FM AND TELEVISION

Price 25 Cents

Sept. 1948

★ ★ Edited by Milton B. Sleeper ★ ★

PATTERN for FM PROFITS

A Special Section in This Issue

8th Year of Service to Management and Engineering

No Service is too Rugged for FEDERAL . . .

This specially designed shock platform vibrates at 5 G's. A Federal Mobile Radiotelephone, placed on it without shock mounts, must operate perfectly throughout a shock test of 10 minutes.

You can specify Federal Mobile Radiotelephone with confidence—and be sure of the finest performance under the toughest operating conditions. At the factory, every Federal Mobile Radiotelephone has to operate at peak efficiency under "engineered" conditions that far exceed those encountered normally in police, fire, taxi, utility, bus, truck, forestry or any other kind of duty.

Every Federal Mobile Radiotelephone undergoes a test even more severe than that given to military tank and aircraft equipment – the Federal "shock test." The unit is vibrated, *without shock mounts, at 5 G's—which is the force of an impact equivalent to 5 times its own weight. This rigorous test continues for 10 minutes while the equipment is in actual operation.*

This is only one of the thorough tests which every Federal Mobile Radiotelephone must pass – and pass with flying colors – before it is shipped. You will find it profitable to get the facts on Federal . . . the shock-tested Mobile Radiotelephone. Write to Department I-720.

Federol's Mobile Transmitter-Receiver Unit

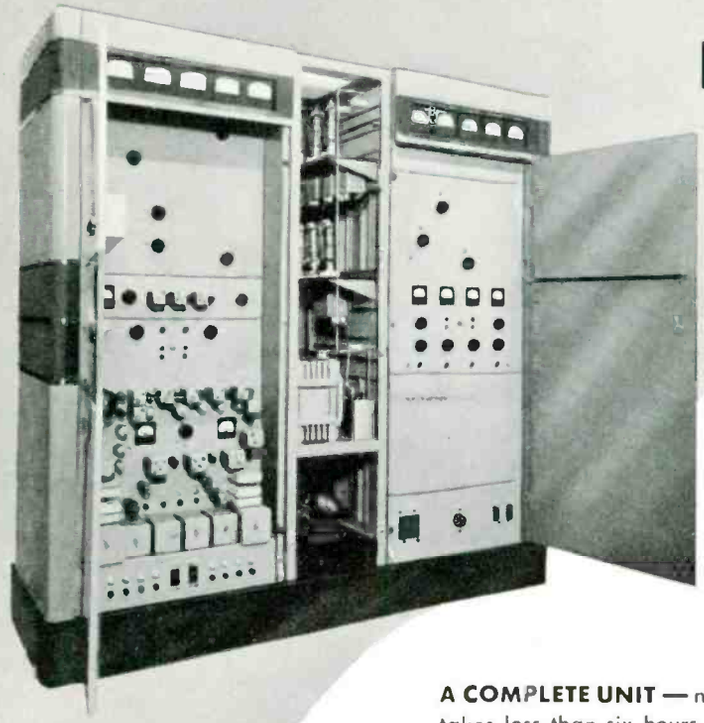
KEEPING FEDERAL YEARS AHEAD... is IT&T's world-wide research and engineering organization, of which the Federal Telecommunication Laboratories, Nutley, N. J., is a unit.

Federal Telephone and Radio Corporation

100 KINGSLAND ROAD, CLIFTON, NEW JERSEY

In Canada: Federal Electric Manufacturing Company, Ltd., Montreal, P. Q.
Export Distributors: International Standard Electric Corp. 67 Broad St., N. Y.

EASY
- TO INSTALL
- TO OPERATE
- TO CONVERT TO HIGHER POWER



Front view of RF3 3KW-FM Transmitter with doors open showing convenient arrangement of controls for tuning driver and amplifier. Center litt-off panel has been removed to show accessibility of power supply.

RAYTHEON
250W—1KW—3KW—10KW
FM TRANSMITTERS

A COMPLETE UNIT — normal installation takes less than six hours.

SIMPLIFIED OPERATION — by direct crystal control requiring no corrective circuits or mechanism.

NO SPECIAL TUBES — only standard low cost receiving-type tubes are used in the modulator.

NO SLIDING RF CONTACTS — standard amplifier techniques used in all RF stages. The amplifier maintains it settings *permanently*.

NO NEUTRALIZATION — the tetrode tubes used require no complicated tuning adjustments.

SINGLE POWER CONTROL — for full range adjustment of power output.

ECONOMICAL — in initial cost as well as in operation and maintenance.

AUTOMATIC OVERLOAD RESET — returns transmitter to the air twice at full power and once at half power before locking out.

NO OBSOLESCENCE — Use the RF-3A amplifier in converting from 250 watts — use it later as the driver for a 10KW unit. Raytheon's integrated design policy eliminates obsolescence.

. . . and no ice problem . . .

The new Raytheon Type RFW FM Antenna is highest in gain ratio but it's lowest in cost, lowest in height, lowest in wind loading. Get the whole story today.

See your Raytheon Representative for complete information

VISIT THE RAYTHEON EXHIBIT—FMA CONVENTION
CHICAGO—SEPTEMBER 27 - 28 - 29

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FM AND TELEVISION

★ ★ Edited by Milton B. Sleeper ★ ★

Formerly, *FM* MAGAZINE and *FM* RADIO-ELECTRONICS

VOL. 8 SEPTEMBER, 1948 NO. 9

CONTENTS

FM AND TELEVISION IS INDEXED REGULARLY BY ENGINEERING INDEX, INC.

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THIS MONTH'S COVER

The picture of G.L.F.'s non-directional antenna on this month's cover was chosen because it symbolizes the new thinking exemplified in the Rural Radio Network policy of recognizing that the true measure of service to listeners is the quality of program reproduction in the listeners' homes.

It appears that RRN has not only given broadcasters, manufacturers, and dealers a workable Pattern for FM Profits, but a revolutionary formula of constructive policies for meeting radio's obligation to serve public interest, convenience, and necessity.

All phases of the RRN operation are covered in the six Sections of this issue devoted to Pattern for FM Profits.

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MEMBER, AUDIT BUREAU OF CIRCULATIONS ABC

WHAT'S NEW THIS MONTH

1. Radio Set Production
2. Service to FM Stations
3. TV-FM & TV-Only Sets

1. The sharp cut in July AM production, as shown by RMA figures, seems to set a storm warning for receiver manufacturers. While TV dropped 14% in July as compared to June, and FM dropped 17%, these are no more than seasonal variations. On the other hand, AM was down 43%. This new post-war low is 52% under the average for the first six months of 1948!

Actually, the AM situation is even more serious than these figures indicate because 193,000 automobile sets and 106,000 portables were produced in July. Of the 250,000 standard home models, some considerable number went into export shipments. It is safe to predict that, before the end of this year, manufacture of FM-AM models will exceed straight AM types.

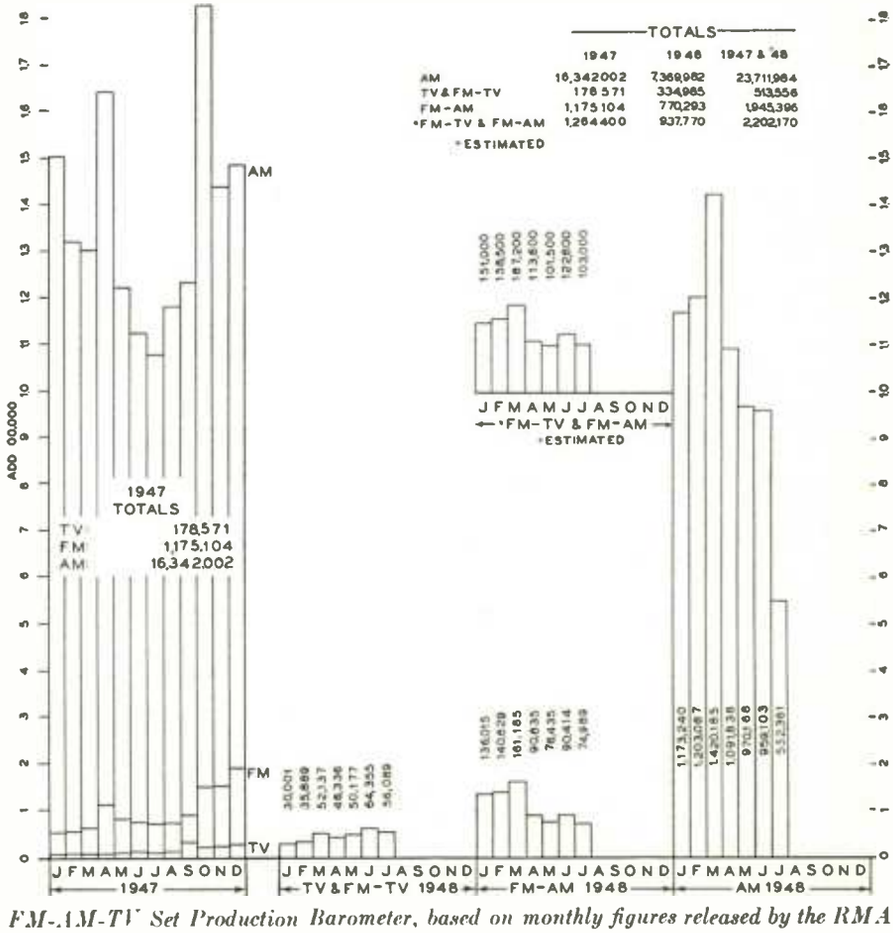
Demand for TV is taking all the television sets that can be turned out, but July was less than 10,000 sets ahead of the average production for the first six months of '48. While there should be a steady gain during the rest of this year, it will not be large because of the picture-tube bottleneck. Whatever the increase in picture tubes, it will be readily absorbed by the few leading manufacturers of TV receivers.

What about the others? What will they manufacture? Certainly not AM sets. Their alternative is to get behind FM if they are to continue in the radio industry. And if they are to succeed in selling FM sets, they will have to produce models substantially superior in performance to those being turned out by most companies today.

Sensitivities of 250 to 500 microvolts just won't do. They must give full limiting action at 50 microvolts, and preferably at 20 microvolts. From the listeners' point of view, FM sets that require 250 to 500 microvolts for full limiting are about as worthless as the average short-wave band. It's possible to hear something, but most people don't enjoy listening to it.

It is as plain as the blocks on this month's Production Barometer that

(Continued on page 22)



FM-AM-TV Set Production Barometer, based on monthly figures released by the RMA

You Asked For It...

Here It Is!

A ZENITH FM-AM TABLE RADIO

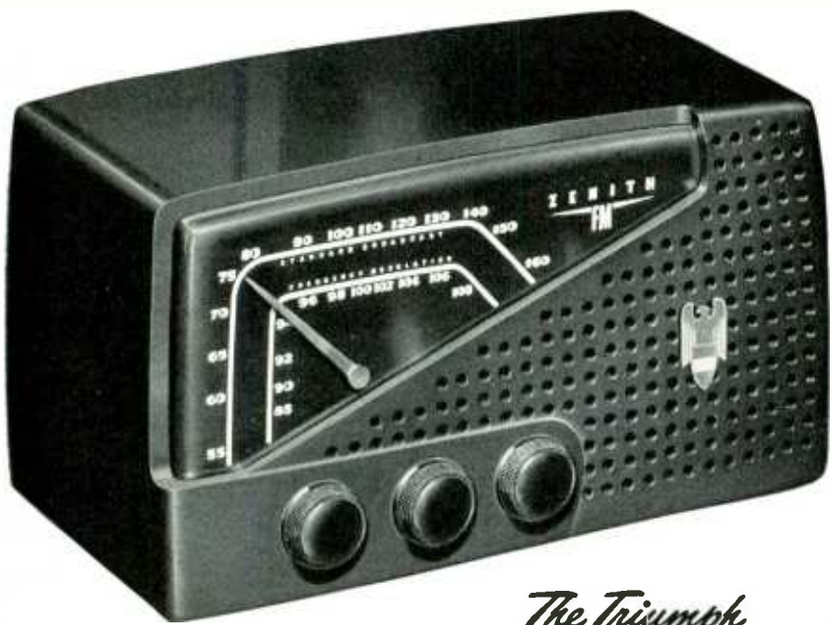
with

Zenith-Armstrong

FM

For Only

$49.95



The Triumph

A Quality FM Set With

EAR APPEAL-EYE APPEAL BUY APPEAL!

Just look what's yours to sell at this new low price!—Static-free *Zenith-Armstrong FM*—invented by Armstrong, perfected by Zenith . . . *Long Distance AM*—for powerful, cross-country listening . . *FM-AM Aerials Built-In*—just "plug in" and play on AC or DC . . . a smart *New "Cut-Away" Cabinet*—in shock-resistant Swirl Walnut plastic and a rich, pure *luxury* tone even *we* never expected at such a value price! Stock up on the new Zenith "Triumph" *now* and get set for a big boom in table FM set sales!

KEEP AN EYE ON

—And just to make *sure* you get your full share of "Triumph" sales, here's an eye-dazzling display that spells volume business no matter how you look at it. It's in full color for dynamic sales appeal—order *yours* today—by R-8128!

ZENITH RADIO CORPORATION • 6001 DICKENS AVENUE • CHICAGO 39, ILLINOIS

TELENOTES

Baltimore TV Survey:

WAAM, WBAL-TV, and WMAR-TV have organized a circulation committee to report monthly on TV set sales in their area. Work will be directed by F. L. Allman, H. P. See, and R. B. Cochrane of the three stations respectively. Current report shows 18,530 sets within their area, and sales at the rate of 3,000 per month.

TV Antenna Service:

JFD Manufacturing Company, 4110 Ft. Hamilton Parkway, Brooklyn, has organized a special department to advise and assist servicemen with their antenna problems. Aid will be given without charge.

Video Transcriptions:

Great success has been scored by theatres which make movies of TV images, and run them through projection machines. Using Paramount's high-speed processing, film can be run within 60 seconds after exposure. A price schedule on this service has just been issued by Paramount Pictures, Inc., 1501 Broadway, New York 18.

Channel 11 Reception:

WPIX New York announces that a survey conducted during July showed that 88.6% of TV owners queried are getting satisfactory reception of this station's programs on channel No. 11.

KTTV Under Way:

While the *Los Angeles Times-Mirror* transmitter is being installed on Mt. Wilson, the entire 14th floor of the Bekins Building is being remodelled for TV studios and offices. CBS has applied to the FCC for permission to acquire a 49% interest in this station.

WPTZ Accounts:

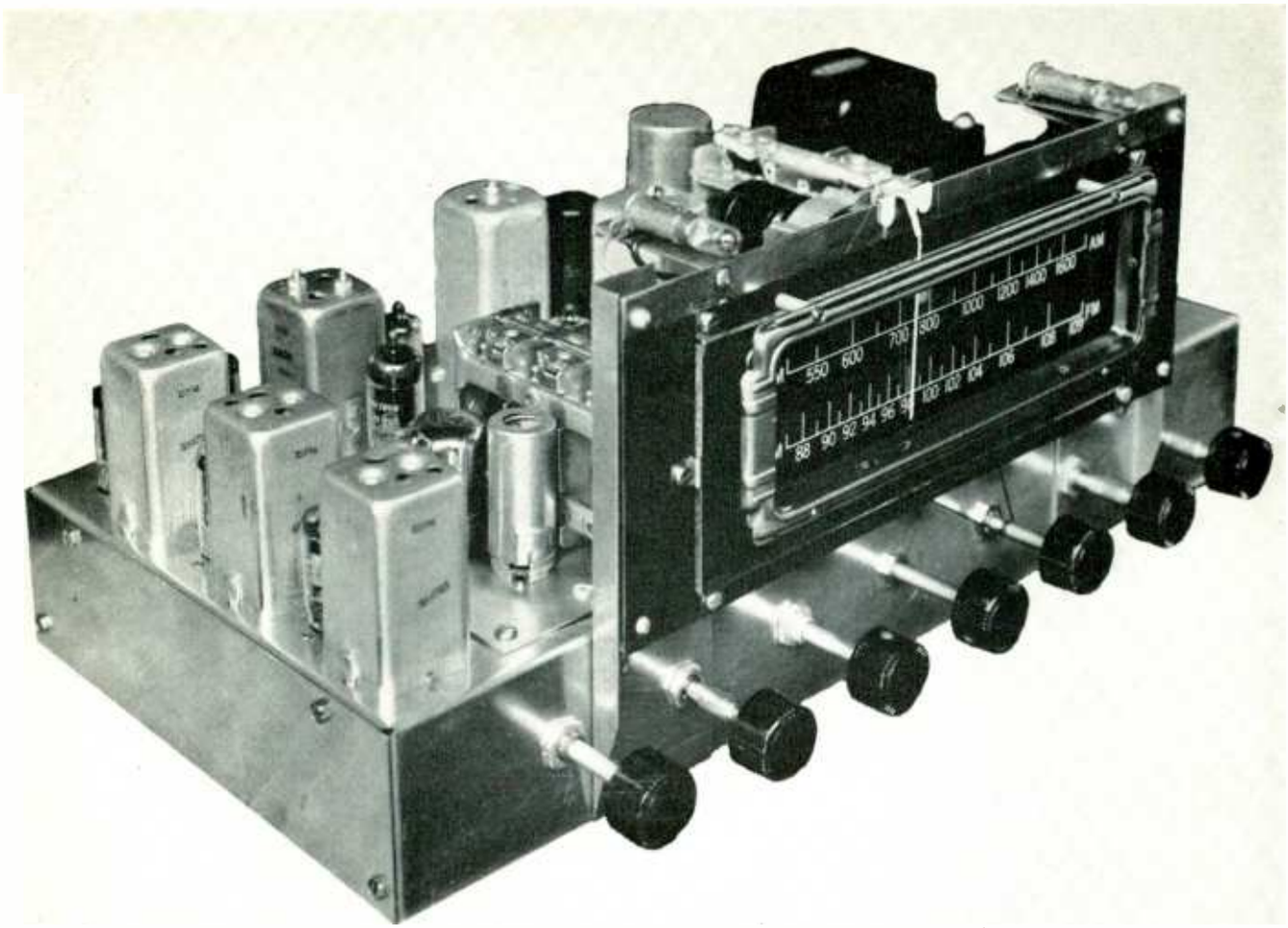
Philco claims first place in number of commercial accounts, with a total of 55 sponsors. New transmitter, costing $87,000, is now being installed.

New TV Models:

Three new designs are being produced by Sightmaster Corporation, comprising one 10-in. and two 15-in. types. A remote control unit is also available for installations where the picture tube is wall-mounted. These sets are on demonstration at 220 Fifth Avenue, New York.

Projection TV Sets:

A feature article in our October issue will describe the construction of a projection-type home TV receiver. Standard parts and sub-assemblies make the job easy for custom set-builders.



Here's an FM-AM Set that Is Winning Friends and Building Audiences!

6½ MICROVOLTS SENSITIVITY ON FM

Consider the FM-AM features of this new RJ-20 BROWNING Tuner, with 12 tubes plus tuning eye and rectifier:

1. Complete FM-AM tuner, 2-stage high-fidelity amplifier. and power supply.

2. On FM, 6½ microvolts produce 20-db quieting. Sensitivity of 5 microvolts on AM.

3. Genuine Armstrong circuit with dual cascade limiting.

4. Separate RF and IF systems for FM and AM improve performance by eliminating coil switching.

5. Added efficiency from the use of miniature tubes in the FM section.

6. Variable bandwidth on AM for the IF system, with 9-kc. width on broad position and 4-kc. on narrow position.

7. Separate treble and bass controls give 20-db boost in either tone range.

8. Two-stage audio amplifier gives FM response flat within 3 db from 15 to 15,000 cycles.

9. New 6AL7 tuning eye makes FM tuning easy and accurate, even on weak signals.

10. Bandswitch control for FM, AM, and phonograph. 20,000 ohms output impedance.

11. Terminals provided for both 72- and 300-ohm antenna.

12. Your choice of unmounted chassis, illustrated, or rack panel 8¾ by 19 ins.

WRITE TODAY for descriptive bulletin, performance curves, and prices on this completely new BROWNING model RJ-20 super-sensitive FM-AM Tuner.

BROWNING LABORATORIES, INC.

750 MAIN STREET, WINCHESTER, MASSACHUSETTS

In Canada, Address: **MEASUREMENT ENGINEERING, Ltd., Arnprior, Ontario**

PRODUCTS & LITERATURE

MACHINING PLASTICS: Booklet features methods of machining polystyrene plastics from bar or sheet stock, or for finishing operations after molding. Booklet 22. Monsanto Chemical Co., Springfield, Mass.

WIRE RECORDER: Fidelity surpassing that of acetate recordings is said to be obtained in 13-tube wire recorder with response from 40 to 10,000 cycles. Listening volume adjustable without affecting recording volume; separate bass and treble controls; two microphone channels; separate 8 in. speaker. Built-in radio, phono play back arm. Bulletin 95. Precision Audio Products Inc., 1133 Broadway, New York.

AUDIO AMPLIFIER: Consisting of two units and designed for remote operation, amplifier delivers 30 watts and is flat within 0.2 db. from 20 to 20,000 cycles. Large chassis contains amplifier and power supply; separate small unit houses pre-amplifier, operating controls, and four input channels. Bulletin C-310. Brook Electronics, Inc., 34 DeHart Place, Elizabeth 2, N.J.

METER: Multitester features freedom from frequency and temperature errors through use of germanium rectifiers. Three models cover wide range of DC and AC volt, megohm, milliampere and decibel measurements. Accuracy is maintained within 2%. Prices: $20.95 to $32.50. Bulletin 815. Radio City Products Co., 152 West 25th Street, New York 1, N.Y.

CAPACITORS: Impregnated with an exclusive high temperature plastic, these capacitors are said to be the smallest molded tubulard ever produced. Rated for minus 50 degrees to plus 125 degrees C. operation. Bulletin 826. Sprague Electric Co., North Adams, Mass.

VHF TUBE: Type 4X500-A is intended for vhf operation as a power amplifier and oscillator, providing a maximum plate dissipation of 500 watts. Features low-inductance leads, low grid-plate capacitance, and a grid terminal at the center of the filament end of the tube to facilitate its use in coaxial circuits. Bulletin 829. Tube Dept., RCA, Harrison, N.J.

PRE-AMPLIFIER: Compact pre-amplifier permits exact compensation for widely varying recording characteristics. Eighteen combinations of bass and treble curves provide crossover frequencies of 300, 500, and 800 cycles and high-frequency response from flat to slightly more than NAB slope-off. Matching power supply is available separately if needed. Size of amplifier unit is 8¼ by 2 7/8 by 6 ins. Bulletin 825. Brociner Electronics Lab., 1546 2nd Ave., New York City.

ELECTRONIC HARDWARE: 16-page catalog of electronic hardware, chemicals, tools, and finishing specialties. Catalog 824. Walter L. Schott Co., 9306 Santa Monica Blvd., Beverly Hills, Calif.

CRYSTAL HEAT STABILIZER: Designed to accommodate crystals from 80 to 10,000 kc., this heater operates at 50 degrees C. plus or minus 1 degree on 6.3-volt heater. Large 7-pin base. Recommended for broadcast and frequency standard applications. Bulletin 823. James Knights Co., Sandwich, Illinois.

OSCILLOSCOPE: Five-inch cathode ray oscilloscope is combined with the familiar Stethoscope for TV and FM servicing at moderate cost: $89.95. Bulletin 822. Feiler Engineering Co., 947 George St., Chicago, Ill.

WAVEMETER: Pocket-size instrument covers bands up to and including 420 mc. with plug-in coils. Checks frequency, percentage modulation, and antenna field patterns, and monitors quality of transmission. Bulletin 821. Simpson Electric Co., Chicago.

RECORD CHANGER: Moderately priced automatic record changer features separate platforms for 10- or 12-in. records, removable center spindle, drum turntable drive, and a parallel-lift tone arm. Available with a wide range of pickup cartridges. Bulletin 820. Garrard Sales Corp., 315 Broadway, New York 7, N.Y.

PRE-AMPLIFIER: Designed for use with variable reluctance pick-ups, this phono pre-amplifier is equipped with its own rectifier and transformer, and therefore does not need to be tapped into the receiver's circuit. Bulletin 819. General Electric Co., Electronics Park, Syracuse, N.Y.

SYNCHRONIZING GENERATOR: Advanced engineering design is incorporated in a diminutive TV generator which provides mixed driving, blanking, and synchronizing signals, and half-line driving pulses. Requiring only AC power, it is completely self-contained in a case 9¼ by 17 1/8 by 19½ ins. Bulletin 818. Allen B. DuMont Labs., Inc., Clifton, N.J.

POWER TRIODE: Type 812-A is an improved version of the popular 812, giving greater dissipation capability which permits increased ratings for plate current and plate input. For instance, a pair of the new tubes operated as modulators under ICAS conditions can modulate 100% an RF amplifier with an input of 100 watts, in class B audio service. Bylletin 827. Tube Dept., RCA, Harrison, N.J.

GERMANIUM RECTIFIERS: Tiny germanium varistors can replace diodes in many applications such as power rectifiers, detectors, limiters, and pulse generators. Much smaller size, freedom from heater power requirements, reduction of noise voltages, and smaller input and output capacitances are advantages. Ratings on six models are from 35 to 60 milliamperes continuous forward current, and 60 to 115 peak inverse volts. Bulletin 809. Western Electric Co., 195 Broadway, New York, N.Y.

SQUARE WAVE GENERATOR: Precision instrument has six overlapping frequency ranges covering 5 to 125,000 cycles. Delivers a rectangular wave output voltage with a 25% negative pulse and a rise time for the leading edge of .3 microsecond. Power supply self-contained. Bulletin 812. General Electric Co., Syracuse, N.Y.

VOLTAGE STABILIZERS: New line of stock catalog and custom-engineered stabilizers for regulating AC lines to plus or minus 0.5% within 0.05 seconds. Bulletin 811. Raytheon Mfg. Co., 60 E. 42nd St., New York City.

SWITCHES: Shorter rotor arms on new line of switches and attenuators decrease stray capacity coupling between sections, and permit more circuits per deck. Up to six poles on one deck are obtainable in a unit 2¾ ins. in diameter. Bulletin 804. Daven Co., 191 Central Ave., Newark, New Jersey.

EMBOSSED PLATES: Made from aluminum, zinc, brass, stainless steel, and other metals, these embossed plates are said to cost 50% to 75% less than etched plates. Available in a wide range of sizes. Bulletin 801. Chicago Car Seal Co., 634 N. Western Ave., Chicago 12, Ill.

AUDIO *and* ULTRASONIC OSCILLATOR

with Low Distortion • Uniform Output • Excellent Stability

THIS oscillator was designed to fill the need for a wide range, continuously adjustable instrument for laboratory measurements of gain, distortion, impedance and frequency response at frequencies well above the audio range.

With a single calibrated dial and four push-button-controlled multipliers the Type 1302-A Oscillator covers the range of 10 to 100,000 cycles. Because of its wide frequency range, high stability and flat output this oscillator is particularly suited to taking frequency response characteristics on amplifiers, telephone lines, filters and other such circuit elements.

FEATURES

- **WIDE FREQUENCY RANGE** — 10 to 100,000 cycles — 180 degree rotation of dial covers the 10 to 100 cycle decade, panel push buttons add in decade steps
- **ACCURATE CALIBRATION** — adjusted within ± (1½% + 0.2 cycle)
- **LOW DISTORTION** — less than 1% at any frequency
- **SMALL FREQUENCY DRIFT** — less than 1% in first 10 minutes; less than 0.2% per hour thereafter
- **FREQUENCY DRIFT CONSTANT PERCENTAGE OF OPERATING FREQUENCY** — particularly helpful with bridge measurements at low frequencies
- **CONSTANT OUTPUT VOLTAGE** — within ±1.0 db over whole range; 20 volts open circuit on 5,000-ohm output, 10 volts on 600 ohms
- **STABILIZED SUPPLY** — compensated for transient line voltage surges and average line voltage variations between 105 and 125 (210 and 250) volts
- **VARIABLE CONDENSER FREQUENCY CONTROL** — avoiding contact difficulties often found in variable resistance control
- **TWO SEPARATE OUTPUT CIRCUITS** — balanced 600 ohm and unbalanced 5,000 ohm

TYPE 1302-A OSCILLATOR . . . $365.00

GENERAL RADIO COMPANY

Cambridge 39, Massachusetts

90 West St., New York 6 | 920 S. Michigan Ave., Chicago 5 | 950 N. Highland Ave., Los Angeles 38

Where a second is

. . . in the clock that varies less than 1/1000th of a second a day

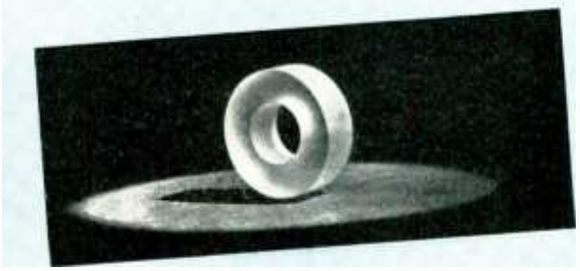
There's a clock at Bell Telephone Laboratories —evolved by the scientists there—that keeps accurate time within 0.001 second a day. It is the latest step in a series of developments that began 20 years ago when Bell Laboratories built the first crystal clock.

Why are the men of Bell Laboratories, whose basic interest is *communications*, so concerned with *time?* Because the study of communications is largely the study of frequency—and frequency is the inverse of time. To deal with frequencies in megacycles requires accurate measurement of fractions of micro-seconds.

In their early studies of piezoelectric crystals for frequency control, Bell scientists saw the desirability of using them also as a source of accurate time.

Two obstacles stood in the way of devising a crystal clock: the relatively high temperature coefficient of crystals, and the fact that their frequencies were too high to drive a synchronous motor. Annular crystals, with extremely low temperature coefficients, solved the first problem. Sub-multiple generators solved the second, accurately dividing the crystal frequency. Thus the barrier between *frequency* standards and *time* standards was finally broken down.

How a quartz ring drove the first crystal clock in 1928



Heart of the crystal clock built 20 years ago at Bell Laboratories was this quartz ring, adjusted to a frequency of 100 kc. With the crystal cut to correct proportions in this annular shape, positive and negative temperature coefficients of frequency effectively neutralized each other. Resultant temperature coefficient was less than 1 part in 10^6 per degree C.

In the complete oscillator, the crystal was mounted inside a chamber in which the temperature was kept constant within 0.01° C, and placed in a hermetically sealed bell jar to maintain uniform pressure. The frequency of the oscillator output was reduced to 1,000 cycles by means of sub-multiple generators.

In the clock mechanism, a 1,000-cycle synchronous motor, driven by the output of the sub-multiple generators, was geared to the clock hands. Accuracy of this clock in 1928 was within 1 part in 10^6. Accuracy of its present-day successor is of the order of 1 part in 10^8—an advance made possible by continuing research.

a long, long time . . .

...in a frequency standard that's accurate to 1 part in 10^8 a day

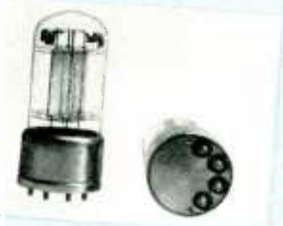
Continuing research on piezoelectric crystals at Bell Laboratories resulted in a development of far-reaching importance—the GT cut.

This opened the way to revolutionary advances in instruments for time-frequency measurements. The GT-cut crystals make possible entirely new standards of accuracy, because of their extremely low temperature coefficient—less than 19 parts in 10^8 per degree C, far lower than produced by any other method of cutting.

Moreover, GT-cut crystals are admirably adapted to wire-suspension mounting, which virtually nullifies the effect of shock on frequency. This greatly enlarges the range of conditions under which accurate measurements can be made.

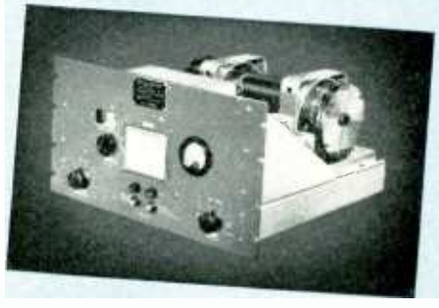
The Western Electric Primary Frequency Standard is the embodiment of these new concepts in design. It is a 100-kc source that combines accuracy and ruggedness to a remarkable degree. Frequency variation is less than 1 part in 10^8 over a 24-hour period; yet the Standard, far from being confined to the laboratory, performs with equal accuracy on ships, planes and vehicles—even in earthquake areas! *Wherever* there is a need for time-frequency measurements, or the synchronous operation of two or more systems, the Frequency Standard is ready and able to take on the job.

How the Frequency Standard maintains its accuracy



Key to the accuracy of the Western Electric Primary Frequency Standard is a GT-cut crystal, surpassing even the annular cut in the degree to which it nullifies the effect of temperature on frequency. The crystal is suspended by wires inside an evacuated glass envelope. The wire mounting results in an exceptionally rugged crystal unit, practically immune to shock.

The GT crystal is mounted inside this oven in which temperature is controlled electronically with extreme accuracy. In conjunction with sponge rubber pads, the oven acts as a further safeguard against vibration and shock, contributing to the outstanding ruggedness of the instrument.



The complete Standard, compactly designed, ruggedly built, weighing only 90 pounds, brings the accuracy usually associated only with delicate laboratory apparatus into field service.

—QUALITY COUNTS—

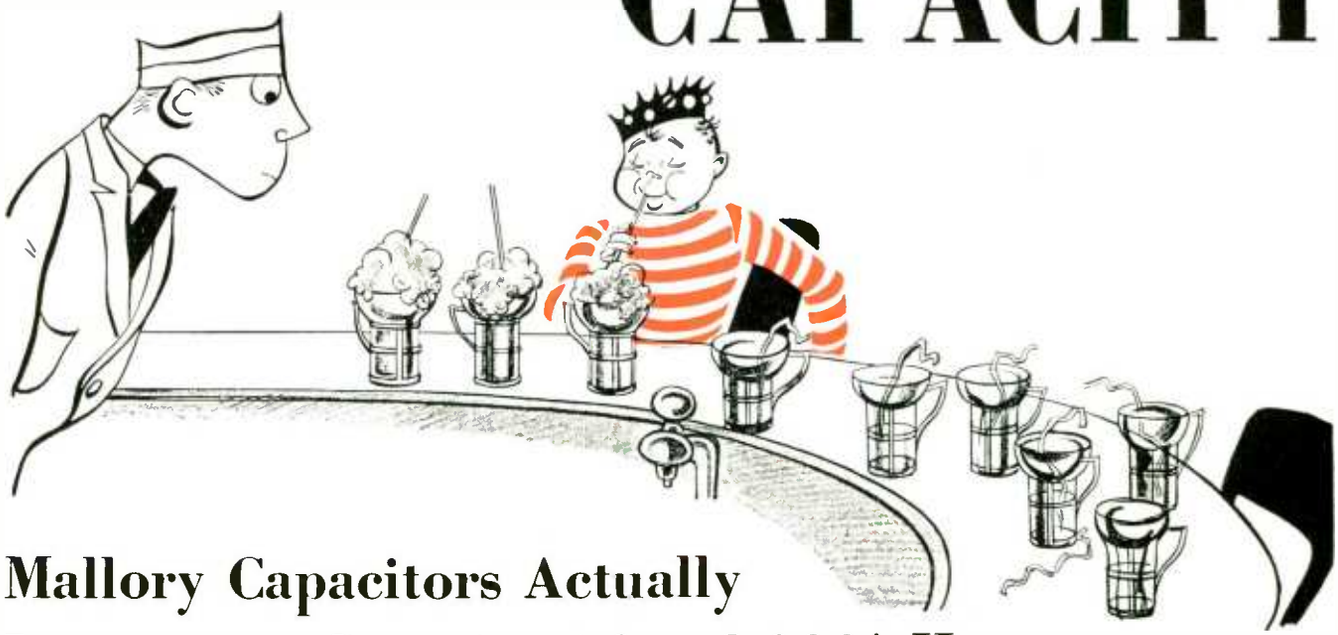
Western Electric

Manufacturing unit of the Bell System and the nation's largest producer of communications equipment.

Distributed by Graybar — Offices in 100 Principal Cities

DISTRIBUTORS: IN U. S. A.—Graybar Electric Company. IN CANADA AND NEWFOUNDLAND—Northern Electric Co., Ltd.

Sustained CAPACITY



Mallory Capacitors Actually Increase in Capacity After 2,000* Hours

Install Mallory FP Capacitors with the knowledge that they will last in a "hot set" with temperatures up around 185° F.—they will last on the shelf or in an inactive set without needing reaging—and they will last without loss of capacity.

Mallory is never satisfied to produce parts that just get by. In all Mallory Parts you will find a generous margin in *your* favor. Mallory capacitors will operate at 185° F. —that's 35° hotter than R. M. A. requirements.

Their RF impedance—their ability to withstand ripple current, are other plus values that make Mallory capacitors popular with radio service men, as well as with manufacturers of radio equipment.

THE MALLORY "GOOD SERVICE FOR GOOD BUSINESS" PLAN

will increase business and profits in your shop.

A unique follow-up file makes it easy to keep customers.

You tie in with Mallory acceptance to develop new business—ask your distributor about it.

***2,000 HOURS OF OPERATION**

An actual test of Mallory capacitors operated in an oven at 185°F. and 450 volts DC, plus 10 volts of 120 cycle ripple, showed them still going strong and with increased capacity at the end of 2,000 hours. Typical results:

At Start of Test		*After 2,000 Hours*	
Capacity	*Resistance*	*Capacity*	*Resistance*
20.9 mfd	6.16 ohms	23.5 mfd	6.5 ohms
20.1 mfd	6.5 ohms	23.4 mfd	6.55 ohms

BUY MALLORY ASSURED QUALITY AT REGULAR PRICE LEVELS

P.R. MALLORY & CO. Inc.

MALLORY

CAPACITORS . . . CONTROLS . . . VIBRATORS . . .
SWITCHES . . . RESISTORS . . . RECTIFIERS . . .
VIBRAPACK* POWER SUPPLIES . . . FILTERS

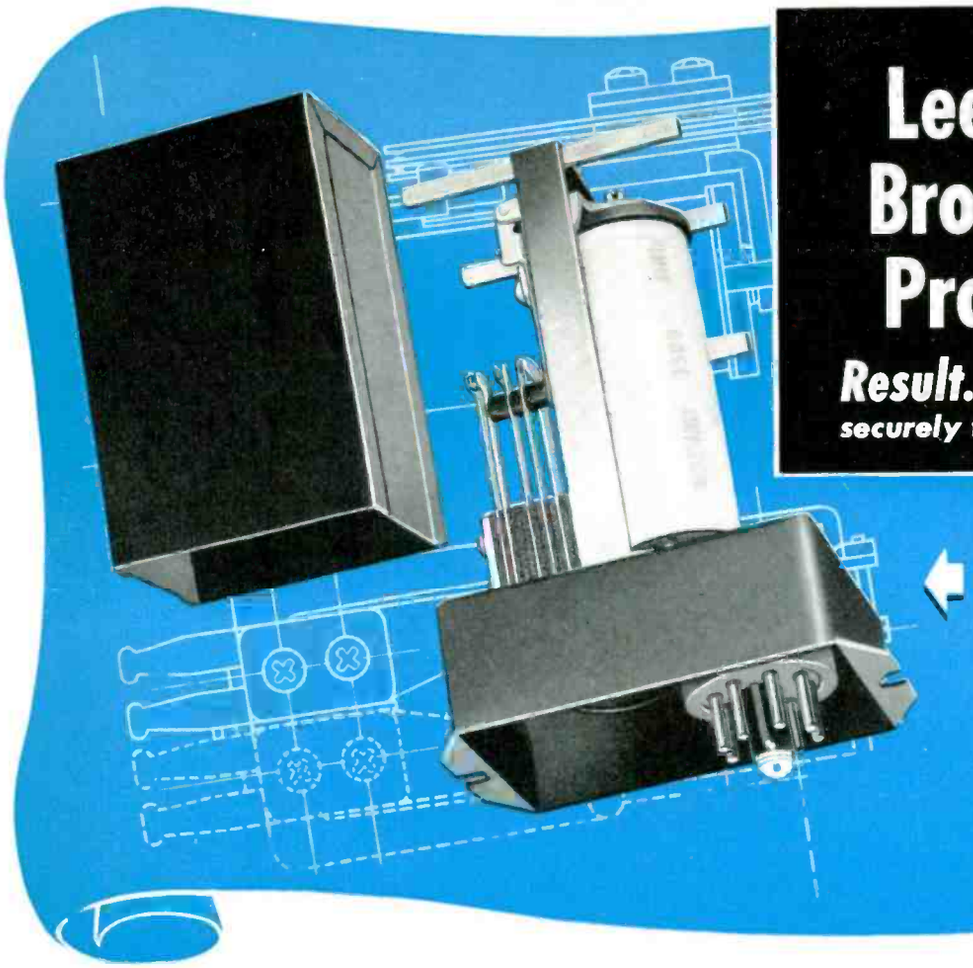
*Reg. U.S. Pat. Off.

APPROVED PRECISION PRODUCTS

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

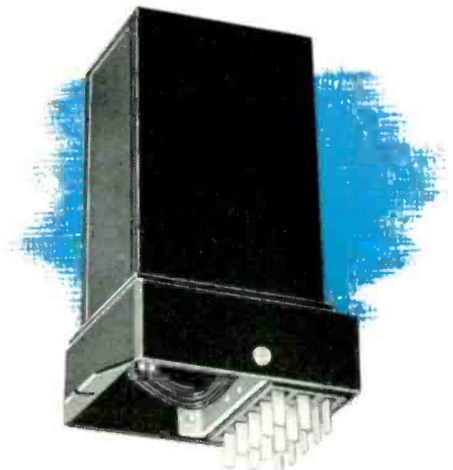
Leeds & Northrup Brought This Relay Problem to CLARE

Result... ***A dust-tight relay base and cover, securely fastened, with cover easily removed!***



Clare Type "C" d-c Relay, dust-tight mounted on base provided with Neoprene gasket, with easily removable dust-tight steel cover, as developed for Leeds & Northrup.

View of base assembly of dust-tight relay mounting showing terminals brought through Neoprene gasket. Note radio-type plug and flanges for securing to chassis.



Same installation as changed for use of United Air Lines. Note installation of the 15-point plug and single flange for mounting to chassis.

● Electrical controls produced by Leeds & Northrup, Philadelphia, are frequently called upon to operate at plant locations where dust conditions may affect the operations of unprotected components.

Their engineers called on CLARE for a plug-in relay that could be firmly secured to a chassis so that the plug could not be jarred or pulled out accidentally. A thoroughly dust-tight cover was required, yet it had to be easily removable for inspection.

CLARE engineers, in cooperation with Leeds & Northrup engineers, provided a cover base which contained a Neoprene gasket, closely fitted to the relay terminals for effective dust protection. They devised a steel cover which, firmly secured to the base by a thumb nut, could be readily removed. A standard radio type plug and notched flanges to permit rigid chassis installation completed the equipment.

Flexibility of this installation was soon demonstrated when a similar dust-protection problem came to CLARE engineers from United Air Lines. In this case a 15-point plug of different design was provided and a single flange for securing to the chassis.

If your problem has to do with relays, save time and expensive experiments by bringing it to CLARE. Take advantage of our long experience with every type of industrial relay problem. Call on CLARE sales engineers, located in principal cities, or write now to C. P. Clare & Co., 4719 West Sunnyside Avenue, Chicago 30, Illinois. In Canada, contact Canadian Line Materials Ltd., Toronto 13. Cable Address: CLARELAY.

CLARE RELAYS

First in the Industrial Field

4 New Ways to put live quality into transcriptions...

G-E VARIABLE RELUCTANCE PICKUP NOW WITH DIAMOND STYLUS!

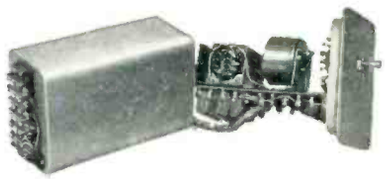
Virtually banishes Needle Scratch, Needle Talk, and Distortion! Rides lightly in the grooves—responds only to *lateral* motion. Rugged mechanically . . . built to stand abuse . . . practically unaffected by temperature or humidity. Available with the long-wearing Diamond Stylus with either of 2 Stylus radii—2.5 & 3 mil. (G-E Sapphire Stylus pickups are all 3 mil). Net to broadcasters.....$29.63.

G-E TRANSCRIPTION TONE ARM

Especially adapted for use with the G-E Pickup. Newly designed in strong, feather-light magnesium, this low mass tone arm is easily mounted on a standard turntable. Offered now by General Electric at an economical price to broadcasters.....$35.00.

G-E EQUALIZED TRANSCRIPTION PRE-AMPLIFIER

This high quality AC operated audio amplifier enables broadcasters to take full advantage of the superior performance of the G-E Variable Reluctance Pickup. A switch mounted on the turntable permits selection of 4 types of reproduction. Net to broadcasters .....$125.00 (less tubes). Set of tubes for pre-amplifier .....$8.00.



G-E TRANSCRIPTION EQUALIZER

For use with your present unequalized pre-amplifier. This equalizer is expertly engineered to complement present record and transcription frequency characteristics when used with the G-E Pickup mounted in the G-E Tone Arm. Extra magnetic shielding reduces hum pickup. Price net to broadcasters.....$45.00.

USE THIS CONVENIENT COUPON TO ORDER THIS G-E AUDIO EQUIPMENT TODAY!

If you want further information, consult your nearest General Electric transmitter representative, or write: *General Electric Company, Transmitter Division, Electronics Park, Syracuse, N. Y.*

LEADER IN RADIO, ELECTRONICS AND TELEVISION

GENERAL ELECTRIC

160-G1A-6914

General Electric Company, Transmitter Division,
Electronics Park, Syracuse, N. Y.

Please ship me, subject to your standard conditions of sale, the items checked below:

- ☐ G-E Pickup (diamond stylus) (specify which model) ☐ 2½ mil stylus ☐ 3 mil stylus
- ☐ G-E Tone Arm (Pickup not included)
- ☐ G-E Equalized Transcription Pre-Amplifier ☐ (set of tubes for Pre-Amp)
- ☐ G-E Transcription Equalizer
- ☐ Send me descriptive bulletins on all of these items
- ☐ Check or M.O. enclosed. ☐ Bill me.

NAME.....

STATION.....ADDRESS.....

CITY.....STATE.....

Mail this coupon today.

IN THE BATTLE FOR THE LISTENER'S EAR...

Here's increased coverage for your station!

with the new

LIMITING AMPLIFIER

FITS neatly into your audio cabinet—attractive, sturdy, quiet. But what a *wallop* it packs when you want attention from Mr. Big—the listener!

Based on engineering developments by CBS engineers, the Limiting Amplifier has been designed by General Electric to give you greater coverage and more potential listeners without changing your present transmitter or antenna.

For more information, call your nearest G-E broadcast equipment representative, or write us. *General Electric Company, Transmitter Division, Electronics Park, Syracuse, New York.*

MEMO TO STATION MANAGERS:

- Increases modulation and thus makes signal reach farther, sound clearer.
- Raises effective signal strength—this means increased coverage.
- Low installation cost—quickly, easily mounted in G-E Audio Cabinet Rack.
- In FM, too—protect your listeners against receiver distortion caused by transmitter overswing. Dynamic range, so important in FM, is maintained.

MEMO TO ENGINEERS:

- Increases average level of modulation as much as 8 to 10 db.
- Anticipatory circuit prevents overmodulation—even on the first half cycle of the overmodulation peak. Automatic recovery time improves program fidelity!
- Prevents distortion and adjacent channel splatter.
- G-E popular hinged panel construction—easy to get at.
- Vertical mounted for better ventilation.

G-E Limiting Amplifier at the 50,000 watt transmitter of WTOP, Washington, D. C.

LEADER IN RADIO, TELEVISION AND ELECTRONICS

GENERAL ELECTRIC

160-G2A-6914

The "Little Wonder" . . . a New H. H. Scott Instrument

Type 110-A Dynamic Noise Suppressor for average radio-phonographs and other record-reproducing systems.

No. 3 of a series on the reproduction of music from FM and phonograph records

PHONOGRAPH hobbyists, experimenters, and servicemen often build Dynamic Noise Suppressors* based upon published technical data, but results are not always perfect because of wiring errors, improper laboratory adjustment, the use of inferior parts, or outmoded circuits. Such suppressors are no credit to either the other licensees or us, and tend to harm rather than help the already enviable reputation which the Dynamic Noise Suppressor has established.

Hence we are announcing the Type 110-A Dynamic Noise Suppressor unit, designed for average radio-phonographs and other record-reproducing systems. *(*It can, of course, also be used on AM or FM reception, if suitable connections are made to the tuner.*)* Utilizing the original *two-inductance* gate circuit and a separate *bass gate,* it includes control circuits similar to many more expensive models.

For practical application to existing phonographs, the Type 110-A has a *single control,* and this is of the *remote* type connected with the main suppressor unit only by a cable. Hence the Suppressor can be mounted physically at any desired location in the phonograph cabinet without any regard to the control unit which, in turn, can be located conveniently on the main panel of the phonograph or in the record-changer compartment. The leads can be extended also if desired, for operating the control at a distance.

To insure best performance, each Suppressor is equipped, at no extra charge, with a matched pickup *(*list $8.50*)* of the latest type and particularly designed for low needle talk. The performance of the system will therefore depend mainly upon the amplifier and loudspeaker. The 110-A derives its operating power from an adapter placed under one of the output tubes in an AC receiving set.

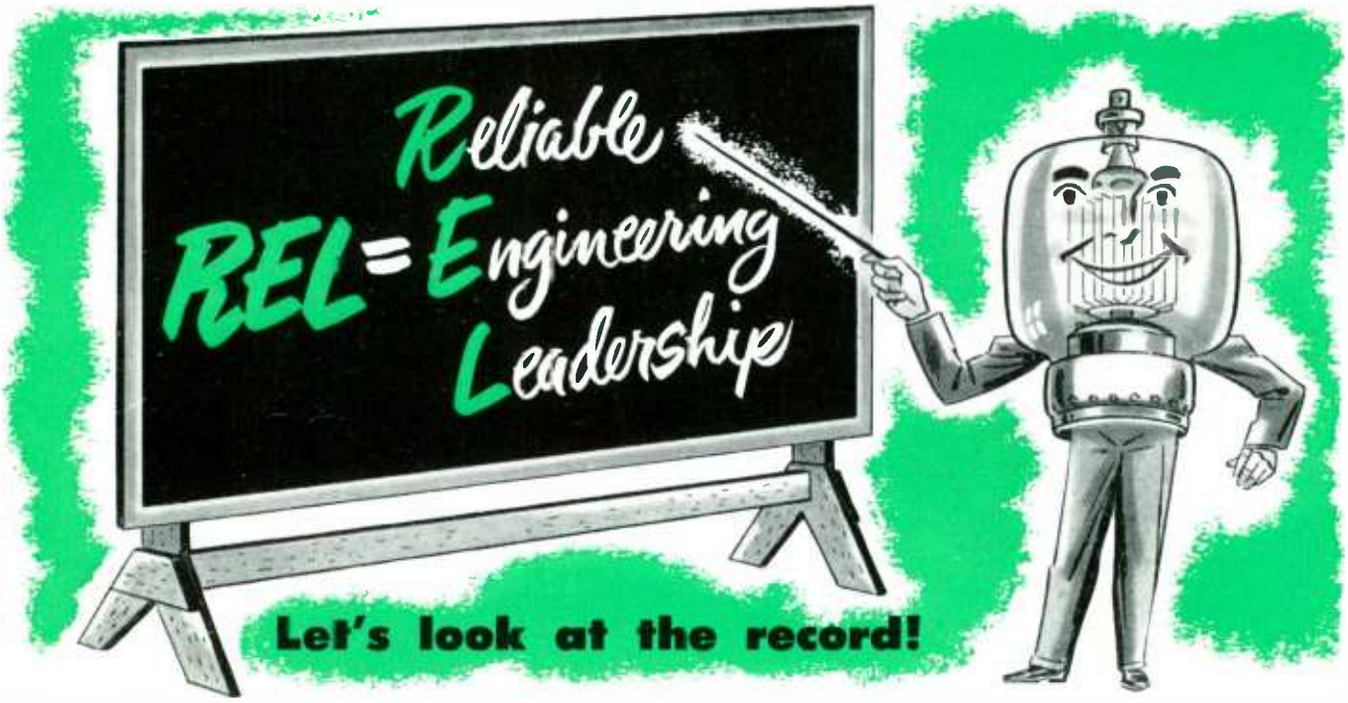
We do not claim that this Suppressor is as good as our broadcast unit, the system included in our Type 210-A Amplifier, or in any of the complete amplifiers or radio-phonographs manufactured by our licensees. For best possible results, the Suppressor should be an integral part of the amplifier. The new Suppressor is, however, superior to the average radio-phonograph or sound system with which it will be used, and represents the best balance between low cost and operating characteristics. The improvement in realism on most radio-phonographs is amazing.

The "Little Wonder" is now available from leading distributors, radio and music stores. It is also available through servicemen who can provide suitable installation for non-technical customers. The cost is low, $82.50 list, a small price for the practical rejuvenation of your record library. Complete specifications upon request. Order at once — production is limited.

* *Licensed under United States and foreign patents issued and pending.*

Hermon Hosmer Scott, Inc.
383 Putnam Ave., Cambridge 39, Mass.

Representatives and distributors and dealers in all principal cities



1935 FIRST TO BUILD FM EQUIPMENT!

REL manufactured the equipment used by Major Armstrong in the first public demonstrations of practical FM transmission.

1939 FIRST WITH COMMERCIAL FM!

REL was the first manufacturer to produce and install commercial transmitter equipment for FM broadcasting.

1939 FIRST WITH AN FM RELAY!

REL established the first studio to transmitter FM relay ever installed. This equipment is still functioning between Boston and Paxton, Mass., 43 miles airline over two ranges of hills.

1940 FIRST WITH 50 KW FM!

REL engineered and built the first commercial FM transmitter rated at 50 KW output.

1947 FIRST WITH THE "QUADRILINE"!

The *"Quadriline"* circuit structure, at one stroke, eliminated a host of expensive RF and mechanical construction problems at the 10 KW level.

1947 FIRST WITH AN FM NETWORK!

REL transmitting and receiving equipment was used exclusively to establish the first FM-all-radio-linked network. This net covered a total distance of 445 miles with total radiated power of approximately 450 KW.

1948 FIRST WITH UHF STL!

With the introduction of REL Model 694 STL equipment, the art and practice of FM broadcasting took another great stride forward free from the handicap of inadequate wire line facilities.

1948 FIRST WITH THE "SERRASOID" MODULATOR!

Simultaneously with the introduction of high performance STL equipment REL announced the amazingly efficient and economical *"Serrasoid Modulator."*

1948 CONTINUOUS ENGINEERING LEADERSHIP!

Another REL first is in the making. We can't release information now but you'll hear about it soon. Just remember the *"80-80"*—it's going to be big news for FM broadcasting.

REL

RADIO ENGINEERING LABS • INC

35-54 36th STREET, LONG ISLAND CITY 1, N. Y.

Super Phase Shift Modulation

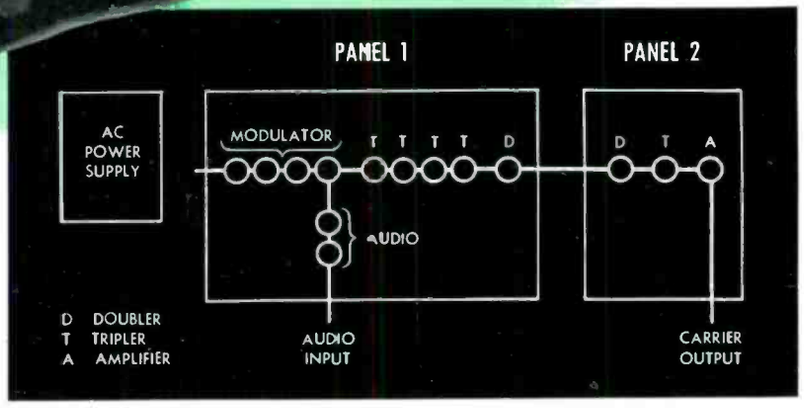
THE REL SERRASOID MODULATOR

CHARACTERISTICS:

1. The signal to noise ratio for 75 KC deviation is approximately 80 db.
2. Harmonic distortion over the audio range from 50 to 15,000 cycles is substantially less than .25%.
3. Employs only 11 receiving type tubes from crystal oscillator to carrier frequency in the 88 to 108 mc band. No special or expensive tubes are used.
4. Direct crystal control—no complicated electronic frequency correcting circuits nor mechanical gadgets are required.
5. The total power drawn from the AC lines is less than 125 watts.
6. The two units comprising the modulator, occupy only 19¼" of standard rack space.
7. The approximate weight of the two units combined is 70 lbs.
8. Can be used as an exciter for any make of FM Broadcast Transmitter.

SPECIFICATIONS:

1. Direct crystal control.
2. Modulation process involves 4 receiving type tubes operated at saturation, and aperiodically (no tuned circuits).
3. FM noise—approximately 80 db. below 100% modulation.
4. FM distortion less than 0.25% for all modulating frequencies from 50 to 15,000 cycles at 100% modulation. Intermodulation products negligible.
5. Carrier frequency stability ±.0003%.
6. Frequency response ±0.5 db. from 50 to 15,000 cycles.
7. Modulation input +10 dbm. (±2 db.) for 100% modulation.



Unquestionably the *SERRASOID MODULATOR* is one of the most significant advances in FM equipment ever announced. Employing an entirely new approach to the generation of FM signals under the Armstrong Phase Shift principle, the *SERRASOID MODULATOR*, virtually eliminates the individual transmitter as a factor in controlling the quality of an FM system.

The separate and distinct functions of modulation and carrier frequency control are secured with only four tubes and without the use of critical circuits or adjustments—the balance of the RF portion of the unit comprises simple frequency multiplier stages. Convincing evidence of the outstanding performance and economy of this unit is presented in the list of characteristics above.

That REL developed this equipment is in keeping with the established tradition of REL *Reliable Engineering Leadership.* This leadership, acknowledged throughout the industry, is the direct result of over 14 years of application to the exclusive task of advancing the art of FM transmission and reception. Literature covering REL equipment will be supplied promptly on request.

REL

RADIO ENGINEERING LABS • INC

LONG ISLAND CITY 1 • NEW YORK

THE BROADCAST VERSION OF THE *SERRASOID MODULATOR* HAS BEEN IN CONTINUOUS USE FOR OVER FIVE MONTHS AT MAJOR ARMSTRONG'S HIGH-BAND FM STATION, *W2XEA*, ALPINE, N. J.

Horizons opened by the introduction of the SERRASOID BROADCAST MODULATOR are fascinating enough in themselves, however, the portent of its principles and performance extend well beyond its application in the commercial equipments described here.

Multiplexing, telemetering, point-to-point, and other applications where it is vital to secure a means of obtaining large phase shifts with great linearity and low noise, are bound to be influenced and improved by the SERRASOID.

This development is, in fact, a part of a broad program for exploiting the fullest capabilities of wide-band FM on all fronts, and is in keeping with REL's policy of continuous engineering leadership.

THE STL VERSION OF THE *SERRASOID MODULATOR* HAS BEEN IN CONTINUOUS USE FOR OVER FIVE MONTHS IN THE SAN BUENO TO *KSBR* FM LINK AT MT. DIABLO, CALIFORNIA.

DESIGNERS AND MANUFACTURERS OF FM EQUIPMENT EXCLUSIVELY

REL

REL MODEL 694

STUDIO-TRANSMITTER FM LINK EQUIPMENT

● As might be expected from REL's leadership in the development of the FM art and in particular in the advancement of FM broadcasting, REL again leads the field by presenting its most recent achievement to the industry.

● This development is the result of many months of research. It is presented in answer to increasing demands for equipment to link studio and transmitter with very great fidelity and without the use of wire lines. The success of this development is measured in terms of equipment which will in no way contribute to the noise, distortion, or audio limitations of the overall system.

TRANSMITTER SECTION OF THE MODEL 694

RECEIVER SECTION OF THE MODEL 694

FREQUENCY: 940 to 960 megacycles.

RANGE: To be employed between positive line of sight points and, in no case, over a path in excess of thirty miles.

EQUIPMENT INCLUDES: Transmitter, 10db gain Transmitting antenna, Receiver, One set of operating tubes and crystals.

ADDITIONAL EQUIPMENT OPTIONAL: 40 foot supporting structures for transmitting and receiving antennas; Higher gain transmitting and receiving antennas; Transmission lines and fittings.

ELECTRICAL PERFORMANCE

AUDIO RESPONSE: 0.3 DB FROM 50 TO 15,000 CYCLES

SIGNAL TO NOISE RATIO: 75 DB BELOW 100% MODULATION. (TRANSMITTER INPUT TO RECEIVER OUTPUT. DOES NOT INCLUDE SPACE ATTENUATION.)

DISTORTION: NO GREATER THAN 0.3% AT 100% MODULATION THROUGHOUT THE AUDIO RANGE FROM 50 TO 15,000 CYCLES.

TRANSMITTER POWER OUTPUT: 15 WATTS.

RADIO ENGINEERING LABS. INC., LONG ISLAND CITY 1, N. Y.

FERRIS INSTRUMENTS

FOUR SIGNAL GENERATORS
FOR F M AND TELEVISION WORK

The well known Model 18-C Microvolter for general circuit design and testing. Also the 18-FS covering up to 235 mc.

The Model 24-A with 15 spot frequencies for production testing in the 10 to 150 mc range

The Model 24-B with 7 spot frequencies in the range 5 to 220 mc includes AM-FM and Video and finally the Model 50 Precision Laboratory Standard Signal Generator with many refinements making precise FM and Television measurements possible. Write for details to the

FERRIS INSTRUMENT COMPANY

110 CORNELIA STREET, BOONTON, N. J.

Special Services Directory

WHAT'S NEW THIS MONTH

(Continued from page 4)

AM sales are on the toboggan. Public demand has put the industry in the position where manufacturers must recognize that it's TV or FM or else.

2. With many FM stations largely dependent on the use of recorded music, there is special emphasis on the need for high-quality recordings. Thus the following communication from SESAC is of special interest to FM broadcasters:

The technical requirements of FM broadcasting, in addition to the precise NAB standards, call for recorded music which will assure flawless tonal reproduction. SESAC has met the mark by cutting its top-quality vinylite discs under the guidance of Columbia Records, Inc.

Music recorded in the library is cleared under the SESAC performance License, thus eliminating all the burden of copyright clearance procedure. To further assist FM broadcasters through their present pioneering period, SESAC is making its repertory of over 200,000 standard copyrighted selections available to FM stations under a gratis license.

This library service consists of several novel, workable features including pre-built program series, invaluable for commercial program production; participating shows; title indexes with continuity suggestions; miscellaneous programming; and simple copyright clearance. Each disc is made up of short, separate cuts which assure balance, pace, and sparkle. These individual tunes can be built consecutively for full 15-minute periods or they can be interspersed with spot continuity. In this manner, the broadcaster is able to build his own package shows according to the specifications of a prospective client.

Programs produced from the diversified material in this service are easily sold, since the pre-built feature allows the broadcaster to produce shows ranging from 5 to 60 minutes duration with the use of only two records. The program notes which accompany each record side are invaluable because a sponsor can see in advance what music is to be used program by program, day by day, or week by week for his entire series.

The library is ideal for participating shows because there are from seven to eight selections on each record side, varying from one to three minutes in length. Two or more complete compositions can be played between commercial announcements. Yet, and this is important, more announcements can be made in any time segment

(Continued on page 24)

Special Services Directory

WHAT'S NEW THIS MONTH

(Continued from page 22)

than is possible by using phonograph records or other transcriptions, if it is desired.

The program guide furnished to each subscriber includes classified and alphabetical listings. These indexes eliminate the inconvenience and inadequacy of card files and their maintenance. Even more important are the program notes available to the stations' script departments. These notes are factual, authentic, and smoothly presented, making them adaptable to ad lib shows or as suggestions to individual continuity writers.

3. You may have noticed that, beginning last July, we added to the Production Barometer estimated figures for FM-TV and FM-AM receivers. These totals combine the RMA figures for FM-AM sets with one-half the RMA figure for TV sets. In other words, we estimate from such sources as are available that about 50% of the TV sets are capable of FM reception.

The purpose of adding these figures is explained in our letter of June 25, 1948, to the RMA director of public relations:

Dear Mr. Secrest,

As you can imagine, we get a great many inquiries from broadcasters, advertising agencies, and advertising managers about the production of FM and television receivers.

We publish the RMA figures each month because they indicate the rate of growth of FM and TV audiences.

Now, in this connection, a new question has arisen. We are being asked about the number of television sets which are now equipped for FM broadcast reception, also. This is just as important as indicating the number of FM-AM receivers, for each TV set that provides FM broadcast tuning is contributing toward the development of the FM audience.

Since we have information on the number of FM-AM and AM-only receivers, can't we have figures on TV-FM receivers and TV-only sets?

I shall be greatly interested to hear from you about this.

Cordially,

MILTON B. SLEEPER

Mr. Secrest replied promptly in a letter dated June 28, 1948:

Dear Mr. Sleeper,

I have your letter of June 25, suggesting that we provide for the listing of television receivers with FM reception facilities in our

(Concluded on page 25)

WHAT'S NEW THIS MONTH

(Continued from page 24)

monthly reports on radio and television set production. As these statistical forms were set up by the RMA Set Division with the advice of the RMA Statistics Committee, we are not in a position to make any changes in the reporting forms at this time.

However, I am bringing your letter to the attention of Mr. Frank W. Mansfield, Chairman of the RMA Statistics Committee, for future consideration. We appreciate your suggestion and your interest in the RMA industry statistical service.

Cordially,

JAMES D. SECREST
Director of Public Relations

Then on July 8, 1948, we received a letter from Mr. Mansfield, copies of which were sent to Messrs. J.D. Secrest and E. C. Anderson:

Dear Mr. Sleeper,

I have read with a great deal of interest your exchange of correspondence with Jim Secrest at RMA.

Much as our committee appreciates the soundness of your request, there are some very practical difficulties to making radical changes in the method of reporting set production. Inquiries of this kind are always given every consideration, and changes made whenever there is a large and apparent need by the industry for more complete data.

As you probably realize, this work is also coordinated with the work of RCA License Administrator with whom any potential changes are discussed.

Rest assured that we will give your request every possible consideration, but for the reasons listed above you can appreciate why it is impossible for us to commit ourselves at the moment.

Very Truly Yours,

F. W. MANSFIELD, Chairman
RMA Industry Statistics Committee

Since figures on the total number of sets capable of FM reception are essential to broadcasters and time-buyers in estimating the growth of the national FM audience, and since the interests of the manufacturers and broadcasters are so closely related, there appears to be no doubt but what the RMA will provide the separate production figures.

It would be highly informative if RMA could also give the breakdown of FM set distribution, as they are now doing on TV sets. Then we could answer the oft-repeated requests: "Can you tell me how many FM sets are in use in such-and-such area?"

You get all these features ONLY in the *Western Electric 5A Monitor*

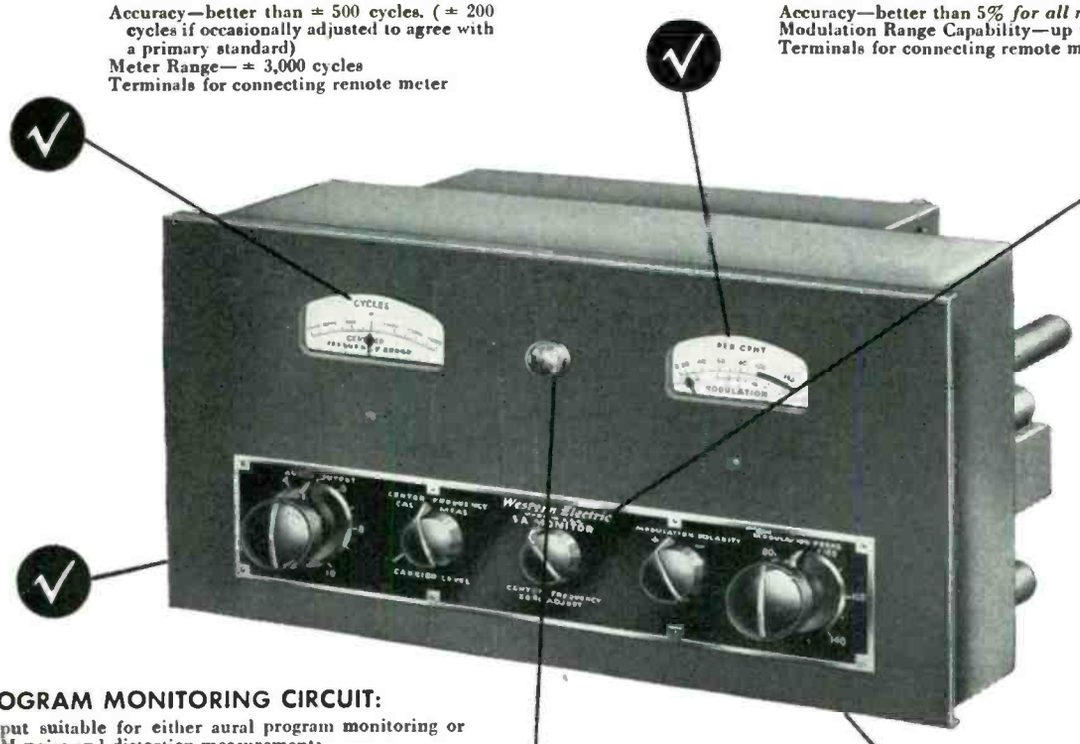
for FM Broadcasting

CENTER FREQUENCY MONITOR:

Accuracy—better than ± 500 cycles. (± 200 cycles if occasionally adjusted to agree with a primary standard)
Meter Range— ± 3,000 cycles
Terminals for connecting remote meter

MODULATION PERCENTAGE MONITOR:

Accuracy—better than 5% *for all readings*
Modulation Range Capability—up to 133% (± 100 kc)
Terminals for connecting remote meter



QUALITY DESIGN AND MANUFACTURE:

Designed by Bell Telephone Laboratories. Built by Western Electric, to Western Electric standards of quality.

PROGRAM MONITORING CIRCUIT:

Output suitable for either aural program monitoring or FM noise and distortion measurements
Frequency Response— ± 0.25 db, 30 to 30,000 cycles, without de-emphasis; with de-emphasis, response is within ± 0.5 db of the standard 75 microsecond de-emphasis curve
Audio Output Power—output level adjustable up to + 12 dbm—permits direct switching of program monitor from transmitter input to 5A Monitor output
Harmonic Distortion—*less than 1/4 of 1%* from 30 to 15,000 cps
Output Noise—at least 75 db below signal at 100% modulation

MODULATION PEAK INDICATOR:

Indication Lamp — flashes when a selected level of modulation is exceeded
Peak Limit Range—continuously adjustable between 40% and 140% modulation

AM NOISE DETECTOR:

An exclusive feature in the 5A Monitor. The output of this detector—which may be read directly on an electronic voltmeter or noise meter — is automatically referred to 100% amplitude modulation, thus simplifying measurement of transmitter AM noise.

POWER SUPPLY: Newly designed 20C Rectifier (furnished as a part of the 5A Monitor) provides electronically regulated d-c *with less than 1 millivolt ripple* from 105-125 volts a-c 60 cycles. May be remotely located if desired.

The 5A Monitor includes numerous other valuable features such as: dual thermostats and dual heaters for each crystal—means for checking the inherent noise level of the monitor from its *input to output terminals*—requires only a low RF input level (1 watt) which can vary from 0.3 to 3.0 watts; i. e., a 10 to 1 variation *without affecting the performance of the monitor.* To get the complete story on this outstanding monitor value, call your Graybar Broadcast Representative or mail the coupon below.

Western Electric

Distributors: In the U. S. A.—Graybar Electric Company.
In Canada and Newfoundland—Northern Electric Company, Ltd.

Distributed by GraybaR
OFFICES IN 95 PRINCIPAL CITIES

—QUALITY COUNTS—

Graybar Electric Company FM-40
420 Lexington Avenue, New York 17, N. Y.

Please send me Bulletin T-2437, including curves, schematics and block diagram of the 5A Monitor.

NAME_____

STATION_____

ADDRESS_____

CITY_____ STATE_____

FM PROFITS

FROM A CHAOS OF POLITICKING, CONTENTION, UNCERTAINTIES, HEADACHES, AND RED INK, AN ORDERLY PATTERN FOR FM PROFITS HAS EMERGED—*By* MILTON B. SLEEPER

IN the course of almost thirty years, broadcasting has become big business in scope, organization, and volume of sales. But during all that time, and all that progress, broadcasters have consistently taken the position: "I don't care how our programs sound in your home as long as you listen to them."

At least, that was the case until, something over two years ago, a group of newcomers began to explore the possibilities of entering the business of FM broadcasting. Perhaps because they knew broadcasting only as listeners, and because they were calculating their chances of success in terms of service to such people as themselves, they tackled the project from the listeners' point of view.

The men comprising this new group were the organizers of the Rural Radio Network. As we view what they have already accomplished, the basic concept of their approach to broadcasting must have been something like this: "If we build programs that meet the needs and tastes of listeners in the area we plan to cover, and if we enable those listeners to get clear, unfading reception, free of interference or static, we shall be delivering a service far superior to what is being furnished by other stations. And with that competitive advantage, we can attract an audience sufficiently large to justify time rates on a scale to assure profitable operation."

Any broadcaster will go along with that thinking, so far. But if the Rural Radio Network had stopped thinking at that point, there wouldn't be any story to tell.

Instead, by carrying their reasoning one step further, they established a precedent in the industry, and set up what we have called the Pattern for FM Profits. They adopted the point of view that: "The *effective* performance of a transmitter is not determined by the quality of the radiated signals, but by the reproduction of those signals from loudspeakers in listeners' homes."

The soundness of that reasoning is so obvious that it requires no supporting argument. Yet it has taken nearly thirty years for the first broadcaster to adopt this basic policy.

You may say: "That's very interesting, but it takes more than a policy to compete with the facilities and the experience of the national networks, or even some of the leading independents."

Of course, but RRN didn't stop at that point, either. The organizers of RRN may have been new to station operation, but they understood *effective performance* from listening to other people's stations. And they had something else, of still greater importance, that no network has ever attempted to acquire. They had the facilities of a long-established product-testing laboratory, and experience in merchandising products of predetermined performance.

So they reasoned: "An FM receiver can only deliver perfect performance if the received signal is strong enough to produce noise-limiting action. Therefore, we must relate the sensitivity of receivers used by our listeners and the signal strength we deliver to receivers in the area we propose to serve."

How this was done is explained in detail in the pages following. Briefly, the organizers of the Rural Radio Network did four things:

1. They engaged a group of engineering consultants to make exhaustive signal strength measurements. This survey showed that receiver sensitivity of 20 microvolts was necessary to assure perfect FM reception at all points within the 50-microvolt contours of the six stations they planned to erect.

2. They set up a laboratory for testing FM receivers. Thus they made a startling discovery. These tests disclosed that the most widely advertised makes of FM-AM receivers show FM sensitivity as low as 500 microvolts, and as high as 250 microvolts. Only one make[1] approached their requirement of 20 microvolts.

3. That might have been a stopping point for any other organization. Not for RRN, though. They set their engineers to work on specifications for a receiver design that could be offered to listeners within their 50-microvolt contours with definite assurance of giving perfect reception, which is to say full limiting action. They had sets built to those specifications by North America Philips.

4. Finally, because they knew that a 20-microvolt set can only give perfect performance if it has 20 microvolts worth of signal delivered to the input, they worked out with Taco the design of a non-directional, two-bay antenna!

In the pages following, RRN executives and engineers have presented the complete details of their project, from the organization of the network and its programming and promotion to the station facilities and the design and merchandising of their special receivers.

The only information not disclosed is the specifications established for the receiver design. Later, perhaps, we may be permitted to publish these specifications.

Meanwhile, we hope that FMA will recognize the need of setting up specifications for what can be considered as acceptable FM receiver performance. RRN ratings on current FM-AM models which appear on page 37 of this issue show this to be a must because:

1. The public has no way of knowing whether the FM band of an FM-AM receiver is capable of giving adequate FM performance or not. Such is the general confidence in advertised merchandise that, if a set bearing a well-known name fails to give perfect FM reception, the public assumes that the fault lies in the FM system, or in the broadcast stations.

2. The easiest way to kill FM is to advertise it as an important added service, and then design the circuits so as to require 250 to 500 microvolts to produce limiting action. In other words, making FM a mere point-of-sale feature, like short waves, does more harm than omitting FM altogether.

Nearly eight years ago[2], and at various times since then, we have suggested that FM receiver standards be established by cooperative effort between broadcasters and manufacturers. In November, 1940, we proposed: "The National Board of Fire Underwriters, for example, has established certain safety standards of design for electrical appliances and devices, including radio sets. The manufacturer of any electrical product which passes the tests in the Underwriters Laboratories may affix the U.L. seal of approval to that product.

"Such permissive regulation is highly useful in protecting manufacturers of approved devices against cheap, substandard competition. Publicity given to the U.L. seal by companies whose products merit it has made the official seal known as a guarantee of safe design and construction.

"The same idea can be applied to FM with even greater effectiveness if FM Broadcasters, Inc. [now succeeded by the FM Association] will set up performance standards relating particularly to sensitivity, effectiveness of noise suppression, and quality of reproduction. Models bearing the seal would be known to provide the improved performance in entertainment quality that is being made available by the FM broadcasting stations.

(*Continued on page 50*)

[1] *Editor's Note:* These tests did not include all makes of FM sets, but only those listed on page 37.

[2] See "Revolution for Profit" by Milton B. Sleeper, *FM* Magazine, November, 1940.

Pattern for FM Profits:

1: INTRODUCTION

RURAL RADIO NETWORK SETS AN EXAMPLE OF REGIONAL FM OPERATION TO MEET LISTENER NEEDS UNSATISFIED BY AM BROADCASTING—*By* MILLER McCLINTOCK*

THE operation of the Rural Radio Network is packed with significance for FM broadcasters. It has demonstrated the soundness of the faith of the most enthusiastic FM zealots. Indeed, it has pushed the FM art over horizons which were considered insuperable barriers only a matter of months ago.

The story of the Rural Radio Network is a simple one. The farmers and the farm organizations of the New York Milkshed (including the States of New York, New Jersey and the upper tier of the counties of Pennsylvania) concluded, after twenty years of experience with commercial radio, that even in such a concentrated area, radio broadcasting as ordinarily operated would not and indeed could not, provide satisfactory service for all the rural population.

At long last, they decided to do something about it themselves and, in typical fashion, called in technical and organizational advisors and asked, "How can radio serve our people better?"

From this question came the Rural Radio Network. On the following pages are presented the details of Rural Radio Network's conception, birth, and operation.

Rural Radio Network, Inc., is a New York State business corporation under the Rural Radio Foundation, which represents all farm organizations in the area. It is in business to perform a service and to make enough money to pay for the service. To do this it must have the listening audience it is acquiring. Now, with the six-station net on the air, FM receivers are being bought by farmers in New York State in unprecedented numbers. They asked for this service, they like it, the audience is growing rapidly.

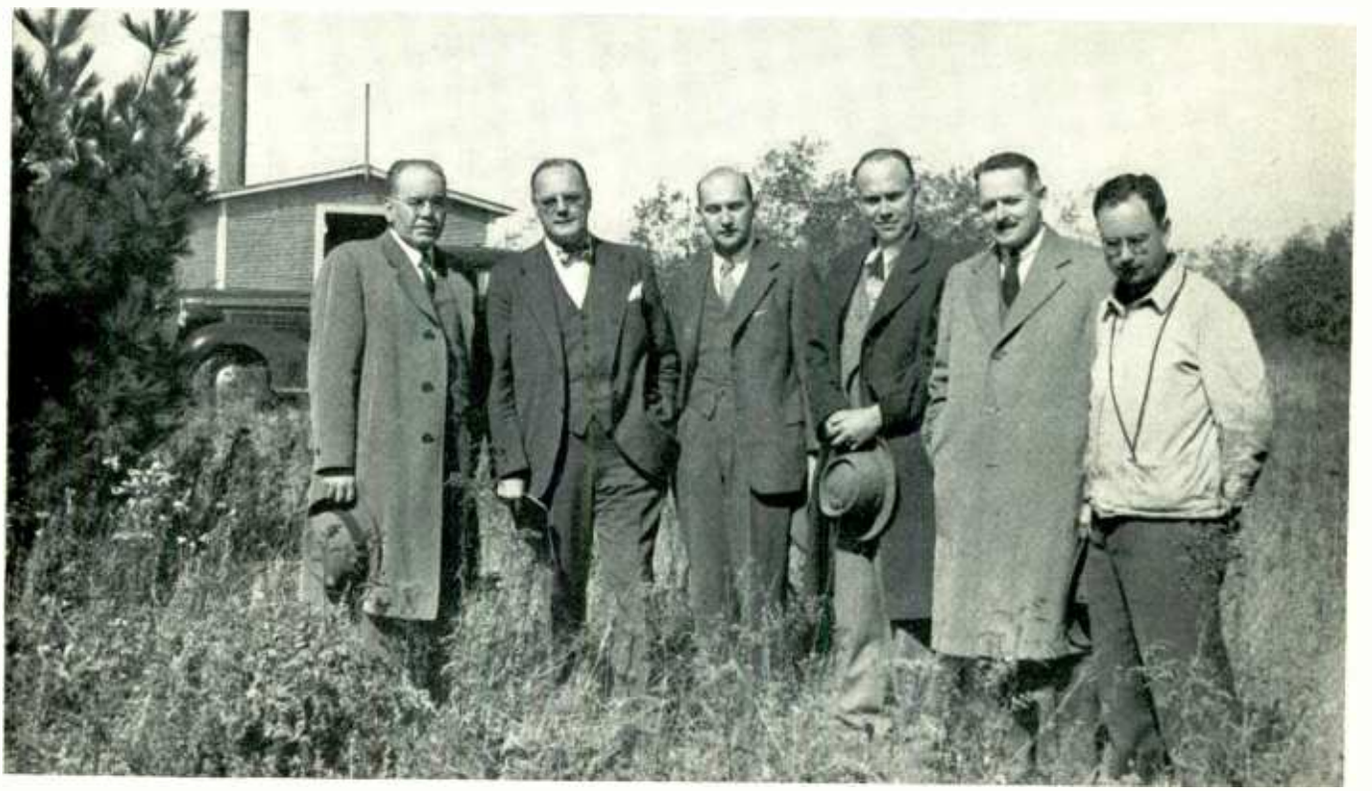
In contra-distinction to the situation two years ago when many "high quality" FM receivers did not have a sensitivity below 250 micro-volts, farmers today have a choice of fairly-priced table or console models with sensitivities of 25 microvolts or better.

The Rural Radio Network was not satisfied to leave the farmers of the New York Metropolitan area without its service. Hence, it entered into an association agreement with Captain W. G. H. Finch for the utilization of transmission and studio facilities of radio station WGHF at 40th Street and Fifth Avenue, New York City. A farm station in the heart of the world's largest city causes raised eyebrows. They drop somewhat when it is realized that within the primary coverage area of WGHF there are more farm homes and more value in annual farm produce than in many entire states of the Union. In addition even the supposedly sophisticated people of the metropolis seem to like the simple and relaxed programming provided by the Network. Other stations in the New York Milkshed meeting the objectives and programming standards of the Network will be added from time to time.

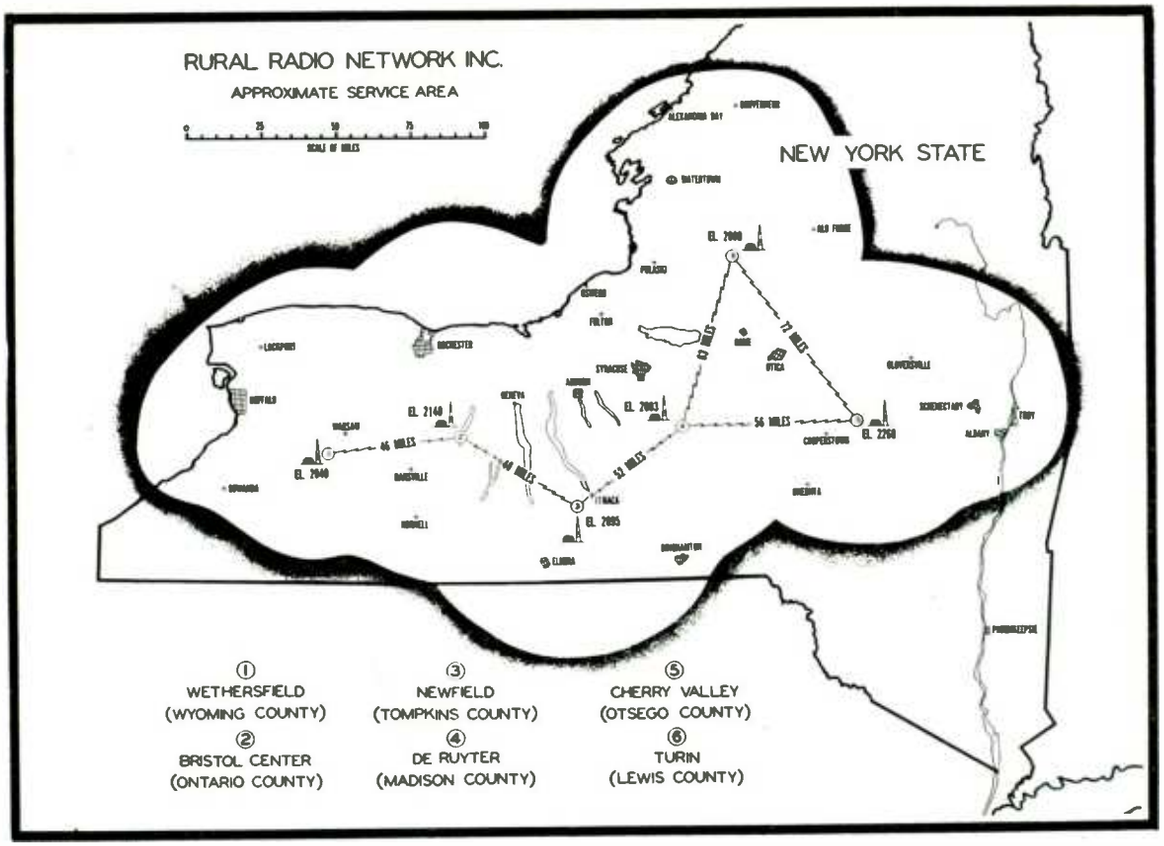
The real significance of the Rural Radio Network lies in a broadening of the concept of the services which can be pro-

(*Concluded on page 65*)

* Former President, Mutual Broadcast System; Senior Consultant, Rural Radio Network; Chairman of the Board, Communication Research Corp. 60 E. 42nd St., New York 17, N. Y.



Here are the men who headed up the engineering of RRN. Left to right: senior consultant Dr. Miller McClintock, chief engineer Donald deNeuf, general manager Bruce Gervan, consultants Murray Crosby and William S. Halstead, and assistant B. C. Lord



Coverage area of basic RRN stations. G.L.F. sets, or others of equal performance, give reception free of static, interference, and fading of RRN programs within this area

Pattern for FM Profits:

2: ORGANIZATION

THE RURAL RADIO NETWORK, A REGIONAL BROADCASTING SYSTEM TAILORED TO THE SPECIFIC INTERESTS OF NEW YORK STATE'S FARM POPULATION — *By* R. B. GERVAN*

BECAUSE so much of radio thinking and planning on radio program material and program distribution is done in New York City and Hollywood, there is undoubtedly a tendency to overlook the fact that 48% of the people in the United States live in towns of 5,000 population or less.[1]

For example, New York State has 1975 towns and cities, with a total (1940 census) population of 13,479,000. Of these, 9,582,000 live in cities of 25,000 or more, while 3,897,000 live in 1,954 towns and villages! These are vital statistics in planning radio service, or radio sales promotion, for there is a sharp distinction between the social and economic habits of rural and metropolitan residents. This distinction has been generally submerged in broadcasters' statistics of total population and sales. Thus we have come to think of high-power AM stations, located in population centers, as mass media for communications and advertising. Although there has been a great increase in the number of local AM stations, they have had little effect on this situation, since limitations of power and co-channel interference restrict their service areas to a radius of only a few miles.

FM Coverage by Rural Stations:

FM has changed this picture completely. The six stations shown on the accompanying map can cover almost all rural New York State, and provide high-quality reception, free from static and fading, to a tremendous number of listeners who do not have satisfactory reception from even one of the ninety-eight AM transmitters within the state!

Now with the affiliates at Ogdensburg and New York City added to the six stations shown on the map, this network, without a single wire-line interconnection except between Ithaca and New York City, covers virtually the entire rural *and* metropolitan population of the state. To give equal quality of reception to the same number of listeners by AM broadcasting would require a very much larger number of stations, and complete interconnection by wire lines, with correspondingly higher operating costs.

The Need for R.R.N.:

These possibilities were in the minds of a group of men representing the farm organizations of New York State when, more than two years ago, they began to study and explore the field of rural communications. Farm organizations have a legitimate and natural interest in this subject, and when such a group of men takes time to study and assemble facts on radio service to farmers and rural residents, a number of things quickly become apparent.

In the first place, it is clear that there

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* General Manager, Rural Radio Network, Ithaca, N. Y.

[1] *Editor's Note:* In the entire U.S.A., 27 states have more than 3 cities of 25,000 and over, 16 states have more than 3 cities of 50,000 and over, and only 9 states have more than 3 cities of 100,000 and over.

We have 1,954 Main Street markets for advertised goods in New York towns and villages

are a number of radio stations in upper New York State which make a sincere effort to provide a real farm radio service; and several have done an outstanding job in this respect. But it is equally clear that under present conditions it is not possible for the great majority of the farm and rural population to receive what we might term ideal radio service *all* the time.

One reason for this is the geographical location of these stations; invariably they are located in relation to towns and cities rather than rural areas. Consequently, while radio service is excellent in some localities, it is weak and almost non-existent in others.

Another reason is that no single existing group of stations can be put together readily in a network that will serve all rural listeners simultaneously.

Finally, and possibly the most important, radio as we know it today has not yet developed the technique of serving specialized interests. In the printed medium there are newspapers and magazines for just about every need; but in radio the various listener groups have not had this specialized attention.

Plan of R.R.N. Stations:

The study showed conclusively that there was a real place in New York State for the development of a farmer-owned radio service, equivalent to that provided by a good farm publication through the printed word, to supplement the existing broadcast stations.

This conclusion was the basis for the Rural Radio Network with the farm organizations, equally represented, in control. Organizationally, the set-up starts with the Rural Radio Foundation, a non-profit corporation, financed by the ten farm organizations. The Foundation, in turn, owns the Rural Radio Network, a normal tax-paying business operation, consisting of six FM stations, with affiliated stations in New York City and Ogdensburg.

These six RRN stations were located on a geographic basis, so as to provide maximum coverage of the rural areas of the state. The transmitters are on hilltop sites, at elevations of 2,000 ft. or more. As indicated on the accompanying map, they are at:

1. Wethersfield, Wyoming County
2. Bristol Springs, Ontario County
3. Newfield, Tompkins County
4. DeRuyter, Madison County
5. Cherry Valley, Otsego County
6. Turin, Lewis County

The affiliates are WGHF New York City, giving the network a New York City originating studio as well as coverage in the Long Island farm area, and WSLB-FM Ogdensburg, to provide coverage in the upper tip of the state along the Canadian border.

R.R.N. Ownership:

Now a word about the organizations behind the Rural Radio Network. Unless you are a farmer in your own right, you may not realize the extent and influence of these organizations.

First there is the Grange. Almost everyone knows about this organization, but few people outside the membership (146,000 in New York State alone) know just what the Grange does. Here are excerpts from the Grange's Declaration of Purposes as adopted at the national convention of 1874: ". . . to foster mutual understanding and cooperation . . . we propose meeting together, talking together, working together, buying together, selling together and, in general, acting together for our mutual protection and advancement."

Then there is the New York State Farm Bureau Federation, a non-commercial organization dealing with the educational and public problems of farming. Here is an excerpt from the Federation's charter. ". . . to improve facilities and conditions for economic and efficient production, conservation, marketing, transportation, and distribution of farm products . . ."

The New York State Federation of Home Bureaus was organized ". . . to develop, strengthen and correlate the work of the . . . home bureaus . . . in their efforts to assist women in promoting all interests pertaining to the higher standards of homes and communities."

The New York State Poultry Council is made up of nine poultry groups, representing everything from chicks to chickens, turkeys, ducks and eggs. The Council ". . . works for the betterment of the poultry producer, devoting attention to problems of disease control, nutrition, breeding, marketing, etc. One of the

(*Continued on page 64*)

Pattern for FM Profit:

3: PROMOTION

HOW R.R.N. HAS SET UP A HIGHLY EFFECTIVE, WELL-ORGANIZED, AND CONTINUING CAMPAIGN TO WIN LISTENERS AND INFLUENCE SPONSORS—*By* PHYLLIS GUTERMAN*

PROMOTION used to acquaint farm and non-farm people in the rural areas of New York State has been a combination of conventional and original methods, planned to suit a wide range of conditions and situations.

Rural dwellers are organization-minded. They are joiners, and take an active part in the organizations they join whether it be the Grange, the Home Bureau, the Farm Bureau, or the local co-op. As a result, the people RRN is set up to serve are in the habit of attending the meetings of the organizations they have joined, and they read the bulletins and pamphlets prepared or distributed by these clubs, societies and associations.

Since the founders of the Rural Radio Network are probably the ten leading farm organizations in the northeast, the Network had a fairly logical pattern to follow in getting across the story of FM and RRN.

From the time the Network construction started, its top executives were busy making their plans known by mail and by personal appearances before the many and varied organizations of the area. They addressed community service clubs, Pomona Granges, County Agents, 4-H Clubs, P.T.A. meetings, local tureen suppers, and church socials. And if a member of the staff was unable to appear, the Network provided display material and text for a brief talk to be given by the chairman of the meeting.

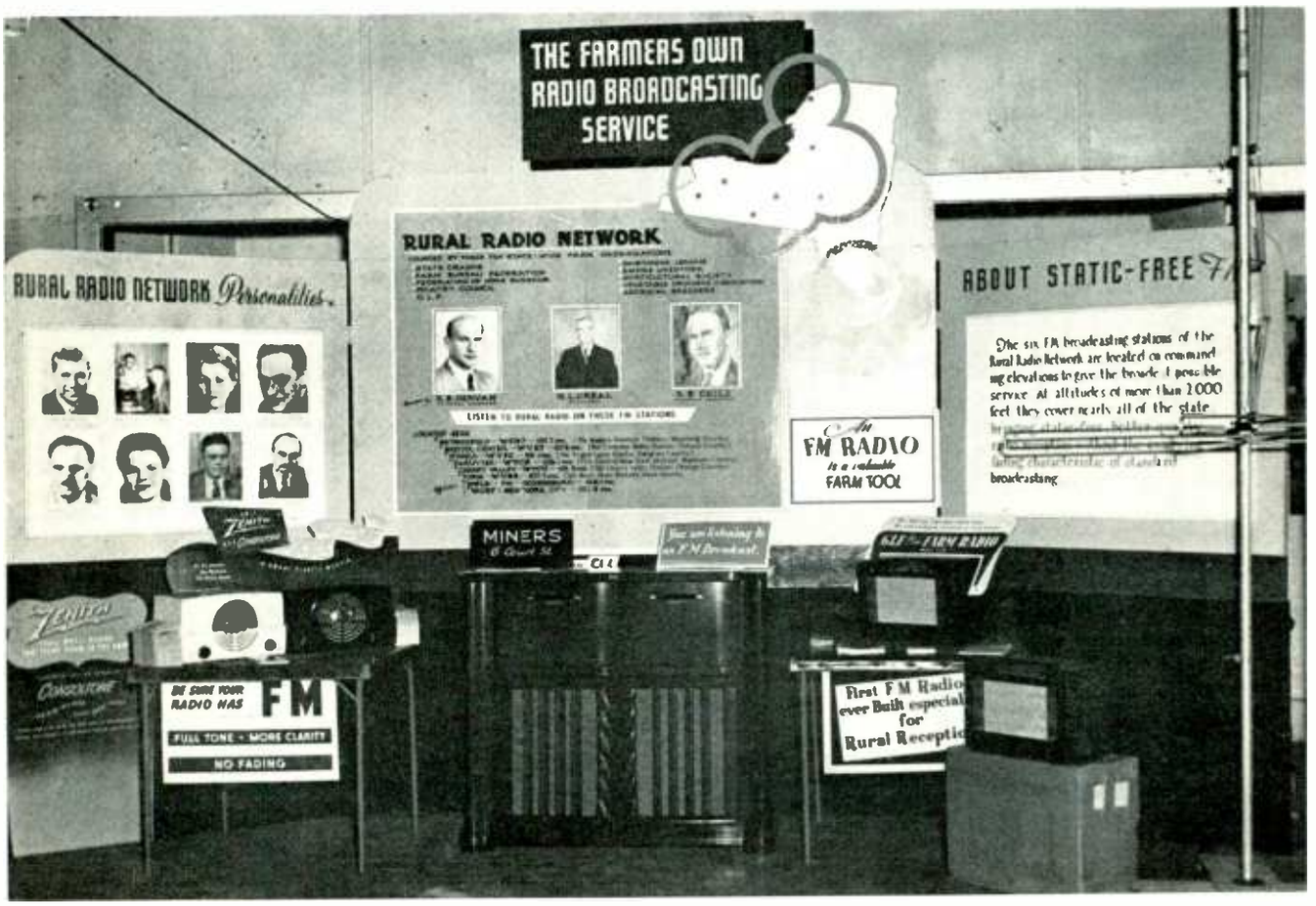
Then, sixty days before the Network went on the air, a series of spotlight advertisements was run in all the weekly and daily papers of rural New York State. The major difference between these and the spotlight announcements of the big-town radio stations was that the RRN advertisements were devoid of flashy artwork. Instead, big type and photos were used in simple layouts, for a flashy appearance tends to have a phony connotation to rural dwellers.

As these newspaper advertisements tapered off, they were replaced by informative inserts enclosed with mailings from farm organizations to their members, and by articles in the house organs of these societies. Also, pamphlets and brochures prepared by RRN were distributed at organization meetings.

Along with this distribution of printed material went data on FM prepared and provided by the radio manufacturers, such as Zenith's FM booklet.

All our promotion material about FM was refined to the ultimate in simplicity, concentrating on the fact that it is static-free, with no noise, no fading, no interference. Rural listeners know these terms from first-hand experience with their own AM receivers.

* Promotion Department, Rural Radio Network, Ithaca, N. Y.



Display at Genesee County Fair. RRN will have others at 14 such events this year

GLF stores are doing a job on FM set sales, installation, and service in rural areas equalled in few metropolitan centers. This is an important element of promotion

When the Rural Radio Network started broadcasting, another series of spotlight advertisements was released. These are being continued in connection with special programs. As soon as scheduled broadcasting began, posters showing the RRN area were sent out. Next, the monthly RRN bulletin was started, containing news stories about network activities and the program schedules. These and other promotion pieces are illustrated here.

The big poster has been placed in almost every radio shop, every farm supply store, and in the meeting rooms of every farm organization within the Rural Radio coverage area.

In metropolitan centers, most public meetings are under cover. Those held outdoors are provided with good public address systems for sound reinforcement. In rural communities, public address systems are few and far between, and seldom mobile. Mostly they are permanent installations of dilapidated equipment possibly adequate for bingo games but not for outdoor meetings.

Into this void we put the RRN nemo truck, pictured on page 35. Where a rural gathering needs a public address system and is a public service function, the RRN nemo unit is available. If the occasion warrants it, we either broadcast the event or transcribe it for rebroadcast, but in any event the nemo truck is on hand, and identified as Rural Radio Network.

This year, Rural Radio Network will have exhibits at fourteen of the bigger county fairs. One of the accompanying illustrations shows a typical display at the Genesee County Fair. Note particularly the sign reading, "An FM Radio is a valuable farm tool." This slogan is the sort of thing that is selling RRN and FM to the rural audience.

But possibly the most effective promotion is that being done through the member organizations of the Network. For example:

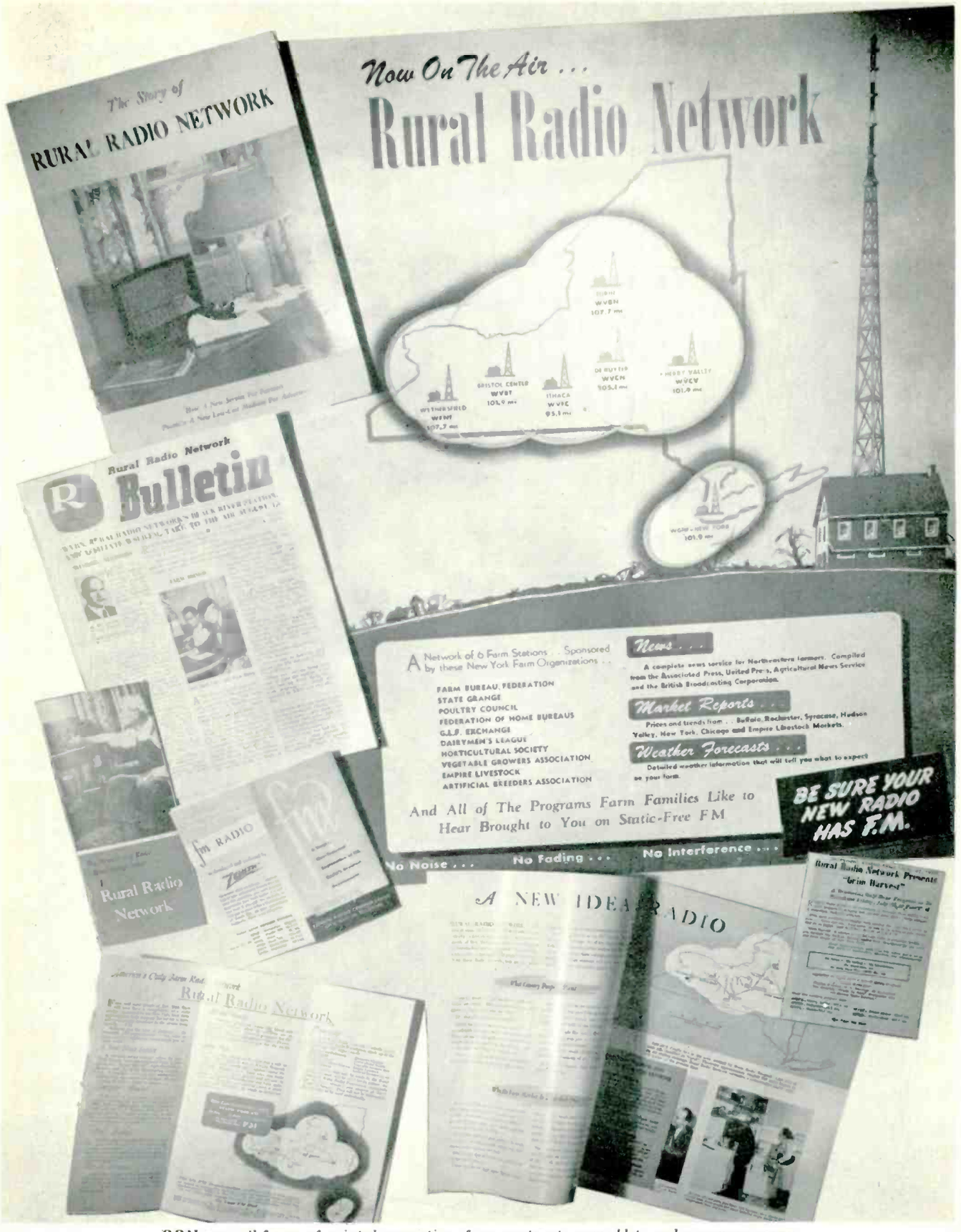
Miss Guterman: "Rural people buy more branded staple goods than city dwellers"

1. The New York State Grange is furnishing articles on RRN to the National Grange Monthly. At least one piece each month is appearing in the New York State edition of this publication. Currently, the many local Granges within RRN's area are participating in an RRN-sponsored contest. The contest, with FM radios as prizes, requires the Grangers to write short statements on "What I expect of FM radio." Then there are the Grange lecturers, each supplied with a kit of data about RRN and the FM contest.

2. The Farm Bureau Federation is closely connected with the Extension Service which includes the County Agents, 4-H Club Agents, and Home Demonstration Agents. All of these people have had letters from their own officers calling attention to what RRN is doing, and asking them to display RRN posters in their offices.

3. GLF has its own GLF brand FM-AM radios on sale at all its consumer stores. This is a quality set of extreme stability and sensitivity. In addition, at all the GLF patron meetings, which some 100,000 people will attend this summer, an RRN display will be set up, complete with banners, literature, and FM sets.

4. Dairymen's League sent each of its 27,000 members a Rural Radio pamphlet



RRN uses all forms of printed promotion, from posters to pamphlets and newspaper copy

along with the monthly milk check. RRN posters are displayed at all their plants, and RRN talks are given at the Dairymen's League county and local meetings. Then too, at the League's annual meeting in October, RRN will provide the entertainment for the 2,000 people attending.

5. Empire Livestock Cooperative operates five livestock auctions at which farmers congregate in large numbers. Each auction is equipped with an FM radio and, while the people are assembling, RRN programs are tuned in.

Thus it is clear that sound principles

(*Continued on page 60*)

Pattern for FM Profits:

4: PROGRAMMING

HOW THE RURAL RADIO NETWORK IS DEVELOPING ITS PROGRAMMING TO SERVE THE SPECIFIC HABITS, PREFERENCES, AND NEEDS OF ITS AUDIENCE—*By* ROBERT B. CHILD*

WHAT do rural listeners want from radio? We don't know all the answers, but we know many of them, and we are learning rapidly. But there are some things we do know.

Statistics for Basic Planning:

We know that rural listeners include farmers and non-farmers living and working in rural areas. We know that farming in New York State is highly diversified, and that fruit, vegetable, poultry and dairy farmers keep different hours at different times of the year. They have different needs and face different kinds of problems. We know that many of the retail and service businesses in rural areas start their work day at 8:00 A.M., and some of them as early as 7:00. Rural New York State is 90% electrified [1], which means running water and radios; that more than 80% of the farms have at least one automobile [2]; that 74% of the farm homes are owner-occupied [3]; that New York State farms and buildings are valued at more than $1 billion [2]; that New York State farmers had a cash income of $550 million in 1945 [2] even though only 16% of New York's 13,500,000 [3] people live in rural areas.

We know also that rural education, typified by New York State Central Schools, is as good if not better than in metropolitan areas. As a result, the Rural Radio Network's audience is literate. And from the activities of our audience Granges, Farm Bureaus, Home Bureaus, and co-operatives we know that these people are socially, financially, and politically aware of their responsibilities and obligations as citizens, businessmen, homemakers, and wage earners.

We have found that people working in the towns and villages, with very few exceptions, go home for lunch just as the farmer does. People live nearer their jobs than city workers. Contrary to the popular notion, not every farmer is up at 5:00 or even 6:00 A.M. Few of the rural wage earners are near radios during the day, but most of the homemakers are closer to their radios during the day than their big-town sisters. Also that juvenile listeners are available at various times according to their age groups. These are some of the things we have culled from our experiences in Rural Radio Network.

We also know that never before has anyone attempted to program an entire network broadcast week specifically for the diversified interests of the rural New York audience.

Timing, Needs, Preferences:

With all these facts in mind, we started out to program the Rural Radio Network.

RRN program director: "We don't know all the answers, but we are learning fast."

Since big-city radio has been serving rural listeners for so many years, we realized that our audience has likes and dislikes essentially akin to those of metropolitan audiences, plus the desire to have less of the programs it finds irritating, and the need for more farm information.

For example, news to the farmer is the same as news to the cityman. However, the farmers need news of northeastern agriculture. We give them world, national, state, and local news, plus information of dollars and cents value, gathered from many parts of the nation. As an example: the price of the first picking of sour cherries in Michigan indicates the price of the sour cherry crop in New York State on the following day.

For another instance, let's take the weather. Urban listeners are generally satisfied to know that it will be either clear, cloudy or rainy. The farmers, on the other hand, must have specific information on local weather. They need to know whether there will be a thunderstorm tomorrow morning or afternoon, or if tonight will be clear without frost. Only with such detailed, local information can they plan and execute their planting or harvesting operations to best advantage.

Consequently, Rural Radio has weather instruments at each of its six transmitters and, by close cooperation with the Weather Bureau, is able to air fairly specific local weathercasts. Most particularly, it is possible to give warnings of sudden changes in weather conditions.

Or take the market reports. Some years back, the home station of a major network staged a breakfast party celebration for its early morning farm service program. No doubt, the program had urban listeners, but farmers are not assisted by a morning broadcast of yesterday's market prices, or in state-wide weather reports. Besides, most farmers were out doing their morning chores when that program was on the air. From the farmers' point of view, that program gave no cause for celebration. That is why R.R.N. airs today's market prices for fruit, eggs, vegetables and livestock as early as they are available.

The reason for this is simple. It's not much use to give yesterday's prices today because farmers cannot get today's produce to market before tomorrow. By then, prices forty-eight hours old may be all out of line. But given today's prices today, plus a report of market trends, farmers can estimate prices their produce will bring at the market tomorrow.

We have developed our own ideas about home economics programs for rural women. They are not interested in general information about freezing or canning food. After all, the older women have been freezing and canning for years and the girls have learned from helping their mothers. What they want to know is whether or not blanching peas for 10 seconds longer than recommended will spoil them for freezing.

Since women listen more hours each day than do other members of the family, our women's programs are broadcast when, according to the farm women's organizations, they can best listen.

Where villages outnumber towns and crossroads communities outnumber both, it is only understandable that organizational activities are important news. Anyone that has ever read the Correspond-

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* Program Director, Rural Radio Network, Ithaca, N. Y.

[1] New York State Electric & Gas Corp., 1948.

[2] U. S. Census of Agriculture, 1945. These figures have increased considerably in the three years since they were compiled.

[3] County Basic Data compiled by the *Farm Journal*.

ent's Column of a weekly paper knows what I mean. So, local news is important to R.R.N. listeners. WVCV, our Cherry Valley station, has already started a weekly local-news program. Eventually,

The Rural Radio Network's program pickup relay and public address equipment builds good will by its presence at outdoor functions. Transcriptions can be made, too

as much as two hours per day will originate from each of the six studios across the state. During these hours each will operate as a local station. In this connection, it should be noted that, although WVFC Ithaca is connected to a city studio by an ST link, studio facilities are provided for the other stations at their respective transmitter buildings.

R.R.N. Programs:

Currently R.R.N. is operating nine and one-half hours a day, from 11:45 A.M. to 9:15 P.M. Most of our programs are aired across the board by the network. The best time for news and information directed at the man of the house is noon to 1:00 P.M. At 1:15 the farm wife wants, and gets, her own program. At 4:45 P.M., between school bus and chores, the youngsters of high school age get their show, "Youth-R.F.D." Children's stories, aimed at the 5-to-15-year-old group, are aired at 5:30 daily. At 7:00 we broadcast the evening farm and home program with our Farm Reporter bringing informative and entertaining programs to rural adults before they leave home for evening organization meetings or social commitments. The final program each day is news, world, national and state news, plus items of interest to New York farmers.

Invariably and inevitably, visitors to Rural Radio Network headquarters ask "What do you do about soap operas?" Here's our answer: A survey made two years ago reported that one-fourth of the farm women contacted named soap operas as the program they would miss the least. Another fourth said they'd miss them most. So we do not carry soap operas. Instead, we offer readings of continued stories every afternoon, keeping in mind the comment of one woman who said, "There is never a happy family life in the soap box opera type of program." Since family life is important to rural audiences, we've never forgotten that comment. The stories we broadcast give what we think is a truer picture of American home life, using humor as a substitute for tragedy.

Local weather reporting is important. Each transmitter has complete instruments

As for remote pickups, our mobile transmitter covers the whole farm scene, everything from Grange meetings to Potato Field Days and County Fairs. Rural listeners, like their city cousins, like to "be there" when anything is happening.

A Typical Schedule:

Our printed schedules, titled *Rural Radio Network* Bulletin list the programs for two weeks. The Sunday schedule is specifically adjusted to the special activities of that day, both as to timing and program content. Emphasis is put on music, and such features as the Chatauqua Symphony Orchestra and the locally renowned Cooperstown Community Sing, attended by some 4,500 people.

Weekdays we follow a fairly uniform pattern. For example, here is the schedule for Wednesday, October 15:

11:45 Morning Prayer — Country Music
12:00 The World at Noon
12:15 Weather Round-up
12:25 Markets
12:30 Cornell Farm & Home Hour
12:45 Bob Child's Farm Highlight
1:00 Tom Moread — Singing for You
1:15 Country Home, with Claire Banister
1:30 Memory Time with Jack Deal
1:45 Joy Beaty at the Keyboard
2:00 Music in the Modern Mood
2:30 Adventures in Harmony
3:00 News
3:05 Meditation
3:15 Selected Short Stories
3:30 Mail Box Tunes
4:00 Meet Miss Mason
4:45 Nature Study
5:00 Treasure Island
5:30 Folk Music
5:45 Portraits in Black & White, by Jack Goodman
6:00 Memo for Tomorrow with Charles Hodges
6:15 Markets
6:25 Weather for Tomorrow
6:30 Sports with Sam Woodside
6:40 Farm Magazine Digest
6:45 Excursion in Science
7:00 Rym Berry & Jack Deal
7:15 Twilight Melodies
7:30 News
7:35 Serenade in Blue, Cynthia Syphax
7:45 Here's To Veterans
8:00 Welcome, WVBN, Turin
8:00 Rural Music Shoppe
8:25 The Lamplighter
8:35 Welcome, WSLB, Ogdensburg
9:00 Today's News & Tomorrow's Headlines
9:15 Evening Prayer

While the foregoing is typical of our present programming, we are keeping close contact with audience reactions through every available channel. Already, revisions are in the making, and others are in the planning stage.

While only the Ithaca transmitter has a remote studio, facilities are available at each of the other transmitters for originating programs. The purpose of this arrangement is to permit special, local features to be broadcast without making it necessary for the participants to travel to Ithaca. In this way, we can tie in the people and the activities of each individual area.

Pattern for FM Profits:

5: RECEIVER & ANTENNA

FOR THE FIRST TIME, FM SETS AND ANTENNAS ARE DESIGNED TO MEET RECEIVING CONDITIONS IN THE AREA WHERE THEY WILL BE OPERATED—*By* WILLIAM C. BLACK *

PART 1: PREPARATION

FROM the beginning of the RRN project, it was realized that, just as a telephone line requires a transmitter and receiver of equal efficiency in order to transmit intelligence, so must successful broadcasting service place as much emphasis on the adequacy of receiving sets as on the transmitting plant.

Specifically, meeting FCC engineering requirements at the broadcast station has no significance in service to listeners who use sets of 400 microvolts sensitivity in an area where a good antenna can deliver only 150 microvolts to the input connections.

Also, the station might as well be off the air as far as giving service is concerned to listeners who need good antennas but do not have them!

Surveying Reception Conditions:

Accordingly, G.L.F. Farm Supplies, a division of Cooperative Grange League Federation Exchange, Inc., was given the problem of determining first, what type of radio receiving equipment was needed to provide good FM reception in rural areas; next, to obtain equipment that would meet the standards set up; and, finally, to correlate distribution and service for such equipment into our regular system of distributing farm production supplies.

Following a pattern that has been used in the past to supply a wide variety of farm production supplies, the first step was to determine definitely what was needed.

United Cooperatives, at Alliance, Ohio, a cooperative wholesale procurement organization handling farm production supplies for member organizations, maintains a quality control and research laboratory at Ithaca, New York. The laboratory, staffed by trained engineers who have had the benefit of farm training or experience, regularly conducts both field and laboratory tests for member organizations. United Cooperatives commissioned the laboratory to set up a project to determine specifically what was needed for good radio reception in the areas of New York, New Jersey, and northern Pennsylvania served by the RRN. From these studies, they were instructed to set up product specifications and make comparative tests as a guide to the final selections.

This, briefly, was the strategy mapped out for a broadcast operation that would not end, but actually begin, when the transmitters went on the air.

FIG. 1. *The mobile laboratory used for the preliminary field strength surveys*

Mobile Reception Tests:

To carry out the first step of the project, a mobile laboratory was constructed and equipped with the necessary instruments, as shown in Figs. 1 and 2. A large observation window was provided, with benches for the equipment and shelves for the receivers to be tested. The mobile laboratory was equipped with a collapsible 12-ft. tower for a folded dipole antenna and reflector. This was constructed to permit rotation of the antenna from the inside of the truck. A field-strength meter, to measure signal strength in microvolts-per-meter, was set up to operate a recording meter. The latter had a 5-millampere movement. To synchronize the recorder with the distance travelled by the mobile laboratory, the chart was driven by a cable connected to the speedometer. A compass for accurate direction checks was included, as well as a standard REL FM receiver for monitoring and comparison purposes. A calibrated dipole, adjustable as to length, was used to check reception on the folded dipole. Finally, a generator delivering 110 volts at 60 cycles, rated at 800 watts, was mounted separately in a trailer.

With the equipment ready, the next problem was to work out routes of travel for the mobile laboratory that would provide the reception data needed. Using an FM broadcasting transmitter as the hub, a series of routes were mapped out on approximately 45° radials. Starting each trip 1 mile from the transmitter, the truck travelled at a speed of 15 miles per hour along each radial. Readings were taken all along the route of travel. The engineer in charge noted identifying landmarks on the charts so that the exact location of the truck could be correlated with the chart readings at a later date.

An inter-communication system was installed between the cab of the truck and the enclosed laboratory to more closely coordinate the work of the driver and the technician.

During these field tests, the strength of signals received from both nearby and distant stations was carefully checked. From the charts and the landmark identifications noted during the tests, the effect of both terrain and elevation could be determined accurately. This method also permitted checking reception on receivers

* Information Service, Cooperative G.L.F. Exchange, Inc., Ithaca, N. Y.

under the many varying conditions of terrain and elevation encountered in the rural areas, as well as at different distances from the transmitter. The truck travelled as far as 75 miles along the radial routes.

After a careful analysis of the test data, it was concluded that the primary area for FM reception should be conservatively considered as 25 to 30 miles from the transmitter used principally during this survey, with the secondary area reaching out 40 to 50 miles. Further, it was concluded that a radio receiver for good FM reception in rural areas should be highly sensitive as well as very selective.

FIG. 2. *Interior of mobile laboratory, showing field-strength measuring equipment*

Laboratory Tests of Receivers:

G.L.F. Farm Supplies and the United Cooperative laboratory staff agreed on basic receiver requirements. Next, a field and laboratory program was planned, to determine what standard receivers would meet the performance specifications.[1]

A definite test procedure was followed. The standard of testing FM receivers, set by the Institute of Radio Engineers, was used to cover the following points:

1. Sensitivity (maximum and quieting signal)
2. Selectivity
3. Distortion characteristics
4. Detuning distortion
5. Frequency stability
6. Overall fidelity (audio frequency response)
7. Output and AVC
8. Set noise

A complete characteristic analysis was made for each FM receiver tested, and the data recorded, from which performance curves were drawn.

As the comparative tests continued, it appeared that our requirements for FM reception called for performance that manufacturers generally had not felt justified in providing, at least within our price brackets.

From the mass of accumulated data, specifications were written for a receiver that would meet the standards set up as a result of the field testing. In doing this, G.L.F. was working to meet the needs of a known market with which it was familiar and experienced in serving.

The North American Philips Company was commissioned to build engineering test models according to the specifications, and these were included in the series of comparative laboratory and field tests. Before this testing program was completed, the performance of 17 different makes of FM receivers had been analyzed. The accompanying charts show some of the data collected.

The outcome of this thorough-going preparation was the design of the G.L.F. model F-770, illustrated in Fig. 3, and manufactured on a production basis by North American Philips. Further details of the set are presented in Part 2 of this Section.

FIG. 3. *The G.L.F. receiver, designed specifically to meet the needs of the RRN audience*

Solving the Antenna Problem:

The survey of needs for rural radio reception demonstrated clearly that a good outside antenna system is required for satisfactory reception. Because of the erection and service problems involved, a suitable FM antenna system must be easy to install, non-directional in its response pattern, and capable of picking up weak signals.

Basic specifications set up for the G.L.F. antenna system are:

1. Non-directional reception
2. Horizontal polarization
3. Operation in the 88- to 108-mc. band
4. Transmission-line impedance to match the receiver input
5. Lightning protection for both the antenna structure and the receiver.

The G.L.F. design finally adopted, and now manufactured by Technical Appliance Corporation, is supplied as a single turnstile composed of two folded dipoles, to which a second turnstile can be added in a stacked array for increased gain. A two-bay installation is shown on the front cover of this issue, with construction details in Part 2 of this Section.

Since installation service is not available in some rural areas, a detailed installation instruction sheet is supplied so that any person with minimum of mechanical skill and without technical knowledge can

[1] Editor's Note: These specifications are not available for publication at this time, but we hope they will be released in the near future.

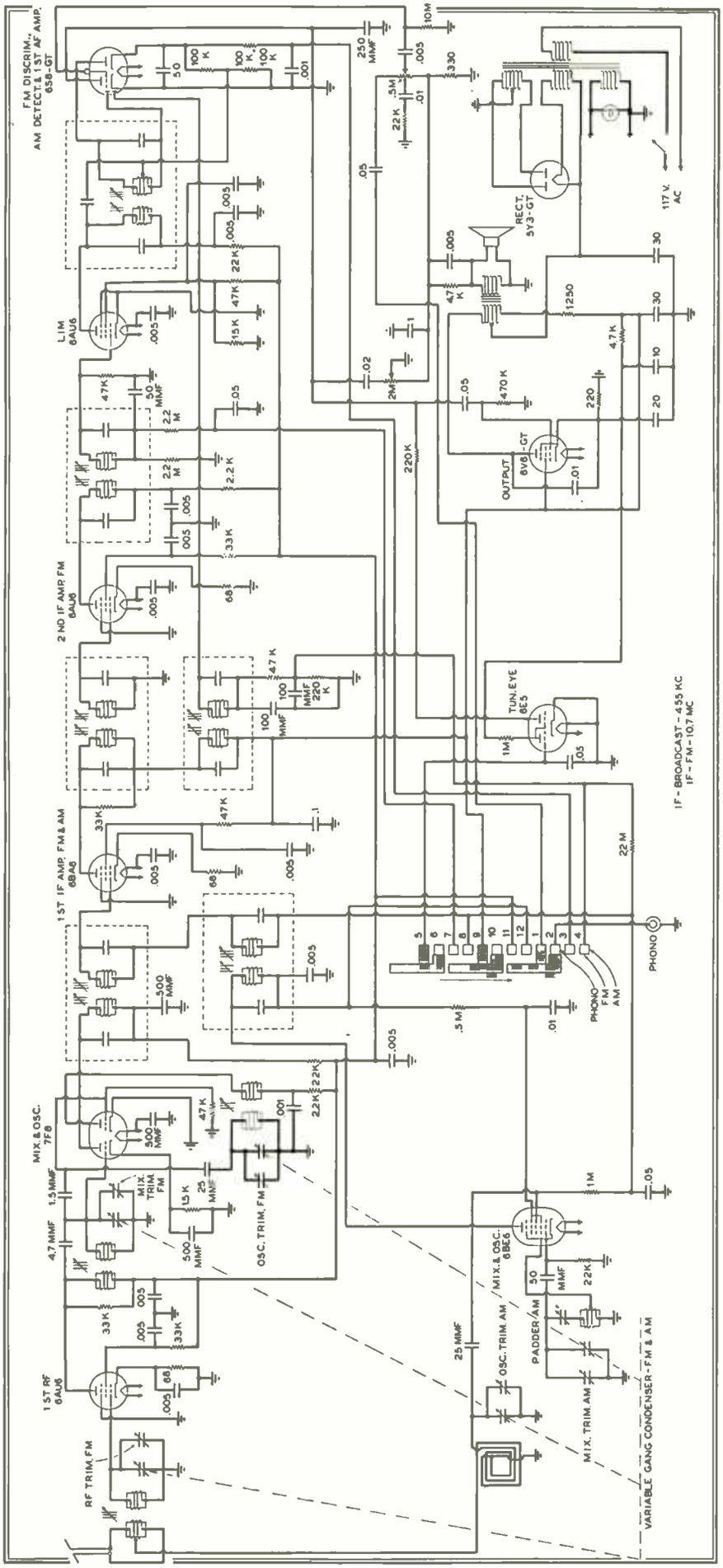


FIG. 4. *G.L.F. table model FM-AM set uses Armstrong limiter-discriminator circuit, has better than 20-microvolt sensitivity*

erect and hook up the antenna correctly. The principal units are preassembled at the factory, and identifying marks make the final assembly fool-proof.

Providing Competent Service:

An experienced G.L.F. service organization was already in existence, with completely equipped service shops at seven of the G.L.F. Farm Supplies Warehouses. Located strategically to serve specific areas in the G.L.F. territory, these shops were already providing service for the G.L.F. retail outlets on such items as AM radios and fence controllers.

To prepare these servicemen to handle the new FM equipment properly, they

	FM STATIONS RECEIVED												
SET NO.	WBNY 92.9 MC 48 KW 130 MI	WBRE 98.5 MC 2.2 KW 80 MI	WBAX 98.9 MC 9 KW 80 MI	WHCU 98.5 MC 20 KW 77 MI	WRFM 98.9 MC 20 KW 75 MI	WNAC 105.3 MC 10 KW 65 MI	WSYR 94.5 MC 9 KW 45 MI	WAGE 98.5 MC 1.6 KW 45 MI	WHAM 106.1 MC 4.2 KW 43 MI	WABF 100.5 MC 1.3 KW 40 MI	WHJT 98.9 MC 4 KW 22 MI	WHCU 97.3 MC 5 KW 5 MI	TOTAL GOOD
494	G	G	G	G	G	G	G	G	VG	G	G	VG	12
526		F	F	F	F	F	G	F	G	G	G	VG	5
600			F	F	F	F	G		G	G	G	VG	5
504				F	F	F	G		G	G	G	VG	5
499						F	G		G	G	G	VG	5
527						F			G	G	G	VG	4
487							G		G		G	VG	4
471									G	G	G	VG	4
489									G	G	G	VG	4
488									G		G	VG	3
525									G		G	VG	3
485									G		G	VG	3
486									G		G	VG	3
472									G		G	VG	3
470									G		G	VG	3
500 T												P	-
G.L.F. F770	G	G	G	G	G	G	G	G	VG	VG	G	VG	12

SET NO.	SENSITIVITY	SELECTIVITY	OVERALL DISTORTION	DETUNED DISTORTION	FREQ. STABILITY	OVERALL FIDELITY	OUTPUT AVC.	SET NOISE	TOTAL GOOD
494	G	G	G	G	F	G	G	G	7
526	G	F	F	F	P	G	G	F	3
600	G	F	G	G	F	F	G	F	4
504	G	F	P	P	P	G	G	F	3
499	F	P	P	P	F	F	F	F	0
527	F	P	P	P	G	F	F	F	1
487	F	P	P	P	P	F	F	P	0
471	F	F	F	F	F	F	F	F	0
489	F	P	P	P	F	F	F	F	0
488	F	F	F	G	F	F	F	F	1
525	P	P	F	F	F	F	F	G	1
485	P	P	F	F	F	F	F	P	0
486	P	P	P	P	F	G	F	F	1
472	P	G	F	F	P	G	F	F	2
470	P	P	F	F	F	P	F	F	0
500 T	B	F	P	P	P	P	P	P	0
G.L.F. F770	VG	G	G	G	G	G	G	G	8

Ratings of reception and performance characteristics of commercial FM sets. P poor — F fair — G good — VG very good

were first provided with technical data for detailed study. Then they were sent to the North American Philips plant for a period of intensive training under the supervision of their engineers. Thus they became familiar with the reasons behind our performance specifications, the receiver circuits and components, and the most advanced methods for repairing and aligning the sets.

Following the period of factory training, technicians from North American Philips were sent to the seven shops to work with our servicemen. As the first shipments

arrived at the warehouse, all circuits and component parts were carefully checked by the servicemen. The purpose was to familiarize our men with the equipment they were to handle and service, to spot any bugs in the production models, and to enable the manufacturer to make changes or corrections if any were needed.

Training for Salesmen:

With the sets in quantity production and the service staff trained, the next consideration was information for the retail personnel in the G.L.F. Service Agencies and the Agent Buyers. A series of nineteen evening meetings were set up. During June, a total of 612 employees attended these four-hour evening sessions. G.L.F.'s interest in FM as an important communication tool to farm families was fully covered. Servicemen explained the characteristics of the new FM farm radio, and what could be expected of it. The proper

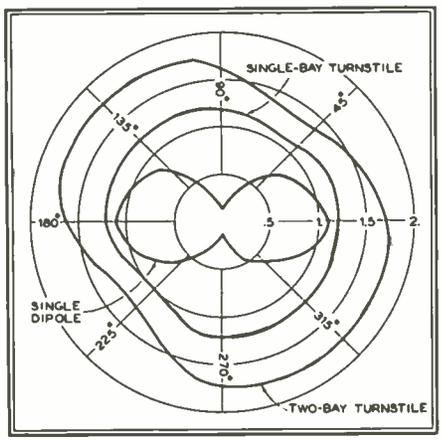


FIG. 5. *Relative performance of single dipole, and G.L.F. single-bay and double-bay turnstile types of FM antennas*

installation of the antenna and receiver was covered thoroughly, to assure the complete satisfaction of each customer. Each group was given an opportunity to erect one of the antenna systems, so they could answer customer questions. Receivers were demonstrated to sell our own sales staff on the fine tone quality and reception characteristics of FM. As the G.L.F. receiver is built for both FM and AM, comparisons were made between the two types of reception. A question and answer period was held after each meeting, so that specific service questions could be cleared.

Store banners, posters, booklets, and other promotional material were prepared and made available to all G.L.F. Retail Service outlets. Thus, during a two-year period of development, a new product was ready for market with quality control, manufacturing, service, and distribution, specifically geared to provide complete radio service in our particular segment of the radio market.

Service on this new equipment will be handled at the seven warehouse points. With the G.L.F. Farm Supplies trucks making regular weekly deliveries to all retail points, receivers can be brought to the service center, checked and adjusted, and returned to the purchaser in a week's time. This assures our customers of service by technicians who are thoroughly familiar with the equipment. The engineered precision originally built into the receivers will be maintained because only replacement parts specified for the purpose are used in the service work.

Periodically, sets are picked out at random from new shipments, and thoroughly checked. This provided the manufacturers, as well as G.L.F., with a constant quality control. In addition, there is a return flow of information from owners' reports and service experience that enables G.L.F. and the manufacturer to be constantly alert for opportunities to improve production methods and equipment design.

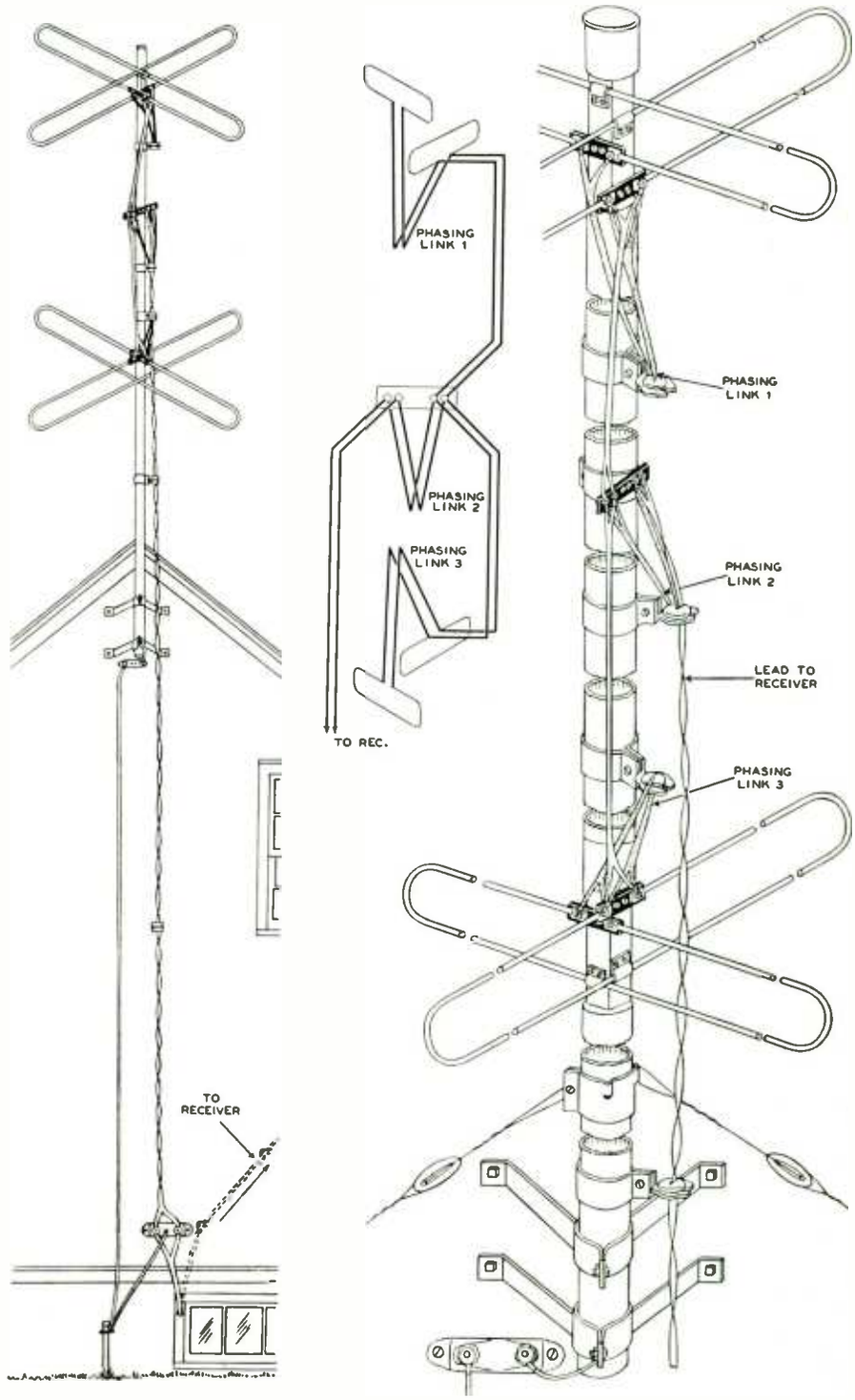


FIG. 6. *Construction details of G.L.F. two-bay turnstile, and method of installation*

(*Continued on page 43*)

FIG. 1. *View of the Wethersfield station shows winter construction methods.* FIG. 2. *Wraps were removed when heat was installed*

Pattern for FM Profit:

6. TRANSMITTERS

PLANNING, CONSTRUCTION, AND EQUIPMENT FOR RURAL RADIO NETWORK, A REGIONAL SYSTEM OPERATED WITHOUT THE USE OF WIRE LINES—*By* DONALD K. DeNEUF*

TWO years have moved over the horizon of New York's hills since the technical planning of the Rural Radio Network first started to take form. Now, with our six stations operating, I can say that this has been one of those dream jobs of the sort that every engineer hopes to do at some time in his career.

A Pioneering Project:

On this project, the engineers were in at the start. Instead of being called upon to find a way to make the system work in spite of the way it had been set up, we took part in the initial planning. Now, with the system in operation, there is no conflict between management objectives and policies and the engineering and operation of the system.

*Chief Engineer, Rural Radio Network, Ithaca, N. Y.

Here, then, is the first example of an idealistic plan for providing primary-coverage radio signals to rural listeners, where table-talk progressed to the planning board and finally into execution in the form of a highly integrated regional network. Looking back on what has been accomplished, we can see that the technical work was just as much a pioneer broadcasting job as the organization, promotion, and programming.

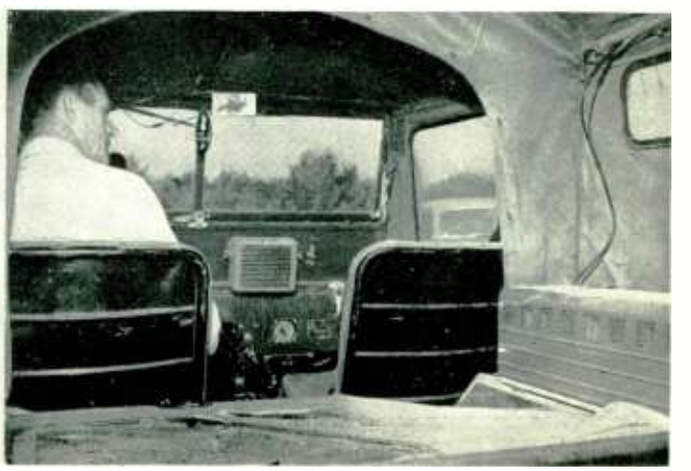
With our prospective listeners scattered throughout New York State, and because our primary objective was to deliver a quality signal free of fading, interference and static, AM was out of the question. Even if the frequencies had been available, and they weren't, AM would not provide the required quality of reception. Another vital consideration was the absolute need in the type of operation we were planning to have consistent, day-and-night coverage, and dependable service under extreme weather conditions which might cut off our listeners from all other sources of outside information.

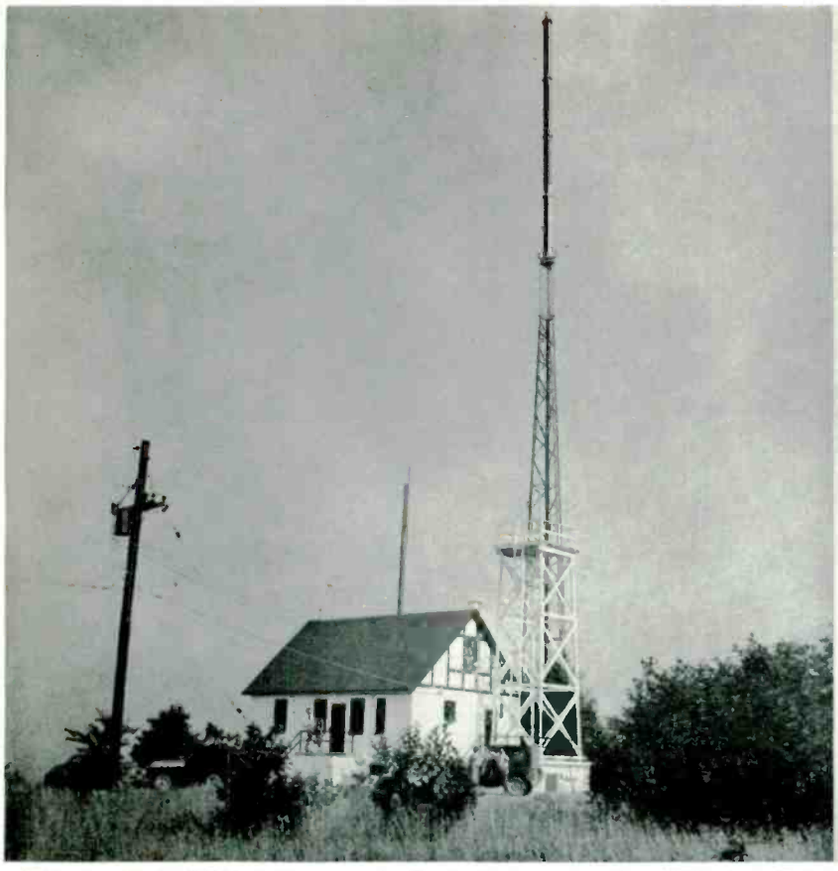
First No-Line Network:

So Rural Radio Network went FM. In fact, it was decided that RRN would go FM all the way, thus eliminating all wire-line interconnections. This decision defined the choice of transmitter locations, for it was necessary to choose sites that would give 1) maximum broadcast service areas, and 2) line-of-sight communications between adjacent stations. Thus it has come about that RRN is the first all-radio, no-line network in the world.

The practical reason for planning operation without wires was that, in rural areas, existing telephone facilities are gen-

FIG. 3. *Types of antennas installed on our Jeeps.* FIG. 4. *Speaker was mounted on the dash, with transmitter-receiver at the right*





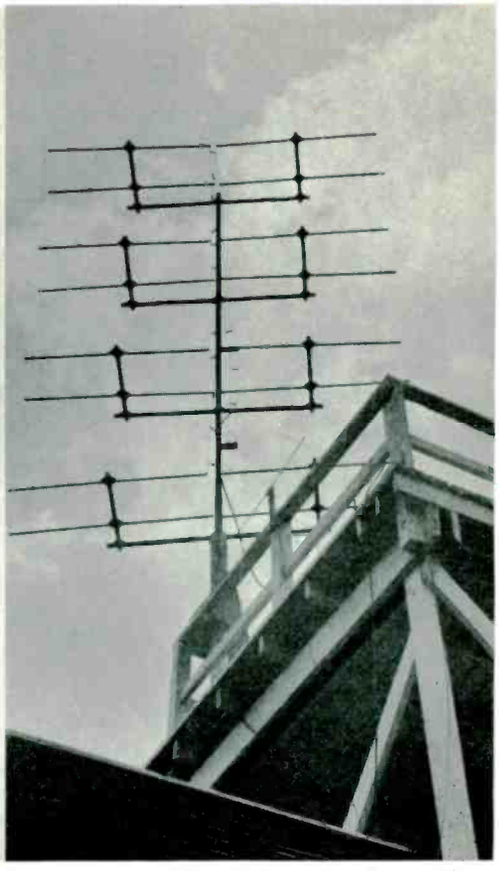


FIG. 5. *All the RRN stations are similar in their construction.* FIG. 6. *A Hoisington antenna used for wireless network operation*

erally limited to party lines. Obviously, such service is inadequate for broadcast station purposes. Then, too, the result of picking transmitter sites by topographical considerations was to spot our stations at points far remote from telephone lines. Linking the network by lines would have been prohibitively expensive for both installation and rental, while FM networking represented a substantial economy that could be reflected in operating costs and rates to advertisers.

Distances between stations and the frequency assignments are as follows, starting at the western end of the system:

WFNF Wethersfield 107.7 mc.
46 miles to
WVBT Bristol Center 101.9 mc.
46 miles to
WVFC Ithaca 95.1 mc.
52 miles to
WVCN De Ruyter 105.1 mc.
56 miles to
WVCV Cherry Valley 101.9 mc.
72 miles to
WVBN Turin 107.7 mc.
75 miles to
WSLB Ogdensburg 106.1 mc.

All networking to these stations is by radio, including our Ogdensburg affiliate WSLB, but affiliate WGHF New York City is connected to the Ithaca studio by wire line, over a distance of approximately 170 miles.

Building the Stations:

The actual construction of the transmitter buildings and the erection of the antennas involved some real headaches. Each site was at an elevation of more than 2,000 ft. In most cases, there were neither roads nor utilities. Construction would have been difficult enough in the summer and fall, but we could not start the work until October 15, 1947, following the granting of our CP's by the FCC. So, in addition to facing the usual hazards, we had to contend with extreme winter cold and deep snow, as well as the mud which developed during the spring thaw. Nevertheless, five of the stations were on the air in June, 1948, and the sixth, although delayed by wintertime difficulties, was ready two months later.

FIG. 7. *Murray Crosby and William Halstead, standing, made the preliminary surveys*

One of our prime needs during the period of construction was dependable communications between each site, our Ithaca headquarters, and our four jeep field vehicles. Even now that we have telephone service, some of the stations are number 15 on rural party lines. But at the beginning, with no phone connections at all, we were confronted with the problem of getting things done without an incredibly expensive waste of time.

Once again, the answer was radio, in the form of an inter-com system that very successfully coordinated the movement of the jeeps and tractors with activities at the separate sites and the main office.

Figs. 1 and 2 indicate typical conditions at the Wethersfield station, and the construction methods employed. The photograph in Fig. 1 was taken in January, 1948. Within the protection of tarpaper and tarpaulins held against the wind by slats, foundations were dug and the shell of the building erected. When the work had progressed to the stage shown in Fig. 2, with the windows and doors in place and heating equipment installed, the outer wraps were removed.

As for our faithful jeeps, we now use them for transporting trouble-shooters and maintenance crews.

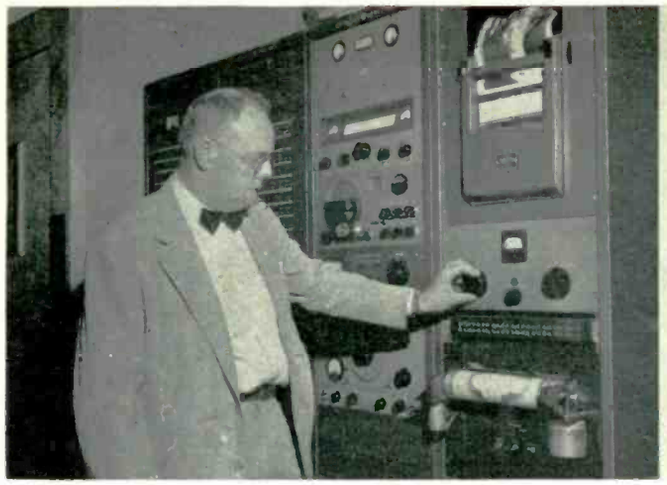


FIG. 8. *The author, checking an experimental facsimile transmitter.*

FIG. 9. *Interior of the nemo truck. Transmitter is at rear*

Figs. 3 and 4 show the antennas and the radio equipment. While the space available is small, we found room for the speaker on the dashboard, Fig. 4, and tucked the transmitter-receiver at the side, behind the right hand seat. Thus, by radio, the jeeps are always within reach wherever an engineer or a spare part is needed in a hurry.

Transmitter Installations:

All six stations are identical in design. The buildings are of cinder-block construction, with wood frames and shingle roofs, as can be seen in Fig. 5. Each has a 100-ft. steel tower supporting a 4-section RCA Pylon antenna. In addition, there is a wooden tower and platform for the special antennas to be described later. The communications antenna can be seen in Fig. 5, mounted separately on a wooden pole.

Each building has garage space for two vehicles and storage room for replacement equipment and the usual gear needed at a transmitter. There are living quarters and a kitchen for the crew, studio facilities for local programming, dual turntables, and a 250-watt General Electric FM transmitter. The latter, with the antenna gain provided, delivers 1.3 kw. effective radiation.

At five of the stations there are 15-kw. gasoline-driven emergency power plants, with automatic switching that goes into action if the commercial power fails. Turin, however, generates its own power, and has duplicate 15-kw. Diesel units. Also, since egress is frequently impossible during the winter, Turin has storage tanks holding 12,000 gallons of oil for power and heating.

Because our stations are located advantageously for collecting local weather data, each has a set of meteorological instruments. Some of the indicators are set up on the transmitter racks, as can be seen in Fig. 13.

Studio-Transmitter Link:

While programs can be originated at any station in the net and distributed to all the others, our master control point and main studios are located in Ithaca. Programs are fed from that point to station WVFC on Connecticut Hill, a distance of 9.5 miles, by an ST transmitter operating on 940.5 mc. This is a G.E. installation.[1] The control panel for the transmitter can be seen just below the banner in Fig. 11, and the transmitter in Fig. 15. The transmitting antenna is illustrated in Fig. 14.

The output of the ST receiver is fed through the control console at the station, and into the FM transmitter. This makes a very simple system.

Network Operation:

The radio repeating system for network operation is simple in design and highly satisfactory in operation. Two Hoisington 16-element directional receiving antennas are used at each intermediate station, and one at the extreme east and west stations. Each antenna faces its respective adjacent station in the net, and is connected to an REL relay receiver.

If, for example, a program originates at the western extremity, all stations to the east use their west-side antennas and receivers to feed their broadcast transmitters. Or, if the program starts at the other end, they use their east-side antennas and receivers.

Fig. 6 shows one of the antennas, mounted on the wooden tower. This is an all-weather design, producing a gain of 34 db. Measurements are made daily over the network to maintain a distortion standard of 1% or less, and a signal-to-noise ratio of 60 db or better.

It is interesting to note that only four different frequencies are used at the six stations of the basic network. Wethersfield and Turin, approximately 160 miles apart, operate on 107.7 mc., while Bristol Center and Cherry Valley, separated by 140

[1] EDITOR'S NOTE: For complete description of the transmitter and receiver, see "G. E. S-T Equipment" by D. J. Nigg, *FM* AND TELEVISION, June, 1948.

FIG. 10. *Studio control room at Ithaca headquarters.*

FIG. 11. *Master control of the intercom system. Small panel is ST control*

miles, operate on 101.9 mc. Affiliate station WGHF New York City is also on 101.9 mc. It is about 220 miles from Bristol Center and 150 miles from Cherry Valley.

Nemo Equipment:

A very important part of our equipment is the nemo unit, hauled by a jeep with 4-wheel drive. Fig. 9 shows part of the interior. It has a 50-watt transmitter operating on 152.75 mc. Commercial power is used on location if available. Otherwise, we operate from a 3-kw. generator driven by a gasoline engine. The nemo unit carries a high-quality wire recorder for program material not used for live transmission.

The antenna is a 40-ft. collapsible rig that gives us a dependable operating range of 50 miles. Thanks to the fact that programs can be fed to any one of the six stations for broadcasting over the entire network, the 50-mile range is adequate for all requirements. In case of special events in the very northern part of the State, we can work through our Ogdensburg affiliate, WSLB.

Conclusion:

This concludes the story of the Rural Radio Network, the first system of its kind in the world and, from the engineers' point of view, one of the most interesting ever conceived.

5: RECEIVER & ANTENNA

(*Continued from page 39*)

This is another example of the original thinking that has been done in connection with the RRN. It is the first time that receiver specifications have been determined in conjunction with a specific network.

FIG. 12. *Each station has a control console and turntables*

and the sets manufactured, sold, and serviced under one control.

PART 2: RECEIVER & ANTENNA

G.L.F. FM-AM Receiver:

Fig. 3 shows the outward appearance of the G.L.F. receiver, with the circuit in Fig. 4. It employs the Armstrong limiter-discriminator system for FM, and a conventional superheterodyne circuit for AM.

The input is a tuned RF stage, necessary to meet the requirement of better than 20 microvolts sensitivity. It also improves image rejection and reduces radiation from the oscillator. One of the new miniature 6AU6's is used because of its very high mutual conductance. This stage is impedance-coupled to the double-purpose 7F8 which acts as a mixer and oscillator. This is a triode mixer, selected to meet the requirement of extremely good signal-to-noise ratio. In order to achieve high oscillator stability, the oscillator frequency is on the low side of the RF.

Two IF stages are used on FM, and one on AM. The first, common stage, has a 6BA6, while the second, for FM only, has a 6AU6 to secure high gain. A combination of fixed silver-mica condensers and adjustable iron cores is used to tune all the IF transformers. Changes of temperature and humidity, or vibration have a negligible effect on the tuning of these circuits.

A conventional Armstrong circuit is employed for the limiter and discriminator. Since sharp cut-off is required for the limiter, this is a 6AU6 tube. Two of the diodes in the 6S8GT are used as discriminator rectifiers. As Fig. 4 shows, this tube is also the AM detector and first AF amplifier. The triode section is resistance-coupled to the grid of the 6V6 output stage which feeds a 7-in. loudspeaker of excellent quality.

Feedback is taken from the output transformer and applied to the grid of the 6S8GT for degeneration. This provides an audio system of high quality and low distortion.

It will be noted that a separate converter is used for the AM section. This is to avoid losses in the RF circuits from the band switch. As a result, the only switching is done on the audio input, plate supply, and tuning indicator. The latter is controlled on FM by the voltage developed in the limiter grid circuit, and on AM by the AVC voltage developed by the detector and AVC diode.

G.L.F. Non-Directional Antenna:

The advantage afforded by the G.L.F. antenna is indicated in Fig. 5, showing the relative performance of a single dipole, single turnstile, and 2-bay turnstile.

In practically any area today, the geo-

(*Concluded on page 58*)

FIG. 13. *Standard equipment includes, left, meteorological instruments and noise and distortion analyzing units; center, relay receivers and nemo receivers; right, amplifier and monitor.* FIG. 14. *Antenna for ST transmitter.* FIG. 15. *ST transmitter*

SPOT NEWS NOTES

ITEMS AND COMMENTS, PERSONAL AND OTHERWISE, ABOUT MANUFACTURING, BROADCASTING, COMMUNICATIONS, AND TELEVISION ACTIVITIES

Trade Associations:

Status of NAB, FMA, and TBA is being reviewed by members who want maximum value from the time and money contributed to these organizations. Conservative management and policies of NAB have kept this senior association out of active FM and TV participation, but accelerated decline in AM set production indicates the need of drastic change. Meanwhile, FMA and TBA, although gaining strength, lack NAB bank account and organization.

Kenneth B. Warner:

Radio amateurs the world over will mourn the sudden passing of Kenneth B. Warner at his home on September 2. As manager of the American Relay League and editor of *QST Magazine*, he took over the postwar remnants of the League in 1919 and built it into a well-organized and highly useful association that exemplified amateur enthusiasm and teamwork at its best. K. B. was born at Cairo, Ill., October 3, 1894. He is survived by Mrs. Warner and their children Betty Jean and Richard.

Du Mont Affiliate:

WGN-TV Chicago has been added to the Du Mont net. Until direct connections are available, programs will be supplied from New York by Du Mont tele-transcriptions.

Waltham, Mass.:

Raytheon has purchased from the Government four buildings of 348,000 square feet and the engineering and production equipment which they contain.

WEAW Goes to 36 Kw.:

Evanston, Ill., now has the most powerful FM station in the Chicago area, and the most powerful of any kind between Chicago and Milwaukee. Frequency is now on the permanent assignment of 105.1 mc.

WRGB Schenectady:

G.E.'s. TV station is to have a mobile pickup unit, new cameras for studio and film use, and a 20-ft. addition to the studio building. Meanwhile, preparations are being made at the Helderberg transmitting site for the installation of a completely new transmitter.

FM-TV Score:

During the month of August, one more TV station went on the air, and 10 new CP's were granted. FM gained 17 operating stations. Score now stands:

	TV	FM
On the air	31	640
Authorized	91	388
Pending	292	97

The FM figure includes 22 educational stations. According to FMA figures, it appears that the number of projected stations was reduced by 12 during August, while TBA figures show an increase of 4 TV applicants.

Ray Davis Kell:

Director of TV research at RCA's Princeton laboratories will be the 1948 recipient of the Stuart Ballantine Medal awarded by the Franklin Institute.

TV Film Council:

Important information on the use of film for TV broadcasting is being made available to its members by the National Television Film Council, 300 W. 23rd Street, New York 11. Membership application forms can be obtained from R. W. Wormhoudt, secretary-treasurer.

Major Emilio J. Baduel:

While the Director of the Military Factory for Mobile Communications of the Argentine Army was getting acquainted with Philco mobile equipment on a tour around Philadelphia, he talked via AT & T to an official in Buenos Aires. This is probably a record in mobile radio annals.

Higher Prices:

To offset increasing cost of materials and wage scales, Emerson has upped their list prices 6 to 15% effective September 1. TV model 571, brought out at $269.50, is now $299.50.

James R. Day:

Will present a paper on the REL Serrasoid Modulator at the September 23rd meeting of the Radio Club of America, Room 502, Engineering Societies Building, 29 W. 39th Street, New York, 8:00 p.m. This radically simplified FM modulator requires only 11 receiver-type tubes between the crystal oscillator and output at broadcast-band frequency.

TV Showroom:

A new display of nine TV models has been set up by Starrett Television Corporation at 521 Fifth Avenue, New York City.

IRE Texas Conference:

Two-day meeting and exhibit, sponsored by the Dallas-Ft. Worth section, will be held at Baker Hotel, Dallas, December 10 and 11. Chairman of the exhibits committee is C. F. Crandell, 801 Telephone Building, Dallas 2.

Capt. William C. Eddy:

Resigned as director of television for Balaban & Katz, Chicago, to become president of Television Associates, Inc., 190 N. State Street, Chicago.

1,000-Station Net:

Independents within NAB ranks are talking about forming a new nation-wide network to operate without wires. FM would be required for main arteries, since AM stations could receive their programs but could not pass them on. Project chairman is Ted Cott of WNEW New York City.

Milwaukee TV Audience:

Survey by WTMJ-TV shows that, as of August 1st, there were 4,142 TV sets in use, of which 928 were in public places and 3,214 in private homes.

Rudolph Reinitz:

Salesmen who call on Andrea Radio won't find Rudy Reinitz at the purchasing agent's desk any more. He passed away on August 21, at age forty-three. Rudy had the admirable capacity of making friends even among those he had to press hardest for prices and deliveries. We hope there's an orchestra where Rudy's gone, for he loved to play the saxophone, and he was a musician of considerable ability.

KDFC San Francisco:

Sundial Broadcasting Corporation is now on the air with 33 kw. radiation at 102.1 mc. Latest additions to engineering staff are Buck Cambell, formerly of KALW, and Oscar Darach, recently resigned from the Chicago office of CAA.

New IRE Section:

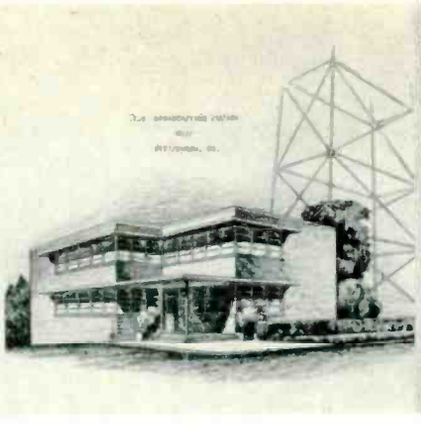
Plans for an Omaha-Lincoln section were formulated at a meeting on August 5 at Omaha. Temporary officers elected were chairman Mark Bullock, KFNF Shenandoah, Ia.; vice chairman Al Bates, KFAB Omaha; and secretary-treasurer B. L. Dunbar, WOW Omaha.

WENR-TV Ready:

ABC's Chicago station will go on the air September 17th. Plans call for a weekly program schedule of 30 hours.

UE Conflict:

There's no doubt that Communists in UE ranks are a minority group, but the fact is that their control is well organized. As *The Times* pointed out not long ago: "Heading the UE is a group of known Communists. The union's secretary-treasurer is Julius Empak, identified as a top official of the Communist party, in which he was known as Comrade Juniper. Its director of organization is James Mantles, a member of the Communist party for many years, according to party officials." We recall our surprise at finding, at the time when Empak and James Carey lived together, that the only books in their apartment were a set of volumes on the life of Lenin. Now Carey, testifying on Communism in the UE, is caught between presentation of facts with which he is thoroughly familiar, and loyalty to UE. So far, his testimony has been neither frank nor in accordance with the record.



NEWS PICTURES

TOP ROW: Philco's service division has launched a major project in training servicemen to handle TV sets. First there is a home-study course, handled from Philadelphia headquarters. With that completed, the students are ready for shop training, given by each of Philco's distributors in some 50 cities. Those who qualify are supplied continuing information.

Because TV studios are so high, it is difficult to maintain comfortable temperature at floor level. Air circulators are inadequate, and keep dust in motion. In Crosley's WLWT studios, radiant heating is used for the 48- by 80-ft. floor.

Architect's drawing of WKJF-FM, now being completed at Pittsburgh. Equipped by W. E. throughout, this installation on Mt. Washington includes a 424-ft. Blaw-Knox tower. Full-time operation, with 20 kw. radiation on 93.7 mc., will start in September. Chief engineer is D. E. Phillips, Jr.

Jim Finneburg, chief engineer of Ward Products, uses this setup, made in accordance with RMA recommendations, to obtain field patterns and response curves from a TV antenna on each transmission channel. Antenna under test is Ward type TVH-9.

CENTER ROW: Test cages have something new added, and testers have new responsibilities where TV sets are being manufactured. This photograph was taken in the Admiral plant, now stepping up production to substantial proportions.

Frank W. Walker, who pioneered police FM in Michigan as chief engineer for the State Police, and later set up the Greyhound Bus system, has joined Motorola. He will return to Michigan as Motorola's communications engineer.

Construction has been started on FM station WBSM New Bedford, Mass. In this picture, l. to r., program director E. L. Merritt, Jr., president J. P. Duchaine, consultant Otto F. A. Arnold, architect Leo LaBrode, contractor A. J. Loranger.

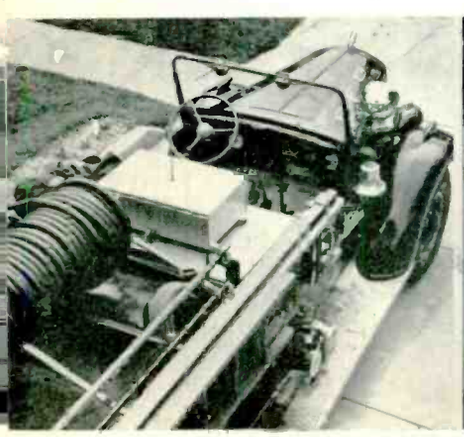
San Francisco section of the Audio Engineering Society devoted its August meeting to a paper on loudspeakers and a comparison test of 20 commercial types.

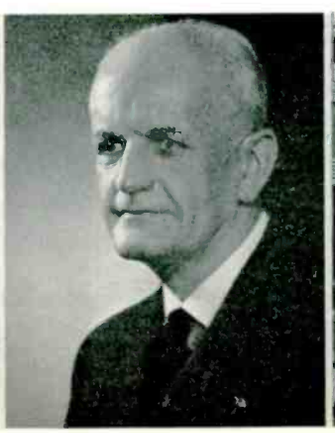
BOTTOM ROW: New FM system installed by RCA for Richmond, Va., includes units for the fire department. Case behind driver carries 156.09-mc. antenna and contains transmitter-receiver. Installation includes 250-watt main transmitter, two 45-watt auxiliaries, and over 100 mobile units.

KRLD Dallas has ordered a $200,000 G.E. TV installation. In this picture, l. to r., manager Clyde Rembert, technical supervisor Roy Flynn, president J. W. Runyan, and G.E. representative Jim Douglas.

Rear Admiral Ellery W. Stone has been elected president of Federal Telephone & Radio, and its subsidiary, International Standard Electric. Admiral Stone was president of Federal Telegraph from 1924 to 1931, when it was acquired by IT & T.

Air-conditioned mobile TV unit has been delivered to WNAC-TV by G.E. Special construction features floor 16 ins. above ground, and a non-skid Rigid-Tex roof. Photo shows unit drawn up at entrance to Yankee Network's Boston studios.





8-BAY PYLON ANTENNA

RATED FOR PRIMARY COVERAGE UP TO 200 MILES FROM HIGH-POWER FM BROADCAST STATIONS—*By* O. O. FIET*

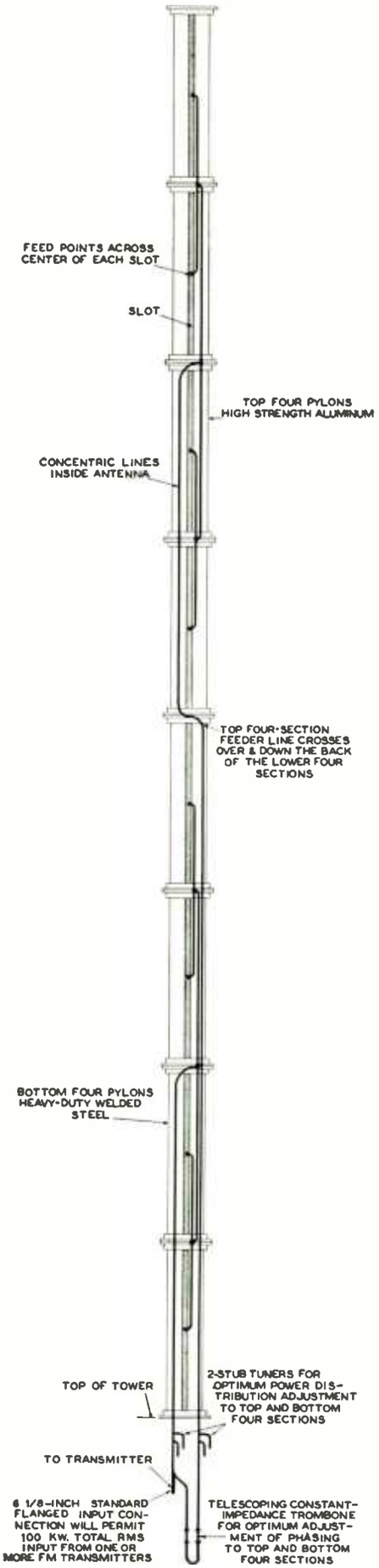


FIG. 1. *Details of the Pylon feeder lines*

THE 8-section RCA Pylon antenna is designed to provide maximum gain from the highest power available from commercially available FM transmitters. As shown in Fig. 1, it consists of two complete 4-section antennas. The lower half is the heavy-duty, welded-steel type frequently used to support RCA Super Turnstile TV antennas. It is designed to withstand wind loads up to 150 mph with ½ in. of radial ice. The upper half is the standard light-weight type, of high-strength aluminum. Designed in exact accordance with RMA standards, the 8-section assembly meets all building-code requirements ordinarily encountered in practice.

A typical installation, at WKJG Fort Wayne, is illustrated in Fig. 2. The photograph at the left was taken after the four lower sections were completed. Here the four upper sections, completely assembled and the harness installed, were being lowered into place. Less than two hours were required to raise and secure this upper half, and to make the transmission line connections. The lower sections, however, because of their greater weight, were taken up one at a time. This installation was made under the capable supervision of Raul Frye, technical director of WKJG-FM.

Circuit System:

Fig. 1 shows the method of feeding the antenna sections, while Fig. 3 gives the details of the sectionalizing system by means of which, through the use of a switch at the base of the tower or in the transmitter building, the top or bottom half can be operated separately or together. This is a great advantage in case maintenance or repair work is required.

The sectionalizing switch functions as follows: When all 8 sections are in operation, the line-shorting switches A and B are open, thus permitting power to flow to top and bottom four sections. The input impedance at the junction of the top and bottom four sections is approximately $\frac{51.5 + jo \text{ ohms}}{2}$ (two 51.5-ohm resistive impedances in parallel). The distance D/λ on the input line is selected to obtain a conductance of 1/51.5 ohms mhos at the stub connection F when eight sections are operating. The distance E/λ, to the stub-shorting switch C, is selected to obtain a negative input susceptance to the stub. This is equal and

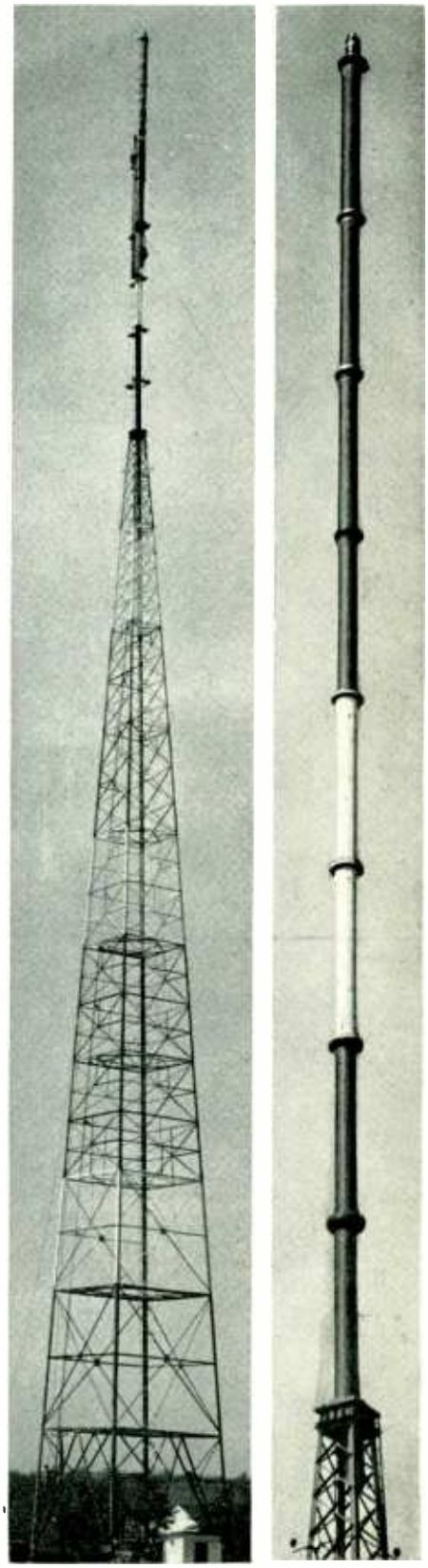


FIG. 2. *The 8-section Pylon at WKJG-FM*

* Transmitter Engineering Section, Engineering Products Department, Radio Corporation of America, Camden, N. J.

opposite to the susceptance of the antenna admittance at point F. When shorting switch C is closed for 8-section operation, the net input admittance at F is then very nearly 1/51.5 + jo mhos, or a resistive input impedance of about 51.5 ohms at the station's operating frequency.

When operation on the top or bottom 4 sections is desired, shorting switch A or B respectively is closed, thus shorting the respective feeder line to the bottom or top four sections. The switches A and B are shorted approximately a quarter-wave from the common input junction. Thus, when either switch A or B is shorted, the input impedance at the common junction to the shorted branch line is very high compared to 51.5 ohms. This condition results in negligible shunting and power loss at the input of the 4 sections to which power is fed. The input impedance at the common junction during 4-section operation is approximately 51.5 + jo ohms, thus providing a nearly perfect impedance match. The two-stub matchers in the 4-section branch lines are adjusted to match the 51.5-ohm transmission lines to the common junction G. Consequently, no stub shunt susceptance at junction F is required. Shorting switch C opens during 4-section operation. The stub shunt admittance at junction F is very small compared to the line admittance of about 1/51.5 + jo mhos. A quarter-wave, shorted stub has a very high input impedance. Thus the quarter-wave, shorted stub connected at junction F during 4-section operation causes negligible change of input impedance and power loss. The input impedance to the antenna system is thereby maintained at very nearly 51.5 + jo ohms during 4- or 8-section operation. No noticeable change in transmitter loading or tuning is observed when the sectionalizing switch is operated.

Provision has been made for later inclusion of three power and standing-wave-ratio monitors. They are used in lines connecting to the top and bottom 4-section units, and at the common input junction. This monitoring system, used in conjunction with the sectionalizing switch, assures continuous control and checking of the antenna system and transmission line performance.

Feed-Line Arrangements:

Installation of the two-stub matchers and the phasing unit is quite flexible in meeting specific requirements. The phasing unit and two-stub tuners can be mounted in the tower just below the Pylon base, as shown in Fig 1.

Several variations in the installation of the two-stub matchers and phasing unit are possible. They are as follows:

1. As described above and shown schematically in Fig. 1.

2. By inserting any desired equal lengths of standard 51.5-ohm line and fittings between each two-stub matcher and the phasing unit.

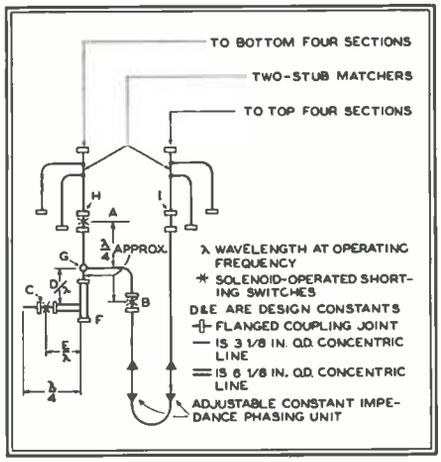


FIG. 3. *Design of sectionalizing system*

3. By inserting unequal lengths of standard line and fittings between each two-stub matcher and the phasing unit.

FIG. 4. *Adjustment of the phasing unit*

4. By inserting any length of line between each two-stub matcher and the antenna input terminals.

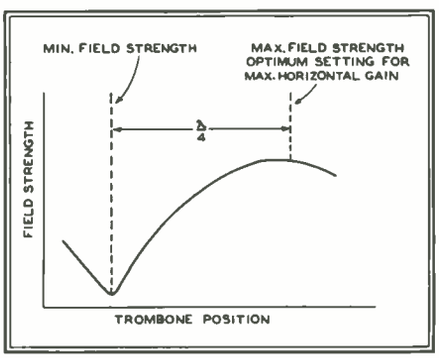


FIG. 5. *Minimum field strength is used to determine optimum trombone setting*

5. By combinations of 2, 3, and 4 above.

Arrangement 1 is the simplest and most economical. The proper stub and phasing-unit settings are furnished with the equipment.

Arrangement 2 can be used where mechanical restrictions below the Pylon antenna base do not permit the installation of the phasing unit, or where dual lines to the transmitter building are desired. This requirement might exist in antenna installations employing the sectionalizing switch.

Considerable care and ingenuity may be required in obtaining the equal lengths of transmission line which are required in certain arrangements involving more complex installations.

Two-stub matchers are mounted directly on the input terminals of the top and bottom four-section units. Two identical 90°, long-sweep elbows connect the stub-tuners to the phasing unit, which is installed in a horizontal position. The phasing unit and any nearby horizontal runs of transmission line should be protected from the possibility of falling ice.

Arrangement 3 can be used when it is considered impractical to install the equal length lines required in arrangement 2. The two-stub matcher settings for arrangement 3 are provided with the equipment. However, the optimum phasing unit adjustment must be determined by a qualified engineer when the installation is being made. This is not difficult, but requires experience.

Arrangements 4 and 5 can be used where restrictions will not permit utilization of 1, 2, or 3. They represent the least desirable type from the standpoint of simplicity, ease of installation, and adjustment. However, no compromise in performance exists in any of the described arrangements. For arrangements 4 and 5, a qualified engineer must determine the proper stub and phasing-unit settings for the assigned frequency after the installation is completed.

Engineering Installation Tests:

Impedance match for the top and bottom four sections is indicated by a zero balance of the high-frequency standing-wave-ratio bridges installed just below each two-stub matcher. The actual shorting-plug settings in the two-stub matchers are determined by calculations based on impedance measurements previously made with a precision slotted line. Many different stub settings will give a 51.5-ohm input resistance, but one particular combination of stub settings will give the least possible loss and maximum bandwidth.

Fig. 4 shows an RCA engineer and workman determining the optimum adjustment of the phasing unit. One engineer is communicating with another, stationed at a suitable distant location,

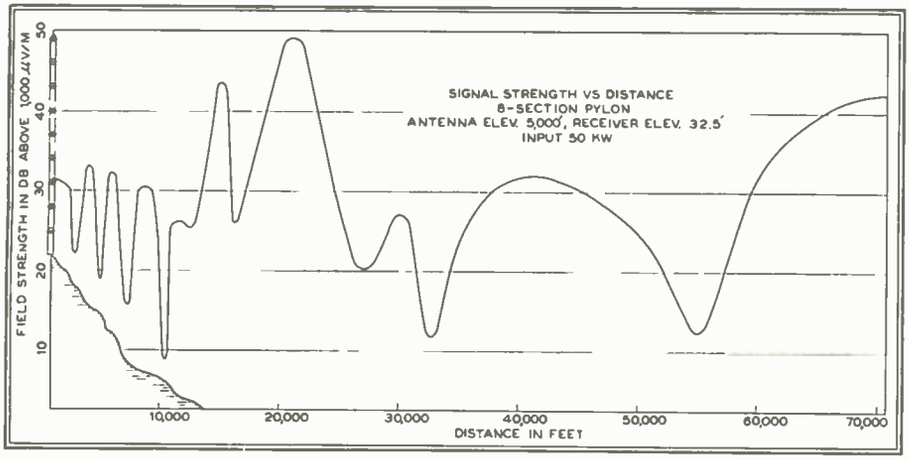


FIG. 8. *Close-in coverage obtained from the 8-section Pylon.*

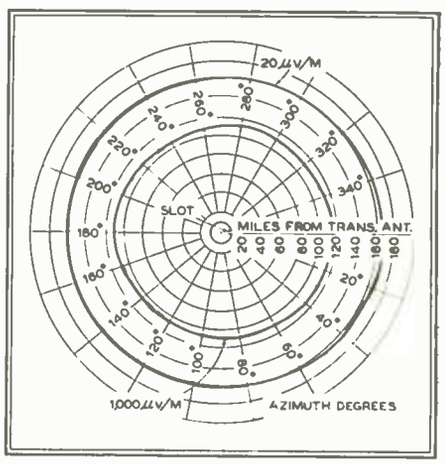


FIG. 9. *Contours at 20 and 1,000 microvolts are virtually circular*

reporting on field strength measurements. The workman is adjusting the trombone position according to the engineer's instructions. The setting of the trombone is not critical, and the field strength variations encountered near optimum trombone adjustment is very small, as shown in Fig. 5. The proper setting is precisely a quarter-wave greater, or less, than the setting which produces minimum field strength at the distant field strength meter. The variation of minimum field strength with trombone setting is quite sharp, and enables an accurate determination of the setting for maximum horizontal gain.

At WKJG-FM, an attempt was made to check the phasing unit adjustment by using a modified high-quality commercial FM receiver. Stray pickup from various sources in the receiver would not permit reliable measurements. A commercial high-frequency field intensity meter was used without difficulty, and field strength measurements produced a curve similar to that shown in Fig. 5. A set of Army surplus field phones was used to communicate with an engineer making adjustments at the tower top, and with an engineer located at the transmitter console. The WKJG engineer checked the transmitter power output and tuning during antenna adjustments, and recorded the data. The field intensity meter was set up at the chief engineer's home where he could communicate by commercial telephone with the transmitter engineer.

Changing from 4 to 8 Sections:

An adapter kit is available to convert existing 4-section lightweight, or heavy-duty installations into an 8 section Pylon combination. This consists of a transmission line, crossover line, two-stub tuners, line-stretcher, and input transformer. The crossover line is used to bring the input of the top sections down the back of the bottom sections, where it connects through a two-stub tuner to the common input junction of the top sections, bottom sections and FM transmitter. The bottom sections are connected through a second two-stub tuner and adjustable, gas-tight, constant-impedance, trombone line-stretcher to the common input junction, as in Fig. 1.

Additional details of the WKJG-FM installation are shown in Figs. 6 and 7. The former shows the transmission-line harness for the four bottom sections as it was assembled on a flat surface for pressure, continuity, and leakage tests. The harness was later strapped to angle-iron stiffeners, and installed as a complete unit within the four lower sections.

In Fig. 7, the four upper sections have been bolted together and the transmission lines installed and tested, ready for hoisting to the top of the lower sections. As the sections are virtually prefabricated, work on the job is greatly reduced.

(*Concluded on page 60*)

FIG. 6. *Transmission-line harness for four bottom sections.*

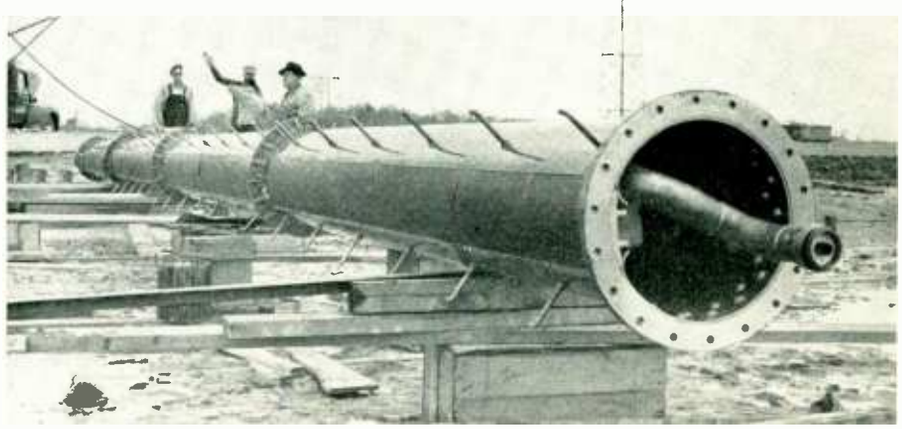


FIG. 7. *Four top sections bolted together and ready to be hoisted*

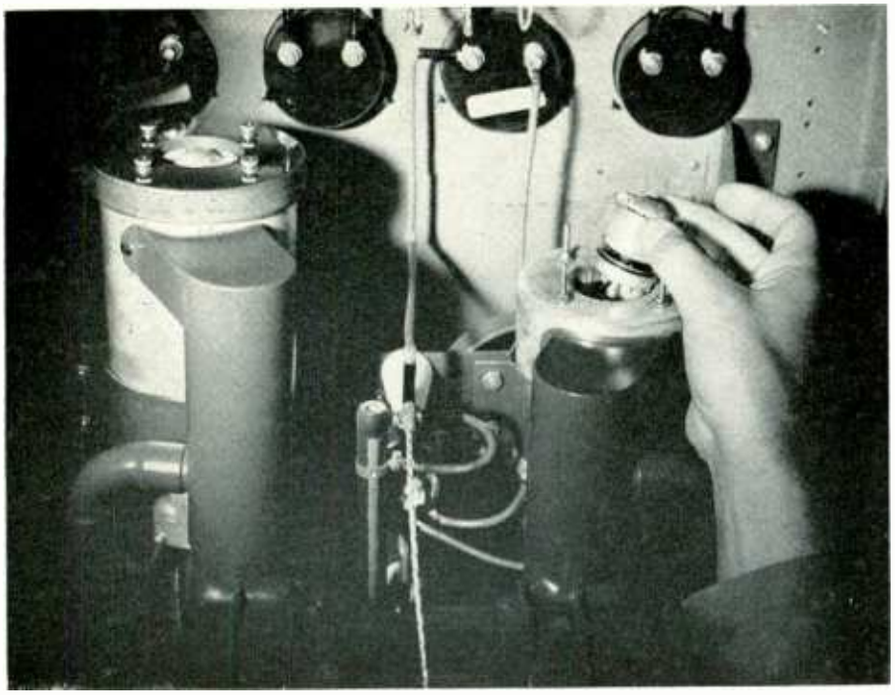


FIG. 2. *Type 4X150A tripler and doubler stages deliver 15 watts at 940 to 952 mc.*

STL CIRCUIT DESIGN

THE EIMAC 4X150A POWER TETRODE FOR CIRCUITS OPERATING ON 940 TO 952 MC. — *By* BYRON O. BALLOU*

SINCE it is highly desirable to locate FM transmitters as high above surrounding terrain as possible, the better transmitter sites are frequently beyond the range of line facilities suitable for carrying 15,000-cycle, low-noise FM programs. Recognizing this problem, the FCC allocated the 940- to 952-mc. band for studio-transmitter link service and, more recently, for FM relay broadcasting. This band has proved to be a good choice because suitable antennas with reasonably high gain are not cumbersome in size, permitting the use of relatively low transmitter power for reliable circuit levels.

Mindful of this and other similar applications, the Eimac organization started development of a power tetrode suitable for use at frequencies above 500 mc. In the design of such a tube, there are essential demands which must be satisfied. The more important of these are:

1. Close spacings between internal elements to reduce transit time loss
2. Low-inductance leads
3. Short elements
4. Adequate input-output shielding
5. Adaptability to UHF circuitry

These requirements dictated that the tube should be of external anode construction, using low-current-density seals, oxide-coated cylindrical cathode, a low-inductance screen grid lead to provide isolation between input and output circuits, and the location of the control grid lead so as to be easily adapted to coaxial circuit design.

The outcome of this project was the new 4X150A. Fig. 1 illustrates the internal construction. Carefully conducted tests showed stable amplifier operation at frequencies well in excess of 500 mc., and operation as a frequency multiplier to frequencies above 1,000 mc. proved excellent, showing that the tube is admirably suited to UHF circuit design.

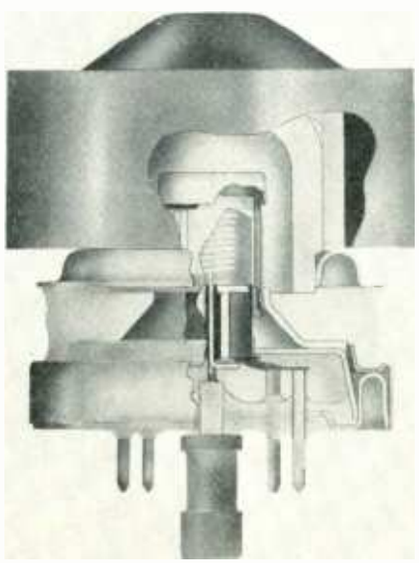


FIG. 1. *X-ray view of the Eimac 4X150A tube shows adaptability to UHF circuitry*

During the test program, it was found that outputs of 10 to 15 watts in the new STL band were obtained without difficulty by using a single 4X150A as a frequency doubler, easily driven by another 4X150A as a tripler from approximately 157.5 mc. with less than 2 watts of driving power.

For use in conjunction with the 50-kw. FM transmitter[1] for Radio Diablo, Inc., the Eimac laboratory built a prototype STL transmitter. It was put in daily service on March 12, 1948, transmitting programs from the studios in San Bruno (San Francisco) to the KSBR transmitter site atop 3,850-ft. Mt. Diablo, 32 miles distant. This STL project was undertaken in collaboration with Radio Engineering Laboratories, who designed and built the serrasoid modulator unit. The REL modulator-exciter is capable of some 2 watts output at one-sixth of the antenna frequency, with a deviation of ±16.6 kc. for 100% modulation. This gives a swing of ±100 kc. at the antenna frequency.

The circuits were adapted from a wide-range, coaxial-line resonator arrangement used for much of the 4X150A testing in our laboratory. This circuit is unusual in the way the arrangement differs from the run-of-the-mill tetrode VHF circuits. In the usual circuits, the screen is by-passed to a ground plate with the grid circuit on one side and the anode circuit on the other side. In single-tube coaxial circuits this arrangement becomes a bit awkward in that the tube is rather inaccessible. In the 4X150A circuit, the screen grid remains by-passed to the ground (cathode) plate with the coaxial grid circuit extended downward from it. Then the anode circuit is pulled down around the grid circuit. In so doing, the anode end of the tube is made easily accessible from the top of the anode cavity. This circuit operates in a thoroughly normal fashion, with no signs of instability even when working as a straight-through amplifier above 500 mc.

The portion of the STL transmitter described here has to do with the two stages, Fig. 2, which multiply the output of the modulator-exciter unit up to the final frequency. The first stage operates as a frequency tripler, the grid drive being supplied in the 156.66- to 158.66-mc. range by the output stage of the REL modulator-exciter at a level of 1.5 to 2.0 watts. The anode circuit is tuned to the third harmonic in the 470- to 476-mc. range. In this stage, both input and output circuits operate on the fundamental

* Laboratory Engineer, Eitel-McCullough, Inc., 200 San Mateo Avenue, San Bruno, Calif.

[1] "KSBR's 50-Kw. High-Band FM Transmitter," by R. L. Norton, Byron O. Ballou, and R. H. Chamberlin, *Electronics*, October 1947 "50 Kw. Output on 88 to 108 Mc." by Arthur Arrigoni, *FM* AND TELEVISION, February 1948.

or λ/4 mode. The second stage is a frequency doubler, with the grid circuit tuned in the 470- to 476-mc. range, and the anode circuit tuned in the 940- to 952-mc. band. In the doubler stage, both the input and output circuits are tuned to the 3λ/4 mode, hence this unit is physically larger than is the tripler stage.

Fig. 3 is a cross-section view of the doubler stage, illustrating the assembly of the socket and resonators. It will be seen that the grid line is a three-quarter wavelength section of coaxial transmission line, shorted on the lower end, and tuned to resonance by the input capacitance of the tube on the open end. There is a small trimmer capacitor located at approximately one-quarter wavelength from the shorted end. At the tube end of the inner conductor is a cylindrical blocking capacitor of approximately 150 mmf., using .005-in. Teflon tape as a dielectric. The inner electrode of this capacitor plugs into a ring which is soldered to the grid connection.

The grid connection is the center pin connector of the standard loktal socket. The control grid bias lead is brought down inside the inner conductor of the line and to the outside through a 500-mmf. ceramic button by-pass capacitor. The drive to the stage is through a standard N chassis connector, mounted on the outer conductor with a small loop attached to it. The socket assembly mounts on the end of the outer conductor of the grid line. This assembly consists of the socket, two ceramic button by-pass capacitors, the annular silvered-mica screen by-pass capacitor, and the screen-grid connector collet. This grid line and socket assembly is then mounted inside the inner conductor of the anode cavity, also a coaxial line three quarter-wavelengths long. The line length is such that with the tube output capacitance across the open end, a very small amount of variable capacitance at about the center of the inner conductor is quite adequate to tune over the required range.

The anode by-pass capacitor is made up of two silvered brass rings, annular in shape. One is soldered to the outer conductor of the anode cavity, and the other carries the connector spring for the anode connection. These rings, separated by clear mica .003 in. thick, provide a capacitance of approximately 1,500 mmf. on DC for the anode is connected to the outer disc by means of a spring connector mounted inside the bakelite protecting cover. In this way the anode potential is positively removed when the cover is lifted for changing tubes. The output coupling loop is mounted on the coaxial cable connector. This, in turn, is mounted on the shorting plug at the bottom of the anode cavity. The coupling is varied by means of a small variable capacitance in series with the ground side of the loop.

Cooling air for the anode is supplied through a rectangular opening at the anode end of the assembly, and is exhausted through the anode cooling fins. Fig. 2 shows the blower arrangement. Cool air passes over the seals of the tube, a feature most desirable from the standpoint of vacuum tube operation. A static air pressure of .25 in. of water is adequate for proper cooling of the tube anode. A small amount of air is introduced into the inner conductor of the grid line to maintain the base seals of the tube at a reasonably low operating temperature. This air exhausts through holes in the grid-line shorting plug. Static pressure should be .5 in. in this case.

The following specifications are presented for the use of development and design engineers:

The grid line of the tripler stage is tuned to resonance by means of a 15-mmf. midget variable air capacitor, mounted as far from the shorting plug in the line as is possible. All parts are silver plated to a depth of .001 in. to reduce circuit losses to a minimum.

Resonator Dimensions:	Doubler Stage	Tripler Stage
Grid line, inner 0.437 in. O.D.	11.25 ins. long	6.62 ins. long
Grid line, outer 1.312 in. I.D.		
Anode line, inner 1.75 in. O.D.	6.0 ins. to ground side of screen grid by-pass	2.813 ins. long
Anode line, outer 3.875 in. I.D.	7.063 ins. inside length	3.875 ins. long

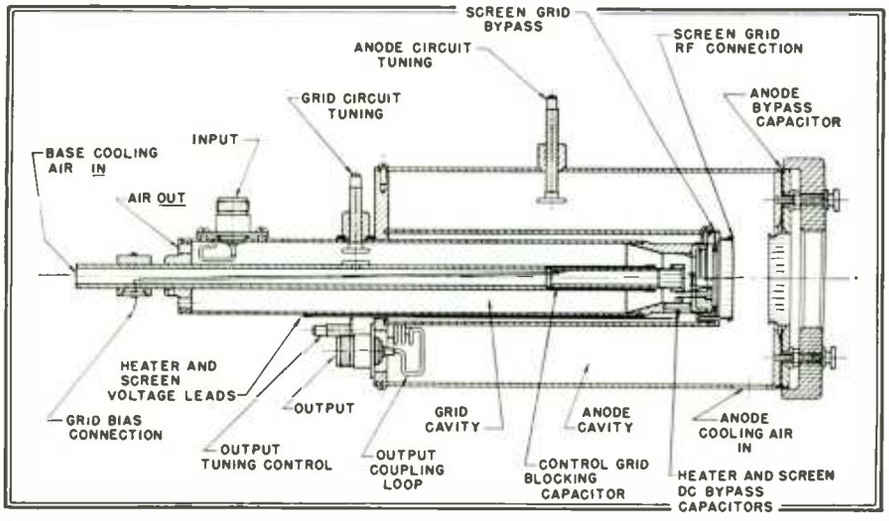


FIG. 3. *A cross-section view of the doubler stage, illustrating the assembly of the socket and resonators, and the two air inlets for cooling the base and anode*

Typical Operation	Tripler	Doubler
Anode	700 volts	700 volts
Anode	125 milliamps.	150 milliamps.
Screen	200 volts	200 volts
Screen	5 milliamps.	5 milliamps.
Grid	8 milliamps.[2]	8 milliamps.[2]
Useful output	15 watts	15 watts

[2] Through 15,000-ohm grid leak.

Transmitter Characteristics

Input Level: plus 10 dbm for 100% modulation (±100 kc.)
FM noise: better than 70 db below 100% modulation.
Distortion: less than 0.5% between 50 and 15,000 cycles at 100% modulation.
Deviation: ± 100 kc. for 100% modulation, 50 to 15,000 cycles.

FM PROFITS

(*Continued from page 27*)

"Since this is permissive regulation, no company would be under compulsion to submit sets for test, or to meet the approved standards. The only pressure would come from purchasers who registered preference for models bearing the official approval."

That was written long before the war. Now, Rural Radio Network has shown that it is both necessary and practical to bring this matter of receiver performance out into the light of day in order to protect purchasers of sets and the Network, too, against the damage that is being done by sub-standard receivers.

It comes down to this: The broadcasters must take aggressive steps to encourage the purchase of sets designed to give adequate sensitivity. RRN experience indicates that this figure should be close to 20 microvolts. Any promotion or implied approval of sets and tuners that only start to operate on 250 to 500 microvolts should be avoided. Names and model numbers of sets which deliver acceptable performance should be made known for the guidance of all concerned.

MORE ABOUT THE DAYLIGHT WAVE

A COMMUNICATION RECEIVED FROM MAJOR E. H. ARMSTRONG RECALLS THE EARLY WORK OF MARCONI AND FRANKLIN, AS DISCLOSED IN PUBLICATIONS OF THAT TIME

RYE BEACH, N. H.
August 28, 1948

To the Editor, *FM* AND TELEVISION:

In my letter published in your July issue, I made the statement that Dr. Jolliffe, on March 31, 1948, in his testimony before the House Committee on Interstate and Foreign Commerce, gave an account of some ancient radio history that cannot be considered in accordance with the facts.

In the August issue of *FM* AND TELEVISION, there appears a statement by Dr. Jolliffe which is accompanied by a letter to him from Dr. Beverage, concerning some work carried on by RCA Communications Company in collaboration with Marconi. This places Marconi in the rôle of a co-worker with RCA, the two cooperating to make the discovery of long-distance, short-wave daylight transmission together. This event is stated to have occurred during the Poldhu transmission tests of October 1924.

Let us now look at the record of radio history and find out if even this later position of Dr. Jolliffe is in accord with the facts.

The record of Marconi's astounding discovery is set forth in three publications that are readily accessible to anyone who wishes to examine them. They are: Marconi's paper presented before the Royal Society of Arts in December, 1924; the *Proceedings of the Institute of Radio Engineers* of January 1928; and Richard N. Vyvyan's book entitled "Wireless Over Thirty Years." These accounts establish that the discovery of long-distance short-wave daylight communication was made by Marconi during a cruise on his yacht *Elettra* in August and September of 1924, in the course of which he received daylight signals in the harbor of Beyruth, Syria, a distance of 2,100 miles from Poldhu.

The following quotations are taken from Marconi's paper published in the *Journal of the Royal Society of Arts*, December 26, 1924, pages 127 and 128:

"Commencing in August of this year (1924) a further series of investigations was carried out between Poldhu and the yacht *Elettra*, the object being to endeavor, if possible, to find means of overcoming the limitation of working hours brought about by daylight, and also to test whether the effect of the reflectors would give the expected increase of signal strength over long distances.

"The yacht proceeded to Spain, then to Madeira, and afterwards to Italy. From Naples we sailed for Beyruth in Syria, touching at Messina and Crete, and returning to Naples via Athens.

"At Madeira it was ascertained that a reflector at the transmitting station increased the strength of the received signals in accordance with our calculations, but that, notwithstanding this increase of strength, when using a 92-metre wave the daylight range was only very slightly augmented.

"At Maderia, and at other places, in the Atlantic and Mediterranean, comparative tests were carefully carried out with waves of 92, 60, 47 and 32 metres.

"These tests enabled us to discover that the daylight range of practical communication over long distances increased very rapidly as the wave length was reduced, the 32-metre wave being regularly received all day at Beyruth, whilst the 92-metre wave failed to reveal itself for many hours each day, even at Madeira, notwithstanding the fact that the distance between Poldhu and Madeira is 1,100 miles, entirely over sea, whilst that between Poldhu and Beyruth is 2,100 miles, practically all over mountainous land.

"Comparative tests on different wave lengths were carried out for a period of over two months in a variety of places, and all observations went to confirm the fact that for waves between 100 metres and 32 metres the daylight absorption decreased very rapidly with the shortening of wave length.

"These results were so interesting and satisfactory that I immediately decided to try further tests over much greater distances.

"In October of this year transmission experiments were carried out on a 32-metre wave from Poldhu to specially installed receivers at Montreal, New York, Rio, Buenos Ayres and Sydney (Australia).

"Although the available power utilized at Poldhu was only 12 kilowatts, it was at once found possible to transmit signals and messages to New York, Rio and Buenos Ayres when the whole of the great circle track separating these places from Poldhu was exposed to daylight.

"During a complete day transmission at fixed intervals, carried out last October with Sydney, New South Wales, that station received the Poldhu signals for 23½ hours out of the 24, and a 48-hour test, which was only completed yesterday, fully confirmed this result."

A similar account appears in a paper presented before the Institute of Radio Engineers when Marconi visited this country in 1927, published in the January 1928 *Proceedings*, pages 47 and 48.

So much for the first part of the second revolutionary discovery[1] made by Marconi during his lifetime which, as the record shows, has heretofore been accorded world-wide recognition.

With respect to the second part of the revolution, which was brought about by Franklin's application of highly directive antennas at both the transmitter and receiver, Vyvyan's "Wireless Over Thirty Years",[2] published in 1933, portrays very well the state of the art in long distance communications prior to the opening of the Britain-to-Canada beam circuit in October 1926. The following quotation is taken from page 92 of Vyvyan's book in the chapter entitled "History of Beam Development":

"Competitors of the Marconi Company abroad had naturally been watching the progress of the short wave developments with considerable interest, and in most cases with considerable scepticism. They realized the many unknown factors and difficulties that would have to be overcome, and doubt was expressed as to whether the radiation from a beam aerial would retain directive form when reflected from the Heaviside layer over great distances. The instantaneous success of the beam installations was entirely unexpected by them, and they suddenly realized that not only was there a highly efficient and profitable system of world-wide communication in operation, but its efficiency and effectiveness was so far in advance of long-wave communication systems that the whole technique of wireless long-distance communication must be changed. All foreign organizations had therefore to enter this new field of development, and two of the main competitors of the Marconi Company brought beam transmitters, receivers, and aerials, while their research workers devised modifications of the Franklin aerial system, although based in principle on the Franklin model. During the past five years since the first beam circuit was opened short-wave directional work has been rapidly developed in every country, and the very high speed and accuracy of communication effected on the beam circuits has profoundly changed the methods of world communication."

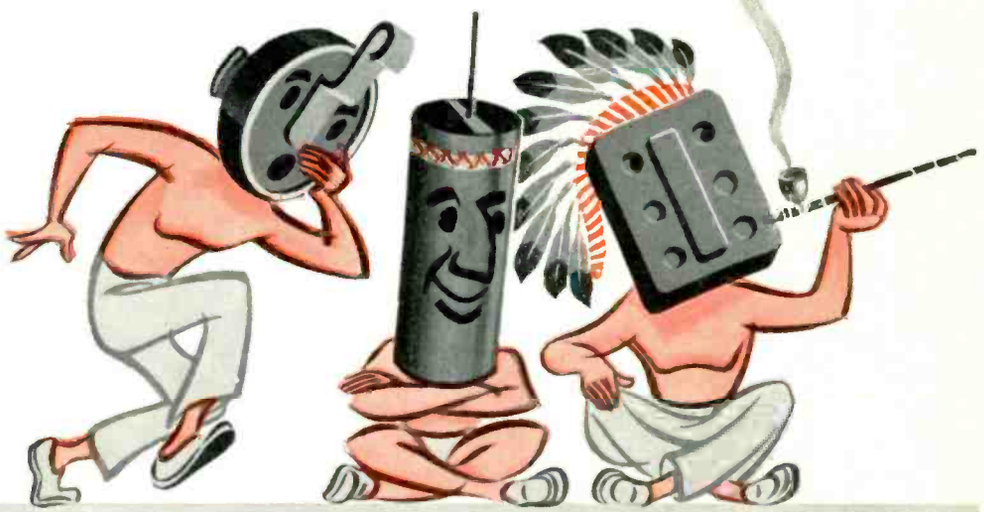
It will be quite evident from the above quotations from the record that Dr. Jolliffe's testimony before the Congressional committees, attributing to RCA

(*Continued on page 65*)

[1] EDITOR'S NOTE: The first great discovery by Marconi was the "grounded wave", made at the turn of the century.

[2] The author of this work was in charge of the engineering arrangements of the Marconi-Franklin Beam Stations.

a new family joins the sangamo tribe...



New Dependability, New Long-Life Performance

Meet Sangamo Electrolytics, the newest family to become linked with the Sangamo Tribe. Introducing, from left to right on the opposite page, are illustrations of the "Chieftain", "Tomahawk", "Warrior", "Apache", and "Mohican". These newcomers now join the established tribe of Sangamo Micas, Silver Buttons, Papers, and Plastic Tubulars. Their heritage of dependability and long-life performance stems from being built in a factory which was constructed *especially* and *exclusively* for the manufacture of contamination-free electrolytics. Their performance will meet and exceed the most stringent requirements of electronic applications. Yet, these new, high-quality capacitors are competitive in every respect from a standpoint of design, construction, and price.

Your own trial-use will convince you that new standards of dependability and longevity have been built into Sangamo Electrolytics. Order from the new Sangamo Electrolytic Capacitor Catalog No. 825F, which is *yours for the asking*, and without obligation.

FCC ANSWERS TV COMPLAINTS

IN THIS OFFICIAL STATEMENT, THE FCC ASSUMES THE NORMAL RANGE OF METROPOLITAN TV STATIONS TO BE 40 MILES, AND COMMUNITY TV STATIONS 20 MILES

THE Federal Communications Commission is receiving many complaints and inquiries at its Washington headquarters and its field offices relative to television reception limits, sources of interference, and methods of improving reception. Because of the public interest in this subject, the following is furnished for general information:

The Commission wishes to emphasize that it does not have sufficient personnel to investigate individual complaints of interference or otherwise faulty reception, and also that it has not adopted standards for nor does it approve makes or types of television receivers.

Allocation Plan:

The Commission assigns television stations to cities and metropolitan areas under a nation-wide plan which is designed to provide an equitable distribution of television service throughout the Country. Because of the scarcity of frequencies available for television use, it has not been possible to provide a television station for every city. Under the allocation plan, however, most of the larger cities and metropolitan areas are assigned from one to seven television stations.

The Commission's allocation plan is designed so that a television station located in a certain city will furnish a signal sufficiently strong to permit television receivers in or near the city to receive satisfactory service. Under the plan, therefore, television stations are spaced geographically so that they will not interfere with each other within their respective service areas, and they are assigned sufficient power so that their signals will be strong enough to overcome unwanted noise caused by electrical disturbances in the area. Since television reception requires a relatively strong signal, this means that the desired signal must be about 100 times as strong as any other signal.

Reception Limits:

Many of the complaints received by the Commission arise from attempts to receive television stations far beyond their normal range. Due to the nature of the frequencies used, television reception is possible only if the receiver is located within a relatively short radius of the transmitting station. At the present time, the maximum range of television reception varies from 20 miles to 40 miles, depending on the type of station involved and the amount of power it is presently using. In general, a television station located in a large city (a metropolitan station) using full power can be received up to 40 miles from its transmitter. However, if the metropolitan station is using less than full power, its range may not be more than 20 miles from its transmitter. Many metropolitan stations at the present time are using temporary, low-power facilities pending receipt of new equipment which will permit them to use the full power assigned to them. Likewise, a television station located in a smaller city (a community station) which is assigned relatively low power, cannot be received more than 20 miles from its transmitter. Though long-distance television reception is reported on occasion, this is a freak condition and cannot be depended upon for regular service.

Other Reception Problems:

If you live within the normal service range (20 to 40 miles maximum) of a television station, it should be possible for you to receive satisfactory, interference-free television pictures. However, even within this range, good service can be expected only with a properly-functioning television receiver, an adequate receiving antenna, and a satisfactory transmission line connecting your antenna and receiver. The reason for this is that television requires a relatively stronger signal for good reception than does AM or FM radio, and your receiver, transmission line, and receiving antenna are important factors in making sure that a strong signal is picked up out of the air, and that unwanted signals are rejected by the receiver.

Interference Problems:

Television receivers may be subject to interference from 1) television stations other than the desired stations, 2) other radio stations, 3) from electrical disturbances caused by medical diathermy machines, industrial heating appliances, etc., 4) other television receivers in the vicinity, and 5) ignition systems of motor vehicles. The last is a particularly common source of interference.

Properly qualified technicians can ordinarily reduce or eliminate objectionable interference. If the interference is caused by a station or device operating on a different frequency from that of the desired television station, the undesired signal frequency can be tuned out by a device attached to the television receiver. This can be done by applying a trap-circuit to the receiver antenna terminals. Trap circuits are tuned transmission lines cut for the frequency of the undesired signal. In case of interference from international short-wave broadcast stations and point-to-point telegraph stations, it is more practical to construct a coil-condenser trap-circuit to reject the undesired signals.

If the interference is caused by a station or device operating on the same frequency as your receiver, the interference cannot be easily avoided. However, the use of a directional receiving antenna may be of some benefit.

Interference from other television receivers in the vicinity of your receiver also may distort the picture or sound you receive. This usually occurs in apartment houses where two or more receivers are in close proximity. It may occur when your neighbor's receiver is tuned to one of the lower television channels (such as channel 2 or 3) and your receiver is tuned to one of the higher channels (such as channel 5 or 6). This type of interference is due to deficiencies in receiver design.

Certain kinds of interference cannot be eliminated. In particular, if you live outside the maximum service range of two television stations operating on the same frequency, and at a point where signals of equal strength are received from both stations, your receiver will receive either a distorted picture or garbled sound or both. This type of interference cannot be eliminated, since it is due to the fact that you are outside the service area of the stations involved. However, the Commission in assigning television stations makes every effort possible to avoid interference of this kind.

Any good television servicing agency should be in a position to determine sources of television reception trouble, provide devices or adjustments to improve reception, and to explain their operation.

Discussion:

In the FCC statement above, very conservative coverage figures are used. Actual experience shows that, with high-gain antennas, reception up to 100 miles is being achieved commonly. This brings up the question: Has TV been limited by industry thinking which consistently tends to soft-pedal the importance of good antennas? Perhaps we need high-gain antennas of very rugged design which, although expensive, would be permanent investments, such as plumbing, and kitchen stoves and refrigerators. Instead of featuring the low cost of antennas that are of dubious electrical and mechanical design, it might be better to put the emphasis on really high-gain types built to last for a lifetime. This deserves consideration.

WHAT IS YOUR OPINION?

HERE IS AN INTERESTING LETTER FROM CONSULTANT MURRAY G. CROSBY ON WHICH, WE EXPECT, MANY OF OUR READERS WILL WANT TO EXPRESS THEIR OWN OPINIONS

ONE of the most interesting letters we have received in a long time, and the most provocative of discussion, was written by Murray Crosby, of Crosby Laboratories. Mr. Crosby is an engineer of long experience in FM, as you probably know. As research engineer for RCA Laboratories from 1925 to 1944, much of his work was devoted to FM development. In 1945 he joined the firm of Paul Godley Co., and later resigned to set up a consulting practice of his own. He was one of the consultants who worked on the plan for Rural Radio Network's FM system.

In short, when Murray Crosby discusses FM, it is evident that he speaks with first-hand knowledge of the subject. As an engineer, he knows what he is talking about.

When we read his letter, it seemed to us that he had stepped out of his accustomed place in the laboratory to tell the sales department some things they ought to know. That's what every set manufacturer's chief engineer would like to do but doesn't, partly because chief engineers aren't supposed to do such things, and also because front office management in general and sales managers in particular feel that their judgment should prevail in arriving at the proper balance between what the public should have and what it is going to get, with due consideration, of course, for competitive conditions. That puts the engineers in the position of taking instructions.

Murray Crosby's letter covers a number of angles which concern not only manufacturers but dealers and broadcasters as well. We might point them out, but that would lead to a discussion of the whole letter. However, this letter covers problems on which our readers have their own opinions because they are struggling with them themselves, under conditions that vary widely in different parts of the country. Mr. Crosby, as a resident of New York, may look upon industry problems as they appear over the horizon of Manhattan. So, rather than comment on it ourselves, we want to publish the views of our readers. Here is the letter:

CROSBY LABORATORIES
MINEOLA, N. Y.

To the Editor, *FM* AND TELEVISION,

I have read your magazine since it started, but it seems that our paths have not crossed sufficiently to afford us the opportunity for a chat. Accordingly, I would like to pass on some of my ideas, as of the present minute, regarding FM and television.

As I see it, television and FM are the "new look" of radio. Several interesting angles have appeared in the past year which, I believe, the engineers have not anticipated. One of these is that television appears to be aimed towards dominance in the broadcasting field. I feel that this outcome was brought about by lay, and not technical reasons. For instance, if you propose to your wife, "Let's buy an FM set," her answer is quite likely to be: "We have a radio." From here on, the selling campaign is somewhat difficult. The niceties of frequency modulation reception have to be sold against such arguments as, "We get Charlie McCarthy okay. What programs will we get with frequency modulation that we do not get on our present radio." On the other hand, if you asked, "Let's buy a television receiver," present indications are that very little sales resistance will be encountered if she has observed television at all. Brought to simple considerations, she is more inclined to take something new than an improvement in something she already has. In other words, she would rather buy an electric icebox which she does not have, than a new vacuum cleaner which is merely an improvement over her old one.

It appears to me that we engineers should try to be guided more by such simple considerations. We can cook up a dish to be served to the public, but we must be sure that the public is hungry for that dish to insure its success. In other words, we should view our engineering proposals through the eyes of the layman when he asks the question: "What do I get that I do not already have?"

As I see it, there is no serious obstacle in the promotion of frequency modulation. The "new look" was sold to the women obviously against their wishes. If such a trick could be performed, the promotion of frequency modulation should be easy.

After observing television for some time, and observing the listening and viewing habits of those who own television receivers, I am forced to the conclusion that television is eventually going to dominate the broadcasting industry and place aural broadcasting on an entirely different basis than heretofore. As I see it, television is likely to take most of the listeners who listen on a basis of undivided attention, as distinguished from listeners on a background basis. This will dilute the aural audience, but will still leave a definite place for aural broadcasting after the readjustment period.

Rather than harbor the thought that television will hold back the progress of frequency modulation, I feel that the opposite might be the case. The television receiver employs a frequency-modulation sound system. This will accustom the listeners to the improved reception obtainable by frequency modulation and make them dissatisfied with their old AM radio. By their television experience, they will also become conscious of the techniques of higher-frequency reception as used in FM.

Furthermore, since with television the listener can see the instruments he is supposed to hear, he is going to demand higher standards of sound reception.

I feel that the outstanding weaknesses of the FM promotional situation are:

1. The relatively high cost of FM receivers
2. The difficulty of tuning an FM receiver
3. The requirement of an outside antenna for satisfactory reception

As you know, the lowest-priced frequency modulation adaptors cost about $30.00. This is a difficult situation for the layman to accept when he knows he can buy a relatively good complete AM receiver for that price. However, as time goes on, we may see improvements in this respect.

What appears to be an overlooked feature is the difficulty of tuning the present FM receivers. Those using ratio detectors have a single tuning point, but reception of real good quality requires some sort of tuning indicating device. The limiter type receivers have three tuning points which bring about a complexity beyond the comprehension of the ordinary layman. On the other hand, the available tuning indicators which have appeared have complexities in themselves which are somewhat discouraging. This feature needs considerable additional investigation.

Many manufacturers are at present conveying the impression that the FM receiver does not require an outside antenna. Line cord and other built-in antennas are being promoted as though they have the same relative efficiency as the loop antenna when used on a standard-band AM radio. Measurements have indicated that an average loss of 500 to 1 in power may result by using a line cord antenna instead of a properly mounted outdoor antenna. This is certainly placing a handicap for frequency modulation to overcome.

Sincerely yours,
MURRAY G. CROSBY

Now that you have read Mr. Crosby's views, won't you write a letter to the Editor, expressing your opinions.

"SOUND SECTION" — A NEW EDITORIAL FEATURE

HERE'S news that will be welcomed by our many readers who have been asking for a special, separate section on sound and sound equipment:

Now that plans and preparations have been completed, we can announce that, following the special Sound Engineering Number in October, we shall start a new "Sound Section" in November. That issue, by the way, will start the ninth year of publication for *FM* AND TELEVISION.

There are, of course, very few men who specialize in sound to the exclusion of all other subjects. Those concerned with the development and manufacture of sound equipment and circuit components work on applications to recording and transmission, or reception and reproduction.

Similarly, those who work on transmitters and receivers must depend upon sound equipment and circuit components for input or output operation

Over the years, *FM* AND TELEVISION has built its readership among these groups. Their common interest lies in the fact that there could be no FM broadcasting and communications or television without sound equipment!

We have published a great number of the most interesting articles written on new audio developments. Readers who complained that we neglected this aspect of their work have been surprised when we sent them lists of articles which have appeared in *FM* AND TELEVISION.

Maybe, these readers say, they skipped over them because they were in among articles on other subjects, instead of being in a separate section of their own.

So we shall not only do what they have asked. We'll go a step further and, after our special audio facilities issue in October, we shall follow up with a regular Sound Section that will present the most interesting and useful material on this subject available from any source.

To give you an idea of what's ahead, here is a partial list of articles on hand and being prepared for publication now:

- Further Developments on the Klipsch Speaker, by Paul W. Klipsch
- Audio Facilities for FM-AM Stations, by John A. Green
- Custom-Built Radio Phonograph Design, by L. B. Keim
- High-Quality Sound on 16-Mm. Film, by the chief engineer, J. A. Maurer, Inc.
- Are Radio-Phonographs Designed Backward? by H. S. Morris
- Microphone Techniques for High-Fidelity Broadcasting, by Harold E. Ennes

The Sound Section will also include a review of new features released by the transcription companies for the use of broadcast stations.

When you have seen the October and November issues, won't you tell us frankly what you think of this new editorial feature? We'll welcome an expression of your opinion.

5: RECEIVER & ANTENNA

(*Continued from page 43*)

graphical distribution of FM stations is such that only a part of those within the normal range of a good receiver can be picked up on a single dipole.

Further improvement is achieved by the 2-bay turnstile. First, there is the obvious gain in signal pickup. Second, and in some areas of greater advantage, is the fact that the field around the antenna is flattened out laterally as is the case with a transmitting antenna. Thus the response to interference sources on the ground near the antenna is reduced substantially. The net result is that the signal-to-noise ratio is improved both by an increase in signal strength and a drop in the noise level.

Fig. 6 shows the 2-bay assembly and the arrangement of the three phasing links. This antenna is supplied in two parts. The single turnstile is finished with a 5-ft. aluminum mast, lead-in, mounting hardware, and lightning arrestors. The second turnstile and 5 ft. mast extension are furnished separately, as an addition to the first.

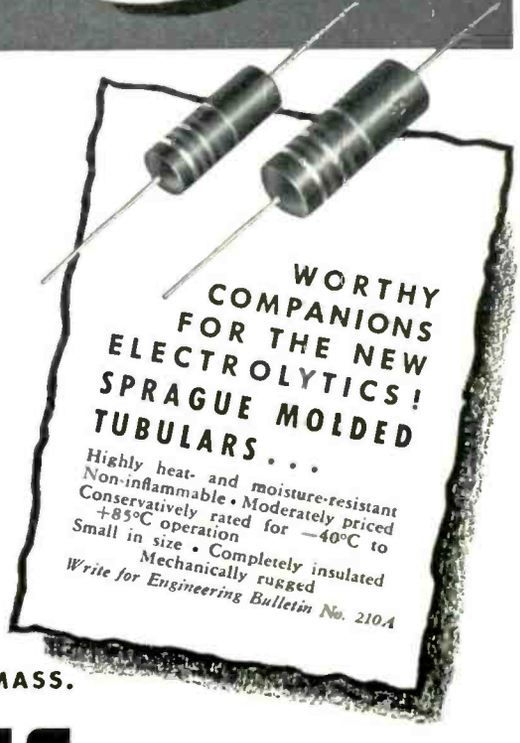
Announcing A NEW LINE OF SPRAGUE ELECTROLYTIC CAPACITORS

Designed for Television Use

(for operation up to 450 volts at 85° C.)

With some 7 times as many components in a television receiver as in the average radio, the possibility of service calls is greatly increased. The new SPRAGUE ELECTROLYTIC line offers the first practical solution to this problem.

Designed for dependable operation up to 450 volts at 85° C. these new units are ideally suited for television's severest electrolytic assignments. Every care has been taken to make these new capacitors the finest electrolytics available today. Stable operation is assured even after extended shelf life, because of a new processing technique developed by Sprague research and development engineers, and involving new and substantially increased manufacturing facilities. More than ever before your judgment is confirmed when you *SPECIFY SPRAGUE ELECTROLYTICS FOR TELEVISION AND ALL OTHER EXACTING ELECTROLYTIC APPLICATIONS!* Sprague Electric Company invites your inquiry concerning these new units.



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SPRAGUE MOLDED TUBULARS . . .

Highly heat- and moisture-resistant
Non-inflammable • Moderately priced
Conservatively rated for —40°C to +85°C operation
Small in size • Completely insulated
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8-BAY PYLON

(*Continued from page 48*)

High-Power Coverage:

Fig. 8 illustrates the close-in coverage of the eight-section Pylon. The signal strength is about 40 db above the 1000-microvolt-per-meter value accepted for good urban coverage, thus indicating the future possibility of still higher FM antenna gains to take the power wasted by unnecessarily strong close-in signals and extend the limiting servicing contour. Fig. 9 shows the calculated 1000-microvolt and 20-microvolt service contours for a typical 50-kw. FM transmitter and eight-section Pylon installation. It is well to remember that the extended service contours illustrated in Fig. 9 are always primary service areas, and are not disturbed by skywave interference and fading so commonplace in low-frequency broadcasting.

This type of antenna and a 50-kw. transmitter will enable FM broadcasters to cover primary service areas up to nearly 200 miles in radius, when mountain elevations are used.

Preliminary field strength measurements at WKJG, Fort Wayne, Indiana, indicate that the radius to the 50-microvolt per meter contour extends 9 to 25% beyond the predicted radius.

Dual-Frequency Operation:

The 100-kw. input rating permits operation of two transmitters with a total of 100 kw. connected to one 8-section Pylon. One common transmission line connects the antenna to short branch lines which run from the transmitters. In general, antennas, transmission lines, and towers, together with their installation, represent a large part of the total equipment costs for an FM station. When two FM stations operate on one 8-section Pylon, there is no sacrifice in performance compared to operation with two separate antennas of this type, and a marked economy can be effected.

Dual-frequency operation utilizes a filter especially designed for the station requirements. It is employed in the output line of each transmitter to prevent cross modulation of the two output frequencies involved. Otherwise, unlicensed, spurious radiation might result.

Acknowledgment:

The antenna described is the result of contributions by many people. Credit is especially due H. E. King, H. H. Westcott, and D. W. Balmer of the RCA FM antenna engineering group.

3: PROMOTION

(*Continued from page 33*)

of promotion are being followed to acquaint potential listeners with the services provided by the Network. This effort is consistent, continuous, and complete in coverage, maintaining interest by the variety of methods employed. Already, we can see that our methods are producing most gratifying results.

The development of an audience must, of course, precede the sale of broadcast time. However, work at both levels has been carried on simultaneously, and with equal thoroughness. In scheduling RRN broadcasting to start in June, account was taken of the timing of annual budgets. Now, while we are developing our audience, we are at work on 1949 time sales.

Following are the rates for the six basic RRN stations:

	A Time	B Time
1 hr.	$240.	$180.
¾ hr.	204.	153.
½ hr.	144.	108.
¼ hr.	96.	72.
10 min.	76.	57.
5 min.	48.	36.
1 min.*		25.
30 sec.*		15.

* During 9:00–10:00 A.M. and 3:30 to 4:00 P.M. on a participating basis only.

Frequency discounts are: 26 times 5%; 52 times 7½%; 104 times 10%; 312 times 20%.

As a rate adjustment for what we call charter advertisers — those buying time during the initial phase of RRN operation — a special scale of graduate discounts, in addition to the usual time and frequency discounts, was established for:

June, July, August 1948	75%
September '48 through February '49	50%
March, April, May 1949	25%

Solid, day-and-night coverage of large rural areas is, in many respects, more productive to sponsors than metropolitan circulation. City-dwellers spend only wages. A farmer spends several times his net taxable income. He must buy feed, seed, machinery, and all the items that enter into the operation and maintenance of his farm. Today, using several kinds of engine-driven equipment, plus an automobile and a truck, his consumption of gas and oil is many times greater than that of city people.

With bigger families — 39% more babies — they use more cereals, soap, flour, and household supplies. Because they work harder, they eat more, and get their clothes dirtier! And it is important to note that they buy more branded staple goods than city dwellers.

There are 117,175 farms in the 42 counties covered by the six basic RRN stations. These counties, with 4,062,000 population, produced food products to the value of $411,534,000 in 1945, when the last agricultural census was taken.

From these high-spot notes, it is clear that network operation with station sites

(*Concluded on page 64*)

NOW OVER 10,000 COPIES

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FM AND TELEVISION

* * Edited by Milton B. Sleeper * *

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Effective October 1, 1948

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Less than six pages.....$240 per page
Six to eleven pages.....$220 per page
Twelve to twenty-three pages..$200 per page
Twenty-four or more.....$190 per page

FRACTIONAL PAGES: rates are based on number of insertions used within one year

	⅔	½	⅓	¼	⅙
1 to 5 times	$168	$126	$90	$70	$50
6 to 11 times	154	115	88	66	46
12 times....	147	110	80	60	40

DIRECTORY CARDS: $12 per insertion. Only orders for 12 insertions are accepted. Copy must be within standard border 2¼ x 1½ ins. high.

CLASSIFIED ADVERTISING: 20¢ per word, with a minimum 10 words, or $10 an inch within ruled borders.

COVERS: inside front or back covers add 40% to earned rates; back cover, add 60%. No additional charge for one color with black.

CENTER SPREAD: regular rates for black and white. Add $70 per page for one color.

COLORS: in run-of-book advertising, red is $50 extra per page. Other colors are $65 extra per page.

BLEED BORDERS: $20 extra per page.

AGENCY COMMISSION: display advertising: 15% commission on invoices paid within 30 days. Directory cards: no commission. Terms are 2% 10 days, 30 days net.

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MECHANICAL REQUIREMENTS

	Width	Depth
1 page	7 ins.	10 ins.
⅔ page	4⅝	10
½ page	7	4⅞
or	4⅝	7⅜
or	3⅜	10
⅓ page	4⅝	4⅞
or	2¼	10
¼ page	3⅜	4⅞
⅙ page	2¼	4⅞

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*Add ⅛ in. top, bottom, and side for plate size.

Gutter width, ¾ ins.

Plates for "Broadcasting Magazine", 8½ x 11 ins., will be accepted without extra charge.

HALFTONES: halftone screen of 110 or 120 is recommended for best results.

PLATES left in our possession will be destroyed after 90 days. Changes and repairs on plates will be charged at cost.

CLOSING DATE: 5th of month preceding date of issue. For example, forms for November will close on October 5th. November issue will be mailed November 10th.

CONTRACTS: rates are guaranteed for only six months from date of contract. Cancellation cannot be accepted after closing date of issue for which advertising is scheduled.

FM HANDBOOK

Advertising rates in the FM Handbook are the same as those earned in FM and TELEVISION. Plate and trim sizes are identical with those of the Magazine.

MISCELLANEOUS

Established 1940.
Subscription: $3.00 per year; single copies 25¢.
Advertising Manager, Richard H. Lee.
Editor and Publisher, Milton B. Sleeper.
Editorial and circulation departments:
Great Barrington, Mass. Tel: Great Barrington 500.

FOR EIGHT YEARS, THE COMPLETE AND AUTHORITATIVE SOURCE OF INFORMATION ON FM AND TELEVISION

How the Rural Radio Network got rid of a problem that plagues every radio station

One of the biggest worries in a radio studio is a proper sound absorption curve. The Rural Radio Network whipped this problem right at the start by building all six of their FM studios with sound conditioning by Acousti-Celotex*—the world's most widely used acoustical material.

Acousti-Celotex assures high-fidelity broadcasting. It eliminates unwanted reverberations . . . provides uniform sound distribution throughout the studio.

If you have a sound problem, your nearest distributor of Acousti-Celotex products will gladly give you the benefit of the accumulated experience of more than a quarter century in sound conditioning.

Write us today for the name of your nearest distributor in the U. S. or Canada. *Sound conditioning is a sound investment.*

*REG. U. S. PAT. OFF.

THE CELOTEX CORPORATION
CHICAGO 3, ILLINOIS

ACOUSTI·CELOTEX
Sound Conditioning

PRODUCTS FOR EVERY SOUND CONDITIONING PROBLEM

Improve the picture

* **with**

AMPHENOL

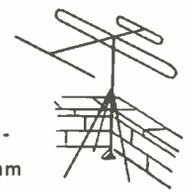
TV ANTENNA

and genuine

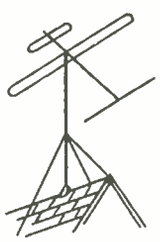
TWIN LEAD TRANSMISSION LINE

All Channels

HIGH AND LOW BAND



Amphenol's TV Antenna needs no tuning adjustments. It's of full folded dipole construction with ½ inch tubing. It has high uniform gain, broad response curve and excellent impedance match to standard 300 ohm transmission line. It has a definite single direction radiation pattern thruout the entire TV spectrum with high front-to-back and front-to-side ratios that assist in reduction of multiple images. All points are at d-c ground potential. It's packaged complete with hardware, easy and fast to assemble and built to withstand high winds, snow and ice. It's rugged, dependable and efficient. It delivers the picture.



Engineered Electrically and Mechanically in the Amphenol Antenna Development Laboratories.

AMPHENOL

AMERICAN PHENOLIC CORPORATION
1830 South 54th Avenue, Chicago 50, Illinois

COAXIAL CABLE AND CONNECTORS, INDUSTRIAL CONNECTORS, FITTINGS AND CONDUIT, ANTENNAS, RADIO COMPONENTS, PLASTICS FOR ELECTRONICS

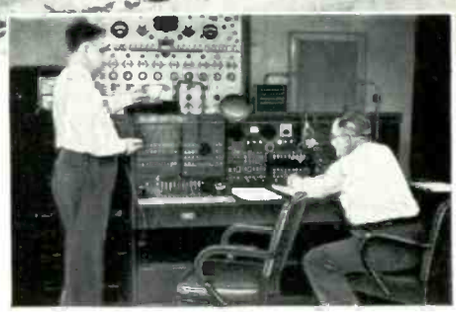
Columbus equipment reaches fires faster sped by 2-way *Motorola* Radio and Sylvania Lock-In Tubes

Those first few minutes are *vital* in fighting a fire!

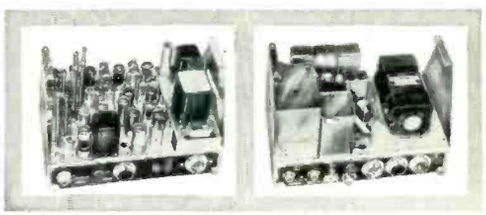
That's why the Columbus (Ohio) Fire Department counts on Motorola 2-way FM to maintain constant touch between the dispatcher's office and 24 radio-equipped vehicles. Equipment returning to the firehouse can be instantly diverted en route—dispatched to the scene of a new alarm.

And where fires are potentially big enough to call for *additional* equipment to bring them under control, a radio message from the scene to the dispatcher's office has the extra vehicles under way within seconds!

For requirements like this, Motorola counts on Sylvania Lock-In Tubes to help maintain uninterrupted, efficient performance of its mobile units. These tubes stay firmly in place through jolting and jarring. They have few welded joints, no soldered ones. No warping or weaving of elements. Low loss, low leakage. See Sylvania Distributors, or write Radio Tube Division, Emporium, Pa.



Dispatcher's office is in constant communication with vehicles at all times, directing them to the scene, checking on progress in bringing fire under control.



Mobile FM transmitting and receiving units built by Motorola, Inc., Chicago, and used in 24 vehicles of the Columbus Fire Department.

Superior mechanical and electrical features of Sylvania Electric's famous Lock-In Tube make it ideal for equipment on the road, in the air, on the rails—for marine radar, FM and television.

SYLVANIA ELECTRIC

RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS

3: PROMOTION

(*Continued from page 60*)

chosen on the basis of geography and topography, and employing FM transmission, bid fair to revise the original concept of radio service to listeners and sponsors as well.

2: ORGANIZATION

(*Continued from page 30*)

major programs . . . is the improvement and clarification of egg-grading standards."

The New York State Vegetable Growers Association is principally devoted to educating its members in improved methods of growing and marketing vegetable crops.

The Cooperative G.L.F. Exchange (Grange League Federation) is a farmers' purchasing and marketing cooperative.

The New York State Horticultural Society devotes most of its work to the technical aspects of fruit growing, development of new varieties, control of diseases, harvesting and packing methods, and marketing practices.

The object of the New York Artificial Breeders' Cooperative is to improve the productivity of dairy herds in the state through better breeding. The association produces semen from quality dairy bulls for shipment to local artificial breeding cooperatives in many parts of the state.

The Dairymen's League Cooperative Association markets the milk of its more than 25,000 members who live in the New York Milkshed.

And finally there is the Empire Livestock Marketing Cooperative Association which operates five livestock auctions throughout the state.

So we see that the interests of the farmers and rural dwellers are many and varied, and probably more diversified than those of the urban radio audiences. Here, then, is the fundamental reason for the creation of the Rural Radio Network, *i.e.* to meet the needs of listeners who require a specialized type of radio service. And it is clear that a radio network, operated by these representative organizations, is in an ideal position to accomplish this purpose.

Initial Investment:

Overall cost figures of the network installation indicate the magnitude of this project. The investment in land and equipment for the six stations totaled $500,000. Of this, the cost of the Ithaca headquarters studios, control equipment, and offices amounted to about $80,000, while each of the six transmitters represent an average investment of $70,000.

Equipment at each transmitter accounted for some $20,000. The balance of $50,000 was spent for roads, water supply, power lines, building construction, and the land. The latter was the smallest

(*Concluded on page 65*)

2: ORGANIZATION

(*Continued from page 64*)

item, since land values are low on rural hilltops.

One important economy that kept down the initial investment and operating expense was the use of radio transmission for feeding programs from the Ithaca studio to the Newfield transmitter, for inter-station program distribution, and for communications purposes. In the whole setup, no wire lines are employed. This will be explained in the subsequent section on RRN facilities.

Finally, there are AM stations at 45 cities in New York State. Still, it is doubtful that, if stations at each of these cities were connected by land wires into a single network, they would give high-quality day-and-night program distribution equal to that provided at much lower cost by the six basic RRN stations and the two affiliates.

1: INTRODUCTION

(*Continued from page 28*)

vided for all parts of the American radio audience. FM, intelligently used, without disturbing the existing and highly competitive pattern of commercial broadcasting, can provide our people with an almost unlimited variety of entertainment, and of cultural, technical, and informational services, designed to meet listener needs which are now unsatisfied.

S-W DAYLIGHT EFFECTS

(*Continued from page 52*)

the credit for the revolution in transoceanic communication, was not in accord with the facts.

Neither is it correct for him to take the position in his communications published in your August issue that Marconi was sort of a co-worker with RCA in the discovery of the "daylight wave".

The references quoted place the fact beyond question that this discovery was made by Marconi and Matthien during the *Elettra's* cruise in the Atlantic and Mediterranean in August and September, 1924, culminating at Beyruth, when the 32-meter wave of Poldhu was received throughout the daylight hours at Beyruth, Syria over a distance of 2,100 miles. The October 1924 tests referred to by Dr. Beverage was the obvious next step for Marconi to take.

No doubt, as Dr. Beverage states, Marconi was surprised to find the Poldhu signals received during daylight at New York, Rio de Janeiro, Buenos Aires, and, most of all, at the report from Sydney, Australia, where the signals were read 23½ hours out of the 24. Who wouldn't be?

I have never found, however, that my subsequent surprise at the effectiveness

(*Concluded on page 66*)

S-W DAYLIGHT EFFECTS

(*Continued from page 65*)

of such discoveries as I have had the good fortune to make had any bearing on the fact of the discovery itself.

In my reply to the comment in Dr. Beverage's letter to Dr. Jolliffe that I might have arrived at a somewhat different conclusion about this situation had I been acquainted with all of the background, I would like to point out that, with a single exception, all the facts referred to by Dr. Beverage in his letter have been published in the technical journals of the art for over twenty years, and that I have, of course, been familiar with them. The single exception is the quotation from the unpublished report referred to by Dr. Beverage on the Belfast-to-Chatham and Belfast-to-Riverhead tests at distances of 200 and 310 miles, respectively. Whatever ultimate significance the quoted paragraph might have had, it was, as Dr. Beverage says, too late to have any bearing on Marconi's discovery.

In further reference to Dr. Beverage's letter, let me say that I have never questioned the excellence with which the RCA Communications Company has carried on its engineering operations. Its engineering has always been of a very high order. However, as I stated in my original communication, the fact that RCA Communications subsequently developed and brought into use apparatus embodying the Marconi discovery and the Franklin principles, giving superior performance to the original British equipment, does not support the claim for credit for the revolution which was brought about by Marconi and Franklin.

For the sake of the record there are listed below Marconi's[3] and C. S. Franklin's[4] papers that bear on this subject. A careful reading of these papers, which describe the work of Marconi and of those men who assisted him, is well worth while, for they tell the story of a classic piece of research carried through by men with relatively limited resources to an astoundingly successful conclusion. Readers of these papers will find Marconi and Franklin experimenting with directive beams in the range of 2 to 15 meters before the Radio Corporation was in existence, one of the experiments culminating in the setting up by Franklin, in 1921, of a 97-mile, 15-meter telephone circuit operating with reflectors at both ends.

[3] "Radio Telegraphy," *Proceedings IRE*, August 1922.
"Short-Wave Directional Wireless Telegraphy, More Generally Referred to As the Beam System," *Journal of the Royal Society of Arts*, July 25, 1924.
"Radio Communications," *Journal of the Royal Society of Arts*, December 26, 1926.
"Radio Communications," James Forrest Lecture, *Institution of Civil Engineers*, October 26, 1926.
"Radio Communication," *Proceedings IRE*, January 1928.

[4] "Short-Wave Directional Wireless Telegraphy," *Institution of Electrical Engineers*, May 3, 1922.

ADVERTISERS INDEX

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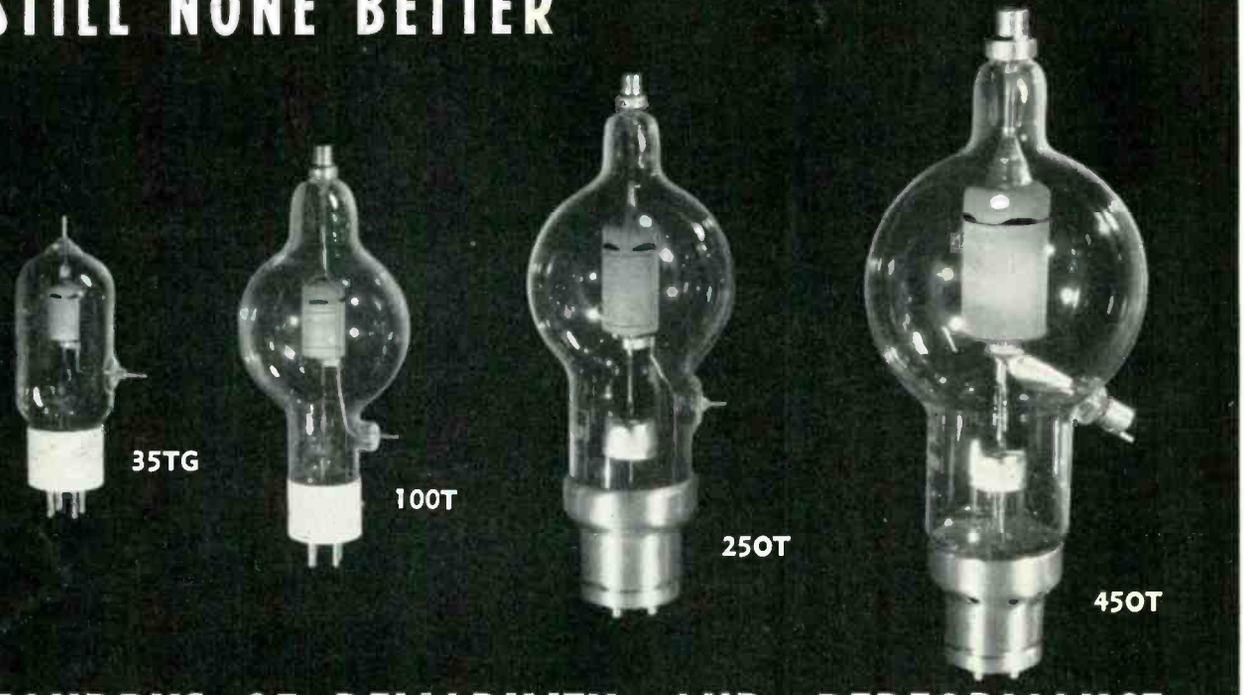

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Tube Data

ELECTRICAL CHARACTERISTICS	35TG	100TH	250TH	450TH
Filament: Thoriated Tungsten				
Voltage	5.0 volts	5.0 volts	5.0 volts	7.5 volts
Current	4.0 amperes	6.3 amperes	10.5 amperes	12.0 amperes
Amplification Factor (Average)	39	40	37	38
MAXIMUM RATINGS				
Plate Dissipation	50 watts	100 watts	250 watts	450 watts
D-C Plate Voltage	2000 volts	3000 volts	4000 volts	6000 volts
D-C Plate Current	150 ma.	225 ma.	350 ma.	600 ma.
Grid Dissipation	15 watts	20 watts	40 watts	80 watts
RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR				
Class-C Telegraphy (Key down conditions)				
Typical Operation—1 Tube				
D-C Plate Voltage	1500 volts	2000 volts	3000 volts	4000 volts
D-C Plate Current	125 ma.	165 ma.	333 ma.	450 ma.
D-C Grid Current	40 ma.	39 ma.	90 ma.	85 ma.
D-C Grid Voltage	—120 volts	—80 volts	—150 volts	—200 volts
Plate Power Output	141 watts	235 watts	750 watts	1350 watts
Plate Input	188 watts	335 watts	1000 watts	1800 watts
Plate Dissipation	47 watts	100 watts	250 watts	450 watts
Peak R. F. Grid Input Voltage, (approx.)	250 volts	230 volts	395 volts	410 volts
Driving Power, (approx.)	9 watts	8 watts	32 watts	35 watts

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STROMBERG-CARLSON

Featuring FM

PIONEER SPECIAL, #1204-FMG, one of the three Stromberg-Carlson FM-AM table models for 1949.

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HEPPLEWHITE, #1409-PGM, one of the six new Stromberg-Carlson radio-phonograph combinations which includes separate 3-gang no-drift permeability tuning on 88-108 mc FM.

Every Stromberg-Carlson radio-phonograph and radio receiver in the 1949 line—except for two small AC-DC table types—will feature Frequency Modulation as a built-in component!

And every television receiver built by Stromberg-Carlson—including the "Rochester" table model—has an 88 to 108 mc FM radio tuning band!

Stromberg-Carlson is putting all its resources into making the glorious dream of FM a happy reality in the homes of listeners. No other manufacturer can match this record of accomplishment and progress:

- *The first demonstration of FM* with a commercial receiver was made by Major E. H. Armstrong in 1939 using a Stromberg-Carlson instrument from regular production.
- *The first complete commercial line of FM* receivers offered to the public was made by Stromberg-Carlson.
- *The first FM broadcasting station* to be owned and operated by a radio manufacturer is the Stromberg-Carlson station, WHFM.

Eighteen console and table models in the Stromberg-Carlson line today feature Frequency Modulation in a variety of period cabinets and service combinations to please every buying preference. All of these receivers have a built-in superiority that comes from consistently applied research and more than a decade of FM designing, broadcasting and manufacturing experience.

STOP!—LOOK!—and LISTEN!...

THERE IS NOTHING FINER THAN A

STROMBERG-CARLSON

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Radiotelephone is too important an investment to be made on the basis of high-flown phrases and advertising slogans. It's easy to make claims that can't be proved and to so word statements that they seem to mean more than they do.

So, choose carefully. Make sure that claims are provable, that features mean something, and that specifications are understandable. The best test is to talk to people who have bought the equipment in question. Is it performing according to claims? *How much does it cost to maintain?* What kind of service does the manufacturer give? The manufacturer who has nothing to hide will welcome your skepticism.

Here are the *FACTS* about *Motorola* -compare them with all the others:

INDUSTRY LEADERSHIP

Motorola manufactures and installs more radiotelephone equipment than any other — BAR NONE. Motorola has more fully qualified mobile-radio developmental engineers in their laboratories devoting time *exclusively* to mobile radio problems than any other manufacturer — BAR NONE. Motorola has the largest mobile radiotelephone research laboratory and offers more product development than any other — BAR NONE. Motorola has pioneered more FM mobile radiotelephone "firsts" than any other manufacturer — BAR NONE: FIRST with 20 D.B. quieting at 0.4 microvolt input. FIRST commercially successful FM 2-way radiotelephone with FIRST noise compensated squelch that makes present day radio communications practicable. FIRST to successfully build equipment for the 152-162 mc. band. FIRST to develop the vibrator power supply in receivers, now accepted as the best power supply system. FIRST with "Precision Selectivity" for channel conservation. FIRST with Precision Cavity for intermodulation control.

ADVANCED DESIGN

Only Motorola guarantees full channel utilization through "PRECISION SELECTIVITY." P.S. provides extraordinary channel protection from nearby central stations and other man-made interference. Motorola's advanced design is your guarantee against early obsolescence.

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It's been proved — Motorola continues to operate when others fail. *Motorola takes less time out ... costs you far less over the years than any other equipment regardless of initial price!*

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Hundreds of official records show Motorola equipment giving "like-new" service for over six years — with only limited routine maintenance required. Part for part, Motorola is the sturdiest equipment in the field today — and Motorola's rugged construction pays off for you.

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A Motorola Communications Engineer will be glad to call and discuss radiotelephone as it concerns your specific problems. He'll put you in touch with people in your business who are using Motorola equipment. He'll give you FACTS, not fiction, FIGURES, not fables —

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