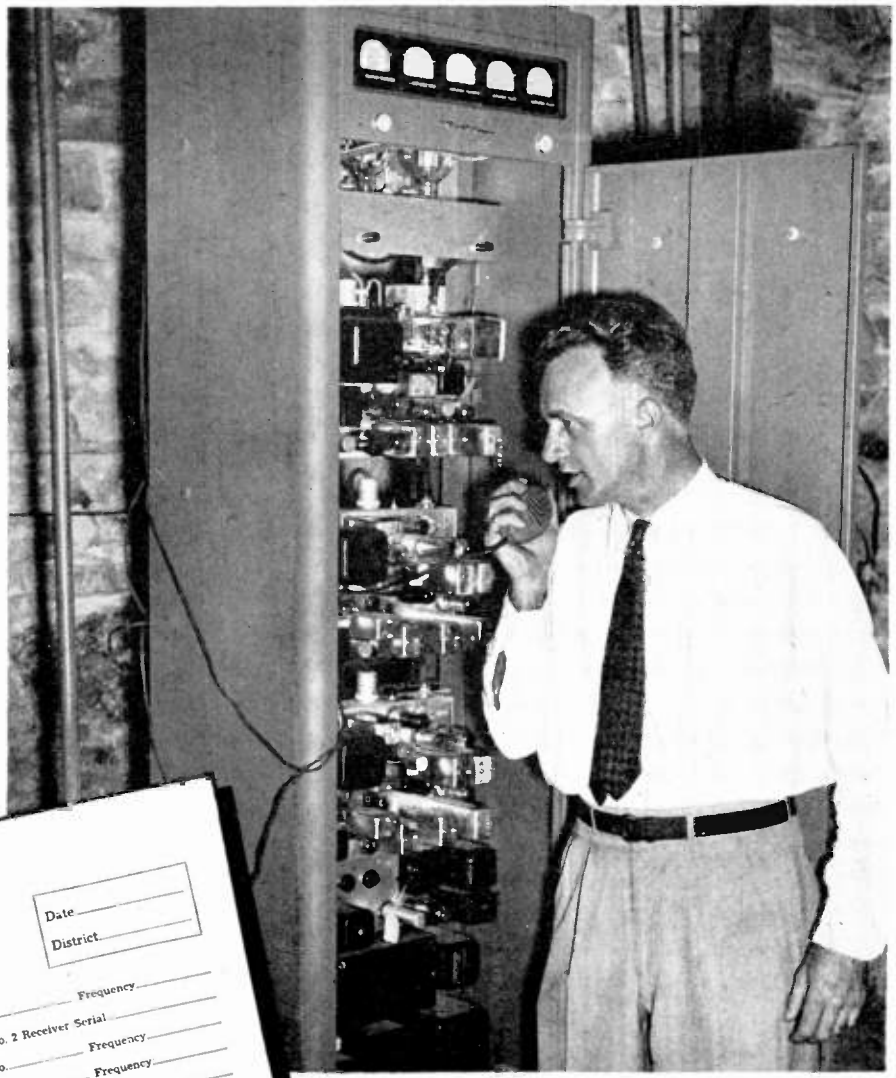
Fortunately, the Department was enthusiastic about this progressive step, and the performance of the equipment, as the installation proceeded, earned their confidence. All the fixed and mobile apparatus was installed by members of the Patrol. They were selected for this work by the simple expedient of checking their previous occupations, as shown on their application blanks.

No attempt was made to give the patrolmen any technical instruction beyond the routine of operation. Gradually, certain of the men who evidenced interest in the radio were permitted to make emergency replacements on vibrators and tubes, but that is all they are allowed to do so far.

"Our failures are limited to tubes, vibrators, and relays," Larry Smyth explained, "and I keep the first two almost at zero as long as I am able to maintain our schedule of inspection. Tubes and vibrators warn us in advance by dropping off in output. Then it's just a matter of replacing them without waiting until they actually quit."

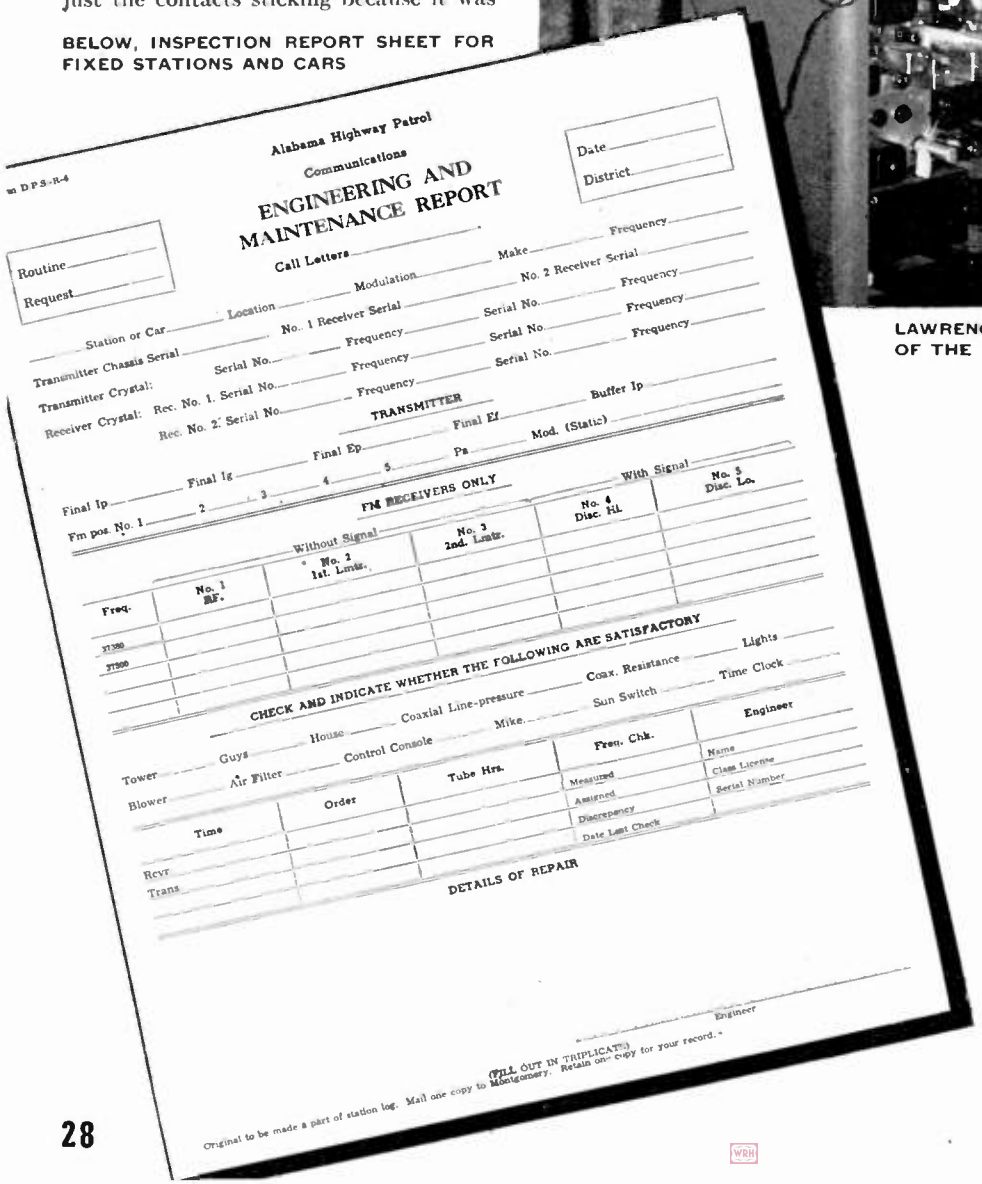
I was with him when the Birmingham station reported that one of their cars had come in with a dead receiver. He looked up the last inspection report, and found that the car equipment had been serviced only a few days before. Then he told the Birmingham operator: "Have him take out the vibrator, tap it gently on the sole of his shoe, and put it back in the receiver." Five minutes later came the answer, "Car . . . is ok again."

Larry Smyth explained, "I knew it was just the contacts sticking because it was a new vibrator. These inspection reports are a great help in keeping cars on the air and saving my time in these cases of minor troubles."



LAWRENCE J. SMITH, CHIEF ENGINEER IN CHARGE OF THE HIGHWAY PATROL'S 2-WAY FM SYSTEM

BELOW, INSPECTION REPORT SHEET FOR FIXED STATIONS AND CARS



Alabama Highway Patrol
Communications
ENGINEERING AND MAINTENANCE REPORT

w DPS-R-4

Routine
Request

Date
District

Call Letters
Station or Car — Location — Modulation — Make — Frequency
Transmitter Chassis Serial — No. 1 Receiver Serial — No. 2 Receiver Serial
Transmitter Crystal: Serial No. — Frequency — Serial No. — Frequency
Receiver Crystal: Rec. No. 1. Serial No. — Frequency — Serial No. — Frequency
Rec. No. 2. Serial No. — Frequency — Serial No. — Frequency

TRANSMITTER
Final Ip — Final Ig — Final Ep — Final Et — Buffer Ip
Fm pos. No. 1 — 2 — 3 — 4 — 5 — Pa — Mod. (Static)

FM RECEIVERS ONLY

Freq.	No. 1 RF.	Without Signal: No. 2 1st. Limtr.	No. 3 2nd. Limtr.	With Signal: No. 4 Disc. Hi.	No. 5 Disc. Lo.
37380					
37500					

CHECK AND INDICATE WHETHER THE FOLLOWING ARE SATISFACTORY

Tower — Guys — House — Coax. Resistance — Lights
Blower — Air Filter — Control Console — Coaxial Line-pressure — Mike. — Sun Switch — Time Clock

Time	Order	Tube Hrs.	Freq. Chk.	Engineer
Rcvr			Measured	Name
Trans			Assigned	Class License
			Discrepancy	Serial Number
			Date Last Check	

DETAILS OF REPAIR

Engineer

(FILL OUT IN TRIPLICATE)
Original to be made a part of station log. Mail one copy to Montgomery. Retain one copy for your record.

a great help in keeping cars on the air and saving my time in these cases of minor troubles."

The report form is reproduced on page 28. It is simple, concise, and at the same time gives all the information necessary for reference purposes. It will be noted that it covers No. 1 and No. 2 receivers. That is because the fixed stations employ one receiver tuned to the fixed transmitter frequency of 37.38 mc., while the other is tuned to the mobile transmitter frequency of 37.5 mc. Each mobile transmitter has two crystals so that the normal car frequency can be shifted to the fixed station frequency, to which the mobile receiver is tuned, for car-to-car communication, or during an emergency when a car may serve as a fixed station.

Experience has shown that the Alabama system is at practically 100% efficiency as long as the inspection schedule is maintained. Trouble is experienced only when inspection lags, and faults show up that

PATROLMEN LISENBY AND WYATT START OUT FROM THE HANDSOME HEADQUARTERS OF THE DEPARTMENT OF PUBLIC SAFETY, HUB OF THE STATE-WIDE RADIO SYSTEM

otherwise would have been caught before they developed. Then that puts a heavy load of work on the chief engineer and such assistance as he has, making it doubly difficult to catch up on the inspection schedule. Due to the energy and devotion with which the chief engineer maintains the equipment, this situation has rarely developed, even though he has often had to carry single handed the responsibilities of a system which should have a minimum of two assistant engineers located in the northern division of the State, two in the southern division, and a fifth at the Montgomery headquarters. In short, in an installation of this magnitude the chief engineer should be free to act in a supervisory capacity only, without having to do any of the actual service work himself.

To enable the entire Highway Patrol to use and operate the radio at maximum efficiency, a very comprehensive instruction book was prepared, entitled *A Guide to the Operation of the Alabama Highway Patrol Communications System*. The 36 pages cover operating procedure very completely under headings: General Information, Dispatch Office, Instructions to Dispatchers, Instructions to Operators, and Rules Governing Sub-Stations. In addition, there is a review of the filing system record cards to be made out from complaints received by phone or radio, and messages transmitted. Other details are included such as keeping the station log, furnishing adequate information on requests for investigations, and messages which may and may not be transmitted by radio. Signal numbers for routine messages, however, are furnished separately.

Dispatchers are told: "The dispatcher is not expected to answer by 'I don't know.' It is his job to find the answer." Emphasis is put on the use of the mail or telephone wherever possible, in order to keep down the transmission of radio messages to a minimum.

Maintenance of Towers and Lines ★ All the fixed station transmitting antennas employ

AN UNUSUAL PHOTO SHOWING DETAILS OF A RADIO MAST AND THE RADIATOR

Wincharger towers. All these antennas were erected by the Wincharger service organization, which continues to inspect and maintain the towers, antennas, and coaxial cables. They also paint the towers, using a portable spray gun. Two days are required to paint a 395-ft. mast. Power connections are maintained by the electric company, and most of the lines running to remote-controlled transmitters are maintained by the telephone company. Tower lights are maintained by local electricians who are paid on a fee basis. The higher the light, the larger the fee for replacing it.

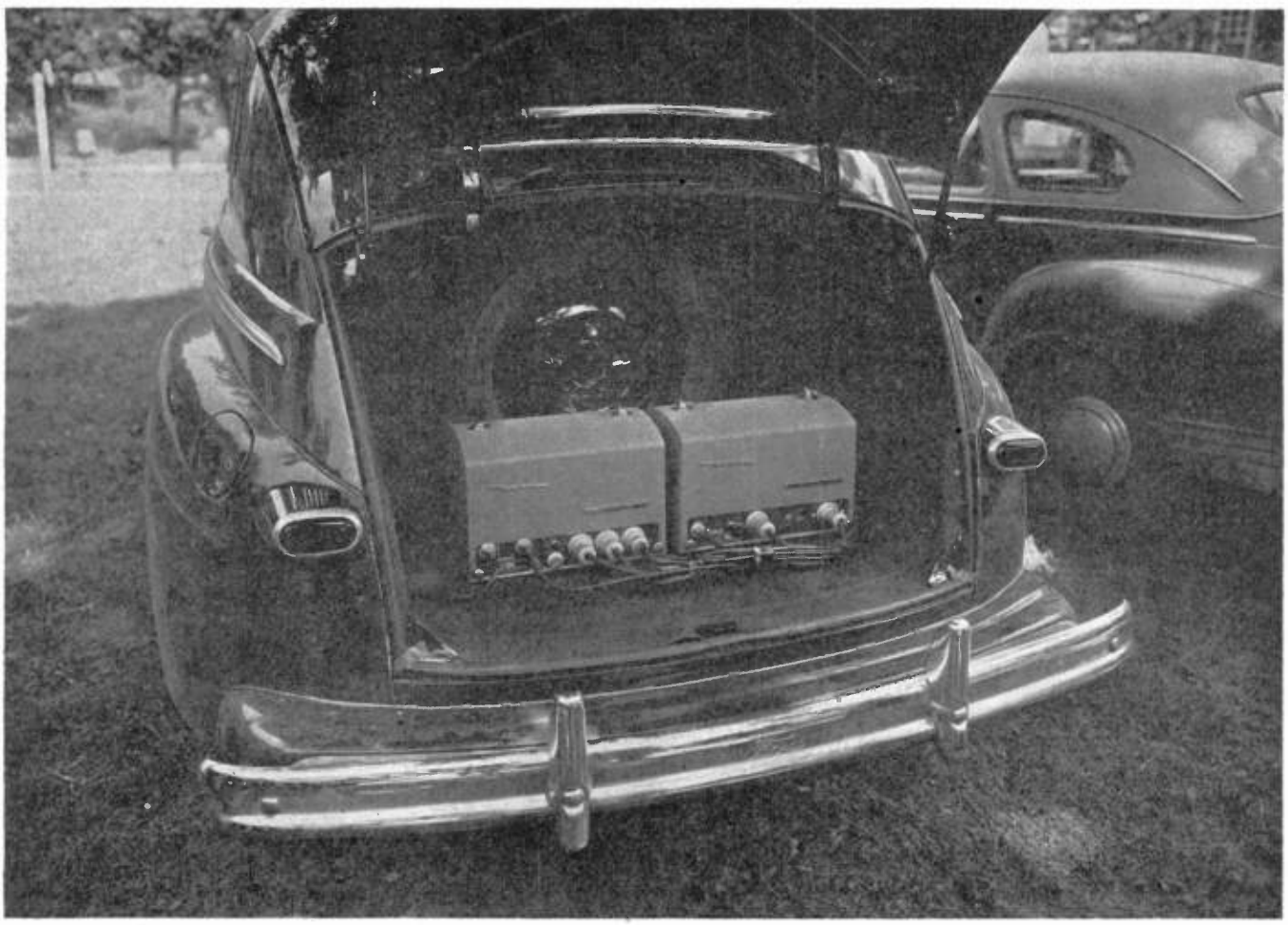
To solve one maintenance problem, it was necessary to call upon Dr. Nixon, the State Toxicologist. One of the remote transmitter houses became infested with black widow spiders. This represented a hazard to both personnel and the equipment. The situation was remedied by buring formaldehyde candles in the transmitter house. The fumes of the candles contain enough gas to kill insects, and rats as well, but do not damage the equipment.

Interference ★ During the time I was in Alabama, there were several periods when signals from the Michigan State Police System came in as strong and clear as from the Alabama transmitters. The interference was mutual, for while I was there a telegram came from Michigan, reporting strong reception of Alabama signals, and asking if Michigan signals were being heard in Alabama. From my own observation, and from discussions with members of the Highway Patrol, I learned that while such interference periods were experienced at irregular intervals, particularly during daylight hours, they do not prevent the normal operation of the system. At such times, when an Alabama station goes on the air, it knocks down the Michigan signals. However, I learned that this interference is not a factor of operation because, if a Michigan station is coming in, operators sometimes wait the few seconds necessary for the message to be completed.

Two of the patrolmen who had previous experience with 1-way AM radio told me that one of the special virtues of FM is that it eliminates the constant grinding noise of background interference heard from AM receivers, and that it is a great relief to the nerves that FM receivers are

CENTER, MRS. PEARL BROW MANAGES ALL OFFICE DETAILS OF THE RADIO DIVISION

BELOW, MOTOROLA FM RECEIVER AND 50-WATT TRANSMITTER IN PATROL CAR



ALL CAR EQUIPMENT WAS INSTALLED BY MEN OF THE HIGHWAY PATROL. L. BERT USSERY, LEFT, FIRST CHIEF RADIO ENGINEER, WAS KILLED IN AN AUTOMOBILE ACCIDENT BEFORE THE SYSTEM WAS COMPLETED. BUILDING IS RADIO DEPT. HEADQUARTERS

entirely silent except when messages are coming in.

Organization ★ From Mrs. Pearl Brown, secretary and assistant to the chief engineer, and from chief dispatcher George Bennett, I learned about the organization of the Department of Public Safety.

Under Chief Van B. Gilbert, as Director of the Department, and his administrative assistant Allen Hargrove are the Drivers License, Equipment Purchasing, Uniformed Patrol, Identification and Inspection, and Radio Divisions. The Chief is appointed by the Governor, while the administrative assistant is appointed by the Chief and approved by the Governor. All other officials and the patrolmen are on the merit system, except the Radio Division. That is due only to the fact that examinations have not been set up yet.

The chief radio engineer, who heads the Radio Division, is responsible to the Director. He is responsible for engineering, which includes maintenance and supplies, and operations, which cover supervision of the dispatchers at the fixed stations and the use of the car radios.

Wartime conditions have made it necessary to employ women dispatchers at some of the stations to supplement the patrolmen assigned to this duty. When a patrolman is working as a dispatcher, he is directly responsible to the chief dispatcher at the Montgomery headquarters.

Radio on the Highways ★ The real story of a police radio system is told by the service it affords the men in the patrol cars. Accordingly, I spent two nights out on the road, first with assistant chief Hargrove and Sergeant Little, and then with patrolmen "Pete" Kennedy and "Duck" Dees. Pete and Duck were the sort of men who give motorists chills down their spines when they come alongside and say: "Pull over!" But I must say that there aren't two finer fellows wearing badges than this team — when you meet them in the right way!

Between what they told me, and what I saw for myself, I learned just how much 2-way radio means to these men in increasing the effectiveness of their own work and in helping them to know, through radio information, that they are not making mistakes.

To pick out just one incident, as an example: Driving out of a side road, they reached Highway 31 just as one car and then another shot past at terrific speed. Pete, at the wheel, turned onto the Highway in pursuit. Although there were no street lights, it was easy to see that the cars were weaving across the road. "DWI" (driving while intoxicated), said Duck. "They must have come from that joint half a mile back. Which one are you going after?" That was a problem. They didn't want to try to pass the rear car in order to stop the first, and they didn't want to let the first one go. So they did something that was very simple with 2-way radio. They called Montgomery headquarters for clearance to talk to another patrol car. The car answered immediately, giving its location. It was at a spot where it could intercept the first car. Duck gave them the necessary information, confident that the first car would be stopped. Then Pete and Duck went after the second.

Of course, it helps a lot to have the law on your side, and also a gun and the right to use it, but just the same, it takes a lot of guts to stop a car, out in the black night, with no idea as to how many men

(CONTINUED ON PAGE 74)

SPOT NEWS NOTES

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

Edward J. Hickey: Commissioner of Connecticut State Police, speaking at New York meeting of Police Chiefs: "Plans must be made now to cope with the bloodiest and most costly crime wave in history after the war, and with juvenile delinquents of today graduating into the criminals of tomorrow, when the moral structure of the populace will undergo a radical revolution. Police departments must start to build their personnel and expand their radio communications."

Facsimile Plans: RTPB Panel 7, committee 1 is working on frequency requirements for postwar facsimile broadcasting. Those interested are being asked to express their opinion of the value of this service, and the extent to which it may grow in the immediate postwar period. A resolution has been passed by Panel 7 to the effect that:

1. Home facsimile broadcasting is destined to become of great public service.
2. Adequate channel assignment should be provided to permit future growth.
3. Present FCC rule calling for multiplexing sound and facsimile limits facsimile development. (See *FM* AND TELEVISION, May, 1944, for text of FCC rule.)
4. Present rule should be modified to permit use of sound, simplex facsimile, or multiplexed sound and facsimile.

Opinions on the matter should be addressed to George M. Nixon, Chairman RTPB Committee 1, Panel 7, Room 578, RCA Building, New York 20.

Lightning Strikes: A freak bolt of lightning, coming in on the telephone line, destroyed the 250-watt transmitter at the Alabama Highway Patrol's Tuscaloosa station July 8th. The antenna was not affected, and the antenna relay, at the top of the rack, was the only undamaged component. A new transmitter was shipped from the Galvin factory on July 12th.

Harold B. Donley: Has been appointed manager of the Westinghouse radio receiver division. He has taken over supervision of the planning and experimental work on the new line of Westinghouse home radio receivers. According to Walter Evans, vice president in charge of radio, development of this line is already under way. It will include AM and FM sets with and without phonographs, and television receivers.

Parts Conference: H. W. Clough, general chairman of the Electronic Parts Equipment Industry Conference, scheduled for October 19, 20, 21 at Chicago's Hotel Stevens, reports very heavy advanced registration. Communications to Mr. Clough should be addressed to Box 5070-A, Chicago 80.

Television Applications: According to a summary made up by the Television Broadcasters Association, 60 applications for commercial television stations were filed with the FCC up to July 1st. They represent 23 states and the District of Columbia.

APCO Convention: The 11th annual convention of Associated Police Communications Officers will be held September 18th to 20th inclusive at Commodore Perry Hotel, Toledo, O. Police Communications officers will be joined by representatives of the FCC to discuss radio interference and communications problems. Equipment will be displayed by the manufacturers. Further information can be obtained from Sgt. C. H. Knudel, Chairman, 720 Jefferson Ave., Toledo 2, Ohio.

2-Way FM for Taxis: First radio system for taxis will be installed in Cleveland, according to D. L. Chestnut, commercial engineer for G. E. Equipment planned for postwar installation will have one transmitter for the downtown area, and two others to cover Greater Cleveland. Each transmitter will have four channels, with 100 cabs assigned to each channel. This system, planned by Jesse Smith, president of the Yellow Taxicab Company, and Arthur B. McBride, head of the Zone Company, will eliminate all unattended call boxes and, by reducing dead mileage, will conserve gas and tires and the cabs, as well. In addition, it will make possible cooperation between taxis and city departments in cases of emergency.

Ernest R. Breech: President of Bendix Aviation Corporation: "If industry is to maintain its present status, re-established in this war as the main driving force in American life, it must take the lead in coordinating science with mass education. . . . In many cases, particularly in the Armed Forces, intensive, streamlined training has given a more complete, workable, and practical scientific education than the average college graduate possessed ten years ago. They have learned to produce and master the efficient use of equipment which represents the highest peaks of development in radio and electronics, mechanical arts, and chemistry.

"Their rediscovered faith in scientific progress and the immense stockpile of personal ingenuity and practical knowledge built up the hard way in this War constitutes one of the Nation's most valuable assets in translating wartime technical advances into terms of the common good.

"We must plan now to use and expand this tremendous educational force to develop a buying public keenly aware of the new opportunities that will be open when civilian production can be resumed."

Television Courses: As a result of a working agreement between NBC and Columbia University, a new school of the radio and television program arts will be instituted at the University next fall. Twenty-two courses will be offered.

Relay Regulations: FCC has amended rules governing relay broadcast stations to increase the license period for such stations from two to three years. Purpose is to have licenses for relays and broadcast stations expire at the same time. If a relay is used with two broadcast stations, two relay licenses will be issued.

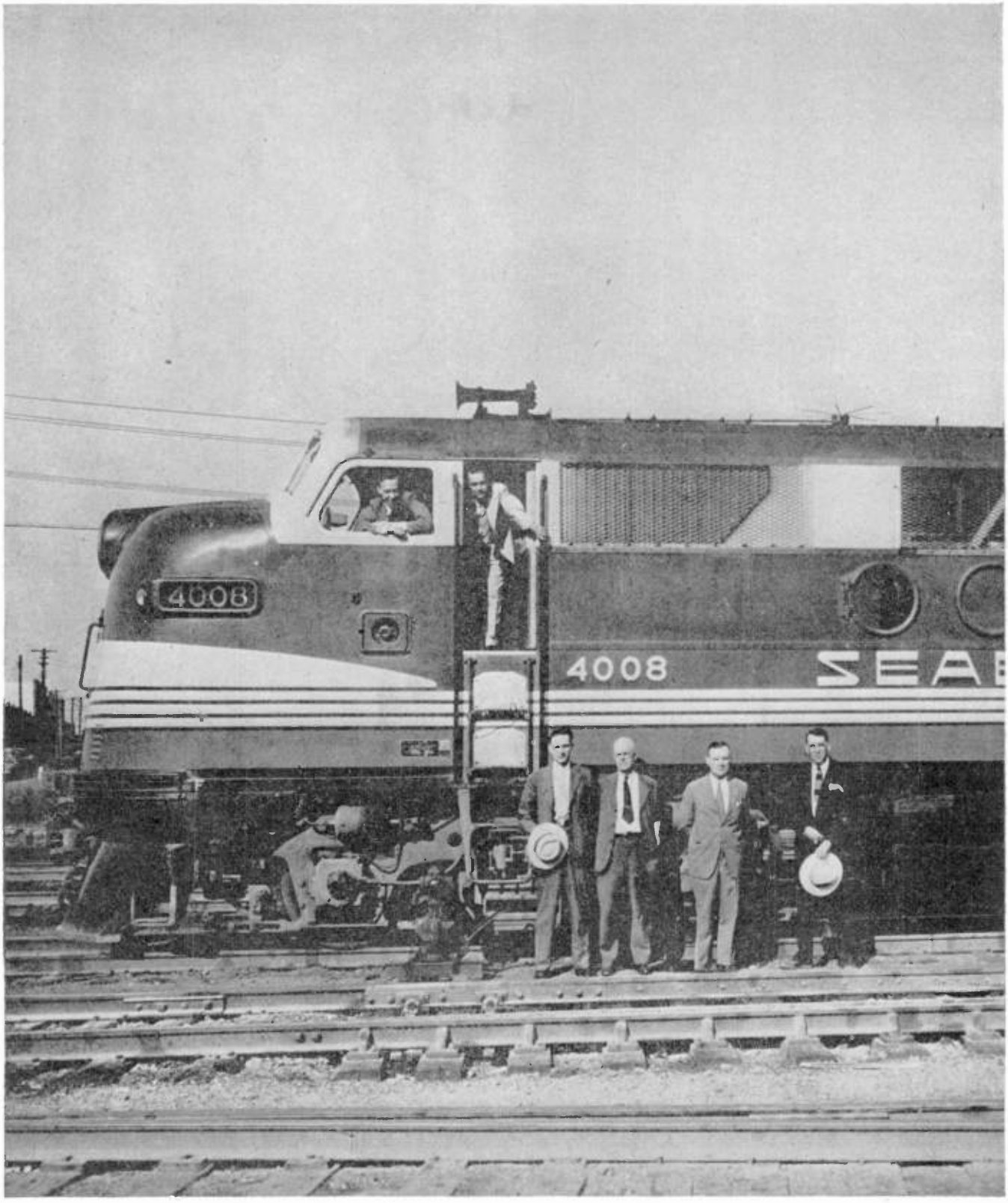
Plants Purchased: James L. Fouch, president of Universal Microphone Company, Inglewood, Calif., has announced the purchase by this Company of the land and buildings it has occupied for the last 12 years. This includes plants 1 and 2, the annex, and the parking lots.

Lester L. Kelsey: Former manager of Stewart-Warner's radio department, in charge of engineering, manufacturing and sales, has been appointed to the executive staff of Belmont Radio Corporation, Chicago. He will handle war contract negotiations and assist in postwar planning.

Chicago: The Hallicrafters Company has established a new department to write ex-employees now in the service, to mail them gift packages, and to contact their families. Purpose is to keep tight the bonds between Company workers and their former associates in the Armed Forces.

Military Radio Production: Hit peak in December, 1943, and has declined steadily through April, 1944, the last month on which figures are available. This includes airborne, ship, and ground radio and radar apparatus, underwater sound, wire communications, and miscellaneous related equipment.

(CONTINUED ON PAGE 71)



NEWS PICTURE

FIRST step in employing radio communication on Seaboard Air Lines is installation of Bendix Radio equipment for 2-way service between engine and caboose of freight trains. J. R. DePriest, Seaboard superintendent of telegraph and signals, reports satisfaction with initial tests. According to W. P. Hilliard, general manager of Bendix Radio, this is first railroad installation to operate above 150 mc. Left to right above are J. R. DePriest, C. I. Morton, assistant superintendent, and H. M. Gold, assistant general manager of Seaboard. In cab window is A. L. Bohn, and W. H. Sims at the door, both Bendix engineers.

FINCH SOUND-FACSIMILE STATION ATOP GENERAL MOTORS BUILDING, NEW YORK

THE FINCH FACSIMILE SYSTEM

Operation of Auto-Synchronous Facsimile Using Electro-Sensitive Paper

BY FRED C. EHLERT*

THE key to the expansion of American Industry lies in specialized scientific research. If new things are to be produced, new knowledge must be gained and so thoroughly learned that to the specialist it becomes a commonplace tool which can be used at will.

Because of such specialized research in radio communications, our men of science have woven networks around the earth that carry messages, music, voices and pictures instantaneously from continent to continent through space. This did not happen overnight. It took years of specialized research — learning new facts — before the present status of radio communications was achieved.

That "a picture is worth ten thousand words" fits communications as it does other arts. The famous Chinese sage may not have thought of facsimile communication, by either radio or wire. Nevertheless, centuries ago when he propounded that axiom, he admirably stated the case for this precise means of modern communication.

The facsimile systems now in use are not fundamentally new. Rather, they represent evolution, refinement, and simplification, based on years of pioneering.

*Development Engineer, Finch Telecommunications, Inc., Passaic, N. J.

THIS author makes no reference to the practical objections to multiplexing sound and facsimile raised by Messrs. Collings and Young of RCA (page 18). While it would be serious if facsimile operated by supersonic signals interfered with sound reception, the extra service possible with multiplexing and the elimination of extra frequencies that would be needed for simplex facsimile make the use of multiplexing highly desirable.

One of the facsimile systems now widely used was invented and developed by W. G. H. Finch. He ranks among the earliest and best known workers in this field. He has served with the Federal Communications Commission and, in 1939, formed the Finch Telecommunications, Inc. of Passaic, N. J., of which he became president. At the time of Pearl Harbor, some 22 broadcasting stations were operating Finch facsimile news bulletin services on their standard broadcast frequencies during early morning hours, for reception by home facsimile receivers.

When our Country entered the War, Finch relinquished his post as president of the Company and entered the U. S. Navy, now holding the rank of Commander.

With over sixty domestic patents and numerous foreign patents already issued and more pending, Finch Telecommunications, Inc. have recently set about refining and simplifying facsimile for FM broadcasting, as well as for business and other commercial uses, in preparation for the great expansion anticipated in this field after the War.

In spite of the rapid development and everyday use of wire and radio facsimile service, many are unaware of its greater capabilities as a mass communications medium in the FM broadcasting field. This is largely because facsimile transmissions have been employed to handle press photographs for newspaper reproduction and, in the average layman's mind, this is the limitation of the method. Many also confuse facsimile with television, and ask why television will not perform the same duty.

For these reasons the first questions to be answered are "What is facsimile?" "How does it differ from television?" and "How does it fit into the FM broadcasting picture?"

Facsimile involves the conversion of written or printed copy, photographs, and other types of illustrations into electrical signals which may be sent over telephone,

telegraph or radio circuits. At the receiver, the signal is converted back into its visible equivalents, appearing on the recording machine as a replica of the original material. The received copy is in record form and can be handled, observed at will, and filed for future reference.

Television involves the conversion of visible aspects of subjects into electrical signals which can be sent to distant points. However, the speed of the conversion is such that ordinary telephone circuits or conventional FM sound broadcasting equipment cannot handle the signal.

. In addition, there is as much difference in the technique of the two communications mediums as there is between the making of a newspaper and a motion picture. Facsimile is concerned only with the transmission and subsequent recording of pictures and printed pages, while television produces a fleeting image on a cathode ray tube, with the basic qualities of a motion picture. When the show is over, the screen is blank. Since nothing is recorded, the images are not seen unless one watches the screen while they are to be received.

Facsimile and television, therefore perform widely different functions. Each fits the communications picture as a separate service, having fundamental distinctions as widely divergent as those of the public press and the motion picture.

With the advent of FM, multiplexing aural and facsimile programs became a reality. This has overcome the only handicap to the general use of facsimile for home reception, and in a manner which greatly enhances the commercial use of facsimile broadcasting because:

1. With FM multiplex operation, facsimile service can be provided without having to use separate and additional frequencies. Since facsimile could not be multiplexed with AM broadcasting, transmission was limited to early morning hours, and could not be put on during the hours of sound transmission.

2. Multiplexed with FM sound broadcasting, facsimile can be used as an important adjunct to the audible programs. This supplemental use will perform an important service to the radio audience and enhance greatly the effectiveness of radio advertising.

The decision of the FCC in 1940 to permit commercialization of facsimile on FM channels opened a new avenue of revenue to FM broadcasters. However, due to our entrance into the War, the introduction of FM facsimile broadcasting was postponed for the duration. Needless to say, as soon as peace comes, facsimile equipment will be available to FM broadcasters and to the public.

Developments and refinements in facsimile transmission which have come about during the war are being followed closely by FM broadcasters, and particularly by newspaper publishers who are operating or are planning to erect FM stations.

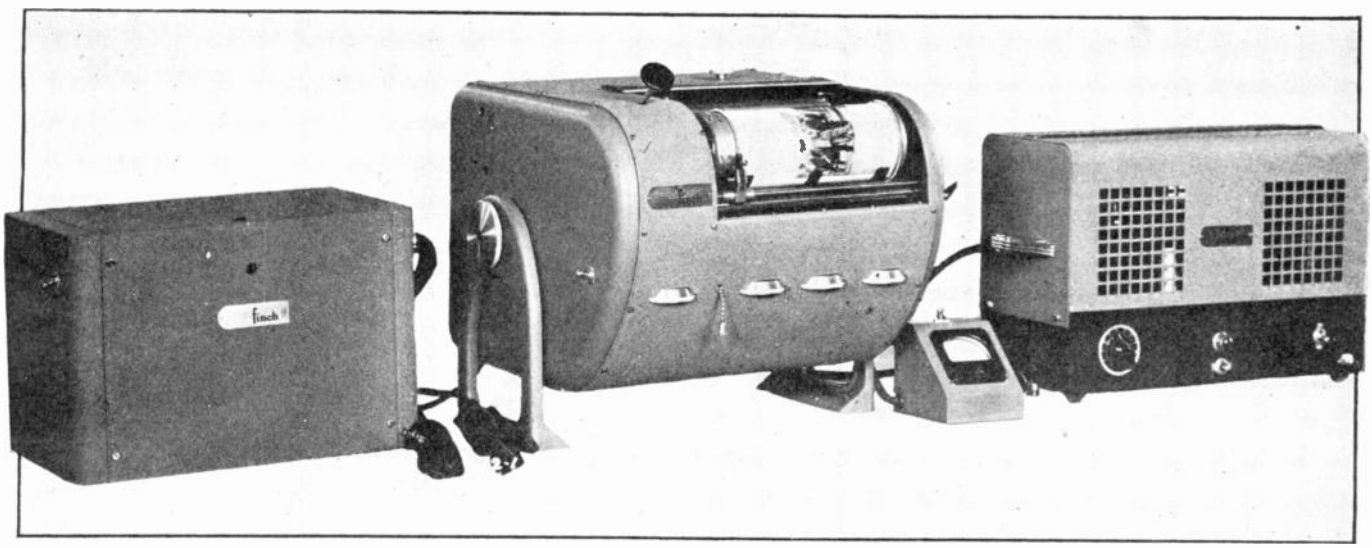
The new industry is now ready to furnish the means for adding the graphic arts to radio broadcasting.

Insofar as transmission technique is concerned, methods employed in facsimile are similar in general respects to those now commonly utilized on a wide scale with conventional wire and radio photo services. However, an important distinction exists in that facsimile for home or industrial use must be entirely automatic. Copy received by Finch equipment appears in permanent, visible form during the recording operation. No processing is required. The Finch system uses a new dry, electro-sensitive paper developed expressly for facsimile recording. Received copy cannot be smudged by handling, as is the case with carbon paper recording.

Production of this paper, which records by direct electrical action at high speed and is not sensitive to light or atmospheric conditions, has given impetus to use of facsimile apparatus. In wire and radio photo services this is not the case, for a recording technique is employed which requires the use of light-sensitive film. An operator must be present at the receiving point to load unexposed film on the recording machine and, subsequently, to develop, fix, wash, and dry the exposed negative from which prints are made.

Automatic recording and synchronizing methods made available by the Finch system open the way to many uses for facsimile in addition to home broadcast reception. In the industrial and business fields, facsimile equipment can be connected to telephone or other inter-office communications systems to exchange routine memoranda, forms, sketches, photographs, and correspondence records now handled by messenger or mail. As an adjunct to press services, it can be applied to existing telephone or radio channels to transmit news, proofs for correction, and other intelligence. In the allied field of advertising, facsimile offers great advantages over methods now employed in exchanging proofs, layouts and other illustrated copy between offices in different cities.

Facsimile apparatus also will enter into service on power-line carrier circuits for load dispatching and other routine duties. On railroads it may supplement present telephone dispatching systems, since written record forms can quickly be transmitted to all dispatching points.



ONE TYPE OF EQUIPMENT IN WHICH THE SCANNER AND RECORDER ARE COMBINED IN ONE UNIT. POWER SUPPLY AND TONE CIRCUITS ARE SEPARATE. HOME FACSIMILE UNIT WILL BE SMALLER, SIMPLER, AND LESS EXPENSIVE

In commercial aviation, the value of facsimile is evident. Weather maps, including storm warnings, barometric readings, wind velocities, and other correlated data can be transmitted over existing communications systems and recorded on planes or ground stations in concise graphic form.

It is anticipated that, with the development of the new Finch portable duplex unit, scarcely larger than a typewriter, and adapted to send or receive copy or sketches at the rate of 8 square ins. per minute, pilots will be able to transmit direct to ground stations. Such messages when received will be immediately usable without processing of any nature.

As an adjunct to marine and other communication services, facsimile provides means for the transmission and reception of maps, charts, diagrams, and other pertinent forms of graphic intelligence.

In the police and fire communications fields, facsimile equipment has already demonstrated its effectiveness in transmitting written orders, identification photographs, fingerprints and other data over telephone, telegraph, or municipal radio circuits.

A brief description of the Finch facsimile transmitter and recorder will probably clarify any points in the foregoing text as to the operation and application of the equipment.

Wide-Measure Scanner ★ To meet the demand for FM transmitting and receiving equipment capable of handling copy 4 columns (8½ inches) wide, special complete scanning and recording machines have been developed. In the new Finch cylinder-type scanner employed to handle copy up to 4 columns, continuous scanning is accomplished through the use of a rotary scanning cylinder and screw-driven scanning head, similar in general respects to those employed in conventional wire photographic services.

In this machine, a removable scanning cylinder approximately 18 inches in length and $2^{21}/_{32}$ inches in diameter is employed to hold copy 8½ ins. wide. A set of clamps, disposed along the cylinder in a line parallel to the axis, keeps the copy firmly in place during the scanning operation. The clamps are controlled as a single unit by a small lever at the end of the cylinder. The scanning head is mounted on an adjustable sliding plate which can be moved to accommodate the cylinder. The exciting lamp, photocell, lens system, carrier-modulator and amplifier tubes are contained in the scanning head assembly.

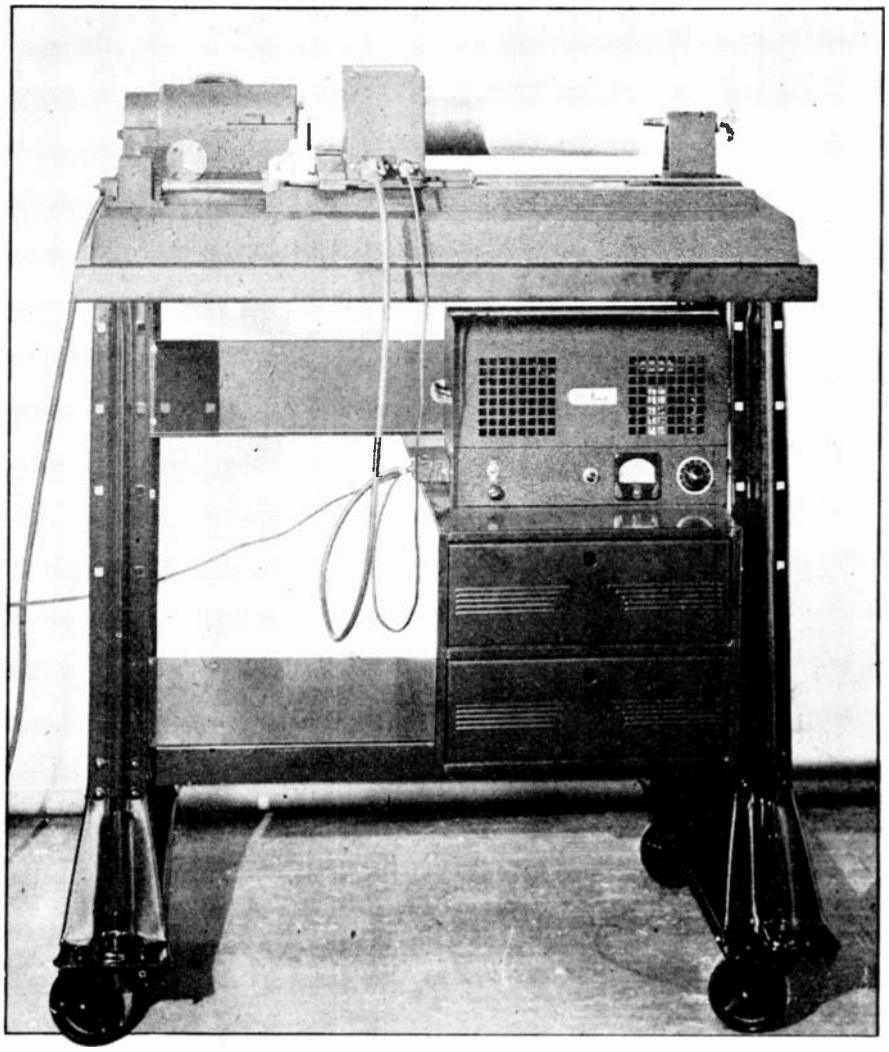
The cylinder is rotated at 100 R.P.M. by means of a self-synchronous motor and associated reduction gears. A clutch, controlled by a small lever on the clutch-case, provides means with which to disengage the cylinder from the driving gears. A lead-screw, similar in appearance to those employed on lathes, moves the scanning head from one end of the cylinder to the other during the scanning operation. In this manner, the light-spot from the exciter lamp, which is .01 in. in diameter, scans the copy, line by line, as the head moves along the rotating cylinder from left to right during the transmitting process.

Adjustments of black and white signal values are made by means of potentiometers mounted on a small control unit at one end of the machine. Cam-actuated switches are utilized to time the transmission of the synchronizing pulse and carrier.

Wide-Measure Recorder ★ In high-speed Finch recorders which have been designed for operation with scanners of the cylinder type, dry electro-sensitive paper is held in a roll mounted in the lower portion of the recording unit. Paper is continuously advanced by means of a platen and pressure-roller arrangement similar to that employed on typewriters.

Recording paper used with these recorders is generally supplied in standard rolls. A dry carbon-impregnated stock is utilized on which a near-white coating of electro-sensitive material has been applied. The coating instantaneously darkens when a marking voltage of sufficient value has been applied by the stylus. In tests made with one typical form of coating, marking begins at 80 volts (stylus to ground) and continues in varying density steps up to 170 volts, at which value a jet-black trace of maximum density is formed.

While the range of density values in recording paper of this type is adequate for many commercial services, concentrated electro-chemical research now under way is leading to the development of recording stock in which gray-scale gradations, comparable to those of photographic emulsions, may be attained. At the present time, with paper now available, density



FACSIMILE SCANNER FOR TRANSMISSION OF NEWS, PICTURES, AND ADVERTISING. THIS INSTRUMENT WILL BE CONNECTED TO FM TRANSMITTER

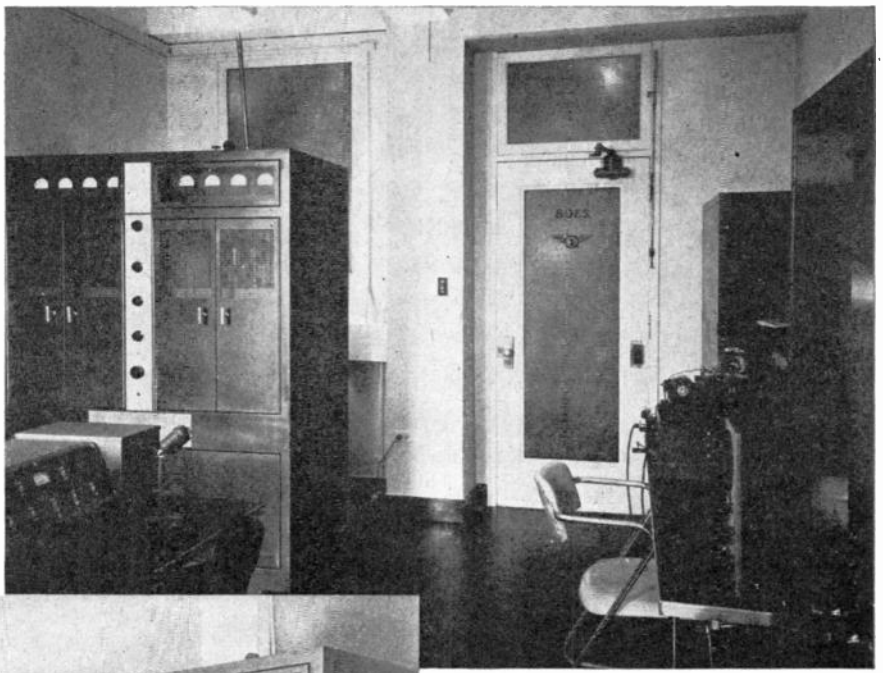
gradations which approximate those of photostatic reproductions are obtained.

In recorders of this type, the stylus is mounted on a resiliently-supported holder which is attached to a contact bar.

The relationship between the position of the clutch stop and that of the recording stylus is such that when the stop is engaged by the release level, the recording arm is in position at the beginning of the recording stroke; that is, at the extreme left-hand side of the recording gate. No paper is fed through the recording gate unless the recording head is in motion.

Since the synchronizing pulse is transmitted immediately prior to the beginning of each scanning stroke, the initiation of each recording cycle is automatically timed by the received pulse. Thus the recorder at the receiving end is lock-stepped with the correlated progress of the light-spot in the scanning gate of the transmitter.

Enough time must be made available in the recording cycle to permit this correction at the beginning of each recording stroke. Therefore, means must be provided to complete the entire operating cycle from left to right and return just before the scanning cycle at the transmitter has been completed. This is accomplished in recorders designed for alternating current operation by employing a synchronous motor of the same speed rating as that of the scanner motor, and a gear-box having a speed-reduction ratio slightly less than that of the corresponding gear-box at the transmitter. These operate the recording mechanism at a speed just above that of the scanner and thereby provide sufficient time in which to correct for any slight speed variations that may occur during successive scanning cycles. The important point is that the speed variations are not allowed to accumulate.



LEFT, TRANSMITTER, CONTROL CONSOLE, AND TURNTABLE. STATION IS NOW OFF THE AIR FOR THE DURATION

VIEWS OF FINCH SOUND-FACSIMILE BROADCASTING STATION. ABOVE, 1-KW. FM TRANSMITTER AND SCANNER

The effectiveness of the Finch auto-synchronous method has been demonstrated on independent power lines in many sections of the country. Successful transmissions have also been conducted to ships and other mobile units provided with motor-driven 60-cycle generators.

For operation from a direct-current power source, such as a storage battery, a small, governor-controlled motor is utilized in the recorder. The governor, of the electro-mechanical type, is provided with a speed-adjusting control knob which can be turned in one direction or the other until the motor is brought to optimum recording speed. In practice, this adjustment is easily made and, when once set, the governor requires little attention over extended periods. To add in providing constant speed, a fly-wheel is attached to the motor-coupling shaft.

Marking voltage is applied to the stylus from the signal rectifier unit. An automatic switch, controlled by the main driving cam, transfers the output circuit of the rectifier to the synchronizing magnet just before the recorder reaches the starting position. At the same time, the switch supplies a by-pass condenser across a portion of the rectifier-input circuit. This affects discrimination between the 500-cycle synchronizing pulse and signals of higher frequency, such as the 2,000-cycle carrier, which might release the recorder at the wrong instant. In practice it has been determined that this feature, which provides signal discrimination of approximately three to one between the synchronizing pulse and the carrier, has largely been instrumental in assuring positive control of the recorder under varying operating conditions.

Portable Duplex Unit ★ A portable duplex unit, designed for use in aviation and general communications services in transmitting and receiving graphic intelligence,

(CONTINUED ON PAGE 71)

HOW CAN THE RCA ELECTRON MICROSCOPE

THE RCA Electron Microscope, an instrument which magnifies up to 22,000 times (and makes micrographs which, enlarged photographically, make possible useful magnifications up to 200,000 times), has enabled scientists to achieve important advances in industry and research. Its tremendous magnifying power is of great value to the chemical, metallurgical, ceramic, plastic, aviation, textile, rubber and petroleum industries—to medical and other branches of scientific research—or to any field where particle size, shape, structure or distribution are of interest, or where minute surface details of metals or other materials must be studied.

Two new models of the RCA Electron Microscope are now available. One is a compact desk model—the other, a new Universal type containing an electron diffraction camera. Information on these instruments, their use and applications, is offered in a new 16-page booklet "The RCA Electron Microscope." The coupon below will bring you this booklet by return mail.

PLEASE USE THIS COUPON

Electron Microscope Section, Dept. 122
Radio Corporation of America, Camden, N. J.

Please send me the new bulletin entitled "The RCA Electron Microscope."

Name.....
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WRH

PLANNING EDUCATIONAL FM BROADCAST STATIONS

Basic Information for the Use of School Boards and City Officials

BY GEORGE P. ADAIR *

WITH so much interest developing in the use of radio in education, particularly the establishment of new stations for this purpose, it is an opportune time to mention briefly some considerations in the filing of applications with the Federal Communications Commission for station authorizations. I would like to point out not only the main factors which suggest themselves, but also to mention some of the other problems encountered by educators in proceeding to construct a station of their own.

A point which has been emphasized before but which merits repetition is adequate planning. Before the filing of an application and before making arrangements for the purchase and installation of equipment, it is essential that a determination be made of exactly (1) what radio service is desired; (2) how it is to be obtained technically; (3) how it is to be financed, and (4) how it is to be used. If necessary, go outside of the school staff for personnel skilled in the design, installation and use of a radio system that will be tailored to fit your needs. A properly engineered system that will do the job proposed may often effect economies that will more than offset added expenditures incurred in the beginning.

Along these lines you may want, perhaps, to first have a station that will serve a limited area or a single school system, but later to provide county-wide service or include possibly several school systems. The United States Office of Education undoubtedly can be of great assistance in your planning, and possibly coördinate your plans with those of other school systems in your vicinity or in your state. Consider the part your station will play in plans for state or regional networks of educational FM stations. Some applications have been received by the Commission where it appeared that rather nebulous, if any, plans had been made, even as to the area that the station was expected to serve.

Having determined the coverage you desire and the transmitter, power, transmitter location, and antenna system necessary to provide it, you are in a position to go ahead with the supplementary details, to estimate more accurately the cost of the system, and to have a proper basis for obtaining an appropriation for it. Other factors enter in, of course, such as the number and size of studios, the construction work and acoustical treatment involved, and the studio amplifiers and transcription equipment required.

Only after this groundwork has been laid should you file your application with the Commission. In addition to specifying the channel assignment you desire and a description of the facilities you propose to install, the application should include an adequate showing of the service you intend to provide. This should describe the extent of the school system or systems you intend to serve, as well as other areas you intend to include. List the plans and purposes of the station, including tentative programming, both as to the service which would be provided to schools and as to other projects such as adult education. Describe how your station would fit into a coördinated plan or network, if such is proposed for your region. Supply in your application the proper showing as to any local authorization needed for filing the application, such as the résolution of the school board, and of the money appropriated or made available for construction and operation of the station. Be sure the application includes duplicate copies of all exhibits, such as resolutions, maps of station location, etc.

In some cases applications for new noncommercial educational broadcast stations have been filed where construction is not proposed in the near future, due to wartime conditions, but where the school system or university desires to have the application pending for future action. Such applications, where there is sufficient evidence that the applicant fully intends to proceed to complete the application as soon as possible, have been accepted. However, such a procedure does not reserve a channel for use at some later time, and I wish to emphasize that the assignment of a channel is based upon the granting of an application and not merely for the reason that an application may be pending. It is not the policy to issue construction permits where construction may not be completed for an indefinite period of time, and applications in this category would probably be retained without present action by the Commission.

In some cases applications have been filed in incomplete form without, for example, specification of all the transmitting equipment proposed to be used. Although such applications are normally not acceptable for filing, they have been accepted on the basis that the missing material will be submitted when required by the Commission at a later date. It is expected that such applications be as complete as feasible at the time of filing and that a showing be included regarding incomplete portions. Some applications in this category have been received and returned for additional information, generally in cases where it was evident that it was available and overlooked or where certain portions of the form had not been answered. No action will be taken until the application is complete and the filing of incomplete applications in no way reserves a frequency or speeds the obtaining of a construction permit.

As to the actual mechanics of filing an application for construction permit, application forms should be requested from the Federal Communications Commission, Washington 25, D. C., or from one of its field offices. Before attempting to complete the application, however, applicants should obtain copies of pertinent portions of the Commission's Rules which describe application procedure and the rules under which educational stations operate. It is therefore suggested that the following portions of the Rules be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., which are available at the prices indicated:

Part 1, Rules of Practice and Procedure, 10¢
Part 2, General Rules and Regulations, 10¢
Part 4, Rules Governing Broadcast Services Other than Standard Broadcast, 10¢
Part 13, Rules Governing Commercial Radio Operators, 5¢

Upon filing of the application and the granting of the construction permit by the Commission, a permit is issued which specifies required dates of commencement and completion of construction, normally two and eight months, respectively, after the date of grant. Upon the completion of construction, certain tests are permitted before the station license is issued, as indicated by Sections 2.42 and 2.43 of the Commission's Rules. The license application must be filed with the Commission

(CONCLUDED ON PAGE 73)

* Chief Engineer, Federal Communications Commission, Washington, D. C. A statement delivered at the Fifteenth Institute for Education by Radio, Columbus, O.

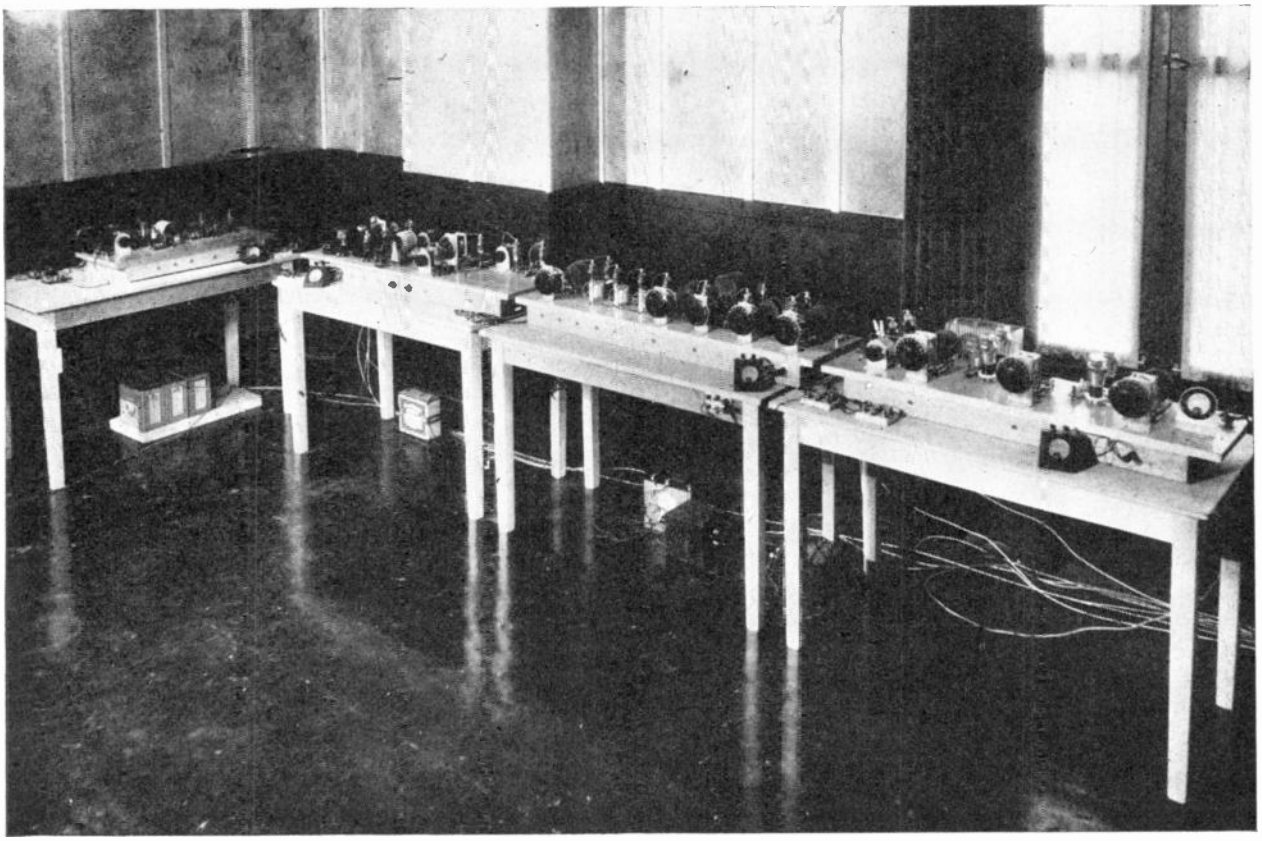


FIG. 20. OUTPUT OF THE MODULATOR SYSTEM IN WHICH AN INITIAL FREQUENCY OF 57.33 KC. WAS INCREASED TO 1733 KC.

The original disclosure of

FREQUENCY MODULATION BROADCASTING

A Method of Reducing Disturbances in Radio Signaling By a System of Frequency Modulation

BY EDWIN H. ARMSTRONG

CONTINUED FROM THE JUNE ISSUE

New York-Westhampton & Haddonfield Tests ★

The years of research required before field tests could even be considered were carried out in the Marcellus Hartley Research Laboratory at Columbia University. Of necessity both ends of the circuit had to be under observation simultaneously and a locally generated signal was used. The source of signal ultimately employed consisted of a standard signal generator based upon the principle of modulation already described and capable of giving 150,000 cycles swing on forty-four megacycles. The generator was also arranged to give amplitude modulated signals. Suitable switching arrangements for changing rapidly from frequency to amplitude modulation at either full or half carrier were set up and a characteristic similar to that of Fig. 18 ultimately obtained.

A complete receiving system was constructed and during the Winter of 1933–1934 a series of demonstrations were made to the executives and engineers of the Radio Corporation of America. That wholly justifiable suspicion with which all laboratory demonstrations of "static eliminators" should be properly regarded was relieved when C. W. Horn of the National Broadcasting Company placed at the writer's disposal a transmitter in that company's experimental station located on top of the Empire State Building in New York City. The transmitter used for the sight channel of the television system delivered about two kilowatts of power at forty-four megacycles to the antenna and it was the one selected for use. This offer of Mr. Horn's greatly facilitated the practical application of the system as it eliminated the necessity of transmitter construction in a difficult field and furnished the highly skilled assistance of R. E. Shelby and T. J. Buzalski, the active staff of the station at that time. Numerous difficulties, real and imaginary, required much careful measurement to ascertain their presence or absence and the relative importance of those actually existing. The most troublesome was due to the position of the transmitter, which is located on the eighty-fifth floor of the building and is connected by a concentric transmission line approximately 275 feet long with a vertical dipole antenna about 1250 feet above ground. Investigation of the characteristics of this link between transmit-

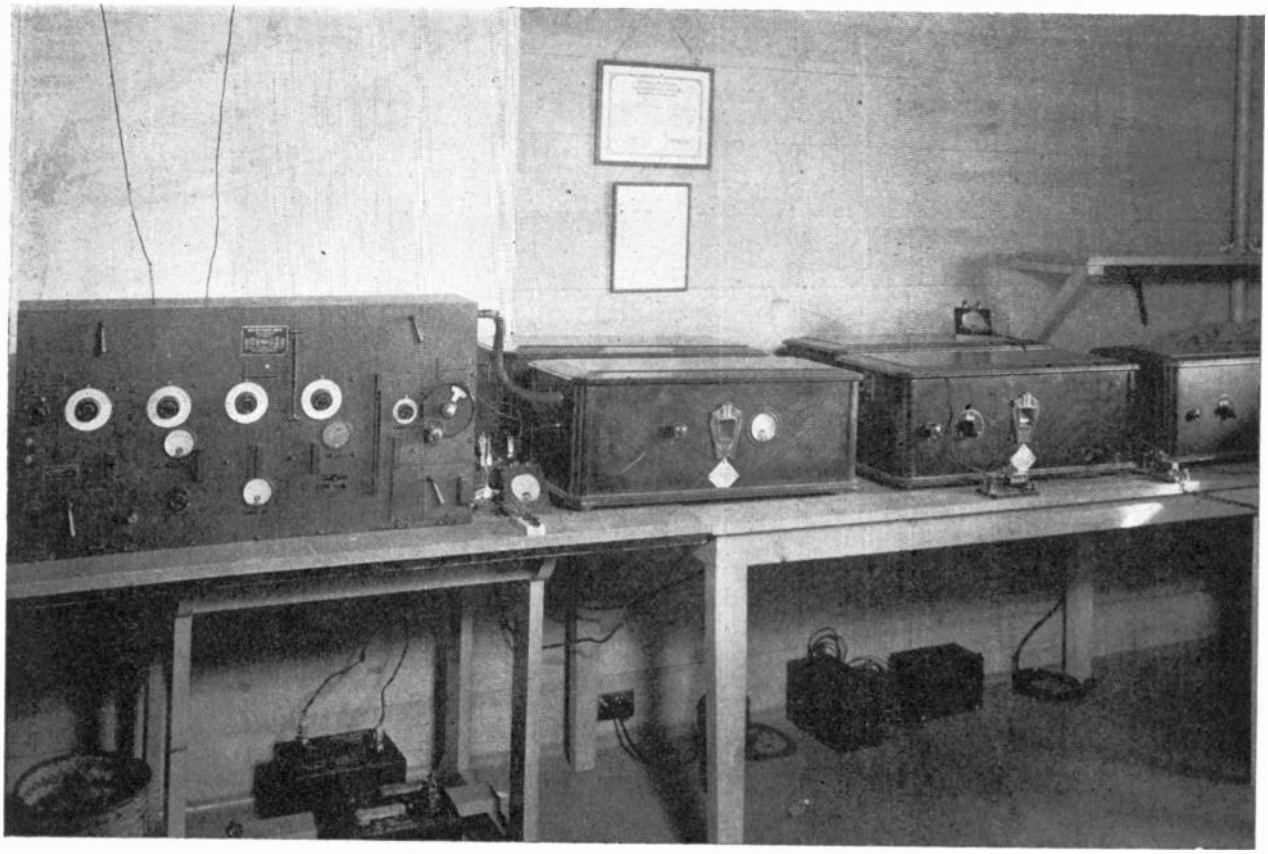


FIG. 21. FM RECEIVER USED IN COMPARING FM AND AM RECEPTION FROM NEW YORK CITY AT WESTHAMPTON BEACH

ter and antenna showed it to be so poorly matched to the antenna that the resulting standing waves attained very large amplitude. The problem of termination afforded peculiar difficulties because of the severe structural requirements of the antenna above the roof and of the transmission line below it. It was however completely solved by P. S. Carter of the R.C.A. Communications Company in a very beautiful manner, the standing waves being practically eliminated and the antenna broadened beyond all requirements of the modulating system contemplated. With the transmitter circuits no difficulty was encountered at this time. The frequency of the system was ordinarily controlled by a master oscillator operating at 1733 kilocycles which was multiplied by a series of doublers and a tripler to forty-four megacycles. The multiplier and amplifier circuits were found to be sufficiently broad for the purposes of the initial tests.

The crystal control oscillator was replaced by the output of the modulation system shown in Fig. 20 in which an initial frequency of 57.33 kilocycles was multiplied by a series of doublers up to the input frequency of the transmitter of 1733 kilocycles. It was found possible to operate this apparatus as it is shown installed in the shielded room of the television studio at the Empire State station as the shielding furnished ample protection against the effects of the high power stages of the transmitter located some seventy-five feet away.

The receiving site selected was at the home of George E. Burghard at Westhampton Beach, Long Island, one of the original pioneers of amateur radio, where a modern amateur station with all facilities, including those for rigging directive antennas, were at hand. Westhampton is about sixty-five miles from New York and 800 or 900 feet below line of sight.

The installation is illustrated in Figs. 21 and 22 which show both frequency and amplitude modulation receivers and some of the measuring equipment for comparing them. The frequency modulation receiver consisted of three stages of radio-frequency amplification (at forty-one megacycles) giving a gain in voltage of about 100. This frequency was heterodyned down to six megacycles where an amplification of about 2000 was available and this frequency was in turn heterodyned down to 400 kilocycles where an amplification of about 1000 could be realized. Two current limiting systems in cascade each with a separate amplifier were used. At the time the photograph was taken the first two radio-frequency stages had been discarded.

The initial tests in the early part of June surpassed all expectations. Reception was perfect on any of the antennas employed, a ten-foot wire furnishing sufficient pickup to eliminate all background noises. Successive reductions of power at the transmitter culminated at a level subsequently determined as approximately twenty watts. This gave a signal comparable to that received from the regular New York broadcast stations (except WEAF, a fifty-kilowatt station approximately forty miles away).

The margin of superiority of the frequency modulation system over amplitude modulation at forty-one megacycles was so great that it was at once obvious that comparisons of the two were principally of academic interest.

The real question of great engineering and economic importance was the comparison of the ultra-short-wave frequency modulation system with the existing broadcast service and the determination of the question of whether the service area of the existing stations could not be more effectively covered than at present. The remainder of the month was devoted to such a comparison. With the Empire State transmitter operating with approximately two kilowatts in the antenna, at all times and under all conditions the service was superior to that provided by the existing fifty-kilowatt stations, this including station WEAF. During thunderstorms, unless lightning was striking within a few miles of Westhampton, no disturbance at all

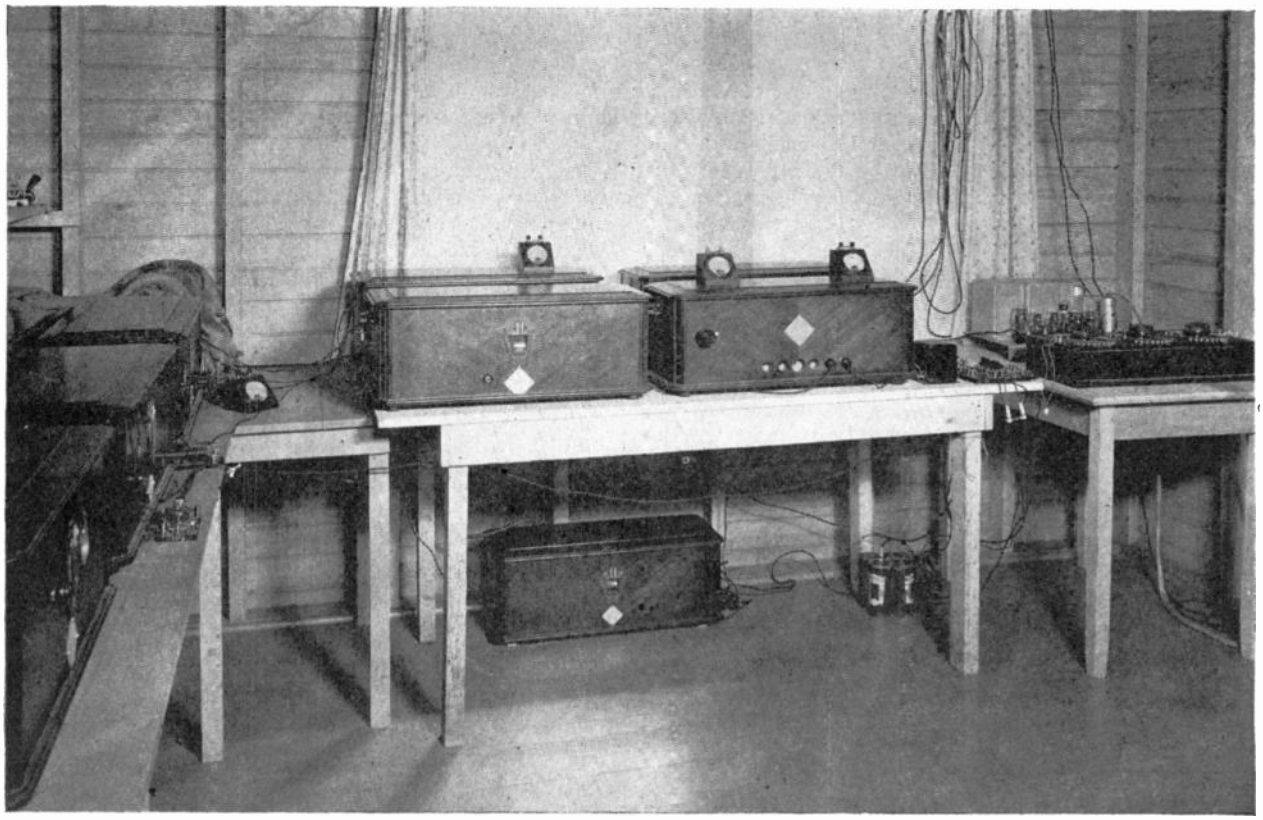


FIG. 22. THE AM RECEIVER USED AT WESTHAMPTON BEACH FOR THE FM-AM COMPARISON TESTS

would appear on the system, while all programs on the regular broadcast system would be in a hopeless condition. Background noise due to thermal agitation and tube hiss were likewise much less than on the regular broadcast system.

The work at Westhampton demonstrated that in comparing this method of transmission with existing methods two classes of services and two bases of comparisons must be used. It was found that the only type of disturbance of the slightest importance was that caused by the ignition systems of automobiles, where the peak voltage developed by the interference was greater than the carrier level. In point-to-point communication this difficulty can be readily guarded against by proper location of the receiving system, and then thermal agitation and shot effect are the principal sources of disturbance; lightning, unless in the immediate vicinity, rarely producing voltages in excess of the carrier level which would normally be employed to suppress the thermal and shot effects. Under these conditions the full effect of noise suppression is realized and comparisons can be made with precision by means of the method already described in this paper. An illustration of the practical accomplishment of this occurred at Arney's Mount, the television relay point between New York and Camden of the Radio Corporation of America. This station is located about sixty miles from the Empire State Building and the top of the tower is only a few feet below line of sight. It is in an isolated spot and the noise level is almost entirely that due to the thermal and shot effects. It was noted by C. M. Burrill of the RCA Manufacturing Company who made the observations at Arney's Mount that with fifty watts in the antenna frequency modulated (produced by a pair of UX 852 tubes), a signal-to-noise ratio of the same value as the two-kilowatt amplitude modulation transmitter (eight-kilowatt peaks) was obtained.

FIG. 23. POWER STAGES OF THE FM TRANSMITTER. (THIS ILLUSTRATION IS NOT SHOWN BECAUSE THE ORIGINAL PHOTOGRAPH IS MISSING)

The power amplifier and the intermediate power amplifier of the frequency modulation transmitter is shown in Fig. 23. The signal with fifty watts output would undoubtedly have had a better noise ratio than the two-kilowatt amplitude modulation system had full deviation of seventy-five kilocycles been employed, but on the occasion it was not possible to use a deviation of greater than twenty-five kilocycles. It was also observed at the same time that when the plate voltage on the power amplifier was raised to give a power of the order of 200 watts in the antenna a better signal-to-noise ratio was obtained than that which could be produced by the two-kilowatt amplitude modulation. A casual comparison of the power amplifier stages of the frequency modulation transmitter shown in Fig. 23 with the water-cooled power amplifier and modulation stages of the Empire State transmitter is more eloquent than any curves which may be shown herein.

In the broadcast service no such choice of location is possible and a widely variable set of conditions must be met. Depending on the power at the transmitter, the elevation of the antenna, the contour of the intervening country, and the intensity of the interference there will be a certain distance at which peaks of ignition noise become greater than the carrier. The irregularity and difficulty of reproduction of these disturbances require a different method of comparison which will be hereinafter described.

As the site at Westhampton, which was on a section of the beach remote from man-made static, was obviously too favorable a site, a new one was selected in Haddonfield, New Jersey, and about the end of June the receiving apparatus was moved there and erected at the home of Harry Sadenwater. Haddonfield is located about eighty-five miles from New York in the vicinity of Camden, New Jersey, and is over 1000 feet below line of sight of the top of the Empire State Build-

ing in New York. Although the field strength at Haddonfield was considerably below that at Westhampton Beach, good reception was obtained almost immediately, the sole source of noise heard being ignition noise from a few types of cars in the immediate vicinity of the antenna, or lightning striking within a few miles of the station. At this distance fading made its appearance for the first time, a rapid flutter varying in amplitude three- or four-to-one being frequently observable on the meters. The effect of it was not that of the selective fading so well known in present-day broadcasting. Very violent variations as indicated by the meters occurred without a trace of distortion being heard in the speaker. During a period of over a year in which observations have been made at Haddonfield, but two short periods of fading have been observed where the signal sank to a level sufficient to bring in objectionable noise, one of these occurring prior to an insulation failure at the transmitter.

It is a curious fact that the distant fading, pronounced though it may be at times, is not so violent as that which may be encountered at a receiving station located within the city limits of New York. The effect, which appears to be caused by moving objects in the vicinity of the receiving antenna, causes fluctuations of great violence. It was apparently first observed by L. F. Jones of the RCA Manufacturing Company within a distance of half a mile of the Empire State transmitter. It occurs continually at Columbia University located about four miles from the Empire State transmitter but no injurious effect on the quality of transmission has ever been noted.

While at first, because of the lower field strength at Haddonfield and the greater prevalence of ignition disturbances, the superiority over the regular broadcast service was not so marked as at Westhampton Beach, the subsequent improvements which were instituted at both transmitting and receiving ends of the circuit have more than offset the lower signal level. Some idea of their extent may be gained by comparison of the initial and final antenna structures. Fig. 24 shows the original antenna during course of erection, a sixty-five foot mast bearing in the direction of New York permitting the use of an eight-wave length sloping wire of very useful directive properties. Fig. 25 shows the final form on which the results are now much better than were originally obtained with the directional wire.

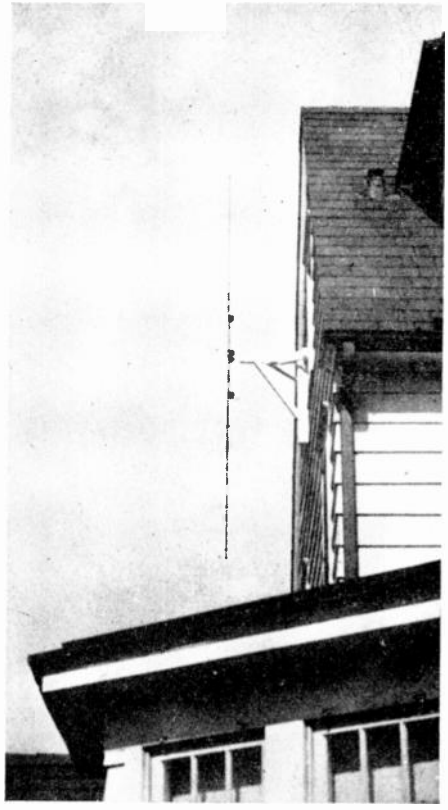


FIG. 25. IMPROVED ANTENNA USED LATER FOR RECEPTION AT HADDONFIELD, N. J.

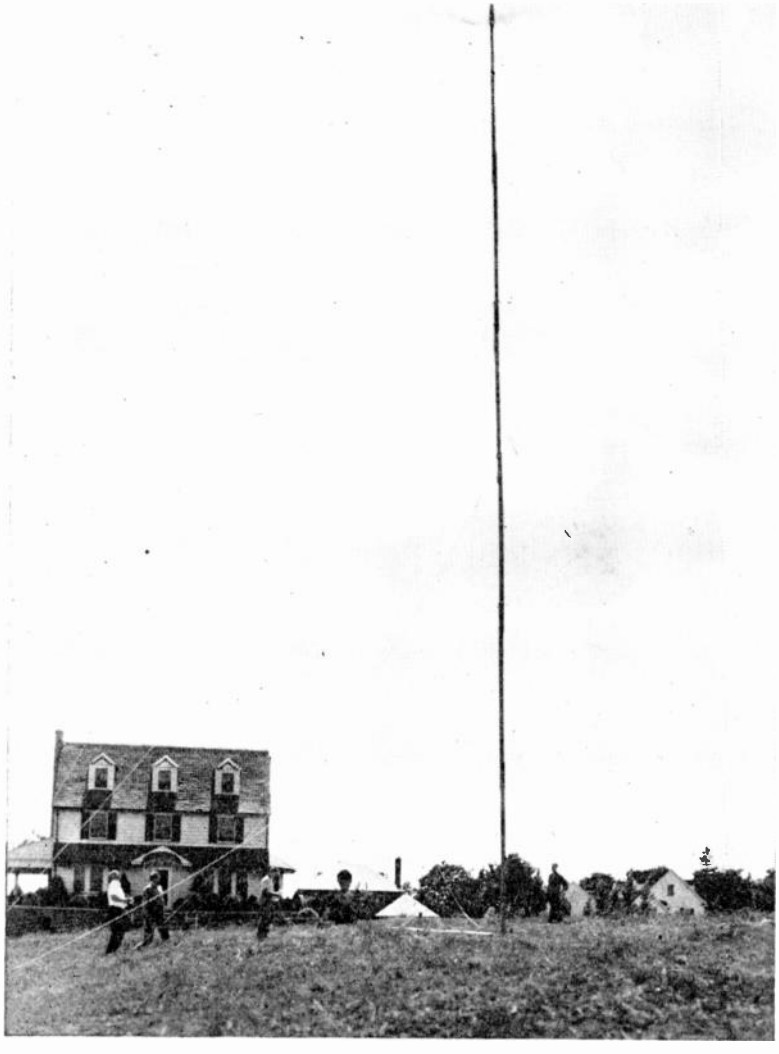


FIG. 24. RECEIVING ANTENNA IN COURSE OF ERECTION, HADDONFIELD, N. J.

During the past summer, which was marked by thunderstorms of great severity in the vicinity of Philadelphia, it was the exception when it was agreeable or even possible to listen to the nightly programs of the regular broadcast service from the fifty-kilowatt New York stations. In some of the heaviest storms when lightning was striking within the immediate vicinity of the antenna, so close in fact that the lead-in was sparking to a near-by water pipe, perfectly understandable speech could be received on the frequency modulation system, although the disturbance was sufficient to cause annoyance on a musical program; but these periods seldom lasted more than fifteen minutes when the circuit would again become quiet. On numerous occasions the Empire State signal was better than that of the fifty-kilowatt Philadelphia station WCAU located at a distance of twenty miles from Haddonfield. Likewise during

periods of severe selective side-band fading in the broadcast band which occurs even from station WJZ at Bound Brook, New Jersey, some sixty miles away, no signs of this difficulty would appear on the ultra-high-frequency wave.

Some of the changes which contributed to the improvement during the past year may be of interest. The introduction of the Thompson-Rose tube permitted the radio-frequency amplification required at forty-one megacycles to be accomplished with one stage and with considerable improvement of signal-to-noise ratio. It had a further interesting result. The tubes previously used for amplifying at this frequency were those developed by the Radio Corporation for the ultra-short-wave inter-island communication system in the Hawaiian Islands. On account of the relatively low amplification factor of these tubes the shot effect in the plate circuit of the first tube exceeded the disturbances due to thermal agitation in the input circuit of that tube by a considerable amount. With the acorn type tube, however, the situation is reversed, the thermal noise contributing about seventy-five per cent of the rectified output voltage.

It should be noted here by those who may have occasion to make this measurement on a frequency modulation system that it cannot be made in the ordinary way by simply mis-tuning the input circuit to the first tube. To do so would remove the carrier from the current limiter and be followed by a roar of noise. The measurement must be made with a local signal of the proper strength introduced into one of the intermediate-frequency amplifiers. Under these conditions the antenna may be mis-tuned without interfering with the normal action of the limiter and the relative amounts of noise due to the two sources may readily be segregated.

Considerable trouble was caused during the early stages of the experiments by an order of the Federal Radio Commission requiring the changing of the frequency of the Empire State transmitter from forty-four to forty-one megacycles; this necessitating the realignment of the large number of interstage transformers in the modulating equipment shown in Fig. 20 and also the retermination of the antenna. It, however, led to the application of the idea inherent in superheterodyne design. While the circuits of the old modulator were temporarily modified and work carried on, a new modulation system was designed standardizing on an initial frequency of 100 kilocycles which was then multiplied by a series of doublers up to 12,800 kilocycles. By means of a local oscillator this frequency was heterodyned down to 1708 kilocycles, the new value of input frequency to the transmitter required to produce forty-one megacycles in the antenna. Any future changes in wave length can be made by merely changing the frequency of this second oscillator. The frequencies chosen were such that a deviation of 100 kilocycles could be obtained without difficulty, because of the extra number of frequency multiplications introduced. Fig. 26 shows the two modulation systems during the process of reconstruction with arrangements for making the necessary step-by-step comparisons between them.

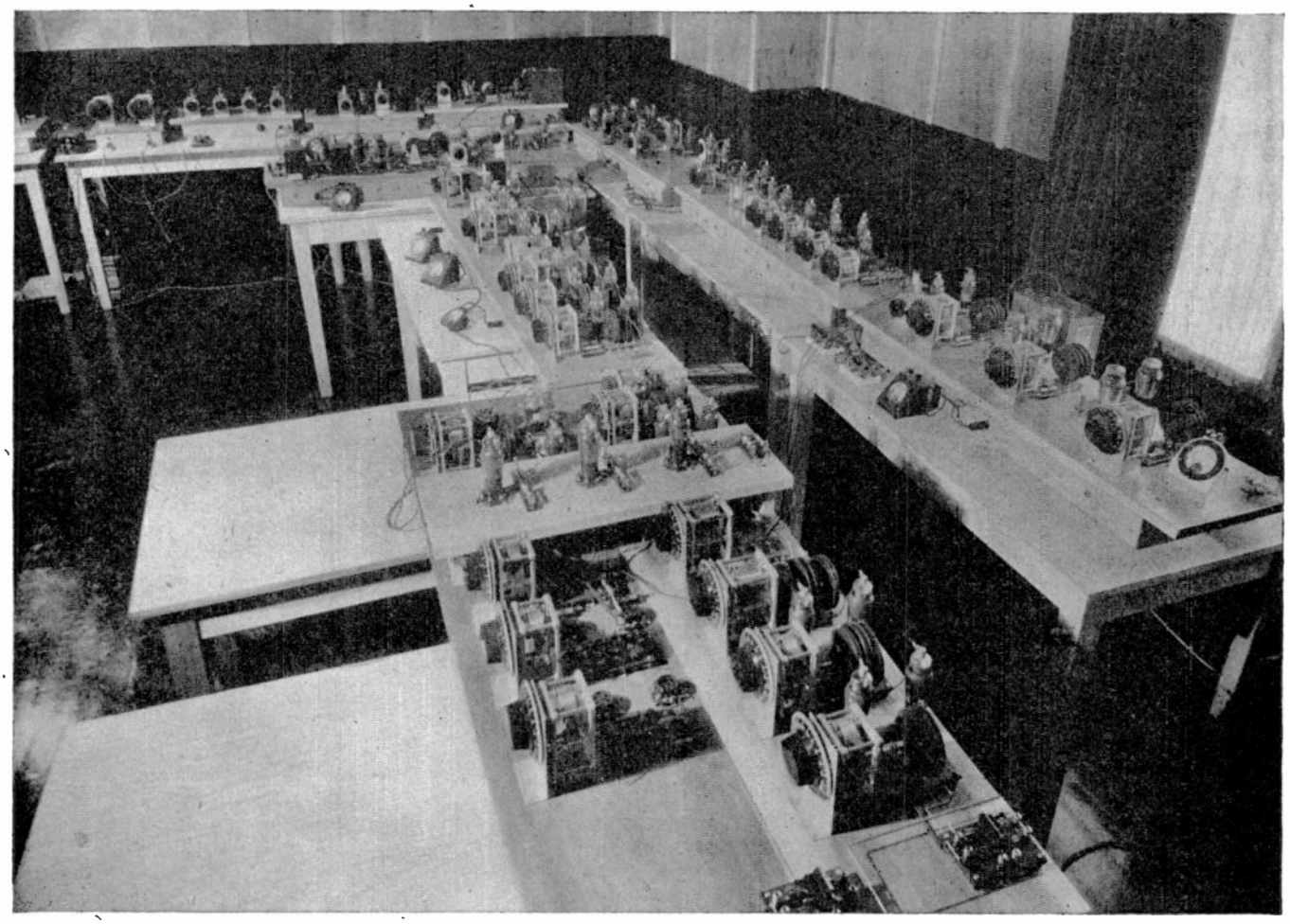


FIG. 26. TWO MODULATION SYSTEMS IN THE PROCESS OF RECONSTRUCTION, AND ARRANGEMENTS FOR COMPARING PERFORMANCE

Much attention was paid during the year to the frequency characteristic of the transmitter, which was made substantially flat from thirty to 20,000 cycles. This required careful attention to the

(CONTINUED ON PAGE 75)

EMERGENCY RADIO STATIONS AND SUPERVISORS

Directory of Marine Fire, Forestry, Special Emergency, Police Systems, with Separate List of Supervisors

MARINE FIRE RADIO SYSTEMS

LOUISIANA

New Orleans 2 Canal St Bd of Commissioners

MASSACHUSETTS

Boston 59 Fenway McCarron JA FA

MAINE

Portland 118 Federal

MICHIGAN

Detroit 697 Macomb A

NEW YORK

New York Municipal Bldg Chambers & Centre Fendrich V A

WASHINGTON

Seattle 301 2nd Av

FORESTRY DEPARTMENT RADIO

ALABAMA

Chapman Dept Conservation Div of Forestry Goodson GM A

CALIFORNIA

Bakersfield 1025 Golden State Av Whiting WE A
Los Angeles 524 N Spring Black CW A
Sacramento State Bldg Div of Forestry Koch WF FA
Salinas 210 Salinas
San Bernardino 3770 Sierra Way Doolittle LP A

CONNECTICUT

Hartford 165 Capitol Av Forestry Dept

FLORIDA

Jacksonville National Turpentine & Pulpwood Corp
Tallahassee Fla Forest & Park Serv Atkinson RL A

GEORGIA

Brunswick Div of Forestry Ervin JE A
Fargo Superior Pine Prods Co Mattox EA A
South Newport Union Bag & Paper Corp Morgan JT A
Springfield 601 Sangamon Av Dept Pub Safety
Townsend S Newport Morgan JT A

MASSACHUSETTS

North Easton 5 Sullivan Av Good GR A

MARYLAND

Baltimore 1409 Fidelity Bldg Dept Forests & Parks
Boston 20 Somerset Dept Conservation
North Easton 5 Sullivan Av Bailey AW A

MICHIGAN

Roscommon Dept Conservation Slocum OB FA
St Paul 343 State Office Bldg Forest Serv

MISSOURI

Jefferson City Monroe Bldg White GO A

NEW HAMPSHIRE

Concord State Off Bldg Cutting BF A

NEW JERSEY

Trenton 143 E State Davis RW A

NEW YORK

Albany Conservation Dept Hyde SJ A

OKLAHOMA

Oklahoma City Capitol Bldg Div of Forestry

OREGON

Salem 2600 State Dept of Forestry Sanders F A

PENNSYLVANIA

Harrisburg Dept Forest & Waters Beaver JA A

RHODE ISLAND

Providence State House Forest Serv

SOUTH DAKOTA

Hermosa Custer State Pk Burns EL F

VIRGINIA

Charlottesville University Station Conservation Comm

WASHINGTON

Olympia Div of Forestry

WISCONSIN

Tomahawk Conservation Comm McGinnis HJ A

HOW TO USE THIS DIRECTORY

Listings by state and city show the name of the radio supervisor. Letter at extreme right indicates: A, amplitude modulation; F, frequency modulation; FA, amplitude talk-out and frequency modulation talk back.

In the Directory of Supervisors, letter at extreme right shows where the supervisor's station is listed:

E Special Emergency	**R Marine Fire**
F Forestry	**S State Police**
M Municipal	**Z Zone Police**

SPECIAL EMERGENCY SYSTEMS

ALABAMA

Birmingham S Natural Gas Co Bomar LC A
Birmingham Birmingham Gas Co 1200 6th Av N Humphreys A

ARKANSAS

Little Rock City Hall Henning EF F

CALIFORNIA

Grass Valley Idaho Maryland Mines Corp Box 1028 Goggin WL A
Grass Valley Nevada Irrig Dist
Long Beach City Hall
Los Angeles S Cal Gas Co 810 Flower Keeling HJ A
Los Angeles LA Co Flood Control Dist 751 S Figueroa Kennedy ME A
Los Angeles Dept Water & Power 207 S Broadway Matney WM F
Los Angeles Superior Oil Co 930 Edison
Los Angeles S Counties Gas Co 810 Flower Keeling HJ A
Modesto Modesto Irrig Dist Gada R A
Riverside Cal Elec Power Co
Robbins Reclamation Dist 1500 Bouton CD A
Sacramento Dept Pub Works Div of Highways
San Diego San Diego Gas & Elec Co 114 10th Av Adams PH F
San Francisco Southern Pacific Gas Co 65 Market St
San Francisco Ambrose Gherini 220 Montgomery
San Francisco Pacific Gas & Elec Co 245 Market St Caribou PH A
San Francisco Pacific Tel & Tel Co 140 Montgomery
San Francisco Southern Cal Tel Co 140 Montgomery
San Francisco Hayside Co 40 Spear
Santa Cruz Coast Counties Gas & Elec 22 Pacific Av

COLORADO

Denver Mountain States Tel & Tel Co

CONNECTICUT

New Haven Southern New England Tel 227 Church Sundius HW A
New Haven United Illuminating 80 Temple Upham WA F
Waterbury Conn Light & Power Co

DISTRICT OF COLUMBIA

Washington Chesapeake & Potomac Tel Co 725 13th NW
Washington Potomac Elec Power Co 929 E St NW Ferguson VL A

FLORIDA

Miami Fla Power & Light Co 25 E 2nd Av
Tallahassee Fla Forest & Park Serv Atkinson RL A

GEORGIA

Atlanta Southern Bell Tel & Tel Co 67 Edgewood
Fargo Superior Pine Prods Co Mattox EA A
Homerville Cons Timber Protective Organization

IOWA

Hastings Natural Gas Pipeline Co of America A
Truro Natural Gas Pipeline Co of America A
Harper Natural Gas Pipeline Co of America A
Geneseo Natural Gas Pipeline Co of America A

ILLINOIS

Chicago Commonwealth Edison Co 72 W Adams Dondanville RV F
Chicago Natural Gas Pipeline Co of America 20 N Wacker Bulla WT A
Chicago Ill Bell Tel Co 212 Wash
Chicago Chicago Surface Lines 231 S LaSalle Murray PE F
Chicago Texoma Natural Gas Co 20 N Wacker Dr
Springfield Dept Pub Safety Div of State Police
Springfield Dept Pub Works & Bldg Bur State Hwy Maintenance

INDIANA

Fort Wayne Ind Serv Corp 2101 Spy Run Av McKean HK A
Goshen Northern Ind Pub Serv 220–222 S Main Hawk RA F
Indianapolis Pub Serv Co of Ind 110 N Illinois Ashlock HD F
Indianapolis Ind Power & Light Co 1230 W Morris Whaley BW F
Indianapolis Ind Bell Tel Co 240 Meridan Hughes JM A
Marion Ind Gen Serv Co Miller EE FA
South Bend Ind & Mich Elec Co 220 W Colfax Kerschner MA FA

KANSAS

Glasco Natural Gas Pipeline Co of America A
Heizer Natural Gas Pipeline Co of America A
Minneola Natural Gas Pipeline Co of America A
Wichita Kans Gas & Elec Co 1900 E Central Reece L A

KENTUCKY

Louisville Louisville Gas & Elec 311 W Chestnut

MARYLAND

Baltimore Chesapeake & Potomac Tel Co of Baltimore City

MASSACHUSETTS

Boston Boston Cons Gas Co 100 Arlington
Boston Boston Edison Co 182 Tremont
Boston Boston Elevated Railway 31 St James Av
Boston New England Power Co 441 Stuart
Boston New England Tel & Tel 50 Oliver
Brockton Brockton Edison
Jamaica Plain Boston Cons Gas Co 144 McBride Krumscheid FJ F
Sharon Police Dept S Main Wright GC A
Springfield United Elec Light 73 State

MICHIGAN

Detroit Mich Bell Tel 1365 Cass Av Coates AL A
Detroit Dept St Railways 12249 Woodward Av Kirby T A
Detroit Detroit Edison 2000 Second Av
Minneapolis Northern States Power 15 S 5th
Minneapolis Rainy River Improvement Co 500 Baker Arcade Bldg

MISSOURI

St Louis St Louis Pub Serv Co 3869 Park Av Miller BB F
St Louis Union Elec Co of Mo 215 N 12th Blvd Woodward JP F
St Louis SW Bell Tel Co 1010 Pine
Kansas City Kansas City Power & Light Co 1330 Baltimore

MONTANA

Butte Mont Power Co 40 E Bway Blanmeyer WH A

NEBRASKA

Beatrice Natural Gas Pipeline Co of America A
Omaha Northwestern Bell Tel 118 S 19th Smith TH A

NEVADA

Tonopah Calif Elec Power Co Reaves JK F

NEW YORK

Buffalo Div of Water 504 City Hall
Buffalo Buffalo Niagara Elec Corp 535 Wash Av
East Hampton Police Dept Leddy FD F
New York Western Union Tel Co 60 Hudson Corweth HP FA
New York American Tel & Tel 32 6th Av
New York Bd of Trans 250 Hudson
New York Cons Edison Co of NYC 4 Irving Pl
New York NY Tel Co 140 West
Queens LI NY & Queens Elec Light & Power 28–19 Bridge Plaza

OHIO

Akron Ohio Edison Co 47 N Main Nerhood HE F
Alliance Ohio Pub Serv 247 E Main
Canton Ohio Power 606 2nd SE Phillips WM F
Cincinnati Cincinnati St Railway 4th & Walnut
Cleveland Div of Transportation 1404 E 9th
Cleveland Cleveland Trans System 1022 Carnegie Av Teplany AJ F
Cleveland Ohio Bell Tel 750 Huron Rd
Columbus Columbus & Southern Ohio Elec 215 N Front F
Columbus 100 W Hickory Schwartz JW F
Dayton Dayton Power & Light 25 N Main Crouse AV F
Toledo Dept of Pub Serv Div of Water
Toledo Toledo Edison Co Edison Bldg F

OKLAHOMA

Oklahoma City Oklahoma Gas & Elec 321 N Harvey Hartman H F
Tulsa Standolind Pipe Line O'Connor FP A

OREGON

Portland Northwestern Elec 2126 N Lewis Campbell WL A
Portland Portland Gen Elec 621 SW Alder Leidigh WA A
Portland Portland Gas & Coke 920 SW 6th Av

PENNSYLVANIA

Pittsburgh Peoples Nat Gas 545 William Penn Pl Campbell CD
Allentown Penn Power & Light 901 Hamilton
Philadelphia Bell Tel Co of Pa 1835 Arch

(Special Emergency Systems, continued)

Philadelphia Philadelphia Elec 1000 Chestnut
Pittsburgh Duquesne Light 435 6th Av
Pittsburgh Pittsburgh Railway 435 6th Av

PUERTO RICO

Guayama Dept of the Interior Utilization Water Resources

SOUTH CAROLINA

Anderson 401 S Main Ward RB A

TENNESSEE

Chattanooga Dept of Power Operations TVA Bennington FR A

TEXAS

Corpus Christi Central Power & Light 120 N Chaparral
Woods JE F
Beaumont City of Beaumont Mulbery & Walnut
Fritch Texoma Natural Gas Co A
San Antonio 326 Jones Av Gouger B F
Stinnett Texoma Natural Gas Co A

UTAH

Salt Lake City Telegram Pub Co 137–143 S Main

VIRGINIA

Richmond Chesapeake & Potomac Tel Co of Va 703 E Grace Saunders RC A
Roanoke Appalachian Elec Power 129 E Campbell Av
Krebs WW A

WASHINGTON

Everett Water Dept 3102 Cedar
Seattle Puget Sound Power & Light 860 Stuart Bldg
Spokane Washington Water Power 825 Trent Av
MacLean TW A

WEST VIRGINIA

Charleston Chesapeake & Potomac Tel of Va

WISCONSIN

Appleton Wis Mich Power Co 825 S Oneida Brown HH F
Milwaukee Wis Tel Co 722 N Bway

WYOMING

Rock Springs Mountain Fuel Supply 615 Conn Av
Woodrow WA

STATE POLICE RADIO SYSTEMS

ALABAMA

Montgomery Highway Bldg Smyth LJ F

ARIZONA

Phoenix 1701 W Jackson LaRue R A

ARKANSAS

Little Rock 3701 Roosevelt Rd Kiehl CL FA

CALIFORNIA

Sacramento Cal Highway Patrol McKee EH FA

CONNECTICUT

Hartford 100 Washington Boas WJ G

COLORADO

Denver 1308 Lincoln

DELAWARE

Wilmington P.O. Box 629 Gentry JH F

FLORIDA

Miami 1045 NW 50th Demby B F
Tallahassee Florida Highway Patrol

GEORGIA

Atlanta Dept Pub Safety Mattson CL A

ILLINOIS

Springfield 601 Sangamon Av Hopper CL FA

INDIANA

Connersville Ind State Police Brown LW FA
Indianapolis 126 State House Mentzer WV FA
Indianapolis Ind State Police Baumgart RC FA
Jasper Jasper Post No 8 Ind State Police Nolan HC FA

IOWA

Des Moines Dept Pub Safety State Fair Grounds Sutton GR FA
Des Moines State House

KANSAS

Topeka Masonic Temple Miller HB A

LOUISIANA

Alexandria 2420 Lee St Golson WT A
Baton Rouge Foster Dr Golson WT A
Franklin 314 Willow St Golson WT A
Lake Charles Hy 90 East Golson WT A
Leesville 802 Port Arthur Av Golson WT A
Monroe 128 Island Rd Golson WT A

MAINE

Augusta State House Parker RH A
Augusta 66 Hospital Parker RH FA

MARYLAND

Baltimore 21st & Guilford Av

MASSACHUSETTS

Boston Dept Pub Safety Div of State Police Commonwealth Pier F

MICHIGAN

East Lansing S Harrison Rd Walker FW FA
Roscommon Mich Dept of Conservation Slocum OB FA

MINNESOTA

Redwood Falls 200 E 2nd St

MISSISSIPPI

Jackson 2500 N State Coker RC A

MISSOURI

Jefferson City Highway 50 E Wherritt JM FA

MONTANA

Helena E 6th Av & Roberts

NEVADA

Carson City Capitol Bldg Sowle NA A
Reno P.O. Box 890 Sowle NA FA

NEW HAMPSHIRE

Concord Police Dept Cutting BF FA

NEW JERSEY

Trenton 164 W State Kelly F F

NEW YORK

Albany State Capitol Clipperly WL FA

NORTH CAROLINA

Cary Highway Patrol Rte 1 Sloop WB FA
Raleigh Dept Highway Patrol

OHIO

Columbus 111 E Broad

OKLAHOMA

Oklahoma City Dept Pub Safety Kimsey HL FA

OREGON

Salem Highway Shops Cannon CD A

PENNSYLVANIA

Harrisburg State Capitol Bldg Wagner DE FA

RHODE ISLAND

N Scituate State Police Bks Bonat ER FA
Providence Police Dept

SOUTH CAROLINA

Columbia P.O. Box 1498

TENNESSEE

Nashville Dept of Safety Griffith PE A

TEXAS

Austin Camp Mabry Box 1164

UTAH

Elkins Karickhoff RR A
Salt Lake City State Capitol Bldg Littlejohn JB FA

VIRGINIA

Richmond P.O. Box 1200 Dept State Police

WASHINGTON

Olympia Transportation Bldg Dept of Fisheries
Olympia Legislative Bldg Quantz RG FA

WEST VIRGINIA

Moundsville Bucy JF A
Romeny Dept of Pub Safety Freeland JG A
Charleston State Capitol Bldg Koch CF FA
S Charleston Jefferson Park Myers HC FA
Shinnston Powell GM A

WISCONSIN

Madison State Capitol Bldg

WYOMING

Cheyenne State Capitol Bldg

ZONE AND INTERZONE POLICE

ARKANSAS

Little Rock 3701 Roosevelt Rd
Fort Smith New Ct Hse & City Hall

CALIFORNIA

Los Angeles Cty Hall Rm 49
Palm Springs 381 Palm Canyon Dr Platt H FA
Santa Ana 615 N Sycamore

COLORADO

Denver Police Bldg

FLORIDA

Tampa Police Hdqtrs

GEORGIA

Atlanta 175 Decatur Dept Pub Safety
Columbus 937 1st Av

ILLINOIS

Peoria Fulton & Madison
Rockford 425 E State
Springfield 601 Sangamon Av Hopper CL FA

INDIANA

Connersville Ind State Police Brown LW FA
Indianapolis 3445 N Tacoma Baumgart RC FA
Indianapolis 37 S Alabama Batts RL
Indianapolis 126 State House Mentzer WV FA
Jasper Jasper Post 8 Nolan HC FA
Richmond City Bldg

IOWA

Des Moines St Hse Dept Pub Safety
Des Moines Dept Pub Safety State Fairgrounds Sutton GR FA

KANSAS

Topeka 204 W 5th Johnson EN
Wichita 109 E Williams Byers HO A

KENTUCKY

Louisville 1306 Bardstow Rd Lane W F
Louisville 601 W Jefferson

LOUISIANA

Baton Rouge 308 N Blvd
New Orleans 2700 Tulane Av

MARYLAND

Annapolis Gloucester St Rawlings GW A

MASSACHUSETTS

Boston Dept Pub Safety Div State Police Commonwealth Pier

MICHIGAN

Detroit 1300 Beaubien
E Lansing S Harrison Rd
Grand Rapids 35 Crescent
Duluth 2138 Minnesota Av
Pontiac Pike & Mill

MINNESOTA

Minneapolis 2220 Locust S

MISSISSIPPI

Jackson 2550 North

MISSOURI

Jefferson City Mo State Patrol Highway 50 E Wherritt JM FA
Kansas City 1125 Locust
St Louis 1200 Clark Av

NEW MEXICO

Clovis 322 Mitchell

NEW YORK

Buffalo Church & Franklin
Buffalo Delaware Pk Buchanan J FA

OHIO

Akron 168 S High
Cincinnati City Hall
Columbus 117 E Broad St
Cleveland 2001 Payne Av
Toledo 550 N Erie
Youngstown 2107 Market

OKLAHOMA

Lawton 311 S 4th
Oklahoma City 2205 N Central
Oklahoma City Dept of Pub Safety Box 1826 Kimsey HL FA
Tulsa 405 E 4th

OREGON

Salem Police & Hway Dept

PENNSYLVANIA

Harrisburg Main Capitol Bldg Wagner DE FA

TEXAS

Austin Camp Mabry Box 1164
Beaumont Walnut & Mulberry
Fiskville Dept Pub Safety Broman WN A
Wichita 902 Ohio Av

TENNESSEE

Memphis 179 S Barksdale McCoy MN A

UTAH

Salt Lake City State Capitol Bldg Littlejohn JB FA

WASHINGTON

Olympia Transportation Bldg Dept Hways & Patrol Quantz RG FA

WEST VIRGINIA

Charleston Dept Pub Safety Koch CF FA
Romney Dept Pub Safety Freeland JG A
S Charleston Jefferson Pk Dept Pub Safety Myers HC FA

WISCONSIN

Milwaukee 935 N 8th

MUNICIPAL AND COUNTY SYSTEMS

ALABAMA

Anniston 1200 Gurnee Av
Birmingham City Hall Jones RM FA
Dothan N St Andrews
Florence 114 Short Crt

(Municipal & County Systems, continued)

Gadsden N 5th Cook CM
Huntsville P.O. Box 500 Gillis JH A
Mobile 59 St Emanuel Black HP
Montgomery Perry & Madison Av
Northport Main
Sylacauga 1313 3rd
Tuscaloosa 2524 7th Arendale JW A

ARIZONA

Bisbee Box F Sheriff's Office
Flagstaff E Birch LaRue R A
Florence Court House LaRue R A
Mesa 59 N McDonald
Phoenix City Hall
Phoenix 1st Av & Wash
Prescott Court House
Prescott 117 W Goodwin
Safford Sheriff's Office
Tucson Alameda & Church
Tucson City Hall
Winslow 207 2nd Hartley AT A

ARKANSAS

Arkansas City Police Hdqtrs Bailey JE A
Blytheville 2nd & Walnut
Fayetteville Police Hdqtrs Allen D A
Ft Smith New Crt Hse & Cty Hall Fields JD A
Hot Springs Nat'l Pk Quachita Av & Hawthorne
Little Rock Bdway & Markham Henning EF A
Little Rock C'o Jail Henning EF A
Monticello City Hall
N Little Rock 300 Main Stinnett RL A
Pine Buff Barraque & Main
Texarkana Municipal Bldg Henderson EV A

CALIFORNIA

Alameda Santa Clara & Oak
Albany 805 San Pablo Av
Alhambra 18 N Stoneman Av Cowley L A
Anaheim 204 E Center Whiteman WE A
Arcadia 50 Wheeler Locher A A
Atherton 95 Ashfield Rd Harrington WH A
Bakersfield City Hall Fox RH A
Bakersfield 800 Truxton Av Whiting WE A
Banning 165 W Ramsey
Beaumont 500 Grace
Benicia City Hall Davena W A
Berkeley 2171 McKinley Av McKinney LF A
Berkeley 306 Arlington Av
Beverly Hills 450 N Crescent Dr
Brawley 455 N 8th
Brea 403 S Pomona Av
Burbank 275 E Olive Barber ES A
Burlingame 269 Park Rd Hartnett JJ A
Carmel 7th & Dolores Stalter HS A
Chico 441 Main
Chino 701 D Anderson C F
Chula Vista 294 3rd Av Dupree F
Claremont 221 W 2nd Zeigler H A
Colton 146 East I St
Colusa 555 Market
Compton 205 S Willowbrook Hurst WW A
Corona 723 Main Platt H FA
Coronado 1011 6th
Corte Madera City Hall
Culver City 4010 Duquesne Av Dunn HC A
El Centro 142 S 6th
El Centro 9th & State Ware RW
El Cerrito 1300 San Pablo Av A
El Monte 216 S Tyler Av
El Segundo 205 W Franklin Av
Escondido 100 Valley Blvd Thompson VW
Eureka Box 113
Eureka 300 G St Benzinger AE A
Fairfax City Hall
Fairfield Sheriff's Office
Fresno Merced & Bdway Schuler RM FA
Fullerton 124 W Whiting Av
Gardena 1580 Market
Gilroy 3 E 6th
Glendale 111 N Howard Wasmansdorff C A
Grass Valley 127 E Main
Hemet Police Hdqtrs
Hollister Monterey Barlich J FA
Huntington Beach 6th & Orange
Indio 413 Town Av
Inglewood 105 E Queen Muir YE FA
Kensington Pk 306 Arlington Av Tibbetts DR A
Lakeport Court House Reese LM FA
La Mesa 4751 Spring Stuckey AE
Larkspur 404 Magnolia Lewis M A
La Verne 2601 3rd Dove AF
Lindsay P.O. Box 465
Lodi City Hall
Long Beach City Hall
Long Beach City Hall (City of Signal Hill)
Los Angeles 500 Spruce Crowder F A
Los Angeles 211 W Temple Ellison CW FA
Los Banos 520 J McSwain A
Lynwood 11331 Plaza Martin G
Madera 201 W 6th Justice WO FA
Manhattan Beach 1400 Highland Av Ravich MI A
Martinez City Hall
Martinez Court House Burton GK A
Marysville 6th & Oak Le Boeuf M FA
Menlo Park City Hall Harrington W A
Merced 18th & M Margaretic T A
Merced 21st & M Margaretic T A
Mill Valley City Hall
Modesto 1114 H St
Modesto 614 10th
Monrovia 140 E Lime Av Locher A A
Montebello 140 N 6th Hale JN A
Monterey Colton Hall Simpson CE A
Napa 822 Brown
National City 1243 National Av Curtis KM A
Nevada City 317 Broad
Newport Beach 2011 Court
N Sacramento 1501 Del Paso Blvd
Oakland 1225 Fallon
Oakland Grover St Pier
Oceanside 305 N Nevada Berg TH A
Ontario 225 S Euclid Av
Orange 338 E Chapman Av Whiteman Mr A
Oroville Sheriff's Office
Oxnard 617 A St Smith CD
Pacific Grove Forest & Laurel Simpson CE FA
Palm Springs 381 N Palm Canyon Dr
Palo Alto 450 Bryant
Pasadena 142 Arroyo Pkway Calvert HB A
Petaluma City Hall
Piedmont 120 Vista Av Hudson I A
Pomona 232 W 5th
Porterville 201 E Cleveland
Quincy Court House Sowle NA FA
Redlands 215 5th
Redwood City 715 Middlefield Rd Harrington WH FA
Reedley 1752 10th
Richmond 145 Park Pl Watson HM F
Riverside 4000 Orange Platt HO FA
Riverside 4089 Orange Platt HO FA
Roseville City Hall
Sacramento 6th & H Lindfeldt EW A
Sacramento 620 H St
Salinas 144 W Alisal
Salinas W Gabilan St
San Anselmo Tunstead & San Anselmo
San Bernardino 426 3rd
San Bernardino 351 Arrowhead Av Anderson RC A
San Carlos City Hall
San Diego 801 W Market Lewis G A
San Diego 1050 Front
San Fernando 111 Hagar Gorin JL A
San Francisco 205 City Hall
San Francisco Hall of Justice Bogardus HL FA
San Gabriel 530 W Mission Dr
San Jacinto 5th & Sheriff Meek RW A
San Jose Market & San Antonio Kirby H A
San Luis Obispo 867 Higuera
San Marino 2200 Huntington Dr Rothrock J A
San Mateo 215 B St Trinta M A
San Rafael City Hall
San Rafael Court House Lewis JM FA
Santa Ana 217 N Main
Santa Ana 615 N Sycamore Whitman A
Santa Barbara De La Guerra Plaza Brittain HW A
Santa Barbara Court House
Santa Cruz Locust St City Hall
Santa Maria 110 E Cook
Santa Monica 1685 Main Cavaness E A
Santa Rosa Hinton Av City Hall
Sausalito 727 Bridgeway
Seal Beach 8th & Central
Signal Hill 2175 Cherry Av A
South Gate 8439 Victoria Av Martin GL A
S Pasadena 1422 Mission Calvert H A
S San Francisco City Hall
Stockton City Hall
Stockton Court House
Susanville Sheriff's Office Sowle NA FA
Torrance 1515 Cravens
Tracy 25 W 8th
Tulare Kern & M St Police Hdqtrs
Turlock 125 S Front Gada R A
Tustin 135 E Main
Upland 159 D St
Vallejo 724 Marin
Ventura Police Hdqtrs Cleveland WG A
Ventura Sheriff's Office Smith CD FA
Visalia 201 E Acequia
Visalia 202 E Oak
Watsonville 231 Union
W Covina 361 W State Hway Ziegler HW A
Whittier 112 S Bailey Amsbury RL A
Woodland 300 First Bouton CD A
Yreka City Hall

COLORADO

Boulder City Hall
Colorado Spgs City Hall Boatright JD A
Denver 9th & Columbine Derby JR A
Fort Collins 242 Walnut Kelley OP F
Gnd Junction Station KQXT Dexter RL A
Greeley 901 7th Cooper KH A
La Junta 13 E 2nd
Longmont 4th & Kimbark Cooper K FA
Pueblo 125 Central Main Barraclough RE A
Sterling 214 Poplar

CONNECTICUT

Bridgeport 398 Fairfield Av Fraser CF FA
Bristol 17 N Main Muckel CD F
Danbury Main Oliva SJ A
Darien Hecker Av Whitney LH
Dover E Loockerman
E Hartford 740 Main
Fairfield 100 Reef
Glastonbury 2367 Main Hall GC A
Greenwich Greenwich Av
Hamden 2372 Whitney Av
Hartford Market & Kingsley Taylor HD A
Manchester 66 Center
Meriden Liberty City Hall
Middletown 255 Main Reed GU A
Milford West Rivr Parkinson TP A
N Britain Police Hdqtrs Perkoski SC A
New Haven 165 Court
N London 57 N Bank Morey GJ F
Norwich Union Square
S Norwalk City Hall
Stamford City Hall
Stratford 2725 Main Nichols WB
Suffield Town Hall Gould JR A
Terryville 100 Main Mukkel CW F
Thompsonville Town Hall Broderick HM A
Torrington City Hall
Trumbull Town Hall Beckwith R F
Waterbury 235 Grand Sullivan EF F
W Hartford 28 S Main
W Haven Main Brill F F
Westport 52 E State
Wethersfield 193 Wells Rd
Wilmington 10th & King

DISTRICT OF COLUMBIA

Washington Interior Bldg Havens AG F
Washington District Bldg Beall F FA

FLORIDA

Bradenton 12th & Manatee Av
Clearwater 100 N Garden Av
Clearwater Box 238 Ponce de Leon
Daytona Beach Marion & Magnolia Grogan WH A
Dunedin City Hall
Ft Lauderdale 117–119 S Andrews Av Schwerdt CV A
Ft Pierce City Hall Curl ME A
Ft Myers Police Hdqtrs
Gainesville Court House
Gainesville City Hall
Hallandale Police Hdqtrs
Holly Hill Ridgewood Ave Grogan WH A
Hollywood W Hollywood & 26th Person LL A
Jacksonville 1040 Laura Connell EW A
Jacksonville City Hall
Lakeland Police Hdqtrs
Lakeland Sheriff's Office
Lake Worth 1010 Lucerne Av Curl ME A
Miami 3810 NW 8th Av Demby B FA
Miami Beach 1130 Wash Av Bate C A
Ocala Court House
Orlando Main & Court
Orlando 1 W Jackson Sachse FJ A
Palm Beach Municipal Bldg Curl ME A
Panama City 407 Luverne Av Beach CH A
Panama City Court House Sq Beach CH F
Pensacola Jefferson & Main Mead GE A
St Augustine City Bldg F
St Petersburg P.O. Box 820 Hirshberg HD A
Sanford 300 N Park Av Williams RG A
Sarasota 6th & Lenon Av
Sarasota P.O. Box 631
Tallahassee 107 S Adams Douglas SM A
Tampa Florida Av & Jackson Bailey DC A
W Palm Beach 116 S Dixie Curl ME A

GEORGIA

Americus City Hall Wrothy JN
Atlanta 175 Decatur SE Fleming JC A
Augusta 104 9th Aderhold HR FA
Brunswick 200 Mansfield Av
Columbus 937 First Av
La Grange 200 Ridley
Macon Poplar & Cotton City Hall
Rome City Auditorium
Savannah 2 W Broughton
Thomasville Jackson & Crawford
Valdosta 105–107 S Ashley
Waycross 417 Pendleton

HAWAII

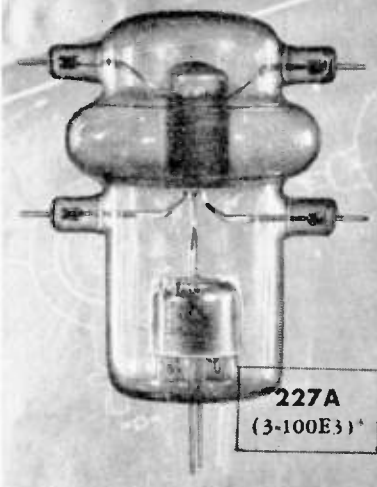
Hilo 141 Kalakaua Av Larsen G A
Honolulu Bethel & Marchant Chock WYK
Wailuku High St Box 157 Sousa JF A

IDAHO

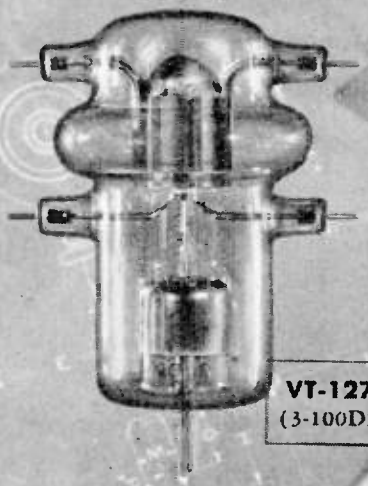
Boise 118 N 8th French E FA
Boise 512 Jefferson
Coeur d'Alene Sheriff's Office
Emmett 415 E Main Riggs BG
Lewiston 13th & Main Steiner HE A
Moscow Court House Harland R A
Nampa 203 12th Av
Pocatello 239 E Lewis Mitchell J A

ILLINOIS

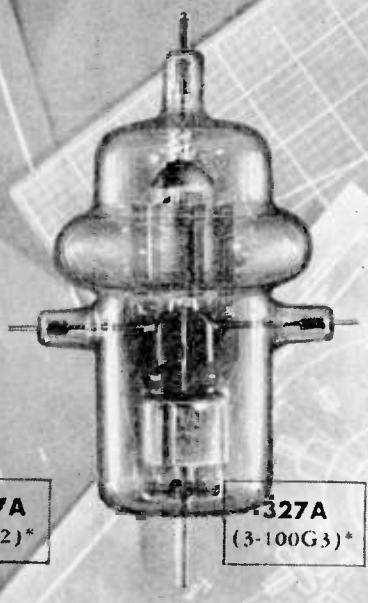
Alton 101 E 3rd Rungle B A
Argo 7731 W 66th Pl
Arlington Hgts Police Hdqtrs
Aurora 15 Fox Dickerson CA A
Bartonville Village Hall
Batavia Island Av
Belleville 101 S Illinois Dechant LE A
Belvidere N Main Sheriff's Office Bennett PC A
Berwyn 26th & Wesley
Bloomington 310 N Madison Farnsworth JD A
Bloomington Wash & East Farnsworth JD A
Cairo 1111 Commercial Montgomery R A
Calumet City 202 Pulaski Rd
Canville 24 N Walnut Nolan C A
Centralia 222 S Poplar Vaughn EP A
Champaign 102 N Neill
Chicago City Hall
Chicago Hgts 1600 Halsted Hahn GW FA
Chicago Morgan Pk Station Village of Calumet Pk
Cicero 4932 W 25th Pl Spevacek J A
Clinton Court House
Clinton 316 W White Farnsworth JD FA
Collinsville 100 Church
Danville Court House
Decatur City Hall
Decatur 227 E Wood
Des Plaines Graceland & Miner Graham K A
Dolton Police Hdqtrs
Downers Grove 5154 Main
E St Louis 111 N Main Rungle B
E Peoria City Hall Wright CL
Edwardsville Court House
Elgin N Spring Kadow AC A
Elmhurst 118 Schiller Johns OG A
Elmwood Pk City Hall Dodman J F
Evanston 1556 Sherman Av Perdew WH F
Evergreen Pk 94th & Kedzie Av
Flossmoor Sterling Av Dineen JB A
Forest Pk City Hall
Freeport 7 N Walnut Av Price CW F
Galesburg Police Station Bevenour RW F
Geneva James & Third Kadow AC A
Glencoe 675 Vernon Av
Glen Ellyn 498 Pennsylvania Av Brierton LW A
Glenview 965 Pine Melka E A
Granite City 20th & Edison Rungle B
Harvey 156 E 154
Highland Pk St Johns & Hazel Av Kopp ME A
Hinsdale 23 E 1st
Homewood 2020 Chestnut Rd
Joliet 76 N Joliet Bowdre W F
Joliet 116 N Joliet
Kankakee 441 E Court Chinski EJ A
Kenilworth 419 Richmond Rd
La Grange Town Hall
Lake Forest 665 Forest Av Tiffany F A
Lansing 3400 Lake
La Salle City Hall Nicholson RM F
Libertyville 166 W Cook Av Quandt HF A
Lincoln City Hall Bldg Farnsworth JD A
Lincoln 816 Broadway Farnsworth JD A
Lyons 1701 Ogden Av
Maywood 1601 Roosevelt Rd
Moline 619 16th Anderson R A
Morton Grove 8525 Callie Av Melka EG A
Morton Grove 6918 N Keeler Av
Mt Vernon Courthouse Featherstun AH F
Mt Vernon 1100 Main Featherstun AH F
Mundelein Police Hdqtrs
Naperville 128 W Jefferson
Normal 128 Beauford Farnsworth JD A
Oak Park Euclid Av & Lake Watson VL A
Oglesby Police Hdqtrs
Ottawa 105 Lincoln Pl Nicholson RM A
Ottawa 829 Columbus Nicholson RM F
Pk Ridge Touhy Av & Park Av Johnson HW F
Pekin Court House
Pekin 400 Margaret Patterson WK A
Peoria Fulton & Madison Birren WL A
Peoria Court House
Peru 1530 4th
Princeton 750 S Main Billeaux GM F
Quincy 301 Hampshire Hartman PF A
Riverdale 137 & Wabash Av Fuller F A
River Forest 400 Park Av
River Grove 2601 Thatcher Av
Riverside 127 Riverside Rd Hefele CP F
Rockford 417 Elm
Rockford 410 Walnut Ward LS A
Rock Island 1528 Third Av
St Charles Police Hdqtrs
Skokie 5127 Oakton Melka E A
S Beloit 519 Blackhawk Blvd Graves
Springfield Court House
Springfield 621 E Jefferson
Streator Police Station



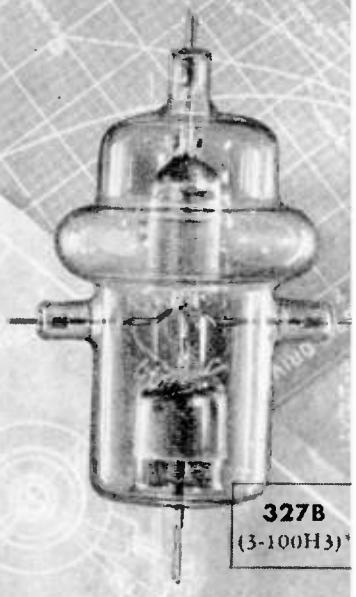
227A
(3-100E3)*



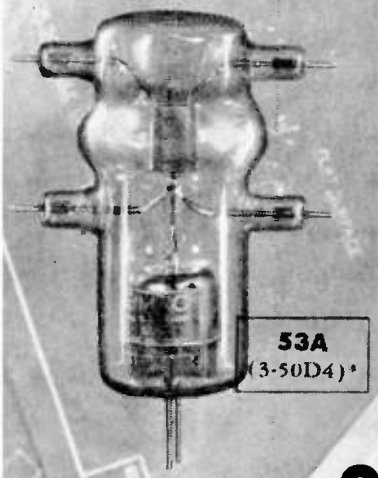
VT-127A
(3-100D2)*



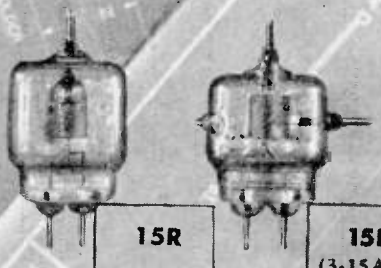
327A
(3-100G3)*



327B
(3-100H3)*

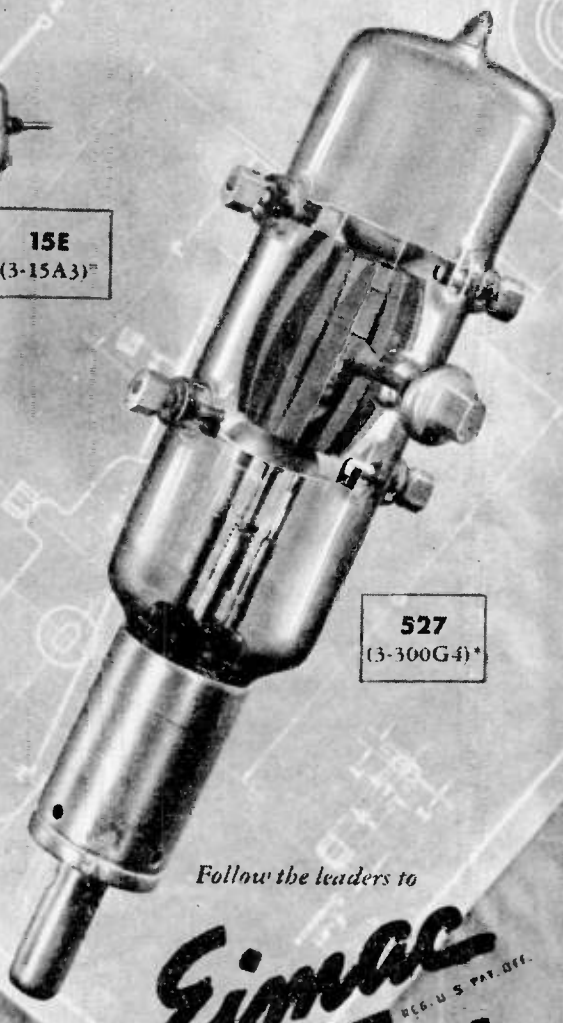


53A
(3-50D4)*



15R

15E
(3-15A3)*



527
(3-300G4)*

Here are 8 special purpose Vacuum Tubes originated, developed and quantity produced by Eimac during the past few years

*The designations on these tubes are new Eimac type numbers which are descriptive of the tube characteristics. For example (3-100G3): the first digit 3 indicates triode, the figure 100 indicates plate dissipation, the letter "G" indicates physical type and the last digit 3 is a code indication of the mu of the tube.

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Urbana Broadway City Hall Wainscott JM A
Villa Park 20 S Ardmore Av Wozniak C A
Waukegan 111 Madison Duncan D A
Waukegan 316 Wash Quandt HF FA
Waukesha 130 Delafield
Western Spgs 914 Hillgrove Dondanville RV F
W Chicago 132 Main
Wheaton Police Station
Wheaton Court House Fettweis CP FA
Wilmette 1200 Wilmette Av Hall TE F
Winnetka 510 Green Bay Rd Halbert L A

INDIANA

Anderson 732 Central Av Titus AJ A
Anderson 708 Main Titus AJ A
Alexandria City Hall Titus AJ A
Angola Co Jail
Auburn City Hall Hull MJ A
Auburn 204 S Cedar Miller P FA
Bedford City Hall May Clarence F
Bloomington City Hall
Bluffton 128 E Market Hull MJ A
Columbia City Court House Hull MJ
Columbus City Hall
Connersville State Police Bks Brown LW A
Connersville West 4th Brown LW A
Crawfordsville Court House Burkhardt FR A
Crawfordsville City Hall
Crown Point Bd of Commissioners
E Chicago 4535 Indianapolis Stull JL A
Elkhart 133 E Franklin Wiegner WW A
Elwood 16th & Main Hickey J A
Evansville 200 SE 3rd Covert ND A
Evansville Court House
Ft Wayne Court House
Ft Wayne 319 E Main Gaskill RJ A
Frankfort Court House
Frankfort 10 Main Nickols GL A
Gary 30 E 7th Av Billick P F
Goshen 111 N 3rd Hawk R A
Goshen 124 W Lincoln Av Hawk R A
Greencastle Court House
Hammond 5925 Calumet Av Maynard GV A
Hartford City Court House
Huntington City Bldg Hull MJ A
Huntington Court House
Indianapolis 33–37 S Alabama Batts RL A
Indianapolis 36 S Alabama Petit O A
Jasper Police Hdqtrs
Kokomo Walnut & Wash Snyder H A
Lafayette City Hall Garba HC A
La Porte 803 Indiana Av
La Porte Court House
Logansport 6th & Bdway
Logansport Court House
Marion Adams & 2nd Welcht B A
Michigan City Superior Court House
Mt Vernon 530 Main Covert ND A
Muncie Jackson & Jefferson Smith RO A
New Castle 1311 E Church Wood CM A
Noblesville Court House Titus AJ A
Noblesville City Hall Titus AJ A
Peru 21 E 3rd
Richmond 2 SW 11th McDonald R FA
Richmond N 5th McDonald R FA
Shelbyville Court House
Shelbyville 54 W Washington
South Bend 214–222 N Main Wery LH
Terre Haute City Hall Casteel F A
Valparaiso Court House
Valparaiso 16 Indiana Av
Vincennes 14 S 4th Nutty G A
Wabash City Hall
Wabash Court House
Warsaw City Hall
W Lafayette City Hall Garba HC A
Whiting 1600 Fishrupp Av Springgate RS F

IOWA

Ames Kellogg & 5th
Burlington 412 Valley Klein AG A
Cedar Rapids 310–312 2nd Av SW Nemec HJ A
Clinton 611 S 3rd
Council Bluffs 211 Pearl
Davenport 216–230 W 4th Phillips R A
Des Moines E 1st St & Court Av
Dubuque 13th & Central Av Osterhoff JI
Ft Dodge 813 1st Av S Sinclair DG A
Ft Madison Av E & 8th St Taylor DE A
Iowa City City Hall White OA A
Mason City 19 S Delaware Av Whiteman UF FA
Marshalltown 24 N Center
Oskaloosa 220 S Market McGlothlen M A
Ottumwa 124 N Market McGlothlen M A
Sioux City 116 6th Cooper JD A
Waterloo 619 Lafayette Whitman SB F

KANSAS

Abilene 415 N Broadway
Atchison 6th & Kansas Av Linville WC A
Chanute 2nd & S Santa Fe
Coffeyville 7th & Walnut Jaminet JS A
Dodge City 4th & Spruce Hickman R A
Eldorado 101 N Vine
Emporia Municipal Auditorium Davis HC A
Garden City 113 E Chestnut Snyder RW A
Girard 229 S Ozark
Great Bend Lakin & Williams Houdyshell VH A
Hutchinson 18 E Av B Baumhart DG A
Iola 119 ¼ W Madison Gardner H A
Kansas City 710 N 7th St
Kansas City 805 N 6th Wilt J A
Lawrence 747 Vermont Ciesner C F
Leavenworth City Hall
Manhattan 112 N 3rd FA
Pittsburgh 4th & Pine Stafford LS FA
Salina 114 E Ash Bayne RL FA
Topeka 204 W 5th Johnston EN A
Wichita 115 E Williams Byers HO A

KENTUCKY

Ashland 17th & Greenup
Bowling Green 10th & College Gerard JI A
Covington 3rd & Court Dickerson JE F
Earlington 105 W Main
Hazard E Main Igoe O F
Henderson Police Hdqtrs
Henderson Sheriff's Office
Hopkinsville 501 S Main
Lexington Main & Upper Helt S A
Lexington City Hall
Louisville 601 W Jefferson Russell FW A
Louisville 1306 Bardstow Rd Lane W F
Madisonville Court House A
Madisonville 209 ½ E Center Collins WH F
Maysville 223 Court
Owensboro 325 St Ann McIntyre MM A
Paducah 4th & Kentucky Av Clark RW A

LOUISIANA

Alexandria 518 Lee Sandefur MN A
Baton Rouge Court House
Baton Rouge 305 N Blvd
Bogalusa Arkansas St Toups EC F
Franklinton Sheriff's Office Watts FW F
Lake Charles 1000 Ryan St Ayers JC
Monroe City Hall Morgan OL FA
New Iberia 110 W Main Wheeler RK A
New Orleans 2700 Tulane Av
Shreveport P.O. Box 1192 801 Crockett

MAINE

Auburn 45 Spring
Houlton Brackett WE F
Lewiston Park St Perkins FM A
Portland 132 Federal Barry TH A
Presque Isle 5 Church
Rockland 62 Union
S Portland City Hall

MARYLAND

Annapolis Gloucester Rawlings GW A
Baltimore Fallsway & Fayette Taylor WE A
Bel Air Main St Fulker RA F
Cumberland Liberty & Frederick Orr J F
Eastport Police Hdqtrs
Ferndale Police Hdqtrs Souers JH A
Frederick City Hall
Galesville Police Hdqtrs
Hagerstown Potomac St. McIntire GW A
Hyattsville 5012 Rhode Island Av Mackall L A
Pikesville State Armory Weber WH F
Rockville Court House
Salisbury City Hall
Silver Spgs 8135 Georgia Av Culver FE F
Towson Police Hdqtrs

MASSACHUSETTS

Acton Main St
Andover Park St Zink A A
Arlington 7 Central Scannel CW F
Athol 206 Exchange Callahan WJ F
Attleboro Wall St Marron PJ A
Auburn Rockland Rd
Belmont Police Hdqtrs Heyd WG
Beverly Cabot St Anderson RF A
Boston 154 Berkeley Vickerson AH A
Boston 20 Somerset McFarlane DJ F
Braintree Union St Myrbeck EF A
Brighton Soldiers Field Rd McFarlane DJ FA
Brockton 30 E Elm Macadam ML A
Brookline 339 Washington Charlton WA F
Cambridge 7 Western Av Tierney EF F
Chelmsford Town Hall
Chelsea Chelsea Sq Police Hdqtrs F
Cohasset 8 Main
Concord Monument Sq
Danvers 7 School
Dartmouth Russells Mills Rd
Dedham 600 High
E Weymouth 1391 Pleasant Ells RP A
Everett 371 Broadway
Fairhaven Town Hall Parker ET F
Fall River Bedford St
Fitchburg 20 Elm
Foxborough 24 School Dean JP A
Gardner 115 Pleasant
Gloucester 10 Duncan
Greenfield Main St Wheeler LF F
Haverhill Court St
Hingham Lincoln St Sylvester A A
Holyoke Newton Place Senay A A
Hudson Police Hdqtrs
Lawrence 16 Lawrence
Leominster West St Smith GH A
Lexington 1625 Mass Av
Lincoln Bedford Rd
Longmeadow Town Hall
Lowell 12 Market Morrison HA A
Lynn 18 Sutton
Lynnfield Summer St Anderson RT F
Malden 15 Middlesex Porter JF A
Manchester Central St
Mansfield Town Hall Nielson AJ A
Marblehead Washington St A
Medford 80 Main MacInnis JA A
Methuen Town Hall Fengill C F
Milton 36 Central Av
Nantasket Beach P.O. Drawer 6
Natick 2 Park St
Needham 99 School Rowe MB A
New Bedford 25 Spring Soboski W F
Newton 1325 Wash Hartford WW A
North Adams 40 Rear State Lavendoll L
Northampton Center St Egan AC F
North Andover Town House McKee AH A
Norwood Nahatan St Babcock HC F
Phillipston Police Dept Harrington J A
Pittsfield 39 Allen Marcel CL F
Plymouth Russell St Dearborn RP A
Quincy 442 Southern Artery Duffy JP A
Reading Pleasant St
Revere Pleasant St Tranfaglia T A
Rockport 37 Broadway
Salem 17 Central Stacey FA A
Saugus 7 Taylor Anderson RF A
Scituate First Parish Rd
Sharon 8 Main Town Hall
Somerville 67 Union Sq MacInnis JA A
Southbridge Maine St Police Hdqtrs
S Dartmouth Russells Mills Rd Brownell CH A
Springfield 80 Court St
Stoneham Police Hdqtrs
Taunton 16 Court St McNamee G F
Tewksbury Police Hdqtrs
Wakefield Town Hall F
Waltham City Hall
Wareham Marion Rd Town Hall
Watertown 38 Cross
Wellesley Waban St Police Hdqtrs
Westfield Broad St
Westford Boston Rd Police Hdqtrs
West Newton 1325 Washington
Westport Old Co Rd Police Hdqtrs
W Springfield 136 Park
Westwood 580 High
Winchendon 113 Front Preston MW F
Winchester Mt Vernon St
Woburn Common St Stockellburg A FA
Worcester 5 Waldo Driscoll FJ A

MICHIGAN

Allen Park Allen & Ecorse Rd Riley
Alpena City Hall Greene GH A
Ann Arbor 119 W Ann Nevins CR F
Ann Arbor 220 E Huron Nevins CR FA
Battle Creek 32 N Division Wellivere WT FA
Bay City City Hall Simons FE A
Bay City Detention Bldg
Benton Harbor City Hall A
Berkley 3322 Coolidge Hway
Birmingham Municipal Bldg Hackett JP F
Bloomfield Hills Police Hdqtrs
Clawson 35 W Clawson Rd
Dearborn 4440 Maple Av
Detroit 1300 Beaubien Denstaedt EC FA
Detroit 697 MaComb Van Damme AJ A
E Detroit 16083 Nine Mile Rd
Ecorse Cicotte & High Gillman A A
Escanaba 121 S 11th Ettenhofer MF F
Ferndale 12205 Woodward Av
Flint 615 Beach Jewett G A
Grand Haven 12 S 4th Boeve WM F
Grand Rapids 35 Crescent NW Sellon RJ A
Grosse Pointe Woods 1006 Vernier Rd Clark P A
Grosse Pointe 17145 Maumee Av
Hamtramck 8521 Joseph Campau Av Jerzykowski SA A
Hazel Pk 27452 John R St Brady LE A
Hazel Pk 44–48 W 9 Mile Rd
Holland 61 W 8th
Huntington Woods 12775 W 11 Mile Rd
Jackson 110 S Jackson
Jackson 231 E Cortland
Kalamazoo County Bldg
Kalamazoo 146 E Water MacGregor JA A F
Lansing City Hall
Lincoln Pk Ft Park & State Crichton FM A A
Marquette 210 W Washington
Marshall 212 S Grand Wellivere WT F
Marysville Huron Blvd
Menominee 715 Sheridan Rd Lund M A
Midland 202 Ashman Burd LW A
Monroe 2nd & Macomb
Mt Clemens 6th Fl Co Bldg Kaeding AA A
Mt Clemens Gratiet & Cass
Muskegon Walton & Jefferson Castenholz FE FA
Muskegon Hgts 12 Hackley Pl
New Haven Main St Morrison DO A
Niles 2 S Third Keene L A
Owosso City Hall Rice TA FA
Parchmont Police Hdqtrs
Pleasant Ridge 23646 Woodward Av
Pontiac Pike & Mill Gocha E F A
Pontiac 104 Wayne Gocha E A A
Port Huron 415 Huron Av
Port Huron 601 Broad
River Rouge 1381 Coolidge Hway Howe R A
Roseville 27770 Gratiot Av
Royal Oak 205 Williams Blount GF A
Saginaw 1315 S Washington Av Manchester RM FA
St Clair Shores 27705 Jefferson Av
St Joseph 616 Broad
St Joseph Port & Wayne
Sault Ste Marie City Hall Kaari ET F F
Traverse City 142 Cass Ealy JV A A
Van Dyke 22720 Van Dyke
Wayne 33809 Michigan Watson WR F
Wyandotte 3505 Biddle Av Wesser CH A
Ypsilanti 56 N Huron

MINNESOTA

Austin Police Hdqtrs
Brainerd 509 Laurel
Cloquet City Hall Elmgren RO A
Duluth 2138 Minnesota Av Jarvi AA A A
Faribault City Hall
Hibbing 105 E 17th Jackson HE A
Hastings Sheriff's Office
Mankato 128 S Front Houts J A
Minneapolis Sheriff's Office Aro LJ F
Minneapolis 2220 Locust S Kelly HO A A
Red Wing City Hall Dosdall L A
Rochester 3rd & 1st Av SW Hagaman BB A
St Cloud 306 St Germain
St Paul 101 E 10th Ginther LA A
St Paul 167 City Hall & Crt Hse
S St Paul City Hall
Virginia 4th Av & 1st St Begley E A A
Willmar Court House
Winona 207 Lafayette Haeussinger WA F

MISSISSIPPI

Biloxi Main St Murphy D FA
Greenville 220 Main
Greenwood City Hall Shurden RR A F
Gulfport 1510 24th Av Murphy D F
Hattiesburg Forest & Front
Jackson 423 E Pearl Ellington WM A
Laurel City Hall
Natchez Pearl & State
Vicksburg 1401 Walnut

MISSOURI

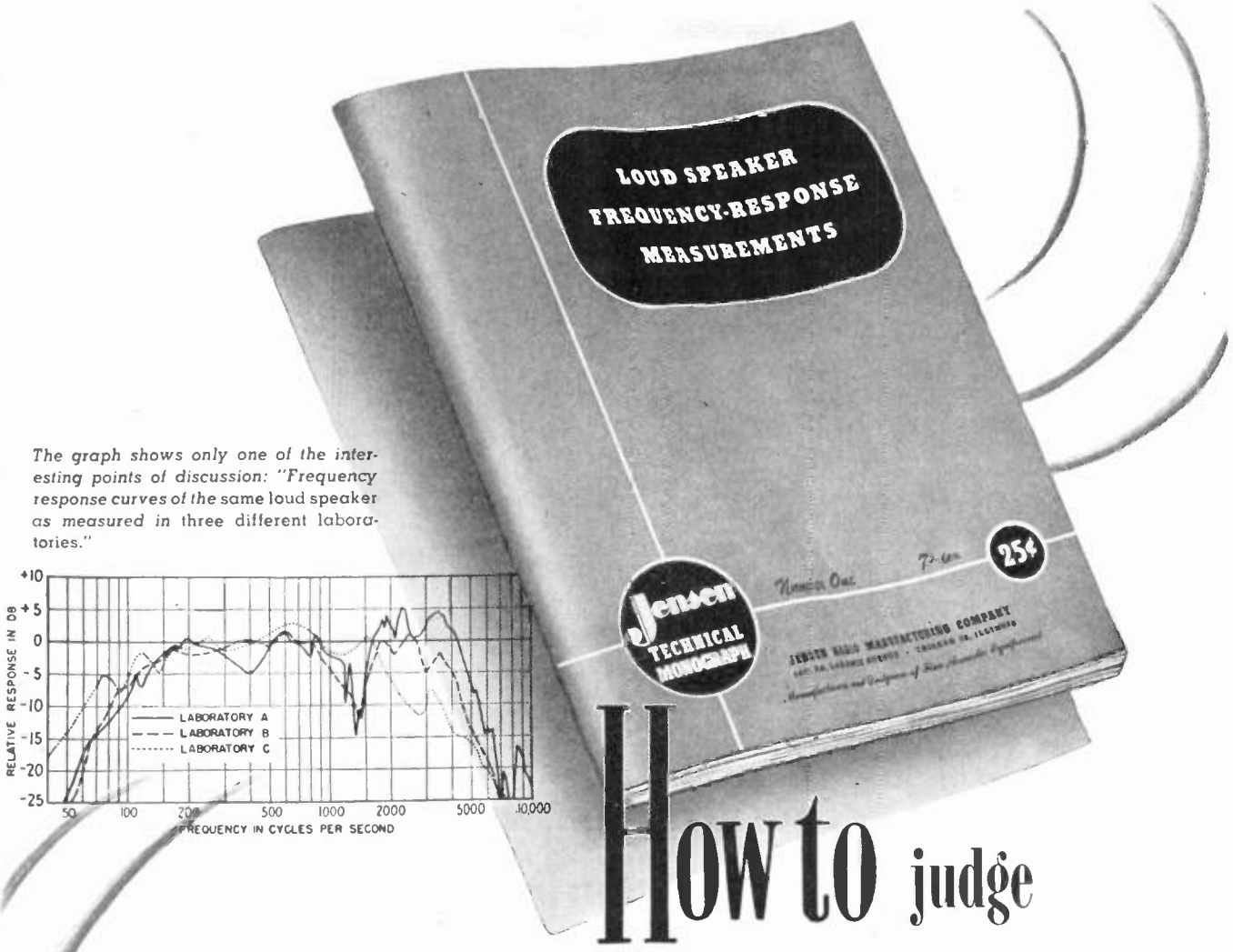
Cape Girardeau 538 Independence Schneider FL A
Columbia Fire & Police Dept
Hannibal 201 S 4th
Independence Main & Kansas Hall ME F A
Joplin 2nd & Joplin Meek RP A
Kansas City 415 E 12th
Kansas City 1125 Locust DeShaffon R A
Ladue 9345 Clayton Rd Kilby P A
St Charles City Hall F
St Joseph 9th between Mary & Locust Olson CE A A
St Louis 1200 Clark Av Teeter JH A
Sedalia Second & Osage Curmitt GT A
Springfield 214 S Market Maxey EL A

MONTANA

Anaconda 401 E Commercial
Billings 224 N 27th Grube LE F A
Bozeman 315 W Main Moore LS A F
Bozeman 326 E Main
Butte 24 E Bdway Whipple WI A
Great Falls 423 2nd Av Dolva V A
Helena Civic Center Pfeiffer G A
Kalispell Police Hdqtrs Gorman D A
Miles City 19 S 8th
Miles City Police Hdqtrs
Missoula Court House Schermerhorn DB A

NEBRASKA

Falls City 1700 Stone
Grand Island 210 N Pine Barrett WA A
Hastings 1st & Burlington
Lincoln Police Dept Lautzenheiser F A
Norfolk 121 N 4th
N Platte 618 N Vine Kindekugel WA A
Omaha 105 S 11th Gaines CC FA



The graph shows only one of the interesting points of discussion: "Frequency response curves of the same loud speaker as measured in three different laboratories."

How to judge Loud Speakers from Frequency Response Curves

For years we at Jensen have keenly felt the need of dependable and useful information to guide both the professional and the layman in their selection, purchase, installation and use of loud speakers. Now we are going to meet that need by a series of informative technical Monographs prepared by the Jensen Technical Service Department. ¶ The first Monograph in the series deals with one of the most interesting and controversial subjects in the field of acoustics, "LOUD SPEAKER FREQUENCY RESPONSE MEASUREMENTS." It discusses thoroughly the practical aspects of this subject in such a way that the material is unhesitatingly recommended to the whole profession: the engineer, the trade, the student, and even the layman. The first Monograph is ready now. Copies are available from Jensen jobbers and dealers everywhere, or fill out the coupon below and send it with 25c to

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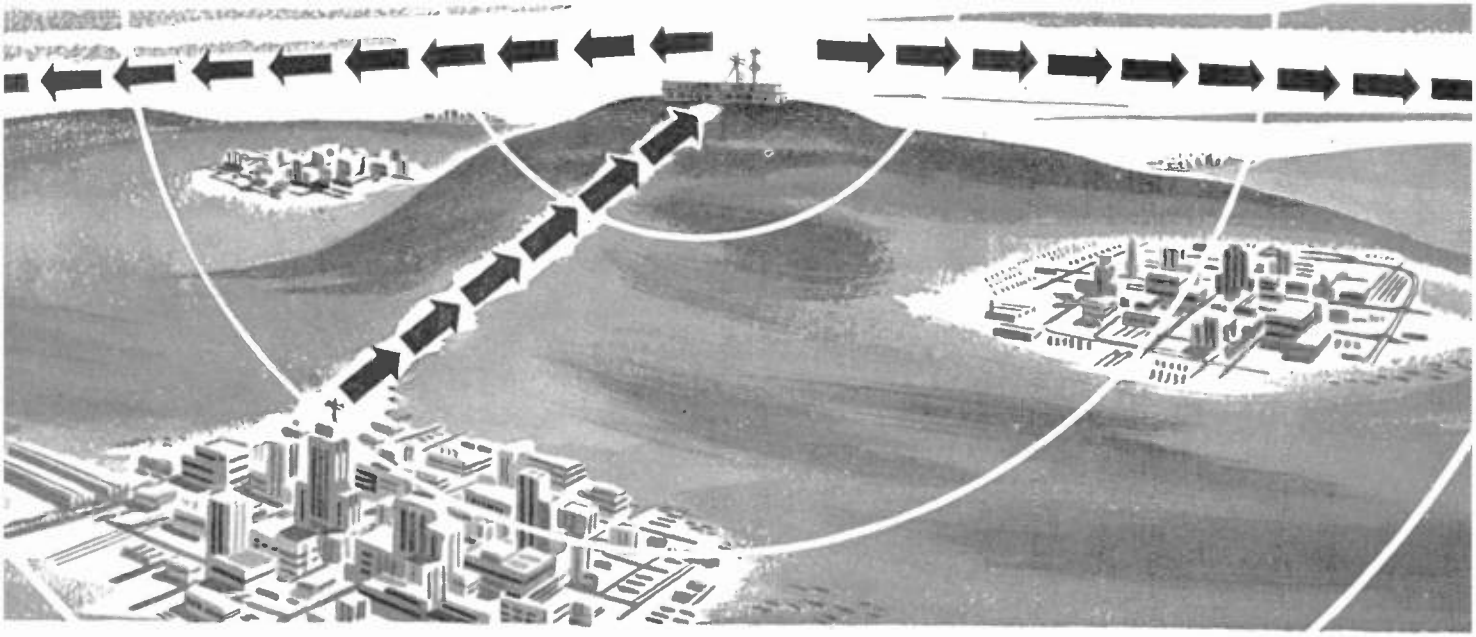


S-T Directional Relay Antenna

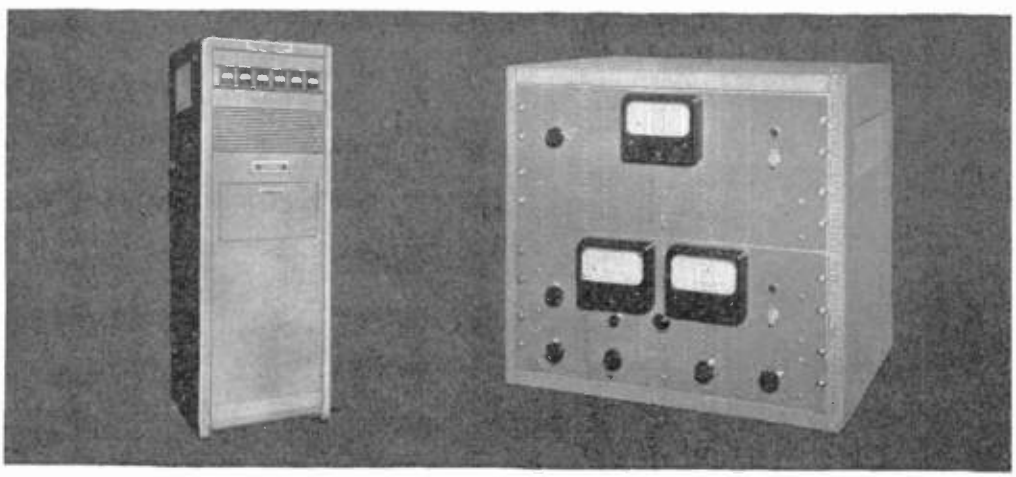
FM Broadcast Antenna

100-C9

Locate your transmitter for maximum coverage

Locate your studio for maximum convenience

Bridge the gap without wires



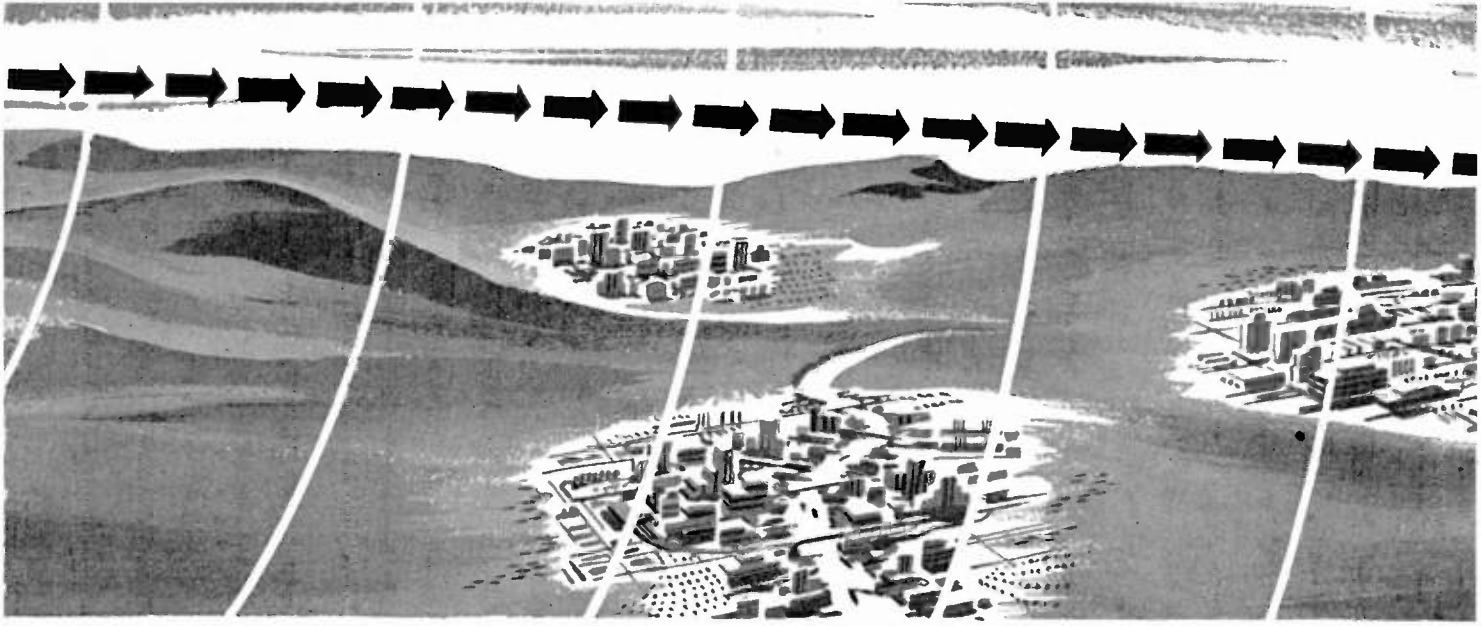
S-T Relay Transmitter (25-watt)

Station Monitor and Converter

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

STATION AND STUDIO EQUIPMENT • TRANSMITTERS • ELECTRONIC

GENERAL ELECTRIC



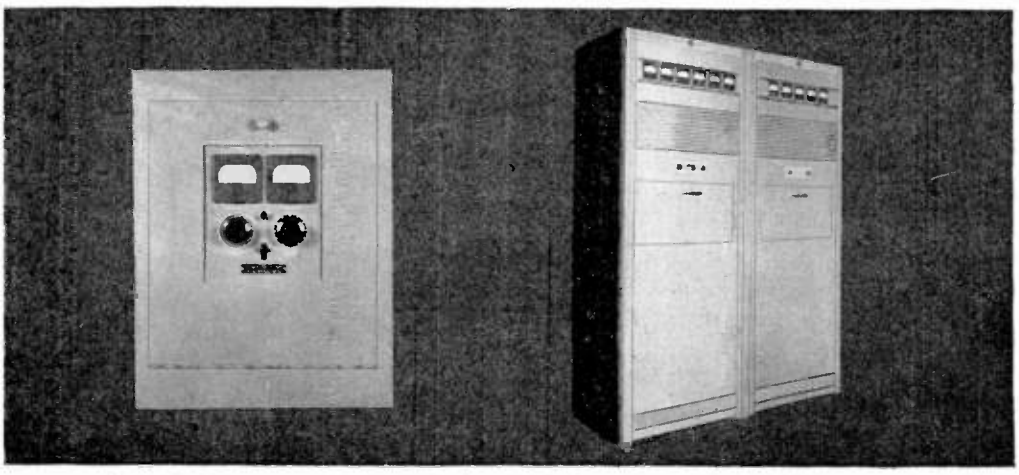
THROUGH proved performance in the six already established relay systems, G-E *S-T* (studio-to-transmitter) relay equipment offers a practical method by which you can reliably and economically relay your FM programs from studio to transmitter.

Extremely high fidelity, low noise level and a virtual absence of distortion are additional advantages of this exclusive G-E equipment. Completely dependable, too! Rain, sleet, floods or windstorms have no effect on this unique system "without wires." Distance is not a problem, for G-E *S-T* equipment is now reliably functioning up to airline distances of as much as 110 miles.

The G-E *S-T* relay transmitter is of the economical low-power rating of 25 watts. The G-E directional *S-T* relay antenna beams the signals to a receiving antenna of the same type at your G-E broadcast transmitter location. The total power gain of this system is 100. Thence, with full fidelity and further power gain, the programs go out over your service area through the easily tuned G-E circular broadcast antenna. . . . G-E *S-T* equipment is low in initial cost and economical to operate. Write for details, and information. Our engineers will be glad to discuss your problems with you. *Section 3-D, Electronics Department, General Electric, Schenectady, N. Y.*

NEW G-E DEVELOPMENT

The G-E disk-seal tube, an ultra-modern transmitting type, makes possible radio relaying of FM and television programs at very high frequencies. It will be used in post-war studio-to-transmitter and network relays.



S-T Receiver *FM Broadcast Transmitter (1000-watt. Others 250-watt to 50-kw)*

50 FM STATIONS ARE ON THE AIR—157 APPLICATIONS ARE PENDING

Now is the time to plan your FM station. The "G-E Equipment Reservation Plan" enables you to obtain a post-war priority and early delivery on equipment. Send for it and descriptive literature on FM — today.

TUBES • ANTENNAS • RECEIVERS

FM—television—AM

See G.E. for all three!

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Omaha 17th at Farnam Bates AG F
Scottsbluff 11 W 16th
S Sioux City Police Hdqtrs

NEVADA

Las Vegas 120 N 2nd
Reno Sheriff's Office Sowle NA F
Reno 41 E 1st Sowle NA FA

NEW HAMPSHIRE

Claremont Court House Cutting B F
Concord 3 Warren
Keene 3 Washington
Keene Court House Jennison AN
Laconia 68 Pleasant
Manchester 351 Chestnut Wheeler JA A
Nashua 231 Main Wheeler JA A
Portsmouth 126 Daniels
Rochester Wakefield

NEW JERSEY

Alpine Sylvan Blvd
Asbury Pk Police Hdqtrs
Atlantic City Smith L A
Atlantic Highlands Mount St
Audubon Oak & W Atlantic Av
Bayonne 26th & Av C Doyle VJ A
Belleville 152 Washington
Belmar Redman & F
Belmar 9th Av & E
Bergenfield 198 N Wash Av Ulrich R A
Bloomfield Municipal Plaza
Bloomingdale Main
Bogota 375 Larch Av
Bound Brook 226 Hamilton Cain TJ F
Brigantine City Hall Ockenlander RM A
Bridgeton 168 E Commerce
Brielle Police Dept FA
Budd Lake Mt Olive Twp
Burlington 432 High
Butler High St
Camden City Hall Howell JA A
Camden Court House
Carney's Pt Admin Bldg
Cedar Grove Pompton Av
Cliffside Pk Jersey & Palisade Av
Clifton 741 Main
Closter Main St
Collingswood 26 W Collings Av
Cranford 114 N Union Av Linder F A
Cresskill 67 Union Av
Deal Durant Sq Wallace J FA
Deepwater Chester Av & Penn
Dumont 42 Park Av
E Hanover Ridgedale Av Shrader RS A
E Orange 61 N Munn Av
E Paterson Market St
Eatontown Borough Hall
Edgewater 916 River Rd
Elizabeth 35 Morell
Emerson Lindwood Av
Englewood City Hall Bellingham JH A
Englishtown Main St
Fair Lawn 11–01 Gardiner Rd Risacher LJ F
Fanwood N Av Gorsky JL
Fort Lee 309 Main
Freehold Main St Johnson RS FA
Garfield 107 Somerset
Garwood South Av & Center
Hackensack 66 Zabriskie Levin F A
Hackensack 65 Central Av
Haddonfield Kings Highway E
Haddon Hghts 608 Station Av
Haledon 408 Morisse Av
Hanover Mt Pleasant Av
Hasbrock Hgts 348 Hamilton Av
Hawthorne 417 Lafayette Av
Highland Pk Raritan Av Platt WM F
Hillside 1284 N Broad
Hohokus Franklin Turnpike
Jersey City 765 Montgomery Arnold E A
Kearney 404 Kearny Av
Keyport Front St
Lakewood Third St Theibault EH A
Lawrenceville Main St
Leonia 233 Central Av
Linden Wood Av & Blanche
Little Silver Prospect Av
Livingston 62 S Livingston Av Hunt RB A
Long Branch Broadway Johnson RS A
Longport 4 S 31st
Lyndhurst Valley Brook Av
Mahwah Police Hdqtrs
Madison Kings Rd & Maple Av
Manville 101 Main
Margate Washington & Ventnor Atkinson WH A
Matawan 188 Main Sloat EC
Matawan Atlantic Av
Maywood Park Av
Metuchen Main & Middlesex
Middlesex Lincoln Blvd
Middletown Highway 35 F
Millburn 375 Millburn Av Currey A F
Millville City Hall
Morristown 40 E Main Collins AJ A
Morristown 110 South St Laird T A
Mountainside Springfield Rd
Mt Holly 21 Washington
Neptune City 141 Sylvania Av
Neptune 137 S Main
Newark City Hall McGowan JM A
New Brunswick 78 Bayard Platt WM A
New Brunswick Woodbridge Av
New Market Piscataway Twp
New Milford 249 Center
N Arlington 214 Ridge Rd
N Bergen 1122 Hillside Pl Andes WF F
N Haledon Linda Vista Av
N Plainfield Somerset & Lincoln Pl
Nutley Chestnut Pl
Oakland Oakland Av
Oaklyn Borough Hall
Oceanport Oceanport Av & Main Riddle KC F
Oradell 355 Kinderkamack Rd
Orange 29 Day
Palisades Pk City Hall
Passaic 336 Passaic
Paterson 149 Market Moore DF A
Pennsauken 6512 Wyndam Barrington RW A
Penns Grove State & Main Kearnes F A
Perth Amboy 56 Fayette Munay JF F
Pequannock Pompton Plains
Phillipsburg S Main Halley T F
Piscataway Stelton Rd
Pitman S N Broadway
Plainfield 40 S Cleveland Av
Pleasantville N First Av Atkinson WH A
Pt Pleasant Arnold Av & Ocean Rd Bresnahan LA F
Pompton Lakes Hamburg Turnpike Charles WF A
Pompton Lakes Hamburg Turnpike Warner HM A
Princeton 50 Stockton
Princeton State Rte 31 Twp Hall
Prospect Park N Tenth & Brown Av
Rahway 59 Main
Red Bank Monmouth St Johnson RS F
Ridgefield 595 Broad Av
Ridgefield Pk 232–234 Main
Ridgewood 31 Hudson
Ringwood Ringwood Av
River Edge 705 Kinderkamck Rd
Roselle 210 Chestnut Peterson IJ A
Roselle Pk 139 Chestnut
Rumson River Rd Kruse HS A
Rutherford 176 Park Av
Salem 94 Market
Scotch Plains Park Av
Secaucus Rte 3 Temple A A
Somerville 41 N Bridge
S Dover 37 N Sussex
S Plainfield Hamilton Blvd
Sparta Main St Twp Hall
Springfield Trivet Av
Spring Lake 311 Washington Av
Summit 350 Springfield Av
Teaneck Cedar Lane & Teaneck Rd
Totowa Lincoln Av
Trenton Chancery Lane Neese LF A
Union 981 Caldwell Av
Union City 38th & Palisade Av
Ventnor City City Hall Atkinson WH A
Verona 600 Bloomfield Av
Wanaque Municipal Bldg
Watchong Plainfield St
Wayne Police Hdqtrs
Weehawken 400 Park Av Rossel C A
W Caldwell 3 Fairfield
Westfield 121 Prospect
W Long Branch 377 Monmouth Rd
W Milford Main Rd Police Hdqtrs
Westmont 8 Reeve St
W New York 16th & Harrison Pl
W Orange 66 Main St
W Paterson 1070 McBride Av
Westwood 93 Center Lich AC A
Wildwood 4401 Pacific Av
Woodbridge Main St
Woodbury 33 Delaware

NEW MEXICO

Albuquerque 2nd & Tijeras Av
Clovis 322 Mitchell
Roswell 421–5 N Richardson Av
Roswell Sheriff's Office
Santa Fe 145 Washington Av

NEW YORK

Albany Beaver & Eagle
Amityville 16 Greene Kelly J A
Amsterdam 61 Church
Auburn North St House H A
Babylon 47 Main
Babylon Merrick Rd
Batavia 2 School
Bath Co Jail Balcom BH F
Bear Mountain Police Hdqtrs Hlavaty A F
Binghamton 18 Hawley Squires HW A
Briarcliff Manor Pleasantville Rd
Bronxville 125 Parkway Rd
Buffalo Delaware Pk Buchanan J FA
Buffalo Franklin & Church
Canandaigua Court House
Canton Sheriff's Office Moore C A
Chappaqua Allen Pl Romaine CL F
Corning City Hall Mulligan J A
Courtland 23 Court
Eastchester Main St
E Hampton Village Hall
Elmira City Hall
Elmira City Hall Weaver ED F
Endicott 41 Washington Yeager CJ FA
Falconer Dept of Highways Bldg Chipman VD F
Floral Pk 9 Floral Blvd
Fonda Court House
Freeport 40 N Ocean Av Elar P A
Fulton 67 1st Maude F A
Garden City 110 7th
Geneseo Main St Kinney G F
Geneva 47 Castle Haussman AC
Glen Cove Glen St
Harrison 226 Harrison Av
Haverstraw Fairmont & Maple Av
Hempstead 10 N Franklin Crane ES A
Hillburn Police Hdqtrs Starr AZ A
Hornell Broadway Clark F F
Huntington Main St Biggs AW FA
Huntington Stewart Av
Ithaca Seneca & Tioga Simmers WC A
Jamestown 210 E Third Carlson HA F
Kingston 408 Broadway Boss EA A
Larchmont 11 Edgewood Av Bolvin LV A
Larchmont Municipal Bldg
Lindenhurst 215 S Wellwood Av
Little Valley Court House Sigel ML
Lockport 36 Pine Sy HP F
Mamaroneck Mt Pleasant & Prospect
Middletown 16 James Curran GM A
Mineola 15th St Allen WK FA
Mt Vernon Police Hdqtrs Hoffman MA A
New City Police Hdqtrs
New York 240 Centre Burns FA A
New Rochelle 23 Lawton Doege JP A
Niagara Falls Main St Best N A
N Pelham 5th Av
N Tarrytown 28 Beekman Av
N Tonawanda City Hall Hewitt JS F
Nyack 134 Main St
Nyack Police Hdqtrs
Olean 106 Whitney Av
Oneonta 202 Main Bates WR A
Ossining Croton Av
Oswego Court House
Patchogue S Ocean Av Town Hall
Peekskill 828–848 Main
Pelham Village Hall
Pelham Manor 4 Penfield Pl
Piermont Main St Mun Bldg Edmonson W A
Plattsburg City Hall Fleming CL
Port Chester 346–350 N Main Stevenson HR A
Port Jervis 21 Sussex Rippon S A
Port Washington 325 Main
Poughkeepsie Little Washington
Rochester 140 Bronson Av Connell WJ A
Rockland Co Nyack Police Hdqtrs
Rome City Hall
Rye Third St Police Hdqtrs Burke V A
St James Village of Nissequoguo Lobnitz E A
Sands Point Lighthouse Rd
Scarsdale Fenimore Rd Shwedo JJ A
Schenectady 301 Clinton Wells GH F
Schenectady Court House
Sloatsburg Rte 17 Village Office
Smithtown Br Main St Police Hdqtrs A
S Nyack Police Hdqtrs
Spring Valley Police Hdqtrs
Suffern Lafayette Av Town of Ramapo
Suffern Police Hdqtrs
Suffern RFD Viola NY McDermott WR A
Syracuse 400 City Hall Quick HO FA
Tarrytown 54 Main
Tonawanda Payne Av City Hall
Troy 51–55 State
Tuckahoe Village Hall Robinson WE
Utica 315 Oriskany Beyer WRG
Warsaw Main St Kinney G F
Watertown Court St Lewis JB F
White Plains 225 Main St
White Plains Tarrytown Rd
Williamsville 5595 Main St
Yonkers Wells & Woodworth Av

NORTH CAROLINA

Asheville City Bldg Bridgewater AZ A
Asheville College St
Burlington Worth & Front Beaty JS A
Charlotte 700 E Trade Brandon R A
Charlotte 600 E Trade
Concord Barbrick St
Durham City Hall de Bruyne AL A
Elizabeth City City Hall
Fayetteville 121 Gillespie
Gastonia 202–254 W Franklin Av Van Sleen R A
Goldsboro 221 Center Hines HT F
Greensboro Court House
Greensboro 206 N Greene Parish CA
Kings Mountain 106 Piedmont Av Aderholdt AE F
Kinston 110 W King Civils HB F
Lenoir Police Hdqtrs Bush JG A
Lexington 26–28 W Center Harris WC A
Monroe Jefferson St Armfield E F
Morganton Sterling & Meeting
New Bern Craven & Pollack
Newton Sheriff's Dept
Raleigh Fayetteville St Wynne WA F
Reidsville 110 Morehead Worsham LW
Rocky Mount 132 N Washington Primm WW A
Salisbury 115 W Fisher Taylor JD A
Shelby Graham & Washington
Statesville City Hall Taylor JB F
Wilmington 14 S Fourth Jones SH F
Wilson City Hall Wooten Warren FA
Winston-Salem Court House Brewer CR A
Winston-Salem Main & 1st Brewer CR A

NORTH DAKOTA

Bismarck 513 Thayer Av
Fargo 639 N Pacific Av
Grand Forks 404 2nd Av Hough E

OHIO

Akron Buchtel & Union Myers RJ F
Alliance City Hall Stark HL F
Ashland Second St Atterholt FM F
Ashtabula 250 W 44th Gautney G A
Bucyrus 116 E Rensselaer Gearhart EE A
Canton 1727 Mahoning Rd NE Walker NS F
Canton 201 Second Walker NS A
Canton 101 Market
Chardon 219 Main Harland SM F
Chillicothe S Paint St
Cincinnati Comm Bldg Eden Pk Hearn JL A
Cleveland 2001 Payne Chatterton LN FA
Clyde City Hall
Columbus Gay & Water Harkins JG FA
Cuyahoga Falls 2–6 Front Bock AW A
Dayton 15 E Monument Benton PE A
Dayton 3rd & Main Crouse AB F
Elyria Court House
Elyria City Hall Bldg Finegold I A
Fremont City Hall Swartzlander GW A
Galion 301 Harding Way E
Hamilton High & Monument Av Norton TS A
Ironton Memorial Hall
Jackson Court House
Jefferson Court House
Kenton 224 W Columbus
Lancaster Main & Broad
Lima 215 E High Albridge RG A
Lockland Rte 6 Conrad CA A
Logan 50 S Mulberry
Lorain 500 W Erie Kauffman HC F
Mansfield 2nd & Walnut Capbell LV F
Marietta City Hall Clark CE A
Marion 283 W Center Brown DA F
Massillon Charles Av SE Getz I A
Mentor 1373 Mentor Av Bay J A
Middletown 1425 Central Av
Newark 16 N 4th Clark JV FA
Newark 3rd & Canal Clark JV FA
Niles 33 W Park Av
Norwalk 37 Linwood Av Kromer FA F
Norwood Main & Elm Wright CL A
Oakwood 30 Park Av
Painesville N Park Pl F
Painesville 40 N St Clair
Perrysburg 111 W Second Drake JF F
Piqua 219–21 W Water Davis D A
Port Clinton 130 Adams Swartzlander GW A
Portsmouth City Bldg Gammon WC A
Reading 1000 Market St A
St Clairsville 1E Main McGlumphy W A
Salem 160 E State Young JK A
Sandusky Market St Swartzlander G FA
Shelby 16 W Main
Sidney 111 S West Av F
Smithfield Wayne Twp Villers R A
Springfield Police Hdqtrs Free RJ A
Steubenville Court House Villers R A
Steubenville 123 S Third
Stillwater 723 Lewis
Tiffin City Hall
Tiffin Court House
Toledo 550 N Erie
Toledo Municipal Bldg
Toronto City Bldg Villers R A
Tulsa 405 E 4th
Warren Court House Young JK F
Warren 122 Franklin Young JK F
Wellsville City Bldg Villers R A
Westlake 2728 Center Ridge Rd
Wewoka 110 S Wewoka Av
Wickliffe 575 Euclid Av Montgomery L A
Wyoming 500 Grove Av Thomas PK F
Youngstown 2107 Market Civita RL A
Youngstown Sheriff's Office
Zanesville 332 South St Combs RD A

(Municipal & County Systems, continued)

OKLAHOMA

Ada 13th & Townsend Kimsey H A
Altus 209 W Commerce
Ardmore Box 507
Bartlesville Municipal Airport
Blackwell 224 W Blackwell Frampton RL A
Bristow City Hall
Chickasha 602 Chickasha Av Raborn GT A
Cushing City Hall
Duncan 714 Main St Groff O F
Durant City Hall
Edmond Box 142 Green WR A
El Reno City Hall
Enid 213 S Independence Stewart C A
Guthrie City Hall F
Lawton 311 S 4th St Gale EP A
Muskogee 230 Court Bernard SE A
Newkirk Court House
Norman 122 N Peters Corbin E A
Norman 200 S Peters Blackert C A
Oklahoma City 300 NW 1st Spooner AJ FA
Oklahoma City 6529 Avondale Dr
Oklahoma City 248 W Calif Av
Okmulgee 5th & Morton City Hall Wynn WS A
Pawnee 601 Harrison
Ponca City 500 E Grand Av
Sapulpa Police Hdqtrs Edwards JO A
Seminole 215 Fourth
Shawnee 9th & Broadway
Tulsa Police Hdqtrs Hicks R A

OREGON

Albany 326 W 2nd St
Astoria 655 Commercial Titus JM A
Bend City Hall Gullick KC A
Eugene City Hall
Hillsboro Wash Co Court House
Klamath Falls 5th & Walnut
McMinnville City Hall
Medford 5th & Central
Oregon City Clackamas Co Court House
Portland Court House
Portland NE 21st Av & Pacific
Salem 295 N High
Salem 100 N High

PENNSYLVANIA

Abington York Rd & Horace Av
Aliquippa City Bldg Villers R A
Allentown 901 Hamilton
Altoona Mun Bldg Burgoon G F
Ambridge 1001 Merchant Straube C A
Ardmore Lancaster Av Hatton LM A
Beaver Falls 715 15th
Beaver Jail Bldg Villers R A
Berwick 344 Market Peterson HC F
Bethlehem 53 E Broad
Bradford City Jail Edmonds E A
Breemal Police Hdqtrs
Bristol Pond & Mulberry
Butler 130 W North
Chambersburg S 2nd McIntire GW A
Charleroi 334-38 Fallowfield Av
Cester Market & 5th Cullis JH F
Chester 142 W Elkon Rd
Chestnut Hill 402 Bethlehem Pike
Clairton St Clair & Miller Av Busch B A
Clifton Hgts Springfield Av & Baltimore Rd
Coatesville 1st & Harmony
Collingdale McDade Blvd
Coraopolis City Bldg Villers R A
Easton Court House
Elkins Pk E Church Hallowell TH A
Erie City Hall
Essington 517 Saude Av
Folcroft 1553 Baltimore Av
Folsom Sutton Av
Ft Washington Bethlehem Pike
Glenolden Borough Hall
Harrisburg City Hall Delmotte RW A
Huntingdon Valley Murray Av Fletcher RF A
Jeanette 2nd & Clay Av
Jenkintown Leedom & West Av Sweeney FA A
Kingston 166 S Sprague Av
Lancaster 27 E Grant Carlson A F
Lansdown Baltimore Av
Latrobe 316 Main
Lebanon 9th & Scull Sherman CJ A
Lewistown 3rd & Main
Lock Haven City Hall
McKeesport 323 Market
Meadville 156 Chestnut French BC A
Media State & Jackson
Media State Rd Police Hdqtrs
Milton 28 N Front Reice ME FA
Monessen 3rd & Donner Av Horlbeck W A
Monongahela Main St Gamble W F
Morrisville Washington St
Moylan-Rose Valley Police Hdqtrs
New Castle East St Sines WU FA
New Kensington 1050 4th Av
Norristown City Hall A
Norristown Court House Guinan JJ • FA
Norwood W Winona Av Box 25
Oil City 248 Seneca
Parkside Co of Delaware Techton JM A
Philadelphia City Hall Burns TP FA
Phoenixville 140 Church
Pittsburgh Bedford Av & Francis
Pottsville 401 N Centre
Prospect PK Post Office
Reading 8th & Washington Hartman GR A
Ridley Pk Ward & Crosswell
Scranton W Washington & Mulberry
Sewickley Hgts Club Rd Pearce J A
Sewickley Municipal Bldg Prendergast T A
Sharon 50 Chestnut Av Helges GE F
Sharon Hill Sharon Av & Spring
Springfield Saxer Av & Powell
State College 118 S Frazier Waring A F
Swarthmore 105 Park Av Timmons RE A
Wallingford Plush Mill Rd
Wallingford Providence Rd
Warren 318 3rd Av W
Washington Wheeling Police Hdqtrs
Waynesboro 57 E Main
W Chester 15 S High Gilsson AF A
Wilkes-Barre 18 N State Alles JJ A
Williamsport 454 Pine
Willow Grove York & Easton Rds
Yeadon Church Lane U Baily Rd
York 50 W King Weaver WN A

RHODE ISLAND

Apponaug 3275 Post Rd Boss LJ FA
Bristol 400 Hope

War News from Italy

—broadcast by the transmitter you might have had!

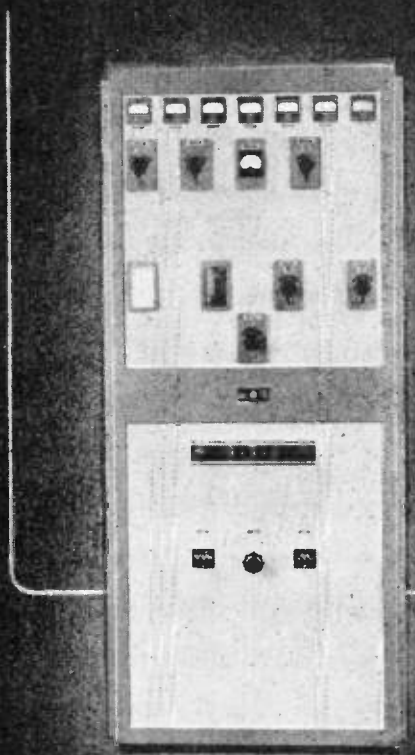
When the Allies invaded Italy the War Department asked RCA Communications, Inc., to build and operate a complete new radio station in Italy.

Men and material were rushed overseas to the Italian site. Night and day RCA engineers labored — the flash of big guns lighting the night horizon.

In 43 days the new station ICA was on the air. On February 1 it began sending America spot news from the Italian front. A notable transmission was the first broadcast from the Anzio beachhead (which was picked up from a low-power transmitter on the beachhead and relayed directly to the U.S. by Station ICA).

The two transmitters installed at ICA are RCA Police Transmitters — the type employed for emergency communications in many American communities. Except for the war your community might be using one of these very transmitters today.

This incident may help you to understand why RCA cannot supply equipment for civilian emergency communications requirements now. But when this war is over, RCA will be in a position to furnish better equipment than ever before. Moreover, RCA engineers will help you right now to plan an effective emergency communications system for postwar installation.



RCA Transmitter used by station ICA

RCA

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION • CAMDEN, N. J.

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

AM or FM
RCA Makes Both

(Municipal & County Systems, continued)

Central Falls 503 Broad
Cranston 1741 Cranston Atkinson SW FA
E Providence Grove & Taunton Av
Newport City Hall
Pawtucket 121 Roosevelt Av Petit EB A
Providence 209 Fountain Lawless J A
Warren Main St Town Hall
Warwick 3275 P st Rd Boss LJ FA
Westerly Town Hall
Woonsocket 139 Front Hoyt CJ F

SOUTH CAROLINA

Charleston 103 St Philip Searson FM A
Columbia 1415 Lincoln Campbell LJ A
Greenwood 513-17 Main
Greenville 22 W Broad
Rock Hill 128 E White
Spartanburg 145 Broad A

SOUTH DAKOTA

Huron 153 3rd SE
Mitchell 210 W 2nd Av
Mitchell Police Dept Casey LW A
Rapid City 307 Main
Sioux Falls 9th & Dakota Av March RR A
Watertown W Kemp & First SW Downs MR F

TENNESSEE

Chattanooga 10th & Lindsay Richmond RE A
Chattanooga 609 Walnut
Dyersburg Market & Mill
Elizabethton 116 N Main Jones EB A
Jackson 321 E Main Brummel BC A
Johnson City 218 W King Jones EB FA
Kingsport 232 Shelby
Knoxville 409 N Bdway Mayes P FA
Memphis 179 S Barksdale McCoy MW A
Nashville Police Dept Base CW F
Nashville Court House
Paris City Hall Brown JM F
Union City City Hall

TEXAS

Abilene 1209 N 2nd Irvine LD A
Amarillo 114 W 4th Clack MH A
Anahuac Court House Kay AP A
Austin Box 1160 Kreuz LB A
Baytown 222 Virginia Toyder FA A
Beaumont Mulberry & Walnut Kay AP A
Beeville Court House
Big Spring Box 391 Wells LG A
Brownsville Market Sq
Brownwood 400 Fish Stewart AW A
Bryan City Hall
Cleburne Office of the Mayor Thompson JF A
Corpus Christi Police Hdqtrs Dunn EC A
Corsicana Municipal Bldg
Dallas 3800 University Blvd Settle NC A
Dallas 4710 Drexel Dr Meredith BD A
Dallas Main & Harwood Tucker DJ A
Dallas Criminal Courts Bldg Tucker DJ A
Denison 108 W Main Johnson CF A
Denton 221 N Elm Phillips CO A
Electra 111 E Cleveland
El Paso 210 S Campbell Bakofsky CG A
El Paso Court House
Floresville Court House
Ft Worth City Hall Basham C A
Ft Worth 10th & Throckmorton Bunday DL A
Gainesville Main & Rusk Garvey JR A
Galveston 20th & Av C Clough GR A
Gaveston Sheriff's Dept A
Goose Creek 209 Goose Creek Royder FA A
Harlingen City Hall
Highland Pk 4710 Drexel Dr
Houston 401 Caroline Franklin PE A
Kilgore City Hall Bldg Moore EM A
Longview Court House Smith L FA
Lubbock 1015 9th Portwood RT A
Lufkin 210 Lufkin Av Hartman SP A
Marshall City Hall Beard LJ A
McKinney 114 S Ky Floyd J A
Mexia Municipal Bldg
Midland 119 W Illinois
Nacogdoches 214 Pillar
Orange City Hall Kay AP A
Pampa City Hall Bonnett J A
Paris 39 S 21st
Pasadena Shaver & Fifth
Plainview 120 7th Curry H A
Port Arthur 4th & Waco Kay AP A
San Angelo City Hall Anderson WL A
San Antonio Market & St Mary's Gallagher VR A
San Antonio Court House Gallagher VR A
San Antonio 6116 Bdway City of Alamo Hgts
San Antonio 504 Milan Bldg Gallagher VR A
Sherman Court House
Sherman 315-319 S Travis
Sweetwater 201 E 4th
Temple Municipal Bldg
Texas City 519 6th Ladish WL A
Tyler City Hall Wynn TM A
Victoria 210 W Constitution
Waco City Hall Mitchell AD A
Waxahachie 200 Franklin
Wharton 100 E Burleson McClean B A
Wichita Falls 900 Ohio Av S Payne CW A

UTAH

Ogden 2550 Kiesel Av
Provo 21 S University Av Peterson GW F
Salt Lake City 105 S State Morgan EH A
Salt Lake City City & County Bldg

VERMONT

Burlington Church & Main

VIRGINIA

Alexandria 126 N Fairfax
Arlington Court House
Bristol 123 Water Cross HG A
Charlottesville 5th & Market
Christiansburg Sheriff's Office
Danville Court & Patton
Fairfax Police Dept McMichael EH F
Fredericksburg 809 Princess Ann Stone WW FA
Hampton N King Curtis HS F
Harrisonburg 89 W Water A
Hopewell 404 E Poythress
Lynchburg City Hall
Newport News 25th & Huntington Av
Norfolk Police Hdqtrs

HARVEY
OF CAMBRIDGE

A GOOD NAME TO KEEP IN MIND...

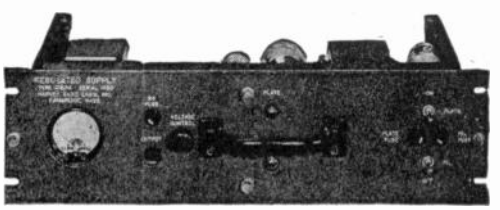
Here's why:

The HARVEY organization devotes itself entirely to the development and production of electronic and radio equipment and components.

The HARVEY organization has the engineering and creative resources to assure you a source of supply of the utmost reliability. This was true long before the present crisis and intensive war work of the highest importance has vastly increased our scope and facilities for present and postwar usefulness to you.

For radio-electronic apparatus you can depend on and for assistance on your present or projected plans remember—

HARVEY
"AMPLI-STRIP"
For I-F and AUDIO Amplification



HARVEY Regulated Power Supply 106PA
(Write for new bulletin)

HARVEY RADIO LABORATORIES, INC.
443 CONCORD AVENUE • CAMBRIDGE 38, MASSACHUSETTS

(Municipal & County Systems, continued)

Petersburg Court House Biggs RN A
Radford Police Dept Helton MC A
Richmond City Hall Annex
Richmond Dept State Police Lee WM A
Roanoke Municipal Bldg Aldhizer JT A
Staunton 15 N New St F
Suffolk N Main St Arnold L FA
Virginia Beach Police Hdqtrs
Waynesboro 126 Wayne Av
Williamsburg Boundary St Kelly WH F
Winchester 5 N Cameron Funk FM A

WASHINGTON

Aberdeen City Hall True P A
Asotin 2nd & Filmore
Bellingham City Hall Featherkile A
Bremerton 4th & Washington Grubo L FA
Camas City Hall
Centralia Pearl & Maple Kendrick JC A
Chehalis Sheriff's Office
Colfax City Hall
Coupeville Sheriff's Office
Davenport 4th & Sinclair
Ephrata Sheriff's Dept
Everett Central Fire Station Machin LH FA
Hoquiam Police Hdqtrs
Kelso 101 S 4th Mietske JT A
Kelso Court House
Mt Vernon Skagit Co Court House
Olympia Court House Tambly FC A
Olympia Police Hdqtrs
Pt Angeles 3rd & Lincoln
Pt Orchard Cline & Division Durgin CH F
Pt Townsend Sheriff's Office
Pullman City Hall
Puyallup 313 S Meridian Lenfesty JA F
Ritzville 210 W Broadway Schafer J A
Seattle 416 Yesler Way
Spokane Court House
Spokane City Hall Brown CL A
Tacoma Court House Dahl EC F
Tacoma 415 S Tacoma Av McDonough DM F
Vancouver Court House Brady RE
Vancouver 715 Washington
Walla Walla 3rd Av & Rose
Wenatchee Chelan & Yakima Kimm CC
Wenatchee Court House
Yakima 10 E Walnut

WEST VIRGINIA

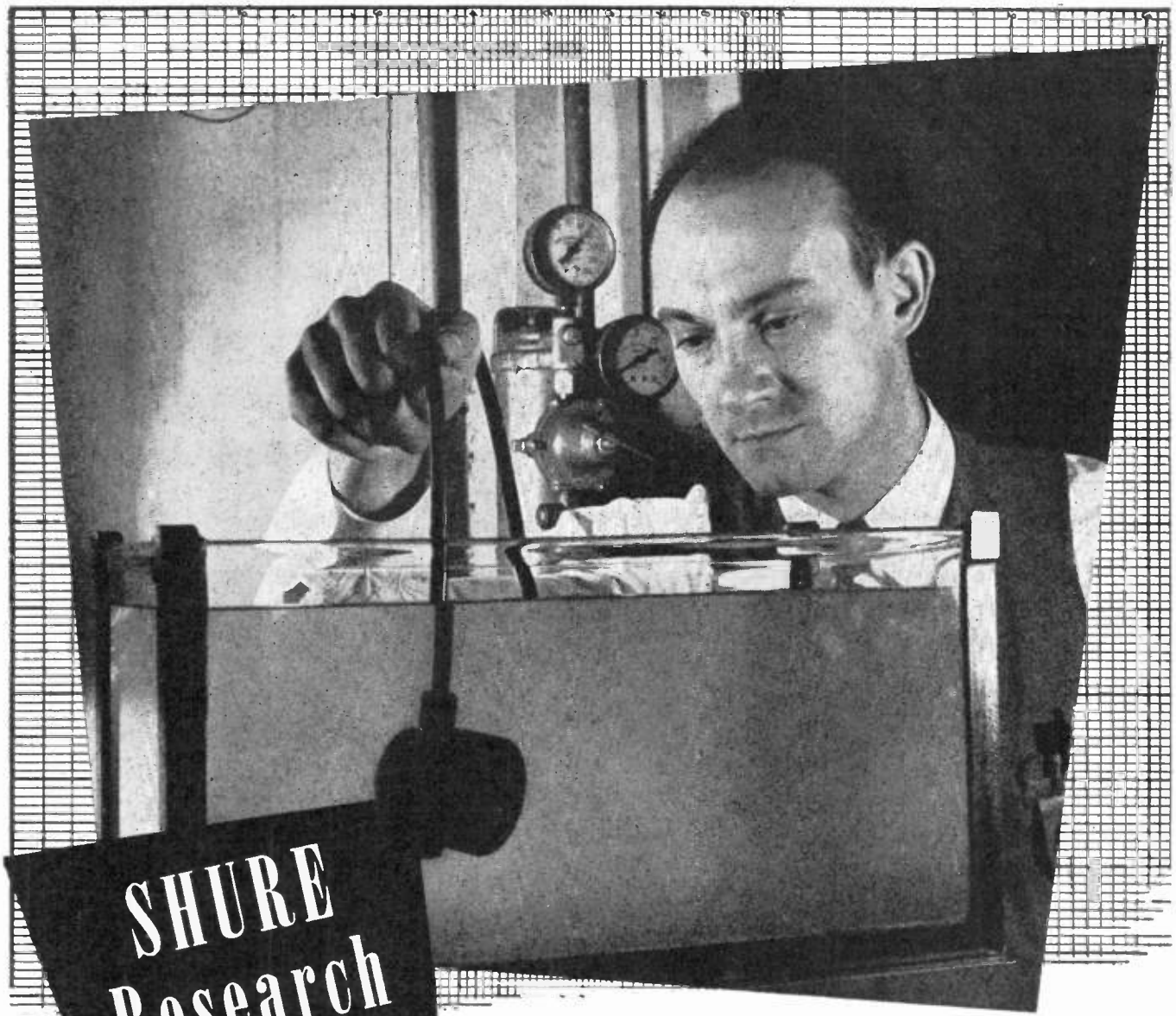
Beckely S Kanawaha Russell CO F
Bluefield Bland St Flanagan PT F
Charleston Court & Virginia Stone WD F
Clarksburg 437 W Main
Follansbee City Bldg Villers R A
Holidays Cove Main St Smith GE A
Keyser Davis St Hesen JE F
Martinsburg 224 W King
Morgantown 389 Spruce Spence RC F
Parkersburg Market & 5th Knowles C A
Princeton 1018 Mercer St
S Charleston Carbide & Carbon Chem Corp Zaharis G A
Weirton Sheriff's Office Villers R A
Wellsburg Court House Villers R A
Wellsburg City Bldg Villers R A
Wheeling 16th & Chaplain

WISCONSIN

Appleton 137 N Mill Merkl G F
Baraboo Court House
Baraboo 135 4th Nietz JW A
Beaver Dam N Spring Beneditz E A
Beloit 430 N State Crittenden KW A
Black River Falls Court House
Chilton 161 Court Schwabe E
Eau Claire Safety Bldg Jorgenson TO A
Eau Claire 414 Grand Av E Jorgenson TO A
Elkhorn 4 N Church
Fond du Lac 226 Linden Matteson RS A
Ft Atkinson 111 N Main A
Green Bay City Hall
Janesville Wall & Jackson
Janesville 102 Water Stone FA A
Jefferson 608 Main Skalitzky L A
Juneau 30 N Main Beneditz E A
Kenosha 804 56th Christopherson FB A
La Crosse 5th Av & State Jenks LE A
La Crosse Court House Mattison S A
Lake Geneva Police Hdqtrs
Madison RFD 45
Madison RFD 50
Madison RFD 4
Madison 14 Webster Groenier RS A
Madison 2044 S Park Klenast FG
Manitowoc 8th & Hancock Duben W FA
Marinette 1901 Hall Av
Milwaukee 4715 W Vliet Wareing HF FA
Monroe RFD 4 Sarter FJ A
Neenah 208 S Commercial
Oshkosh Jackson & Algoma Davis H A
Plymouth 218 Smith
Portage 707 E Cook Jones OL A
Pt Washington 1026 W Molin
Racine Court House
Racine 1400 10th Beck RT A
Sheboygan Court House
Sheboygan 828 Center Av Wagner WH A
Superior 922 Hammond Av Berg HC A
Stevens PT 612 Clark Zeaman EL
Two Rivers 1519 18th Duben W A
Viroqua Vernon Co Jail
Watertown 110 N First Knight EC A
Waukesha 130 Delafield Lathrop RE A
Wausau Court House
Wisconsin Rapids 430 Baker Nickel VW A
West Bend 340 Fifth Av

WYOMING

Casper City & Co Bldg
Cheyenne 320 W 19th
Rawlins City Hall
Rock Springs City Hall Marcina HJ
Sheridan City Hall



SHURE Research

. . . in Resistance to Corrosion and Moisture

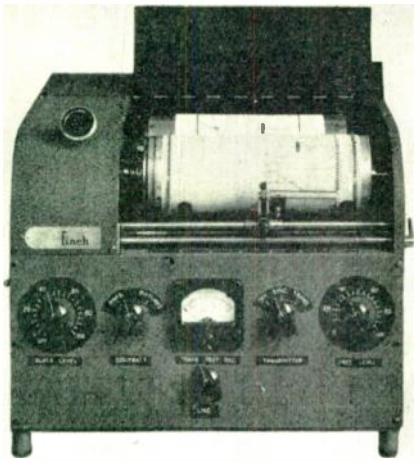
This is a standard test at Shure Brothers. The microphone is connected to the air pressure line and submerged. No bubbles—its "insides" are protected against rain and ocean spray. More than that, Shure engineers have successfully defeated corrosion of iron, steel, brass and aluminum microphone parts—and they were the first to moisture-proof, successfully, Rochelle Salt Crystal Microphones. You may well look to Shure engineers to provide you with better microphones and headphones.

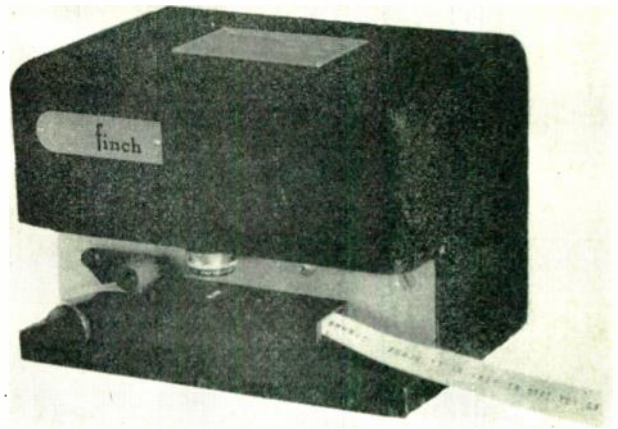
SHURE BROTHERS, 225 West Huron Street, Chicago

Designers and Manufacturers of Microphones and Acoustic Devices

SHURE MICROPHONES

Below are two of several types of Finch Facsimile equipment for commercial uses. At left, transmitter and receiver combined in one complete unit. At right, newly developed Finch electronic tape recorder.





When the Green Light is given

FACSIMILE BROADCASTING is not a postwar dream, but a working actuality—officially recognized as one of the great rich fields for American pioneering.

At the time of "Pearl Harbor," more than a score of prominent broadcasting stations, licensed by Finch, were transmitting photographs, maps, cartoons, editorials and other newspaper features to receiving sets in homes.

During the same period, new opportunities for profit had been opened by FM Facsimile "Multiplexing"—the simultaneous broadcasting of sound and sight over one wave-band without interference—oral and printed radio in one closely coordinated double program.

The interlude of war production has detracted nothing from, and added much to, the future profit possibilities of Finch Facsimile Broadcasting. When the Government gives the "green light" for transition to peacetime activities, and stations will be seeking new means of service and profit, *you'll find Finch ready!*

Meantime, Finch engineers are devoting their entire attention to the needs of our armed forces and the winning of the war.

first in facsimile broadcasting

mum's the word...NOW

...BUT TIME WILL REVEAL THE STORY OF Doolittle ENGINEERING

Long before Pearl Harbor . . ."specialized communications equipment by Doolittle" was well and favorably known to aviation, broadcast and police radio engineers.

Since then . . . Doolittle Engineers have constantly been at work developing and producing vital equipment for the Naval Aircraft Factory and the Bureau of Aeronautics, to hasten Victory.

Their added experience will bring important benefits to future peacetime communications. *Look ahead . . . with Doolittle.*

Doolittle RADIO, INC.

Builders of Precision Radio Communications Equipment

7421 South Loomis Boulevard, Chicago 36, Illinois

Back the Attack
Buy More War Bonds

"When we think of the OD3/VR-150, we think of HYTRON"

This enthusiastic comment by an expediter for one of the largest electronic equipment manufacturers, is typical. Engineers and purchasing agents everywhere are automatically associating Hytron with the OD3/VR-150. Since the tube was not originated by Hytron (Hytron was called upon to manufacture the tube to help satisfy a mushrooming demand), the reason must lie in Hytron's ability to do a better job.

WHY THE HYTRON OD3/VR-150 IS PREFERRED

1. **CAREFUL ENGINEERING DESIGN** — Hytron re-design, among other improvements, resulted in the addition of a new starting electrode which permits a uniformly lower starting voltage.

2. **RIGID PRODUCTION CONTROL** — Handling and dimensioning of internal parts during pre-processing and assembly are extremely painstaking.

3. **TIGHTER FACTORY SPECIFICATIONS** — For example, the minimum required starting voltage is 180 volts. Average starting voltage of the Hytron OD3/VR-150 is less than 160 volts.

4. **CONTINUOUS ENGINEERING CONTROL OF QUALITY** — In over 15 months, there have been no Government rejections of lots submitted for inspection.

5. **MASS PRODUCTION** — This apparently simple tube is in fact difficult to produce. Yet Hytron is manufacturing it at a rate sufficient to meet on schedule the growing demands of both new and old customers.

MORAL: You too should specify the Hytron OD3/VR-150 (and OC3/VR-105).

OD3/VR-150 AND VR-150-30 COMPARED

Frequently engineers ask how the OD3 and VR-150-30 differ. The maximum regulation limit for the VR-150-30 was 5.5 volts from 5 ma. to 30 ma. The OD3 has a maximum regulation limit of 4 volts from 5 ma. to 30 ma. Viewed another way, the current range is expanded to 40 ma., with the original maximum voltage regulation limit of 5.5 volts. The OD3/VR-150 is in short an improved replacement which supersedes the VR-150-30; it has the advantages of the increased 40 ma. max. rating.*

** The OC3/VR-105 also has ratings up to 40 ma. max.; it supersedes and is a replacement for the VR-105-30.*

OD3/VR-150 CHARACTERISTICS

Type	Glow Discharge Voltage Regulator
Maximum Overall Length	4-1/8"
Maximum Diameter	1-9/16"
Bulb	ST-12
Base	Small Shell Octal 6-Pin

Average Operating Conditions

Starting Supply Voltage	180 min. d.c. v.
Operating Voltage (approx.)	150 d.c. v.
Operating Current	5 min. d.c. ma. 40 max. d.c. ma.
Regulation = (E_{40}—E_5)	3.5 d.c. v.

OLDEST EXCLUSIVE MANUFACTURER OF RADIO RECEIVING TUBES

HYTRON CORPORATION ELECTRONIC AND RADIO TUBES

SALEM AND NEWBURYPORT, MASS.

BUY ANOTHER WAR BOND

COAXIAL CABLES

ANDREW Coaxial Cables for the famous HALLICRAFTERS SCR-299

ANDREW Coaxial Cables are standard equipment on the Hallicrafters-built SCR-299: the mobile communications unit that is doing such an outstanding job on the fighting fronts. It is highly significant that ANDREW Coaxial Cables were chosen as a component of this superb communications unit.

The Andrew Company is a pioneer manufacturer of coaxial cables and accessories. The facilities of the Engineering Department are available to users of radio transmission equipment.

DRY AIR PUMP

ANDREW CO.

COAXIAL CABLES. The Andrew Company is now able to supply standard 70 ohm 7/8" soft temper coaxial cable in lengths up to 4,000 feet! The cable is electrically identical to rigid cables of equal size, but has these extra advantages: the cable may be uncoiled and bent by hand, thus greatly simplifying installation; no connectors, junction boxes or expansion fittings need be installed in the field; thus a big saving is made in installation time and labor.

DRY AIR PUMP. This hand-operated pump quickly, efficiently and economically dehydrates the air inside coaxial cables, in addition to having a multitude of other applications. It dries about 170 cubic ft. of free air, reducing humidity from 60% to 10%.

GAS-TIGHT TERMINAL. The new Andrew glass insulated terminal is an outstanding development that provides a 100% air-tight, gas-tight system for gas filled coaxial cables. A special design that minimizes shunt capacity makes this terminal ideally suited to high frequency operation.

COAXIAL ANTENNA. Suitable for fixed station use and pretuned at the factory to the desired operating frequency, the Andrew type 899 vertical coaxial antenna provides an efficient, easy-to-install, and inexpensive half-wave radiator in the frequency range from 30 to 200 MC. Careful engineering has utilized to the utmost the well known advantages of the coaxial antenna over other types of vertical half-wave antennas.

GAS-TIGHT TERMINAL

CATALOG DESCRIBING COAXIAL CABLES AND ACCESSORIES FREE ON REQUEST. WRITE FOR INFORMATION ON ANTENNAS AND TUNING AND PHASING EQUIPMENT.

THE ANDREW COMPANY • 363 EAST 75TH STREET • CHICAGO 19, ILLINOIS

RADIO SUPERVISORS

— A —

Adams PH San Diego Cal E
Aderhold HR Augusta Ga M
Albridge RG Lima O M
Aldhizer JT Roanoke Va M
Allen D Fayetteville Ark M
Allen WK Mineola NY M
Alles JJ Wilkes-Barre Pa M
Amsbury RL Whittier Cal M
Anderson C Chino Cal M
Anderson RC San Bernardino Cal M
Anderson RF Beverly Mass M
Anderson RF Lynnfield Mass M
Anderson RF Saugus Mass M
Anderson R Moline Ill Z
Anderson WL San Angelo Tex M
Andes WJ North Bergen NJ M
Arendale JW Tusculoosa Ala M
Armfield E Monroe NC M
Arnold E Jersey City NJ M
Arnold L Suffolk Va M
Aro LJ Minneapolis Minn M
Ashlock HD Indianapolis Ind E
Atkinson RL Tallahassee Fla M
Atkinson SW Cranston RI M
Atkinson WH Margate NJ M
Atkinson WH Pleasantville NJ M
Atkinson WH Ventnor City NJ M
Atterholt FM Ashland O M
Ayers JC Lake Charles La M

— B —

Babcock HC Norwood Mass M
Bailey AW North Easton Mass M
Bailey DC Tampa Fla M
Bailey JE Ark City Ark M
Bakofsky CG El Paso Tex M
Balsom BH Bath NY M
Barber ES Burbank Cal M
Barlick J Hollister Cal M
Barraclough RE Pueblo Colo M
Barrett WA Grand Island Neb M
Barrington RW Pennsauken NJ M
Barry TJ Portland Me M
Basham C Ft Worth Tex M
Bass CW Nashville Tenn M
Bates AG Omaha Neb M
Bates WR Oneonta NY M
Batts RL Indianapolis Ind MZ
Baumgart RC Indianapolis Ind MZ
Baumhart DG Hutchinson Kan M
Bay J Mentor O M
Bayne TL Salina Kan M
Beach CH Panama City Fla M
Beall FM Washington DC M
Beard LJ Marshall Tex M
Beaty JS Burlington NC M
Beaver JA Harrisburg Pa E
Beck RT Racine Wis MZ
Beckwith R Trumbull Conn M
Begley E Virginia Minn M
Bellingham JH Englewood NJ M
Beneditz E Beaver Dam Wis MZ
Bennett PC Belvidere Ill M
Bennington RF Chattanooga Tenn E
Benton PE Dayton O M
Benzinger AE Eureka Cal M
Berg HC Superior Wis M
Berg TH Oceanside Cal M
Bernard SE Muskogee Okla M
Best N Niagara Falls NY M
Bevenour RW Galesburg Ill M
Beyer RG Utica NY M
Biggs AW Huntington NY M
Biggs RN Petersburg Va M
Billeaux BM Princeton Ill M
Billick P Gary Ind M
Birren WL Peoria Ill MZ
Black CW Los Angeles Cal F
Black HP Mobile Ala M
Blackert C Norman Okla M
Blankmeyer WH Butte Mont E
Bliesner C Lawrence Kan M
Blount GF Royal Oak Mich M
Boas WJ Hartford Conn S
Boatright JD Colorado Spgs Colo M
Bock AW Cuyahoga Falls O M
Boeve WM Grand Haven Mich M
Bogardus HV San Francisco Cal M
Bolvin LV Larchmont NY M
Bomar LC Birmingham Ala E
Bonat ER Scituate RI M
Bonnett J Pampa Tex M
Boss EA Kingston NY M
Boss LJ Apponaug RI M
Bouton CD Robbins Cal E
Bouton CD Woodland Cal M
Bowdre W Joliet Ill M
Brackett WE Houlton Me M
Brady LE Hazel Pk Mich M
Brady RE Vancouver Wash M
Brandon T Charlotte NC M
Bresnahan LA Point Pleasant NJ M
Brewer CR Winston-Salem NC M
Bridgewater AZ Asheville NC M
Brierton LW Glen Ellyn Ill M
Brill F West Haven Conn M
Brittain HW Santa Barbara Calif M
Broderick HM Thompsonville Conn M
Broman WN Fiskville Tex M
Brown C Spokane Wash M
Brown DA Marion O M
Brown JM Paris Tenn M
Brown LW Connersville Ind MS
Brown R Akron O M
Brownell CH S Dartmouth Mass M
Brummel BC Jackson Tenn M
Buchanan J Buffalo NY MZ
Bucy JF Moundsville W Va S
Bulla WT Chicago Ill E
Bunday DL Ft Worth Tex M
Burd LW Midland Mich M
Burgoon G Altoona Pa M
Burke V Rye NY M
Burkhardt ER Crawfordsville Ind M
Burns EL Hermosa SD F
Burns FA New York NY M
Burt n GK Martinez Cal M
Busch B Clairton Pa M
Bush JB Lenoir NC M
Byers HO Wichita Kan MZ

— C —

Cain TJ Bound Brook NJ M
Callahan WJ Athol Mass M
Calvert H Pasadena Cal M
Campbell CD Pittsburgh Pa E
Campbell LJ Columbia SC M
Campbell LV Mansfield O M
Campbell WL Portland Ore E
Cannon CD Salem Ore M
Caribou PH San Francisco Calif E
Carlson HA Jamestown NY M
Casey LW Mitchell SD M
Castenholz FE Muskegon Mich M
Cavaness E Santa Monica Calif M
Charles WF Pompton Lakes NJ M
Charlton WA Brookline Mass M
Chatterton LN Cleveland O M
Chinski EJ Kankakee Ill M
Chipman VD Falconer NY M
Chock WY Honolulu TH M
Christopherson FB Kenosha Wis M
Civils HB Kinston NC M
Clack MH Amarillo Tex M
Clark CE Marietta O M
Clark F Hornell NY M
Clark JV Newark O M
Clark MH Amarillo Tex M
Clark P Grosse Pte Woods Mich M
Clark TW Paducah Ky M
Cleveland WG Ventura Cal M
Clipperly WL Albany NY S
Clough GR Galveston Tex M
Coates AL Detroit Mich E
Coker RC Jackson Miss S
Collins AJ Moorestown NJ M
Collins WH Madisonville KY M
Combs RD Zanesville O M
Connell EW Jacksonville Fla M
Connell WJ Rochester NY M
Conrad CA Lockland O M
Cook CM Gadsden Ala M
Cooper JD Sioux City Ia M
Cooper KH Greeley Colo M
Longmont Colo M
Corbin E Norman Okla M
Corweth HP New York NY E
Covert ND Evansville Ind M
Mt. Vernon Ind M
Cowley L Alhambra Cal M
Crane ES Hempstead NY M
Critchton FM Lincoln Pk Mich M
Crittenden KW Beloit Wis M
Cross HG Bristol Va M
Crouse AB Dayton O E
Crowder F Los Angeles Cal MZ
Cullis JH Chester Pa M
Culver FE Silver Spgs Md M
Curl ME Ft. Pierce Fla M
Lake Worth Fla M
Palm Beach Fla M
W Palm Beach Fla M
Curmitt GT Sedalia Mo M
Curran GM Middletown NY M
Currey A Millburn NJ M
Curry H Plainview Tex M
Curtis HS Hampton Va M
Curtis KM National City Cal M
Cutting BF Concord NH MS
Claremont NH M

— D —

Dahl EC Tacoma Wash M
Davena W Benicia Cal M
Davis D Piqua O M
Davis HC Emporia Kan M
Davis R Glastonbury Conn M
Davis RW Trenton NJ F
Dean JP Foxborough Mass M
Dearborn RP Plymouth Mass M
de Bruyne AL Durham NC M
Dechant LE Belleville Ill M
Delmotte RW Harrisburg Pa M
Demby Ben Miami Fla ME
Denstaedt EC Detroit Mich MZ
Derby SR Denver Colo M
DeShafton R Kansas City Mo M
Dexter RL Gr'Junction Colo M
Dickerson CA Aurora Ill M
Dickerson JE Covington Ky M
Dineen JB Flossmoor Ill M
Dodman JH Calumet City Ill M
Doege JP New Rochelle NY M
Dolva V Gt Falls Mont M
Dondanville RV Chicago Ill E
Western Spgs Ill M
Dosdall L Red Wing Minn M
Doubles SM Tallahassee Fla M
Dove AF LaVerne Cal M
Downs MR Watertown SD M
Doyle VJ Bayonne NJ M
Drake JF Perrysburg O M
Driscoll EJ Worcester Mass M
Duben Wenzel Manitowoc Wis M
Two Rivers Wis M
Duffy JP Quincy Mass M
Duncan D Waukegan Ill M
Dunn EC Corpus Christi Tex M
Dunn HC Culver City Cal M
Dupree F Chula Vista Cal M
Durgin CH Port Orchard Wash M

— E —

Ealy JV Traverse City Mich M
Edmonds E Bradford Pa M
Edmonson W Piermont NY M
Edwards JO Sapulpa Okla M
Egan AC Northampton Mass M
Elar P Freeport NY M
Ells RP E Weymouth Mass M
Ellington WM Jackson Miss M
Ellison CW Los Angeles Cal M
Elmgren RO Cloquet Minn M
Ervin JE Brunswick Ga F
Esterwold T Montebello Cal M
Ettenhofer MF Escanaba Mich M

— F —

Farnsworth JD Bloomington Ill M
Clinton Ill M
Lincoln Ill M
Normal Ill M
Featherkile MW Bellingham Wash M
Featherstun AH Mt Vernon Ill M
Fenddrich V New York NY M
Fengill C Methuen Mass M
Ferguson VL Washington DC E
Fettwels C W Chicago Ill M
Wheaton Ill M
Fields JD Ft Smith Ark M
Finegold I Elyria O M
Flanagan PT Bluefield W Va M
Fleming JC Atlanta Ga M
Flemming CL Plattsburg NY M
Floyd J Dallas Tex M

(Radio Supervisors, cont.)

Fox RH Bakersfield Cal M
Frampton RL Blackwell Okla MZ
Franklin PE Houston Tex M
Fraser CF Bridgeport Conn M
Free RJ Springfield O SZ
Freeland JG Romeny W Va M
French BC Meadville Pa M
French E Boise Idaho M
Fulker RA Bel Air Md M
Fuller F Riverdale Ill M
Funk FM Winchester Va M

— G —

Gada R Modesto Cal E
Turlock Cal MZ
Gaines CC Omaha Neb M
Gale EP Lawton Okla M
Gallagher VR San Antonio Tex M
Gamble W Monongahela Pa M
Gamble WM Pittsburgh Pa M
Gammon WC Portsmouth O M
Garba HC Lafayette Ind M
W Lafayette Ind M
Gardner H Iola Kan M
Garvey JR Gainesville Tex M
Gaskill RJ Ft Wayne Ind M
Gautney G Ashtabula O M
Gentry JH Wilmington Del S
Gerard JI Bowling Gr Ky M
Getz I Massilon O M
Gillis JH Huntsville Ala M
Gillette H San Bernardino Cal F
Gillman A Ecorse Mich M
Ginther LA St Paul Minn M
Glisson AF W Chester Pa M
Gocha E Pontiac Mich M
Goggin WL Grass Valley Cal E
Golson WT Alexandria La S
Baton Rouge La S
Franklin La S
Lake Charles La S
Leesville S
Monroe La S
Goodson FM Chapman Ala F
Gould JR Suffield Conn M
Gorin JL San Fernando Cal M
Gorman D Kalispell Mont M
Gorsky JL Fanwood NJ M
Graham K Des Plaines Ill M
Graves AQ S Beloit Ill M
Green WR Edmond Okla M
Greene GH Alpena Mich M
Griffith PE Nashville Tenn S
Groenier RS Madison Wis M
Groff O Duncan Okla M
Grogan WH Daytona Beach Fla M
Hollyhill Fla M
Grube LE Billings Mont M
Gruber LE Bremerton Wash M
Guinan JJ Norristown Pa M
Gullick KC Bend Ore M

— H —

Habberley RR Springfield Mass E
Hackett JP Birmingham Mich M
Haenssinger WA Winona Minn M
Hagaman BB Rochester Minn M
Hahn GW Chicago Hgts Ill M
Halbert L Winnetka Ill M
Hale JN Montebello Cal M
Hall GC Glastonbury Conn M
Hall ME Independence Mo M
Hall TE Wilmette Ill M
Halley T Phillipsburg NJ M
Harkins JG Columbus O M
Harland R Moscow Idaho M
Harland SM Chardon O M
Harrington J Phillipston Mass M
Harrington WH Atherton Cal M
Menlo Park Cal M
Redwood City Cal M
Harris WC Lexington NC M
Hartford W Newton Mass M
Hartley AT Winslow Ariz M
Hartman GR Reading Pa M
Hartman H Oklahoma Okla E
Hartman PF Quincy Ill M
Hartman SP Lufkin Tex M
Hartnett JJ Burlingame Cal M
Hatton LM Ardmore Pa M
Haussman AC Geneva NY M
Havens AG Washington DC M
Hawk RW Goshen Ind ME
Hearn JL Cincinnati O MZ
Hefele CP Riverside Ill M
Heiges GE Sharon Pa M
Holt S Lexington KY M
Helton MC Radford Va M
Henderson EV Texarkana Ark M
Henning EF Little Rock Ark ME
Hesen JE Keyser W Va M
Hewitt JS N Tonawanda NY M
Heyd WG Belmont Mass M
Hickey J Elwood Ind M
Hickman R Dodge City Kan M
Hicks R Tulsa Okla M
Hirshberg HD St Petersburg Fla M
Hlavaty A Bear Mountain NY M
Hoffman MA Mt Vernon NY M
Hollowell TH Elkins Park Pa M
Hopper CL Springfield Ill MZ
Horlbeck W Monessen Pa M
Houdyshell VH Great Bend Kan M
Hough E Grand Forks ND M
House H Auburn NY M
Houts J Mankato Minn M
Howe R River Rouge Mich M
Howell JA Camden NJ M
Hoyt CJ Woonsocket RI M
Hudson I Piedmont Cal M
Hughes JM Indianapolis Ind E
Hull MJ Auburn Ind M
Bluffton Ind ME
Humphreys TG Birmingham Ala E
Hunt RR Livingston NJ M
Hurst WW Compton City Cal M
Hyde SJ Albany NY M

— I —

Igoe O Hazard Ky M
Irvine LD Abilene Tex M

— J —

Jackson GC Westlake O M
Jackson HE Hibbing Minn M
Jaminet JS Coffeyville Kan M
Jarvi AA Duluth Minn MZ
Jenks LE LaCrosse Wis M
Jennison AN Keene NH M
Jewett G Flint Mich M
Jerzykowski SA Hamtramck Mich M
Johns OG Elmhurst Ill M
Villa Park Ill M
Johnson CF Denison Tex M
Johnson EN Topeka Kan Z
Johnson HW Park Ridge Ill M
Johnson RS Freehold NJ M
Long Branch NJ M
Red Bank NJ M
Johnson TN Daytona Beach Fla M
Johnston EN Topeka Kan M
Jones EB Elizabethton Tenn M
Johnson City Tenn M
Jones OL Portage Wis M
Jones RM Birmingham Ala M
Jones SH Wilmington NC M
Jorgenson TO Eau Claire Wis MZ
Justice WO Madera Cal M

— K —

Kaari ET Sault Ste Marie Mich M
Kadow AC Elgin Ill M
Geneva Ill M
Kaeding AA Mt Clemens Mich M
Karickoff RR Elkins W Va M
Kauffman HC Lorain O M
Kay AP Anahuac Tex M
Beaumont Tex MZ
Orange Tex M
Pt Arthur Tex M
Kearmes F Penns Grove NJ M
Keeling HJ Los Angeles Cal E
Kelley OP Ft Collins Colo M
Kelly HO Minneapolis Minn MZ
Kelly Jos Amityville NY M
Kelly WH Williamsburg Va M
Kendrick JC Centralia Wash M
Kennedy ME Los Angeles Cal E
Kerscher MA South Bend Ind E
Kiehl CL Little Rock Ark S
Kieling TH Yuma Ariz M
Kienast FG Madison Wis M
Kilby P Ladue Mo M
Kimm C Wenatchee Wash M
Kimsey H Ada Okla M
Oklahoma City Okla S
Kinney G Genesco NY M
Kirby H San Jose Cal M
Kirby T Detroit Mich E
Knight EC Watertown Wis M
Knowles C Parkersburg W Va M
Klein AG Burlington Ia M
Koch CF S Charleston W VA ZS
Koch WF Sacramento Cal F
Kopp ME Highland Park Ill M
Krebs WW Roanoke Va E
Kreuz LB Austin Tex M
Kromer FA Norwalk O M
Krumscheid FJ Jamaica Pl Mass E
Kruse HS Rumson NJ M

— L —

LaCivita RS Youngstown O MZ
Ladish WL Texas City Tex M
Laird T Morristown NJ M
Lane W Louisville Ky MZ
Larson G Hilo TH M
LaRue R Flagstaff Ariz M
Florence Ariz M
Phoenix Ariz S
Lathrop RE Waukesha Wis M
Lautzenheiser F Lincoln Neb M
Lavendoll L N Adams Mass M
Lawless J Providence RI M
LeBoeuf M Marysville Cal M
Lee WM Richmond Va S
Leddy FD E Hampton NY E
Leidigh WA Portland Ore E
Lewis AE Grand Rapids Mich E
Lewis Glenn San Diego Cal M
Lewis JM San Rafael Cal
Lewis JB Watertown NY M
Lewis M Larkspur Cal MZ
Lindekugel WA N Platte Neb M
Linder F Cranford NJ M
Lindfeldt EW Sacramento Cal M
Linville WC Atchison Kan M
Littlejohn JB Salt Lake Utah MZ
Lobnitz E St James NY M
Locher A Arcadia Cal M
Monrovia Cal M
Lund M Menominee Mich M

— M —

MacAdams ML Brockton Mass M
MacGregor JA Kalamazoo Mich M
Machin LH Everett Wash M
MacInnis JA Medford Mass M
Somerville Mass M
Mackall L Hyattsville Md M
MacLean TW Spokane Wash E
Manchester RM Saginaw Mich M
Marcel CL Pittsfield Mass M
Marcina HJ Rock Spgs Wyo M
Margaretic T Merced Cal M
Marron PJ Attleboro Mass M
Marsh RR Sioux Falls SD M
Martin GL South Gate Cal M
Lynwood Cal M
Matney WW Los Angeles Cal E
Matteson RS Fond du Lac Wis M
Mattison S LaCrosse Wis M
Mattox EA Fargo Ga F
Mattson CL Atlanta Ga S
Maude F Fulton NY M
May C Bedford Ind M
Mayes P Knoxville Tenn M
Maynard GV Hammond Ind MZ
Maxey EL Springfield Mo M
McCarron JA Boston Mass M
McClean B Wharton Tex M
McCoy MN Memphis Tenn MZ
McDermott WR Viola RFD Suffern NY M
McDonald R Richmond Ind MZ
McDonough DM Tacoma Wash M
McFarlane DJ Belchertown Mass M
Boston Mass M
Brighton Mass M
McGinnis HJ Tomahawk Wis G
McGlothlen M Oskaloosa Ia M
Ottumwa Ia M
McGlumphy W St Clairsville O M
McGowen JM Newark NJ M
McIntire GW Hagerstown Md M
Chambersburg Pa M
McIntyre MM Owensboro Ky M
McKean HK Ft Wayne Ind E
McKee AH N Andover Mass M

SPOT NEWS

(CONTINUED FROM PAGE 32)

New WCEMA Members: Following companies have been accepted recently as members by the West Coast Electronic Manufacturers Association:

Brittain Sound Equipment Co., Los Angeles
Merle F. Faber, San Francisco
Harvey Machine Co., Inc., Los Angeles
Howard Pacific Corp., Los Angeles
The Lake Mfg. Co., Oakland
Special Electric Laboratories, Los Angeles

These additions bring the total membership to more than 50, indicating the strong position of the radio-electronics industry on the West Coast.

Newspaper FM: An interesting analysis of the competitive relationship between newspapers and radio, and the possibilities of newspaper-owned FM stations is presented by Ernest L. Owen, publisher of the Syracuse Post-Standard, in a booklet issued by the Syracuse University School of Journalism, N. Y. Copies can be obtained on request.

FINCH FACSIMILE SYSTEM

(CONTINUED FROM PAGE 37)

has been developed also. This unit is approximately the size of a typewriter, measuring 15 ins. wide, 9 ins. deep, and 14 ins. high. Weight is less than 25 lbs. It is designed to transmit and receive copy on paper the size of standard telegraph forms, $8\frac{1}{2}$ ins. wide by 7 ins. long. Two identical cylinders, 7 ins. long and $2\frac{9}{16}$ ins. in diameter, are employed. One is to hold copy for transmission, and the other carries electro-sensitive recording paper for reception.

In the transmitting section of this duplex unit, a small scanning head, comprised of a photocell, exciting lamp, and lens system, is moved along the scanning cylinder by means of a lead-screw similar in construction to that employed in the 4-column ($8\frac{1}{2}$-in.) transmitters. Modulator, recording rectifier, photocell amplifier, and associated controls are included in a small compartment behind the scanning head assembly. Copy to be transmitted is wrapped around the drum and is held in place by means of two spiral-wound springs formed as closed loops about the cylinder. These are slid over the ends of the copy.

In the receiving portion of the unit, a similar arrangement on the recording cylinder is employed to hold the electro-sensitive paper in place. A tungsten wire stylus, affixed to a recording arm which is moved longitudinally by the lead-screw, is utilized to form the trace on the electro-sensitive coating.

Simultaneous control of framing and synchronizing operations is effected by a clutch which is actuated by a 500-cycle signal. Electrical circuits of the duplex unit are identical in function to those employed in scanning and recording equipment previously described. A black carrier signal at a level of zero db is provided at the output terminals when connected with a 500-ohm line.

Scanning is at the rate of eight square inches per minute, 100 lines per inch. This is equivalent in speed to 150 words per minute when single-spaced typewritten copy is transmitted.

With equipment of this particular type, it is anticipated that facsimile methods will be applied in general communications service in many new fields.

WHAT'S NEW THIS MONTH

(CONTINUED FROM PAGE 4)

preceding our entry into the War. It seems to be another case of being too busy with today's problems to tackle tomorrow's.

Ray Ellis will head up a meeting on August 15th when the matter of civilian radio production will be discussed. He has been highly successful in laying out plans and making them work. He will succeed in this case if anyone can, for he has the confidence of the industry.

If an opinion based on almost thirty years active participation in radio is worth anything, we hazard the guess that any attempt to bring the manufacturers to a point of agreement will come to nothing. It seems more likely that Ray Ellis will have to make a decision, and then tell the industry what it is going to do. Otherwise, when civilian radio production starts, there will be a free-for-all, with no holds barred.

(CONTINUED ON PAGE 73)

(Radio Supervisors, cont.)

McKee EH Sacramento Cal S
McKinney LF Berkeley Cal M
McMichael EH Fairfax Va M
McNamme GE Taunton Mass M
McSwain RH Los Banos Cal M
Mead GE Pensacola Fla M
Meek R Joplin Mo M
Meek RW San Jacinto Cal MZ
Melka E Skokie Ill M
Melka EG Morton Grove Ill M
Mentzer WV Indianapolis Ind S
Meredith BD Dallas Tex M
Merkl G Appleton Wis E
Mietske RH Keiso Wash M
Miller BB St Louis Mo E
Miller EE Marion Ind E
Miller HB Topeka Kan S
Miller P Auburn Ind M
Mitchell AD Waco Tex M
Mitchell J Pocatello Idaho M
Montgomery L Wickliffe O M
Montgomery R Cairo Ill M
Moore C Canton NY M
Moore DF Paterson NJ M
Moore EM Kilgore Tex M
Moore LS Bozeman Mont M
Morey GJ New London Conn M
Morgan EH Salt Lake City Utah M
Morgan JT South Newport Ga F
Morgan MA Fairmont W Va M
Morgan OL Monroe La M
Morrison DO New Haven Mich M
Morrison HA Lowell Mass M
Muckel CD Bristol Conn M
Muir YE Inglewood Cal MZ
Mukkel CW Terryville Conn M
Mulligan J Corning NY M
Munay JF Perth Amboy NJ M
Murphy D Biloxi Miss M
Murphy D Gulfport Miss M
Murray PE Chicago Ill E
Myers HC Charleston W VA S
Myers RJ Akron O M
Myrbeck ER Braintree Mass M

— N —

Neese LF Trenton NJ M
Nemec HJ Cedar Rapids Ia M
Nerhood HE Akron O E
Nevins C Ann Arbor Mich M
Nichols WB Stratford Conn M
Nicholson RM Ottawa Ill M
Nickel VW Wisconsin Rapids Wis M
Nickols GL Frankfort Ind M
Nielsen AJ Mansfield Mass M
Nietz JW Baraboo Wis M
Nixon RW Huntington WVA M
Nolan C Danville Ill M
Nolan HC Jasper Ind SZ
Norton T Hamilton O M
Nutty G Vincennes Ind M

— O —

Ockenlander RM Brigantine NJ M
O'Connor FD Tulsa Okla E
Oliva SJ Danbury Conn M
Olson CE St Joseph Mo M
Orr J Cumberland Md MZ
Osterhoff JI Dubuque Ia M

— P —

Parker ET Fairhaven Mass M
Parker JF Malden Mass M
Parker RH Augusta Me S
Parish CA Greensboro NC M
Parkinson TP Milford Conn M
Patterson WK Pekin Ill M
Payne CW Wichita Falls Tex M
Pearce J Sewickley Hgts Pa M
Perdew WH Evanston Ill M
Perkins FM Lewiston Me M
Perkoski SC New Britain Conn M
Person LL Hollywood Fla M
Peterson GW Provo Utah M
Peterson HC Berwick Pa M
Peterson IJ Roselle NJ M
Petit EB Pawtucket RI M
Petit O Indianapolis Ind M
Pfeiffer G Helena Mont M
Phillips C Denton Tex M
Phillips R Davenport Ia M
Phillips WM Canton O E
Piatt WM Highland Park NJ M
New Brunswick NJ M
Piatt H Corona Cal M
Palm Springs Cal Z
Riverside Cal M
Pletcher RF Huntingdon Valley Pa M
Portwood RT Lubbock Tex M
Porter JF Malden Mass M
Powell GM Shinnston W Va S
Preston MW Winchendon Mass M
Price CW Freeport Ill M
Prichard DW Poughkeepsie NY M
Primm WW Rocky Mt NC M

— Q —

Quandt HF Libertyville Ill M
Waukegan Ill M
Quantz RG Olympia Wash SZ
Quick HO Syracuse NY M

— R —

Raborn GT Chickasha Okla M
Ralph CC Portland Ore M
Ravich MI Manhattan Beach Ca M
Rawlings GW Annapolis Md MZ
Reaves JK Tonopah Nev E
Reece L Wichita Kan E
Reed GU Middletown Conn M
Reese LM Lakeport Cal M
Relce ME Milton Pa M
Rice TA Owosso Mich M
Richmond RE Chattanooga Tenn M
Riddle CK Oceanport NJ M
Riggs BG Emmett Idaho M
Riley W Allen Park Mich M
Rippon S Port Jervis NY M
Risacher LJ Fair Lawn NJ M
Robinson WE Tuckahoe NY M
Romaine CL Chappaqua NY M
Rossell C Weehawken NJ M
Rothrock J San Marino Cal M
Rowe MB Needham Mass M
Royder Fa Goose Creek Tex M
Rungle B Alton Ill M
E St Louis Ill M
Granite City Ill M
Russell CO Beckley W Va M
Russell FW Louisville Ky M
Chapmanville W Va S

— S —

Sachse FJ Orlando Fla M
Sandefur MN Alexandria La M
Sanders WF Salem Ore F
Sarter FJ Monroe Wis M
Saunders RC Richmond Va E
Scannell CW Arlington Mass M
Schafer J Ritzville Wash M
Schermerhorn DB Missoula Mont M
Schneider FL Cape Girardeau Mo M
Schuler RM Fresno Cal M
Schwabe E Chilton Wis M
Schwartz JW Columbus O E
Schwerdt CV Ft Lauderdale Fla M
Searson FM Charleston SC M
Sellon RJ Grand Rapids Mich MZ
Senay A Holyoke Mass M
Settle NC Dallas Tex M
Sherman CJ Lebanon Pa ME
Shrader RS E Hanover NJ M
Shurden RR Greenwood Miss M
Shwedo JJ Scarsdale NY M
Sigel ML Little Valley NY M
Sights HC Manhattan Beach Cal M
Simmers WC Ithaca NY M
Simons FE Bay City Mich M
Simpson CE Monterey Cal M
Pacific Grove Cal M
Sinclair DG Ft Dodge Ia M
Skalitzky L Jefferson Wis M
Sloat EC Matawan NJ M
Slocum OB Lansing Mich F
Sloop WB Cary NC M
Smith CD Oxnard Cal M
Ventura Cal M
Smith GE Hollidays Cove W Va M
Leominster Mass M
Smith L Atlantic City NJ M
Smith L Longview Tex M
Smith RO Muncie Ind M
Smith TH Omaha Neb E
Smyth LJ Montgomery Ala S
Snyder H Kokomo Ind M
Snyder RW Garden City Kan M
Soboski W New Bedford Mass M
Sommerville RB Selma Ala M
Souers JH Ferndale Md M
Sousa JF Wailuku TH S
Sowle NA Carson City Nev S
Reno Nev MS
Quincy Ill M
Susanville Cal M
Spence RC Morgantown W Va M
Spengler HC Anderson SC M
Spevacek J Cicero Ill M
Spooner AJ Oklahoma City Okla MZ
Springgate RS Whiting Ind M
Squires HW Binghamton NY M
Stacey FA Salem Mass M
Stafford LS Pittsburg Kan M
Stalter HS Carmel Cal M
Stark HL Alliance O M
Starr AZ Hillburn NY M
Steiner H Lewiston Idaho M
Stevenson HR Port Chester NY M
Stewart AW Brownwood Tex M
Stinnett RL N Little Rock Ark M
Stockelburg A Woburn Mass M
Stone FA Janesville Wis M
Stone WD Charleston W Va M
Stone WW Fredericksburg Va M
Straube C Ambridge Pa M
Streeter F Guthrie Okla M
Stuckey AE La Mesa Cal M
Stull JL E Chicago Ill M
Sullivan EF Waterbury Conn M
Summerville RB Selma Ala M
Sutton GR Des Moines Ia S
Swartzlander GW Fremont O M
Port Clinton O M
Sandusky O M
Sy HP Lockport NY M
Sylvester A Hingham Mass M

— T —

Tamblyn FC Olympia Wash M
Taylor DC Ft Madison Ia M
Taylor HD Hartford Conn M
Taylor JB Salisbury NC M
Taylor WE Baltimore Md M
Teeter JH St Louis Mo M
Temple A Secaucus NH M
Teplany AJ Cleveland O E
Theibault EH Lakewood NJ M
Thomas PK Wyoming O M
Thompson JF Cleburne Tex M
Thompson VW Escondido Cal M
Tibbetts DR Kinsington Pk Cal M
Tierney EF Cambridge Mass M
Tiffany F Lake Forest Ill M
Timmons RE Swarthmore Pa M
Titus A Alexandria Ind M
Anderson Ind M
Noblesville Ind M
Titus JM Astoria Ore M
Torgenson TO Eau Claire Wis M
Toups EC Bogalusa La M
Tranfaglia T Revere Mass M
Trinta M San Mateo Cal M
True P Aberdeen Wash M

— U —

Ullrich R Bergenfield NJ M
Upham WA New Haven Conn E

— V —

VanderWal H Grand Haven Mich M
Van Sleen R Gastonia NC M
Vaughn EP Centralia Ill M
Vickerson AH Boston Mass M
Villers R Smithfield O M
Steubenville O M
Toronto O M
Wellsville O M
Aliquippa Pa M
Beaver Pa M
Cornopolis Pa M
Chester W Va M
Follansbee W Va M
Weirton W Va M
Wellsburg W Va M

— W —

Wagner DE Harrisburg Pa MZ
Wagner WH Sheboygan Wis M
Wainscott JM Urbana Ill M
Walker FW E Lansing Mich S
Walker NS Canton O M
Wallace J Deal NJ MS
Wallivere WT Marshall Mich M
Ward LS Rockford Ill M
Ward RD Anderson SC E
Ware RW El Centro Cal M
Wareing HF Milwaukee Wis MZ
Waring A State College Pa M
Warner HM Pompton Lakes NJ M
Wasmansdorff C Glendale Cal M
Watson HM Richmond Cal M
Watson VL Oak Park Ill M
Watson WR Wayne Mich M
Watts FW Franklinton La M
Weaver ED Elmira NY M
Weaver WN York Pa M
Weber WH Pikesville Md M
Weicht B Marion Ind M
Wells GH Schenectady NY M
Wells LG Big Spring Tex M
Wery LH South Bend Ind M
Wesser CH Wayndotte Mich M
Whaley BW Indianapolis Ind E
Wheeler J Nashua NH M
Wheeler LF Greenfield Mass M
Wheeler RK New Iberia La M
Wherritt JM Jefferson City Mo SZ
Whipple WI Butte Mont M
White GO Jefferson City Mo F
White OA Iowa City Ia M
Whiteman M Orange Cal M
Whiteman B Huntington Beach Cal M
Whiteman WE Anaheim Cal M
Santa Ana Cal MZ
Whiting WE Bakersfield Cal M
Whitman SB Waterloo Ia M
Whitman CF Mason City Ia M
Whitney LH Darien Conn M
Wiegner WW Elkhart Ind M
Williams RG Sanford Fla M
Wilt J Kansas City Kans M
Wood CM New Castle Ind M
Wood GR N Easton Mass F
Woodrow WH Rock Springs Wyo E
Woods JE Corpus Christi Tex E
Woodward JP St Louis Mo E
Wooten W Wilson NC M
Worsham LW Reidsville NC M
Worthy JN Americus Ga M
Wright CL E Peoria Ill M
Wright GC Sharon Mass E
Wynn WS Okmulgee Okla M
Wynn TM Tyler Tex M
Wynne WA Raleigh NC M

— Y —

Yeager CJ Endicott NY M
Young JK Salem O M
Warren O M

— Z —

Zaharis G S Charleston W VA M
Zeaman EL Stevens Point Wis M
Zeigler H Claremont Cal M
West Covina Cal MZ
Zink A Andover Mass ME

WHAT'S NEW THIS MONTH

(CONTINUED FROM PAGE 71)

4. While we're on the subject of postwar planning — what has happened to RTPB? We know that engineers are not inclined to relate their efforts to the calendar, but at the present rate of RTPB progress, Chairman Fly is going to get tired of waiting, and he'll come up with a blueprint of his own.

If anyone doesn't like it, he will say: "The radio industry was given carte blanche to lay out its own program, and it had ample time to do it. Its accomplishments amounted to nearly zero. Now you'll have to accept my plan because, while it may not be perfect, it's better than none at all."

5. There's one radio matter, however, that does not seem to interest Mr. Fly at all, although it concerns everyone in the radio industry directly or indirectly. That is the conduct of little Caesar (Baby Face) Petrillo and his AFM. We have too much respect for Mr. Fly's ability to think that he couldn't give him a proper going over if he were so inclined, but he just doesn't seem interested.

A bench warrant for Petrillo's arrest has been issued in Minneapolis. He was cited for contempt of court when he ordered eight musicians to strike at KSTP, despite the fact that the union and union members were enjoined from striking pending a hearing on whether a permanent injunction should be issued.

Little Caesar will continue in his contempt of court because, unfortunately, the warrant for his arrest can be served only in Minneapolis, and he was in New York when the warrant was issued. This compatriot and disciple of Mussolini will, undoubtedly, come to the ignominious end which he deserves, but it will not be soon enough.

Meanwhile he is at large, not as an emigrant who has come here to enjoy and share the opportunities we accord to everyone, but to use the privilege of freedom of speech and action to deliberately ape the arrogance and insolence of those his father sought to escape when he brought his family from Italy to the United States. — *Milton B. Sleeper.*

EDUCATIONAL FM STATIONS

(CONTINUED FROM PAGE 40)

before the completion date specified by the construction permit.

Summarizing these comments, may I say that a little extra time and expense in planning today should reap rich dividends in the better performance and reduced cost of your radio system tomorrow. Radio in education depends upon the use we make of it, and so let us plan carefully now for the benefits it will bring in the time ahead.

HOW ALABAMA USES 2-WAY FM

(CONTINUED FROM PAGE 31)

there are in it, and who they may be. I certainly wouldn't have wanted the job, but it seemed all in the night's work to Pete and Duck. They stopped the car and took it and the occupants back to the County Jail, arriving just as the other patrolmen came in with the car they had stopped a little farther down Highway 31!

Later that night, they slowed down as they passed a car with a flat tire. Duck called out, "Need any help, mister?" The man mumbled something, and Pete was about to drive off when Duck said, "Back up so you can see his license tag, and check on the number while I get out and speak to him." Duck jumped out, flashlight in hand, while Pete pulled back until he could read the license number. Then he speeded up the engine to make a little extra noise while he called Montgomery. In a matter of seconds, the dispatcher had checked his record of stolen cars and was back on the air. Yes, a black Chevrolet, license number . . . , engine number . . . was reported stolen on May 15th. So Pete and Duck added one more car to the total recovered by the Highway Patrol. It was so simple that I wondered how anyone would have so little sense as to steal a car.

Probably what counts most with the taxpayers whose money pays the cost of installing radio equipment is when accidents happen on the highways. Sometimes they are discovered by the patrolmen. Sometimes they are reported by telephone, and a car is dispatched to the scene. Then, when minutes count in relieving pain or saving lives, the speedy action that 2-way radio makes possible really shows up!

Pete and Duck had a lot to say about their pre-radio experiences when, coming upon a wrecked car at night, one stayed to do what little he could for the occupants while the other drove off to find a farm house where he could phone for an ambulance and wrecker. Then, having fought off the yard dogs, awakened a sleepy and perhaps uncoöperative farmer, and convinced him that he was an officer on an errand of mercy, he might learn that the time and effort was wasted because the farmer had no telephone.

Today, there are many motorists alive because 2-way FM radio has reduced the time required to summon aid from hours to minutes. That, in itself, is reason enough for Chief Gilbert to say: "This radio system is the stuff!"

FM SERVICE RESTORED

The Yankee Network recently reduced the evening hours on FM stations at Paxton, Mass., and Mt. Washington, N. H., from 11:00 P.M. to 8:15 P.M. This change was considered necessary because of manpower shortage. The storm of protests resulted in a prompt restoration of evening programs.

(CONTINUED FROM PAGE 45)

characteristics of the doubler and amplifier circuits of the transmitter, and to John Evans of the RCA Manufacturing Company and to T. J. Buzalski I am indebted for its accomplishment. Continuous improvement of the transmitter and antenna efficiency was effected throughout the year, but of this phase of the development R. M. Morris of the National Broadcasting Company, under whose direction the work was carried on, is better qualified to speak. As the final step, the lines connecting the transmitter with the control board of the National Broadcasting Company at Radio City, from which the test programs were usually supplied, were equalized to about 13,000 cycles, and when this had been done the quality of reception at Haddonfield was far better than that obtainable from any of the regular broadcast stations.

TO BE CONCLUDED IN AUGUST

RCA FACSIMILE EQUIPMENT

(CONTINUED FROM PAGE 22)

In this field, RCA was a pioneer, having maintained an experimental service from New York City to ships in the North Atlantic in 1932 and 1933. During the last few years, in cooperation with the U. S. Weather Bureau, a limited wire line service has been maintained from LaGuardia Field to a few nearby points. Much has been learned not only about the facsimile requirements but also about the best methods of preparing the maps, and the experience has demonstrated again that facsimile has great possibilities in this field. A typical recorder for this purpose is shown in Fig. 7.

There are many other cases where it is much better to send a picture reproduction of the original copy than to transmit the information by code, teletype, or telephone. One great advantage lies in the fact that the copy cannot have any transscription errors. If it has been transmitted, for example, over a poor radio circuit having fading or noise, there may be irregularities in the recording, and parts may be missed, but there will be no errors which are not obvious as such.

Models of a simplified scanner and recorder for communication service are shown in Fig. 8. The scanner has great operating advantages over the conventional type where it is necessary to mount the subject on a rotating cylinder. Here the sheet is simply laid in place and the cover closed over it. The optical system moves instead of the subject. Sheets of any size and shape are handled with equal ease, and even folders of several pages. The recorder is of the continuous type, so that it is always loaded and ready to go, and printing is by the carbon paper method. If desired, hectograph carbon may be used instead and multiple copies made from the recorded sheet. The speed of the equipment shown is 10 square inches per minute.

WQWQ
REL 1-KW. TRANSMITTER

WMFM
REL 50-KW. TRANSMITTER

WHEF
REL 3-KW. TRANSMITTER

WENA
REL 50-KW. TRANSMITTER

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This preference for REL is not due to high-pressure salesmanship on our part. We haven't had time nor manpower for that purpose since Pearl Harbor, although, in our military production, we have made great strides in FM development.

Neither is this preference due to the lower cost of REL equipment. The purchase of an FM transmitter is an investment in public service, and price must be a secondary consideration. Still, the enormous expansion of the REL plant has made it possible to offer greatly increased value.

Our real salesmen are the REL stations which have now been on the air for 3 years or more. Their record of technical performance and economy of operation tell a more eloquent story than any promises or proposals. And remember: Every FM station of 50 kw. now on the air is of REL manufacture.

PEACETIME LEADERSHIP

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Bergenfield Police and Fire
Bloomfield Police and Fire
Bogota
Boonton
Bradley Beach
Brielle
Budd Lake
Butler
Caldwell Township
Carlstadt
Cedar Grove Police and Fire
Clifton Police and Fire
Cresskill
Denville
Dover Police and Fire
East Orange Fire
East Paterson
Eatontown
Edgewater Police and Fire
Emerson
Englewood Cliffs
Englishtown
Fair Haven
Fanwood
Fairview
Fairville
Garfield Police and Fire
Glen Rock
Hackensack Police, Fire and Water
Haledon
Hasbrouck Fire
Hasbrouck Heights
Haworth
Hawthorne
Hayden Chemical Company
Hillside
Ho-Ho-Kus
Interlaken
Kearnsburg
Keyport
Leonia
Little Falls Police and Fire
Little Silver
Long Branch
Lyndhurst
Madison Township
Manasquan
Matawan Boro
Matawan Township
Maywood
Middletown Township
Millburn
Monmouth Beach
Montclair
Moonville
Neptune City
Nutley Township
New Jersey Motor Vehicle
New Jersey State Police
New Milford
North Arlington
North Bergen Police and Fire
North Haledon
Ocean Grove
Oceanport
Ocean Township
Oradell
Paramus
Palisades Interstate Park
Passaic
Paterson
Perth Amboy
Piscataway Township
Point Pleasant Beach
Pompton Lakes
Princeton
Princeton Township
Prospect Park
Raritan Township
Red Bank
Ridgefield Park
Ridgewood Police and Water
River Edge
Roselle
Roselle Park
Rumson
Rutherford
Saddle River
Sayreville
Sea Bright
Sea Girt
Shrewsbury Boro
South Amboy
South Belmar
Spring Lake
Spring Lake Heights
Springfield
Tenafly
Teaneck Police and Fire
Totowa Boro
Union
Ocean Township
Union Beach
Verona
Wall Township
Wanaque
Wayne Township
West New York
West Paterson
West Long Branch
West Point Pleasant
Westwood
Woodbridge
Woodridge
Wycoff
Port Authority
Bayonne Bridge
George Washington Bridge
Outer Bridge
New York
Babylon
East Hampton
Federal Communications Commission
Floral Park
Grumman Aircraft
Hastings
Huntington
Islip
Lake Success
Lloyds Harbor
Lynbrook
Nassau County Police and Fire Marshal
New York Central
New York City Police and Fire
New York State Police
Oyster Bay Cove
Patchogue
Riverhead
Rockville Centre
Shelter Island
Smithtown
Southampton
Southold
Suffolk County Sheriff
Republic Aircraft
Yonkers
Connecticut
Bethel Police, Fire and Public Works
Bloomfield Police, Fire and Public Works
Bridgeport Police and Fire
Connecticut State Police
Danbury Police and Fire
Darien Police, Fire and Public Works
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Greenwich Police, Fire and Public Works
Hamden Police, Fire and Public Works
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