

Price 25 Cents

July '49

# FMA-TV

★ Edited by ★  
Milton B. Sleeper



**COMMUNICATIONS  
DIRECTORY—Part 1**

SYSTEMS OPERATED BY:  
MUNICIPAL, COUNTY  
& STATE POLICE  
FIRE  
FORESTRY  
RAILROADS  
OIL COMPANIES

LISTINGS REVISED TO  
JULY 1, 1949

9th Year of Service to Management and Engineering

# Greater Selectivity

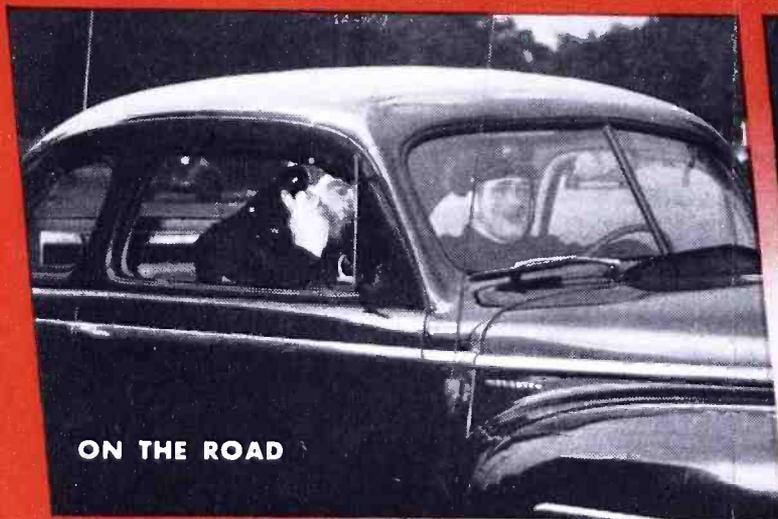
means less interference . . .



AT HEADQUARTERS



THE NEW RCA STATION RECEIVER  
Type CR-9A (152-174 Mc)



ON THE ROAD



THE NEW RCA CARFONE  
Mobile 2-way FM radio, 152-174 Mc

## . . . you get the greatest selectivity with RCA's All-New Communication Equipment

● You're going to hear a lot about selectivity from now on. In communication systems, receiver selectivity, more than any other single factor, determines the degree of freedom from interference. This is important both for today and for the future.

Recognizing this fact, RCA has taken the necessary steps to make its all-new communication equipment the most selective of any on the market today. To the user, this means reliable operation substantially free from interference. In addition, this greater selectivity now makes adjacent-channel operation a practical possibility—thereby greatly increasing the number of

potentially useful channels for mobile radio communication systems.

For complete details on the new RCA Station Receiver type CR-9A, and the new RCA CARFONE for mobile use, write today. RCA engineers are at your service for consultation on problems of coverage, usage, or complex systems installations. Write Dept. 38 G.

Free literature on RCA's All-New Communication Equipment—yours for the asking.



**COMMUNICATION SECTION**

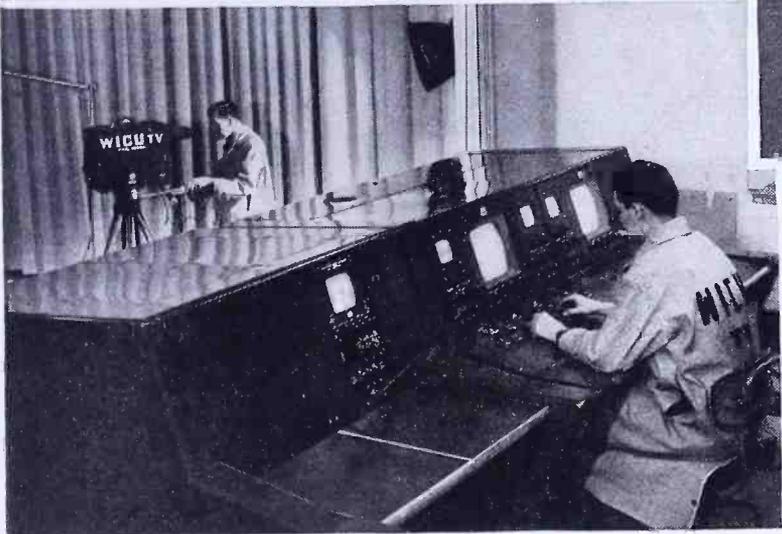
**RADIO CORPORATION of AMERICA**  
**ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.**

In Canada: RCA VICTOR Company Limited, Montreal

*Another successful start  
with DUMONT!*

**THE ERIE DISPATCH**  
News Gathering Organization  
Associated Press—World's Greatest

**ERIE'S FIRST  
TV STATION  
WICU**



► Says EDWARD LAMB, publisher of "The Erie Dispatch" and owner of TV Station WICU:

"In bringing the only telecasting service to Erie, Penna., we insist on five prerequisites: (1) Best pictorial quality obtainable; (2) Adequate signal strength throughout area served; (3) Equipment operable by previously-inexperienced local personnel; (4) Dependable service, regardless; and (5) Equipment that, with minimum obsolescence, can be expanded in step with

telecasting economics.

"Du Mont equipment fulfills that bill. And so Station WICU was, is and will continue to be Du Mont-equipped."

► Regardless what your telecasting start may be—leading metropolitan TV station or network studios, or again the small-town independent TV station—you can always count on Du Mont "know-how" for economically-safe-and-sound guidance.

© ALLEN B. DUMONT LABORATORIES, INC.

**DUMONT** *First with the Finest in Television*

DUMONT LABORATORIES, INC. • TELEVISION EQUIPMENT DIVISION, 42 HARDING AVE., CLIFTON, N. J. • DUMONT NETWORK AND WABD, 515 MADISON AVE., NEW YORK 22, N. Y. • DUMONT'S JOHN WANAMAKER TELEVISION STUDIOS, NEW YORK 3, N. Y. WTTG, WASHINGTON, D. C. • STATION WDTV, PITTSBURGH, PA. • HOME OFFICES AND PLANTS, PASSAIC AND EAST PATERSON, N. J.

*Zenith Challenges Any Comparison*

WITH THIS

**The Most Sensitive FM Radio Ever Built**

FOR THE PUBLIC



**ONLY ZENITH GIVES YOU THIS**

**Most Sensitive Performance**

Superb reception even on weak signals.

**Longer Distance**

Because of high sensitivity, brings in stations in fringe areas others miss.

**No Interference**

No whistles, no overlap, no cross-talk, no background hiss. \*

**No Static**

Even in the worst storms. Only rich, glorious tone.

**No Special Antenna**

With Zenith's patented Power-Line Antenna, just plug in and play.

Whatever has been your experience with FM—whatever FM radio you have ever heard—Zenith† now asks you to listen to a new marvel of Radionic† science.

This all-new Zenith Model is the climax of years of acknowledged leadership in genuine Zenith-Armstrong FM—that hundreds of thousands know as true FM—the FM radio that leading FM stations over the nation rely upon to monitor and test their own broadcasts—truly the FM of the Experts! Now, in a new Super-Sensitive circuit that gives perfected performance even on signals too weak for ordinary sets to catch.

So we say—hear, compare! Be prepared to hear the most sensitive FM receiver you have ever listened to—a genuine Zenith-Armstrong receiver at a sensation-ally low price.

**The Super-Sensitive "MAJOR"**

The lowest price ever for genuine Zenith-Armstrong FM! . . . only

**\$39<sup>95</sup>\***



\*Suggested Retail Price. Prices subject to change without notice.



Formerly, FM MAGAZINE and FM RADIO-ELECTRONICS

VOL. 9

JULY, 1949

NO. 7

COPYRIGHT 1949, by Milton B. Sleeper

## CONTENTS

### INDUSTRY NEWS

#### TV-FM-AM Set Production

Compiled from figures released by the RMA ..... 4

#### New Catalogs & Design Data

Review of new products and equipment ..... 6

#### What's New This Month

1. FCC's new plan for call letters
2. Policies of the Ad Hoc Committee
3. National Mobile Radio System Is Formed
4. Data on radio sales by appliance dealers ..... 8

### MOBILE RADIO

#### Mobile Radio Systems

A discussion of potential expansion ..... 13

#### Low-Power FM Portable

Howard V. Carlson ..... 14

#### Operator License Requirements

Letter from FCC Secretary T. J. Slowie ..... 17

#### Radio Communications Services, Parts

New FCC rules and allocations ..... 18

#### Mobile Radio News & Forecasts

Jeremiah Courtney ..... 22

#### Dynamotor Power Supplies

Robert W. Carter ..... 25

#### Directory of Mobile Radio Systems, Part 1

Corrected to June 15, 1949 ..... 27

### SPECIAL DEPARTMENTS

*Professional Directory* ..... 10

*Special Services Directory* ..... 11

*Spot News Notes* ..... 22

THE COVER DESIGN AND CONTENTS OF FM AND TELEVISION MAGAZINE ARE FULLY PROTECTED BY U. S. COPYRIGHTS, AND MUST NOT BE REPRODUCED IN ANY MANNER OR IN ANY FORM WITHOUT WRITTEN PERMISSION

**MILTON B. SLEEPER, Editor and Publisher**

CHARLES FOWLER, *Business Manager*  
LILLIAN BENDROSS, *Circulation Manager*  
SOPHIE FORTY, *Production Manager*  
Published by: FM COMPANY

Publication Office: 264 Main St., Gt. Barrington, Mass. Tel. Gt. Barrington 500  
FM-TV Magazine is issued on the 20th of each month.

Single copies 25c—Subscription rate: \$6.00 for three years, \$3.00 for one year in the U. S. A.—Canada, add 50c per year postage—foreign, add \$1.00 per year postage.

Contributions will be neither acknowledged nor returned unless accompanied by adequate postage, packing, and directions, nor will FM-TV Magazine be responsible for their safe handling in its office or in transit.

Entered as second-class matter August 22, 1946, at the Post Office, Great Barrington, Mass., under the Act of March 3, 1879. Additional entry at the Post Office, Boston, Mass. Printed in the U. S. A.

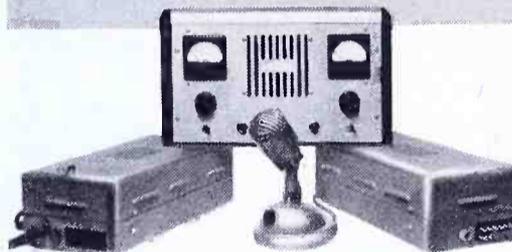
MEMBER,  
AUDIT  
BUREAU OF  
CIRCULATIONS

## Announcing our new...

### 25-50 Megacycle FM 2-Way Radio Communication Systems

# RAYTHEON

# RADIOPHONE



(above)  
VS 50-1—50 watt  
Fixed Station. Operates on 117v 60 cycles A.C. (25-50 megacycles). Remote control optional.



(below)  
VM 30-1 (25-50 megacycles)—30 watt. Compact Mobile Station.

(not illustrated)  
UM 15-1 (152-162 megacycles)—15 watt (local reception). Compact Mobile Station.

Now Raytheon Radiophone offers dependable 2-way communication systems in both 25-50 megacycle and 152-162 megacycle. Whatever your needs, you can be sure that there is a Raytheon Radiophone to meet your requirements *exactly*—manufactured to Raytheon's high standard of excellence in electronics.

#### COMPARE RAYTHEON'S ADVANTAGES

NOISE-FREE RECEPTION  
COMPACT—OUT OF SIGHT  
OUT OF THE WAY  
SIMPLIFIED INSTALLATION

#### COMPARE RAYTHEON'S PERFORMANCE

LOWEST BATTERY DRAIN  
LOW MAINTENANCE  
LONG LIFE

#### COMPARE RAYTHEON'S PRICE

LOWEST PRICE IN THE INDUSTRY

## BELMONT RADIO CORPORATION

A Subsidiary of Raytheon Manufacturing Company

5939 W. DICKENS AVENUE • CHICAGO 39, ILLINOIS

### Mail Coupon for Quotations and Information

Belmont Radio Corporation  
5939 W. Dickens Avenue, Chicago 39, Illinois

I'd like to have full information on Raytheon Radiophone—

25-50 megacycle     152-162 megacycle

NAME \_\_\_\_\_

ORGANIZATION \_\_\_\_\_

ADDRESS \_\_\_\_\_

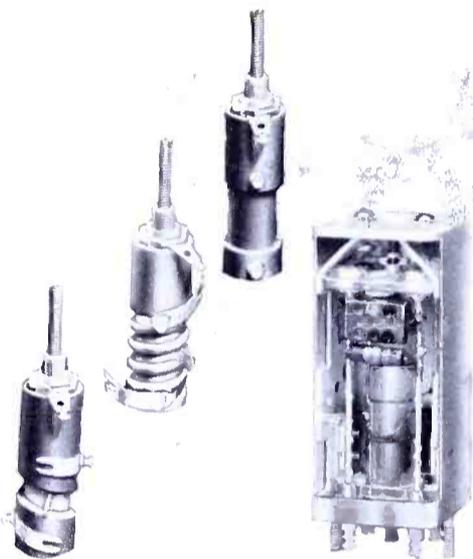
CITY \_\_\_\_\_ STATE \_\_\_\_\_





# NATIONAL

- **P**roven
- **D**ependable
- **Q**uality



## HIGH FREQUENCY COMPONENTS

National offers a complete line of coils, coil forms and transformers for critical high frequency work. These components have been tested and proved superior in performance in National's own world-famous communication equipment. Write Dept 194 for complete catalog.



**R**ADIO set production by RMA members during April, as indicated in the Production Barometer, portrays a confused and unhealthy trend. TV and FM sets combined still represent a very small number of units for an industry that started the postwar period with such a tremendous capacity for quantity production. As for AM sets, April was at a new low for the period starting January 1947. Dollarwise they have dropped to starvation level.

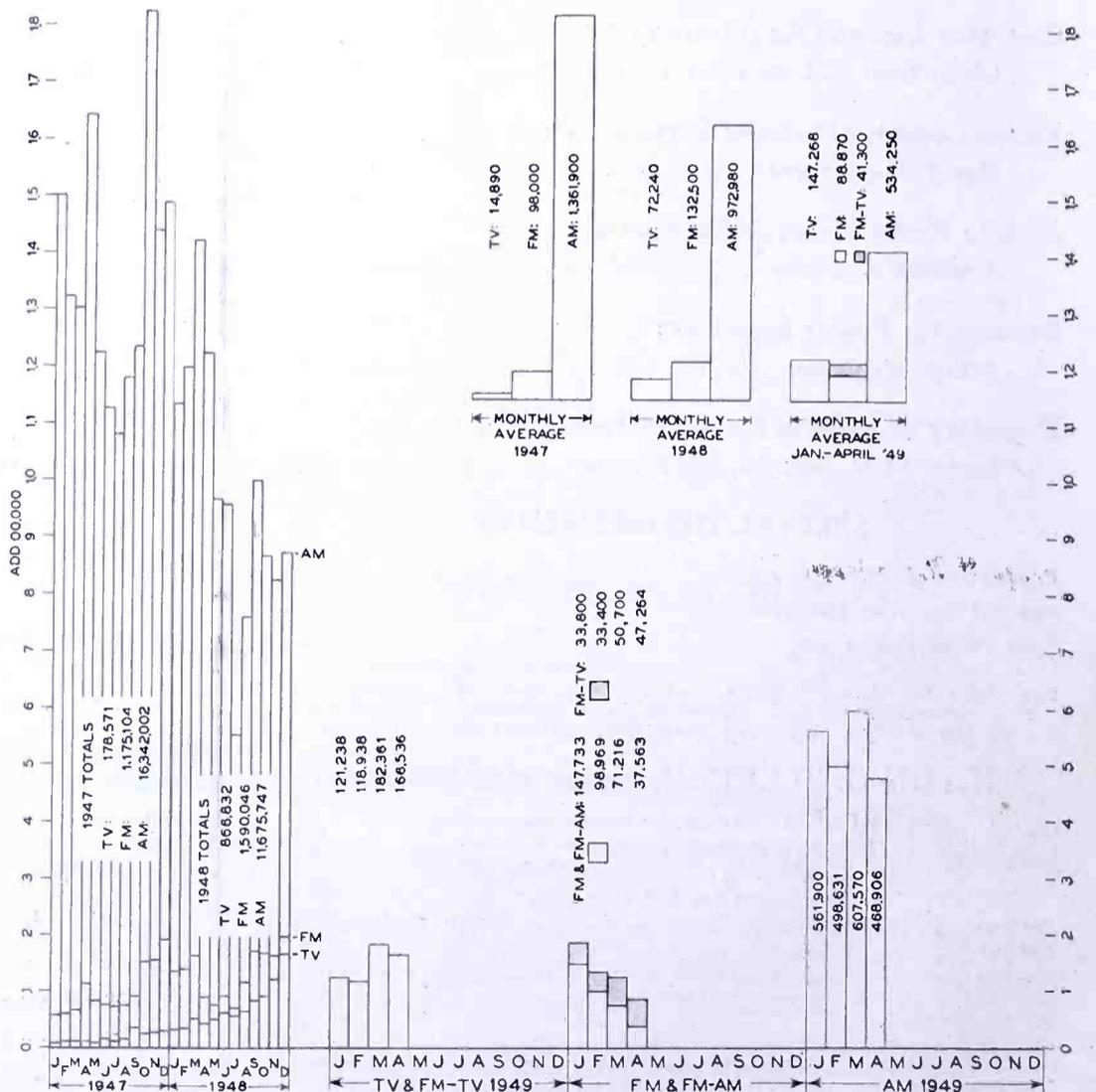
The blocks showing average monthly production sum up the situation realistically. In 1947, average AM set production the first four months of the year exceeded the average for the year by 5%. In '48, those months exceeded the average for the year by 25%. In '49 it is reasonable to expect that the total AM sets produced will be under 5 million, a drop of 75% since 1947.

Television has climbed steadily but not spectacularly. Average production in the first four months this year is 3 1/2

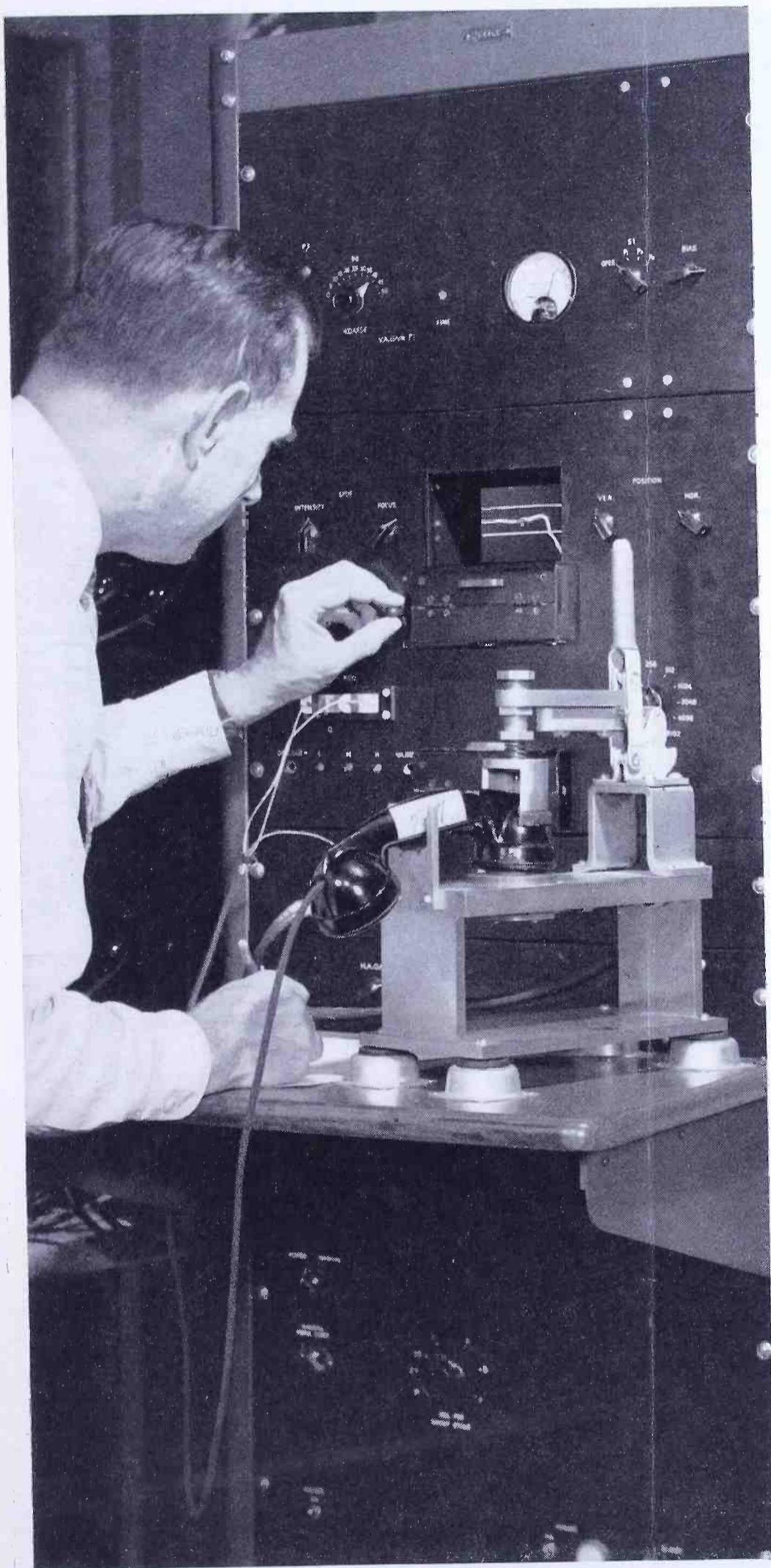
times that of the same period in '48. Expressed in numbers, however, 3 1/2 times 41,000 is still a very small figure to broadcasters, who are in the habit of counting network audiences in millions.

FM followed AM sets to a new low. The exact significance of this will not be clear until fall, when manufacturers will have had time to produce and promote FM models competitive with the performance of Zenith's \$39.95 receiver. This month, shaded areas on the FM blocks indicate the number of TV sets with FM broadcast circuits. RMA has just added this figure in its monthly reports. In April, 47,264 TV-FM sets were produced, or 28% of all TV models. We applied this 28% to TV figures for January, February, and March.

The year-end progress of TV cannot be assayed at this time, nor until the FCC's freeze is lifted, and the public has registered its reaction to whatever allocations plan is finally adopted by the Commission.



TV, FM, and AM Set Production Barometer, prepared from RMA figures



**Y**OUR telephone receiver should treat each tone in the voice alike; that is important to you, because proper balance makes pleasant listening and easy understanding. Naturalness in receiver performance is pictured in a matter of seconds by the apparatus shown at left.

The receiver is clamped in place and an oscillator feeds into it frequencies representing all talking tones. Then a bright spot darts across an oscilloscope screen leav-

---

**It listens so  
YOU  
can hear better**

---

ing behind it a luminous line which shows instantly the receiver's response at each frequency. It is precise; and it is many times faster than the old method of measuring receiver performance point-by-point and then plotting a curve.

At Bell Laboratories, development of techniques to save *time* parallels the search for better *methods*. For each time an operation is made faster, men are freed to turn to other phases of the Laboratories' continuing job—making your telephone system better and easier for you to use each year.



**BELL TELEPHONE LABORATORIES**  
PIONEERS IN THE RESEARCH OF FM RADIO AND TELEVISION, AND  
ACTIVE IN DEVELOPING IMPROVEMENTS IN BOTH FIELDS TODAY.

## NEW CATALOGS & DESIGN DATA

THE products listed here are described in new catalogs and bulletins now available. Unless otherwise noted, they will be sent on request, without charge.

### BROADCAST EQUIPMENT

#### Film Projector:

Description and application data on a 35-mm. projector designed for TV studios. *RCA Engineering Products, Camden, N. J.*

#### TV Transmitter:

For upper and lower VHF bands, has 5-kw. video and 3-kw. audio output. Video transmitter employs mid-level modulation. *Federal Telephone & Radio Corp., Clifton N. J.*

### HOME RECEIVERS

#### FM-AM Receiver:

Six-tube table model features high-sensitivity Armstrong limiter-discriminator FM circuit, Model 218. *General Electric Co., Electronics Park, Syracuse, N. Y.*

#### TV Tuner:

Replacement unit to fit the majority of TV sets. Covers 12 VHF channels. *Standard Coil Products Co., 2329 N. Pulaski Rd., Chicago 39.*

#### TV Distribution System:

Amplifier and distribution unit for operation from signals of 5,000 microvolts is designed to operate up to 8 TV receivers in apartment house or store installations. *Electro Engineering & Mfg. Co., 627 W. Alexandrine, Detroit 1, Mich.*

### AUDIO EQUIPMENT

#### 3-Speed Record Changer:

Has one turntable and one tone arm, with adjustments to play 33 1/3, 45, and 78 RPM records of all diameters and with large or small spindle holes. *Garrard Sales Corp., 315 Broadway, New York.*

#### Bridged-T Attenuators:

Smaller in size but interchangeable with present standards. The 12-step VU meter multiplier is 2 1/8 ins. in diameter, while the 30-step bridged-T mixer control is 2 1/2 ins. in diameter. These and 180 other types are listed in a new bulletin on attenuators. *Shalleross Mfg. Co., Collingdale, Pa.*

#### Magnetic Tape Splicer:

Produces strong, smooth, diagonal splice in 1/4-in. tape, without scraping, cementing, or use of adhesive. Joint is made by plastic weld during an accurately-timed heating cycle. Total time is 10 seconds. Thickness of tape is not increased. *Prestoseal Mfg. Co., 38-01 Queens Blvd., Long Island City, N. Y.*

### GENERAL COMPONENTS

#### AN Connectors:

Wall chart shows 203 insert layouts and additional insert positions, together with service voltages, and illustrations of all basic AN shell types. Charts are available with half-scale or full-size drawings. *Cannon*

*Electric Development Co., 3209 Humboldt St., Los Angeles 31.*

### Telephone Type Relays:

Design data and mechanical dimensions are given in a new catalog for standard, miniature, and special AC and DC relays, including a series of interlocking relays. *Phillips Control Corp., 612 N. Michigan Ave., Chicago 11.*

### Twin-Line Connectors:

Polarized and non-polarized connectors for splicing 300-ohm flat line, and terminal and baseboard connectors, all in the form of polystyrene blocks. These are handy and much-needed items. *Products Engineering Co., 4753 N. Broadway, Chicago 40.*

### Miniature Selenium Rectifiers:

Are described in a 48-page handbook giving dimensions, performance characteristics, and circuits for applications to audio and video receivers. Price 25c. *Federal Telephone & Radio Corp., 900 Passaic Ave., E. Newark, N. J.*

### Carbon Resistors:

Of molded composition, in a new series rated at 2 watts. They are available in a complete range from 10 to 100,000 ohms, plus or minus 5, 10, and 20%. Design is in accordance with JAN specs. Size 11/16 in. long by .312 in. diameter. *Stackpole Carbon Co., St. Marys, Pa.*

### TV Replacement Transformers

Complete line of blocking oscillator, power, and filament transformers and filter chokes, designed as replacements on all types of TV receivers. *Merit Coil & Transformer Corp., 4427 N. Clark St., Chicago 40.*

### Low-Wattage W.W. Resistors:

Technical bulletin describes type BW wire-wound resistors of .5, 1, and 2 watts capacity, designed for high stability. *International Resistance Co., 401 N. Broad St., Philadelphia 8.*

### COMMUNICATIONS EQUIPMENT

#### Mobile Unit for 152-162 Mc.:

Single unit, designed for lower prices, has 10-watt output. Draws 7.3 amperes standby, and 23.9 amperes transmit on 6-volt battery. All miniature tubes. Case is 5 5/16 ins. high, 12 3/16 ins. wide, 14 1/8 ins. deep, weighing 27 1/2 lbs. *Federal Telephone & Radio Corp., Clifton, N. J.*

#### FM Units for 72 to 76 Mc.:

A 50-watt transmitter and companion receiver for point-to-point and relay service. Receiver features permanent adjustment of the squeelch. Designed for desk mounting or relay rack. *Philco Corp., Industrial Div., Phila. 34.*

#### Beam Antenna for 152-162 Mc.:

Corner reflector design for high-gain, narrow-angle transmission or reception. Can be mounted on pipe mast or fabricated tower. Requires no tuning. Gain is 8 db over dipole. Vertical polarization. *Andrew Corp., 363 E. 75th St., Chicago 19.*

### TEST & MEASURING INSTRUMENTS

#### DC Electronic Microammeter:

Input resistance is 50 ohms, with 1 micro-ampere full scale. Used as an amplifier, this instrument actuates a 1-milliamperer,

1,400-ohm recorder directly. Multiple ranges are available. *W. S. Macdonald Co., Inc., 33 University Rd., Cambridge 38, Mass.*

### VT Voltmeter:

Designed for servicing audio and video receivers. Multi-range controls afford measurements of resistance, and current and voltage at DC or AC frequencies up to 500 mc. *Sylvania Electric Products, Inc., 500 Fifth Ave., New York 17.*

### 4-Beam Oscillograph:

Equipped with a special K1027P11 cathode-ray tube, it displays four related or unrelated phenomena simultaneously. Contains complete controls and power supply. *DuMont Laboratories, Clifton, N. J.*

### MANUFACTURING EQUIPMENT

#### Small Power Shears:

Floor mounted types, with 12- or 24-in. blades, taking up to 16-gauge sheet steel. Designed for fast, economical production. Floor space 18 by 30 or 18 by 40 ins. *O'Neil-Irwin Mfg. Co., Lake City Minn.*

#### C-R Tube Sealing Machine:

Automatic machine has interchangeable adapters to handle 12 tubes up to 16-in. size or 16 tubes up to 12 1/2-in. size per cycle. *Kahle Engineering Co., North Bergen, N. J.*

### VACUUM TUBES

#### Tube Data:

Nearly 50 subminiature tubes and 150 other types, including magnetron, klystron, rugged-design, transistor, hearing aid, transmitter, rectifier, and voltage-regulator tubes, are listed in a new chart which shows characteristics and base diagrams. *Raytheon Mfg. Co., Newton 58, Mass.*

#### TV Tube Compliment Chart:

Lists tube types employed in 110 receiver models produced by 44 TV set manufacturers. *Sylvania Electric Products, Inc., Emporium, Pa.*

#### Sub-Miniature Ballast Tube:

Up to 3 watts can be dissipated from a flat-bulb tube 1 1/2 ins. long. Maximum current is .9 ampere. A 100% increase in voltage produces a current change of less than 5%, while ambient temperature from -50° to +70° C causes the current to change less than 2%. *Amperite Co., Inc., 561 Broadway, New York 12.*

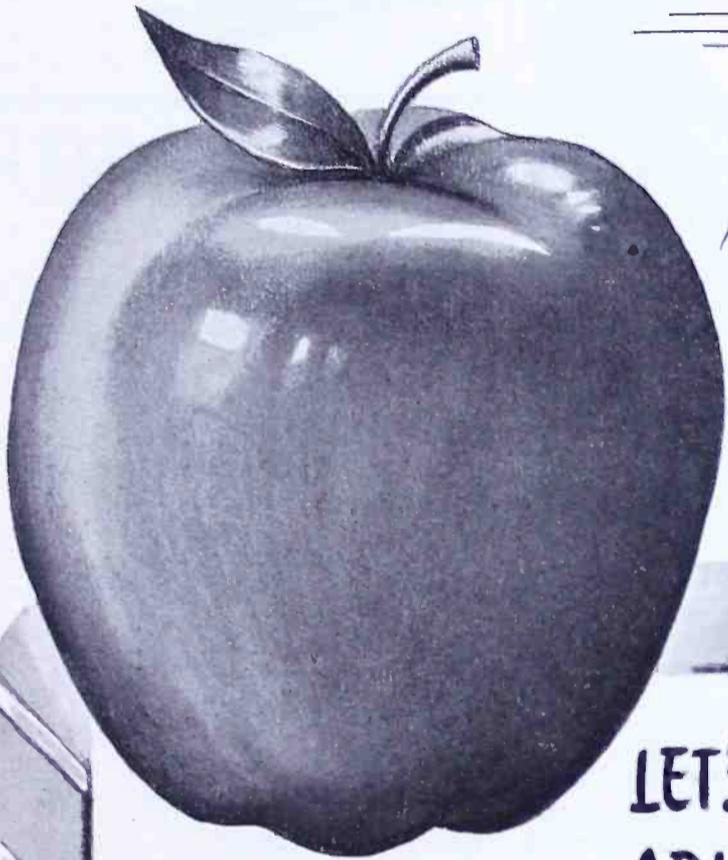
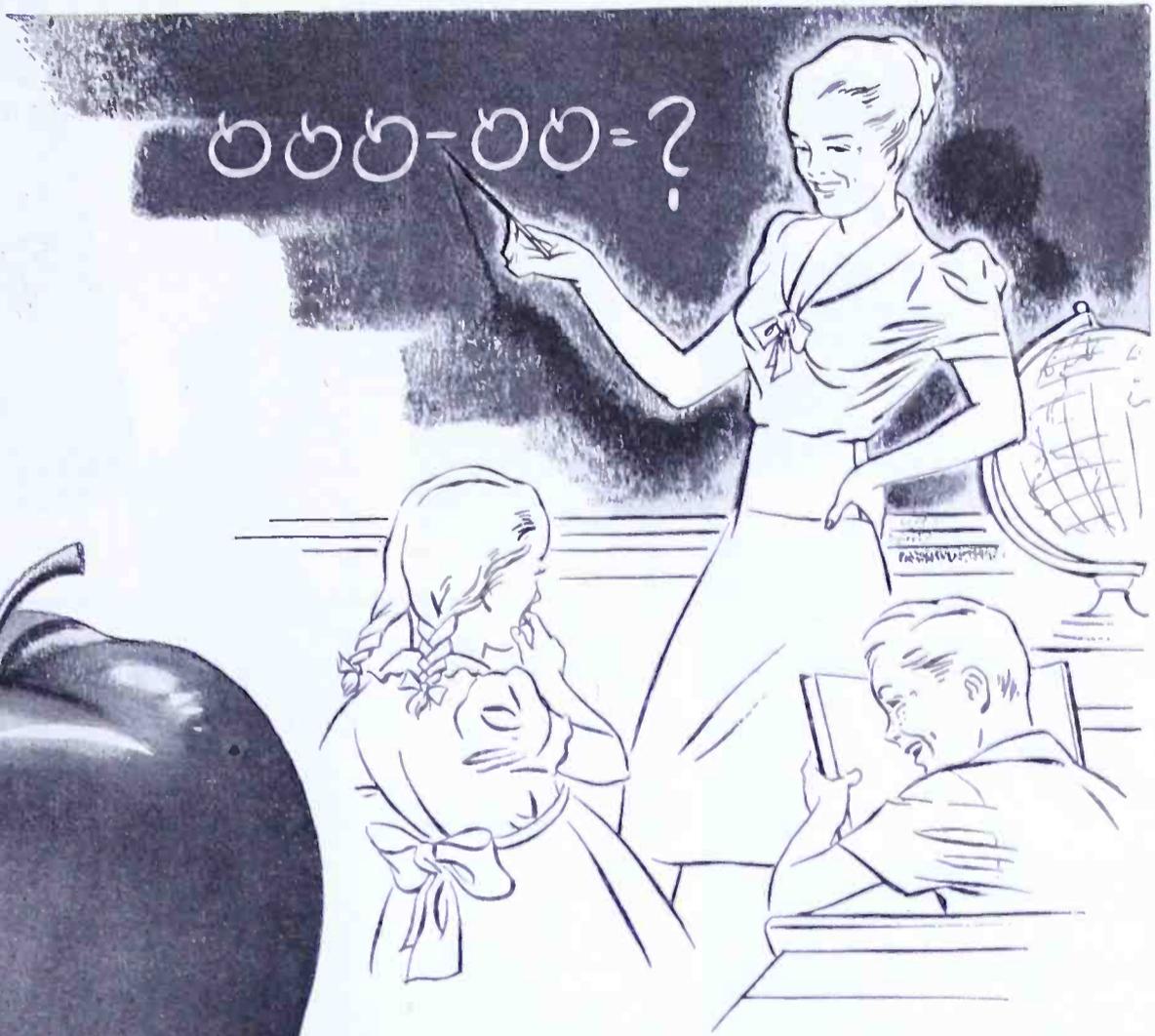
#### Beam Power Amplifier:

Type 19BG6-G, particularly designed for horizontal deflection circuits in TV receivers, with picture tubes operated at less than 10,000 volts. DC plate, 500 volts, 100 milliamperes; peak heater cathode voltage, 250 volts with heater positive or negative with respect to cathode. *General Electric Co., Tube Division, Schenectady, N. Y.*

### MATERIALS

#### Pipe & Conduit Markers:

Designed to identify materials carried in pipes and voltages of lines in conduit. Markings and colors conform with ASA Standard A13. Self-adhesive markers, 2 1/4 by 9 ins. long, include 150 stock designs for pipes and 23 for conduit, with NEMA voltages from 110 to 4,800. Samples sent on request. *W. H. Brady Co., Dept. 98, 815 N. 3rd St., Milwaukee 3.*



## LET'S NOT DO CAPACITOR ARITHMETIC IN APPLES!

Remember the old story?

"Look, Ruthie," said the substitute teacher, "if you had 3 peaches and gave 2 to Johnny, how many peaches would you have left?"

Ruthie pondered.

"I don't know, teacher," she finally whispered. "When our regular teacher is here, we always do arithmetic in apples."

In capacitor arithmetic, calculations *a la Ruthie* may not add up in your best interest.

Because Sprague, and only Sprague, makes all four—ceramic, mica, paper and electrolytic—Sprague can recommend and supply the particular kind of fixed capacitor best suited for your specific application with due regard for the performance, space and economic considerations involved.

When you want peaches, Sprague doesn't try to sell you apples, for we have plenty of *both* on the shelf.

SPRAGUE ELECTRIC COMPANY • NORTH ADAMS, MASS.

# SPRAGUE

PIONEERS IN ELECTRIC AND ELECTRONIC DEVELOPMENT

For The  
Best In

# RADIO COMMUNICATIONS

always specify

# Link

Design Leader  
in the Field

Since 1932  
with Equipment

"PREFERRED  
THE WORLD OVER"

## FM

25-50 MC 72-76 MC 152-162 MC  
450 MC Band 960 MC Band

## AM

25-50 MC 1500-3000 KC

FIXED STATION, MOBILE AND  
PORTABLE EQUIPMENT  
INCLUDING   
MOTORCYCLE RADIO  
EQUIPMENT

**Link Radio Corporation**

125 W. 17th St., New York 11, N. Y.

### THIS MONTH'S COVER

Fire department officials have been notably reluctant to make use of mobile radio because they have been taught, over the years, to shun any apparatus which does not give a signal if it fails. Thus, they are having to overcome an ingrained prejudice against a means of communication that does not use wires. Gradually, though, fire chiefs are coming to use mobile radio in their own cars, and from this start they are adding installations to their fire apparatus. The dramatic photograph on this month's cover was taken by Charles Fowler at Pittsfield, Mass., just as the hook and ladder roared out to the street from the fire house.



## WHAT'S NEW THIS MONTH

1. NEW SYSTEM OF CALL LETTERS
2. POLICIES OF THE AD HOC COMMITTEE
3. NATIONAL MOBILE SYSTEM
4. SALES BY NARDA MEMBERS

**1.** For the first time, call letters assigned in accordance with the FCC's new plan appear in our Directory of Mobile Radio Systems. This plan, adopted April 27, 1949, employs letter and numeral combinations, the former selected in accordance with area assignments listed below, while the number of digits is related to the class of service.

This will not affect broadcast station calls, but all other transmitters, except coastal stations not in Alaska, will be changed over, while the new calls are being assigned as new licenses are issued. No date has been set when all calls must be changed, but July 1, 1950, will probably be the deadline.

The plan for assignments to mobile radio services is as follows:

**BASE STATION:** (The headquarters transmitter or transmitters of a mobile radio system) Station call comprises 3 letters and 3 digits, from KAA200 through KZZ999, or WAA200 through WZZ999.

**MOBILE TELEPHONE, ASSOCIATED WITH BASE STATION:** Uses the same call letters as the base station.

**MOBILE TELEPHONE, NOT ASSOCIATED WITH BASE STATION:** (As in the case of mobile units licensed to a town which takes service from a base station licensed to another town) Station call comprises 2 letters and 4 digits, from KA2000 through KZ9999.

**OPERATIONAL FIXED STATIONS:** (Such as relays and repeaters) Station call comprises 3 letters and 2 digits, from KAA20 through KZZ99, and WAA20 through WZZ99.

**ZONE, INTERZONE TELEGRAPH:** Station call comprises 3 letters and 2 digits, from

KAA20 through KZZ99, and WAA20 through WZZ99.

The area assignments of letters are in accordance with the following state groups.

KAA-KBZ WAA-WBZ  
Colo., Iowa, Kans., Minn., Mo.,  
Nebr., N. D., S. D.

KCA-KDZ WCA-WDZ  
Conn., Me., Mass., N. H., R. I., Vt.

KEA-KFZ WEA-WFZ  
N. Y., N. J.

KGA-KHZ WGA-WHZ  
Del., D. C., Md., Penn.

KIA-KJZ WIA-WJZ  
Ala., Ga., Fla., Ky., N. C., S. C.,  
Tenn., Va.

KKA-KLZ WKA-WLZ  
Ark., La., Miss., N. M., Okla., Texas.

KMA-KNZ WMA-WNZ  
Calif.

KOA-KPZ WOA-WPZ  
Ariz., Idaho, Mont., Nev., Ore.,  
Utah, Wash., Wyo.

KQA-KRZ WQA-WRZ  
Mich., Ohio, W. Va.

KSA-KTZ WSA-WTZ  
Ill., Ind., Wisc.

KUA-KVZ  
Pacific areas.

KWA-KZZ  
Alaska.

WWA-WWZ  
Atlantic-Caribbean areas.

WWV  
Standard Frequency.

**2.** Engineering consultant Raymond Wilmotte has suggested that a permanent board of engineers be set up to function along the lines of the Ad Hoc Television Committee, to assist the FCC

(Continued on page 9)

## WHAT'S NEW THIS MONTH

*(Continued from page 8)*

Commissioners, without infringing on the work of the Commission's Engineering Division.

In support of this proposition, he has given the first information on the operations of the Ad Hoc Committee: "Working on the Ad Hoc Committee has been a real pleasure. It is seldom that one has an opportunity to be part of a group, working on a project of national importance, that is searching for the engineering truth and nothing but that truth. This experience is of value, for it shows it can be done; that in the proper atmosphere commercial alliances can be forgotten, and all engineering factors given full and careful consideration.

"Throughout its work, the Committee has had practically no disagreements. There were of course, wide differences of opinion on the method of attacking many of the engineering problems that came up, but in each case of such differences the Committee resorted to measurements as the only true, impersonal, engineering arbiter. What the measurements said decided the issue.

"The atmosphere was in sharp contrast to the picture that one would have expected from listening not to all but certainly to much of the engineering testimony at FCC hearings where too often an engineering opinion is given without the engineering data to back it; where those whose commercial needs require large service areas find weak signals satisfactory, and those of different interests find strong signals essential; where figures of field intensity are argued at length to an accuracy of one per cent because the printed curves can be so read, without regard to the fact that the curves may be more than 100% in error when applied to a particular case; where engineering factors are deliberately neglected because, even though true, they are not part of the ritual; or, to sum up, where the truth, some of the truth, and something less than all the truth is presented.

"How was this ideal atmosphere of the Ad Hoc Committee produced? The Committee decided from the beginning that its job was not a policy job. Its job was to evaluate engineering facts; that engineering facts are not matters of policy or of personal egos; and that it would not consider or discuss the effect of various factors on the ultimate policy decision of the mileage separation between stations before fully evaluating the facts of propagation, because personal and preconceived ideas as to mileage separation might super-impose an undesirable trend to the evaluation of the data available.

*(Continued on page 10)*

## NOW! Modern, Comprehensive TV "Staging" plus NEW TV REVENUE from Pattern Time

# with the **GRAY TELOP**



*This most versatile telecasting optical projector enables dual projection with any desired optical dissolve under exact control.*

*The accessory STAGE NUMBER 1 adds three functions separately or simultaneously: a) teletype news strip, b) vertical roll strip and c) revolving stage for small objects.*

*The TELOP, used with TV film cameras, permits instant fading of one object to another, change by lap dissolve or by superimposing. Widest latitude is given program directors for maximum visual interest and increased TV station income.*

*For full details write for Bulletin T-101*

**GRAY RESEARCH  
and Development Co., Inc.**  
16 Arbor St., Hartford 1, Conn.

# MOBILE RADIO HANDBOOK

Edited by Milton B. Sleeper

Completely up-to-date, the **MOBILE RADIO HANDBOOK** is an invaluable source of practical, working information for:

Radio Supervisors, Communications Engineers, Servicemen  
Officials responsible for mobile systems, Operators

This large-size book, 3 $\frac{3}{4}$  by 11 $\frac{5}{8}$  inches, covers all classes of mobile radio systems, from police and fire to taxicab and public utility installations. The top authorities, each an expert in his own field, were selected to prepare the individual chapters. Of special interest are the chapters on units which feature adjacent-channel operation and automatic modulation limiting, and microwave relay apparatus. Except for the section on theory, no mathematics are employed. The text is profusely illustrated with large, detailed photographs and drawings printed on fine paper.

**ORDER YOUR COPY NOW!**

CLOTH BOUND \$4.00, PAPER BOUND \$2.00

**Published by FM-TV Magazine**

Savings Bank Building, Great Barrington, Mass.

## Professional Directory

### Jansky & Bailey

AN ORGANIZATION OF  
*Qualified Radio Engineers*  
DEDICATED TO THE  
**SERVICE OF BROADCASTING**  
National Press Bldg., Washington, D. C.

### GARO W. RAY

**CONSULTING RADIO ENGINEERS**  
*Standard, FM and Television Services*  
HILLTOP DRIVE  
STRATFORD, CONN. Tel. 7-2465

### ANDREW ALFORD

Consulting Engineers  
**ANTENNAS & RF CIRCUITS**  
Laboratory and Plant:  
299 Atlantic Ave., Boston 10, Mass.  
Phone: HAncock 6-2339

### DALE POLLACK

**FREQUENCY MODULATION**  
development and research  
transmitters, receivers  
communications systems  
352 Pequot Avenue New London, Conn.  
New London, 2-4824

### GEORGE C. DAVIS

*Consulting Radio Engineers*  
501-514 Munsey Bldg.—Sterling 0111  
Washington 4, D. C.

### AMY, ACEVES & KING, INC.

*Specialists in the  
Design and Installation of*  
**HIGH-GAIN  
AM, FM, and TELEVISION  
ANTENNA SYSTEMS**  
LOnacre 5-6622  
11 West 42nd St., New York 18, N. Y.

## WHAT'S NEW THIS MONTH

(Continued from page 9)

Similar efforts were made throughout the Committee's work to endeavor to eliminate personal and psychological factors from invading and influencing decisions which should be utterly and completely objective.

"Throughout its work, consideration was also given to the accuracy to which the Committee's evaluation of the facts available could be depended upon to represent average conditions needed in allocation. It was hoped that this information would help the policy makers apply the information presented with a proper appreciation of the inherent engineering uncertainties for, without such an appreciation, allocations can fall seriously out of line.

"The subordination of commercial psychologies and egos, the search for estimates of accuracy, and the raising of measurements to the status of arbiter were probably the principal tangible factors that created the harmony within the Committee."

This information on the manner in which Ad Hoc deliberations were carried out is reassuring. However, their conclusions may be completely right on the basis of engineering facts, and yet they may prove to be impossible of practical, commercial applications.

Still, a knowledge of engineering facts and the extent of variable factors should be of great protection to the Commissioners when they are subjected to the persuasions of policy-level witnesses who shift the variables to such upper or lower limits as support the positions they see fit to take. At best, the lot of the Chairman and the Commissioners is not an easy one.

3. The operation of limited common carrier mobile systems has been given a tremendous impetus by provisions of the new FCC rules which quite properly have the effect of limiting the number of private systems operated in urban areas. As explained by Jeremiah Courtney on his page this month, city service and distribution companies can no longer operate their own systems, but must use the facilities of the Telephone Company (common carrier) or the independent operators.

Now that FCC rules have cleared the track for LCC expansion, the independent operators have announced the formation of the National Mobile Radio System. With nearly 100 independent operators in principal cities from coast to coast, cooperative arrangements are being worked out by the association members to handle calls from cars or

(Concluded on page 11)

## Professional Directory

### McNARY & WRATHALL

**CONSULTING RADIO ENGINEERS**

906 National Press Bldg. DI. 1205  
Washington, D. C.  
1407 Pacific Ave. Phone 5040  
Santa Cruz, California

### KEAR & KENNEDY

*Consulting Radio Engineers*  
1703 K St., N.W. STerling 7932  
Washington, D. C.

### GEORGE P. ADAIR

*Consulting Engineers*  
Radio, Communications, Electronics  
1833 M St., N.W., Washington 6, D.C.  
EXecutive 1230

### FRANK H. McINTOSH

*Consulting Radio Engineers*  
710 14th St. N.W., Wash. 5, D. C.  
METropolitan 4477

### WELDON & CARR

**CONSULTING RADIO ENGINEERS**

Washington, D. C.  
1605 Connecticut Ave. MI. 4151  
Dallas, Texas  
1728 Wood St. Riverside 3611

### COMMUNICATIONS RESEARCH CORPORATION

System Planning—Engineering  
Research & Development  
FM—TV—Facsimile  
VHF—Communications  
60 E. 42nd St., New York 17, N. Y.  
Mu 2-7259

## Professional Directory

### RAYMOND M. WILMOTTE Inc.

Paul A. deMars  
Associate

Consulting Engineers  
Radio & Electronics

1469 Church St., N. W. Decatur 1234  
Washington 5, D. C.

### RUSSELL P. MAY

CONSULTING RADIO ENGINEERS

★ ★ ★

1422 F Street, N. W. Wash. 4, D. C.  
Kellogg Building Republic 3984  
Member AFCE

### LYNNE C. SMEBY

Consulting  
Radio Engineers

820 13th St., N.W. EX 8073  
WASHINGTON 5, D. C.

### Winfield Scott McCachren AND ASSOCIATES

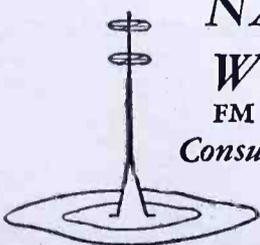
Consulting Radio Engineers  
TELEVISION SPECIALISTS

2404 Columbia Pike 410 Bond Bldg.  
Arlington, Va. Washington, D.C.  
GLEbe 9096 District 6923

### RATES FOR PROFESSIONAL CARDS IN THIS DIRECTORY

\$12 Per Month for This Standard  
Space. Orders Are Accepted  
for 12 Insertions Only.

**NATHAN  
WILLIAMS**  
FM TV AM  
Consulting Engineer



20 Algoma Blvd.  
Oshkosh, Wis.

Phone: Bl'khawk 22

## WHAT'S NEW THIS MONTH

(Continued from page 10)

trucks when they are outside their home areas. This follows the original plan of linking independent telephone companies, in the early days of telephone service.

A technical coordinating committee, headed by Peter T. Kroeger of Mobile Radio Dispatch Service, New Brunswick, N. J., has been set up to integrate the communications facilities of member stations, to work out uniform practices and standards, and to develop high-speed techniques for handling radio-landline message traffic. William S. Halstead of Communications Research Corporation is engineering consultant. Jeremiah Courtney is legal counsel for the new association.

Officers of NMRS are: president, Norman W. Medlar, Westchester Mobilephone System, Inc., White Plains, N. Y.; vice president, Terence McCarthy, Telephone Exchange, New York City; treasurer, J. F. Donovan, Autofone, Inc., Springfield, Mass.; secretary, George di Matteo, Secretarial Exchange, Inc., Newton, Mass.

4. There's so much tall talk going around about radio's high place in American industry that one might expect the volume of sales to rank high in comparison to other home appliances. Sad to relate, that doesn't seem to be the case, according to figures released by the National Appliance and Radio Dealers Association.

Data on percentage of total sales for 1946, '47, and '48 show radio sets consistently below refrigerators, washing machines, and ranges. Not only that, but audio broadcast receivers dropped 54% in that period while refrigerator sales increased 50%. As for television, which NARDA listed for the first time in 1948, dollar volume in receivers was less than for the combined sales of freezers and ironers.

Here is the percentage breakdown of dollar volume by NARDA members:

	1948	1947	1946
Refrigerators	28.6%	24.0%	19.0%
Washing Machines	16.9	18.0	16.0
Ranges	12.2	13.0	12.0
Radios	7.8	17.0	17.0
TV Sets	4.4		
Freezers	2.5		
Ironers	2.0		
Vac. Cleaners	1.4	3.0	3.0
Other Appliances	24.2	25.0	33.0

To be sure, this report is from only one dealer group, but the figures are reasonably typical of other types of stores handling home radio equipment.

## Special Services Directory

### METHODS ENGINEERS

Materials & Methods engineers in America's leading manufacturing plants use Topflight's Printed Cellophane, Self-Adhesive Tape to meet A-N specs. - assembly line - follow through - instruction labels. Easy to Apply.  
TOPFLIGHT TAPE CO. YORK PA.

### RANGERTONE

TAPE RECORDERS

HIGH-FIDELITY EQUIPMENT FOR  
BROADCAST & RECORDING STUDIOS

RANGERTONE, INC.

73 Winthrop St. Newark 4, N. J.  
Tel. Humbolt 5-2550

### THE WORKSHOP ASSOCIATES

INCORPORATED

Specialists in  
High-Frequency Antennas

66 Needham St., Newton Highlands, Mass.  
Bigelow 3330

Collins Custom Components

*The Very Finest*

FM TUNERS FM/AM TUNERS  
FM RECEIVERS

Custom Matched Components

*Collins*

Audio Products Co., Inc.

P. O. Box 368 Westfield, N.J.

### RADIO-MUSIC CORP.

REPRODUCERS **R** TURNTABLES

**M**

AMPLIFIERS **C** SPEAKERS

F. M. broadcast quality for custom  
sound installations for the studio and  
the home.

PORT CHESTER, NEW YORK

### KAY ELECTRIC CO.

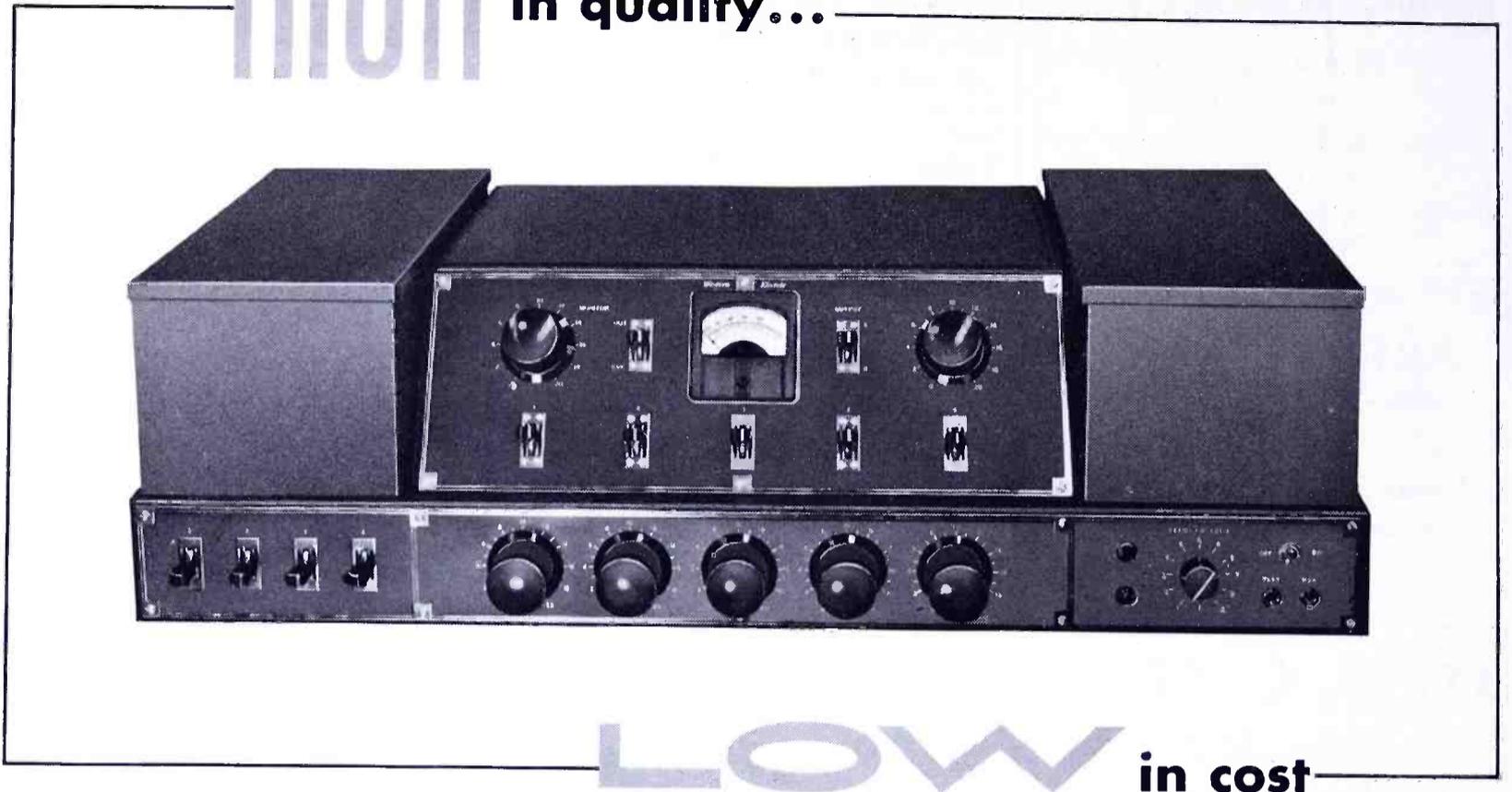
INCORPORATED

Manufacturers of:  
Television Test Equipment  
Laboratory Instruments  
Electronic Devices

14 Maple Avenue Pine Brook, N. J.  
Tel. Caldwell 6-3710

# HIGH

in quality...



# LOW

in cost

## 23C SPEECH INPUT EQUIPMENT for AM and FM Stations

**H**ERE is a complete, compact, high-quality Amplifier and Control Assembly—available at minimum cost!

The Western Electric 23C Speech Input Equipment serves either one or two studio layouts, in either AM or FM stations—can be used as part of a larger system, with outputs switched in a master control room.

The 23C incorporates four microphone input circuits with pre-mixing amplifiers and one input circuit for incoming program lines—all combined in a 5-channel mixer. Three-stage amplifier boosts signals to level needed for outgoing program lines or output switching systems. Also includes independent monitoring amplifier.

The 23C will handle 8 studio microphones or low-output-level transcription turntables; 4 remote lines or other medium-level inputs; control room announce and talkback mike. Controls are conveniently arranged, easily operated.

Get the full facts on the 23C from your local Graybar Broadcast Representative—or write Graybar Electric Company, 420 Lexington Avenue, New York 17, N. Y.



DISTRIBUTORS: IN THE U. S. A.—Graybar Electric Company. IN CANADA AND NEW-FOUNDLAND—Northern Electric Co., Ltd.

—QUALITY COUNTS—

# Western Electric

FM AND TELEVISION

# MOBILE RADIO

FAST BECOMING THE MOST IMPORTANT APPLICATION OF FM, IT IS ALSO THE GENESIS OF THE LONG-DISTANCE FM PHONE AND TELEVISION RELAY SYSTEMS

By MILTON B. SLEEPER

Twenty years ago, use of the long-distance telephone was looked upon in business and private life as an emergency service, and even then invoked only after inquiry as to rates and probable time required to complete the connection. Today, crowding each waking hour to make it produce more profit or accomplishment, we have become a nation of long-distance talkers, indifferent to the cost, expecting the calls to be completed as quickly as those to our next-door neighbors.

Up to now, we have considered mobile radio as an emergency service, limited to the use of police and others concerned with the protection of life and property. But in the next ten years, we shall come to use mobile radio without thought of distinction between wire-line and wire-less service.

The turning point in the use of mobile radio was, of course, the release of new rules and frequency allocations by the FCC, on May 6, 1949. These allocations provide 616 channels for mobile services between 25 and 460 mc., plus bands totalling 7,940 mc., in width between 1,850 and 30,000 mc. for non-government fixed, mobile and operational fixed transmitters.

When equipment is developed for the upper frequencies, these bands will permit unlimited extension of telephone service to all the people of our Country, wherever they may live, work, or travel. It is no exaggeration to say that the expansion of mobile radio from this time forward will be comparable to that of the wire telephone following the invention of the vacuum tube.

To mark this turning point, this entire issue of *FM-TV* has been devoted to subjects concerned with mobile radio. If we have disappointed readers whose special interests are concerned with other subjects, may we say that everyone engaged in manufacturing, operation, sales, and service should follow mobile radio developments closely, for it will be a close com-

petitor to audio and video broadcasting, both as to volume of sales and personnel employed.

Our Directory of Mobile Radio Systems is not only an important service to communications engineers, operators, and supervisors. It is also a picture of the present dimensions of this field.

Within the next year, the number of systems may well increase by 50%, and the number of mobile units by an even larger amount. To bring our July, 1948 Directory up to date for publication in this issue, 1170 additions and changes were required. We also recorded over 1,250 pending applications, to which we are currently adding nearly 100 each week. These will appear in subsequent Directories, after the licenses have been granted.

The July Directory covers only one-half of the total systems. The other classifications, including taxis and public utilities, are listed each January.

Why does *FM-TV* devote so much space to mobile radio? It is because mobile radio is FM. Audio broadcasting was a highly developed service before FM was ever invented, but mobile radio actually started with the demonstrated success of the statewide FM system put into operation by the Connecticut State Police in 1940. Since that time, FM has come into exclusive use for all new installations, and the relatively few AM systems have been almost entirely replaced with FM.

Meanwhile, a by-product of that FM development is growing into a major contribution to other communications services. First, FM repeaters were used to extend the range of mobile radio installations. Then followed the wartime use of multiplexed FM relays. And now, with the Telephone Company's FM relay between New York and Boston exceeding the capabilities of coaxial cable, it is safe to predict that, when television is networked coast-to-coast, the signals will be carried by elaborated versions of equipment that had its beginning in the mobile radio service!

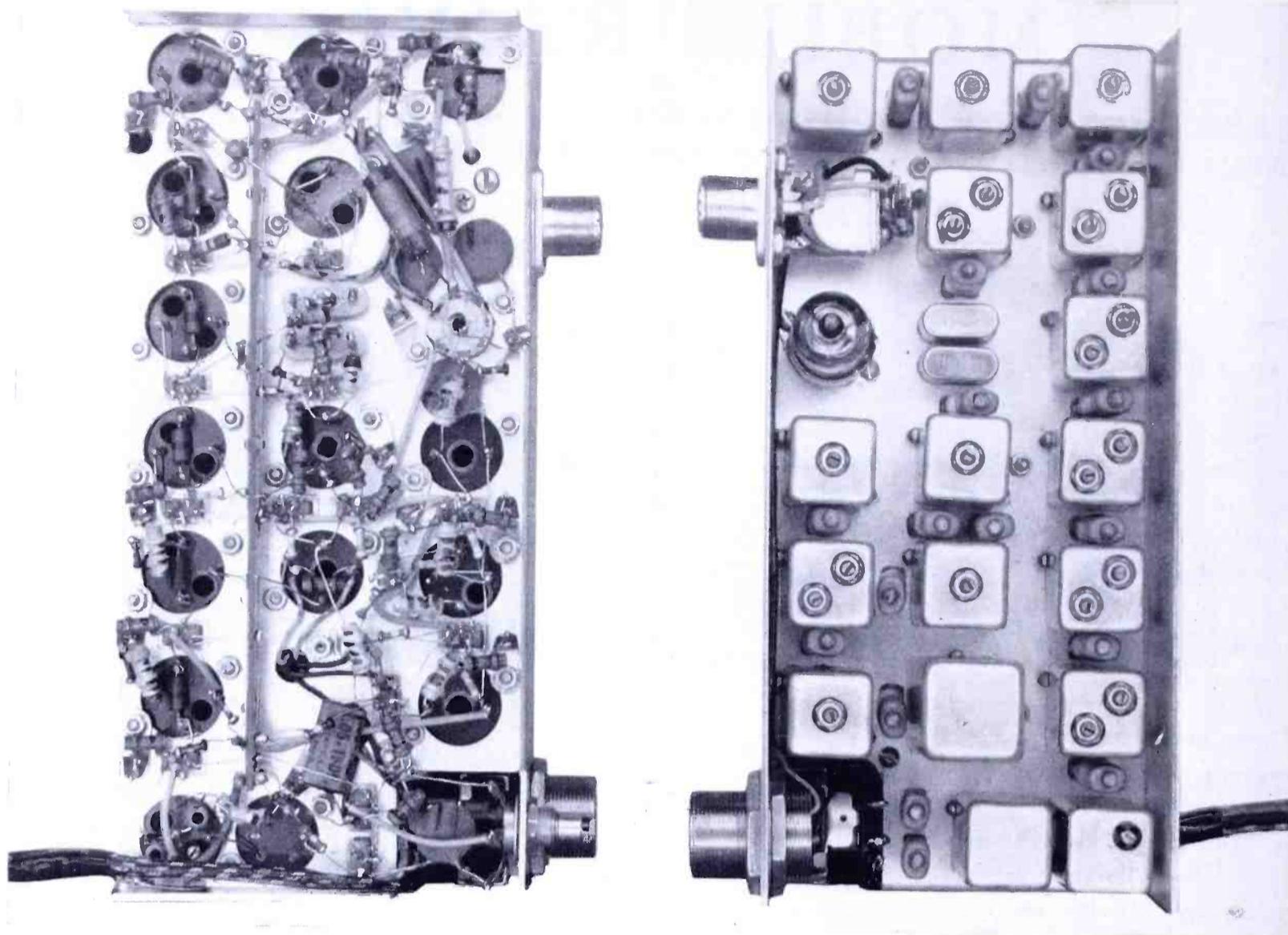


Fig. 2. This panel carries all the components of the transmitter and receiver. Connectors are for the antenna and handset

## PORTABLE FM EQUIPMENT

HAND-CARRIED UNITS, WEIGHING UNDER 10 POUNDS, OPERATE ON 25 TO 50 OR 152 TO 165 MC. OVER DISTANCE UPWARD OF 2 MILES—By HOWARD V. CARLSON\*

EVER since the wartime development of highly efficient, hand-carried radio telephone equipment, there has been a growing demand for similar units by the various communications services. Unfortunately, military designs are so highly specialized that they do not meet civilian requirements adequately.

The light-weight FM transmitter-receiver illustrated here is specifically a peace-time development. It provides solid telephone communications up to 2 miles and more on level ground, under severe noise conditions such as are encountered in railroad yards. When one unit is used on the ground and another in an airplane at 2,500 ft., satisfactory operation has been obtained at 60 miles.

There are two models to cover the frequencies assigned to the emergency and industrial services. The PJZ-1A op-



Fig. 1. Ten-pound, self-powered portable

erates on any fixed frequency between 25 and 50 mc., while the PJZ-11 is for the band from 152 to 165 mc. Either model can be used to communicate with fixed or mobile stations of any make designed for FM on the same channels.

Fig. 1 shows the PJZ-1A, identified by the collapsible antenna. The PJZ-11 has a fixed antenna rod, similar to those used for mobile installations on the upper band.

Either storage cells or dry batteries can be used to furnish power. In the former case, two 2-volt non-spillable cells are operated in parallel to drive a vibrator B supply. They will give 10 hours of continuous reception, or approximately 8 hours with the normal amount of transmitting. The batteries can be recharged from 6 volts DC, or from a 110-volt charger. It is not necessary to remove the batteries while charging, as they are vented to the outside of the case, and

\*Doolittle Radio, Inc., 7421 S. Loomis Blvd., Chicago 36, Ill.

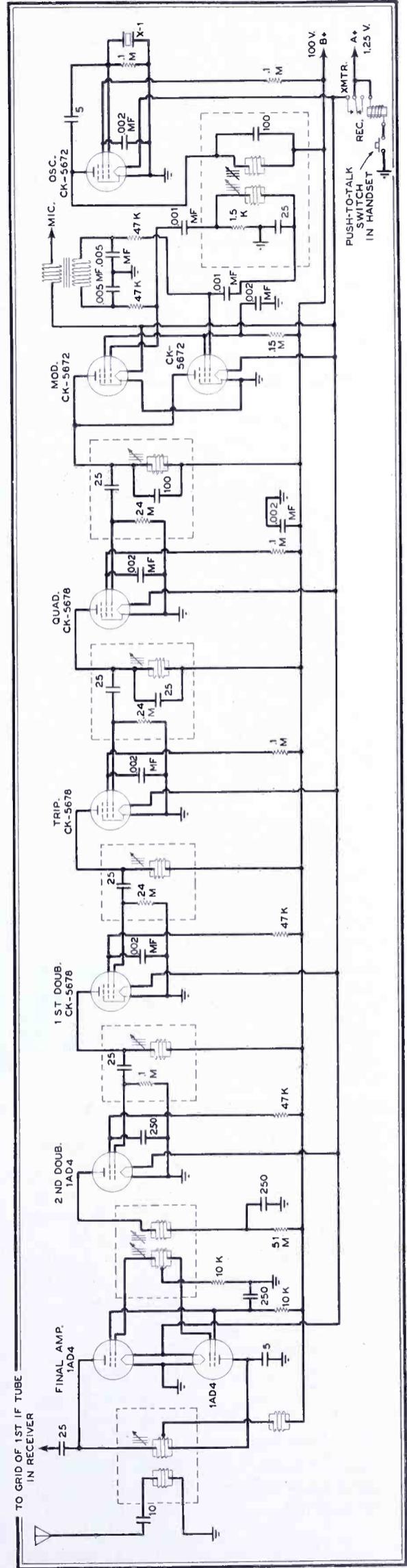
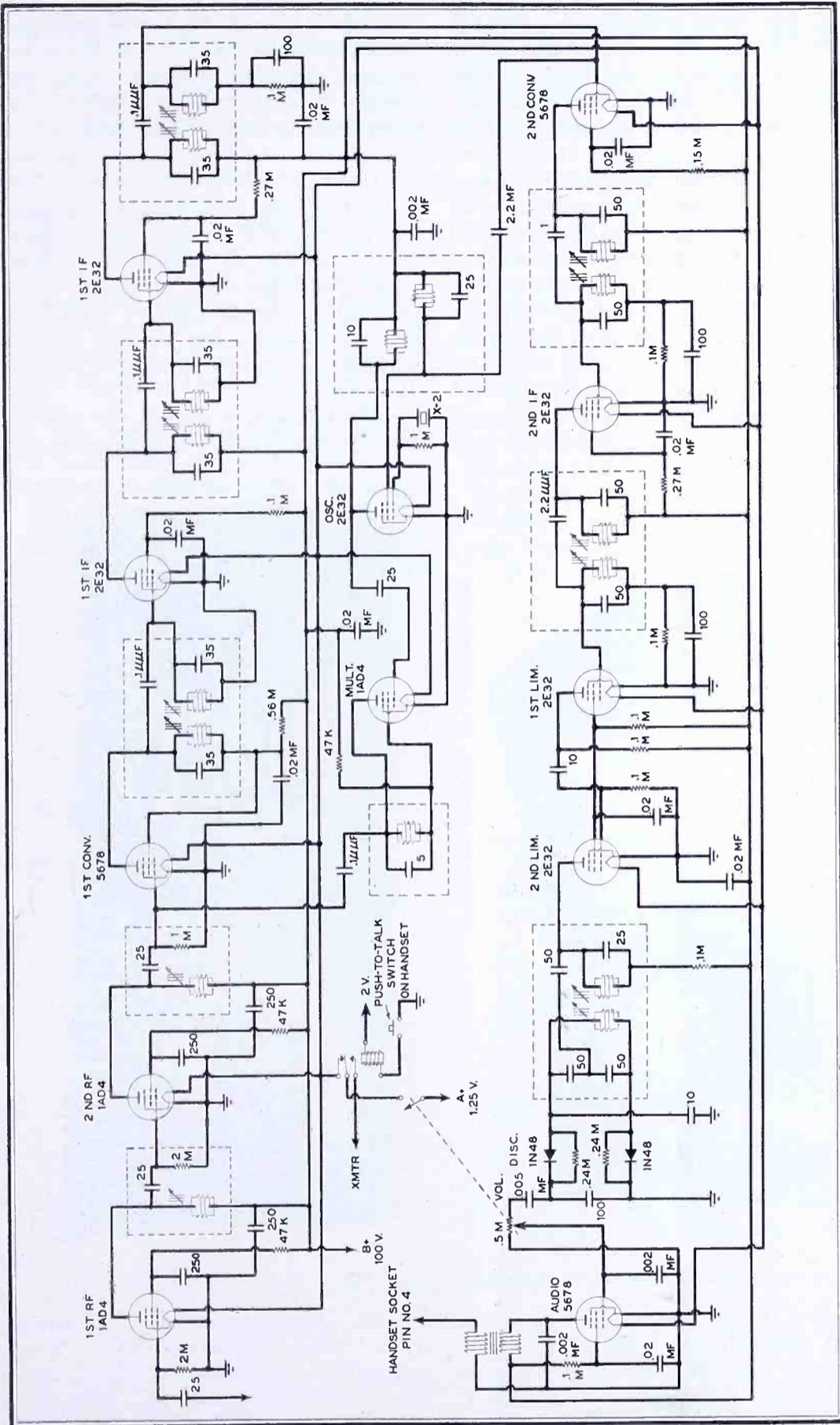


Fig. 5. Receiver circuit for 152 to 165 mc. Fig. 6. The corresponding transmitter

an external connection is provided for plugging in the charger.

Fig. 3 shows the mechanical arrangement of the battery and vibrator.

When dry cells are used, the weight is the same as for storage batteries. Nine 1½-volt batteries and six of the 45-volt type are required. The cost figures about 25 cents per hour. Fig. 4 shows the arrangement of the A cells and the terminal board. Four B batteries that fit on top have been removed.

It might appear that the design of

such a unit would be rather simple, but the conditions of operation and use for hand-carried equipment create mechanical and electrical problems that are far more difficult to resolve than those encountered in the design of mobile types, for example, where limitations of size and weight are less severe.

Overall dimensions of the case are only 8 ins. high, 8 ins. wide, and 3½ ins. thick. The relative size can be judged by comparison with the standard handset, in Fig. 1. This degree of compact-

ness has been made possible by the use of sub-miniature tubes throughout in the version for 152 to 165 mc., and only one miniature tube in the 25- to 50-mc. model. The former has 21 sub-miniature tubes of only 4 types, while the latter has 19 tubes of 3 types. Life expectancy of these tubes is rated at 5,000 hours, except for the 1AD4. It has just come into commercial use, but its life should be about the same as the others. Following is the list of types and their functions:

25 to 50 MC. RECEIVER	152 TO 165 MC. RECEIVER
2E32 Osc. Mult.	2E32 Osc. Mult.
5678 1st RF	1AD4 Quad.
5678 2nd RF	1AD4 1st RF
2E32 1st Mixer	1AD4 2nd RF

employ a double-conversion superheterodyne circuit. The receiver diagram in Fig. 5 is for the 152- to 165-mc. design. Sensitivity is 1 microvolt for 20-db quieting, with spurious responses down to 60-db. Selectivity is 60 db at 60 kc. removed from the operating frequency, and 85 db at 120 kc. The output of 10 milliwatts is sufficient to drive a small speaker or a conventional handset.

The transmitter meets all the requirements of the new FCC rules for power under 3 watts. Stability is well within the permissible tolerance of .01%, and the modulation capability is plus and minus 15 kc.

All components of the transmitter and

antenna, so other types can be substituted for special purposes. A simple way to increase the range of the standard antenna is to connect a 6-ft. length of wire to the case, and let it hang down.

Several items of auxiliary equipment are available for use with this unit. The metal case has been designed to give ample protection against all outdoor weather conditions. However, a fabric carrying case and shoulder strap or back pack harness can be supplied. Hand or throat microphone can be used with a separate push-to-talk switch and an ear-piece receiver.

FCC regulations permit the use of these portable units on frequencies al-

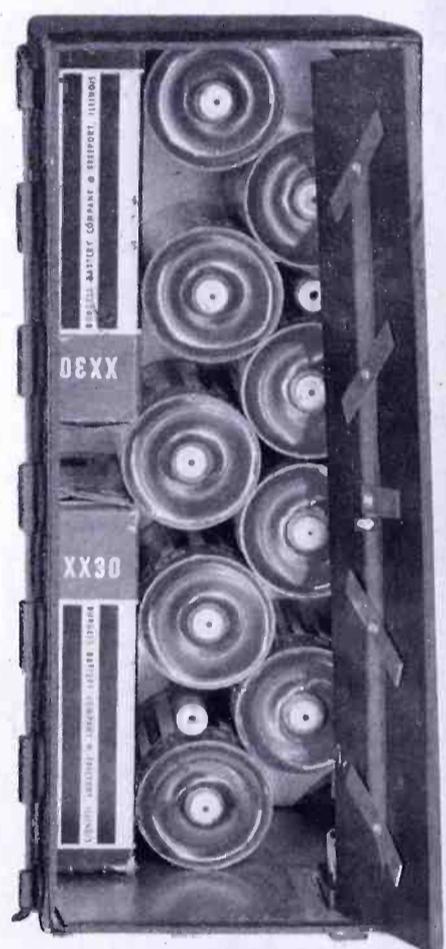


Fig. 3. The hinged case gives access to the two storage batteries and vibrator power supply. Fig. 4. Alternate dry-cell power

2E32 1st IF	5678 1st Mixer
2E32 2nd Mixer	2E32 1st IF
2E32 2nd IF	2E32 2nd IF
2E32 1st Limiter	5678 2nd Mixer
2E32 2nd Limiter	2E32 3rd IF
2E32 1st Audio	2E32 1st Limiter
2E32 Output	2E32 2nd Limiter
	2E32 Output
TRANSMITTER	
5672 or 2E32 Osc.	5672 Osc.
2E32 Mod.	5672 Mod.
2E32 Mod.	5672 Mod.
2E32 Quad.	5678 Quad.
2E32 Doubler	5678 Tripler
2E32 Doubler	5678 Doubler
2E32 or 5678 Doubler	1AD4 Doubler
3V4 Final	1AD4 Final
	1AD4 Final

As the tube lists indicate, the receivers

receiver circuits are mounted on a vertical panel directly beneath the top of the case. This arrangement can be seen in Fig. 2. When service is necessary, the complete assembly can be removed from the case. It should be noted that anyone acquainted with FM circuits can make the simple adjustments on the radio circuits. Factory service should not be necessary at any time.

To that end, all tuned circuits are compensated for operation at ambient temperatures from  $-25^{\circ}$  to  $+125^{\circ}$ F. to assure frequency stability. The condensers are either ceramics or oil-filled types, operated at a small percentage of their rated capacity. Even the vibrator, rated at 6 watts, operates at only 2 watts.

An Amphenol fitting is used for the

located to mobile transmitters. In addition, special frequencies have been assigned for transmitters of not more than 3 watts input to the final RF stage, for low-power industrial radio service. The exclusive channels are 27.51, 33.14, 35.02, and 42.98 mc., with 154.57 available on a shared basis.

Authorization may be granted to any person engaged in a commercial activity, or an industrial enterprise. Emission must be confined to voice radiotelephony, and must not be used to communicate with stations operating on other frequencies. It is further specified that the antenna must not be more than 3 ft. from the transmitter, the antenna power gain must not be greater than unity, and the use of remote control is prohibited.

# OPERATOR LICENSE REQUIREMENTS

## OFFICIAL EXPLANATION OF THE FCC LICENSE REQUIREMENTS FOR OPERATORS RESPONSIBLE FOR OPERATION AND MAINTENANCE OF MOBILE RADIO SYSTEMS

### FOREWORD

THE number of mobile radio systems is growing much faster than the number of men qualified to operate and maintain them. This has become a serious problem to the radio manufacturers, since each new installation sold calls for the services of a licensed operator.

Also, because the FCC permits unlicensed operators to use mobile radio equipment, there has been a tendency to discount the need of engaging a licensed operator to assume full responsibility for the *adjustment* and *maintenance* of the equipment.

Because, to those not familiar with the complexities of FCC regulations, the book of Rules is highly confusing, we asked George Rollins at FCC headquarters for a simple statement on operator license requirements. In reply, we received the following official information over the signature of T. J. Slowie, Secretary of the FCC:

FEDERAL COMMUNICATIONS COMMISSION  
WASHINGTON 25, D. C.

May 24, 1949

Editor, *FM-TV Magazine*  
Great Barrington, Mass.

Dear Sir:

This is in reply to your letter of April 25, 1949, addressed to Mr. George K. Rollins in the Bureau of Engineering of this Commission, in which you request certain information for publication in *FM-TV Magazine* regarding the operator requirements for the normal operation and servicing of mobile radio communication equipment.

As an introductory remark, it may be pointed out that any station normally transmitting telegraphy by any type of the Morse Code must be operated, during such transmissions, by the holder of an appropriate grade of radiotelegraph operator license or permit. It is presumed, however, that your inquiry relates to stations in the land mobile services which normally transmit telephony, and the balance of this discussion will have reference only to such stations.

Under the provisions of Section 318 of the Communications Act of 1934, as amended, the actual operation of all transmitting apparatus in any radio station for which a station license is required by that Act shall be carried on only by a person holding an operator's license issued in accordance with the Act, and no person shall operate any such

apparatus in such station except under and in accordance with an operator's license issued to him by the Commission; however, the Commission is authorized, under certain conditions, to waive the above requirement to the extent that public interest, convenience, or necessity would be served thereby.

The duties of a radio operator, with respect to any licensed station, include not only the handling of communications, the manipulation of on-off controls, and the keeping of station logs (if required) but also, in a larger sense, the performance of any technical duties with respect to that station which may affect the proper operation of the station and its compliance with the terms of its license and with the Commission's Rules and Regulations. By reference to Sections 13.61 and 13.62 of the Commission's Rules Governing Commercial Radio Operators,<sup>1</sup> it will be seen that, with respect to fixed, land, base, and mobile radiotelephone stations in the land mobile services, only the holders of radiotelephone or radiotelegraph first- or second-class operator licenses are authorized to perform all the above functions. As a condition to the authorization of holders of Restricted Radiotelephone or Radiotelegraph Permits to perform a portion of those duties, Section 13.61 specifies that:

1. Such operator is prohibited from making any adjustments that may result in improper transmitter operation; and
2. The equipment must be so designed that none of the operations necessary to be performed during the course of normal rendition of service may cause off-frequency operation or result in any unauthorized radiation; and
3. Any needed adjustments of the transmitter that may affect the proper operation of the station must be regularly made by or in the presence of an operator holding a first- or second-class license, either radiotelephone or radiotelegraph, who shall be responsible for the proper operation of the equipment.

Commission Order No. 133 and the various Parts of the Commission's Rules and Regulations which govern the land mobile services provide that certain classifications of stations in these services, particularly mobile stations operating on frequencies above 30 mc., may be operated during the course of normal

<sup>1</sup>Obtainable from the U. S. Government Printing Office, Washington 25, D. C. The price is 5c. Do not send stamps.

rendition of service by individuals, authorized to do so by the station licensee, who hold no radio operator license of any class, but that the same conditions apply to such operation as would apply if the stations were operated by holders of Restricted Radiotelephone or Radiotelegraph Permits. It follows, therefore, that regardless of whether a given station may be operated during the course of normal rendition of service by an unlicensed individual or whether the holder of at least a Restricted Permit is required to perform those functions, in either case any tests or adjustments coincident with the installation, service, repair, or maintenance of the transmitting apparatus must be performed by or under the immediate supervision and responsibility of the holder of a valid first- or second-class radiotelephone or radiotelegraph operator license.

In the case of a station licensee who does not have in his employ on a full-time, regular basis an operator holding a license valid for the unlimited performance of all operating duties at that station, such an operator must be available to perform those duties which only he is authorized to perform, or the station must be shut down until such an operator can be obtained, whenever conditions require any adjustments, repairs, or maintenance which might affect the proper operation of the station. It may be emphasized that the independent serviceman who may be on call or under contract to perform installation, repair, service, or maintenance duties may not perform adjustments or tests that might affect the proper operation of the station unless he holds at least a second-class radiotelephone or radiotelegraph operator license, or unless he performs those duties under the immediate supervision and responsibility of an operator holding such license. The mere fact that an operator holding this grade of license is employed by the station licensee is not sufficient; at least one such operator must be responsible for any transmitter adjustments and tests during or coincident with the installation, servicing, and maintenance of any radio station which may affect the proper operation of that station, and such properly-licensed operator must either perform those duties or they must be performed under his immediate supervision and responsibility. It is the sense of this requirement that the responsible licensed operator

(Concluded on page 45)

*What the New FCC Allocations and Rules Mean to the*

# RADIO COMMUNICATIONS SERVICES

A QUICK-REFERENCE GUIDE TO THE FREQUENCY ASSIGNMENTS AND TECHNICAL REQUIREMENTS FOR THE VARIOUS CLASSES OF MOBILE RADIO SERVICE—Part 2

**PUBLIC SAFETY RADIO SERVICE**  
(Docket 9001, Part 10)

**POLICE RADIO SERVICE**

Types of stations in the police radio service include base and mobile, mobile relay, control, repeater, and zone and interzone stations. In addition, subject to certain limitations, installations may be made in vehicles, which, in an emergency, would require the co-operation of the police, such as fire department vehicles, ambulance, emergency units of public utilities, life-guard emergency units, and rural school buses.

**Frequency Assignments:**

Available frequencies are listed in the accompanying table, subject to qualifications set forth in the footnotes.

**Technical Information:**

**EMISSION LIMITATIONS:** Bandwidth for AM telegraph is .1 kc.; for AM phone, 8 kc.; for FM phone 40 kc. The specified band shall contain those frequencies upon which a total of 99% of the radiated power appears, extended to include any discrete frequency upon which the power is at least .25% of the total radiated power. Radiation in excess of these limits is considered unauthorized emission. Any emission appearing on any frequency removed from the carrier frequency by at least 50%, but not more than 100% of the maximum authorized bandwidth shall be attenuated not less than 25 db below the unmodulated carrier. Spurious or harmonic emission appearing on any frequency removed from the carrier frequency by at least 100% of the maximum authorized bandwidth shall be attenuated below the unmodulated carrier by not less than:

- 40 db with maximum plate power input to the final RF stage of 3 watts or less
- 60 db with more than 3 watts and including 150 watts
- 70 db with more than 150 watts and including 600 watts
- 80 db with more than 600 watts.

**MODULATION:** AM or FM phone or tone-signal modulation is authorized, with a maximum modulation of 3,000 cycles. On FM, deviation due to modulation must not exceed plus or minus 15 ks. from the unmodulated carrier.

Each transmitter authorized or installed after July 1, 1950, must be provided with a device which will automati-

**POLICE RADIO FREQUENCIES**

FREQ.	CLASS	NOTES	FREQ.	CLASS	NOTES	FREQ.	CLASS	NOTES
1610	Kc. Base, Mob.	6, 7, 12	39.26	Mobile		45.18	"	
1618	"	"	39.30	Mobile		45.22	"	
1626	"	"	39.34	"		45.26	Mobile	
1634	"	"	39.38	"		45.30	"	
1642	"	"	39.42	Base, Mob.		45.34	"	
1650	"	7, 12	39.46	"		45.38	"	
1658	"	"	39.50	"		45.42	Base, Mob.	
1666	"	"	39.54	"		45.46	"	
1674	"	"	39.58	"		45.50	"	
1682	"	"	39.62	"		45.54	"	
1690	"	6, 7, 12	39.66	Mobile		45.58	"	
1698	"	"	39.70	"		45.62	"	
1706	"	"	39.74	"		45.66	"	
1714	"	7, 12	39.78	"		45.70	"	
1722	"	"	39.82	Base, Mob.		45.74	Mobile	
1730	"	"	39.86	"		45.78	"	
2326	"	6, 7, 12	39.90	"		45.82	"	
2366	"	"	39.94	"		45.86	"	
2382	"	7, 12	39.98	"		45.90	Base, Mob.	
2390	"	6, 7, 12	42.02	"	7, 8	45.94	"	
2406	"	7, 12	42.06	"	"	45.98	"	
2414	"	"	42.10	"	"	46.02	"	
2422	"	"	42.14	"	"	72.02 to		
2430	"	"	42.18	Mobile	"	74.58	Op. Fixed	2
2442	"	"	42.22	"	"	75.42 to		
2450	"	"	42.26	"	"	75.98	"	"
2458	"	"	42.30	"	"	154.65	Mobile	
2466	"	"	42.34	Base, Mob.	"	154.71	"	
2474	"	"	42.38	"	"	154.77	"	
2482	"	"	42.42	"	"	154.83	"	
2490	"	"	42.46	"	"	154.89	Mobile	
2804	Zone, Int'zone	9, 12,	42.50	"	"	154.95	"	
2808	"	"	42.54	"	"	155.01	Base, Mob.	
2812	"	"	42.58	"	"	155.07	"	
5135	"	"	42.62	"	"	155.13	"	
5140	"	"	42.66	Mobile	"	155.19	"	
5195	"	9, 10, 12	42.70	"	"	155.25	"	
7480	"	9, 11, 12	42.74	"	"	155.31	"	
7805	"	"	42.78	"	"	155.37	"	
7935	"	"	42.82	Base, Mob.	"	155.43	"	
37.02	Mc. Mobile		42.86	"	"	155.49	"	
37.06	Base, Mob.		42.90	"	"	155.55	"	
37.10	"		42.94	"	7, 8	155.61	"	
37.14	"		44.62	"	"	155.67	"	
37.18	"		44.66	"	"	155.73	"	
37.22	"		44.70	"	"	155.79	"	
37.26	"		44.74	"	"	155.85	Mobile	
37.30	"		44.78	Mobile	"	155.91	"	
37.34	Mobile		44.82	"	"	155.97	"	
37.38	"		44.86	"	"	156.03	"	
37.42	"		44.90	"	7, 8	156.09	"	
39.02	Base, Mob.		44.94	Base, Mob.	"	156.15	"	
39.06	"		44.98	"	"	156.21	Base, Mob.	
39.10	"		45.02	"	"	156.27	"	5
39.14	"		45.06	"	"	156.33	"	"
39.18	"		45.10	"	"	156.39	"	"
39.22	"		45.14	"	"	156.45	"	"

156.51	"	"	159.51 to	3500 to	
156.57	"	"	161.79	4 3700 Base, Mob.	"
156.63	"	"	454.05 to	6425 to	
156.69	"	"	455.95	1 6575	"
156.75	"	"	952 to	6575 to	
158.73	"	"	960 Op. Fixed	6875 Op. Fixed	"
158.79	"	"	1850 to	11700 to	
158.85	"	"	1990	12200 Base, Mob.	"
158.91 Mobile			2110 to	12200 to	
158.97	"	"	2200	12700 Op. Fixed	"
159.03	"	"	2450 to	16600 to	
159.09 Base, Mob.			2500 Base, Mob.	18000	"
159.15	"	"	Op. Fixed	1, 2 26000 to	"
159.21	"	"	2500 to	30000	"
			2700 Op. Fixed	1	

cally prevent modulation in excess of that specified above, except that this shall not apply to mobile transmitters using a maximum plate power input to the final RF stage of 3 watts or less.

**FREQUENCY STABILITY:** Frequency tolerance of the carrier frequency must be maintained at .01% below 50 mc., and .005% from 50 to 220 mc. Stability above 220 mc, will be specified in the FCC authorization.

For transmitters with a maximum plate power input to the final RF stage of 3 watts or less, the frequency tolerance required is .02% below 50 mc., and .01% from 50 to 220 mc. Stability above 220 mc. will be specified in the FCC authorization.

**MAXIMUM POWER:** Maximum plate power input to the final RF stage shall not exceed 2 kw. at 1.6 to 3 mc.; 500

<sup>1</sup> Limited to developmental operation only with the assigned frequency and particulars of operation specified in each authorization.

<sup>2</sup> Subject to no protection from interference due to the operation of industrial, scientific, and medical devices in this band.

<sup>3</sup> Assignable frequencies spaced by 40 kc. beginning with the frequencies 72.02 and 75.42 mc. and ending with the frequencies 74.58 and 75.98 mc. respectively, are available on a shared basis to operational fixed stations in the police radio service on the condition that no harmful interference will be caused to the reception of television stations on Channels 4 or 5.

<sup>4</sup> Assignable frequencies spaced by 60 kc. beginning with the frequency 159.51 mc. and ending with the frequency 161.79 mc. are available on a shared basis to base and mobile stations in the police radio service upon an adequate showing of need and upon the condition that no harmful interference will be caused to the service of any existing or future station operating in the railroad radio service.

<sup>5</sup> The use of this frequency may be authorized to base and mobile stations in the police radio service on the condition that no harmful interference will be caused to the maritime mobile service.

Police operations at points within 150 miles of coastal areas and navigable gulfs, bays, rivers and lakes may be authorized only after a factual finding indicates that, on an engineering basis, no

watts at 25 to 100 mc.; and 600 watts at 100 to 220 mc. Power at frequencies above 220 mc. will be specified in the FCC authorization. Stations presently authorized to use power in excess of the limits specified above may continue their operation until the expiration of their current license term. Power and antenna height shall be no more than the minimum required for satisfactory technical operation commensurate with the area to be served and local conditions which affect transmission and reception.

**TRANSMITTER MEASUREMENTS:** Frequency and modulation measurements on each fixed and mobile unit must be made and entered in the log every 6 months, or whenever an adjustment is made that might affect frequency or modulation. Mobile units may be checked on the bench if they are oper-

harmful interference will be caused to the maritime mobile service.

<sup>6</sup> The use of this frequency is subject to the condition that no harmful interference will be caused to the service of any Canadian station.

<sup>7</sup> This frequency is available for assignment only in accordance with a geographical assignment plan.

<sup>8</sup> This frequency is reserved primarily for assignment to state police licensees. Assignment to other police licensees will be made only where the frequency is required for coordinated operation with the state police system to which the frequency is assigned. Any request for such assignment must be supported by a statement from the state police system concerned, indicating that the assignment is necessary for coordination of police activities.

<sup>9</sup> This frequency is available for assignment to zone and interzone stations in the police radio service for use with type A1 emission only and a maximum plate input power of 1,000 watts to the final radio frequency stage of the transmitter.

<sup>10</sup> This frequency is authorized for use as a calling frequency; however, the transmission of operating signals or a single short radio telegram is permissible provided no harmful interference will be caused to any calling signals.

<sup>11</sup> This frequency may be used only during that period of time between 2 hours after local sunrise and 2 hours before local sunset.

<sup>12</sup> This frequency may be subject to change when the Atlantic City table of frequency allocations below 27.50 mc. comes into force.

ated under load conditions. The use of automatic frequency monitors is approved for frequency checking.

Any independent, qualified engineering measurement service may be employed, provided the log entries show the name and address of the firm, and the name of the person making the measurements.

**OPERATOR'S LICENSE:** While unlicensed persons may operate the transmitters, all adjustments or tests for installation, service, or maintenance "which may affect the proper operation of such a station, shall be made under the immediate supervision and responsibility of a person holding 1st or 2nd class commercial radio operator license, either radiotelephone or radiotelegraph, who shall be responsible for the proper functioning of the station equipment."

In the case of radiotelegraph stations, however, adjustments affecting the frequency must be made by a person holding a 1st or 2nd class commercial radiotelegraph operator license.

No person is required to be in attendance at a transmitter when operating in the course of normal service, or at transmitters used for telemetering or for self-actuated retransmission.

**CHECKING LIGHTS:** The licensee shall make a daily check of the tower lights "either by visual observation of the tower lights or by observation of an automatic indicator to insure that all such lights are functioning properly." Any observed failure of a code or rotating beacon light not corrected within 30 minutes must be reported immediately by telegraph or telephone to the nearest Airways Communication Station or CAA office regardless of the cause of the failure, and notice given immediately on resumption of illumination. Lights and light controls must be inspected at least once every three months.

In addition, at intervals not to exceed three months, the voltage must be measured at each socket under load. If that is not practicable, the voltage may be computed from measurements under load at some other point in the circuit.

Station records, which must be signed, dated, and retained for one year, are specified in detail in the Rules.

#### FIRE RADIO SERVICE

Fire department base stations are authorized to intercommunicate with mobile units on fire apparatus, with other stations in the public safety services, and with receivers at fixed locations. Relay stations will be authorized only where a showing is made that a fire radio system cannot function satisfactorily over necessary distances, or where, in an integrated system comprising two or more fire licensees, the number of nec-

#### FIRE RADIO FREQUENCIES

FREQ.	CLASS	NOTES	FREQ.	CLASS	NOTES	FREQ.	CLASS	NOTES
1630 kc.	Base, Mob.	7	33.74	"		46.14	"	
33.42 mc.	Mob., Fixed	6	33.78	"		46.18	"	
33.46	Mobile		33.82	"		46.22	Mobile	
33.50	"		33.86	"		46.26	"	
33.54	"		33.90	"		46.30	Mob., Fixed	6
33.58	"		33.94	"		46.34	Mobile	
33.62	"		33.98	"		46.38	Base, Mob.	
33.66	"		46.06	"		46.42	"	
33.70	Base Mob.		46.10	"		46.46	"	

essary frequencies can be reduced. Subject to certain limitations, mobile units may be installed in public utility and water department vehicles.

**Frequency Assignments:**

Available frequencies are listed in the accompanying table, subject to qualifications set forth in the footnotes.

**Technical Information:**

The same requirements apply to the fire radio service as are listed under Technical Information for the police radio service.

<sup>1</sup> Limited to developmental operation only with the assigned frequency and particulars of operation specified in each authorization.

<sup>2</sup> Subject to no protection from interference due to the operation of industrial, scientific, and medical devices in this band.

<sup>3</sup> Assignable frequencies spaced by 40 kc., beginning with the frequencies 72.02 and 75.42 mc. and ending with frequencies 74.58 and 75.98 mc., respectively, are available on a shared basis to operational fixed stations in the fire radio service on the condition that no harmful interference will be caused to the reception of television

46.50	"	154.37	"	2500 to		
72.02 to		154.43	"	2700	Op. Fixed	1
74.58	Op. Fixed	3 159.51 to		3500 to		
75.42 to		161.79	"	4 3700	Base, Mob.	1
75.98	"	3 166.25	"	5 6425 to		
153.77	Mobile	170.15	"	5 6575	"	1
153.83	Mob., Fixed	6 454.05 to		6575 to		
153.89	Mobile	455.95	"	1 6875	Op. Fixed	1
153.95	"	952 to		11700 to		
154.01	"	960	Op. Fixed	1 12200	Base, Mob.	1
154.07	"	1850 to		12200 to		
154.13	Base, Mob.	1990	"	1 12700	Op. Fixed	1
154.19	"	2110 to		16600 to		
154.25	"	2200	"	1 18000	"	1
154.31	"	2450 to	Base, Mob.	1, 2 26000 to		
		2500	Op. Fixed	30000	"	1

stations on Channels 4 or 5.

<sup>4</sup> Assignable frequencies spaced by 60 kc., beginning with the frequency 159.51 mc. and ending with the frequency 161.79 mc. are available on a shared basis to base and mobile stations in the fire radio service, upon an adequate showing of need and upon the condition that no harmful interference will be caused to the service of any existing or future station in the railroad radio service.

<sup>5</sup> This frequency may be assigned to stations in the fire radio service, only at points within 150 miles of New York, N. Y.

<sup>6</sup> The maximum plate power input to the final radio frequency stage of any transmitter authorized to operate on this frequency shall not exceed 3 watts.

<sup>7</sup> This frequency may be subject to change when the Atlantic City table of frequency allocations below 27.50 mc. comes into force.

**FORESTRY-CONSERVATION**

Forestry-conservation base stations are authorized to intercommunicate with mobile units in the same service, with other stations in the public safety services, and with receivers at fixed locations. Relay stations will be authorized only where a showing is made that a forestry-conservation radio system cannot function satisfactorily over necessary distances, or where, in an integrated system comprising two or more forestry-conservation licensees, the number of necessary frequencies can be reduced.

**Frequency Assignments:**

Available frequencies are listed in the accompanying table, subject to qualifications set forth in the footnotes.

**Technical Information:**

The same requirements apply to the forestry-conservation service as are listed under Technical Information for police radio service.

<sup>1</sup> Limited to developmental operation only with the assigned frequency and particulars of operation specified in each authorization.

<sup>2</sup> Subject to no protection from interference due to the operation of industrial, scientific, and medical devices in this band.

<sup>3</sup> Assignable frequencies spaced by 40 kc., beginning with the frequencies 72.02 and 75.42 mc. and ending with the frequencies 74.58 and 75.98 mc., respectively, are available on a shared basis to operational fixed stations in the Forestry-Conservation Radio Service on the condition that no harmful interference will be caused to the reception of television stations on Channels 4 or 5.

<sup>4</sup> Assignable frequencies spaced by 60 kc., beginning with the frequency 159.51 mc. and ending with the frequency 161.79 mc. are available on a shared basis to base and mobile stations in the Forestry-Conservation Radio Service upon an adequate showing of need and upon the condition that no harmful interference will be caused to the service of any existing or future station operating in the Railroad Radio Service.

**FORESTRY-CONSERVATION FREQUENCIES**

FREQ.	CLASS	NOTES	FREQ.	CLASS	NOTES	FREQ.	CLASS	NOTES
2212 kc.	Base, Mob.	6, 12	31.86	Base, Mob.	7, 9, 10	172.225	"	8, 10, 14
2226	"	6, 12	31.90	"	7, 9, 10	172.275	"	8, 10, 13
2236	"	6, 12	31.94	"	7, 9, 10	172.375	"	8, 10, 14
2244	"	6, 12	31.98	"	7, 9, 10	454.05 to		
30.86 mc.	"	11	46.54	"		455.95	"	1
30.90	"	11	46.58	"		952 to		
30.94	"	11	46.62	"		960	Op. Fixed	1
30.98	"	11	46.66	"		1850 to		
31.02	"	7, 9, 10, 11	46.70	"		1990	"	1
31.06	"	7, 9, 10, 11	46.74	"		2110 to		
31.10	"	7, 9, 10, 11	46.78	"		2220	"	1
31.14	"	7, 9, 10, 11	46.82	"		2450 to	Base, Mob.,	
31.18	"	7, 9, 10	72.02 to			2500	Op. Fixed	1, 2
31.22	"	7, 9, 10	74.58	Op. Fixed	3	2500 to		
31.26	"	7, 9, 10	75.42 to			2700	Op. Fixed	1
31.30	"	7, 9, 10	75.98	Op. Fixed	3	3500 to		
31.34	"	7, 9, 10	156.87	Base, Mob.	5	3700	Base, Mob.	1
31.38	"	7, 9, 10	156.93	"	5	6425 to		
31.42	"	7, 9, 10	159.27	"		6575	"	1
31.46	"	7, 9, 10	159.33	"		6575 to		
31.50	"	7, 9, 10	159.39	"		6875	Op. Fixed	1
31.54	"	7, 9, 10	159.45	"		11700 to		
31.58	"	7, 9, 10	159.51 to			12200	Base, Mob.	1
31.62	"	7, 9, 10	161.79	"	4	12200 to		
31.66	"	7, 9, 10	170.425	"	8, 10, 14	12700	Op. Fixed	1
31.70	"	7, 9, 10	170.475	"	8, 10, 13	16600 to		
31.74	"	7, 9, 10	170.575	"	8, 10, 14	18000	"	1
31.78	"	7, 9, 10	171.425	"	8, 10, 13	26000 to		
31.82	"	7, 9, 10	171.475	"	8, 10, 14	30000	"	1
			171.575	"	8, 10, 13			

that, on an engineering basis, no harmful interference will be caused to the Maritime Mobile Service.

<sup>8</sup> The use of this frequency is subject to the condition that no harmful interference will be caused to the service of any Canadian station.

<sup>9</sup> This frequency is available for assignment only in accordance with a geographical assignment plan.

<sup>10</sup> This frequency will be assigned only to licensees directly responsible for the prevention, detection, and suppression of forest fires, subject to the condition that no harmful interference will be caused to the service of any U. S. Government station.

<sup>11</sup> This frequency may be used for conservation activities upon the condition that no harmful interference will be caused to the service of any station using the frequency for forest fire prevention, detection and suppression.

tion, detection and suppression.

<sup>12</sup> This frequency is reserved primarily for assignment to state licensees. Assignments to other licensees will be made only where the frequency is required for coordinated operation with the state system to which the frequency is assigned. Any request for such assignment must be supported by a statement from the state system concerned, indicating that the assignment is necessary for coordination of activities.

<sup>13</sup> This frequency is shared with the Urban Transit Radio Service.

<sup>14</sup> This frequency may be subject to change when the Atlantic City table of frequency allocations below 27.50 Mc. comes into force.

<sup>15</sup> This frequency will be assigned for use only in areas east of the Mississippi River.

<sup>16</sup> This frequency will be assigned for use only in areas west of the Mississippi River.

## HIGHWAY MAINTENANCE

Highway maintenance base stations are authorized to intercommunicate with other fixed and mobile stations in the same service, with other stations in the public safety services, and with receivers at fixed locations. Relay stations will be authorized only where a showing is made that a highway maintenance radio system cannot function satisfactorily over necessary distances, or where, in an integrated system comprising two or more highway maintenance licensees, the number of necessary frequencies can be reduced. Subject to certain limitations, mobile units may be installed in vehicles of contractors or others having direct responsibility for maintenance, supervision, or operation of public highways.

### Frequency Assignments:

Except for systems licensed to states, assignments will be limited to the use of only one frequency per system. Available frequencies are listed in the accompanying table, subject to qualifications set forth in the footnotes:

### Technical Information:

The same requirements apply to the highway maintenance service as are listed under Technical Information for police radio service.

<sup>1</sup>Limited to developmental operation only with the assigned frequency and particulars of operation specified in each authorization.

## HIGHWAY MAINTENANCE FREQUENCIES

FREQ.	CLASS	NOTES	FREQ.	CLASS	NOTES	FREQ.	CLASS	NOTES
33.02	Base, Mob.	6	47.38	Base, Mob.	7, 8	2450 to	Base, Mob.	
33.06	"	6	72.02 to			2500	Op. Fixed	1, 2
33.10	"	6	74.58	Op. Fixed	3	2500 to		
37.90	"	6	75.42 to			2700	Op. Fixed	1
37.94	"	6	75.98	"	3	3500 to		
37.98	"	6	156.99	Base, Mob.	5	3700	Base, Mob.	1
46.86	"	7, 8	157.02	"	5	6425 to		
46.90	"	7, 8	157.11	"	5	6575	"	1
46.94	"	7, 8	157.41	"	5	6575 to		
46.98	"	7, 8	159.51 to			6875	Op. Fixed	1
47.02	"	7, 8	161.79	"	4	11700 to		
47.06	"	7, 8	454.05 to			12200	Base, Mob.	1
47.10	"	7, 8	455.95		1	12200 to		
47.14	"	7, 8	952 to			12700	Op. Fixed	1
47.18	"	7, 8	960	Op. Fixed	1	16600 to		
47.22	"	7, 8	1850 to			18000	"	1
47.26	"	7, 8	1990	"	1	26000 to		
47.30	"	7, 8	2110 to			30000	"	1
47.34	"	7, 8	2200	"	1			

<sup>2</sup> Subject to no protection from interference due to the operation of industrial, scientific, and medical devices in this band.

<sup>3</sup> Assignable frequencies spaced by 40 kc. beginning with the frequencies 72.02 and 75.42 mc., and ending with the frequencies 74.58 and 75.98 mc., respectively, are available on a shared basis to operational fixed stations in the highway maintenance radio service on the condition that no harmful interference will be caused to the reception of television stations on Channels 4 or 5.

<sup>4</sup> Assignable frequencies spaced by 60 kc. beginning with the frequency 159.51 mc., and ending with the frequency 161.79 mc., are available on a shared basis to base and mobile stations in the highway maintenance radio service upon an adequate showing of need and upon the condition that no harmful interference will be caused to the service of any existing or future station operating in the railroad radio service.

<sup>5</sup> The use of this frequency may be authorized to base and mobile stations in the highway main-

tenance radio service on the condition that no harmful interference will be caused to the maritime mobile service. Highway maintenance operations at points within 150 miles of coastal areas and navigable gulfs, bays, rivers, and lakes may be authorized only after a factual finding indicates that, on an engineering basis, no harmful interference will be caused to the maritime mobile service.

<sup>6</sup> This frequency is shared with the special emergency radio service.

<sup>7</sup> This frequency will be assigned only in accordance with a geographical assignment plan.

<sup>8</sup> This frequency is reserved primarily for assignment to highway maintenance systems operated by states. The use of this frequency by other highway maintenance licensees will be authorized only where such use is necessary to coordinate activities with the particular state to which the frequency is assigned. Any request for such use must be supported by a statement from the state concerned.

## SPECIAL EMERGENCY SERVICE

Special emergency stations are intended for use by persons having establishments in remote locations where other communications facilities are not available, relief agencies which have a disaster communications plan, physicians normally practicing in remote areas, ambulance services, beach patrols responsible for life saving, rural school buses and communications common carriers.

Special emergency base stations are authorized to intercommunicate with other fixed and mobile stations in the same service, with other stations in the public safety services, and with receivers at fixed locations. Transmission of non-emergency communications is strictly prohibited, except that common carriers may use communications for restoring temporarily a normal communications service disrupted as a result of an emergency.

### Frequency Assignments:

Operation of mobile system in the special emergency service is restricted to the use of only one frequency per system. Available frequencies are listed in the accompanying table, subject to qualifications set forth in the footnotes:

## SPECIAL EMERGENCY SERVICE

FREQ.	CLASS	NOTES	FREQ.	CLASS	NOTES	FREQ.	CLASS	NOTES
2726 kc.	Base, Mob.	9	75.42 to			2450 to	Base, Mob.	
3190	"	9	75.98	Op. Fixed	3	2500	Op. Fixed	1, 2
33.02 mc.	"	6	157.47	Base, Mob.	5, 8	2500 to		
33.06	"	6	159.51 to			2700	Op. Fixed	1
33.10	"	6	161.79	"	4	3500 to		
37.90	"	6	161.85	"	5, 8	3700	Base, Mob.	1
37.94	"	6	161.91	"	5, 8	6425 to		
37.98	"	7	161.97	"	5, 8	6575	"	1
47.42	"	7	454.05 to			6575 to		
47.46	"		455.95	"	1	6875	Op. Fixed	1
47.50	"		952 to			11700 to		
47.54	"		960	Op. Fixed	1	12200	Base, Mob.	1
47.58	"		1850 to			12200 to		
47.62	"		1990	"	1	12700	Op. Fixed	1
47.66	"		2110 to			16600 to		
72.02 to			2200	"	1	18000	"	1
74.58	Op. Fixed	3				26000 to		
						30000	"	1

### Technical Information:

The same requirements apply to the highway maintenance service as are listed under Technical Information for police radio service.

<sup>1</sup> Limited to developmental operation only with assigned frequency and particulars of operation specified in each authorization.

<sup>2</sup> Subject to no protection from interference due to the operation of industrial, scientific and medical devices in this band.

<sup>3</sup> Assignable frequencies spaced by 40 kc. beginning with the frequencies 72.02 and 75.42 mc., and ending with the frequencies 74.58 and 75.98 mc., respectively, are available on a shared basis to operational fixed stations in the special emergency radio service on the condition that no harmful interference will be caused to the reception of television stations on Channels 4 or 5.

<sup>4</sup> Assignable frequencies spaced by 60 kc. beginning with the frequency 159.51 mc. and ending with the frequency 161.79 mc. are available on a shared basis to base and mobile stations in the special emergency radio service upon an adequate showing of need and upon the condition that no harmful interference will be caused to the service

(Concluded on page 45)

# SPOT NEWS NOTES

## NOTES AND COMMENTS ABOUT SIGNIFICANT ACTIVITIES OF PEOPLE & COMPANIES



*"Don't look now, but I think that newest arrival was a State Trooper!"*

### **Gordon Gray:**

Newspaper publisher and pioneer broadcaster of Winston-Salem was confirmed unanimously by Senate on June 13 as Secretary of the Army. Even before his prewar FM station W41MM (now WMIT) was completed on Clingman's Peak, N. C., he shunned the short cuts and joined the Army as a private. At the end of the war, he had risen to the rank of Captain. So we shall have as Secretary of the Army a man who knows the Service from all angles, even the way it looks to a rookie.

### **This is Really Good:**

We've held forth at some length about the confusion caused by using the words "radio and television" as a means of differentiating between audio and video broadcasting. So we nearly slid off our chair when we heard this question on a quiz program: "If audio means radio, what does video mean?"

### **John Ballantyne:**

On June 10, John Ballantyne, chairman of the board of Philco Corporation, collapsed and died while delivering a commencement address at the Meadowbrook School for Boys. He was 49 years old. His son John William, age 13, was a member of the graduating class. Perhaps the most widely known figure among the retail radio trade, he joined the company in 1934 as treasurer, and served as president from 1943 to 1948.

### **Another C-R Tube Producer:**

Eitel-McCullough's new Salt Lake plant will be producing 16-in. metal TV tubes

before the end of this year. This announcement is of special interest because of Eimac's strong position in transmitter tubes, and their many contributions to tube design and manufacturing methods.

### **FM for Handi-Talkies:**

If the famous handie-talkie of World War 2 goes into battle again, it will be the new design, operating on FM.

### **RMA-IRE Fall Meeting:**

Will be held this year at Hotel Syracuse, Syracuse, N. Y., and not at Rochester, as in years past. Session will run from October 31 to November 2. Further information can be obtained from Virgil Graham, Chairman, Sylvania Electric Products, Inc., 40-20 Lawrence Street, Flushing, N. Y.

### **New FM-AM Set:**

General Electric has just announced a high-sensitivity, 6-tube set featuring the Armstrong limiter-discriminator.

### **Transit Radio Sponsors:**

In 11 months, Transit Radio has built its list of program sponsors to 355, including department stores and specialty shops which have not used AM time. Systems are already operating in 10 cities, with 5 more already under contract to start, and others in process of negotiation.

### **1950 Chicago Parts Show:**

Will eliminate all restrictions on attendance. Manufacturers selling through jobbers will be permitted to display their products in the exhibit hall, in display rooms, or in both places. Purpose is to increase volume of orders placed during the Show.

### **Commissioner Frieda B. Hennock:**

Speaking at the dedication of ILGWU's New York FM station WFDR: "People won't listen to FM merely because it has technical advantages over other media. The medium, after all, is but a tool. It must be used properly to attract the public."

### **Norman Wunderlich:**

There's nothing official, but we look to see him back in mobile communications again, now that the FCC allocations plan has opened the way for wide expansion.

### **More TV Set Production:**

About 80,000 square feet of space at RCA's Bloomington, Ind. factory is being converted to TV set manufacture.

When sets roll out in August this will be the third RCA plant producing TV receivers. Others are at Camden and Indianapolis.

### **Honorary Degree:**

In recognition of his achievements in the field of television, the degree of Doctor of Engineering was conferred on Dr. Allen B. Du Mont during the commencement exercises at Brooklyn Polytech on June 15.

### **Slow-Speed Records:**

As far as we've been able to observe, the introduction of 45-RPM records cancelled out public interest in long-playing discs by introducing an element of confusion. Net result, therefore, was only to hurt the sale of 78-RPM records and good radio-phonograph combinations.

### **\$350,000 FM Promotion:**

This sum will be spent by Zenith to launch the high-sensitivity, straight FM set described in detail by G. E. Gustafson in the April issue of *FM-TV*, and further discussed by Ted Leitzel in the May issue. National schedule includes \$100,000 in *Successful Farming*, *Capper's Farmer*, *Progressive Farmer*, *Ladies' Home Journal*, and *Saturday Evening Post*, backed by \$250,000 to be spent chiefly in newspapers across the Country.

### **New Sales Setup:**

Under a new arrangement, mobile radio equipment manufactured by West Coast Electronics Company, 1601 S. Burlington Avenue, Los Angeles, will be sold by its own dealer organization. Previously, all sales were handled by Mobile Communications Company. This concern will now act as a WCEC dealer.

### **FMA Policy:**

We are not impressed favorably by the Association's recent attack on the Chicago station that cut its hours of FM programming. Public interest, convenience, and necessity will be served much more effectively if FMA efforts are directed toward making converts rather than creating enemies. No one profits from winning an argument and losing a sale!

### **C-R Tube Development:**

Sylvania is setting up a new division to specialize in the design, engineering, and production of picture tubes at Seneca Falls, N. Y. General manager of the division will be W. H. Lamb. Production of C-R tubes will be continued at Ottawa, Ohio, and Emporium, Pa.

# JEREMIAH COURTNEY'S MOBILE RADIO NEWS and FORECASTS

**A**FTER four years of labor (pains to industry), the Federal Communications Commission has produced its final Rules and frequency assignments for all the land mobile radio services. With frequency revisions issuing at the rate of one a month ever since May, 1945, when the Commission adopted its Report of allocations above 25 mc., the mobile radio industry greeted the delivery of the final Rules with a sigh of relief.

Everyone interested in the new Rules has probably now obtained from the Superintendent of Documents a copy of the Federal Register of May 6, in which the various Parts were collected in definitive form. This month, we shall discuss the questions most frequently raised at the Commission concerning the interpretation of the new Rules.

### Public Safety Rules:

**When do we have to change frequencies to accord with the new frequency assignments that became effective July 1, 1949?**

Frequencies now in use by public safety services in the 152- to 162-mc. band that do not accord with the frequency assignments that became effective on July 1, 1949 may be continued in use until the expiration of a station's present license term.

Frequencies in the 72- to 76-mc. band used for mobile communications must be surrendered by June 14, 1953, five years following the effective date of the Commission Report in Docket No. 8487. Frequencies used in this band for fixed-circuit purposes may be continued until June 14, 1953, and thereafter if no interference is caused to television reception in the area of operation.

Frequencies used in the 30-mc. band that do not accord with the plan of assignments that became effective for that band on April 1, 1947 (FCC public notice 3529) may be continued until July 1, 1950, when frequencies must be changed to conform with the plan of April 1, 1947.

The situation in the medium band, 300

to 3,000 kc., is somewhat more complicated. These assignments are subject to determinations reached at the Fourth Inter-American Regional Radio Conference, which convened in Washington in April, 1949 and is still in session at this writing. This conference will determine the overall allocations for the North and South Americas, which will, of course, accord with the international allocations decided upon at the Atlantic City convention. After the Fourth Inter-American Regional Radio Conference has concluded its deliberations, FCC and IRAC will divide the bands between non-government and government assignments. Definitive allocations will thereafter be issued by the FCC, with appropriate time for readjustments.

Controlling factor in all frequency-shifting cases is the well-established principle that a station license, once issued, cannot thereafter be modified legally by the Commission unless a prior public hearing has been afforded to the licensee. This fundamental principle was established in the broadcast field by the Supreme Court in the case of *F.C.C. vs. National Broadcasting Co. (KOA)*, 319 U. S. 289. The reasoning of the KOA case is equally applicable to the non-broadcast field.

Since, presumably, the Commission does not wish to be bogged down with the countless hearings that would be necessary if each licensee now using a frequency not in accord with the present plan of assignments were called upon to change frequency at once, the Commission will undoubtedly permit all licensees to use presently-assigned frequencies until the expiration of their outstanding licenses. When the license renewal application is presented, however, the FCC in all cases will require a shift in frequency to accord with the presently-effective assignments.

There is also little doubt that the FCC would welcome a prior voluntary shift on the part of all those now using frequencies that do not accord with the new assignments. Such voluntary moves would appear to be indicated in the interest of better radio use on the part of all concerned. Cooperation within a par-

ticular industry or group of users is possible; cooperation with more than one industry or group of users has been found well-nigh impossible of prompt accomplishment. The licensee has the legal option, however, to move or not to move prior to the expiration of his present license.

### Industrial Radio Services:

**1. Are we eligible for a special Industrial Radio Service grant or not?**

Section 11.501 of the Industrial Radio Service Rules disqualified any person who is engaged in "activities of a service or distribution nature." As a considerable number of such persons had obtained experimental authorization, they are now concerned as to whether their activities fall within the proscribed character of the Rule. One example of the questions presented is that raised in the case of armored car fleets, which will probably be found to be excluded under the wording of Section 11.501. That does not mean that the equipment investment of these armored car licensees has been wiped out. They may continue to use their equipment by taking service from a common carrier or limited common carrier, but they will probably not be found eligible to operate their own private radio communications systems after November 1, 1949.

Another provision that is giving trouble is the requirement for otherwise-qualified special industrial applicants to use radio "within the yard area of a single plant." Many of our largest industrial concerns have separated plants which, functionally, represent a single plant area. Some slight physical separation may exist between plants, however, so that unless a reasonable interpretation is accorded this rule, very arbitrary and unreasonable results may be expected from its literal interpretation. If the Commission's Law Department does not adopt a common sense interpretation of the rule, the Commission itself should and probably will grant a waiver of the rule in such cases, upon appropriate request.

**2. May the 72- to 76-mc. operational fixed circuit band be used for communications as well as control-circuit purposes?**

Yes, provided no interference is caused to TV reception on the adjacent TV channels 4 and 5.

**3. What frequency limitations govern the various methods of extending the range of the 25- to 50-mc. and 152- to 162-mc. bands?**

The very large area coverage required for certain types of industrial operation, principally petroleum, presents a need for extending the communications range in these bands. This can be accom-

\*Courtney, Krieger, and Jorgensen, Washington 6, District of Columbia.

plished through the use of control and repeater stations or by mobile relay stations. In the industrial and land transportation radio services, however, the heavy communications needs of these users have required the Commission to ban, at least temporarily pending the submission of further information, mobile relay stations.

A mobile relay radio station is defined in the Public Safety Rules (where their use is permitted) as a base station established for the automatic retransmission of mobile service communications which originate on the transmitting frequency of the mobile stations and which are retransmitted on the receiving frequency of the mobile stations. Let us assume under that method of operation that point H represents the dispatching office located on level terrain, T indicates the mountaintop location of the mobile relay station, and M indicates the mobile unit which is out of range of H but within range of T. Under that setup, the control station at H would transmit to T on mobile service frequency A; the base station at T would automatically retransmit the communication to M on mobile service frequency B. Communications from the mobile unit to the headquarters office would be effected in reverse: M, using the same frequency as the control station at H, would transmit on mobile service frequency A, which would be received at T and retransmitted to H on mobile service frequency B.

It will be noted that under this system two land mobile service frequencies are required, and this is the precise reason why the Commission has banned mobile relay stations for industrial and land transportation users. The use of frequencies between 30 and 40 mc. for mobile relay purposes is not indicated because of the long-distance sky-wave skip characteristics of this band. Assignments between 152 and 162 mc. are limited because of the extreme shortage of frequencies in this band. The petroleum industry, for example, has only nine mobile frequencies in the 152- to 162-mc. band, shared with Forest Products users.

However, the extended communications range often necessary can be obtained by use of control and repeater stations operating either at 72 to 76 mc. or in the microwave bands. The objection to the use of the 72- to 76-mc. band is that it is extremely difficult to avoid interference with the adjacent TV channels, a necessary prerequisite to any fixed-circuit authorization in that band. The objection to microwave stations has been the high cost of equipment, but prices will probably come down.

Assuming, however, that a fixed circuit can be operated without adjacent channel TV interference, or that the opera-

tion involved will warrant the use of microwave equipment, the extended range required is obtained in the following manner. Using the letters of the above example again, the control station at H would transmit to the repeater station located at T on fixed-circuit frequency A (72 mc. or microwave frequency); T would transmit the communication to the out-of-range mobile unit M on mobile service frequency B. Reversing the communication, the mobile unit would transmit on the same mobile service frequency B to repeater station T; and T would then retransmit the mobile unit communication to the otherwise out-of-range headquarters office on fixed-circuit frequency C.

It will be noted that where communications systems involve the use of control and repeater stations, three frequencies are used as against the two used in the mobile relay operation. However, only one of the three frequencies employed in the control and repeater communications setup is a mobile service frequency, while both frequencies employed in the mobile relay system are mobile service frequencies. As of the moment, therefore, mobile relay operation is out for the power, petroleum, and other industrial radio users. In a great many areas this will force industrial users immediately, and many land transportation users later, into microwave-circuit utilization. The present expense factor will undoubtedly result in some protest on the part of the petroleum and power utilities to the mobile relay station proscription. It is expected that the FCC will give further consideration to this problem in the light of the presentations to be made by the petroleum and power utility industries.

#### Land Transportation Services:

**1. Does the first taxicab company to use the present frequencies on an experimental basis have any priority as against late-comers in the exclusive regular use of these frequencies?**

No. This is one case where possession is not nine points of the law. All frequencies in the safety and special services are assigned on a non-exclusive basis. The first user does not obtain any homestead rights. If the companies now using the present channel cannot agree on a move that will be in the interest of all concerned, every company that applies for the present channel will get it. It's agree or suffer.

**2. Will the Commission entertain applications for all four taxi channels in the same area, although separated by only 60 kc.?**

Apparently yes, especially if supported by an overall agreement on the subject by all operators in the area.

**3. What procedure will govern the assignments of the new channels?**

No licenses were issued prior to July 1, when the Rules became effective. Even after that date no licenses will be issued for the use of taxicab channels 3 and 4, which are now assigned to Telephone Company use in a number of metropolitan areas under experimental licenses expiring November 1, 1949. Taxicab applications requesting the use of taxicab channels 3 and 4 will be co-ordinated with the common carrier engineering department of the Commission. As soon as the Telephone Company completes its move to the new channels assigned for their purposes (which they may do on July 1 and must do by November 1) taxicab channels 3 and 4 will be available for assignment. Announcement of definitive procedures regarding the assignment of the present and new taxicab channels were expected from the Commission at the time this material was prepared.

**4. When will railroads that are using the now-deleted railroad frequencies be obliged to change frequencies?**

Those railroads which are using any of the 21 deleted frequencies may continue their use until the expiration of their current licenses. Voluntary requests for change of frequencies will be entertained, perhaps solicited. The railroads will have to re-make their master allocation plan, which was based on the assignment of 60 frequencies for railroad purposes, assuming ultimate denial of the May 26 petition the railroads filed for vacation of the Commission's deletion Order, or for re-opening for hearing and reconsideration.

**5. Under the new Rules, what is the position of the trucking companies?**

A number of truckers are bothered by this eligibility question. The Highway Truck Radio Service Rules specifically provide that "the service is not available for truck routes within a single metropolitan area." Exclusively intra-city truckers cannot have their own private radio systems. A city newspaper delivery truck, for example, is clearly out. An intercity trucker, operating between New York and Washington on a route basis, is clearly in. But how about the trucker who delivers to an airport quite a few miles out of the city, or one who delivers butane gas or oil on a scheduled route? A number of marginal cases such as the foregoing will give the FCC legal staff some headaches (in addition to the present railroad situation) and will probably require final treatment by the Commission itself on a case-to-case basis. The greatest care should be exercised in the preparation of these marginal applications.

*(To be continued next month)*

# DYNAMOTOR POWER SUPPLIES

DESIGN, PERFORMANCE, AND SERVICE DATA ON DYNAMOTORS SUPPLYING HIGH VOLTAGE DC TO MOBILE TRANSMITTERS AND RECEIVERS—By ROBERT W. CARTER \*

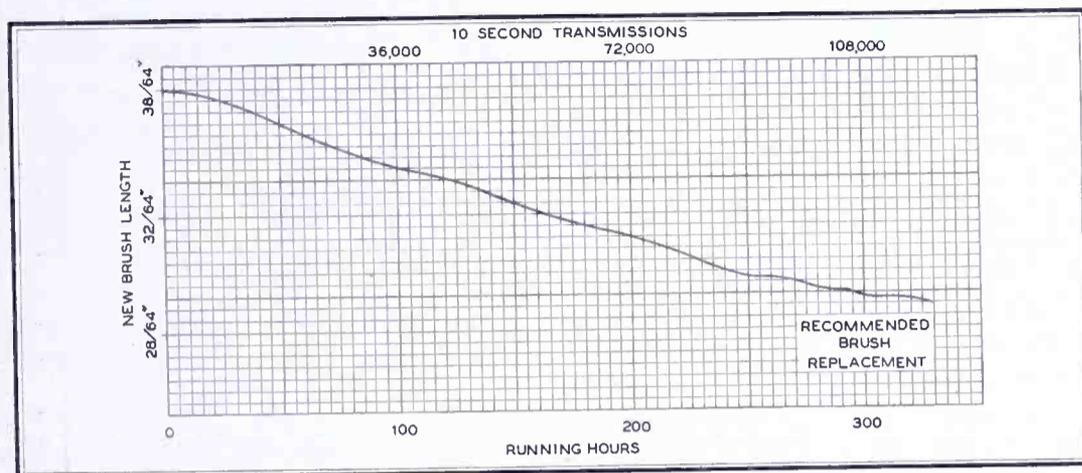


Fig. 2. Rate of wear of input brushes. Output brushes wear 3 to 4 times longer

THE dynamotor has become recognized as a highly dependable power supply wherever DC to DC conversion is required. Small, efficient, and capable of generating high output DC voltage and current, dynamotors afford years of reliable service. Police and fire departments, aircraft, marine, taxicab, forestry, railroad, and other branches of mobile communications now employ dynamotor power supplies because of their dependability as a source of high-voltage DC. They are also specified by the Armed Services for the majority of military communications.

## Dynamotor Design & Performance:

In brief, a dynamotor consists of a primary or motor winding for rotation, and a secondary or generator winding to provide the specified output, both wound on a common armature core and rotating in

\*President, Carter Motor Co., 2644 N. Maplewood Avenue, Chicago 47, Ill.

a single DC field. Two standard types are shown in Fig. 1. Unlike a motor

be regulated by changing field excitation. Because both primary and secondary windings are wound on a common core and rotate in the same field circuit, the output voltage varies in direct proportion to fluctuations of input voltage.

Many factors, not generally recognized by radio engineers, enter into dynamotor design. We learned much, of course, during the war about increasing the efficiency and extending the life of dynamotors intended to deliver optimum mobile service. For example, we use 26-gauge transformer-grade armature laminations, cross-stacked when assembled, to reduce eddy current losses and increase efficiency. This permits a savings of about 3 amperes battery drain on an

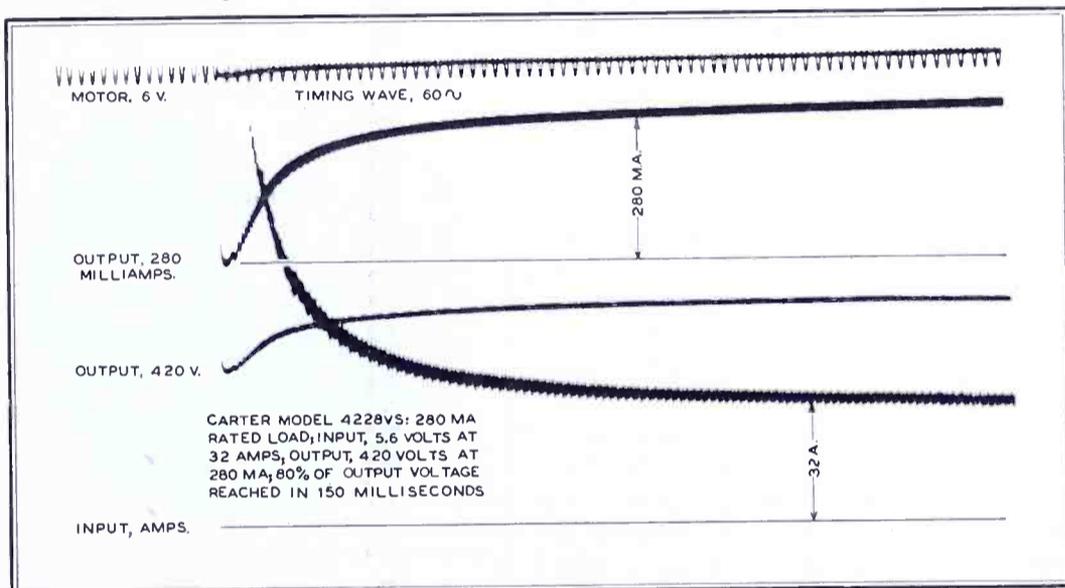


Fig. 3. Average starting time required for Genemotor to reach 80% of rated output generator, with separate field circuits, the dynamotor output voltage cannot

average 6-volt transmitter dynamotor. High-dielectric slot in insulation virtually

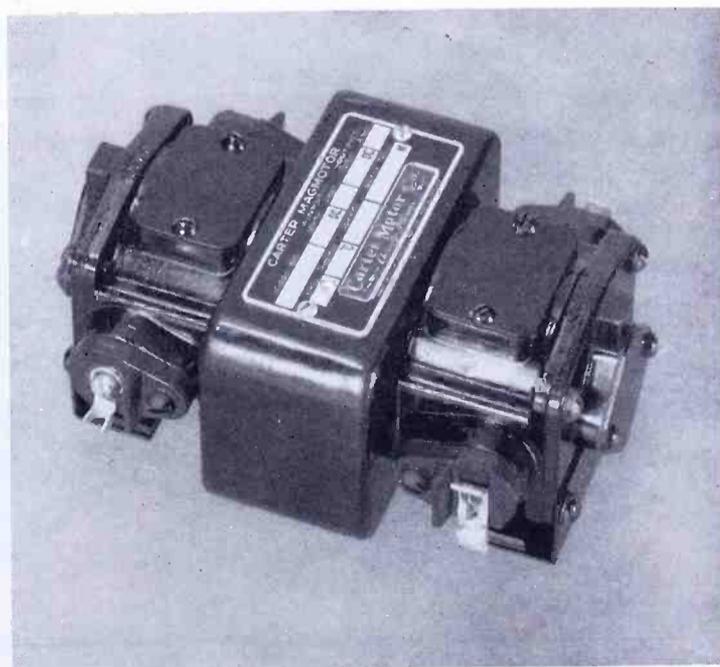
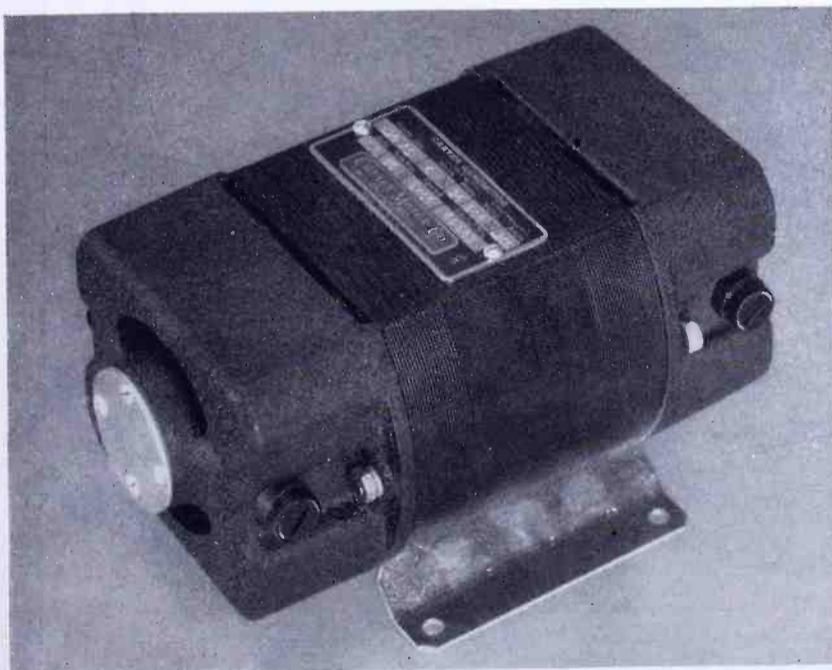


Fig. 1. Standard dynamotor designs. Genemotor, left, has laminated field frame; Magmotor, right, has alnico field magnets

eliminates armature grounds. Input and output commutator life has been increased by using 25- to 30-ounce silver alloy copper segments to resist the annealing effects of heat, and to assure

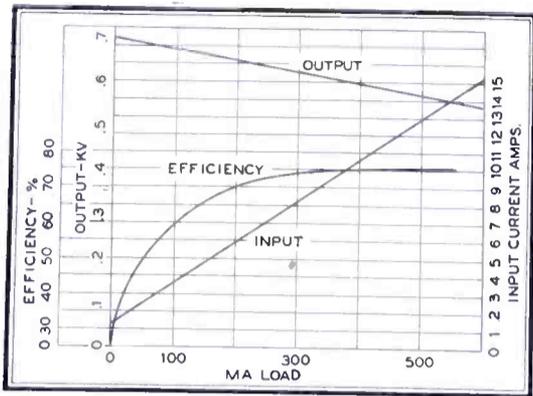


Fig. 4. Performance of high-efficiency unit

good commutation. Armatures are both statically and dynamically balanced to assure smooth mechanical performance.

Ball bearings and sleeve-type oilless bearings have proved to be best suited for mobile dynamotor service. The sleeve type is preadjusted for end play and locked at the factory to assure proper performance. A felt washer, saturated with oil or grease, is usually placed around or next to the bearing. The porous bearing material absorbs this lubricant as needed, depending upon temperature requirements. In normal service, this type of bearing requires no additional lubricant for the life of the dynamotor, providing dirt is not allowed to enter the bearing.

Most transmitter dynamotors, however, employ ball bearings, as they possess certain advantages over the sleeve type. Single row, sealed or shielded bearings are used to prevent the entrance of dirt or dust. Super-precision grades are used to assure quiet mechanical operation, as commercial types are not satisfactory. We pre-assemble and line-ream the dynamotor frames for precision alignment. Armatures are then assembled in the frames.

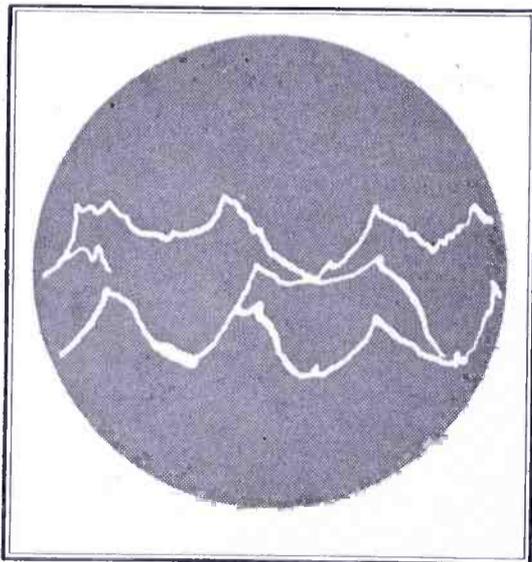


Fig. 7. These transients, due to incorrect secondary turns, cannot be filtered out

This assures highest possible quality mechanical performance. Ball bearings lubricated with long-life grease, now operate satisfactorily at temperatures from approximately  $-55$  to  $+95^{\circ}\text{C}$ ., depending on the dynamotor model.

### Brushes and Commutators:

Brushes of course, are all important, and go hand in hand with commutation. Carefully selected grades of the proper size are essential to longest possible brush and commutator life without loss of efficiency due to excessive drag on the armature. Consideration of duty cycles also enters into the brush performance, as intermittent transmitter operation requires that brushes withstand frequent starting surges. An example of input brush wear on a popular transmitter Genemotor model is illustrated in Fig. 2. Output brushes usually wear 3 or 4 times longer than input brushes, (300,000 to 400,000 ten-second transmissions aver-

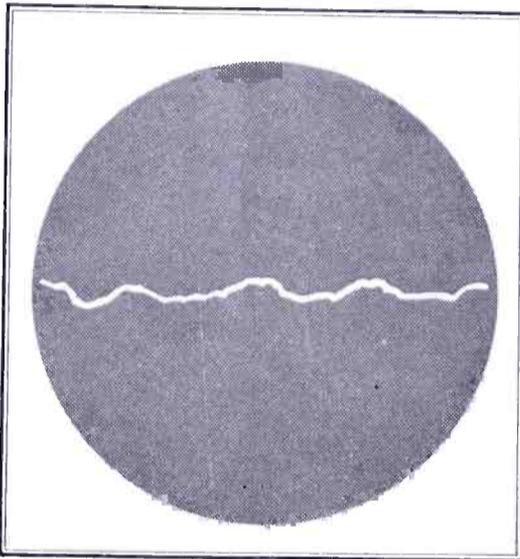


Fig. 6. Normal 8% unfiltered AC ripple

age), and therefore require virtually no attention.

Commutation of DC rotary machines embraces far more scientific research than is realized by most engineers. In this work we have been aided greatly by

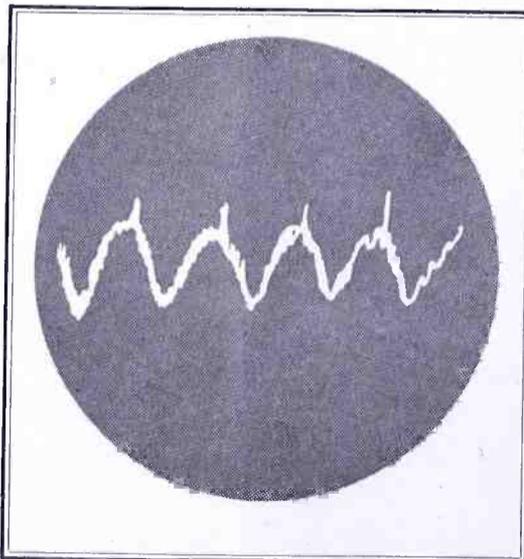


Fig. 8. This electrical noise is caused by poorly-seated input and output brushes

the use of oscilloscopes, for they disclose much information that meters cannot reveal. Long brush and commutator life are entirely dependent upon commutator film, the microscopic cupric oxide film a few millionths of an inch thick, created by the electron transfer, friction, oxidation, and other electrical, chemical,

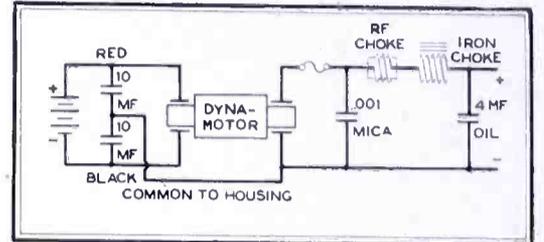


Fig. 5. Filter for receiver power supply

and dynamic actions. Brush and commutator wear and the coefficient of friction are greatly affected by atmosphere, presence of acids, smoke, oil, and other contaminations which break down the protective film and greatly accelerate wear. The commutator finish is highly important to long brush and commutator life, as well as to reducing AC ripple. Exhaustive tests with many types of finishing tools and grinders have been made in an effort to obtain the ideal surface. The diamond tool has been found to provide by far the smoothest and most satisfactory finish. Brush and commutator life are greatly prolonged, and ripple is reduced when commutators are diamond-lapped. The commutators should never be touched with the fingers, as perspiration leaves an oxide on the segments that may possibly impair commutation.

### Regulation and Ripple:

On crowded or busy channels, mobile transmitter dynamotors must start instantly. Otherwise, the first words of a message will not get on the air. Compound-type field coils with a series winding, in addition to the regular shunt field

(Continued on page 39)

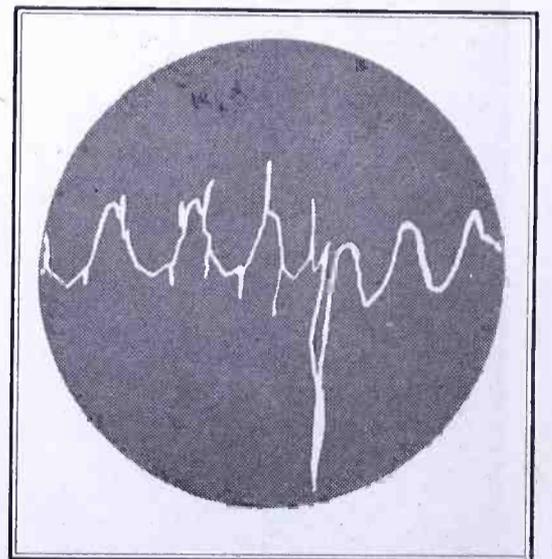


Fig. 9. Typical trace due to open secondary winding or commutator connection

# MOBILE RADIO SYSTEMS, Part 1

DIRECTORY OF MOBILE RADIO SYSTEMS OPERATED BY POLICE, FIRE, FORESTRY-CONSERVATION, RAILROADS, AND OIL COMPANIES, CORRECTED TO JUNE 1, 1949

## MUNICIPAL & COUNTY POLICE ALABAMA

Alexander	15 KIA303	155.01
Aniston	7 WRBD	33.10*
Athens	10 KIA241	155.01
Auburn	6 WEQM	155.01
Autauga	2 KA3115	37.50
Baldwin C (Bay Minette)	2 WKUV	37.50
Bessemer	45 WKIU	155.13
Birmingham	1 WJGZ	2382*
	WPFM	2382*
	19 WPFM	30.58*
		30.98*
	119 WPFM	30.58*
		30.98*
Blount C (Oneonta)	2 WAQR	37.10
Butler C (Greenville)	2 WBTK	37.50
Calhoun	4 WCTM	37.50
Chickasaw	WCHG	155.61
Choctaw C (Butler)	WAEV	37.50
Clarke C (Grove Hill)	WCHJ	37.50
Clay C (Ashland)	WKSF	37.10
Cleburne C (Heflin)	WCML	37.50
Colbert C (Tusculumbia)	WKHM	37.50
Cullman	20 KIA451	155.01
Cullman C (Cullman)	WGNT	37.50
Decatur	WADN	35.90
DeKalb C (Fort Payne)	WRLT	37.50
Dothan	WKAD	35.50
Elmore C (Wetumpka)	WXAI	37.50
Escambia C (Brewton)	WFGB	37.50
Etowa C (Gadsden)	WYU	37.50
Fairfield	1 KIA535	155.61
Florence	4 WKUH	35.90
Fort Payne	10 KIA512	155.01
Gadsden	WQJG	2382*
	16 WQJG	37.02*
Greene C (Eutaw)	2 WRTW	37.50
Hale C (Greensboro)	2 WSMG	37.50
Houston C (Dothan)	3 WNME	37.50
Huntsville	4 WMHA	35.90
Jackson C (Scottsboro)	2 WUAZ	37.50
Jasper	5 WKDF	155.01
Jefferson C (Birmingham)	6 WQFR	37.50
Lauderdale C (Florence)	2 WDFM	37.50
Lawrence C (Moulton)	2 KA3293	37.50
Lee C (Opelika)	2 WCVE	37.50
Limestone C (Atens)	2 WDRP	37.50
Macon C (Tuskegee)	2 WJFF	37.50
Madison C (Huntsville)	2 WLZC	37.50
Marengo C (Linden)	3 KA2851	37.50
Marshall C (Guntersville)	2 WMDO	37.50
Mobile	50 KIA559	154.89
		154.89
Mobile C (Mobile)	20 WNDM	154.89
Montgomery	50 WMPM	154.89
		154.89
Morgan C (Decatur)	2 WEHY	37.50
Muscle Shoals	1 WVR	35.60
Northport	1 WDBZ	35.90
Piedmont	8 KIA553	155.01
Pike C (Troy)	3 KA3250	37.50
Randolph C (Wedowee)	2 WKXG	37.50
St Clair C (Pell City)	2 WXAE	37.50
Selma	1 KIA528	2382*
Sheffield	27 WKIM	37.50
Shelby C (Columbiana)	2 WSPD	37.50
Sylacauga	6 WBVS	155.01
Tuscaloosa	5 WQLH	35.90
Tuscaloosa C (Tuscaloosa)	3 WJWN	37.50
Walker C (Jasper)	2 WRSN	37.50

## ARIZONA

Apache C (St. Johns)	5 KOA237	39.18
Buckeye	1 KA2459	39.18
Casa Grande	1 KRQN	35.10*
Cochise C (Bisbee)	10 KRHS	39.18
Coconino C (Flagstaff)	4 KOA348	39.18
Coolidge	1 KQWD	39.18
Douglas	4 KOA362	39.18
Flagstaff	2 KFPX	39.90
Gilbert	1 KVFJ	39.18
Glendale	10 KOA205	155.25
Graham C (Safford)	3 KRJA	35.10*
Maricopa C (Phoenix)	22 KQXU	39.18
Mesa	4 KRIZ	39.18
Mohave C (Kingman)	7 KSPW	39.18
Navajo C (Holbrook)	8 KICG	39.18
Nogales	1 KOA346	39.18
Phoenix	KZGJ	2430*
	45 KZGT	30.58*
Pima C (Tucson)	37 KOA258	39.18
Pinal C (Florence)	12 KOA301	39.18
Prescott	3 KNHG	39.18
Santa Cruz C (Nogales)	6 EYVN	39.18
South Tucson	1 KEVZ	35.10*
Tempe	1 KEYU	35.10*
	2 KEYU	39.18
	1 KBZD	39.18
Tolleson	KQA255	2430*
Tucson	KQA256	155.01
	14 KOA255	31.78*
	80 KOA255	155.01
Wickenburg	1 KSMG	39.18
Williams	1 KOA235	39.18
Winslow	4 KOA203	39.18
Yavapai C (Prescott)	KQHM	2430*
	10 KQHM	39.18
	10 KQHM	35.10*
	1 KQEX	2430*
Yuma C (Yuma)	22 KADF	39.18
Yuma	10 KOA200	39.60

## EXPERIMENTAL

Tucson	W6XEH	73.54*
--------	-------	--------

## ARKANSAS

Blytheville	1 KPBA	30.58
	14 KPBA	37.10
Brinkley	5 KKZL	158.89
Camden	2 WIXY	31.50
Crittenden C (Marion)	6 KIOC	37.10

## INFORMATION ABOUT THIS DIRECTORY

1. This Directory, published by authority of the Federal Communications Commission, is compiled directly from FCC license records.
  2. Mail addresses are shown for each system, except experimental repeater stations. Municipal stations should be addressed "Police Headquarters" or "Fire Department Headquarters". County systems, marked "C", show the name of the city in parenthesis. They should be addressed "County Sheriff's Office". State police systems should be addressed "State Police Barracks".
  3. The number preceding the call letters indicates the number of mobile units.
  4. Where several frequencies are shown following one call, the transmitter operates on the different frequencies listed.
  5. Equipment used for geophysical exploration is indicated by "Geoph. Mobile".
- PART 2 of the Directory, including systems operated by taxis, public utilities, and other services, appears in each January issue.
- NEW APPLICATIONS: For information on the weekly report of new applications, address Directory Editor, FM-TV Magazine.

\*Indicates AM transmitter. All others are FM.

Desha C (Arkansas City)	1 KSDC	31.50*
Fayetteville	2 KRUIQ	30.56*
Forrest City	2 KA2881	35.78
Fort Smith	4 KNHA	30.58*
Garland C (Hot Springs Nat'l Park)	KQMC	2403*
	KQEH	2406*
	2 KQEH	30.58*
	2 KIKS	30.70
Helena	4 KKA704	156.69
Hope	6 KKA267	38.10
Hot Springs C (Malvern)	KQGT	2406*
Jefferson C (Pine Bluff)	2 KQGT	30.58*
	2 KQGT	30.58
Jonesboro	10 KTHR	156.69
Little Rock	40 KKA510	155.61
Mississippi C (Blytheville)	14 KPMA	30.58*
Monticello	KPDM	2406*
	2 KPDM	30.58*
Newport	16 KRKI	155.01*
N Little Rock	10 KRAE	156.69
Ouachita	2 KSGO	31.50
Paragould	5 KKA670	155.01
Pine Bluff	4 KPBR	37.10
Pulaski C (Little Rock)	12 KA2955	155.61
Texasarkana	11 KTAP	33.22*
Union C (El Dorado)	6 KWXI	37.10
Van Buren	5 KIDN	155.25
Washington C (Fayetteville)	5 KKA683	37.10
West Helena	1 KUHE	30.70

## CALIFORNIA

Alameda C (Oakland)	1 KAKQ	1658*
Alameda	KMA217	155.81
	40 KMA217	154.65
Albany	5 KGCW	37.78*
	20 KMA247	155.13
Alhambra	16 KRBC	31.50*
Alturas	1 KSYH	39.38
Anaheim	4 KQCL	37.34*
Antioch	5 KSHW	37.02*
Arcadia	24 KQAP	156.69
Arcata	1 KCLN	161.0*
Atherton	2 KQXC	33.78*
Auburn	5 KRQP	154.65
Azusa	KMA238	155.49
Bakersfield	3 KGPS	30.58*
Banning	10 KQLY	30.58*
Beaumont	6 KQJH	30.58*
Bell	9 KPBC	35.50*
Berkeley	100 KSW	155.65
	1 KGHJ	39.78*
Beverly Hills	34 KQAI	37.10*
Blythe	2 KAPY	39.18
Brawley	6 KBMP	155.01*
Brea	3 KA2017	37.34*
Burbank	35 KMA345	156.21
Burlingame	9 KQCM	37.22*
Butte C (Oroville)	13 KBYQ	39.38
Calxico	5 KVRJ	155.25
Carmel-by-the-Sea	5 KQFI	35.22*
Chico	18 KQEO	155.49
Chino	5 KQKN	33.22*
Chula Vista	15 KQJG	37.34*
Claremont	2 KA2391	33.22*
Coachella	4 WJCO	30.58*
Coalinga	2 KCFJ	33.50
Colton	1 KIHV	35.22
Colton	4 KQVO	33.22*
Cotulla	6 KQRO	39.38
Compton	1 KQAQ	31.78*
Contra Costa C (Martinez)	W6XCD	73.54
	KMA371	1658*
	W6XWU	73.54
	64 KA2958	37.34*
	35 KA2988	155.01
Corcoran	3 KKNE	37.50
	1 KKNJ	37.78
Corona	6 KRIV	30.58*
Coronado	15 KQKV	37.34*
Corte Madera	1 KPDM	33.22
Covina	1 KIQH	155.49
Culver City	12 KMA394	158.09
Daly City	5 KILZ	35.90
Davis	2 KMA213	37.02*
Delano	2 KEYG	35.90*
Del Norte C (Crescent City)	15 KMYA	155.73
Dinuba	5 KAAAT	155.79
El Cajon	1 KEIJ	33.70*
El Centro	2 KNGJ	35.10
	1 KQVN	2490*
El Cerrito	20 KAMM	155.13
El Dorado C (Placerville)	4 KRZY	39.78
El Monte	5 KROR	155.73
El Paso de Robles	3 KAGT	39.10
El Segundo	11 KQJL	155.61
Eisner	1 KGTS	30.58*

Escondido	3 KQHX	33.76*
Eureka	10 KQRM	155.25
Fairfax	2 KDIC	33.22
Fairfield	10 KAGR	30.98*
Fresno	68 KQZA	31.22
Fullerton	6 KQBI	37.34*
Gardena	5 KMA387	155.61
	3 KQEG	39.10*
	KROB	1674*
Gilroy	60 KQCI	156.57
Glendale	1 W5XWC	74.18*
Glendora	3 KBPA	155.49
Glenn C (Willows)	5 KQVE	39.38
Grass Valley	1 KGVC	35.22
Hawthorne	10 KAGS	155.61
Hemet	1 KBJT	30.58*
Hermosa Beach	5 KRMZ	155.61
Hillsborough	7 KMA368	39.60*
	1 KANQ	1674*
Humboldt C (Eureka)	7 KHCP	33.76
Huntington Bch	4 KQAL	37.34*
Huntington Park	13 KHPM	39.90
Imperial C (Centro)	21 KEZQ	35.10
Indio	2 KQJH	30.58*
Inglewood	25 KMA309	39.50
Kensington	4 KCSQ	37.78*
Kern C (Bakersfield)	KMA338	2414*
	78 KMA338	31.78*
	11 KMA338	155.21
	63 KEWB	37.78
	KEWB	2414*
	5 KQEH	37.34*
Laguna Bch	13 KVAL	33.22
Lake C (Lakeport)	2 KEZT	33.78*
La Mesa	1 KDII	33.22
Larkspur	4 KAEX	39.38
Lassen C (Susanville)	2 KQPZ	33.22*
La Verne	5 KMA365	155.37
Lindsay	6 KIGY	39.38
Lodi	7 KGJC	153.33
Lompoc	11 KQAO	31.78*
Long Beach	1 KQST	33.10*
	1 KBQW	33.10*
	KQXJ	33.10*
Los Angeles	285 KGPL	155.37*
	468 KGPL	155.37*
	1 KNGJ	1730*
	6 KQEF	37.50*
	KQJI	2366*
	KQJO	2366*
	KQJP	1730*
Los Angeles C (Los Angeles)	137 KQBV	31.90*
	3 KERL	37.22*
	1 KQHK	35.50*
Los Banos	14 KFWH	37.76
Lynwood	3 KRIB	37.50*
Madera C (Madera)	KMA224	1610*
Manhattan Bch	47 KMA224	33.22
Marin C (San Rafael)	1 KEZB	1610*
	2 KQBD	37.22*
Mariposa C (Mariposa)	4 KQKA	155.01
Martinez	4 KADS	30.38
Marysville	9 KHNJ	35.50*
Maywood	12 KRKH	39.78
Mendocino C (Ukiah)	11 KQXV	33.78*
Menlo Pk	2 KQDP	37.22*
Merced	20 KSMO	37.22*
Mill Valley	2 KDJO	33.22
Modesto	21 KQDQ	39.38*
Modoc	5 KSYJ	39.38
Monrovia	7 KQAG	33.50*
Montebello	20 KQFE	155.73
Monterey	KRLF	1674*
	5 KRLF	31.22*
	50 KRLF	156.57
Monterey C (Salinas)	KMA393	156.33
Monterey Pk	5 KGKR	31.50*
Napa	9 KHCO	33.22
	15 KPNC	155.49
	8 KQBF	33.10
National City	6 KNCF	33.22*
Needles	2 KQRN	35.22
Nevada City	8 KPLN	39.76
Nevada C (Nevada City)	8 KQAF	37.34*
Newport Bch	12 KMA397	156.57
N Sacramento	2 KQRV	35.22*
Oakland	KMA301	31.10
	KMA301	156.45
	77 KMA301	31.78
	18 KMA301	156.09
	182 KMA301	154.89
Oceanside	KADI	2490*
	7 KADI	33.78*
	7 KADI	37.34*
Ontario	14 KQKT	33.22*
Orange	4 KQBI	37.34*
Orange C (Santa Ana)	KGHX	2490*
	49 KGHX	37.34*

Oroville	1 KSPQ	39.38
Oxnard	KQXC	2474*
	15 KQXC	156.33
	KAZI	1674*
Pacific Grove	1 KAZI	30.58
	10 KAZI	156.57*
Palm Springs	6 KMA380	37.10*
Palo Alto	17 KGHK	33.78*
Palos Verdes Estates	1 KQXK	37.90*
Pasadena	61 KGJX	33.22*
Perris	1 KIDW	30.58*
Petaluma	4 KMA399	154.89
Piedmont	16 KQCP	37.22*
Pittsburgh	3 KQBT	30.70
Plumas C (Quincy)	KMA389	1722*
	8 KMA389	39.38
	KMA384	1714*
Pomona	35 KMA384	33.22*
	KALM	17.14*
Porterville	3 KQAU	37.10
	1 KQAX	35.10
Red Bluff	10 KMA377	155.37
Redding	4 KMA363	154.65
Redlands	1 KQPT	33.22*
Redondo Bch	3 KTEQ	155.61
Redwood City	KRAZ	1674*
	9 KRAZ	33.78*
	20 KRAZ	155.97
Reedley	2 KRCP	33.50*
Rialto	3 KRQJ	33.22*
Richmond	KRLW	31.50
	80 KRLW	155.37
	73 KRLW	33.78
	KMA358	31.50
Riverside	69 KQJE	30.58*
Riverside C (Riverside)	157 KQSG	30.58*
	KERC	24.42*
	1 KEZE	24.42*
Roseville	1 KRPD	39.22
Ross	1 KRFC	33.22
Sacramento C (Sacramento)	10 KFPN	154.77
Sacramento	KNGF	1722*
	53 KNGF	154.77
	1 KSPD	1722*
Salinas	25 KQHY	155.57
San Anselmo	5 KQBP	33.22
San Bernardino	33 KQAC	33.22*
San Bernardino C (San Bernardino)	49 KSBC	33.22*
(Barstow)	3 KIIM	33.22*
San Benito C (Hollister)	8 KDHB	39.10
San Buenaventura	14 KACI	

**MUNICIPAL & COUNTY POLICE, Cont.**

Visalia	10 KQBQ	155.49
Watsonville	KMA340	1674
Weed	6 KMA330	155.01
West Covina	1 KREQ	31.10
Whittier	28 KGHY	155.73
Woodland	25 KAGD	155.85
Yreka	KAGD	1722
Yuba City	1 KQZQ	30.58
Yuba C (Marysville)	2 KBQY	39.38
	6 KBQZ	39.38

**EXPERIMENTAL**

Contra Costa C R	W6XCD	73.54
Fresno R	W6XHU	74.14
	W6XHV	75.98
	W6XW	75.56
Glendale N	W6XGL	75.98
Grapevine M	W6XW	73.22
Kettleman R	W6XWD	74.58
Long Beach N	W6XWA	74.58
Los Angeles N	W6XWA	72.04
Los Angeles R	W6XG	75.98
Mt Tamalpais M	W6XHG	74.58
Monterey R	W6XIJ	75.98
Orange C M	W6XIL	75.98
Orange C R	W6XJL	73.18
Orange C M	W6XVJ	74.58
Pasadena N	W6XWV	74.58
Pomona N	W6XWG	74.58
Richmond R	W6XWU	73.54
Riverside R	W6XEH	73.62
Riverside N	W6XWH	74.58
San Bernardino CM	W6XVY	74.58
San Diego M	W6XHA	75.98
San Diego N	W6XVN	74.58
San Jose R	W6XHW	73.14
San Mateo R	W6XHO	73.62
San Mateo M	W6XVQ	74.38
Santa Ana M	W6XVI	74.58
Ventura C R	W6XIB	73.62
Williams Hill R	W6XOW	74.02

**COLORADO**

Boulder	5 KQGA	33.78
Colorado Spgs	15 KPCC	31.50
Denver	KGPX	2442
	151 KGPX	37.02
El Paso C (Colorado Spgs)	5 KFHR	31.50
Englewood	2 KIUE	37.02
Fort Collins	KAA290	2442
	5 KAA290	33.78
Grand Junction	15 KQXT	37.02
Greeley	7 KPDD	33.78
Jefferson C (Golden)	36 KRSS	39.50
La Junta	10 KPLJ	156.33
Larimer C (Fort Collins)	3 KAEU	33.78
Las Animas C (Trinidad)	2 KEHM	30.58
Longmont	9 KPDL	33.78
Pueblo	15 KQCX	30.98
	KRHY	24.42
	2 KESY	33.78
Sterling	2 KHRI	30.58
Trinidad		

**CONNECTICUT**

Ansonia	2 WKSS	33.10
Bethel	1 WHNK	35.90
Bloomfield	1 WLST	33.90
	1 KA3162	37.18
Branford	2 WMVO	31.10
Bridgeport	23 WPFW	30.58
	KCA284	2466
	KCA284	39.10
	33 KCA284	39.10
Bristol	6 WJVO	31.10
Danbury	3 WSRE	35.90
Darien	4 WQYB	33.78
Derby	6 KCA298	155.49
Easton	1 WIVR	39.10
E. Hartford	8 WBXC	33.10
Enfield	1 WBMW	39.10
Fairfield	KCA279	31.10
	11 KCA279	31.78
Glastonbury	2 KA3167	37.18
Greenwich	20 WQLE	39.90
	WWEF	39.90
Groton	1 WIZY	31.90
Hamden	13 WHPD	37.90
Hartford	21 KCA330	37.18
Manchester	3 WRZP	33.94
Meriden	5 WKSM	35.10
Middletown	4 WSKV	155.37
Milford	16 WBLD	31.80
Monroe	3 WRPC	39.10
New Britain	9 WRAF	37.10
New Haven	KCA280	37.10
	40 KCA280	37.10
	29 KCA280	37.18
Newington	2 KA3166	37.18
New London	4 WAKB	31.90
N Haven	2 WKKD	37.78
Norwalk	7 WEIS	35.50
Norwich	3 WBXY	39.90
Plymouth	1 WHHL	31.10
Seymour	8 WMYN	31.50
Southington	5 WQWQ	155.01
	5 KCA347	155.25
Stamford	KCA336	39.02
	KCA337	39.02
Stratford	7 WCBH	30.98
	2 WKSC	30.98
	WKEQ	30.70
Suffield	1 WCSO	30.70
Torrington	4 WKPJ	39.90
Trumbull	3 WJUY	30.98
Wallingford	7 WMHR	39.90
Waterbury	37 WMPW	39.10
Watertown	1 WJYX	39.10
W Hartford	13 WQJI	31.50
W Haven	7 WBLB	155.01
Westport	4 WBLT	33.94
Wethersfield	3 WABT	33.10
Willmantic	1 WEGT	31.10
Windsor	7 KA2332	37.18
Woodbridge	2 WAQX	37.10

**DELAWARE**

Bridgeville	2 WLHO	39.78
Dover	5 WAZO	33.50
Milford	1 WMDM	37.50
New Castle	2 WBKW	39.78
New Castle C (Wilmington)	2 KA2873	39.78
Newark	2 WNBA	39.50
Seaford	2 WXAK	39.78
Smyrna	2 WKBL	39.78

Wilmington 64 WWPD 30.58  
WRPF 31.50

**DISTRICT OF COLUMBIA**

Washington	113 WPDW	37.22
	40 WDCC	39.50
	1 WJHJ	39.50
Washington D C Jail	5 WDPG	39.02

**FLORIDA**

Alachua C (Gainesville)	10 KIA305	155.19
Baker C (Macclenny)	6 WRWD	155.01
Bartow	2 WBPJ	155.31
Bay C (Panama City)	5 WKRE	31.10
Belleair	1 WAJT	30.58
Boca Raton	1 WHPZ	35.90
Bradenton	4 WRMO	37.10
Broward C (Ft.Lauderdale)	10 WTKR	155.13
Clearwater	8 WQOI	150.33
Coral Gables	17 WOCG	156.45
	17 WOCG	156.45
	17 WOCG	154.65
Dade City	2 WPLT	30.70
Dade C (Miami)	25 WQSK	154.95
Dania	2 WQXM	37.10
Daytona Beach	10 KIA218	155.25
Delray Bch	3 WAFD	35.90
Dixie C (Cross City)	2 WDKX	31.10
Dunedin	1 WBLE	30.58
Escambia C (Pensacola)	7 WFFF	31.10
Ft Lauderdale	35 WAKO	155.13
Fernandina	3 KKVJ	31.10
Ft. Myers	15 KIA407	155.61
Ft. Pierce	3 WFPF	35.50
Gainesville	15 WQFC	158.03
Gulfport	1 KA3150	155.73
Haines City	1 WITW	35.90
Hallandale	2 WSVE	37.10
Holly Hill	2 KA2364	155.25
Hollywood	7 WQNL	37.10
Jacksonville	50 WPFJ	155.67
Jacksonville Bch	7 WJBB	30.70
Lakeland	17 WFBT	31.50
Lake Worth	12 WLWP	156.51
Leesburg	3 WQPD	37.50
Leon C (Tallahassee)	2 WCGV	33.10
Miami	WPFZ	155.67
	75 WPFZ	155.67
	WPFZ	156.63
	75 WPFZ	156.63
	72 WQMA	156.03
Ocala	6 WBTW	35.90
Orlando	25 WPHM	37.26
Ormond	3 WMJI	155.67
Pahokee	3 WBNO	155.31
Palm Bch	40 KIA405	155.01
Palm Bch C (West Palm Bch)	9 KA2777	31.10
Panama City	6 WAZU	37.10
Pensacola	18 WRGP	155.61
Pinellas	2 WBWU	33.50
Plant City	3 WRFP	35.50
Putnam C (Palatka)	3 WKGH	31.10
Riviera Bch	4 WLRG	155.01
Quincy	5 WYMB	156.57
Sanford	5 WQRA	39.58
St. Augustine	4 WQSU	33.10
	4 WFLI	39.50
St Lucie C (Ft Pierce)	3 WMQP	35.50
St Petersburg	30 KIA439	155.73
Sarasota	6 WEAG	31.50
	4 WBYI	30.70
Tallahassee	19 KIA586	33.10
Tampa	WFPT	37.90
	32 WPHN	37.78
Vero Bch	14 WOGA	155.67
W Palm Bch	18 WRZY	35.50
Winter Haven	3 WQFN	35.90

**GEORGIA**

Albany	20 WIVJ	155.01
Americus	8 KIA552	155.25
Athens	3 WMUO	39.50
Atlanta	KIA532	155.21
	47 KIA532	155.85
	47 KIA532	156.21
	47 KIA532	156.45
Augusta	22 WQFV	31.78
Bibb C (Macon)	18 WIAF	155.49
Bulloch C (Statesboro)	7 WFHT	155.01
Brunswick	12 WQTC	155.61
Columbus	75 WPFJ	155.57
Dalton	6 KIA531	37.90
Decatur	15 WLAS	155.01
Dougherty C (Albany)	9 WDKK	42.02
East Point	10 WBFF	35.50
Elberton	5 WKYI	155.73
Floyd C (Rome)	7 WNPQ	35.90
Gainesville	2 WHNX	35.50
Glynn C (Brunswick)	8 WQGI	155.61
Griffin	10 WJET	155.73
La Grange	5 KIA454	155.73
Macon	60 WQFB	156.21
Martetta	3 WANT	33.94
Richmond C (Augusta)	9 WGMA	35.90
Rome	8 WQNG	35.90
Savannah	28 WQTR	33.10
Statesboro	5 WFNP	155.01
Thomasville	15 WROH	155.01
Toccoa	2 WHVT	39.50
Valdosta	2 WBVY	33.50
Waycross	3 WMPF	35.90

**TERRITORY OF HAWAII**

Hawaii C (Hilo)	40 KADK	35.10
Honokaa	1 KAFR	1714
Honolulu	1 KFJD	37.10
	303 KGPQ	35.10
	KFJJ	37.10
Kaiaiko Fire Sta	1 KFJP	37.10
Kalihi Fire Sta	KHAB	1714
Kaneohe	55 KCKT	37.90
Kaual C (Lihue)	10 KRLB	30.58
Kaunakakai	KIRU	1714
Kealakakua Kona	KENW	1722
Lahaina	KBSN	1722
Lanal City	KHAC	1714
Oahu	KHAA	1714
Wahaiwa	52 KAPM	30.58
Wailuku	1 KCKU	37.90
Waiimea		

**IDAHO**

Ada C (Boise)	5 KAHF	37.22
Bannock C (Pocatello)	9 KAAL	42.54
Boise	10 KOA360	37.22
Bonneville	2 KAOA	37.22

Burley	4 KREV	42.54
Caldwell	2 KEHK	42.54
Coeur D'Alene	1 KA2466	42.54
Elmore C (Mountain Home)	2 KECC	37.22
Gem C (Emmett)	1 KFEM	37.22
Gooding C (Gooding)	6 KCTZ	37.22
Jerome C (Jerome)	4 KAHA	42.54
	2 KCKK	42.54
	3 KHFP	39.42
	3 KSTD	30.58
	3 KRLG	30.58
Minidoka C (Rupert)	1 KRRT	37.22
Moscow	6 KMTT	37.22
	5 KQJF	39.42
	4 KQZS	39.42
Nampa	1 KQZS	155.01
Payette	1 KQRY	37.22
Pocatello	12 KRBL	42.54
Power C (American Falls)	2 KRZH	42.54
Twin Falls	16 KRZD	42.54
Wallace	3 KHFY	39.42

**ILLINOIS**

Alexander C (Cairo)	1 WKXZ	39.50
Alton	6 WQSR	37.10
Arlington Hgts	3 WBNO	155.13
Aurora	4 WQRM	155.61
Batavia	3 WKDN	155.01
	WKDV	154.89
Bedford Park	9 WJVI	39.10
Belleville	8 WQTG	155.49
Bensenville	1 KSA282	155.01
	KSA282	154.89
Berwyn	5 WSVH	33.50
Bloomington	10 WQRI	155.13
Broadview	1 WDBL	31.50
Brookfield	5 WEUC	31.50
Calo	1 WIPC	39.98
Calumet	2 WKJN	39.10
Calumet Park	1 WBWG	33.78
Canton	2 WHNB	37.10
Carbondale	1 WRLI	39.50
Cary	1 WCVP	39.50
Centralia	2 WSKZ	39.50
Champaign	4 WQJB	155.61
Chicago	WPDB	1714
	201 WPDG	35.22
	WDDD	1714
	103 WQJF	31.10
Chicago Hgts	3 WQKZ	33.22
Cicero	12 WRHC	155.49
Clinton	6 WMPJ	39.50
Collinsville	1 WBEP	39.10
Crawford C (Robinson)	5 WRUI	39.50
Creve Coeur	1 WNGC	155.73
Crystal Lake	1 WCLV	39.50
Danville	12 WBSJ	39.50
	10 KSA369	155.01
	10 WQTF	33.10
Decatur	1 WAAO	33.10
Decatur Pk Dist	WRIJ	155.13
Des Plaines	WRIJ	155.37
	4 WRIJ	155.13
	3 WAGW	39.50
Dixon	WBVY	33.78
Downer's Grove	3 WRIW	37.22
E. Moline	4 WEMY	156.21
E. Peoria	4 WJVM	155.01
E. St. Louis	21 KSA317	33.10
Edwardsville	1 WKIJ	33.94
Elgin	6 WQNO	154.89
Elmhurst	8 WQJX	154.89
	3 WIEG	31.50
Elmwood Park	21 WQLO	155.61
Evanston	1 WBKL	33.78
Evergreen Park	3 WJLA	33.94
Flora	1 WEKB	33.78
Flossmoor	2 WBXG	37.10
Forest Park	1 WJUR	33.94
Fox River Grove	3 WJWT	155.49
Franklin Park	3 WBYP	37.10
Galesburg	WRIJ	154.89
Geneva	2 WKBP	155.01
	5 WDA	35.50
Glencoe	4 WQLN	35.50
Glen Ellyn	3 WAEX	154.89
Glen View	2 WGLI	37.10
Granite City	4 KSA217	39.10
Harrisburg	1 WALG	39.50
Harvard	1 WHPK	39.50
Harvey	3 WSKP	37.90
Havana	6 WVFZ	39.50
Henderson C (Oquawka)	1 WMQD	39.50
Herrin	1 WDKY	39.50
Hennepin	1 WLNK	39.50
Highland Park	5 WQRE	35.90
Highwood	1 KA3365	155.49
Hillside	1 WBRQ	31.50
Hinsdale	3 WROG	37.22
Homewood	1 WBHY	33.78
Jacksonville	2 WNRN	39.50
	3 WCUN	39.50
Joliet	18 WQLW	155.13
Kankakee	4 WSTU	30.58
Kenilworth	2 WKPD	35.90
Kewanee	7 WWHO	154.89
LaGrange	2 WAFB	31.50
LaGrange Park	2 WMHZ	31.50
Lake Forest	7 WQLK	155.85
Lansing	WBMG	33.78

**MUNICIPAL & COUNTY POLICE, Cont.**

Munster	2 KA2150	155.61
Harpurree	1 WOH	155.85
New Albany	3 WBWX	39.10
New Castle	1 WBNC	154.89*
	1 WBNC	155.13
Noblesville	5 WKUO	154.89
N Manchester	1 WIMD	154.89
Peru	4 WASC	154.89
Plymouth	1 WPAC	155.13
Porter C (Valparaiso)	1 WBVT	30.58*
Princeton	2 WPNP	155.85
Rutnam C (Greencastle)	1 WHHB	35.10*
Richmond	14 WPDH	33.50
Rush C (Rushville)	1 WIAD	154.89
Rushville	2 WIJF	154.89
St Joseph C (South Bend)	6 WJAJ	155.89
Seymour	3 WVVC	154.89
Shelby C (Shelbyville)	2 W3TL	154.89
Shelbyville	3 WDP5	154.89
Bend	32 WPGH	154.89*
Shelby C (Angola)	3 WIUM	155.13
		154.89
Tell City	1 WSHI	154.89
Terre Haute	15 WQOF	155.85
Tippecanoe C (La Fayette)	2 WJNU	154.89
Tipton C (Tipton)	2 WMQI	154.89
Valparaiso	6 WMPV	154.89
Vanderburgh C (Evansville)	6 WBXF	30.70*
Vigo C (Terre Haute)	3 WIJZ	155.13
Vincennes	3 WQKT	155.13
Wabash	2 WBIE	30.58*
Wabash C (Wabash)	3 KA3297	154.89
		155.13
Warsaw	2 WJKM	154.89
Washington	1 WNKO	154.89
Wayne C (Richmond)	10 KA3335	33.50
Wells C (Bluffton)	2 WJAK	154.89
West Lafayette	2 WRMW	154.89
West Terre Haute	1 KA2488	155.61
Whiting	2 WQKD	37.10
Whitley C (Churubusco)	1 WDNF	154.89

**IOWA**

Ames	5 KQFW	37.10
Appanoose C (Centerville)	3 KOPF	37.10
Beacon	3 KCBT	37.10
Burlington	8 KAA450	37.10
Calhoun C (Rockwell City)	1 KKLJ	37.10
Carroll C (Carroll)	1 KCUA	37.10
Cass C (Atlantic)	1 KHQD	37.10
Cedar C (Tipton)	1 KFRA	37.10
Cedar Falls	5 KESN	37.10
Cedar Rapids	2 KGOZ	37.10
Centerville	1 KKNK	37.10
Cerro Gordo C (Mason City)	1 KQHY	37.10
Cherokee C (Cherokee)	1 KA3297	37.10
Clinton	15 KRJX	37.10
Clinton C (Clinton)	2 KA2393	37.10
Council Bluffs	20 KPCB	37.10
Crawford C (Denison)	12 KAIS	37.10
Emmas C (Adel)	1 KXRQ	37.10
Evansport	1 KQPN	37.10*
Fairfax C (Bloomfield)	3 KRPS	37.10
Des Moines C (Burlington)	1 KHGX	37.10
Des Moines	50 KGZG	156.69
Dubuque	20 KQDT	37.10
Fairfield	1 KAMJ	37.10
Fayette C (West Union)	5 KKVQ	37.10
Fort Dodge	5 KQZF	37.10
Fort Madison	6 KBYS	33.10*
Fremont C (Sydney)	5 KAA441	37.10
Greene C (Jefferson)	1 KCHZ	37.10
Guthrie C (Guthrie Center)	1 WRKL	37.10
Hamilton C (Webster City)	3 KFSC	37.10
Hardin C (Eldora)	6 KAA449	37.10
Iowa City	4 KAWP	37.10
Iowa Falls	5 KAPO	37.10
Jackson C (Maquoketa)	1 KWGO	37.10
Keokuk	7 KRAT	37.10
Lee C (Fort Madison)	4 KXZB	37.10
Louis C (Wapello)	2 KAA412	37.10
Lucas C (Chariton)	3 KAA389	37.10
Marion	1 KA2145	37.10
Marshall C (Marshalltown)	5 KMCZ	37.10
Marshalltown	3 KRHL	37.10
Mason City	7 KQAE	31.78
Mt Pleasant	1 KHOR	37.10
Muscatine	13 KAA407	37.10
Newton	5 KJXH	37.10
O'Brien C (Primghar)	3 KAA317	37.10
Oswego	2 KFLR	37.10
Oskaloosa	15 KQJI	37.10
Ottumwa	17 KPDO	37.10
Page C (Clarinda)	3 KCJJ	37.10
Pocahontas C (Pacahontas)	1 KWIV	37.10
Polk	6 KIGR	35.22
Red Oak	3 CKFK	37.10
Sac C (Sac City)	5 KAA414	37.10
Shenandoah	1 KDEN	37.10
Sioux City	13 KGPK	31.78*
Tama C (Toledo)	2 KCJN	37.10
Taylor C (Bedford)	5 KWNJ	37.10
Waterloo	10 KRMJ	37.10
Webster City	5 KQZH	37.10
Woodbury C (Sioux City)	4 KPMF	37.10

**KANSAS**

Allen C (Iola)	1 KAKP	31.50
Arkansas City	10 KIBH	39.50
Atchison	4 KACA	33.22*
Chanute	1 KGZF	33.22*
Coffeyville	1 KGZP	39.58
Cowley C (Winfield)	2 KA3124	39.58
Crawford C (Girard)	6 KRHU	164.01
Dodge City	6 KNCH	39.58
Douglas C (Lawrence)	6 KA2375	39.58
Eldorado	3 KAA350	31.50
Ellis C (Hays)	1 KAA452	39.58
Emporia	4 KAA433	39.58
Franklin	7 KXYO	39.58
Garden City	15 KAA305	39.58
Geary C (Junction City)	1 KBXW	39.58
Great Bend	1 KBQJ	39.58
Hutchinson	20 KA2240	144.25
Iola	1 KAPG	31.50
Johnson C (Olathe)	1 KBNW	37.10
Junction City	6 KAA248	39.58
Kansas City	100 KQBH	156.09
		156.09
Labelle C (Oswego)	1 KROK	156.09
Lawrence	3 KANH	15.22
Leavenworth	8 KAA242	39.58
Manhattan	10 KNFF	155.97
Marion C (Marion)	7 KRJC	39.58
McPherson	6 KAA288	39.58
Newton	10 KWGD	39.58
	15 KAMH	39.58

Parsons	3 KAHZ	31.50
Pittsburgh	3 KGKD	35.22
Salina	20 KPGK	155.01*
Summer C (Wellington)	18 KNOV	39.58
Topeka	5 KTKP	39.58
	30 KAA420	155.73
	10 KAA420	155.97
Wellington	10 KAHG	39.58
Winfield	3 KWCL	39.58
Wichita	75 KGPZ	155.13
	15 KWUH	37.10
Wyandotte C (Kansas City)	7 KQJK	158.09
		156.33

**KENTUCKY**

Ashland	12 WSAG	155.61
	WSAG	155.85
Bowling Green	4 WRNM	30.70*
Corbin	5 KIA394	155.73
Covington	20 WKXC	154.77
Danville	5 KIA509	155.13
Fayette C (Lexington)	6 WQOB	37.10
Fort Thomas	8 WKNU	158.57
Frankfort	5 WKHX	155.61
Glasgow	15 KIA564	39.50
Harlan	5 WFOJ	155.13
Hazard	1 WMHK	39.50
Henderson	2 WQTT	30.70*
Henderson C (Henderson)	12 WKKZ	30.70*
Hopkins C (Madisonville)	2 WKYP	30.70*
Hopkinsville	2 WRPE	155.13
Lexington	17 WPET	39.50
Louisville	100 WPDE	37.10
Laurel C (London)	1 WUEW	39.90*
Madisonville	1 WMKY	30.70*
Mayfield	5 WRKE	155.61
Maysville	2 WRPG	31.50*
Owensboro	13 WRPJ	30.70*
Paducah	5 WQNP	30.70*
Pikeville	3 KIA548	155.01
Richmond	5 KIA247	155.01
Rowan	1 WKIM	39.90
Somerset	5 KIA292	155.61
Shively	1 WSYK	30.70
Winchester	10 WLHG	155.01

**LOUISIANA**

Alexandria	65 KKA613	33.22*
		155.61
Baton Rouge	35 KKA422	155.61
Bezauregard	8 KKA541	39.50
Bogalusa	3 WFKK	39.58
Bossier	6 KA3203	155.01
Cado	16 KKA387	39.50
Calcasieu Parish	4 KHIT	39.50
Claiborne	5 KFDD	39.50
Crowley	4 KISP	155.01
E Baton Rouge	15 WAME	39.50
E Carroll Parish	10 KKA368	39.50
E Feliciana	10 KKA580	39.50
Iberia Parish	12 KKA582	39.50
Jackson Parish	7 KKA082	39.50
Jefferson Parish	25 KFZR	39.50
Jennings	5 KUKL	155.01
Lafayette	8 KRRA	39.50
LaFayette C (Lafayette)	3 KLFJ	39.50
Lake Charles	3 KRKP	37.22*
La Salle Parish	5 KKA302	39.50
Madison	12 KKA270	39.50
Monroe	25 KKA271	155.01
Morehouse	16 KKA296	39.50
Natchitoches C (Natchitoches)	7 WNPD	39.50
New Iberia	2 KRVA	155.13
New Orleans	22 WPEK	31.78*
	102 WPEK	155.85
Opelousas	12 KKA687	37.10
Ouachita	10 KA2340	39.50
Plaquemines	12 WJNN	39.50
Point Coupee	1 KFPF	39.50
Rapides Parish	5 KHML	39.50
Rayne	3 KKA591	155.01
Sabine	3 KKA512	39.50
St Landry	10 KPZ	39.50
St Tammany	7 KUMV	39.50
Shreveport	8 KNGO	243.0*
	8 KNGP	155.01
Vernon Parish	5 KKA537	39.50
West Monroe	6 KKA219	155.25
Winn Parish	5 KKA569	39.50

**MAINE**

Auburn	4 WSAH	30.70*
Augusta	11 WALR	39.10
Bangor	6 WJTM	39.10
Bar Harbor	25 WXTH	155.13
Bath	2 WLBM	39.10
Brewer	1 WAQT	39.10
Brunswick	4 WECT	39.10
Cape Elizabeth	4 WCYW	39.10
Gardner	20 KCA332	155.01
Houlton	4 WLDU	39.10
Lewiston	7 WRQH	33.50*
Old Orchard	10 KCA339	155.01
Portland	17 WPFU	39.58
	WKJD	39.58*
Presque Isle	1 WPIN	39.10
Rockland	5 WJLL	155.25
Saco	1 WMQT	39.50
Sanford	16 KCA296	39.50
South Portland	11 WCAD	39.50
Waterville	2 WJYE	39.10
Westbrook	2 WAWL	39.50
Winslow	1 WBAG	39.10
York	2 WMSM	39.90

**MARYLAND**

Annapolis	2 WAMD	39.18
Baltimore	139 WPPH	33.22*
	150 WPPH	155.85
Calvert	2 KA3177	39.10
Charles C (La Plata)	3 WCAI	39.10
Cumberland	5 WMEY	39.50
Dorchester C (Cambridge)	2 WJYN	39.10
Frederick	5 KGA247	39.98
Frederick C (Frederick)	1 WFMQ	39.10
Greenbelt	2 WABV	39.90
Hagerstown	4 WHMD	31.10
Harford	9 WMHF	37.18
Hyattsville	2 WAOL	39.90
Laurel	1 WGPB	39.10
Montgomery C (Rockville)	90 KGA241	37.10
Prince Georges C (Upper Marlboro)	25 WJLU	39.90
(Cheverly)	56 KGA240	39.90
St Mary's C (Leonardtown)	1 WXKE	39.10

Salisbury	2 WBVQ	35.50
Washington C (Hagerstown)	2 WRHO	39.10

**MASSACHUSETTS**

Abington	1 WLIH	155.73
Acton	1 WITY	155.25
Agawam	4 KCA234	155.37
Andover	3 WBRJ	39.10*
Arlington	12 WPED	30.70
Ashland	1 WRPI	35.90
Athol	3 WBJA	31.90
Attleboro	11 WBVC	33.50
Auburn	1 WBHC	33.78*
Barnstable	15 WRAQ	39.90*
Barnstable C (Barnstable)	1 WBPW	39.90*
	3 WRAR	39.90*
(Bourne)	10 WRAG	39.90*
(Chatham)	2 WEWE	39.90*
(Falmouth)	3 WQTL	39.90*
(Harwick)	1 WQTM	39.90*
(Osterville)	1 WMUV	39.90*
(Nantucket)	1 WBYS	39.90*
(Provincetown)	1 WMUZ	39.90*
(Wellfleet)	4 WLBY	39.90*
(West Yarmouth)	3 WGBU	39.90*
	WRLQ	39.90*
Bellingham	1 WBBA	37.90
Belmont	15 WRJZ	156.45
Beverly	10 WBMP	154.77
Billerica	5 WECQ	155.49
Bolton	3 WKTJ	37.10
Boston	WQJP	35.50*
	110 WRAS	30.95*
	125 WRAS	154.89
	1 WAGJ	35.50*
Braintree	5 WPUA	37.90*
Bridgewater	3 KA2938	145.73
Brockton	6 WMPF	30.95*
Brookline	36 WQKK	33.50*
Burlington	WCWV	31.50*
Cambridge	WKWU	33.10
	25 KCA312	39.38
Carver	1 WDOP	37.10*
Chelmsford	2 WSTI	37.10*
Chelsea	5 KCA343	37.22*
Chicopee	5 WBMT	30.55*
Clinton	3 WQKY	37.10
Cohasset	3 WPGU	37.78*
Concord	4 WRAC	155.25
Danvers	2 WRAU	39.98*
Dartmouth	6 WRIT	154.77
Dedham	6 WRNU	155.61
Dracut	1 WKTK	37.10*
Duxbury	1 WDBI	31.90
E Bridgewater	1 WQJN	155.73
Easthampton	4 WAMT	31.78
Everett	9 WAKF	37.78*
	25 WAKF	155.85
Fairhaven	2 WFMP	30.70
Fall River	9 WAKV	33.10
Fitchburg	15 WPHA	155.61
Gardner	2 WEWZ	33.94*
Gloucester	6 WGMP	31.78*
Greenfield	6 WKQT	39.90
Groton	4 WJQN	37.90
Hanson	1 WBGF	155.73
Harvard	1 WMYK	37.10
Haverhill	8 WHGF	155.85
Hingham	5 WQTI	37.10*
Holbrook	4 WUWM	155.73
Holliston	1 WDMN	35.10
Holyoke	15 WQJF	156.57
Hudson	8 WEHB	155.13
Hull	7 WQYD	37.10*
	2 WQYE	37.10*
Ipswich	2 WMJQ	37.90*
Kingston	WKDX	31.90
Lancaster	2 WKHS	37.10
Lawrence	7 WBLC	39.90*
Leominster	3 WBND	33.50*
Lexington	2 WBTZ	39.90*
Lincoln	1 WBOQ	155.25
Longmeadow	4 WBUI	37.22*
Lowell	14 WQNR	37.10*
Lynn	9 WKLM	33.22
Lynnfield	2 WLDP	35.90
Malden	16 WSVQ	33.22*
Manchester	1 WBRT	33.94*
Mansfield	3 WAQO	33.78*
Marblehead	20 WBVZ	33.50*
		156.33
Stoneham	2 WRHB	31.10*
Stoughton	4 KAC214	155.73
Taunton	6 WKTB	37.22
Wakefield	7 WKWM	30.58
Walpole	4 HNRQ	31.10
Waltham	8 WRNA	37.78*
Wareham	2 WSTW	37.90*
Watertown	8 WBNE	31.90
Wayland	1 WPEE	37.78
Webster	4 KCA315	150.21
Weymouth	1 WBBM	155.73
Wellesley	7 WQJG	33.78*

**MUNICIPAL & COUNTY POLICE, Cont.**

Sylvan Lake	1 WNVE	155.97
Three Rivers	3 KQA416	155.61
Traverse City	5 WRMB	155.85
Trenton	2 WQWN	31.90
Warren Township	4 WBNR	39.90
Washtenaw C (Ann Arbor)	29 WBJG	35.10
Wayne	48 WQMF	30.98
Wayne C (Flat Rock)	WQZY	37.38
W Bloomfield	5 WBOL	155.97
Wyandotte	5 WRHV	39.50
Ypsilanti	3 WQOK	31.78
	10 KQA226	155.13
	10 KQA226	154.89

**MINNESOTA**

Albert Lee	15 KQEZ	155.01
Austin	9 KQBG	155.13
Bemidji	10 KBJ5	155.01
Bralnerd	1 WRJP	30.98
Cloquet	4 WJFC	37.10
Dakota	2 KPDW	33.94
Duluth	23 KNFE	30.58
	10 KNFE	30.58
	4 KQED	155.01
Faribault	10 KQBC	156.89
Fairmont	55 KANN	39.90
Hennepin	3 WJUI	33.50
Hibbing	3 KSOZ	155.25
International Falls	15 KAA206	31.50
Kandiyo	5 KQAA	39.38
Mankato	77 KQPB	30.58
Minneapolis	1 KGPB	30.58
	35 KGPB	154.15
Moorhead	4 KRSG	39.90
New Ulm	10 KPFF	155.01
Owatonna	4 KOGC	154.77
Ramsey	3 KQKW	33.94
Red Wing	1 KQDB	33.50
Rochester	4 KQAM	37.10
St Cloud	2 KQFY	154.65
St Louis C (Duluth)	KKNF	30.58
St Paul	47 WPD5	33.94
Scott	10 KA2048	155.01
Shakopee	10 KAA355	155.01
South St Paul	3 KQGR	33.94
West St Paul	1 WMRV	33.94
Winona	3 KBZB	35.90
Virginia	2 WDCX	31.50

**MISSISSIPPI**

Adams C (Natchez)	3 WAUA	31.78
Biloxi	3 WJUN	35.90
Cleveland	5 KKA542	155.01
Columbus	20 WUEL	155.13
Greenville	6 WMFG	35.90
Greenwood	25 WSRW	155.25
Grenada	8 WRHF	155.01
Gulfport	5 WGPP	33.50
Harrison	3 WJYG	33.50
Hattiesburg	3 WBJC	33.50
Hinds C (Jackson)	10 KA2709	39.18
Jackson	37 WAMK	39.18
Laurel	3 WLCP	30.98
Meridian	12 WJUA	35.90
Natchez	15 WAMJ	155.31
McComb	10 WKNV	155.25
Oktibbeha C (Starkville)	1 KA2650	42.02
	1 KA2650	42.18
Picayune	6 WFVO	155.25
Vicksburg	4 WRNC	35.10

**MISSOURI**

Cape Girardeau	1 KQBS	30.98
Carthage	6 KCMU	155.61
Cass C (Harrisonville)	3 KAA432	155.73
Colombia	16 KQDE	155.13
Excelsior Sngs	2 KGTE	155.37
Hannibal	4 KGRU	155.13
Independence	3 KRLK	35.90
Jackson C (Independence)	14 KRHW	155.01
Joplin	5 KQAJ	30.58
Kansas City	125 KAA359	155.61
Kirkwood	6 KXYU	155.25
Ladue	6 KQOU	155.73
Marshall	12 KAA329	155.01
Moberly	6 KXRS	155.61
Nevada	10 KSTF	155.25
N Kansas City	6 KFIV	155.85
Sedalia	5 KAA442	155.25
Springfield	14 KQBO	33.10
St Charles	6 KAA217	155.49
St Charles C (St Charles)	2 KBMB	39.78
St Joseph	16 KQBV	39.10
St Louis	150 KGPC	155.85
	100 KSLC	155.13
	100 KSLC	154.89

**MONTANA**

Anaconda	2 KQHU	39.38
Billings	5 KQJZ	39.38
Butte	10 KQA278	39.82
Cascade	6 KOA210	39.82
Custer C (Miles City)	2 KGRC	39.38
Gallatin C (Bozeman)	3 KROI	39.38
Great Falls	6 KPGF	39.38
Helena	3 KHMP	39.38
Kalispell	15 KGKC	39.38
Lewis & Clark C (Helena)	1 KTNQ	39.38
Livingston	3 KVR1	39.50
Miles City	2 KFMW	39.38
Missoula	2 KQKD	39.38
Park C (Livingston)	2 KVRD	39.50
Silver Bow	3 KTMH	39.82
Yellowstone	6 KA3172	39.38

**NEBRASKA**

Alliance	1 KANB	39.90
Beatrice	4 KSIJ	39.90
Boys Town	5 KUWB	155.01
Cass C (Plattsmouth)	1 KSKU	39.90
Chase C (Imperial)	1 KVVY	39.90
Colfax	2 KRLT	39.90
Columbus	5 KQHF	39.50
Dodge C (Fremont)	2 KXCU	39.90
Fremont	2 KCVB	39.90
Grand Island	8 KQAV	155.01
Hastings	8 KRLX	39.90
Kelth C (Ogallala)	5 KA2147	39.90
Lancaster	10 KCGB	39.90
Lincoln C (North Platte)	1 KPIJ	39.90

Lincoln	17 KGZU	30.58
McCook	7 KAA233	155.01
Norfolk	KNGN	24.90
N Platte	3 KRGW	35.50
Omaha	30 KAA312	33.78
	50 KAA312	156.09
	1 KAA358	33.94
Redwillow C (McCook)	3 KA2113	42.30
Saline C (Wilbur)	1 KUWX	39.90
Saunders C (Wahoo)	2 KDBX	39.90
Scottsbluff	10 KRKV	155.01
Scotts Bluff C (Gering)	10 KA2284	39.90
S Sioux City	1 KQWD	31.78
York C (York)	5 KPFS	39.90

**NEVADA**

Carson City	2 KXRL	39.38
Clark C (Las Vegas)	22 KNER	39.38
Elko	10 KOA224	39.38
	10 KQNZ	39.38
Fallon	2 KEUN	39.38
Las Vegas	16 KGHG	155.73
N Las Vegas	3 KQHD	155.01
	3 KQHD	154.77
Reno	31 KOA303	39.38
Sparks	3 KGHC	39.38
Washoe C (Reno)	9 KKWG	39.38

**NEW HAMPSHIRE**

Berlin	10 WUBK	37.50
Claremont	1 WKTX	33.50
Concord	2 WRJV	37.90
Dover	1 KCA352	37.10
Farmington	8 WVEZ	155.25
Hillsboro C (Hudson)	1 WLHB	154.77
Keene	2 WJLR	33.50
Laconia	2 WCOT	30.70
Manchester	25 WQLQ	155.97
Mashua	10 WPHB	154.77
Portsmouth	2 WKSA	33.50
Rochester	2 WHIL	39.50

**NEW JERSEY**

Allendale	2 KA2103	37.10
Allenhurst	2 WMQZ	39.90
Alpine	1 WQRO	37.78
Asbury Park	9 WABM	155.61
Atlantic City	1 WLDN	33.10
	1 WYB	33.10
	10 WQJY	155.57
Atlantic Hghlnds	1 WJZB	39.26
Audubon	6 WETQ	155.37
Avon by the Sea	1 WBSK	39.90
Bay Head	1 WIZN	37.18
Bayonne	20 WQXN	155.49
Beach Haven	1 WJXE	37.18
Beachwood	1 WKBX	37.18
Belmar	2 WQNT	37.10
Belmawr	6 WKWN	155.37
Belleville	20 KEA388	155.61
	20 KEA388	155.85
Bergen C (Hackensack)	22 KEA334	37.10
	9 KEA334	37.78
Bergenfield	4 WRJU	35.90
Bloomfield	9 WAKH	37.22
Bloomington	1 KA3133	37.42
Bogota	3 WIUA	39.50
Boonton	1 WFUA	37.90
Bound Brook	2 WQKA	37.90
Bradley Beach	2 WQHW	39.90
Bridgeton	1 WSKA	31.10
	1 WSKA	31.10
	1 WDBX	39.26
Brielle	1 WJVN	33.10
Brigantine	1 WRWK	155.37
Brooklawn	2 WBSX	37.90
Burlington	1 KA2048	37.42
Butler	1 WAFB	37.90
Caldwell	25 WQNI	155.73
Camden	3 WFZG	156.21
Camden C (Camden)	3 WFUM	156.69
Cape May	1 WKVZ	37.38
Carlstadt	3 WANV	33.10
Carteret	2 WAWX	33.10
Cedar Grove	1 WKTH	156.69
Cinnaminson	2 WFTQ	156.31
Clark	2 WBVX	35.50
Cliffside	20 WSQO	154.05
Clifton	3 WRLZ	155.61
Closter	5 WQNG	156.21
Collingswood	3 WQMC	155.25
Cranford	1 WRPR	39.90
Cresskill	6 KEA262	155.01
Deal	6 KEA395	155.49
Delaware	2 WEDE	33.50
Denville	4 WDHM	33.50
Dover	1 WBNW	37.50
Dumont	10 WTPM	155.13
Dunellen	3 KA2827	156.33
E Hanover	18 WQKI	39.50
E Orange	5 KEA301	156.69
E Rutherford	5 WLDW	155.73
Eaton	1 WFJV	39.26
Eatontown	4 WBOO	39.10
Edgewater	13 WRAD	39.10
Elizabeth	1 WHBA	37.90
Emerson	2 WQJK	33.50
Englewood	1 WBMC	37.78
	1 WJJE	39.26
	3 WIHC	155.37
Englishtown	1 WRKY	37.26
Essex Falls	1 WRXN	39.26
Ewing	2 WQAZ	156.45
Fair Haven	3 WCYK	37.90
Fanwood	2 KEA396	155.49
Fair Lawn	5 WSLC	35.50
Florence	2 WNKR	156.45
Florham Park	2 WBKN	39.26
Franklin Lakes	2 WAI1	39.26
Fort Lee	4 WRQE	39.10
Freehold	1 WGP1	155.25
Garfield	1 WHNU	155.25
Garwood	3 WBYY	37.22
Glassboro	2 WSBF	156.73
Glen Ridge	4 WXAH	155.37
Glen Rock	1 KA2495	155.37
Gloucester	1 WAKV	39.90
	9 WQJ1	37.50
	2 WBKH	156.21
Guttenburg	4 WRAN	155.37
Hackensack	3 WRBJ	155.49
Haddon	6 WQJM	37.26
Haddon Heights	1 WLSH	39.02
Haddonfield	1 WFGQ	155.61
Hamilton	10 WXAG	156.21
Hanover	2 WBXX	33.10
Harrington Park	2 WRGN	39.90
Harrison	2 WBXL	33.95
Hasbrouck Hgts		
Hawthorne		
Highland Park		

Highlands	1 WJSR	39.26
Hightstown	1 WBGJ	39.26
Hillsdale	1 WRNG	155.13
Hillside	6 WSYZ	35.50
Hoboken	25 WMFH	156.57
Hoboken	1 WSRP	37.78
Hoboken	1 WAAG	39.26
Interlaken	10 WLSN	35.90
Irvington	46 WQRS	31.90
Jersey City	1 WRMJ	31.90
Keansburg	2 WPKO	155.37
Keary	13 KEA245	39.90
Keypoint	1 WDCM	39.26
Lakewood	2 KEA268	37.18
Lavallette	1 KEA278	37.18
Lawrence	2 WQJN	37.26
Leonta	5 WSTB	35.90
Lincoln Park	1 WRBO	31.50
Linden	1 WAJQ	31.10
Linwood	4 KEA288	155.73
Little Falls	4 KEA377	156.09
Little Silver	1 WFAF	39.26
Livingston	6 KEA318	156.33
Long Branch	3 WQNF	37.10
Longport	6 KEA308	155.73
Lower Penns Neck	5 KEA242	155.25
Lyndhurst	5 WSOM	155.73
Madison	5 WQJU	39.02
	1 WJSH	39.26
	1 KA2843	37.18
Mahwah	1 WMNJ	39.26
Manasquan	1 WBYP	31.90
Manville	6 WAPK	37.50
Maplewood	10 WRLY	155.73
Margate City	1 WCBL	39.26
Matawan	1 WKZB	39.26
	5 WQMX	155.01
Maywood	1 WFZD	37.90
Middlesex	2 WBXZ	39.26
Middleton	1 WRB3	33.50
Midland Park	8 WQKJ	37.10
Milburn	1 WMNS	33.94
Milltown	1 WRHR	33.94
Millville	1 WMNF	39.26
Monmouth Beach	55 KEA317	39.26
Monmouth C (Freehold)	1 WKJE	155.25
Monroe	12 WQMO	156.57
Montclair	3 WKQL	155.37
Montvale	1 KA2647	37.42
Montville	3 WQNG	37.50
Moorestown	2 WQXK	39.10
Morris	9 WFRF	155.01
Morris C (Morristown)	50 WKYE	39.02
Mt Ephraim	5 WQQA	155.37
Mt Holly	1 WBOD	30.70
Mountainside	1 WBXE	33.50
Neptune	3 KEA276	37.26
Neptune City	1 WPKG	39.26
Newark	100 WQIE	156.21
New Brunswick	30 KEA379	155.61
New Milford	1 WGS3	37.90
New Providence	2 WGXZ	33.50
North Arlington	3 WBRZ	154.65
North Bergen	14 WAHG	31.10
North Caldwell	1 WAMM	39.10
Northfield	5 KEA300	155.73
North Haledon	1 WBVF	35.50
North Plainfield	2 WQJ5	155.73
North Wildwood	3 WITO	156.21
Nutley	4 KEA216	155.37
Oakland	1 KA2646	37.42
Oaklyn	1 WRMG	156.21
Ocean	10 WEMD	156.57
Ocean City	4 WHTV	39.10
Ocean C (Tom's River)	9 WBAK	37.18
Oceanport	2 WCBU	39.26
Oradell	1 WGMU	37.90
Orange	13 WQTS	155.01
Palisades Park	1 WPPP	37.10
	1 WPPP	37.10
	8 WPKF	155.01
Palmyra	2 WBKE	37.78
Paramus	6 WQJ1	156.21
Park Ridge	20 WQRH	154.77
Passaic	22 WRGO	35.50
Paterson	5 WWSB	155.25
Paulsboro	3 WSPT	39.10
Pennsauken	10 WSPT	155.61
	1 WBSL	35.50
Penns Grove	1 KA2645	37.42
Pequannock	5 WFTK	37.90
Perth Amboy	2 WENX	156.09
Phillipsburg	1 KA2832	37.18
Pine Beach	3 WQJY	39.90
Piscataway	7 WAOV	155.25
Pitman	10 WJKG	156.45
Plainfield	12 WQMQ	155.73
Pleasantville	1 WAXV	39.26
Point Pleasant	3 KEA291	37.42
Pompton Lakes	2 WQTA	37.10
Princeton	2 WRBI	37.10
	1 WBTL	35.50
Prospect Park	8 WQYQ	156.33
Rahway	1 KA3114	33.50
Randolph	8 WQJC	39.26
Raritan	1 WBVI	

# GENERAL ELECTRIC

## Electronics Department Offices in:

Atlanta 3, Ga. • Boston 1, Mass. • Chicago 54, Ill.  
 • Cincinnati 2, Ohio • Cleveland 4, Ohio • Dallas  
 2, Texas • Denver 2, Colo. • Detroit 26, Mich. •  
 Kansas City 6, Mo. • Los Angeles 14, Calif. •

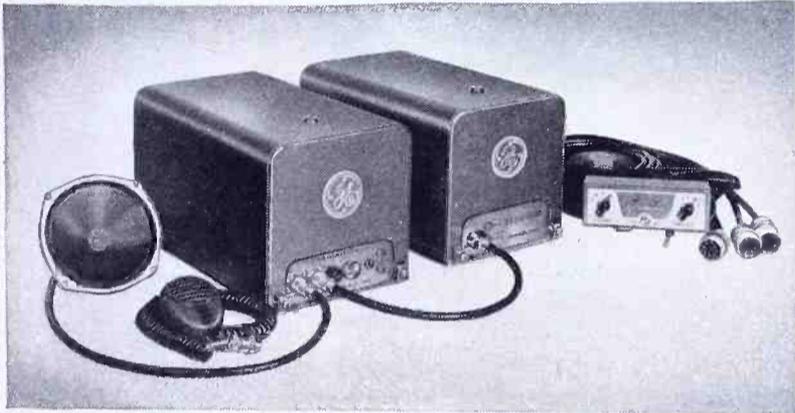
**ELECTRONICS PARK  
 SYRACUSE, N. Y.**

Minneapolis 2, Minn. • New York 22, N. Y. •  
 Philadelphia 2, Pa. • Salt Lake City 9, Utah •  
 San Francisco 4, Calif. • Schenectady, N. Y. •  
 Seattle 4, Wash. • Syracuse 1, New York •  
 Washington 5, D. C.

In Canada, Canadian General Electric Company, Ltd., Toronto, Ont.

Outside the U. S. A. and Canada, by International General Electric Company, Inc., Electronics Dept., Schenectady, New York, U. S. A.

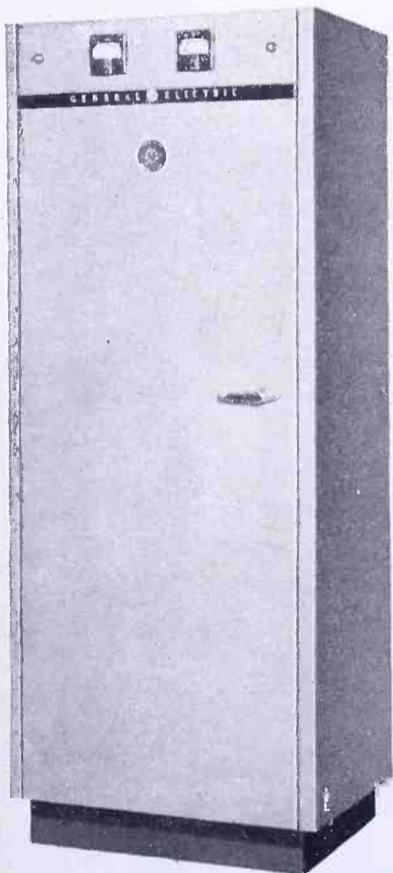
## **2-WAY RADIO** **for time-saving communication**



**25-50 MC MOBILE**—General Electric Mobile Combination for operation in the 25-50 mc band. These combinations consist of the receiver, 30 (or 50) watt transmitter, loud speaker, microphone with retractable cord, antenna cables, control unit, antenna, and power and control cables. Designed to withstand the grueling road-shock of day-in, day-out operation in the oil fields.

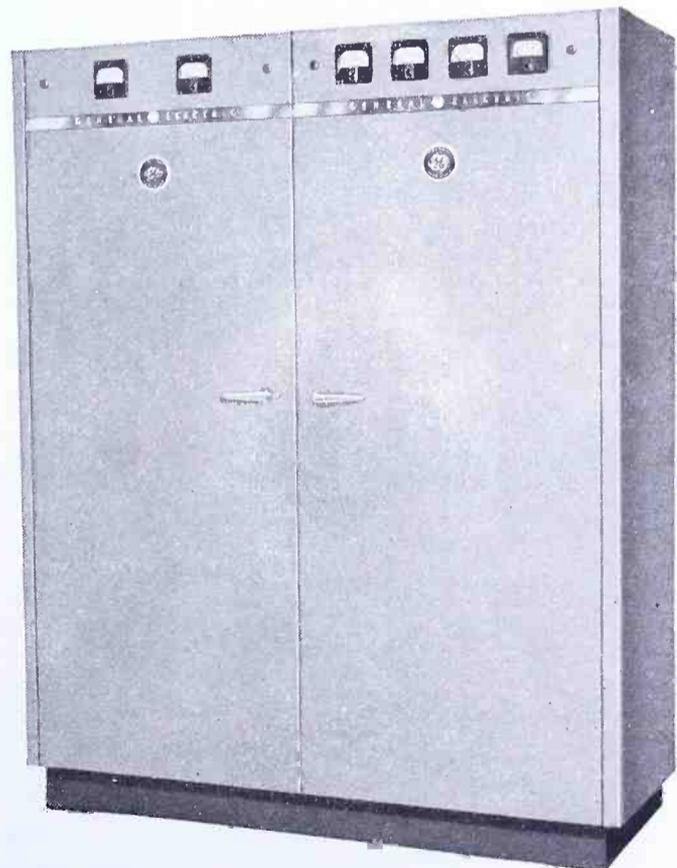


**GENERAL ELECTRIC MOBILE COMBINATION MC-201** for dependable operation in the 152-162 mc band. Features single unit design with receiver, transmitter and power supply mounted mechanically on one main chassis. Electrical connection is made instantly through G-E special-design plug-in feature. MC-201 consists of receiver, transmitter, power supply, loud speaker, microphone with retractable cord, antenna, control unit, power and control cables.



◀ **GENERAL ELECTRIC 50 WATT STATION COMBINATION** for use in the 25-50 mc or 152-162 mc band. Consists of 50 watt transmitter, receiver, local or remote control terminal equipment and extra space for additional receivers or accessory equipment. Height, 66 inches; width, 24 inches; depth, 20 inches. Designed for "block-building" so that the simple addition of a 250 watt amplifier will boost the power output rating.

**GENERAL ELECTRIC 250 WATT TRANSMITTER-RECEIVER STATION COMBINATION** for the 25-50 mc or 152-162 mc bands. The cabinet contains a 250 watt power amplifier, 50 watt exciter, receiver, local/remote control equipment and ample space for additional receivers or accessory equipment. Height, 66 inches; width, 48 inches; depth, 20 inches.



*General Electric manufactures a complete line of radio communication equipment and accessories.*

In addition to the combinations shown on this page, and of special interest, are a desk cabinet 50 watt station, a polemounted outdoor type station, a portable trunk unit and a weather proof housing for vehicular mounting. For complete information, call your nearest G-E office or write: General Electric Company, Transmitter Division, Electronics Park, Syracuse, New York.

**MUNICIPAL & COUNTY POLICE, Conf.**

New York (Bronx)	88 WEYW	39.82
(Brooklyn)	WPEF	33.94
(Manhattan)	WPEE	33.94
	99 KEA394	245.0
(Jamaica)	150 KEA370	39.90
	1 WNAJ	33.94
	11 WNYM	30.98
(St. George, S I)	29 WRFN	33.94
Niagara Falls	45 WNFJ	37.10
Nissequogue	1 KA3336	155.09
N Castle	3 KEA234	35.90
North Pelham	4 WQLD	155.25
Northport	2 WRKD	31.50
N Tarrytown	1 WBXN	37.10
N Tonawanda	14 WBTI	35.90
Norwick	5 KEA321	155.25
Nyack	1 KEA332	37.18
Ogdensburg	5 WHJC	155.55
Olean	2 WQMV	37.90
Old Westbury	3 WDQK	37.34
Oneida	4 WJAM	35.10
Oneonta	3 WQFJ	30.58
Ononaga C (Syracuse)	14 KA2173	39.98
Ontario C (Canandaigua)	18 WNYT	37.90
Orangetown	3 KEA378	37.10
Ossining	1 WVAE	37.10
Oswego C (Pulaski)	20 KEA271	37.90
Oyster Bay Cove	1 KA2208	37.34
Pekskill	2 WBZW	31.50
Pelham	2 WQOT	37.10
	4 WDAG	155.25
Pelham Manor	5 WFJU	155.25
Pleasantville	3 WHBP	155.37
Piermont	1 WRHE	37.18
Plattsburg	10 WDGS	156.33
Port Chester	6 WRSY	156.45
Port Jervis	1 WQXY	155.73
Port Washington	3 WABN	156.57
Poughkeepsie	10 WRCV	155.13
Putnam Vly	1 WIKI	31.50
Ramapo	3 KA2892	37.18
Rensselaer	2 WVSM	155.01
Riverhead	2 WAYT	39.18
Rochester	76 WPDH	30.58
Rockland C (New City)	7 KEA323	37.18
Rotterdam	3 WRTK	35.50
Rye	12 WQKU	155.01
Salamanca	2 WBSB	37.90
Sands Point	2 WQHZ	35.90
Saratoga Spgs	2 WJGB	35.90
Scarsdale	8 WQKL	155.49
Schenectady	13 WQRB	37.10
	2 WBGJ	39.50
Scotia	2 KA3325	39.50
Sloatsburg	1 WCUJ	31.10
Smithtown	7 KEA387	156.09
	7 KEA387	156.21
Solvay	3 WCOY	35.90
Southampton	8 WHTS	39.18
	2 WKPH	155.73
South Nyack	1 KA3251	37.18
Spring Valley	2 KA3146	37.18
Suffern	1 KA3149	37.18
Syracuse	32 KEA207	39.74
	10 KEA207	39.98
Tarrytown	3 WBLN	35.50
Troy	25 WRCD	155.61
Tuckahoe	5 WQJD	155.49
Tuxedo Park Assoc. Inc.	1 KEA357	37.18
Upper Nyack	1 KA3370	37.18
Utica	23 WPGJ	31.50
Warsaw	1 WMLJ	37.90
Watertown	6 KEA223	37.10
Watervliet	1 WMJN	37.90
Westchester C (White Plains)	27 WJKS	37.26
Westfield	27 WJKS	37.42
West Seneca	1 WEQK	37.90
White Plains	12 WSEN	155.01
Yonkers	22 WQKS	37.10
Yorktown	9 WPFY	37.22
	2 WNHO	31.50
<b>EXPERIMENTAL</b>		
Brookhaven	W2XML	74.50
Patchogue	W2XMK	73.22

**NORTH CAROLINA**

Albemarle	13 WFAQ	155.13
Asheboro	5 WKRD	155.13
Asheville	13 WQMJ	39.98
Beaufort	10 WEHV	35.90
Burlington	10 WRJE	39.98
Canton	5 WBKG	37.10
Chadbourn	2 KA2389	39.50
Charlotte	30 KIA565	35.90
Concord	3 WQNE	33.10
Craven C (New Bern)	4 KA2080	35.90
Durham	25 WDMF	39.10
Durham C (Durham)	10 WUEV	39.10
Edentown	4 WQZE	35.90
Elizabeth	5 WBIV	39.50
Fayetteville	13 WRO3	33.50
Forsyth C (Winston-Salem)	10 WRPU	155.25
Gaston C (Gastonia)	12 WMHY	37.10
Gastonia	4 WQNZ	37.10
Goldsboro	4 WABQ	35.90
Granite Falls	1 WEVQ	37.50
Greensboro	22 WQMR	37.10
Greenville	4 WJPT	35.90
Guilford C (Greensboro)	14 WLSG	39.50
Henderson	6 WSQP	39.50
Hendersonville	6 WHSD	39.10
Hickory	5 WRGY	37.50
High Point	6 WHPP	39.50
Iredell C (Statesville)	3 WDBR	33.94
Jackson C (Sylva)	6 KIA313	37.10
Jacksonville	5 WMHU	39.10
Kings Mountain	2 WIUD	37.50
Kinston	6 WQLR	35.90
Leaksville	2 WGNJ	39.58
Lenoir	11 WBNL	37.50
Lexington	2 WRNT	33.10
Lumberton	15 WKQM	39.50
Mecklenburg C (Charlotte)	10 KIA473	37.90
	22 KIA488	39.98
	2 WKZM	39.50
Monroe	6 WKWO	155.13
Mooreville	2 WQME	35.90
Mt Airy	3 WADX	35.90
New Bern	5 WEKH	39.38
Oxford	2 WTEJ	35.90
Pitt C (Greenville)	10 WQLY	31.50
Raleigh	2 WRPW	39.58
Reidsville	10 WPXC	35.90
Roanoke Rapids	4 WQLI	33.50
Rocky Mount		

Rutherfordton	9 WATU	33.50
Salisbury	5 WQLU	33.10
Shelby	3 WANY	37.50
Statesville	2 WDBS	33.94
Sylva	2 KA2357	37.10
Tabor City	2 KA2387	39.50
Thomasville	2 WETO	39.50
Washington	6 WDPJ	35.90
Wayne C (Goldsboro)	1 WJDZ	35.90
Whiteville	2 KA2388	39.50
Wilmington	17 WDPW	155.01
Wilson	10 WQNU	155.13
Winston-Salem	31 KIA397	155.25

**NORTH DAKOTA**

Bismarck	10 KAA328	39.90
Cass C ( Fargo)	1 KXYX	39.90
Fargo	22 KNHM	39.90
Grand Forks	5 KQSO	39.90
Mandan	4 KA2432	39.90
Minot	10 KAA291	39.90

**OHIO**

Adams	2 WJQB	30.70
Akron	12 WPDO	155.97
Allen C (Lima)	2 WAAL	37.90
Alliance	4 WJUK	33.94
Amberly	12 WBIU	155.85
	WBIU	155.61
Ashland	2 WAXC	37.90
Ashtabula	12 WSTK	155.61
	WSTK	155.37
Ashtabula C (Jefferson)	20 WSIG	39.58
Athens	6 KQA206	39.58
Barberton	6 WJGD	155.61
	6 WJGD	155.85
Beachwood	1 WANW	37.90
Bedford	6 WBQF	155.61
Bellevue	3 WBAU	39.58
	3 WBAU	39.66
Berea	10 WTNE	155.61
Bexley	4 WBTR	154.65
Bowling Green	12 KQA251	39.58
	12 KQA251	39.66
Brecksville	2 WMLB	37.90
Bucyrus	6 KQA229	39.58
Canal Winchester	4 WJZA	39.58
Canton	25 WQKW	156.57
Campbell	2 WNKQ	37.22
Chagrin Falls	2 WJZN	37.90
Champaign C (Urbana)	1 KA3144	39.58
	1 KA3144	39.66
Chillicothe	12 KQA412	154.89
Cincinnati	45 KQA387	30.58
	160 KQA387	156.09
	6 KQA304	155.85
Clark C (Springfield)	10 KA2291	154.77
	10 KA2291	156.69
Cleveland	WEND	33.10
	WRPD	33.50
Cleveland Hgts	11 WSKO	37.50
Clyde	6 WLDO	39.66
Columbiana	6 KQA356	39.58
	6 KQA358	39.66
Columbus	80 WPDJ	154.85
Coshocton	5 WDQH	155.85
Cuyahoga Falls	8 WBUJ	35.90
Defiance	8 KQA361	155.61
	8 KQA361	155.85
Defiance C (Defiance)	2 WJES	39.78
Delaware	1 WHIV	39.66
Delaware C (Delaware)	2 WHNL	39.66
East Cleveland	10 KQA214	155.13
	10 KQA214	154.89
East Liverpool	4 WMLC	37.90
Elyria	12 KQA377	31.50
Erie C (Sandusky)	5 WALU	30.98
Euclid	11 WLSD	39.90
Fairfield C (Lancaster)	3 WFPV	33.22
Fairview Park	5 KQA404	155.61
	5 KQA404	155.85
Findlay	8 WUVB	155.61
Gallon	1 WRQM	30.98
Gallipolis	10 KQA360	39.58
Garfield Hgts	3 WBHA	37.90
Gates Mill	2 WKWB	37.90
Gibsonburg	1 WGBY	39.78
Girard	1 WJSD	37.22
Grand River	1 WNZW	31.50
Grandview Hgts	8 WKTI	154.65
Geauga C (Chardon)	1 WNZE	37.90
Greenville	1 WQZE	37.90
Hamilton C (Cincinnati)	25 KQA230	39.58
	25 KQA230	39.66
	1 KQA231	39.58
Hardin C (Kenton)	1 WHCO	37.90
Hilliards	2 WJZJ	39.58
Hills & Dales	1 WRSI	155.57
Hunting Valley	4 WKUW	37.90
Indian Hill	8 WQST	155.85
Ironton	3 KQA330	155.61
Jackson	WSPX	243.0
Jefferson C (Steubenville)	5 WWRV	33.10
Kenton	2 WKMP	37.90
Kirtland Hills	2 WKWX	31.50
Knox C (Mt Vernon)	8 WAWI	39.66
Lakewood	11 WHTL	37.90
Lancaster	4 WQFO	33.22
Licking	11 WHHA	39.66
Lima	7 WAFU	37.90
Lisbon	3 KA2839	39.66
Lockland	3 WBMZ	37.90
Logan	1 WBOH	31.50
Lorain	8 WLOP	37.10
Lyndhurst	2 WKVE	37.90
Madison	3 KQA389	39.58
	3 KQA389	36.66
	4 WJZE	37.90
Mahoning C (Youngstown)	7 WRMY	37.22
Mansfield	5 WQFY	37.90
Maple Heights	3 WMVH	37.90
Marietta	10 WRGL	39.66
Marion	12 WJJI	39.66
	2 WKUI	39.58
Marion C (Marion)	10 KA2685	39.66
Martins Ferry	4 KQA250	155.61
Massillon	6 WBGT	37.10
Maumee	3 WMFS	30.70
Mayfield	2 KA2953	37.90
Mayfield Hgts	3 WKVF	37.90
Mentor	WMOP	31.50
Menton on the Lake	1 WAIS	31.50
Middletown	11 WBVB	35.90
Montgomery C (Dayton)	15 WBAV	155.85
Moreland Hills	2 WKVH	37.90
Morrow C (Mt Gilead)	1 WKTR	39.78

Mt Vernon	4 WMVK	39.66
Nelsonville	4 WKAU	155.61
Niles	4 WRQL	155.13
Newark	5 WQRW	39.66
Norwalk	2 WJUM	37.90
Norwood	10 WBVG	39.50
Oakwood	4 WBKC	33.50
Orange	2 WJZL	37.90
Osborn	8 WEQS	155.85
Ottawa Hills	4 WDHV	39.66
Ottawa C (Port Clinton)	3 WQOL	31.50
Painesville	3 WKHL	37.90
Parma	8 WTAK	35.90
Pepper Pike	2 WKVK	37.90
Perrysburg	4 WKYF	39.66
Pickaway C (Circleville)	10 KA2344	155.85
Piqua	5 WQTP	155.13
Port Clinton	4 WSTM	39.66
Portage C (Ravenna)	4 WFRK	37.90
Portsmouth	9 WPGI	30.58
Ravenna	1 WRAA	37.90
Reading	3 WCDE	37.90
Rocky River	8 WAFX	39.50
Rossford	2 KQA394	154.89
	KQA394	155.13
St Bernard	3 WJBS	37.50
Salem	5 WBGW	37.10
Sandusky	4 WAKI	30.98
	5 WBTU	39.66
Seneca C (Tiffin)	4 WBNA	39.66
Shaker Hgts	4 WQHN	37.90
Shelby	4 WAMH	155.13
Sidney	6 WSGO	155.85
Silver Lake	1 WKUJ	35.90
Solon	1 WBUG	37.90
South Euclid	3 WKTW	37.50
Springfield	30 KQA447	156.69
	KQA447	154.77
Stuebenville	3 WPHD	33.10
	5 WPHD	154.85
Sylvania	1 WSFI	30.70
Tallmadge	1 WTAJ	39.66
Terrace Park	1 KA2743	39.58
Tiffin	4 WKTTP	39.66
Toledo	33 WRDQ	35.22
Toronto	1 WRIL	33.10
Troy	3 WQTX	37.90
Trumbull C (Warren)	10 WAFE	39.66
University Hgts	4 WKDK	37.90
Upper Arlington	5 WUAP	154.65
Urbana	2 KQA422	39.66
Van Wert C (Van Wert)	2 WBPG	39.78
Van Wert	4 WGEB	155.85
Waite Hill	2 WKKU	31.50
Warren	9 WCBK	39.66
Warrensville Hts	4 KA3307	39.90
	1 WMPY	37.90
Wellsville	2 WMPD	

# NEW FD-12 FM FREQUENCY and MODULATION MONITOR

by *Doolittle*

HANDLES UP TO 4 FREQUENCIES

Anywhere between 25mc. and 170mc.

*...and with .0015% accuracy!*

Another first  
by Doolittle  
**ONE Monitor for All  
FM Emergency Services!**

Now you can stop worrying about a frequency change. With this *one* direct-reading Monitor, you can handle one, two, three or four frequencies... or any combination up to four... on the same or different bands... anywhere between 25 Mc. and 170 Mc. And you can check not only frequency deviation, *but also your percentage of modulation!* Ideal for today's FM Emergency Services. Based on years of experience in the design and manufacture of frequency monitors, the FD-12 gives you all the features you've wanted... in *one* instrument. Meets *all* FCC requirements. Assures utmost convenience, accuracy and reliability.



*Doolittle*

**RADIO, INC.**

Builders of Precision Communication Equipment • 7421 South Loomis Blvd., Chicago 36, Ill.

**MUNICIPAL & COUNTY POLICE, Cont.**

Sewickley	5 WBXP	155.13
Sewickley Hgts	3 WQIA	33.10*
Shaler	1 WRFY	39.38
Shamokin	2 WKXU	155.61
Sharon	5 WQFU	39.42
Sharon Hill	2 WQOC	37.90*
Sharpsburg	1 WBFH	39.38
Spring City	2 WFUQ	30.58
Springfield	2 WSRT	31.78*
Spring Garden	2 WKVS	156.57
State College	1 WJZD	39.10
Steelton	5 WSPJ	155.49
Stowe	1 WCHX	39.38
Swarthmore	2 WPPQ	31.78*
Tinicum	1 WBOI	31.78*
Trainer	1 WDLC	37.90
Uniontown	2 WQTN	39.10
Upper Chichester	1 WKYU	37.90
Upper Darby	12 WGBJ	156.57
Upper Dublin	2 KA2471	39.18
Upper Moreland	1 KA2472	39.18
Upper Providence	1 WBLP	31.78*
Warren	5 WENZ	155.13
Washington	2 WKYR	39.10
Waynesboro	2 WIUY	33.50*
West Chester	4 WQNV	33.10
West Deer	1 WDKV	39.38
W Goshen	1 WBQE	33.10
West Mifflin	2 WMIJ	39.38
West View	1 WTQD	39.38
Whitehall	2 WBWT	39.38
Wilkes Barre	15 WQFM	156.09
Wilkesburg	6 KGA239	156.57
WilliamSPORT	15 WQOH	156.45
Wyomissing	1 KA2959	156.01
Yeadon	5 WRLO	39.42
York	6 WAKX	156.33

**PUERTO RICO**

Aguadilla	1 WSJP	155.13
Arecibo	1 WSJH	155.13
Bayamon	1 WSJL	155.13
Caguas	1 WSJK	155.13
Culebra	WSJE	155.13
Guyama	1 WSJF	155.13
Humacao	1 WSJG	155.13
Mayaguez	WLHP	155.13
	WSJL	155.13
Ponce	WSJB	155.13
Puerto Rico, Govt.	1 KJRF	155.13
San Juan	1 WSJO	155.13
	WSJC	155.13
Vieques	WSJD	155.13

**RHODE ISLAND**

Barrington	6 WSNE	155.49
Central Falls	3 WAAA	39.38*
Cranston	20 WPGK	156.97
Cumberland	4 KCA261	156.45
E Providence	16 WPEI	33.22*
Middleton	1 WVFJ	155.73
Newport	8 WMPH	155.73
N Kingstown	8 WNHZ	37.10
N Providence	3 WRKF	155.85
	3 KCA235	156.45
Pawtucket	9 WPFV	39.38*
Providence	100 WPGF	155.85
Warwick	35 WSYV	154.89
Westerly	10 WCZC	155.85
Woonsocket	6 WPFM	39.10

**EXPERIMENTAL**

Providence	45 W1XVI	154.57*
------------	----------	---------

**SOUTH CAROLINA**

Aiken	3 WRXP	39.50
Anderson	3 WRJQ	37.50*
Charleston	3 WCPD	243.0
Chester	5 WJSU	155.25
Chester C (Chester)	10 WJVF	155.25
Clinton	4 WCWQ	155.73
Columbia	14 WCMP	39.38
Darlington	3 KA2487	39.58
Florence	7 KIA244	37.50
Fort Mill	5 WGXB	156.89
Greenville	35 WQLG	155.25
	16 WPGR	37.10
Greenwood	25 WSVQ	155.13
Hartsville	3 KIA388	39.98
Lancaster	6 WIAT	35.50
Laurens	12 WOMU	155.73
Laurens C (Laurens)	15 WONH	155.73
Orangeburg	10 WJQC	155.13
Rock Hill	10 KIA357	39.10
Spartanburg C (Spartanburg)	20 WBPB	35.90
Spartanburg	10 WSSC	35.90
Sumter	3 WLAH	33.10
Union	15 WKWQ	155.01
York	11 KIA468	39.10

**SOUTH DAKOTA**

Aberdeen	2 KAWC	39.10
Belle Fourche	2 KXYM	39.10
Beresford	2 KAOJ	39.18
Brookings	2 KQJF	39.10
Brookings C (Brookings)	3 KUMD	39.18
Brown C (Aberdeen)	2 KRQA	39.10
Charles Mix C (Lake Andes)	2 KWVI	39.18
Clay C (Vermillion)	1 KVML	39.18
Codington C (Watertown)	4 KJXP	39.18
Custer	3 KA3110	39.18
Davison C (Mitchell)	1 KGLK	39.18
Day C (Webster)	2 KRDR	39.18
Deadwood	1 KBPR	39.18
Deuel	4 KBON	39.10
	4 KUON	39.10
	3 KDCQ	39.10
Elk Point	2 KXQK	39.18
Fall River	2 KXQV	39.10
Faulkton	2 KAVY	39.18
Grant C (Milbank)	2 KSTY	39.18
Gregory C (Burke)	1 KAMW	39.10
Hanson C (Alexandria)	1 KWAR	39.10
Hot Springs	2 KPVB	39.10
Huron	1 KCIA	39.10
Kingsbury	2 KVUF	39.18
Lake Andes	5 KAA408	39.10
Lawrence C (Deadwood)	5 KAA408	39.18
	2 KHFT	39.18
Madison	2 KUOR	39.18
McIntosh	2 KXAB	39.18
Minnehaha	2 KXAB	39.18

Mitchell	1 KQSP	39.10
Pennington C (Rapid City)	2 KRTX	39.18
Pierre	2 KBKV	39.10
Rapid City	10 KNGM	39.50
Redfield	1 KAA343	39.10
Roberts C (Sisseton)	4 KAA257	39.10
	4 KAA257	39.18
Sioux Falls	11 KBTY	39.10
Spink C (Redfield)	1 KSCD	39.10
Sturgis	2 KTIA	39.18
Sully C (Onida)	2 KHNK	39.10
	1 KRUE	39.10
Vermillion	3 KAZM	39.10
Walworth	3 KAZM	39.18
Watertown	1 KQJM	39.18
Yankton	3 KQXR	39.18
Yankton C (Yankton)	2 KUQG	39.18

**TENNESSEE**

Alcoa	2 WNLF	33.50
Belle Meade	25 KIA233	37.26
Bristol	1 WHTW	37.90
Chattanooga	35 WRCK	37.10
Clarksville	3 WGTQ	155.01
Cleveland	2 WNOC	37.26
Columbia	4 WDDV	37.26
Dyer C (Dyersburg)	1 WKXI	39.38
Dyersburg	4 KIA385	39.38
Gallatin	10 WBBG	37.26
Greenville	7 WNTH	37.26
Jackson	3 WPGZ	31.50
Johnson City	15 WKHJ	155.01
Knoxville	5 KIA376	155.25
Lawrenceburg	5 KIA321	155.25
Lexington	2 WNPO	33.50
Maryville	10 WEAA	37.26
Maury C (Columbia)	77 WPEC	30.58*
Memphis	13 WEBT	37.26
Murfreesboro	51 KIA231	37.10
Nashville	2 WBTV	37.10
Paris	6 WTRW	155.25
Springfield	1 WR1X	37.9*
Union City	5 WMLA	155.81
Washington C (Jonesboro)		

**TEXAS**

Abilene	14 KADR	30.98*
Alamo Hgts	1 KQZW	33.22*
Amarillo	4 KQDH	30.55*
Angelina	10 KHFW	37.22*
Austin	102 KKA484	155.61
Beaumont	50 KGPJ	37.22*
	35 KGPJ	37.22*
Bell C (Belton)	3 KA3190	37.18
Bexar C (San Antonio)	24 KPBT	33.22*
Big Spring	2 KACM	33.22*
Borger	3 KGCV	30.58*
Brazos C (Bryan)	4 KCFV	37.10
Brown C (Brownwood)	5 KAGJ	24.58*
Brownwood	4 KNGW	33.58*
Brownsville	7 KGHT	35.10
Bryan	20 KPBR	37.10
Cameron C (Brownsville)	9 KOGA	35.10
Carthage	1 KHUU	35.50
Cherokee C (Rusk)	8 KKA590	37.26
Cibola	4 KNGE	35.10
Corpus Christi	18 KGHV	33.22*
Corsicana	5 KRGA	30.98*
Cuero	3 KLFQ	35.50
Dallas	72 KVP	33.22*
	KVPA	171.4*
Dallas C (Dallas)	11 KRMB	33.22*
Denison	10 KQAT	31.50*
Denton	8 KKA614	37.10*
El Campo	3 KA2975	37.26
Electra	3 KPDE	245.8*
El Paso	5 KGZM	33.10*
	40 KGZM	154.65*
El Paso C (El Paso)	8 KRHV	33.10*
Ennis	1 KAAV	35.10
Fort Worth	71 KQAN	37.14*
	KRLJ	33.10*
Freeport	5 KSME	37.26*
Gainesville	12 KADM	30.58*
Galena Park	2 KBZQ	35.50
Galveston	18 KRPW	33.22*
	5 KGCT	33.22*
Gladewater	1 KBYN	33.22*
Grande Prairie	KISE	39.10
Grayson	5 KFYL	39.10
Greenville	15 KIFX	39.50
Gregg C (Longview)	25 KKA463	37.26
Hardin C (Kountze)	2 KKA224	37.18
Harlingen	10 KXDJ	155.61
Harrison C (Marshall)	6 KSVH	37.26
Hempstead	15 KRLS	37.26
Henderson	6 KDLV	35.10
Highland Park	7 KQGS	37.10*
Houston	25 KHTP	156.03
	1 KHPR	171.4*
Howard C (Big Spring)	KFEA	33.22*
Hunt C (Greenville)	4 KKA367	39.50
Kendall C (Boerne)	1 KA2496	42.90
Kilgore	4 KKPD	33.22*
Kingsville	10 KKA264	37.26
Lamar C (Paris)	6 KTUY	155.25
Laredo	25 KYNL	39.10
Liberty	10 KRVT	37.18
Longview	8 KACU	31.78*
Lubbock	9 KGZW	33.22*
Lufkin	5 KQDN	37.22*
Marshall	12 KADT	39.38
	2 KADT	39.38*
McAllen	13 KBQI	155.13
McKinney	8 KTRV	37.22*
McLennan C (Waco)	10 KRWH	39.42
Mexia	3 KOXW	33.22*
Midland	12 KKA662	37.18
Midlothian	1 KRPT	35.10
Nacogdoches	1 KRAN	37.22*
Nueces	4KA3189	37.18
Odessa	25 KKA490	37.18
Olmos Park	7 KEZU	33.22*
Orange	2 KRYS	35.50
Palestine	3 KPAM	30.58*
Panola C (Carthage)	6 KQKM	155.25
Pampa	3 KPPI	33.22*
Paris	1 KRKQ	245.8*
Pasadena	8 KPAT	37.22*
Plainview	7 KKA380	37.18
Port Arthur	15 KRTP	37.26
Refugio C (Refugio)	15 KRTP	37.26
Rosenburg	5 KKA398	37.22*
San Angelo	70 KQZE	33.22*
San Antonio	6 KQUV	39.10
Sherman	7 KA2910	37.26
Smith C (Tyler)	5 KKA348	39.10
Sweetwater		

Taylor	5 KKA327	155.13
Temple	5 KKA646	37.18*
Terrell Hills	1 KQJB	33.22*
Texas City	3 KTWL	33.22*
Tyler	6 KQCF	31.90
University Park	13 KQZI	31.50*
Vernon	4 KHGZ	30.58*
	4 KBLB	245.8*
Victoria	6 KDJD	33.50
	15 KEPL	33.50
Waco	35 KGZQ	39.42
Waxahachie	5 KRKC	35.10
	KQIH	35.10
Westover Hills	KRIW	33.10*
West Univ Place	2 KHQK	33.22*
Wharton	9 KWSO	37.26*
	1 KWSO	37.26
	1 KA2315	37.26
Wichita	15 KGZI	30.58*
Williamson	1 KA2494	42.90
Yoakum	1 KPRQ	33.50

**UTAH**

Ogden	8 KQCH	30.58
Provo	9 KPMU	155.01
Salt Lake City	58 KGPW	30.58*
	15 KGPW	155.01
Springville	1 KRWA	35.78

**VERMONT**

Brattleboro	5 WBQG	33.50
Burlington	5 WRCW	155.37
Rutland	2 WBMI	39.10
Springfield	4 WIUF	39.10

**VIRGINIA**

Alexandria	16 WAVA	31.10
Appomattox C (Appomattox)	1 WNKV	47.20
Arlington	10 WPAV	33.50
Augusta C (Staunton)	2 WKUG	39.90
Bedford C (Bedford)	2 WBCL	42.70*
Bristol	2 WPHV	37.80
Caroline C (Bowling Green)	2 WDLV	42.70
Charlotte C (Court House)	WEKC	35.38
Charlottesville	10 WQTE	36.50
Chesterfield	20 WMSO	36.50
Colonial Hts	4 WAVP	36.50
Danville	6 WBGU	33.10
Dinwiddie C (Dinwiddie)	3 WMMW	42.70
Fairfax	8 WMFC	35.90
Franklin	10 WENW	155.13
Falls Church	2 WHCN	35.90
Frederick C (Winchester)	3 KA2682	37.18
Fredericksburg	2 WRQG	30.82
Hampton	2 WELH	33.10*
Hanover	5 WCAQ	42.70
Hearick	30 WEUG	156.09
Hopewell	2 WQOZ	37.10*
James City	1 WAQJ	33.10
Lexington	8 WMKO	39.10
Lynchburg	12 WQFH	35.10
Marion	2 WKME	35.50
Martinsville	4 WHTJ	36.10
Nansemond	2 WFRU	35.50
New Kent C (New Kent)	1 WTNF	36.78
Newport News	12 WRIV	35.90*
Norfolk	46 WQNK	37.10*
Orange C (Orange)	2 WBSJ	42.70
Patrick C (Stuart)	2 KA3357	42.70
Petersburg	7 WQPI	35.50
Portsmouth	26 WPVL	37.90
Prince George C (Prince George)	6 WVDA	39.50
Pulaski	2 WDGL	39.50
Radford	4 WTMV	39.50
Richmond	126 WPHF	154.09
Roanoke	45 WQFG	155.13
Rockingham	3 WMMG	37.90
Salem	20 WCTG	39.50
	5 WSPQ	39.50
Scott C (Gate City)	2 KA3375	42.70
S Norfolk	2 WHTG	155.13
Stafford C (Stafford)	3 KA2902	38.62
Staunton	7 WRID	37.20
Suffolk	5 WRGV	36.50
Vinton	3 KA2167	155.13
Virginia Beach	9 WADB	33.94
Waynesboro	2 WIGV	37.90
Williamsburg	2 WKYT	33.10
Winchester	6 KIA408	37.18
York C (Yorktown)	1 WRWJ	42.90

**WASHINGTON**

Aberdeen	20 KGZV	155.73
Anacortes	5 KAEV	35.50
Asotin	1 KBSM	30.58*
Bellingham	28 KACK	39.90
Bremerton	30 KOA353	33.50
Burlington	2 KTFJ	35.50
Camas	10 KREB	155.01
Centralia	4 KGHV	35.50
Chehalis	10 KOA254	155.01
Clark C (Vancouver)	8 KRDL	30.58*
Clarkston	KHBX	30.58*
Colfax	1 KQKC	30.58*
Ellensburg	2 KBGR	35.50



## Browning Frequency Meters Are Standard Equipment for All Communications Services

**Model S-4:** Calibrated at any 1 to 5 points, 1.5 to 70 mc.

Crystal-controlled frequency meter, hand-calibrated to an accuracy of .0025%, as required by FCC, so easy to use that any fixed or mobile transmitter can be checked in 60 seconds. Rugged construction will withstand years of use. Built-in, regulated power supply for 110-115 volts, AC or DC.

**Model S-7:** 1 or 2 points, 72 to 76 and/or 152 to 162 mc.

For systems operating on either or both of the bands indicated. Hand-calibrated to an accuracy of .0025% as required by FCC. Similar in design and ease of operation to the model S-4. Built-in, regulated power supply operates on 110-115 volts, AC or DC. Will keep your system at peak efficiency.

**BROWNING** Frequency Meters conform to the new FCC Rules effective July 1, 1949. These meters can be ordered from the manufacturer supplying your initial mobile radio installation. Or, if you prefer, place your order with your local distributor. In either case, insist upon the accuracy and convenience of a **BROWNING** meter.

**Model S-5:** 1, 2, or 3 points between 30 and 500 mc.

Accuracy of .0025% maintained by temperature-controlled crystal and temperature-compensated electron-coupled oscillator. Transmitter signals can be checked with a receiver to which the meter is coupled. Can be supplied on rack panel 8 3/4 by 19 ins. Operates on 105-115 volts AC.



**IMPORTANT:** The accuracy of any **BROWNING** frequency meter can be checked in the field against WWV standard frequency signals because the crystal frequencies employed are sub-multiples of WWV. *This essential feature is not found in other communications-type meters.* NOTE: Use the **BROWNING** WWV Calibrator for precision checking.



IN CANADA, ADDRESS:  
Measurement Engineering, Ltd., Arnprior, Ont.

EXPORT SALES  
9 ROCKEFELLER PLAZA, Room 1422  
NEW YORK 20, U. S. A.

**BROWNING LABORATORIES, Inc.**

750 Main St., Winchester, Mass.

Please send me technical details and prices on the following Browning precision products:

- S-4 Frequency Meter     S-7 Frequency Meter  
 S-5 Frequency Meter     WWV Frequency Calibrator

Name .....

Address .....

Company Connection .....

**STATE POLICE**

**ALABAMA**

Montgomery Hq	WRBU	37.50
	175 KA2108	37.50
		37.38
Anniston	4 WQXB	37.50
Birmingham	WKVG	37.50
Blakely Island	WLBA	37.50
Decatur	WKSQ	37.50
Demopolis	WKSJ	37.50
Dothan	WKSJ	37.50
Evergreen	KIA310	37.50
Florence	WQXF	37.50
Gadsden	WKSJ	37.50
Grove Hill	WSQY	37.50
Hamilton	KIA360	37.50
Huntsville	WKSJ	37.50
Opelika	WQXG	37.50
Selma	WKSJ	37.50
Tuscaloosa	WHTX	37.50

**EXPERIMENTAL**

Dothan	W4XWM	74.50
Newton	W4XWO	73.22

**ARIZONA**

Phoenix Hq	KIEE	39.18
	KOA292	1698*
		39.18
	24 KA2542	35.10*
	85 KA2542	39.18
Ehrenberg	KA2542	39.26
Tucson	KFHA	39.18
	KOA391	39.18

**EXPERIMENTAL**

Phoenix	W7XIS	75.98
Yavapai C	W7XEF	73.52

**ARKANSAS**

Little Rock Hq	KASP	1722*
	75 KA0B	35.78
	1 KHAD	1722*
Clarksville	KFDL	1722*
El Dorado	KQSR	1722*
Forrest City	KFDK	1722*
Harrison	KWBQ	1722*
Hope	KEZX	1722*
Newport	KBSL	1722*
Warren	KFDO	1722*

**CALIFORNIA**

Sacramento Hq	KAAS	1690*
	KADJ	1690*
	685 KAPA	39.78
	2 KGHV	1690*
Alturas	KHFW	1690*
Bakersfield	KADC	1682*
California, State of	1 KA3235	39.38
Cedar Springs Camp	KMA336	1682*
Chino	KSCC	39.90
Los Angeles	KAWF	1682*
Newhall	KQUI	1682*
Nevada City	KAPI	1690*
Oak Glen	KFPE	1682*
Oakland	KRBU	1690*
Oroville	KPDF	1690*
Pomona	KQUG	1682*
Redding	KCFR	1690*
Represa	KSRF	39.90
San Luis Obispo	KQDO	1682*
San Quentin	KSQP	39.90
Stockton	KXPN	1690*
Vallejo	KXPN	1690*
Ventura	KHNY	1690*
Willows	KIUF	1682*
Yerba Buena Island	KASG	1690*
Yreka	23 KKTW	156.89
	KSCY	1690*

**EXPERIMENTAL**

Bloomer Mt	W6XJC	74.50
Blue Canyon	W6XH	73.22
Corona	W6XAR	72.25
Kern	W6XIE	74.14
Los Angeles	W6XWB	74.58*
Lyons Peak	W6XHL	74.14
Mt Pierce	W6XJB	74.14
San Marcos Pass	W6XHM	74.14
Sacred Oak Peak	W6XIK	74.14
Santa Clara C	W6XFY	74.50
Santa Pauli	W6XHI	74.14
S Fork Mt	W6XDD	74.14
State Park	W6XDJ	74.14
Strawberry Peak	W6XHK	74.14
Twp 27 nr Klaus Mine		
San Luis Obispo C	W6XIC	74.14

**COLORADO**

Denver Hq	KDPY	156.69
	1 KRAR	33.78*
	KGSP	42.46
	191 KQKY	42.46*
Gran J Junction	KA437	42.46
Idaho Springs	KDQE	154.77

**CONNECTICUT**

Hartford Hq	345 WCSE	39.50
Bethany	WJTI	39.50
Canaan	WJTB	39.50
Colchester	WJTK	39.50
Croton	WJTE	39.50
Danielson	WJTD	39.50
Hartford	WJTH	39.50
Litchfield	WJTI	39.50
Ridgefield	WJTA	39.50
Stafford Springs	WJTC	39.50
Westbrook	KCA223	39.50
Westport	WJTG	39.50

**DELAWARE**

Dover Hq	WJRF	39.50
	90 WJH	39.78
Bellefonte	WAFF	39.50
Bridgeville	KGA283	39.50
Georgetown	WAYY	39.50
New Castle	WDSP	39.50

**FLORIDA**

Tallahassee Hq	WKTF	31.10
	3 WKGJ	31.10

Bartow	182 WJXD	31.10
Chipley	WKSO	31.10
Crestview	WLIU	31.10
Cross City	1 KIA285	31.10
Deland	WJSK	31.10
Florida, State of	WJXX	31.10
Fort Myers	202 KA2773	31.10
Jacksonville	WSPP	31.10
Lake City	WJXJ	31.10
Miami	WKDR	31.10
Ocala	WSWP	41.10
Pahokee	WJXI	31.10
Palatka	WRSF	31.10
Pensacola	WSWY	31.10
Tampa	WSWR	31.10
West Palm Beach	WKGZ	31.10
	WSYU	31.10

**GEORGIA**

Atlanta Hq	WGSP	1688*
Albany	1 WSIK	1688*
	1 WSIK	42.02
Gainesville	WGRN	1688*
Griffin	WSIN	1688*
Madison	WCEZ	42.02
Newman	1 WVCZ	42.02
Perry	WHIK	42.02
	WKPG	1688*
Reidsville	WSIJ	1688*
Toccoa	WHGO	42.02
Thomaston	1 WWWW	42.02
Thomson	WJCG	42.02
Valdosta	KIA242	42.02
Villa Rica	1 WVRA	42.02
Washington	1 WSIO	1688*
	1 WSIO	42.02
Waycross	WHIX	42.02

**IDAHO**

Boise Hq	77 KFEO	42.54
Boise	KOA368	42.54
Montpelier	KOA300	42.54

**ILLINOIS**

Springfield Hq	WQPS	1610*
	1 WQPY	1610*
	1 WQPX	1610*
	1 WQPZ	1610*
	1 WQPQ	1610*
	1 WQPV	1610*
	1 WQPI	1610*
	488 WSTE	42.50
Blue Island	WQPB	42.50
Chicago	WQPC	155.37*
DuQuoin	WQPD	1610*
East St Louis	WQPJ	1610*
Effingham	WQPF	1610*
Elgin	WQPE	42.50
Joliet	WQPO	42.50
Macomb	WQPM	1610*
Peoria	WQPL	1610*
Pontiac	WQPP	1610*
Rock Island	WQFR	42.50
Springfield	KSA213	1610*
Sterling	WQPG	1610*
Urbana	WQPH	42.50

**EXPERIMENTAL**

Beverly R	W9XJK	74.14
Fairmont R	W9XFM	74.14
Goreville R	W9XPM	74.14
Marceilles R	W9XNS	74.14
Mill Shoals	W9XPL	74.14
Mt Olive R	W9XHU	74.14
Seward R	W9XNT	74.14
Springfield	W9XSW	42.50
Warrensburg R	W9XAW	74.14
Woodstock R	W9XNR	74.14

**INDIANA**

Indianapolis Hq	WPHE	1634*
	1 WAHO	1634*
	1 WAHQ	1634*
	1 WAHR	1634*
	1 WAHP	1634*
	1 WRSH	1634*
	284 KA2181	35.78
	75 KA2181	42.26
	1 KA2181	1634*
Charleston	WBMO	1634*
Chesterton	WPHS	1634*
Connorsville	WBII	1634*
Indianapolis	WPHE	1634*
Jasper	WPHU	1634*
Ligonier	WQFW	155.37
Pendleton	WRNR	1634*
Putnamville	WQGB	1634*
Seymour	WQFE	1634*
West Lafayette	WROR	1634*

**EXPERIMENTAL**

Hartford City	W9XQG	74.58
---------------	-------	-------

**IOWA**

Des Moines Hq	171 KADW	35.78
	1 KADW	1682*
	KGHO	1682*
	4 KRPA	35.78*
Atlantic	KACD	1682*
Belmond	KOBA	73.42
Burlington	KAA46	73.42
Cedar Falls	KNPN	1682*
Essex	KRPE	73.42
Fairfield	KACC	1682*
Ladora	KNGI	73.42
Maquoketa	KCMW	37.10
Ossian	KAA47	73.42
Storm Lake	KNFO	1682*

**KANSAS**

Topeka Hq	1 KANI	42.46
	KBGE	42.46
	KBGF	42.46
	121 KRXE	42.46
		42.30
Chanute	KAQB	42.46
Hutchinson	KAHR	42.46
	KCJI	42.46
Garden City	KHSN	42.46
Norton	KJAD	42.46
	KJPR	42.46
Wheaton	KHNS	42.46
	KBGD	42.46

**EXPERIMENTAL**

Colby R	WXDJ	73.30
Council Grove	W9XIB	75.98
Garnett R	WXDI	73.30
Great Bend R	WXDL	73.30
Hutchinson N	WXDC	74.58
McLouth	W9XIC	75.98
Norton N	WXDM	74.58
Pratt R	WXDK	73.30
Stockton R	WXDN	73.30
Topeka	WXCE	73.98
Wheaton	W9XIE	75.98
Wichita R	WXDO	73.30

**KENTUCKY**

Frankfort Hq	150 WMLI	39.90
	WQWY	39.90
Bowling Green	KIA239	39.90
Elizabethtown	KIA481	39.90
Hazard	WKBG	39.90
London	WKBF	39.90
Madisonville	WKYM	39.90
Mayfield	WHG	39.90
Morehead	WKPE	39.90

**LOUISIANA**

Baton Rouge Hq	WLSP	1682*
	WLSF	30.50
	92 KA2746	39.50
Alexandria	KRAD	1682*
Franklin	KRAD	39.50
	KSPF	1682*
	KSPF	39.50
Hammond	WEKK	39.50
La Place	WNJB	39.50
Lake Charles	KSPB	1682*
	KSPB	39.50
Leesville	KSPB	1682*
	KSPB	39.50
Louisiana, State of	KKA386	39.50
Monroe	1682*	
	KSPC	1682*
	KSPC	39.50
New Orleans	WHHI	39.50
Ruston	KIHL	39.50
Shreveport	KKA720	1682*
		39.50

**MAINE**

Augusta Hq	WBNV	39.90
	231 WSYD	39.90
Houlton	WGLS	39.90
	WLDQ	39.90
Lucerne-in-Maine	KCA277	39.90
Skowhegan	WGIO	39.90
Thomaston	WSTR	39.90
Waterboro	WEAH	39.90

**EXPERIMENTAL**

Castle Hill R	WIXIF	73.30
Houlton N	WIXJF	74.58
Waterboro	WIXDR	73.30
Wells	WIXDT	74.58
West Scarborough	WIXDU	74.58

**MARYLAND**

Annapolis Hq	287 KA2097	39.10
	KA2097	39.18
Belair	WEVN	39.10
College Park	WWCP	39.10
Conowingo	WMSH	39.10
Cumberland	WMEB	39.10
Easton	WMSE	39.10
Hagerstown	1 WMQU	39.10
High Knob	WMSR	39.10
Randallstown	WMSR	39.10
Salisbury	WWSG	39.10
Waterloo	WHWN	39.10

**MASSACHUSETTS**

Boston Hq	208 WEGI	35.90
	WKFA	35.90
Bridgewater	WKGC	35.90
	WPEL	35.90
Framingham	WMP	35.90
Nantucket	WSPN	35.90
Northampton	WKFI	35.90
Oak Bluffs	WPEW	35.90
Pt Holden	WSPO	35.90
	WSQL	35.90

**EXPERIMENTAL**

Adams R	WAWT	154.65
Holden N	WBUN	158.69
Princeton R	WBVW	154.65

**MICHIGAN**

Lansing Hq	554 KA2255	1642*
	KA2255	37.10
	KA2255	37.38
	KA2255	42.58
	KA2255	42.74
	KQA256	1642*
		37.50

## Specialists in MOBILE RADIO ENGINEERING

Whether your problem is in meeting the stringent new requirements of the F.C.C. for mobile services . . . establishing a new VHF station in one of the mobile radio networks now being formed . . . or providing 100% satisfaction to your customers for VHF communications over large coverage areas . . .

OUR ENGINEERING GROUP,\* WITH MORE THAN 10 YEARS' SUCCESSFUL EXPERIENCE IN THE MOBILE RADIO FIELD, CAN BE OF SERVICE TO YOU . . .

VHF and induction radio systems for governmental, industrial, common carrier services—satellite and remote control systems—multiplex equipment for FM and TV stations—network planning.

## Communications Research CORPORATION

250 Park Avenue, New York 17, N. Y.  
\* W. S. Halstead & Associates  
Tel. PL 3-2635

## ★ POLIC FM ALARM ★

FOR  
POLICE CALLS  
TAXI CABS  
AND OTHERS

### Radio Receiver Tunes Emergency Communications Band . . . 152-162 Megacycles

NEW IMPROVED MODEL PR-7

True F.M. superhetrodyne, 6 miniature tubes, including rectifier. 110 volts, AC-DC, 5-inch speaker, highest quality components.

Attached Antenna →

- \* Clear Vision dial
- \* Size 10½" x 6¾" x 6"
- \* Discriminator detector

# \$39.95

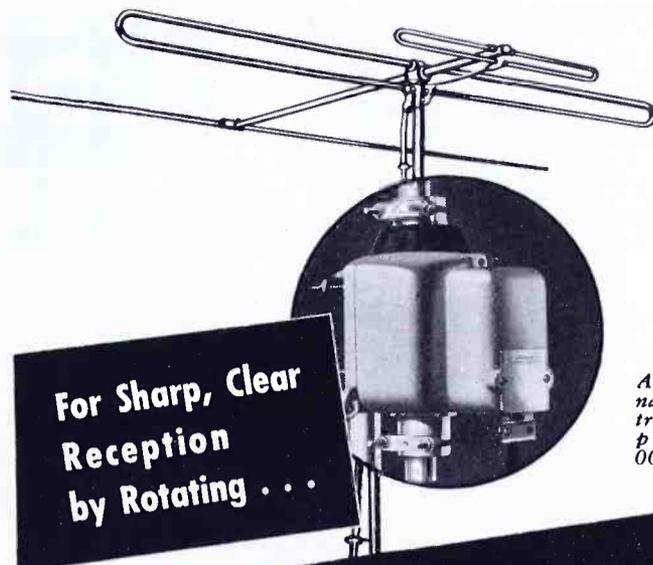


LIST PRICE includes excise tax, F.O.B. Indianapolis. \$10. cash with order, balance C.O.D.

Also available Model PR-30 for 30-44 megacycles **\$44.95**  
band . . . . .

See your DEALER first, or write Dept. FM-1.

**RADIO APPARATUS CORP.**  
303 FOUNTAIN SQUARE THEATER BLDG.  
INDIANAPOLIS 3, INDIANA



For Sharp, Clear  
Reception  
by Rotating . . .

Alliance Ten-  
na-Rotor illus-  
trated with Am-  
phenol 114-  
005 antenna.

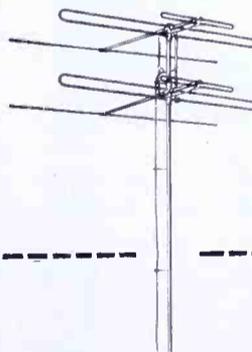
## AMPHENOL ANTENNAS GIVE HIGHEST GAIN!

### AMPHENOL

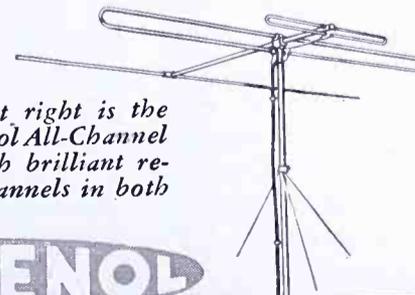
Where TV broadcasting stations are at wide angles from point of reception and re-orientation of the antenna is required to maximize each station, Amphenol television antennas provide the greatest gain by virtue of the in-line high and low band folded dipoles which beam in a clean, narrow directional pattern. The high front-to-side and front-to-back ratios not only provide maximum signal pickup in the exact desired direction, but also secure against any interference from an unwanted direction.

Durable, sturdy, aluminum construction withstands high wind and ice loading combined.

Install Amphenol in single bay or stacked array.



Illustrated at left is the standard Amphenol television antenna shown in stacked array (Model 114-302) for added db gain in fringe areas . . . or each bay may be individually oriented.



Model 114-005 at right is the standard Amphenol All-Channel TV Antenna with brilliant reception on all channels in both bands.

### AMPHENOL

**AMERICAN PHENOLIC CORPORATION**  
1830 SO. 54TH AVENUE • CHICAGO 50, ILLINOIS

**STATE POLICE, Cont.**

Kingdom City	AAA314	42.08
Kirkwood	AAA203	42.08
Lees Summit	AAA202	42.08
Macon	AAA201	42.08
North Kansas City	AAA405	42.08
Poplar Bluff	AAA270	42.08
Potosi R.	W9XGE	75.98
St. Joseph	AAA204	42.08
Springfield	AAA243	42.08
Willow Springs	WXJK	73.14

**MONTANA**

Helena Hq	30 KRNW	39.38*
	2 KRNW	39.50
	10 KRNW	39.82

**NEBRASKA**

Lincoln Hq	KAXD	42.46
	105 KREP	42.46
Gering	KRXW	42.46
Grand Island	AAA430	42.46
Holdrege	KHNP	42.46
McCook	KHNN	42.46
Norfolk	KHIS	42.46
North Platte	KHNB	42.46
Omaha	KBJY	42.46
Oshtosh	KRXN	42.46

**NEVADA**

Carson City Hq	KODH	1634*
	2 KRGL	39.38*
	12 KRGL	39.78
Reno	KRNP	1634*

**NEW HAMPSHIRE**

Concord Hq	WMOE	33.50
	WRPT	1882*
	WAJA	1882*
	92 WJFF	37.38

**EXPERIMENTAL**

Sargent's Purchase	W1XCD	75.98
Warner R	W1XUD	75.98

**NEW JERSEY**

Trenton Hq	5 KA2785	1610*
	2 KA2785	37.42*
	220 KA2785	39.78

**EXPERIMENTAL**

Absecon	W3XTI	27.925
Andover	W3XTN	27.925
Berlin	W3XTK	27.925
Cape May CH	W3XTG	27.925
Elwood	W3XTJ	27.925
Flanders	W3XTQ	27.925
Flemington	W3XTS	27.925
Freehold	W2XZS	27.925
Hightstown	W3XTT	27.925
Keyport	W2XZU	27.925
Malaga	W3XTL	27.925
Manantia	W2XAU	27.925
Mays Landing	W2XIU	27.925
Morristown	W3XTQ	27.925
N. w Brunswick	W3XTX	27.925
Port Norris	W3XTH	27.925
Ramsey	W2XZQ	27.925
Riverton	W3XTW	27.925
Scotch Plains	W2XZR	27.925
Somerville	W3XTR	27.925
Springfield	W3XTU	27.925
Toms River	W2XZT	27.925
Trenton	1 W2XCK	27.925
	W3XTV	27.925
	W1OXQR	27.925
	W1OXQ	27.925
	W1OXQT	27.925
	W1OXRT	27.925
	W1OXRU	27.925
	KEA289	2455*
Tuckerton	W2XZP	27.925
Washington	W3XTP	27.925
Woodstown	W3XTM	27.925

**NEW MEXICO**

Santa Fe Hq	KCQA	39.90
	46 KCQB	39.78
	6 KCQB	39.90
Albuquerque	KMXR	39.90
Cloudercroft	KUBJ	39.90

**EXPERIMENTAL**

Alamogordo	KUBK	75.90
Albuquerque	W5XHY	79.00
Cloudcroft	KUBL	72.18
Santa Fe	W5XHZ	81.00

**NEW YORK**

Albany Hq	30 WFLJ	42.30
	459 WNEH	42.14
	WNEH	42.30
	WNGS	42.14
Allerany	WNHV	42.14
Athol Springs	WNGU	42.14
Auburn	WNHR	42.14
Babylon	WKRI	42.14
Batavia	WNQG	42.14
Bernsen	WNQY	42.14
Bliss	WNHV	42.14
Brightwaters	WNWO	42.14
Canandaigua	WNQK	42.14
Catskill	WNWS	42.14
Duransburg	WNHM	42.14
East Avon	WNIO	42.14
East Islip	WKRN	42.14
Ferndale	WAHU	42.14
	WNJX	42.14
Fonda	WNWJ	42.14
Hawthorne	WNDV	42.14
Herring	KEA236	42.14
	WNHP	42.14
Highland	WNBO	42.14
Home r	WNGW	42.14
Horseheads	WNHY	42.14
Jones Beach	WKRL	42.14
Koesville	2 WNJA	42.14
Lathams	WJSC	42.14
Lewiston	WNJT	42.14
Malone	2 WNHE	42.14
Monroe	WNJP	42.14
Newark	WUYZ	42.14

Newcomb	2 WNQX	42.14
Oneonta	WNWV	42.14
Painted Post	WNWU	42.14
Port Henry	WNHL	42.14
Riverhead	WNWC	42.14
Saranac Lake	WNHG	42.14
Sidney	2 WNHX	42.14
Solvay	WNHA	42.14
S Glen Falls	2 WNQM	42.14
Stark	2 WNRC	42.14
Troy	WNWG	42.14
	WGFV	42.14
Vestal	WNPM	42.14
Wellsville	WNQF	42.14
Westfield	WNHW	42.14
Wurtsboro	WUYU	42.14

**EXPERIMENTAL**

Albany Hq	42 W2XPG	42.14
-----------	----------	-------

**NORTH CAROLINA**

Raleigh Hq	WANH	42.62
	615 WIUK	42.78
Blowing Rock	KIA377	42.62
Elizabeth	WANL	42.62
Elizabeth City	WFGX	42.62
Halifax	WLTJ	42.62
Kernersville	WKJT	42.62
Salisbury	WANK	42.62
Swannanoa	WANJ	42.62
Williamston	WANI	42.62

**EXPERIMENTAL**

Asheville R	W4XTK	74.50
Swannanoa N	2 W4XTN	73.34
	W4XWX	74.58
	W4XTO	74.60
Waynesville R		

**OHIO**

Columbus Hq	WPGQ	39.10*
	1 WDCW	1730*
	6 WFHO	39.10
	306 KA2351	39.78
Athens	WOZY	39.10
Bellefontaine	WPIJ	39.10
Bellevue	WOHO	39.10
Bridgeport	WLSZ	39.10
Cambridge	WPHT	39.10*
Chillicothe	WWCL	39.10
Dayton	WODH	39.10
Defiance	WJAV	39.10
Findlay	WPGG	39.10*
Gallipolis	WCIX	39.10
Geneva	WLSW	39.10
Georgetown	WCIV	39.10
Hebron	WCIU	39.10
Kent	WWCJ	39.10
Lancaster	WJAH	39.10
Lima	WWCN	39.10
Lorain	WOUG	39.10
Mansfield	WLSV	39.10
Marietta	WCGN	39.10
Marion	WOGN	39.10
Massillon	WPHC	39.10*
Medina	KQA446	39.10
Middletown	WOUB	39.10
Mt Vernon	WKFO	39.10
New Philadelphia	WWCK	39.10
Perrysburg	WODX	39.10
Portsmouth	WHNT	39.10
Salem	WOEX	39.10
Springfield	KQA352	39.10
Troy	WTOH	39.10
Van Wert	WDFE	39.10
Warren	WBGQ	39.10
Wilmington	WPHK	39.10*
Wintersville	KQA350	39.10
Wooster	WJEE	39.10

**OKLAHOMA**

Oklahoma City Hq	KOSO	1628*
	KOSR	1628*
	129 KONJ	35.78*
Claremore	KOSU	1628*
Clinton	KOSX	1628*
Coalgate	KOSC	1628*
Lawton	KOSY	1628*
McAlester	KOSW	1628*
Pawnee	KOSP	1628*
Tulsa	KKA514	1628*

**OREGON**

Salem Hq	KOHS	1706*
	31 KOHF	1706*
	10 KOHF	30.98*
	200 KOHF	42.94
	KOA381	1706*
Astoria	KOHA	1706*
Baker	KOS383	1706*
Bend	KOHN	1706*
Burns	KOHU	1706*
Coquille	KOHC	1706*
Eugene	KOHE	1706*
Gov Camp	KOHI	1706*
Grants Pass	KOHG	1706*
John Day	KOHO	1706*
Klamath Falls	KOHK	1706*
La Grande	KOHL	1706*
Medford	KOHQ	1706*
Odell Lake	KOA296	1706*
Ontario	KOA384	1706*
Pendleton	KOA382	1706*
Portland	KOHM	1706*
Roseburg	KOHR	1706*
Santiam	KOHJ	1706*
The Dalles	KOA293	1706*

**PENNSYLVANIA**

Harrisburg Hq	200 WPAZ	42.62
	200 WPAZ	42.78
	WPSP	42.62
	WTQV	42.62
Athens	WTTD	42.62
Avondale	WNSH	42.62
Bedford	WNSH	42.62
Belle Vernon	WTQB	42.62
Blakely	WNSG	42.62
Bloomsburg	WQSC	42.62
Brodheadsville	WTPI	42.62
Butler	WPVK	42.62
Carlisle	WQSF	42.62
Chamberburgh	WNSL	42.62
Clarion	WPLR	42.62
Clearfield	KGA307	42.62
Coatesville	WPQE	42.62
Corry	WPLS	42.62
Coudersport	WQSD	42.62

Dalesville	WQSH	42.62
Dushore	WTSS	42.62
Easton	WTLT	42.62
Ebensburg	WPJX	42.62
Emporium	WQSE	42.62
Erie	WPNA	42.62
Franklin	WPMU	42.62
Gettysburg	WQSG	42.62
Greensburg	WHNI	42.62
Hamburg	WQVK	42.62
Hazleton	WTNL	42.62
Holidaysburg	WNTK	42.62
Honesdale	WTTA	42.62
Huntingdon	WPMW	42.62
Imperial	WPOA	42.62
Indiana	WVML	42.62
Indianantown Gap	WTKK	42.62
Kane	WTIK	42.62
Kittanning	WTIQ	42.62
Lancaster	KG4220	42.62
Lebanon	WDLI	42.62
Lehighton	WTNW	42.62
Lewiston	WPNX	42.62
Lock Haven	WQSI	42.62
Lykens	WQSA	42.62
Mansfield	WTJQ	42.62
McConnellsburg	WPNP	42.62
Mercer	WTQT	42.62
Milford	WQVM	42.62
Milton	WNTA	42.62
Montoursville	WNTZ	42.62
Mt Pocono	WTNH	42.62
New Castle	WTPB	42.62
New Milford	WPJT	42.62
Philadelphia	WNTN	42.62
Pine Grove	WQVS	42.62
Pleasant Gap	WNTF	42.62
Punxsutawney	WNSI	42.62
Quakertown	WTLU	42.62
Reading	WKPP	42.62
Ridgway	WPNU	42.62
Rochester	WTJJ	42.62
Schuylkill Haven	WPXK	42.62
Shickshinny	WTRQ	42.62
Somerset	WTJZ	42.62
Stroudsburg	WTTC	42.62
Towanda	WTKF	42.62
Tunkhannock	WTRL	42.62
Uniontown	WTJP	42.62
Warren	WNSY	42.62
Washington	WNTS	42.62
Waynesburg	WTPJ	42.62
W. Springfield	WTTB	42.62
Wyoming	WPAJ	42.62
York	WQSB	42.62

**RHODE ISLAND**

Providence Hq	70 WKXW	39.78
North Scituate	WRSA	42.62
Richmond	WKQJ	42.62

**SOUTH CAROLINA**

Columbia Hq	3 WKLD	42.10
	500 WKBY	42.10
	WKBY	42.20
	KIA232	42.10
Anderson	WJHJ	42.10
Charleston	WPHY	42.10
Conway	WFRU	42.10
Florence	WCRF	42.10
Greenville	WBAF	42.10
Orangeburg	WJJP	42.10
Spartanburg	WKEW	42.10
Sumter	1 WDYQ	42.10
Walterboro		

**SOUTH DAKOTA**

Pierre Hq	KAVX	39.10
	135 KSDK	39.10
	KAA453	39.10
	KSDP	39.10
Custer State Park	KURM	39.10
Huron	KRBW	39.10
	KSDH	39.10
	KRBE	39.10
	KSDA	39.10
	KSDL	39.10
	1 KSLL	39.10
	KRPD	39.10
	KSDW	39.10

**EXPERIMENTAL**

Arlington R	WXCW	73.22
Custer R	W9XSL	79.00
Deadwood R	W8XST	79.00
Faith R	WXDB	73.22
Gettysburg R	WXCZ	73.22
Huron N	WXDA	74.50
Pierre R	WXCX	73.22
Pierre N	WXFR	74.50
Rapid City N	WXQH	81.06
	W9XSI	81.00
	W9XCY	74.50

**TENNESSEE**

Nashville Hq	280 KA2856	42.26*
	42.42	
	1 WNUW	1818*
	KIA472	42.42
Chattanooga	WJBV	1818*
Huntington	WEBD	1818*
Jordonia	WBVM	1818*
Kingsport	WEOM	42.42
Knoxville	WKVT	1818*
Memphis	WDBW	1818*

**EXPERIMENTAL**

Humboldt R	1 W4XTL	73.98
Rockwood	W4XTH	73.98
St Andrews	W4XTM	73.98

## POWER SUPPLIES

(Continued from page 26)

coils, permit instant starting and reduce starting surge. Surge-current time on the brushes is also greatly shortened, prolonging brush life. The graph in Fig. 3 indicates an average starting time of about 150 milli-seconds to reach 80% of output voltage on the Genemotor shown in Fig. 1.

Efficiency and regulation are important features of dynamotor design. Average 6-volt types for mobile transmitter use have efficiencies from 55 to 65% depending upon load and frame size. Aircraft and marine models of 24, 28, or 32 volts input have even higher efficiency, from 60 to 75%. The performance chart in Fig. 4 illustrates the characteristics of a new marine Genemotor model of exceptionally high efficiency.

Regulation of 6-volt mobile transmitter dynamotors from full output load to no load is normally about 15 to 20%. Here again, the size of load and frame size determine regulation characteristics.

AC output ripple or parasitic voltage on most dynamotor models is usually 1% or less of output voltage. Ripple voltage is normally measured with an AC rectifier meter across the DC output with a 2-mfd. capacitor in series to block out the DC component. Ripple can also be measured with an oscilloscope across the output and a 2-mfd. capacitor in series with the DC. The percentage of ripple can then be determined from the oscilloscope screen. Because of the exceptionally low AC content, dynamotor filtering is not normally necessary on most FM transmitters. AM transmitters usually require only a 2-mfd. capacitor across the dynamotor output for quiet electrical operation. More filtering is necessary, of course, when dynamotors operate mobile receivers. A typical filter network is illustrated in Fig. 5, showing the arrangement of components.

### Temperature Ratings:

Continuous duty dynamotors are normally rated at 30° to 40° C. temperature rise. Intermittent duty transmitter models are rated at 50° C. rise above ambient temperature. Normal operating range on continuous duty models is -55 to +50°C. Intermittent duty operating range usually is from -55 to +70°C.

### Dynamotors and Receivers:

Dynamotors of lower output are admirably suited to use with mobile receivers. When designed for the specific application, receiver-type dynamotors afford reliable operation and long life. Most dynamotors of 15 watts output power or less deliver 2,000 to 5,000 hours of continuous

# COMCO

## Ready!

### Made for operation on your assigned channel!



COMCO'S 275-C IS "Ready"!

Complete 275-C Mobile Unit -- **\$387.00\***

Complete Fixed Station -- **\$450.00\* up**

\*F. O. B. Factory, Coral Gables, Fla. Subject to change without notice.

Tried -- proven successful by months of continuous service. In keeping with its "First-in-the-Field" reputation, **COMCO** foresaw and provided for adjacent channel operation!

- Adjacent Channel Selectivity - at its best.
- Standby drain only 6 amps.
- Rugged . . . Compact. Mounts up front.
- Economical . . . easy to maintain.
- Skilled, nationwide service organization.

### Free

### DEMONSTRATION

Seeing is believing. Write today for a convincing demonstration. (Advise number of vehicles in fleet and operating radius.) Let your nearby COMCO representative prove that COMCO is better . . . best for you!



Manufacturers of Radio and Electronic Equipment  
**COMMUNICATIONS COMPANY, Inc.**  
CORAL GABLES, MIAMI 34, FLORIDA

service before the brushes require maintenance. Where space is limited, the Magmotor type, shown in Fig. 1, employing alnico field magnet construction, offers the advantage of reduced overall size, with 5 to 10% efficiency increase over the conventional electro-magnetic field models.

### Oscilloscope Tests:

To assure perfect electrical performance, all dynamotors should be production-tested on an oscilloscope in addition to normal input, output, and ripple meters. The oscilloscope is connected directly across the dynamotor output with a 2-mfd. blocking capacitor in series, to al-

low only the AC component to be reproduced on the screen. In this manner, partially open windings, reversed commutator connections, brush sparking, high-resistance connections at commutator segments, and other defects can be detected immediately on the screen.

The actual oscilloscope tracings in Figs. 6, 7, 8, 9, clearly picture these defects which cannot be detected by conventional meter testing method only. Together with high voltage breakdown tests of input, output, and field circuits, the oscilloscope test shows every weakness that may be present.

(Concluded on page 43)



*Requested by*  
**MAINTENANCE  
 ENGINEERS ...  
 OPERATORS ...**

*Recommended by*  
**COMMUNICATIONS  
 MANUFACTURERS ...**

**SHURE  
 MICROPHONES  
 are the "FIELD PROVED"  
 STANDARD in MOBILE  
 COMMUNICATIONS**



## *At the Transmitter ...*

Here's the famous "55" Unidyne Dynamic—the favorite microphone of police forces . . . taxis and trucking lines . . . government agencies . . . radio stations throughout the world. There must be a reason for its amazing popularity. Year in—year out dependable performance of the highest standards.



Shure "55"  
 Unidyne Dynamic  
 List Price \$67.50



"100" Series  
 Carbon Microphone  
 List Price \$30.00

## *..... In the Car .....*

This is the "old faithful" Shure "100" Series Carbon—a microphone that can take it under the most severe handling and "knocking around" a microphone could get. Under any and all circumstances the mighty "100" Series Carbon will "get the message through."

## **SHURE BROTHERS, Inc.**

*Microphones and Acoustic Devices*

225 West Huron Street

Chicago 10, Illinois

Cable Address: SHUREMICRO

**INSTANT  
 HEATING**

**IT'S HERE!**

**"4 + 0 = 4"**

That's the story in a nutshell! Combining an entirely new Very Low Drain Receiver (standby drain: 4 amps) with newly designed Instant-Heating transmitters (standby drain: Zero amps), the total standby current consumption of even 50-watt installations is only 4 amps!

The FM-47X receiver together with the FM-177X 15-watt or FM-179X 50-watt transmitter comprise a mobile unit that is more



Equipment shown  
 with dust covers removed

rugged, more economical, more compact than ever—yet maintains the same voice quality excellence for which Kaar equipment has always been noted. Truly, it sets a new standard of performance in the 152-162 mc band.

Write for literature giving all details

**• Ready to go . . . instantly!**



**KAAR  
 ENGINEERING COMPANY**

Middlefield Road, Palo Alto, Calif.

Canadian Licensee

MEASUREMENT ENGINEERING, LTD.

ARNPRIOR, ONTARIO

**FORESTRY-CONSERVATION, Cont.**

Madera	KBII	2226*	153.47
			153.41
			153.53
Mariposa	KRWY	2226*	153.47
			153.41
			153.53
Middletown	KRWV	2226*	153.47
			153.41
			153.53
Monterey (portable)	2 KQPU	2212*	153.47
Nevada City	KXHA	153.41	153.41
			153.53
North Sacto	KXIG	153.47	153.41
			153.53
Oroville	KBGK	2226*	153.47
			153.41
			153.53
Palomar Observatory	KMA93	72.66	153.47
Perris	KAIV	2226*	153.41
Red Bluff	KXKG	153.47	153.41
			153.53
Redding	KRRE	2226*	153.47
			153.41
			153.53
Riverside	KXMD	153.47	153.41
			153.53
St Helena	KXGF	153.47	153.41
			153.53
San Andreas	KBGN	2226*	153.47
			153.41
			153.53
San Bernardino	KMA339	2226*	153.47
Mobile	47 KLYG	2226*	153.41
San Luis Obispo	KRRF	2226*	153.47
			153.41
			153.53
Santa Rosa	KXGC	153.47	153.41
			153.53
			2226*
			153.47
			153.41
			153.53
Sonora	KBGM	2226*	153.47
			153.41
			153.53
Sterling City	KXGA	153.47	153.41
			153.53
Sutter Creek	KXID	153.47	153.41
			153.53
Twenty-Nine Palms	KBIA	2226*	153.47
Visalia	KRVN	2226*	153.41
			153.53
Whitewater	KUNW	72.66	153.47
Yreka	KBGL	2226*	153.41
			153.53
Yucaina	KQRX	31.58*	

**CONNECTICUT**

Hartford Hq	WSP	35.74
Oxford	KCA224	35.74
Sterling	WZPZ	35.74
	WCJM	35.74

**DELAWARE**

Dover Hq	5 WAPL	37.60*
----------	--------	--------

**FLORIDA**

Tallahassee Hq	134 KA2781	2226*
		153.11
		153.35
Bakersfield	WJQX	153.35
Bloomsdale	WJQY	153.35
Clewiston	KIA250	153.11
De Leon Springs	KIA225	153.35
		153.35
Dinsmore	WJRT	153.35
Gainesville	WRMQ	153.11
		153.35
Jasper	WSYC	153.11
La Belle	KIA249	153.11
Lake City	KIA549	2226*
Madison	WFGL	153.11
Molino	WSXR	153.35
Munson	WBWY	153.11
Port St Joe	WSRM	153.35
St James Island	WMTK	153.11
Secota	WGWW	2226*
Shamrock	WAGI	2226*
Southport	WSTD	2226*
Tallahassee	KIA230	153.11
		153.35
Valrico	WRQO	153.35

**GEORGIA**

Baxley	WIRQ	2226*
Brunswick	WGSF	2226*
Colesburg	WMVQ	2226*
Eulonia	WEGK	2226*
Homerville	WANA	2226*
Jesup	WKWD	2226*
Ludowici	WGRR	2226*
Macon	WNES	2226*
Nahunta	WKWJ	2226*
Townsend	WGDH	2226*
Waldosta	KIA237	2226*
Waycross	WJKR	2226*

**IDAHO**

Boise Hq	21 KA2858	2212*
		2212*
Elk River	KRFS	2212*
Orofino	KRFW	2212*
	KRFP	2212*

**ILLINOIS**

Benton	KSA229	31.86
Mobile	34 KA2864	31.86

**LOUISIANA**

Antonia	KKA216	31.38
Belah	KSVJ	31.38
Franklinton	KBSZ	31.50
Hammond	KBRK	31.50
Mandeville	KBSY	31.50
Oberlin	1 KBRW	31.50
Pine Grove	KBSH	30.94
Robert	KBSS	31.50
Springfield	KKA482	31.38
Winona	KKA417	31.50

**MAINE**

Augusta Hq	14 WMML	35.94*
------------	---------	--------

**MARYLAND**

Cumberland Hq	115 WMAU	31.34
---------------	----------	-------

Avalon	WKXD	31.58
Belair	WMBK	31.58
	WBPL	31.34
Brandywine	WMBU	31.58
Burtonsville	WMEQ	31.58
Church Creek	WQWF	31.58
Cub Hill	WMAY	31.34

Great Mills	WMES	31.58
Green Hill	WETJ	31.58
High Knob	WMSY	31.58
Hillmeade	WMCR	31.58
Hollofield	WMDK	31.58
Laurel	WMCL	31.58
Long Hill	WMBX	31.58
Madonna	WMBE	31.58
Mountain Lake Park	WBUQ	31.34
Nassawango	WQWB	31.58
New Germany	WMFQ	31.58
Stoeny Forest	WMAI	31.58
Thayerville	WETH	31.58
Welcome	WMBQ	31.58
Woodlawn	WMBJ	31.58

**MASSACHUSETTS**

Boston Hq	WRNB	31.34
	22 WEQW	31.34
Acushnet	WMHQ	31.34
Agawam	WCXB	31.34
Andover	WRML	31.34
	3 WBMR	31.34
Ashland	4 WIVQ	31.34
Barnstable	KCA289	31.34
Billerica	WQYW	31.34
Bourne	1 WBIQ	31.34
Brimfield	WQWJ	31.34
Buzzards Bay	WRKT	31.34
Carlisle	4 WQWL	31.34
	KCA213	31.34
Carver	1 WAJE	31.34
	1 WAPE	31.34
	WQYR	31.34
Chelmsford	WKWV	31.34
	WMHO	31.54
Dennis	1 WDNH	31.34
Duxbury	2 WSVG	31.34
	4 KCA351	31.34
Fall River	WRKQ	31.34
Falmouth	WQYV	31.34
	6 WQYK	31.34
	2 KA3341	31.34
Halifax	WQYU	31.34
Hanson	WQWG	31.34
Harvard	WQYA	31.34
Harwich	1 WTYG	31.34
Holbrook	WMZI	31.34
Kingston	3 WRMI	31.34
Lakeville	1 WEHD	31.34
Ludlow	KCA288	31.34
Manchester	WMHL	31.34
Marion	2 WJCL	31.34
Mendon	WRKP	31.34
Middleboro	3 WAAN	31.34
	WQYQ	31.34
Monterey	KCA314	31.34
No Andover	2 WHBH	31.34
No Easton	1 WLDK	31.34
No Reading	WMNR	31.34
Osterville	5 WRKW	31.34
Oxford	WRKU	31.34
Palmer	1 WRQJ	31.34
Petersham	WRKR	31.34
Plymouth	WQYS	31.34
	2 WRGE	31.34
	2 WEHE	31.34
Plympton	WQWH	31.34
Princeton	WMHW	31.34
Rehoboth	WRKO	31.34
Sharon	WCXP	31.34
Shelburne	WBPP	31.34
Sterling	1 WBKW	31.34
Stoughton	WBGD	31.34
Stow	WFGQ	31.34
Sunderland	2 WTOQ	31.34
Uxbridge	2 WWEU	31.34
Wareham	WMZH	31.34
Wellfleet	4 WRKV	31.34
West Wareham		

**MICHIGAN**

Marquette Hq	WBHX	35.74*
	146 WIXA	35.74*
Atlanta	WBRD	35.74*
Baldwin	WDAI	35.74*
Baraga	WSWB	35.74*
Boyer City	WDAQ	35.74*
Crystal Falls	WSWK	35.74*
Escanaba	WRRK	35.74*
Gladwin	WBXA	35.74*
Mio	WBKZ	35.74*
Newberry	WEDM	35.74*
Sault Ste Marie	WMIC	35.74*
Traverse City	WDAP	35.74*
Wakefield	KQA429	35.74*

**MINNESOTA**

St Paul	25 KQEY	39.74*
---------	---------	--------

**MISSISSIPPI**

Jackson Hq	331 KA2920	31.22
		31.30
	8 WIGF	37.66
	10 WJOZ	31.42

Canton	WIGE	37.66
Carthage	WVBM	37.66
	KKA222	37.66
DeKalb	WPMZ	31.22
Electric Mills	WBKG	37.66
Perkinson	WJNV	31.42
Rankin	WVBL	37.66

**MISSOURI**

Emlence Hq	185 KQGH	31.30*
Camdenton	1 KCTL	31.42
Piedmont	1 KOAP	31.42
Pineville	1 KWPH	31.30
Sullivan	1 KSHG	31.42
Warrenton	1 KWFG	31.42

**NEW HAMPSHIRE**

Concord Hq	WKJY	39.42*
	WNHF	39.42*
	WKML	39.42*
	258 KA2431	39.42*
	WSRE	39.42*
	WLOM	39.42*
	WNWQ	39.42*

**NEW JERSEY**

Trenton Hq	WQVA	31.78
	70 WHCL	31.78
		31.90
		31.90

Bass River	WQVN	31.74*
Batsto	WQVR	31.74*
Beaufort	WQVI	31.94*
Belle Plain	WQVS	31.42*
Blue Anchor	WQVC	31.42*
Budd Lake	WQVE	31.94*
Butler	WQVH	31.74*
Catfish	WQVG	31.94*
Cedar Bridge	WQVP	31.74*
Culver Lake	WQVF	31.94*
Dias Creek	WQVJ	31.94*
Farmingdale	WQVM	31.74*
Lakewood	WQVQ	31.74*
Lebanon St Forest	WBPN	31.74*
McKeetown	WQVU	31.74*
May's Landing	WQVL	31.74*
Millville	WQVT	31.74*
Milton	WQVJ	31.94*
Mizpah	WQVW	31.94*
Old Bridge	WLBX	31.90
Retreat	WQVO	31.74*
Toms River	WQVX	31.94*
Union Hill	WQVD	31.94*
Windbeam	WQVH	31.94*

**NEW YORK**

Albany Hq	81 WSAE	31.98*
-----------	---------	--------

**NORTH CAROLINA**

Burnsville	WDXT	31.34
Mobile	450 WRVO	31.34
		31.46
Bolton	KIA414	31.34
Clyde	WUVM	31.34
Roaring Gap	WUVU	31.34

**OHIO**

Henley	WTH	31.34
Latham	WFIJ	31.34
Oreton	WTFP	31.34
Zaleski	WTTU	31.34
Mobile	34 WTYP	31.34

**OKLAHOMA**

Oklahoma City Hq	26 KOEA	35.74*
------------------	---------	--------

**OREGON**

Salem Hq	194 KA3198	31.94*
	284 KQSM	31.94*
Coos Bay	KGLM	31.58*
Dallas	KQSD	31.58*
Forest Grove	KRNI	31.58*
Gold Beach	KQHN	31.58*
Grants Pass	KQSC	3

## It's Alden — for ... facsimile dispatching equipment

designed for your specific purposes. It may be for wire or for radio circuit. A pilot operation—or in quantity production

Our engineering provides for messages to be automatically picked up at scanner with recorder starting, stopping, and framing automatically, controlled by transmitter.

Alden Engineering experience covers the range of operations from low speed for narrow bandwidth wire lines to high speed large area equipment.

So whether you are dispatching a memo from office to office—or a full size weather map across the country—Alden has the system and will make to special order equipment that fits your needs.

### For instance—

200 cycle bandwidth	15KC bandwidth
Memo with 4" width—50 LPI	Newspaper with 18" width—100 LPI
2 in./min.	Map with 9 in./min.



## Alden engineering opens new fields in impulse recording

Filling the gap between indicating instruments and the Cathode Ray Oscilloscope.

Giving a permanent record directly without photographic processes.

Alden Recording Equipment operates with Alfax Electrosensitive Recording Paper producing permanent recordings. Alfax is a sensitive high speed paper that does not require special packaging. It is stable in storage, and is permanent in its recording.

To solve that facsimile or impulse recording problem — write now to

**ALDEN PRODUCTS CO.**

Brockton 64FD, Massachusetts

## CHANGING FREQUENCY IN YOUR MOBILE SYSTEM?

IF YOU WANT:

QUALITY

PRECISION

DEPENDABILITY

## SPECIFY BLILEY CRYSTALS

Write for Bulletin 38 showing complete line of crystal mountings available; also advise make and model of your equipment. Better still, consult your nearest Bliley distributor.

**BLILEY ELECTRIC COMPANY**

P.O. BOX 1070, ERIE, PENNSYLVANIA

## POWER SUPPLIES

(Continued from page 39)

### Operation and Maintenance:

Frequency of transmitter operation is an important factor of performance that varies considerably in different mobile services. In police service, a dynamotor may operate anywhere from 2 to 8 years without maintenance, depending upon amount of traffic handled. The same dynamotor may operate only 6 months to 1 year in a taxicab installation before brush servicing is necessary, because of the more frequent use of the mobile transmitter. In our laboratory life tests, we consider 10 seconds on and 20 seconds off 8 hours per day as the normal cycle rating for intermittent duty transmitter dynamotors, as indicated in the brush-life graph, Fig. 2. Continuous duty service, as required for mobile receivers, is rated at 24 hours per day.

Due to the larger charging capacities of present day automobile generator and regulator systems, 6-volt battery voltage is frequently well above the nominal 6 volts. Dynamotors that draw only 20 or 25 amperes do not decrease this voltage sufficiently to assure 6-volt nominal operation. As the dynamotor output voltage varies in proportion to input voltage, a high input voltage not only overloads the dynamotor and reduces brush life, but may shorten tube life, also. We have encountered instances where battery voltage reached 7.5 or 8 volts at the dynamotor leads because the automobile regulator was not adjusted to reduce the voltage to nameplate specifications.

In cases where reduced regulator voltage did not permit a sufficient charging rate to maintain the battery in good condition, the regulator was reset to its former position, and a small, fixed resistance connected in series with one side of the dynamotor primary lead. This is to allow only sufficient current to pass at the specified input voltage. Most dynamotors are designed to operate within  $\pm 10\%$  of specified input voltage, and this fact should be carefully considered when specifying performance requirements.

In determining the performance of a DC supply under operating conditions, it is necessary to consider not only the hours of use between servicing but also the average number and length of mobile transmissions made daily, weekly, or monthly. Mobile transmitter dynamotors should deliver 100,000 ten-second transmissions before input brush servicing is necessary. Continuous-duty dynamotors operating mobile receivers should deliver 2,000 to 5,000 running hours, depending on the output load and the dynamotor model.

## A WORKSHOP HIGH-GAIN ANTENNA

will ...

More than triple the effective power of the transmitter.

Increase the effective power of the mobile transmitter.

Increase the operating area.

Permit the use of low power, low cost equipment.

Workshop High-Gain Beacon Antennas are designed specifically for the 152-162 megacycle band—taxicab, fire, police, and private fleet communications.

### Design Features

- Low angle of radiation concentrates energy on the horizon.
- Symmetrical design makes azimuth pattern circular.
- Can be fed with various types of transmission lines. Special fittings are available for special applications.
- Enclosed in non-metallic housing for maximum weather protection.

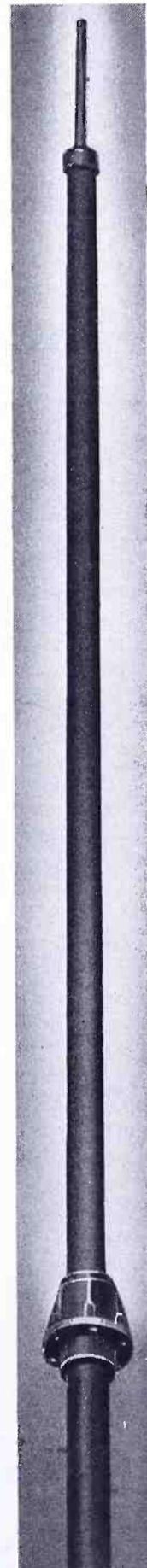
Available for immediate delivery through authorized distributors or your equipment manufacturer.

—THE—  
**WORKSHOP  
ASSOCIATES**

INCORPORATED

PAT. APP. FOR

Specialists in High-Frequency Antennas  
65 NEEDHAM STREET  
Newton Highlands 61, Mass.



**RAILROADS, Cont.**

Mobile	5 WYWT	160.05	Mobile	36 KA2875	161.49	Worldan Wyo	KOA285	33.18
Great Northern Ry Co St Paul Minn		161.01	Steelton & Highspire RR Co		161.19	Mobile	85 KA3238	33.18
4th & Jackson St	KVYA	159.93	Mobile		161.19	Mobile	75 W5XKZ	33.18
Mobile	25 KYYK	159.93	Port	12 KA2876	161.49	Mobile	10 W10XSO	22.92
Port	5 KYYM	159.93	Steelton Pa	KGA256	161.19	Mobile	82 W5XCH	33.18
Gulf Mobile & Ohio Mobile Ala	5 KVYJ	159.93	Mobile	25 KA2398	161.19	California Pipe Line Co New Orleans La		
104 St Francis			Toledo Terminal RR Co			1818 Canal Bldg		
Meridan Miss RR Yd	WTFY	159.03	Mobile Ohio	WECH	159.99	Laramie Wyo	KUKY	33.26
Mobile	44 KA2844	161.73	Mobile	15 WEEN	159.99	Rock River Wyo	KULF	33.28
Illinois Central RR Co Chicago Ill		159.03	Union Pacific RR Co Omaha Neb			Mobile	6 KUKZ	33.28
135 E 11th	2 WWGM	161.11	416 Dodge St			California Research Corp San Francisco Ca		
Hazel Crest Ill 171st & Ashland Ave			Los Angeles Cal UP Yd Office			Calif 200 Bush St		
Mobile	WMWK	161.85	Riverside Cal UP Depot	KAUC	160.17	Mobile	2 KA2790	30.66
Jacksonville Terminal Co	15 WEHM	161.37	Pomona Cal UP Depot	KAUF	160.17	Canadian River Gas Co Amarillo Tex		
Jacksonville Fla 1000 W Bay St			N Platte Neb Humo Tower	KBVH	160.41	Rule Bldg		
Jacksonville Fla Myrtle Ave Tower			N Platte Neb Yardmaster's Off			Amarillo Tex	KKA658	39.99
Mobile	WTVF	161.25	Lawrence Kans UP Depot	KBVI	160.29	Dalhart Tex	KKA601	39.98
Jacksonville Fla Lee St Tower			Menoken Kans UP Depot	KRBG	160.17	Mobile	KKA659	39.99
Lehigh Valley RR New York N Y	12 WTVH	161.97	Emmett Kans UP Depot	KRBT	160.17	Carr Geophysical Co Houston Tex	21 KA3216	39.98
143 Liberty St			Onaga Kans UP Depot	KRBV	160.17	Commerce Bldg		
Jersey City N J Foot of Johnson Ave	WAHW	158.43	Frankfort Kans UP Depot			Portable	4 KKOP	1652*
Mobile	9 WAHY	158.43	Marysville Kans UP Depot	KRCR	160.17	Central Kentucky Natural Gas Co Charleston		
Los Angeles Junction Ry Co Chicago Ill			Denver Colo 36th St Yd Office	KRDA	160.17	W Va 1033 Quarrier St		
80 E Jackson Blvd			Salt Lake City Utah North Yard	KRDB	160.29	Means Ky	WEXP	33.34
Los Angeles Cal 3420 Exchange Ave	KUDL	161.13	Los Angeles Cal UP Yd Office	KRDC	160.29	Mobile	22 WEXQ	33.34
Mobile	6 KA2317	161.13	Kansas City Kans 7th St & RR Yd			Foster Ky	KIA351	33.34
Louisiana & North West New York N Y			Pocatello Idaho Retarder Yd Office			Cities Service Oil Co Bartlesville Okla		
170 Broadway	KKA244	160.05	Pocatello Idaho Pocatello Ydmstr's Off	KUCA	160.41	Masonic Bldg		
McNeill Ark	KKA245	160.05	Portland Ore Albina Yd Office	KUCU	160.29	Geoph. Mobile	5 KA2912	1602
Haynesville La	KKA246	160.05	Kansas City Kans 7th St Ydmstr's Off	KWBV	160.29	Clark Fuel Producing Co Mission Tex		
Emerson Ark	KKA247	160.05	E Riverton Gardens Wash	KOA200	160.17	P O Box 585		
Athens La	KKA248	160.05	Seattle Wash	KOA201	160.29	Mission Tex	K5XDA	33.18
Homer La	KKA249	160.05	Tacoma Wash	KOA221	159.93	South Kelsey Tex	K5XDB	33.18
Gibsland La	KKA250	160.05	Mobile	24 KA2337	160.29	Sam Fordyce Tex	K5XDC	33.18
Minnesota Dakota & Western			Union Railroad Co Pittsburgh Pa			Mobile	1 K5XDD	33.18
Minneapolis Minn Baker Arcade Bldg	KA352	160.41	700 Union Trust Bldg			Consolidated Oil Co Wichita Falls Tex		
International Falls Minn	2 KA2836	160.41	Rankin Pa Carrle Furnances	WNLT	159.87	Hamilton Bldg		
Mobile	KPWY	159.93	Mobile	12 WNLI	159.87	Wichita Falls Tex	KKA677	33.34
Missouri Kans Texas RR St Louis Mo	18 KMFR	159.21	Washington Terminal Co Washington D C			Mobile	20 KA3267	33.34
Ry Exchange Bldg	7 KPFE	159.93	Union Station			Continental Oil Co Ponca City Okla		
Dallas Tex McKinney Ave & Houston			Washington D C 100 Mass Ave NE			1000 South Pine St		
Mobile	32 KMPQ	160.41	Mobile	30 WWNT	159.45	Ponca City Okla	3 KGVA	31.18
Missouri Pacific RR St Louis Mo	6 KA2907	161.49	Western Maryland Ry Co Baltimore Md			Mobile	8 KA2211	39.66
310 N 13th St			Standard Oil Bldg			Geoph. Mobile	10 KA3901	1602
Mobile	8 KA2807	161.49	Baltimore Md Pt Covington Yd Off	WWNB	158.67	Continental Pipe Line Co Ponca City Okla		
New Orleans Terminal Co New Orleans La			Mobile	6 WWND	158.67	Drawer 1287 100 S Pine St		
New York Central New York N Y	WDHC	161.67	West Va Northern Philadelphia Pa			Mercedes Tex	KCRD	39.66
468 Lexington Ave			Broad St Sta Bldg			McAllen Tex	KCRE	32.86
Weehawken N J	KSA277	161.13	Mobile	2 KA2418	161.25	Sullivan Tex	KSCW	39.66
Hammond Ind 5339 Hump Rd	WNKW	158.49	Washington Terminal Co Washington D C			Rio Grande City Tex	KKA340	39.66
Cheektowaga N Y Gardenville Yd			Union Station			Barreda Tex	KKA675	39.66
Bethlehem N Y Selkirk Yd	WNYH	160.41	Washington D C 100 Mass Ave NE			Mobile	11 KA2393	39.66
Manlius N Y Dewitt Yd	WNYJ	158.79	Mobile	30 WWNV	159.45	Cox Drilling Co Wichita Falls Tex		
Mobile	WNYX	161.61	Western Maryland Ry Co Baltimore Md			Staley Bldg		
Mobile	KEA367	161.61	Standard Oil Bldg			Portable	2 W6XAZ	33.34
Mobile	55 KA2487	161.67	Baltimore Md Pt Covington Yd Off	WWNB	158.67	Mobile	15 W6XEZ	33.34
N Y Chicago & St Louis Cleveland Ohio			Mobile	6 WWND	158.67	Dowell Incorporated		
50 Public Sq			West Va Northern Philadelphia Pa			Kennedy Bldg		
Buffalo N Y 970 S Park Ave	WMHG	161.25	Broad St Sta Bldg			Levelland Tex	K5XEX	33.34
Cleveland Ohio	KQA245	161.49	Mobile			Mobile	50 K5XEY	33.34
Mobile	113 KA2202	161.25	Alamo Refining Co Bartlesville Okla			El Paso Natural Gas Co El Paso Tex		
N Y New Haven & Hartford New Haven Conn			Sweeny Tank Farm Pump House Sweeny Tex			1010 Bassett Tower		
71 Meadow St			Freeport Tex	KKA372	33.34	Casa Grande Ariz	KQNR	37.54
New York N Y 132nd St & Mills Ave			Damon Tex	W5XCA	33.34	Ehrenburg Ariz	KQNL	37.54
Hartford Conn	KCA289	161.55	Mobile	KKA371	33.34	Tucson Ariz	KQNM	37.54
Mobile	21 WEQJ	161.49	Amerada Petroleum Corp New York N Y	KKA373	33.34	Gage N Mexico	KQNO	37.54
Northern Pacific Ry St Paul Minn			120 Broadway	25 KA2262	33.34	Jal N Mexico	KQNP	37.54
178 E 5th St			Millar Calif			El Paso Tex	KQJQ	37.54
St Paul Minn Mississippi St Yd Off			Bradford Island Calif	KAPT	31.18	Mobile	KQJP	37.54
Seattle Wash 2266 E Marginal Way	KNCM	161.25	Rio Vista Calif	KIEA	31.18	Portable	81 KA2397	37.54
Auburn Wash	KTQX	161.13	Port Allen La	KKA391	33.18	General Petroleum Corp Los Angeles Calif		
Yakima Wash	KOA210	161.25	Mobile	15 KIEB	31.18	108 W 2nd St		
Mobile	KOA223	161.25	Geoph.	32 KA2761	33.18	Davenport Calif	W6XZJ	153.35*
Pennsylvania RR Co Philadelphia Pa	15 KTCV	161.13	American Exploration Co Lafayette La	26 KA2895	1602	Mobile	2 W6XZK	153.35*
1617 Pennsylvania Blvd			204 N Chestnut St			Gravity Meter Exploration Co Houston 2		
Ridgeway Pa	KGA246	160.77	Geoph.	3 KNFY	1602	Tex 138 Esperson Bldg		
Mobile	5 KA2358	160.77	Geoph.	31 KNFV	1622	Geoph. Mobile	12 KCLF	162.87
Pittsburgh & Lake Erie Pittsburgh Pa			Anderson Bros Corp Houston Tex			Great Lakes Pipe Line Co Kansas City Mo		
Terminal Bldg			707 Drennan St			P O Box 2239		
Youngstown Ohio E Youngstown Yds			Mobile	24 W4XEJ	33.18	Mobile	10 KVUY	33.26
Mobile	33 WPIU	159.69	Apache Exploration Co, Inc Houston Tex			Helmerich & Payne Inc		
Richmond Fredericksburg & Potomac			1451 Esperson Bldg			415 Philtower Bldg		
Richmond Va Broad St Sta			Geoph.	2 KA2911	31.06	Odessa Tex	1 K5MA	30.58
Alexandria Va Potomac Yd	WFSB	161.49	Arkansas Western Gas Co Fayetteville Ark			Houston Industrial Gas Co Houston 2 Tex		
Mobile	18 WFXN	161.49	28 E Center St	W5XAY	33.18	2027 Commerce Bldg		
River Terminal Ry Cleveland Ohio			Fayetteville Ark	W5XAL	33.18	Ganado Tex	KKA777	37.54
3100 E 45th St			Mobile	W5XYL	33.18	Refugio Tex	KHKS	37.54
Cleveland Ohio Steel Plant E			Ashby Drilling Co Dallas Tex	15 W5XYM	33.18	Yoakum Tex	KHMS	37.54
Mobile	WBZX	161.61	3415 Westminister St			Humble Oil & Refining Co Houston Tex		
St Louis San Francisco Ry St Louis Mo	9 KA3283	161.31	Atlantic Refining Co Philadelphia 1 Pa			Drawer 2180 - 1216 Main St		
906 Olive St			260 S Broad St	W3KDT	153.35	Collier C Fla	WHOG	37.14
Springfield Mo 537 E Commercial			Geoph.	2 W3KDT	153.35	Gulf of Mexico		
Mobile	KAA251	161.97	Atlantic Seaboard Corp Charleston W Va			Wagon	WHON	37.14
Seaboard Air Line RR Norfolk Va	15 KRR0	161.97	1033 Quarrier St	WLYQ	33.34	Mobile	KKA470	2134*
211 SAL Bldg			Bridwell Oil Co Wichita Falls Tex			Mobile	KKA471	2134*
Tampa Fla Lafayette & Meridian Ave			City Nat'l Bank Bldg	30 W5XFX	33.26	Mobile	KKA472	2134*
Mobile	WRCL	160.17	Buckeye Pipe Line Co Lima Ohio			Acadia Parish La	KRCJ	39.14
Tampa Fla SAL Yeoman Yd Office			137 W North St			Ascension Parish La	KKA354	37.14
Atlanta Ga Howells Yd Office	WRGS	160.17	Trenton Mich	WVBQ	33.26	Cameron C La	KKA437	37.14
Hamlet N C No Spot House	WSNA	160.17	Cygnat Ohio	WVBR	33.26	Grand Isle La	KKHJ	37.14
Hamlet NC SAL Yd Office	WSRR	160.17	Toledo Ohio	WVVS	33.26	Iberville Parish La	KKA393	2134*
Richmond Va SAL Yd Office	WWSF	160.17	Lima Ohio	WSLV	33.26	Mobile	KKA357	37.14
Savannah Ga SAL Yd Office	WWSH	160.17	Samaria Mich	WSLZ	33.26	La Fouché Parish La	KHOA	37.14
Jacksonville Fla	WJ CZ	160.89	Mobile	100 WSLW	35.26	New Iberia La	KKA756	37.14
Mobile	77 WSNX	160.17	The California Co N Orleans 12 La			Plaquemine Parish La	KHOF	37.14
Port			1818 Canal Bldg			Mobile	WHRR	37.14
Southern Railway Co Washington 13 D C			Waterproof La	WEXCG	33.18	Roanoke La	KHJG	37.14
Box 1808			Cranfield Miss	WEXFD	33.18	St Charles Parish La	KHOQ	37.14
Atlanta Ga Inman Yd	WKXT	158.97	Brookhaven Miss	WEXPO	33.18	St Mary Parish La	KHND	37.14
Knoxville Tenn J Sevier Yd	WSKT	160.65	Lafitte La	WEXSZ	33.18	Terrebonne Parish La	KHJP	37.14
Mobile	WSKU	160.65	Barataria La	WEXXY	33.18	Vermilion Parish La	KKA436	37.14
Birmingham Ala	KIA283	161.49	Meeker Colo	KAA309	33.18	Brookhaven Miss	KEXFL	25.28
Atlanta Ga	KIA470	161.49	Rangely Colo	KAA335	33.18	Columbia Miss	KEXED	25.28
			Ruston La	KKA443	33.18	Davis C Miss	KEXCB	25.28
						Lamar C Miss	KEXCA	25.28
						Marion C Miss	KEXCC	25.28
						Wayne C Miss	KEXCM	25.28
						Baytown Tex	KEXCN	25.28
						Brooks C Tex	KEXCO	25.28
						Chambers C Tex	KEXCP	25.28
						Crockett C Tex	KEXCQ	25.28
						Denver City Tex	KKA355	37.14
						Galveston C Tex	KKA029	37.14
						Galveston Bay Tex	KKA535	37.14
						Harbor Island Tex	KKBD	37.14
						Houston Tex	KKA884	37.14
						Mobile	KKA885	37.14
						Hutchinson C Tex	KKBP	37.14
						Ingleside Tex	KKDD	37.14
						Jefferson C Tex	KKA917	164.49
						Kinsville Tex	KKA839	37.14
						McCamey Tex	KQZL	37.14
						Newton C Tex	KKA310	154.49
						Odessa Tex	KBJM	37.14
						Pampa Tex	KKA702	37.14
							KFJB	37.14

**PETROLEUM COMPANIES**

## RADIO SERVICES

(Continued from page 21)

of any existing or future station operating in the railroad radio service.

<sup>6</sup> The use of this frequency may be authorized to base and mobile stations in the special emergency radio service on the condition that no harmful interference will be caused to the maritime mobile service. Special emergency operations at points within 150 miles of coastal areas and navigable gulfs, bays, rivers and lakes may be authorized only after a factual finding indicates that, on an engineering basis, no harmful interference will be caused to the maritime mobile service.

<sup>7</sup> This frequency is shared with the highway maintenance radio service.

<sup>8</sup> This frequency is reserved for assignment only to national organizations established for relief purposes.

<sup>9</sup> This frequency will not be assigned to stations in the special emergency radio service at any point within 150 miles of Chicago, Illinois.

<sup>10</sup> This frequency may be subject to change when the Atlantic City table of frequency allocations below 27.50 mc. comes into force.

Concluding Part 3 will appear in August

## OPERATOR LICENSES

(Continued from page 17)

will be near by and within hearing and immediately available to the other person whom he is supervising. The licensed operator may not undertake to exercise his supervision and responsibility by means of telephone or similar devices.

In further connection with the above discussion, it may be well to point out that the responsible operator, in every case where service and maintenance duties are performed, is required by Section 13.75 of the Rules to sign and date an entry in the log of the station concerned, or in the station maintenance records if no log is required, giving:

1. Pertinent details of all service and maintenance work performed by him or under his supervision;

2. His name and address; and

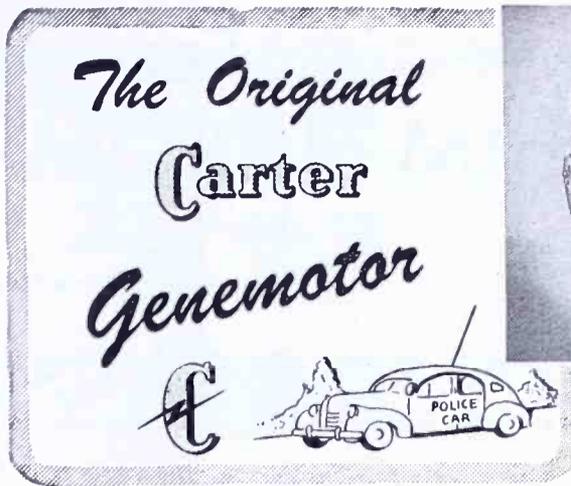
3. The class, serial number and expiration date of his license, except that the information called for by 2. and 3. above, so long as it remains unchanged, is not required to be repeated in the case of a person regularly employed on a full-time basis at the station.

There is enclosed herewith, for your information, a copy of the Commission's Rules Governing Commercial Radio Operators,<sup>1</sup> together with a copy of the publication "Study Guide and Reference Material for Commercial Radio Operator Examinations."<sup>2</sup> Information as to the requirements in obtaining each of the various classes of radio operator licenses, as well as the scope of the various elements of the written examination, is contained therein. There are also enclosed several other publications which may be of interest, in particular one series in connection with the problem of interference to television reception.<sup>3</sup>

T. J. SLOWIE, Secretary

<sup>1</sup>Obtainable from the U. S. Government Printing Office, price 25c.

<sup>2</sup>Mimeograph bulletins 30362, 22929, and 24809, obtainable from the Federal Communications Commission, Washington 25, D. C. No charge.



Carter Genemotor 7-1/16" long, 4-1/8" wide, 3-1/2" high. Weight only 10 lbs.

### for TAXICAB, MARINE and Police Mobile Radios

Unequalled performance and dependability are assured when you specify Carter Genemotor Power Supplies. The favorite for over 15 years.

★ ★ ★ ★ SPECIFICATIONS ★ ★ ★ ★  
Frame capacity 80 watts cont. 150 watts int. (up to 400 watts, on Marine models only.)

Input volts DC—5.5 to 115

Input current DC—up to 50 amps.

Output volts DC—up to 800 volts

Output current DC—up to 500 MA.

AC ripple content—1% or less

Overall efficiency—50-75% average

Output regulation—20% no load to full load

Starting time—300 milliseconds average

### Check These features

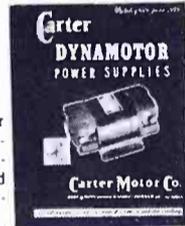
Small size—Can be mounted on its side.

Reliable—100,000 transmissions without servicing.

Armature triple insulated. Transformer grade laminations. Static and dynamically balanced. Precision ball bearings require NO lubrication.

Super Precision—Frames line reamed to .0001 accuracy.

WRITE



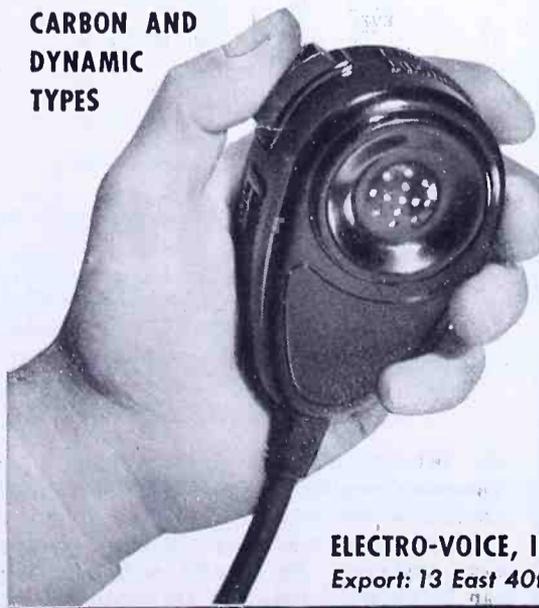
New 24 page Dynamotor catalog No. 649 just released. Genemotors, Magmotors, Dynamotors and complete technical information. Write today.



2641 N. MAPLEWOOD AVENUE

## For the Ultimate in Speech Transmission REPLACE NOW WITH HIGH ARTICULATION Mobil-Mikes

CARBON AND DYNAMIC TYPES



You get high intelligibility, high output, more usable power level, less listener fatigue, and other E-V features. Proved in toughest service. Used in public safety, aircraft, railroad and government communications. High impact phenolic case. Permanent finish. Carbon Model 210 weighs only 7 ounces. List price \$25.00 and up.

**Exact Replacement**  
Carbon Mobil-Mikes also available for exact replacement in current Motorola, RCA, G.E. and similar equipment. Send for Mobil-Mike Bulletin No. 140



## Electro-Voice

ELECTRO-VOICE, INC., BUCHANAN, MICHIGAN  
Export: 13 East 40th St. • New York 16, U.S.A. • Cables: Arlab



# WINCHARGER

REG. U.S. PAT. OFF.

## ANTENNA TOWERS

# 1st CHOICE\*

- \* 1st CHOICE of new station applicants.
- \*\* 1st CHOICE of station operators.
- \*\*\* 1st CHOICE of Police, Airlines, Government, and private communications systems.

There is a reason. VHF, FM, and standard AM broadcasters acclaim the structural excellence and all around low cost of Wincharger's performance proven towers. The precision of Wincharger vertical radiator's patterns is testified by the fact that over one hundred and twenty stations are now using Wincharger towers in directional arrays even six element arrays! Higher quality, wider versatility, lower cost have made Wincharger antenna towers America's first choice.

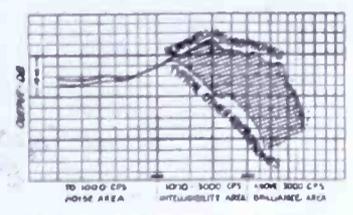
**WINCHARGER Corporation**  
Sioux City 6, Iowa, U.S.A.

## ANNOUNCING *Roanwell's* NEW MOBILE MIKE

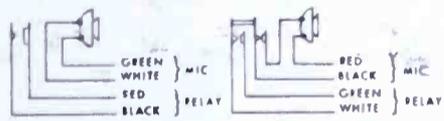
STYLE 737



**THIS NEW MOBILE MICROPHONE PROVIDES  
CONSISTENTLY HIGHER MODULATION PERFORMANCE**



Model 9900, 32 db below 1 volt for 10 bars  
Model 9901, 25 db below 1 volt for 10 bars



Weighs a mere 7 oz. Button is riveted on face of mike. Easy change-over from speaking to hang-up position with turn of wrist. Tough, shock-proof aluminum alloy case. Switch and all other internal elements completely enclosed. Carbon mike element cushioned in rubber makes unit shock-and-vibration proof. Available in two models designed to match 50-200 ohm circuits and to operate at 5-100 ma according to circuit.

**When ordering, specify circuit required as "9900 A" or "9900 B"**

ROANWELL CORPORATION 662 Pacific St. • Brooklyn 17, N. Y.

# LIST

Just released: a Who's Who of the FM broadcast industry. Book includes names and titles of 3,300 top management and operating staff, such as president, general manager, station manager, program director, chief engineer, and many others. Also shown for each of over 700 stations are:

- Call letters
- Frequency
- Name of licensee
- Network
- AM and TV affiliates
- Location

This reference book has been compiled from data furnished by the stations themselves and is the most accurate such list now available. For maximum convenience and usefulness, it is arranged both geographically by location and alphabetically by call letters.

68 pages, 5½ by 8½, sturdily bound. \$2.00 per copy. Order direct from the publishers: FM - TV, Great Barrington, Mass.

# ZOPHAR WAXES COMPOUNDS and EMULSIONS

FOR INSULATING and WATERPROOFING of ELECTRICAL and RADIO COMPONENTS

Also for CONTAINERS and PAPER IMPREGNATION

FUNGUS RESISTANT WAXES

ZOPHAR WAXES and COMPOUNDS  
Meet all army and navy specifications if required

*Inquiries Invited*

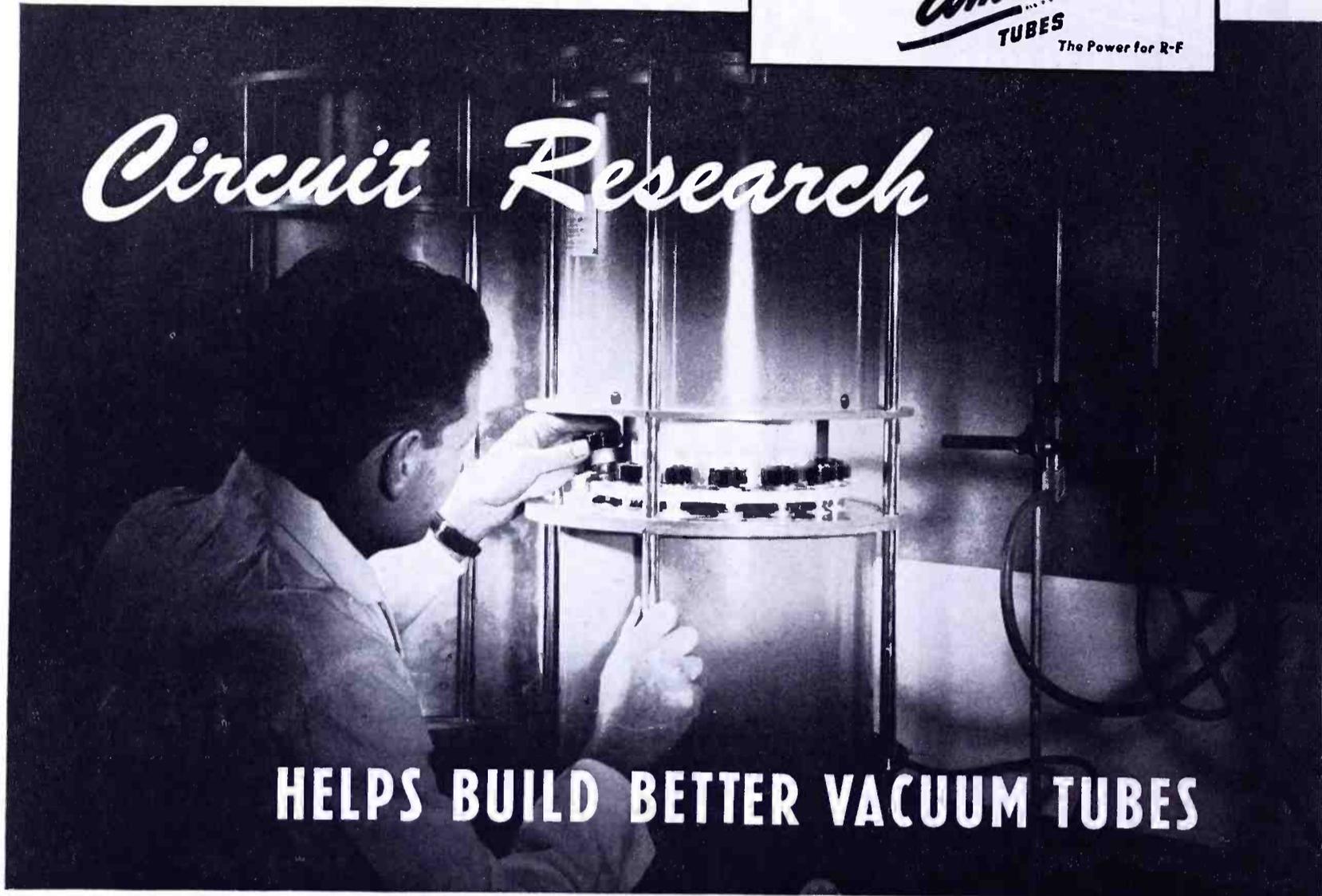
**ZOPHAR MILLS, INC.**  
FOUNDED 1846  
122-26th ST., BROOKLYN, N. Y.

Follow the Leaders to

**Eimac**  
TUBES

The Power for R-F

# Circuit Research



## HELPS BUILD BETTER VACUUM TUBES

With the increasing demand for higher powers at higher frequencies the importance of close relationship between tube and circuit design has become paramount.

A large segment of the laboratory facilities at Eitel-McCullough is concerned with the development of basic new circuits closely correlated with vacuum tube development. The efforts of this group are receiving wide recognition for their outstanding accomplishments. These new circuits are being made available, as developed, to the industry enabling greater realization of a vacuum tube's potential abilities.

Evidence of these efforts is illustrated above . . . A 14-tube annular r-f generator. This compact equipment can provide 500 watts of CW power at 1000-Mc, and has operating possibilities as high as 2500-Mc. This is but one application of the basic annular circuit design developed by Eimac. The power-output in such a generator is directly proportional to the number of tubes used, and single tube efficiency is maintained.

# EITEL-McCULLOUGH INC.

728 SAN MATEO AVE., SAN BRUNO, CALIFORNIA

Export Agents: Frazar & Hansen, 301 Clay St., San Francisco, California

TO THE COMMUNICATIONS ENGINEER . . .



# PHILCO

## *FM Communications Systems*

EXCEL IN FEATURES THAT COUNT

**UNEQUALLED AUDIO QUALITY**—Philco exclusive advanced FM phase modulator and detector assure clearest, crispest speech intelligibility in the industry . . . crystal clear reproduction even at weak signal level.

**FULL COVERAGE**—Philco 30-50 and 152-162 MC units deliver *full rated power* to give maximum coverage.

**UTMOST FLEXIBILITY of INSTALLATION**—Only Philco mobile units can be mounted side by side, end to end or stacked drawer fashion. Fixed station installations provide floor, desk and wall mounting for medium power; cabinet mounting for both high and medium power. All with simplified control and cable connections.

**MINIMUM MAINTENANCE**—Philco FM Systems are engineered for freedom from service problems . . . heavy duty components assure long life . . . transmitters and receivers operate with standard tubes . . . parts are readily accessible . . . interchangeable drawer type mobile chassis do away with time out for servicing.



**Mobile Transmitting and Receiving Unit.** Convenient desk-drawer type for quicker, easier servicing.

**Remote Control Unit (above left).** Operates station transmitter and receiver from remote location. Only single pair of telephone lines required to connect unit with transmitter.

WRITE TODAY FOR THE COMPLETE STORY OF THE MOST MODERN FM COMMUNICATIONS SYSTEMS IN THE INDUSTRY

Industrial Division, Dept. DH7,  
Philco Corporation, Philadelphia 34, Pa.

Please send latest information on  
Philco FM Communications Systems.

NAME \_\_\_\_\_ TITLE \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_

*Motorola* meets the challenge!  
 announces the new **“RESEARCH LINE”**  
 solves the **ADJACENT CHANNEL** problem

**“8” ESSENTIAL  
 INVENTIONS make  
 ADJACENT CHANNEL  
 OPERATIONS PRACTICABLE**

- SENSICON circuit (Pat. Pending)
- ISO-Q cavities (Pat. Pending)
- STATOMIC oscillator (Pat. Pending)
- PERMAKAY filter (Pat. Pending)
- BRIDGE BALANCED CRYSTAL OVEN (Pat. Pending)
- CAPACITANCE DISCRIMINATOR (U.S. Pat. 2,404,359)
- DIFFERENTIAL SQUELCH (U.S. Pat. 2,343,115)
- I.D.C. slope filter (Pat. Pending)

**DESIGN**—Today! The ideal two-way mobile radio communications equipment is here.

Research experimentation, development and field testing in systems operation produced this scientific answer to the adjacent channel operations problem.

The minor problem of super-precision selectivity was solved in six months, but two years of research and the creation of five major inventions were required to solve the major problem of intermodulation before same-area adjacent channel operation became practicable.

**PERFORMANCE**—Here is equipment that is new all through, with the amazing circuits which provide a new standard of performance for the industry. Here is equipment to give you the most modern communications system you can own—actually anticipating the standards of good engineering practice for the future. This startling departure from the conventional offering new simplicity of maintenance and a new standard of reliability—this engineering and scientific achievement is the new **MOTOROLA**.

Remember! Selectivity alone is not the answer to adjacent channel operation. The integrated systems combination of these new inventions is the modern engineering answer to full channel utilization.



the BEST is now BETTER than ever before . . .

*Motorola* **FM 2-WAY RADIO**

COMPARE feature for feature with any other equipment on the market . . . GET THE COMPLETE STORY . . . MAIL THIS COUPON TODAY . . .

**MOTOROLA, INC., 4545 Augusta Blvd., Chicago, Ill.**  
 Communications Division Dept. FM-TV — July

Name \_\_\_\_\_

Position \_\_\_\_\_

Firm \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_