# RADIO CRAFT

## CHICAGO PARTS SHOW NUMBER

HUGO GERNSBACK, *Editor*

KENOTRON TUBE TESTS
SEE PAGE 22

*In this issue—*

An Economy Transmitter

Quick A. C.-D. C. Repairs

R. F. Power Supplies

MAY 1947

25¢ CANADA 30¢

RADIO-ELECTRONICS IN ALL ITS PHASES

# Going places (AGAIN)

# hallicrafters

Hallicrafters famous radio equipment, sold and distributed around the world before the war and used with superb effectiveness in every theater during the war is once again on the move. Watch for latest details of the Gatti-Hallicrafters mobile radio equipped expedition to the Mountains of the Moon in deepest Africa—a new and exciting test for the ingenuity of hams and the performance of Hallicrafters equipment.

## 3 GREAT RECEIVERS designed and priced for hams who are going places, too

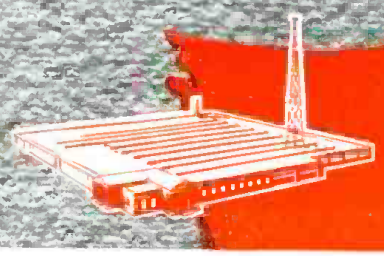
**Model SX-42** Described by hams who have operated it as "the first real postwar receiver." One of the finest CW receivers yet developed. Greatest continuous frequency coverage of any communications receiver—from 540 kc to 110 Mc, in six bands. FM-AM-CW. 15 tubes. Matching speakers available. **$275.00**

**Model S-40A** Function, beauty, unusual radio performance and reasonable price are all combined in this fine receiver. Overall frequency range from 540 kc to 43 Mc, in four bands. Nine tubes. Built-in dynamic speaker. Many circuit refinements never before available in medium price class. **$89.50**

**Model S-38** Overall frequency range from 540 kc to 32 Mc, in four bands. Self contained speaker. Compact and rugged, high performance at a low price. Makes an ideal standby receiver for hams. CW pitch control is adjustable from front panel. Automatic noise limiter..... **$47.50**

Prices slightly higher in zone 2

BUILDERS OF Skyfone AVIATION RADIOTELEPHONE



# hallicrafters RADIO

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

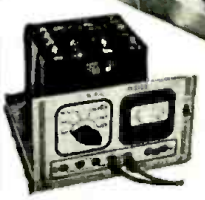
Sole Hallicrafters Representatives in Canada: Rogers Majestic Limited, Toronto-Montreal

# I WILL TRAIN YOU TO START
## A SPARE TIME OR FULL TIME
# RADIO SERVICE BUSINESS WITHOUT CAPITAL

J. E. SMITH
PRESIDENT
National Radio Institute
33rd Year of Training Men for Success in Radio.

## You Build These and Many Other Radio Circuits with Big Kits of Parts I Supply

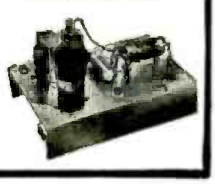
By the time you've conducted 60 sets of Experiments with Radio Parts I supply, made hundreds of measurements and adjustments, you'll have valuable PRACTICAL Radio experience for a good full or part-time Radio job!



You build MEASURING INSTRUMENT above early in Course, useful for Radio work to pick up EXTRA spare time money. It is a vacuum tube multimeter, measures A.C., D.C., R.F. volts, D.C. currents, resistance, receiver output.

You build the SUPERHETERODYNE CIRCUIT above containing a preselector oscillator-mixer-first detector, i.f. stage, diode-detector-a.v.c. stage and audio stage. It will bring in local and distant stations. Get the thrill of learning at home evenings in spare time while you put the set through fascinating tests!

Building the A. M. SIGNAL GENERATOR at right will give you valuable experience. Provides amplitude-modulated signals for test and experimental purposes.



The men at the right are just a few of many I have trained, at home in their spare time, to be Radio Technicians. They are now operating their own successful spare-time or full-time Radio businesses. Hundreds of other men I trained hold good jobs in practically every branch of Radio. Doesn't this PROVE my "50-50 method" of home training can give you BOTH a thorough knowledge of Radio principles and the PRACTICAL experience you need to help you make more money in the fast-growing Radio industry?

### Many Beginners Soon Make Extra Money In Spare Time While Learning

The day you enroll I start sending EXTRA MONEY JOB SHEETS. You LEARN Radio principles from my easy-to-understand, illustrated lessons—PRACTICE what you learn by building, testing and experimenting with parts I send—USE your knowledge to make EXTRA money fixing neighbors' Radios in spare time while still learning! From here it's a short step to your own full-time Radio Shop or a good Radio job!

## VETERANS

**You can get this training right in your own home under G. I. Bill. Mail coupon for full details.**

### Future for Trained Men Is Bright In Radio, Television, Electronics

It's probably easier to get started in Radio now than ever before, because the Radio Repair Business is booming. Trained Radio Technicians also find profitable opportunities in Police, Aviation, Marine Radio, Broadcasting, Radio Manufacturing, Public Address work. Think of even greater opportunities as Television, FM, and many new, war-developed Electronic devices become available to the public! Soon, there will be more Radio equipment to install, operate, maintain and repair than ever before in all history! Get the facts on all these opportunities. Send for FREE books now!

### Find Out What NRI Can Do For You

Mail Coupon for Sample Lesson, "Getting Acquainted with Receiver Servicing," and my FREE 64-page book. It's packed with facts about Radio's opportunities for you. Read the details about my Course. Read letters from men I trained, telling what they are doing, earning. See how quickly, easily you can get started. No obligation! Just MAIL COUPON NOW in an envelope or paste it on a penny postal. J. E. SMITH, President, Dept. 7EX, National Radio Institute, *Pioneer Home Study Radio School*, Washington 9, D. C.

## I Trained These Men — SPARE TIME RADIO BUSINESS

**MINISTER MAKES $10-$20 WEEKLY, SPARE TIME**
"I am a minister. I am in a county seat now trying to serve the people in my church, also trying to keep their Radios playing. I have been making from $10 to $20 per week in spare time."—L. H. SMITH, Benton, Tenn.

**DOING GOOD SPARE TIME BUSINESS**
"I have been getting receivers to repair right along lately, and by using the methods taught me in the NRI Course, I don't have to spend much time on any of them."—STANLEY N. STRICKLAND, 191 Dale Homes, Portsmouth, Va.

**MADE $612 IN 12 MONTHS, SPARE TIME**
"Soon after I finished my experimental kits lessons I tackled my first Radio service job. The neighbors were very cooperative. I soon had all the repair jobs I could handle in spare time. I have made $612 in the past 12 months in spare time."—J. W. CLARK, Wilmington, N. C.

## I Trained These Men — FULL TIME RADIO BUSINESS

**FULL TIME JOB BEFORE FINISHING COURSE**
"After completing about two-thirds of my Course I entered a Radio Repair shop. Later I branched out for myself and opened a shop in my own home. I am much pleased with the work I am doing my first year of business."—A. N. AYERS, Washington 10, D. C.

**MADE $1500 WHILE LEARNING**
"By the time I finished my NRI training I had made $1500. When I started the Course I did not know a resistor from a condenser. I have bought my home. My income from Radio work, etc., is about $3,000 a year."—WILLIAM THOMAS, Baldwyn, Miss.

**AVERAGES BETTER THAN $3,000 A YEAR**
"I now have a shop and am doing fine. I average better than $3,000 per year, and certainly give NRI much of the credit."—RAYMOND F. DAVIS, Ashburn, Ga.

## SAMPLE LESSON FREE

I will send you a FREE Lesson, "Getting Acquainted with Receiver Servicing," to show you how practical it is to train for Radio at home in spare time. It's a valuable lesson. Study it—keep it—use it—without obligation! Tells how Superheterodyne Circuits work, gives hints on Receiver Servicing, Locating Defects, Repair of Loudspeaker, I. F. Transformer, Gang Tuning, Condenser, etc., 31 illustrations.


**My Radio Course Includes**
**TELEVISION • ELECTRONICS**
**FREQUENCY MODULATION**

## GOOD FOR BOTH 64 PAGE BOOK SAMPLE LESSON FREE

J. E. SMITH, President, Dept. 7EX
National Radio Institute, Washington 9, D. C.

Without obligating me, mail your Sample Lesson and 64-page book FREE. I am particularly interested in the branch of Radio checked below. (No salesman will call. Please write plainly.)

- ( ) My own Radio Service Business
- ( ) Spare Time Radio Servicing
- ( ) Service Technician for Radio Stores or Factory
- ( ) Aviation Radio
- ( ) Operating Broadcasting Station
- ( ) Industrial Electronics
- ( ) Public Address Systems
- ( ) Ship, Harbor, Gov't., Military Radio

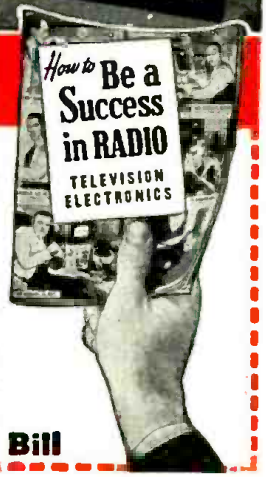
(If you have not decided which branch you prefer—mail coupon for facts to help you decide.)

Name ..... Age .....

Address .....

City ..... Zone ..... State .....

**Approved for Training Under GI Bill**



# SENSATIONAL

Model 15D-NC

# NEW

## Noise Canceling Microphone by TURNER

## Transmits only when spoken to at close range

A new Turner development . . . Now factories, machine shops, engine rooms, trains, aircraft, etc., can have sharp, clear communications. Turner engineers have solved the problem of effective speech transmission under adverse noise conditions. The Turner Model 15D-NC is so expertly designed and balanced it amplifies only sound originating close to its specially engineered diaphragm. Random sound (noise) arriving from a distance strikes both sides of the diaphragm simultaneously and is canceled out. This new microphone transmits only when spoken to at close range from the front.

***The LOUDER the noise—the BETTER the results***

By speaking directly into the front side of the Turner Model 15D-NC clear cut results are achieved at ordinary levels of conversation. The din, clatter, and clang of machinery and other disturbances are canceled out. In fact, the higher the noise level, the more effective will be the results observed.

### *Designed for Convenience*

The Model 15D-NC is a rugged dynamic built to stand severe operating conditions. It is housed in an attractive hand held case of light, tough alloy. When not in use, it may be hung on a hook. If desired, a "push-to-talk" thumb switch is built into the handle for on-off operation or relay work. Available in 50, 200, 500 ohms, or high impedance.

### SPECIFICATIONS Turner Model 15D-NC

EFFECTIVE OUTPUT LEVEL: 56 db below 1 volt/dyne/sq cm.
FREQUENCY RESPONSE: 50 to 5000 c. p. s.
OUTPUT IMPEDANCE: 50, 200, 500 ohms, or high impedance.
DIRECTIONAL CHARACTERISTICS: Close talking only
DIAPHRAGM: High quality corrosive resistant aluminum.
MAGNETIC CIRCUIT: High energy magnetic circuit with moving voice coil. Both sides of diaphram exposed to balance out random sound.
CASE: Smooth, die cast alloy.
FINISH: Gray gunmetal enamel.
MOUNTING: Hand held. Hole provided at top of case for hanging on hook.
CABLE: 7 foot attached, single conductor, shielded.
DIMENSIONS: 7" long x 2⅜" wide x 1½" deep.
WEIGHT: Approximately 24 ounces.
OPTIONAL: "Push-to-talk" thumb switch for on-off or relay operation.

*Also available as Model 15D semi-directional dynamic without noise canceling feature. Level: 56 db below 1 volt/dyne/sq cm. Response: 40 to 7500 c. p. s.*

*Visit the* **Turner Exhibit at the Parts Show Booth 49— Stevens Hotel, Chicago. May 13, 14, 15**

## THE TURNER COMPANY

902 17th Street N. E., Cedar Rapids, Iowa

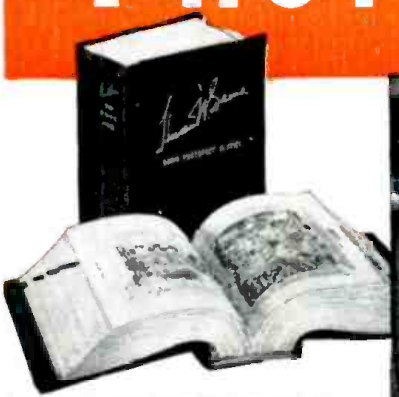
**TURN TO TURNER FOR SOUND PERFORMANCE**

Microphones licensed under U. S. patents of the American Telephone and Telegraph Company, and Western Electric Company, Incorporated. Crystals licensed under patents of the Brush Development Company

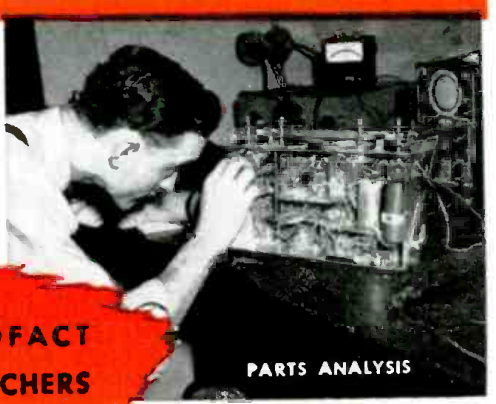
# $400,000 WORTH OF RADIO SERVICE DATA

*A Continuous Service for less than 9¢ a day in*

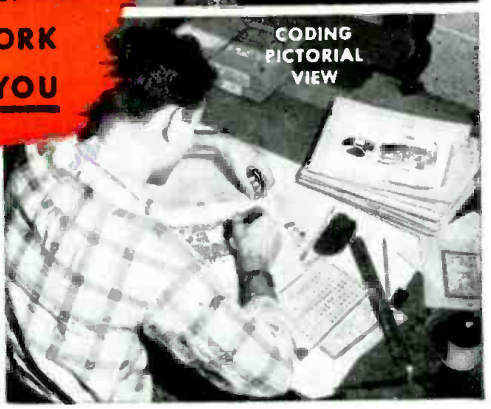
# PHOTOFACT* FOLDERS



VOLUME 1, containing first ten sets of PHOTOFACT FOLDERS in de luxe binder, $18.39. Individual sets Nos. 1 to 10, $1.50 each. De Luxe Binder alone, $3.39.


**PHOTOFACT RESEARCHERS AT WORK FOR YOU**


## COMPLETE

Everything you need in one handy, unified form—large schematics, pictorials keyed to parts lists and alignment data complete listings of parts values and replacements, alignment, stage gain, circuit voltage and resistance analysis, *coil resistances*, dial cord stringing, disassembly instructions, record changer analysis and repair.

## ACCURATE

*All sets are taken apart and analyzed by experts in the Sams laboratories.* Every part is measured, tested and triple-checked for accuracy. All data is original. This means the data you get is *right*.

## CORRECT

PHOTOFACT FOLDERS are issued twice monthly as the new receivers come off production lines. You don't have to wait for information. As receiver changes are made, you get correction and addition sheets for your files. Your data is always up to the minute.

## EASY TO USE

All diagrams and pictures are coded to numbered parts lists. Everything is positively identified for fast work. All folders are set up in uniform, easy-to-follow style: big type, big illustrations —no hunting, guessing or eye strain —no more loss of time and temper.

$403,531.05†—that's what it actually cost us to create, print and distribute Volume 1 of Sams PHOTOFACT FOLDERS. Every penny of that money has been spent to bring the industry the most accurate, complete, up-to-the-minute data ever produced for radio servicemen. And this continuing service, designed to help you make up to *twice as many repairs daily*, actually costs you less than 9 cents a day.

PHOTOFACT FOLDERS could not be produced without the support of America's leading replacement parts manufacturers—without the support, too, of thousands of enthusiastic PHOTOFACT subscribers. With their cooperation, we will continue to place in your hands ALL the information you need to do a better job—facts, figures, photographs, full-page schematics—*information compiled from actual first-hand analysis of all new instruments*. PHOTOFACT FOLDERS cover *all* radios, phonographs, record changers, recorders, communications systems and power amplifiers—*and are timed to reach you as these instruments are released*. The cost is only $1.50 per set of 30 to 50 folders and includes membership in the Howard W. Sams Institute.

Set No. 17 will be ready for mailing April 10th. Set No. 18 on April 25th. Sets Nos. 11 to 16 inclusive, also priced at $1.50 each, are available for immediate order.

Start using PHOTOFACTS to make more profits. Remember, PHOTOFACT FOLDERS actually cost you nothing: *they pay for themselves over and over!* See your replacement parts distributor—or write us direct. In Canada, address A. C. Simmonds & Sons, 301 King Street East, Toronto, Ontario. Canadian price, $1.75.

* Trade Mark Reg.

†C.P.A. Statement Available

## HOWARD W. SAMS & CO., INC.

2924 EAST WASHINGTON STREET, INDIANAPOLIS 6, INDIANA

# PHOTOFACT SERVICE

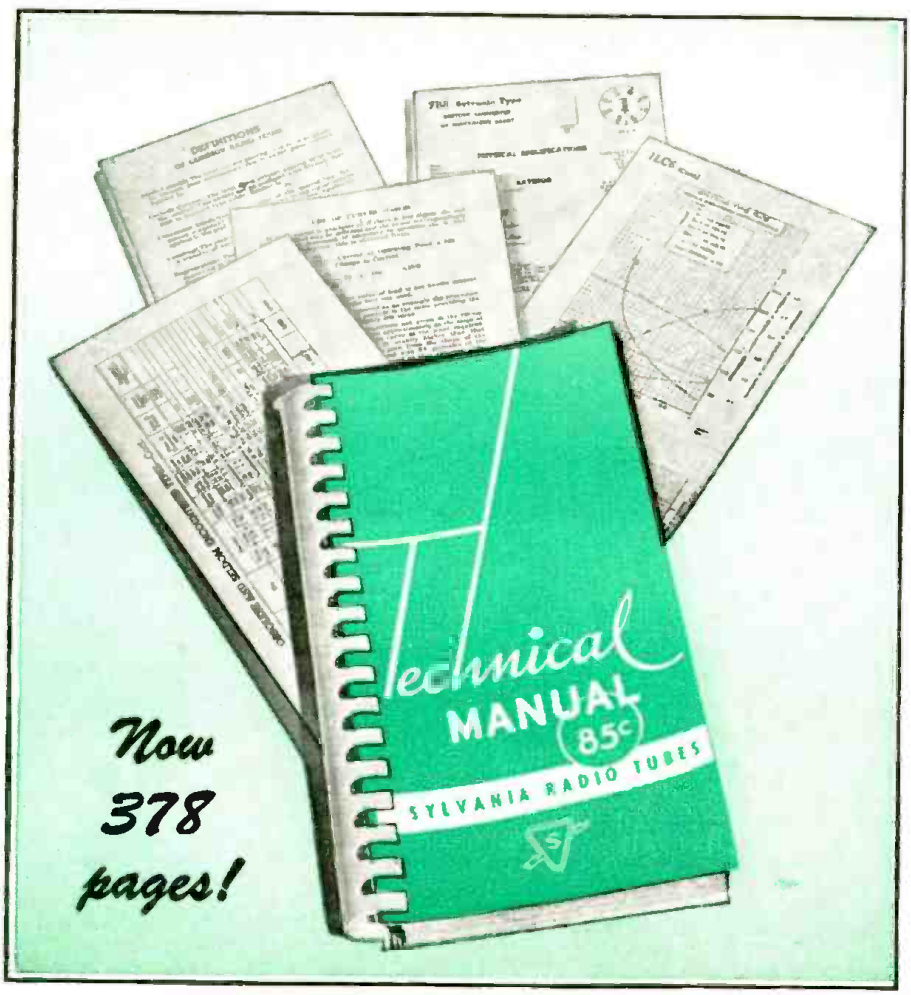
*"The service that pays for itself over and over again"*

# SYLVANIA NEWS
## RADIO SERVICE EDITION

MAY *Prepared by* SYLVANIA ELECTRIC PRODUCTS INC., Emporium, Pa. 1947

# BRAND NEW SYLVANIA TECHNICAL MANUAL NOW AVAILABLE TO RADIO SERVICEMEN!

## Handy Volume Describes Over 500 Receiving Tubes—Is Full Of Helpful, Essential Data




Here's the new, handy volume of valuable radio tube information radio servicemen everywhere have been waiting for. This bigger, better-than-ever latest Sylvania Technical Manual—listing over 500 radio tube types (old and new)—has been made available as a result of the solution of extensive and elaborate tube engineering problems.

### IMPORTANT INFORMATION

You'll surely welcome this handy reference manual, with its important features including: Fundamental Properties of Vacuum Tubes; The Characteristic Curves; General Tube and Circuit Information; Resistance Coupled Amplifier Data—and many more.

### AVAILABLE NOW

We urge you to get your copy right away—because we know you'll find this volume chock-full of invaluable information—facts that will be helpful to you day in and day out.

***See Your Sylvania Distributor or order from Radio Tube Division, Emporium, Pa.***

SYLVANIA ELECTRIC

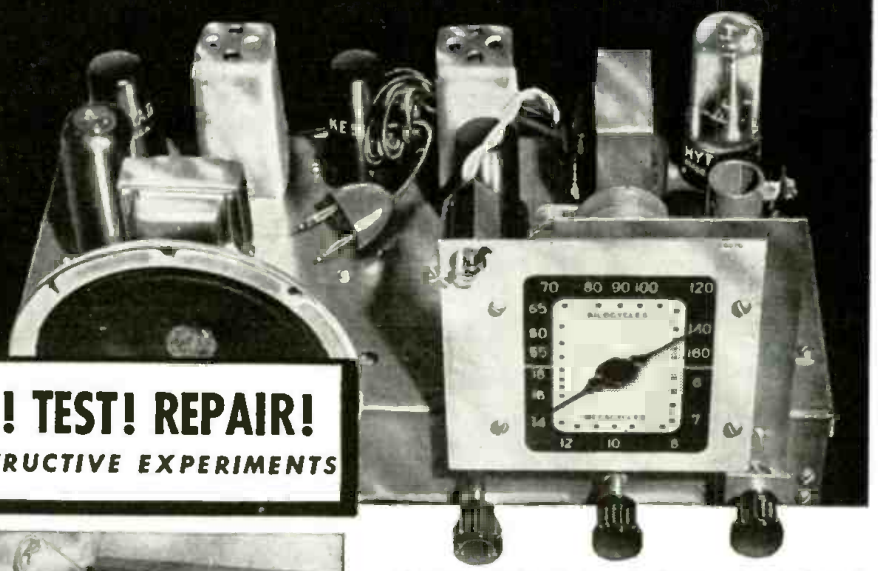
MAKERS OF RADIO TUBES · CATHODE RAY TUBES · ELECTRONIC DEVICES · FLUORESCENT LAMPS · FIXTURES · WIRING DEVICES · ELECTRIC LIGHT BULBS

# NOW! An Amazing Opportunity to LEARN RADIO AT HOME

## I SEND YOU 8 BIG KITS OF RADIO PARTS

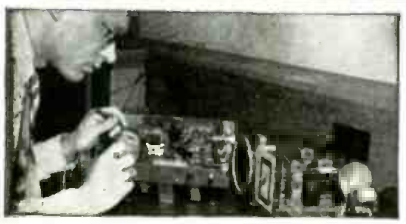
## Including a COMPLETE 6 TUBE SUPER-HETERODYNE RECEIVER

**I TRAIN YOU RIGHT by PUTTING YOU TO WORK with REAL PROFESSIONAL EQUIPMENT!**



## LEARN HOW TO BUILD CIRCUITS! TEST! REPAIR!

YOU DO OVER 175 INSTRUCTIVE EXPERIMENTS



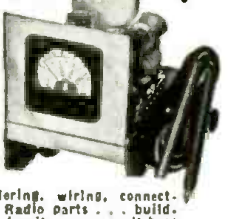
### HERE'S THE EASIEST, MOST PRACTICAL WAY OF ALL TO PREPARE FOR GOOD PAY in RADIO ELECTRONICS and TELEVISION!

I train your mind by putting you to work with your hands on a big 6-Tube Superheterodyne Receiver. And, believe me, when you get busy with real Radio Parts — 8 big Kits of them — you really LEARN Radio and learn it RIGHT! You get the practical stuff you need to be useful in Radio, and that's what it takes to make money. You don't have to worry about what to do with these 8 Kits of Parts. Step by step, I show you how to build circuits, test, experiment, trouble-shoot. And you don't need any previous experience. The Sprayberry Course starts right at the beginning of Radio! You can't get lost! Simplified lessons, coupled with real "Shop" practice, makes every subject plain and easy to understand and remember. Soon after you begin Sprayberry Training, I'll send you my sensational BUSINESS BUILDERS.

**A BUSINESS OF YOUR OWN . . . OR A GOOD RADIO JOB**

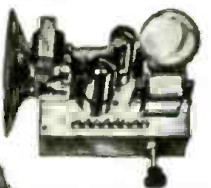
You'll find out how to get and do neighborhood Radio repair jobs for nice profits and rich experience while learning. This sort of work can easily pave the way for a Radio Service business of your own. But with Sprayberry Training, you're not limited. You can swing into any one of the swiftly expanding branches of Radio-Electronics INCLUDING Radio, Television, FM, Radar, Industrial Electronics. Be wise! Decide now to become a fully qualified RADIO - ELECTRONICIAN. Get full details about my Training at once! Mail coupon below for my 2 big FREE Books.

## YOU BUILD THIS USEFUL TEST EQUIPMENT!



I give you a fine, moving-coil type Meter Instrument on Jewel Bearings — with parts for a complete Analyzer Circuit Continuity Tester. You learn how to check and correct Receiver defects with professional accuracy and speed.

Soldering, wiring, connecting Radio parts . . . building circuits — you can't beat this method of learning. When you construct this Rectifier and Filter, Resistor and Condenser Tester, etc., you get a really practical slant on Radio.




You'll get valuable experience and practice building this Signal Generator and multi-purpose Tester. Makes a breeze out of fixing Radios and you don't have to spend money on outside, ready-made equipment.

## GET THESE VALUABLE FREE BOOKS

*"How to Read Radio Diagrams and Symbols"*

Here's a valuable and wonderfully complete new book which explains in simple English how to read and understand any Radio Set Diagram. Includes translation of all Radio symbols. Send for this volume at once. It's free! Along with it, I will send you another Big Free book describing in detail my Radio-Electronic Training.

## RUSH COUPON!

**SPRAYBERRY ACADEMY OF RADIO**
F. L. Sprayberry, President, Room 2057, Pueblo, Colorado

Please rush my FREE copies of "How to MAKE MONEY in RADIO, ELECTRONICS and TELEVISION," and "HOW to READ RADIO DIAGRAMS and SYMBOLS."

Name ..... Age .....

Address .....

City ..... State .....

(Mail in envelope or paste on penny postcard)

# GET YOUR *PROFIT-MAKING* FEDERAL SELENIUM RECTIFIERS FROM THESE JOBBERS!


**There's an outhorized jobber near you who can supply your Federal Miniature Rectifiers — and give you *free selling-aids* that will help you cash in on the big market for this new component that replaces the rectifier tube in AC-DC, Portable, Table, and Console radio receivers.**

**It's the modern way to give better service, improve set performance, get instant starting and longer life. . . . Get in touch with your nearest jobber today.**

**ALABAMA**
*Mobile*—Radio Labs

**ARIZONA**
*Phoenix*—Southwest Wholesale Radio & Appliance Co.

**ARKANSAS**
*Ft. Smith*—Wise Radio Supply

**CALIFORNIA**
*Long Beach*—Fred S. Dean Co.
*Los Angeles*—U. S. Grant Supply Co.
Radio Equipment Distributors
Radio Products Sales Co.
Radio Specialties Company
United Radio Supply Co.
*Sacramento*—Sacramento Electric Supply
*San Diego*—Electronic Distributors
Radio Parts Co.
*San Francisco*—Leo J. Meyberg Co., Inc.
Schuyler-Wilson Co.
Zack-Radio Supply Co.
*Santa Ana*—Radio & Television Equipment Co.

**COLORADO**
*Denver*—Inter-State Radio & Supply Co.
Radio Products Sales Co.

**CONNECTICUT**
*Bridgeport*—R. G. Sceli & Co.
*Hartford*—R. G. Sceli & Co.
*New Britain*—United Radio Supply

**DELAWARE**
*Wilmington*—Radio Electric Service Co of Pennsylvania

**DISTRICT OF COLUMBIA**
*Washington*—Capitol Radio Wholesalers
Emerson Radio of Washington

**FLORIDA**
*Miami*—Herman Radio Supply Co.
Thurow Distributors, Inc.
*Jacksonville*—Thurow Distributors, Inc.
*Orlando*—Thurow Distributors, Inc.
*St. Petersburg*—Welch Radio Supply
*Tallahassee*—Thurow Distributors, Inc.
*Tampa*—Thurow Distributors, Inc.
*W. Palm Beach*—Goddard Distributors
Thurow Distributors, Inc.

**GEORGIA**
*Atlanta*—Concord Radio Corp.
*Augusta*—Prestwood Electronics Co.

**IDAHO**
*Boise*—Craddock's Radio Supply

**ILLINOIS**
*Chicago*—Allied Radio Corporation
The Lukko Sales Corp.
Walker-Jimieson, Inc.

**INDIANA**
*Anderson*—Seybert's Radio Supply Co.
*Evansville*—Wesco Radio Parts
*Indianapolis*—Kiefer-Stewart Co.
Radio Distributing Company
Rodefeld Co.
Van Sickle Radio Supply Co.
*Muncie*—Standard Radio Parts
*South Bend*—Colfax Co., Inc.
*Terre Haute*—Terre Haute Radio

**KANSAS**
*Wichita*—Radio Supply Company

**KENTUCKY**
*Louisville*—P. I. Burks & Co.
Universal Radio Supply Co.
*Owensboro*—General Electronic Supply

**LOUISIANA**
*New Orleans*—Radio Parts, Inc.
Shuler Supply Co.
Southern Radio Supply Co.
Walther Bros. Company

**MAINE**
*Auburn*—Radio Supply Co., Inc.
*Bangor*—Radio Service Laboratory of New Hampshire & Maine
*Portland*—Radio Service Laboratory of New Hampshire & Maine

**MARYLAND**
*Baltimore*—Kann-Ellert Electronics, Inc.
Wholesale Radio Parts Co., Inc.
*Cumberland*—Radio Wholesaler

**MASSACHUSETTS**
*Boston*—De Mambro Radio Supply Co.
Louis M. Herman Company
Hub Cycle and Radio Co., Inc.
Radio Shack Corporation
*Cambridge*—Electrical Supply Corp.
The Eastern Company
*Fall River*—Flint Radio Co.
*Roxbury*—Gerber Radio Supply Co.
*Worcester*—De Mambro Radio Supply Co.

**MICHIGAN**
*Detroit*—Ingram Distributing Co.
*Grand Rapids*—Milton Bursma

**MINNESOTA**
*Minneapolis*—Lew Bonn Co.

**MISSOURI**
*Kansas City*—Potter Radio Company
*St. Louis*—Radonics

**NEBRASKA**
*Omaha*—General Appliance Co.

**NEW HAMPSHIRE**
*Manchester*—De Mambro Radio Supply Co.
Radio Service Laboratory

**NEW JERSEY**
*Camden*—General Radio Supply Co.
Radio Electric Service Co. of Pennsylvania
*Newark*—T. A. O'Loughlin & Co.
Variety Electric Company
*Perth Amboy*—Bennett's Radio Supplies
*Phillipsburg*—Carl B. Williams

**NEW MEXICO**
*Albuquerque*—Radio Equipment Co.

**NEW YORK**
*Albany*—Hudson Valley Asbestos Corp.
E. E. Taylor Co.
*Binghampton*—Broome Distributing Co
Federal Radio Supply
Morris Distibuting Co., Inc.
*Buffalo*—Genesee Radio & Parts Co.
Radio Equipment Corp.
Standard Electronics Cc.
*Elmira*—Fred C. Harrison Co.
Le Valley-McLeod-Kincaid Co.
*Glens Falls*—Ray Distributing Co.
*Hempstead*—Standard Parts Corp.
*New York—Bronx*—Slate and Company
*Brooklyn*—Benray Distributing Co.
Electronic Equipment Company, Inc
Green Radio Distributors
Hornbeam Distributing Co.
*Manhattan*—H. L. Dalis, Inc.
Federated Purchaser Inc.
Harvey Radio Company, Inc.
Milo Radio & Electronics Corp.
Newark Electric Co Inc.
Radio Wire Television Inc.
Radionic Equipment Co.
Stan-Burn Radio & Electronics Co.
Terminal Radio Corporation
*Queens*—Peerless Radio Distributors
*Rochester*—Hunter Electronics
Masline Radio & Electronic Equipment Co.
Rochester Radio Supply Co.
*Schenectady*—M. Schwartz & Son
*Syracuse*—Broome Distributing Co.
W. E. Eerndt
Morris Distributing Co.
Syracuse Radio Supply Co.
*Troy*—Trojan Radio Co., Inc.
*Utica*—Beacon Electronics, Inc.
Electronic Lab's & Supply Co.
Vaeth Electric Co.
*White Plains*—Sound Products Co.
Westchester Electronics Supply Co.

**NORTH CAROLINA**
*Charlotte*—Radiotronic Distributors, Inc.
*Raleigh*—Supreme Radio Suppliers

**OHIO**
*Akron*—Brighton Sporting Goods Corp.
*Cincinnati*—Herrlinger Distributing Co.
Holub & Hogg
*Cleveland*—Goldhammer, Inc.
*Columbus*—Hughes-Peters, Inc.
Thompson Radio Supplies
*Dayton*—Hughes-Peters, Inc.
Standard Radio & Electronics Products Co.
*Toledo*—Lifetime Sound Equipment Co.
Warren Radio Company

**OKLAHOMA**
*Lawton*—Reynolds Radio Supply

**OREGON**
*Portland*—Lou Johnson Company
Tracy & Company, Inc.

**PENNSYLVANIA**
*Allentown*—Radio Electric Service Co. of Pennsylvania
*Ardmore*—O. K. Griffith Radio
*Erie*—Warren Radio Company
*Harrisburg*—Radio Distributing Co.
*Lancaster*—Geo. D. Barbey Co.
*Mt. Carmel*—Big Boys Auto Parts Co.
*Philadelphia*—Almo Radio Co.
Emerson Radio of Pennsylvania
Lectronic Research Laboratories
Radio Electric Service Co. of Pennsylvania
*Pittsburgh*—Cameradio Co.
Tydings Company
*Reading*—Geo. D. Barbey Co.
*Scranton*—Fred P. Pursell
*Sunbury*—Big Boys Auto Parts Co.
*Wilkes-Barre*—General Radio & Electronic Co.
*York*—J. R. S. Distributors

**RHODE ISLAND**
*Providence*—Wm. Dandreta & Co.
De Mambro Radio Supply Co. (Branch)
W. H. Edwards Co.

**SOUTH DAKOTA**
*Rapid City*—Giraud Supply Co., Inc.

**TENNESSEE**
*Memphis*—Bluff City Distributor Co
*Nashville*—Currey's, 109 16th Ave.

**TEXAS**
*Dallas*—Crabtree's Wholesale Radio
Huey & Philip Hardware Co.
Wilkinson Brothers
*Ft. Worth*—Fort Worth Radio Supply Co.
*Houston*—Sterling Radio Products Co.
*San Antonio*—Mission Radio, Inc.

**UTAH**
*Salt Lake City*—S. R. Ross

**VERMONT**
*Burlington*—Vermont Hardware Co.
*Rutland*—Rutland Radio Center

**VIRGINIA**
*Norfolk*—Radio Parts Distributing Co.
Radio Supply Company
*Roanoke*—Leonard Electronic Supply
*Staunton*—Southern Electric Co.

**WASHINGTON**
*Seattle*—Seattle Radio Supply, Inc.
Herb E. Zobrist Co.
*Yakima*—Lay & Nord

**WISCONSIN**
*Milwaukee*—Radio Parts Co., Inc.

**OUTSIDE THE UNITED STATES**

**HAWAII**
*Hilo*—Photo Radio Products, Ltd.
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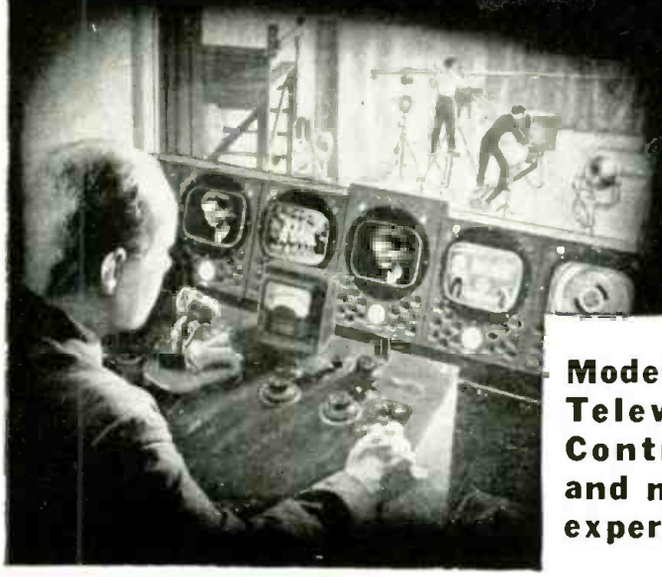
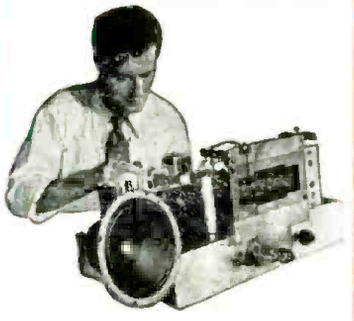


**Modern Radio — FM Broadcast and Reception — Television — Industrial Electronics; Power, Control, Communications — new equipment and methods demand new technical ability and experience. Keep up to date with the latest.**

## MODERN RADIO EQUIPMENT FOR YOU TO USE AND KEEP



The very essence of National Shop Method Home Training is EXPERIENCE. You get actual experience by working with modern Radio and Electronic equipment—building many types of circuits. You may build a fine, long distance MODERN SUPERHETERODYNE, signal generator, miniature radio transmitter, audio oscillator, etc.—many other standard actual operating pieces of equipment—conduct cathode ray and other experiments. This practical work advances with your training—YOU LEARN BY DOING!

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The good jobs in Radio Electronics now go to the men who are equipped to handle them. It takes training and experience. National Schools, one of the oldest and largest trade schools in the country, makes it possible for you to get this training right in your own home IN YOUR SPARE TIME.

National maintains modern resident training Studios, Shops and Laboratories where instructors and engineers are working constantly to improve training methods. SHOP METHOD HOME TRAINING is a logical extension of this practical system.

A FREE lesson that shows you how practical and systematic this new training method is will be sent you without obligation. You may keep and use this lesson to prove to yourself just how practical National Training really is.

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Magnetrons!! Type 2J32 (Jan.) just released. The 2J32 is designed for 10 cm. operation. Rated at 300 kw peak pulse power. Complete information supplied. Listed at $200. Our Price New $25.00
3J31's. One cm. magnetron listed at $95. OUR PRICE...$20.00
720 Magnetron. Value $200. Special...$20.00
2J38 ($245-3263 mcs) Complete with magnet .....$37.50
2J42 (3 cm) complete with magnet.....$37.50
2J26 (10 cm) .....$25.00
Magnets for Magnetrons .....$12.00

Klystrons! 2K25/723AB (3 cm) new; with data listed at $38. Our price ..... $7.75
707B. Limited quantity .....$15.00
External Cavity for 707B ..... $3.50

715B Pulse Power Tube.... ..... $9.50
30 mc oscillator-amplifier with 2 6AC7's. Uses 723ab. Wave guide input, xtal detector. With 6AC7's .....$10.00
With 6AC7's and 723ab, IN24 .....$16.50
Thermistor Beads (D-170396), for use with UHF and Micro-Wave equipment (List $3.00). In separate sealed containers ..... .95

## WAVE GUIDE PLUMBING
### 3 centimeters

T Section with choke terminations.....$5.00
3 cm TR Box (cavity) silvered for 721A TR tube ..... 2.50
2½ foot silver plated with 180° bend (2" radius) ..... 4.50
150° bend with 90° twist 3½" radius with pressurizing nipple and coax coupler.. 3.95
2½ foot 3 cm wave guide choke to cover fitting ..... 4.50
5 foot 3 cm wave guide section, per foot.. 1.95
Slotted Dipole Antenna 3 cm ..... 4.00
90° bend in wave guide 15" ..... 4.00
Silver Plated Directional Couplers with a 20 DB drop with:
A. Wave guide 90° bend 15" long.....$4.00
B. 15° bend in wave guide 15" ..... 4.40
C. 30° bend in wave guide 10" long..... 3.95
D. 90° bend in wave guide 15" long also 90° bend in coupler ..... 5.00
Choke flange for 3 cm. 1"x½". 2 for .... 1.15

### 1.25 Centimeters

Flexible section 1" long, choke to choke....$3.00
Mitred elbow and "S" section, cover to choke ..... 3.50
T-section, choke to cover ..... 4.50
Section—1" long, cover to cover ..... 2.00

### 10 Centimeters

Wave Guide per ft. .....$2.00
16 foot lengths
Coax Coupler 9/16" to ¾" coax ..... 2.50
Coax Rotary Joint with mounting plate.. 8.00

## SO RADAR

Transmitter unit (10 CM) includes 2J26 magnetron, TR-ATR section, pulse transformer. McNally Klystron, IF strip all tubes, blower motor. Used but in good condition .....$150.00
SO Radar antenna assembly (10 Cm) dipole, parabolic reflector 24 in. diameter. Drive and selsyn motors, wave guide couplings, rotary joint. Masking dome, 30x30x40". Used and in good condition .....$45.00
New .....$90.00
SO Radar 10 cm echo boxes .....$15.00
SO Radar indicator unit, with CR tube, focusing and deflection coils, azimuth scale, all controls, tubes and components used and in good condition .....$100.00
SO Radar accessory range unit, with AC voltmeter on front of cabinet .....$35.00
In fact we have the complete SO Radar. New and used. Ask us for quotations.

APS-10 Modulator assembly: Includes 2J42 magnetron, 2—3B24s, 3C45, relays, blower motor.
Together with Low Voltage power supply assembly for APS-10. Chokes, condensers, transformer.
Both units, a buy for .....$50.00

Signal Generator, 2700 to 3000 MC. Regulated power supply, 115V/60C. Contains output meter. Made by Western Electric. Value $400. Our price .....$75.00

## NEW ARC-5 SUPERHET RECEIVERS—NEW!

Tubes (included) 3—12SK7; 1—12K8; 1—12SR7; 1—12A6. Freq. range; A different receiver for each of these bands: 1.5 to 3 Mc; 3 to 6 Mc; 6 to 9.1 Mc. Any one receiver; specify frequency. Tubes and schematic are included .... **$12.00**
Extra to go with ARC-5
Dynamotor .....$2.25
Control Box ..... 1.00
Drive Cable ..... 2.50
Mounts ..... 1.00

## (SCR-274-N) Transmitters

ARC-5 Transmitters; 25 watts CW; 15 watts phone. Tubes: 2—1625; 1—1629; 1—1626; 1 crystal. Range (specify frequency desired); .5-.8 Mc; .8-1.3 Mc; 1.3-2.1 Mc; 4-5.3 Mc; 5.3-7 Mc; Power: 24-28 VDC. Less dynamotor ..... **$12.00**
Dynamotor for Transmitter .....$14.00
Modulator unit (with tubes)1—1625 1—VR150; 1—1215 ..... **$14.50**

**These units are BRAND NEW!!!**

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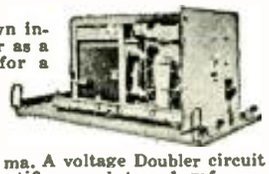
Ideal for detecting underwater sounds, such as fish swimming in schools, within a 15 mile area. Using a Rochelle salt crystal, which is about 1000 times more sensitive than quartz, as the active unit the sound is transmitted up a 60 ft. length of cable. It is completely enclosed in a solid rubber sheath. This sound detector was originally used in harbor defense. Coupled to an audio amplifier, this can be found to have many valuable applications. Ask for SD-1 ..... **$6.95**

## New US Navy Model RAK-7 Ship Receiver

15 kc to 600 kc, 6-tube receiver with: AVC-Band pass filter-Audio filter—Noise limiter—Precision tuning with a Vernier dial—Voltage regulated power supply, with three tubes, for 60 cycle, 115 volts. Can be battery operated. Complete with spare parts box weighing 73 lbs., tubes and instruction book **$69.95**

## RA-58-A HI-VOLTAGE POWER SUPPLY



Ideal for breakdown insulation testing, or as a source of power for a pulse transmitter. This unit supplies continuously variable voltages between 500 and 15,000 volts DC at 35 ma. A voltage Doubler circuit using two 705a rectifiers and two 1 mf condensers is employed. RMS ripple voltage at maximum power is 6%. THIS UNIT OPERATES FROM 115v/60c. Variable voltage is obtained by means of a Variac in the primary circuit of the high voltage transformer. Size is 21"x17½"x29" deep. Net weight 314 lbs. This unit sells for the low price of ..... **$116**

**We have unbelievable bargains in 400 cycle transformers. Ideal for pulse work. At this price you can figure out your uses for them. Most sizes at 50 cents each. Send us your voltage requirements.**

## Values in All Frequencies
## SPECIALS FOR THIS MONTH

Visors for 5-inch scopes .....$ .75
Tube shields for 2AP1 ..... .98
Broadcast band push-button tuning units inductive types .....1.98
Mushroom rubber earphone cushions for lightweight set—2 pairs for ..... .89
Oscilloscope chassis, completely punched for use with a 2-inch tube. Octal sockets included 15"x11"x9" ..... 1.50
Microphone element T-30-K for throat mike selling 2 for ..... .50
Microphone unit MC-419 for lip microphone ..... .98
140 mmf split stator variable midget condenser ..... 1.49
Silver button mica condensers, 175-185 mmf, each ..... .05
Lots of 100 ..... 4.50
Silver button mica condensers: 500 mmf, each ..... .10
Lots of 100 ..... 9.50
Whip antenna—2 sections fasten together —Ideal for 10 meters ..... 1.25
B-29 computer amplifier contains 8-6SN7s, 5 neons, 8 relays completely wired, new.. 9.95
115 volt 60 cycle transformers for plate and filament 570 V CT. 60 MA-5 and 6.3 V ..... 1.89
6 Hy Choke 60 MA. to match above ..... .65
I-F Crystal filter for BC-312, BC-342 Resonant at 470 kc. Crystal included.. 6.95

## Oil Filled Condensers

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|---|---|---|---|
| 1 mf 300 vdc ..$ | .25 | 2 mf 600 vdc .. | .40 |
| 2 mf 300 vdc .. | .30 | 1 mf 1000 vdc .. | .85 |
| 4 mf 300 vdc .. | .35 | 2 mf 1000 vdc .. | .98 |
| 4 mf 400 vdc .. | .55 | 1 mf 1500 vdc .. | 1.05 |
| 5-5 mf 400 vdc .. | 1.15 | .4 mf 1500 vdc .. | .20 |
| 2 mf 550 vdc .. | .30 | 2 mf 660 ac/1000 | .95 |
| .25 mf 600 vdc .. | .25 | 4 mf 1500 vdc .. | 1.30 |
| .85 mf 600 vdc .. | .30 | 1 mf 2000 vdc .. | 1.10 |
| 1 mf 600 vdc .. | .35 | | |

.1-.1 mf 7000 vdc GE. Pyr ..... 2.00
10-10-10 mf synchro cap 90v/60c ..... 2.50

## Hi-Volt Mica Condensers

F3L .0003 mfd 8000V list $29.00 .....$ 3.75
Solar type SX .0015 mf 3000V list $9.95 .. .75
Sangamo G-3 .006 mf 10 kv list $87.50 .. 17.50
.0008 mf 5000 vdc C-D No. 599-6H ..... .80
.0002 mf 5000 vdc Aerovox ..... .75

## Tube Special

| Tube Type | Appro. List | Your Cost | Tube Type | Appro. List | Your Cost |
|---|---|---|---|---|---|
| 2AP1 | $12.00 | $ 3.75 | 837 | $ 2.80 | $ 1.35 |
| 3BP1 | 15.00 | 3.95 | 872A | 7.50 | 2.45 |
| 3FP7 | 27.00 | 3.50 | 3B24 | 12.00 | 3.95 |
| 5BP1 | 20.00 | 4.95 | 705A | 22.50 | 6.75 |
| 5BP4 | 29.00 | 7.95 | 241-B-WE | 85.00 | 40.00 |
| 5CP1 | 45.00 | 4.95 | 861 | 155.00 | 50.00 |
| 5FP7 | 32.00 | 4.25 | 304 TL | | 8.00 |

Sockets for 5CP1, 5BP1, 3BP1, 705A, 829 $.95 ea.

## Hi Volt Transformers

2 KVA Transformer and choke—115 V. 50 to 70 cycle input, single phase. Output 17,000 V. @ 144 Ma; choke 4,000 H @ 0 current, DCR 4500 ohms. Dimensions 26"x29"W. x13"D. Amertran .....$94.50
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SPST Latching relay made by Kurman. Make coil 115v/60c; DCR 1500 ohms. Break coil 115 vdc 10 ma; DCR 5000 ohms .....$2.95
DPST Telephone type; 2 p. 1 cl; 1 open cont. rating 5a at 50v. coil rating 3.5 ma (at 12K ohms). 1000 vac. ..... 1.05
Edison-Sealed Tube Type Thermal Relays—45 to 60 second delay. Normally open. $10. value. Our special price .....$3.45
24 Volt Relay Grab Bag Bargains: SPST, ea., .50; DPDT, ea., .60; TPTT, ea., .70.

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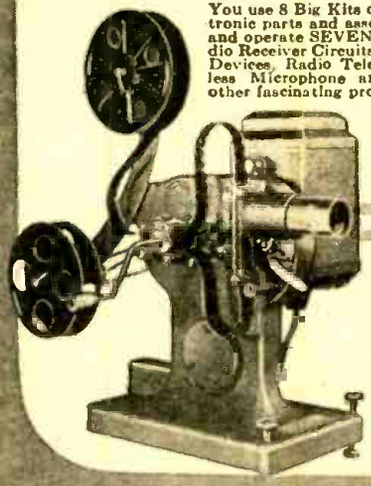

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# MAY • 1947




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A giant tube tester used for testing the kenotrons used for uranium concentration in atomic processes.

*Chromatone by Alex Schomburg from General Electric Photo*


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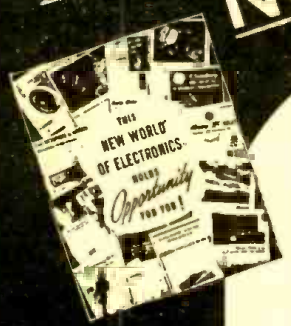


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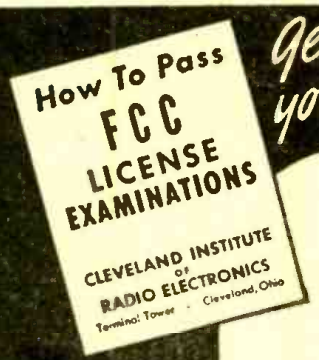


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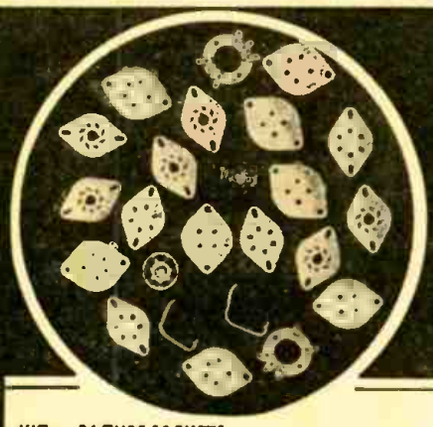

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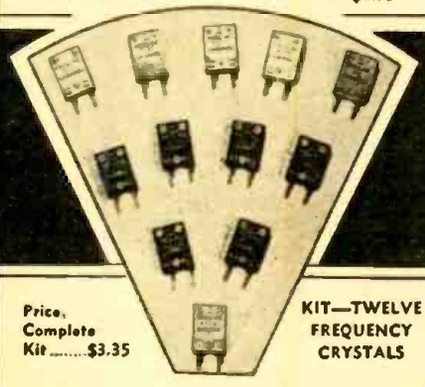

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To convert the BC-348 receiver for 110 V. AC operation. Constructed especially for the Esse Radio Company by a leading transformer company.

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**INTERPHONE AMPLIFIER AM-26/AIC**

Convert to high fidelity phone amp. or speech amp. Case size 9¾"x4¾"x5½". Tubes used and included: 2—12SJ5GT, 2—12A6. Complete with dynamotor as shown, for 24 V. DC operation.

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**SIGNAL CORPS TIME INTERVAL UNIT ML-138**

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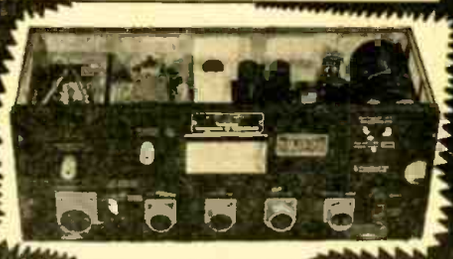

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# SPRAGUE TRADING POST

## SWAP—BUY OR SELL

**FOR SALE**—National SW-3 short wave receiver with power supply, three sets band spread coils for 20, 40, 80 meter bands, one general coil for 20 meters. Good condition. $20 as is. George Kershenbaum, 1100 Albany Ave., Hartford 5, Conn.

**FOR SALE** — RME-69 with re-aligned speaker, $95.00 F.O.B. Radio Wilw, Lykesland, S. C.

**FOR SALE**—Hallicrafters S-20-R in good condition. R.F. and I.F. stages "souped-up" with tri-gain tubes. Want to buy SX-28A. A. J. Elsen, 410 Thurston, Ithaca, N. Y.

**FOR SALE**—Tetrad 18-A standard frequency. Brand new in original carton with extra tubes, $20. Samuel Strauss, 94-06 31th Road, Flushing, N. Y.

**FOR SALE**—2-meter Transmitter-receiver, "7193" osc., 20 watts, 955 Receiver 6C5-6L6, common audio. Switch for fixed or mobile. Black crackle case. Meter. 2" p.m. speaker; plus power supply. $45. J. R. Lowe, 1230 2/3 North Flores St., Hollywood, Calif.

**FOR SALE**—Hallicrafters SX-32 receiver and speaker, Masco 35-watt amplifier and Turner 33X mike. Thordarson T8M22 modulation transformer; Thordarson 1000V d-c power supply; Kenyon 1000V d-c power supply; Millen Xtal control exciter with coils for all bands. M. W. Shellhamer, 224 Pitt St., Tamaqua, Pa.

**FOR SALE**—New BC-375 transmitter, 20 to 160 meters converted for 110V. a-c operation with a-c power supply. Complete with tubes, key, mike and tuning units. Less a-c power supply. Arthur Buck, 413 N. Second St., Wormleysburg, Pa.

**FOR SALE**—Brand new, McMurdo Silver Model 900 Vomax, $49; Model 905 Sparx, $34; Model 901 Bridge, $44. All three for one person for $125. S. R. Bernstein, 319 19th St., Brooklyn, N. Y.

**FOR SALE**—New Abbott TR-4 transmitter and receiver; new Abbott DR-3 portable transceiver complete; Instructograph with ten new tapes and oscillator. Want S-19-R or Howard 430 in good working condition. Wm. H. Lorimer, P.O. Box 361, Williamsport, Pa.

**FOR SALE**—Hallicrafters receiver SX-32 modified with SX-28A panel and new cabinet. John Lim, P.O. Box 2307, San Francisco, Calif.

**FOR SALE**—American code reader with 110V. 60cy. motor, key attachment with 12 learner's tapes, 3-tri-signal beginner's units, earphones, TU7B, TU8B tuner units, QST's 1923 to date. H. E. Leigh, Sr., 197 N. 14th, San Jose, Calif.

**FOR SALE**—Gardner model "S" code sender; Speedex key; BP1 cathode ray tube with socket and leads. Supreme multi-meter. Write for information on other equipment. Edwin W. Ozellus, 977 Warren Ave., Brockton, Mass.



**FOR SALE**—Hallicrafters Sky Ranger S-39 in good condition, $70. Robert Goron, Montecello Hotel, Boulder, Colo.

**FOR SALE**—Webster phono with model 50 changer, plays up to 12 records, fast changing, 8" speaker, 3-tube amplifier, leatherette cabinet, 24" x 17". Bargain at $65 complete. David Ehart, 2219 Sunset Ave., Utica 4, N. Y.

**WANTED**—Solar CE or VTVM. Have new Superior signal generator for trade. Larson, 14 E. 30th St., New York 16, N. Y.

**FOR SALE**—New Precision 200 signal tracer, $25; Simpson 313 signal generator new, $66; Simpson 260 Volt-ohmmeter, $35; New Precision set tester; Used equipment: 535 Simpson 'scope, $30; RCA 156 Tube Tester, $35. Hamilton Radio Clinic. What Cheer, Iowa.

**SELL OR SWAP**—Western Electric sig. generator, 50-100 MC $35; Sola voltage reg. transformer, 300 watt, $20, 500 watt, $35. G. E. 6V battery charger, 1 to 12 batteries, $45; QST's 1927-1932; IRE's 1927-1937. A. J. Gerel, 278 E. Columbia St., Hempstead, N. Y.

**FOR SALE**—Supreme 400R Diagnometer in case. A-C cord missing, otherwise complete; 3 fine Jewell meters A-C, D-C, Ma. Radionic Engineering Co., 620 North and South Rd., University City 5, Mo.

**SELL OR SWAP**—Transmitter, receiver 2-8 mc; 235 mc transceiver, same cabinet; VFO phone/cw/mcw 25 watts; headphones; mike; variometer; Intercoms; antennas; co-axes; dynamotor. Robert Bonuck, 35-63 88th St., Jackson Heights, L. I., N. Y.

**FOR SALE**—Fellers sig. tracing analyzer TS-2, slightly used, good as new, $25; Chicago Instrument VOM 371, new $2.50; Meissner 3-tube midget radio, wired, complete with tubes and 5 coils, $10; Hallicrafters S-28 receiver, $45. Garland Bowman, Star Route, Rockymount, Va.

**WANTED**—Used sig. generator in good condition; condenser tester (cap. resistor bridge). Pay cash or trade. What do you need? Your Radio Doctor, 397 Melrose St., Brooklyn, N. Y.

**WANTED**—Instruction manual, wiring diagrams, parts list, other data pertaining to Hickok tube tester 51X. James W. Hoskins, 212 Middlefield Rd., Palo Alto, Calif.

**FOR SALE**—Motorola portable radio 41D, good condition, uses 1H5, 1N5, 1A7, 1Q5 tubes, $20; good P.A. and instrument amplifier 15 watt; and Turner BX mike, $50. J. E. Decker, Chattanooga, Okla.

**WANTED**—One original Nathaniel Baldwin phone unit in good condition, type C or G, condition of case unimportant. Write E. L. Neill, Box 33, Cleburne, Texas.

**WANTED**—Hickok tube tester 510 or 532, counter or portable type, in good condition. Also Rider's manuals 2, 3, 4, 5. Cash. Leonard Peak, 1920 N. Spaulding, Chicago 47, Ill.

**SELL OR SWAP** — 10,000 V. 23MA transformer taken from oil burner. Good condition, suitable for experimental work. Geo. Weehsler, 1729 E. 17th St., Brooklyn 29, N. Y.

**SELL OR SWAP**—Portable single play phono, with 3-tube amplifier, volume, tone controls, 5" speaker, lightweight pick-up, $25 or equal in trade. H. Kanter, 1301 E. 57th St., Brooklyn, N. Y.

**FOR SALE**—Write for surplus list containing brand new Westinghouse meters and many other items. Alfred C. Denson, 38 Park Place, Rockville, Conn.

**SELL OR SWAP**—Dumont 5" 'scope 274; Supreme combination tester 599a; RCP sig generator 650; de Forest's 1946 radio course. All perfect condition. Need communications receiver, typewriter, automatic 22 rifle or target pistol. John F. Raposa, Jr., 167 Washington St., Fall River, Mass.

**SELL OR SWAP**—Philco auto radio for 1935-37 Ford; Pilot 0-100-0-100; Kurz-Kash 0-100 and 0-180. Used var. condensers; I.F. coils; R.F. coils. Many other items. List free. Smajd Radio, 724 Meadow Ave., Joliet, Ill.

**SELL OR SWAP** — Teleplex telegraph machine A-1. John Zudell, 1968 E. 34th St., Lorain, Ohio.

**FOR SALE**—Lead-acid surplus aircraft batteries, new, dry charged for long storage life. 12V 34AH, $10.50; 12V 17AH, $8.50; 24V 11AH, $15. Special price for orders for more than two. R. N. Esneault, 229 N. E. 70th St., Miami 38, Fla.

**FOR SALE**—T.T.I. television chassis with 7" tube in fair working condition with schematic, less than parts cost $75. Cash or C.O.D. J. I. Frieman, 5025 Arch St., Philadelphia 39, Pa.

**FOR SALE**—Brand new 1 KW motor-generator from army tank, 24 V., 75 Amp. D-C motor and 230 V., 4.5 Amp. D-C generator. Rewind two coils for heavy duty welding. $42. H. Baierlein, Box 415, Camden, N. J.

**SWAP**—RCP electronic multi-tester 660, used 30 days. In good condition. Want late model signal tracer. Chas. C. Butler, 616 E. 5th, Cherryvale, Kan.

**SELL OR SWAP**—Vomax VTVM in A-1 shape, used 3 months, calibration perfect. Need portable tester like Supreme 592. Ray F. Knoepfler, 1059 Rockman Pl., Rock Hill 19, Mo.

**SELL OR SWAP**—Small klelg lights; speakers; tubes; gift items; unused U.S. postage; Want 8mm projector, record player, small vacuum cleaner. G. Zamkofsky, 527 Belford Pl., Brooklyn, N. Y.

**WANTED**—Used volt-ohmmeter; Precision or Supreme tube checker; H. Wager, 211 Tulip Ave., Franklin Sq., L. I., N. Y. State price and details.

**SWAP**—21 jewel Elgin pocket watch and 14 k. white gold chain for tube tester or vacuum tube volt-ohmmeter. Robert R. Hurd, 1713 W. 15th St., Topeka, Kans.

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# 400 MILLION U.S. RADIOS?

## *Radio saturation is not in sight*

By HUGO GERNSBACK

EVERY few years, unimaginative radio people—who really should know better—begin to have grave doubts about the future of radio. This hoary, old depresser has been paraded before the radio world ever since the boom of 1922. It continues to pop up with irritating regularity.

To show how foolish and completely without merit these dark forebodings are, let us look at the record.

From the best available estimates there are now at least 35 million homes equipped with radios. This leaves out automobile radios, radio sets in factories, commercial institutions, and others. The total number of radio receiving sets in the United States in 1946 was computed to be somewhat above 60 million.

If we look at the curve of radio sets in use in the United States we will observe that ever since 1922, when radio broadcasting started, the curve has been one of practically uninterrupted ascent. This curve will not change appreciably in this country for a long time to come, for the following simple reasons:

There was the time when radio sets were used strictly for receiving purposes; news, entertainment, music, etc. Times have now changed. In the future there will be many new and different types of radio sets aside from the ones now in vogue. Take, for instance, the rise of radio amateur sets, which now run into the hundreds of thousands.

In the late 20's we started to install radio sets in cars purely for entertainment purposes, like the radio in the home. Already the radio telephone set, for communication purposes, has been added and is now expanding at an extraordinary rate. With some 26 million passenger automobiles in the United States today the time is not far distant when a very large percentage of automobiles will be equipped with these two-way telephone radios, plus a radio set for entertainment and news, etc., which means that soon there will be *two* radio sets in an automobile.

How many millions of the two different types of car radios there will be during the next ten years is a guess today. At least every business man who owns a car will want to have a communication radio set in his automobile. The limit is apparently only the ability of the telephone companies to manufacture these sets fast enough and install them.

Originally we started out with one radio receiver in the home. Now a very large percentage already has two and three sets; one in the living room, one in the bedroom and children's room, and in the servants' rooms —even an appreciable percentage is in the bathroom.

Where this tendency will stop no one knows, but the chances are that *three radio sets in the home* will certainly be the average before very long.

We next come to a type of radio which was not on the horizon even a few years ago. That is *Citizen's Radio*—the type with which a person can communicate directly with another, by means of ultra-short waves. How many of these radios will come into use during the next decade is difficult of computation, but there certainly will be millions of them.

Next on the list we have the *facsimile radio*. Already newspapers are broadcasting the printed word over facsimile sets in a number of cities in the United States so that with your breakfast in the morning you have spot news on a sheet of paper issuing from your radio set! This is a comparatively new type of radio set on the market, and although it has been known experimentally for several decades, no practical set has been turned out in quantity until recently.

Another type of specialized radio set which is about to make its appearance is the small receiver, the size of a cigarette pack. This will be kept either in your pocket or on your desk at home or in the office and will be designed for only one purpose—time and brief news announcements. You pick up the tiny set any time during the day or night and you will have the time, weather reports and other news shorts. Only a single station will be received with such sets. It is conceivable that anywhere between 30 to 50 million of such receivers will be sold during the next few decades, for the important reason that they are really a necessity in this country.

Still another type of radio—now already beginning to emerge—is the pocket type broadcast receiver. This small type of miniature set—forecast in these pages for several years—is now a reality. When we speak of pocket sets we really mean the type of radio receivers small enough to fit into the vest pocket—a set not much bigger than a pack of cigarettes. There is an enormous demand for such novelty sets. Whenever news appears that someone is bringing out such a receiver the manufacturer is immediately swamped with mail. It probably will be another five years before these radios have been perfected so that they will stand up under *all* conditions and that the reception will be entirely satisfactory to the public. That over 50 million such sets will be sold in this country within an appreciable time is a foregone conclusion.

Add to this the utility sets, such as are used in factories, offices, restaurants, and other commercial houses.

In factories where there is tedious work, radio has been found to enhance the morale of the workers. It speeds their work and improves general conditions. In many plants, where there is much noise, the ordinary type of public address system is often not feasible and in smaller factories individual sets are used right alongside the workers.

If we add up all these different types of radio sets it becomes apparent that *(Continued on page 91)*

# RADIO-ELECTRONICS

## Items Interesting to

**CALLING - CARD RADIOS** were demonstrated by Dr. Cledo Brunetti at the annual meeting of the Institute of Radio Engineers early in March. Not only did he operate a receiver printed on a card 3 inches long and 2 inches wide, but he operated it with a transmitter small enough to be kept in an old lipstick

A complete "calling-card" radio receiver.

case! Dr. Brunetti spoke into a lapel microphone as he walked about the stage, his words being picked up by the calling-card receiver and further amplified through a standard amplifier to fill the large ballroom in which the meeting was held.

The radios are all constructed by the "printed-circuit" technique first described in RADIO-CRAFT in April and June, 1946. The lipstick-size transmitter actually has the coils painted on the glass of the tube itself. A flat disc-shaped condenser, less than a quarter inch across, and a painted resistor complete the circuit. Battery and microphone complete the equipment.

"Lipstick" transmitter used by Dr. Brunetti.

The little radios, of which Dr. Brunetti had nearly a dozen on hand, were built by a group of Bureau of Standards scientists working under his direction.

**TWO FM RADIO STATIONS** in New York City were asked last month by the FCC to adopt new frequencies to avoid interference with aircraft instrument landing systems. The interference is due to technical shortcomings in the aircraft receivers—designed before FM moved to its present frequencies—and the use of new frequencies is to continue only until March 1, 1948, by which time it is expected that all aircraft can be equipped with apparatus of modern design.

Since the users of ILS equipment concede that FM broadcasters are technically blameless for the flying hazard created by their transmissions and that the aviation industry simply has been caught in the unfortunate position of equipping itself with war-time receivers which did not have to contend with the problem of FM interference, they are endeavoring to work out a method whereby they can defray the cost of the FM operators' temporary frequency shift.

**RADIO TECHNICIANS** of San Francisco last month embarked on a plan of study designed to prepare them for the new world of frequency modulation. Seventy members of Radio Division No. 1245 of the Brotherhood of Electrical Workers registered for night school courses at Radio KALW in the Samuel Gompers Trade School, San Francisco.

The courses are being handled under a three-cornered co-operative arrangement between the Board of Education, the union and the manufacturers of FM equipment. Courses are being taught under the direction of Kenneth Nielsen, chief engineer of KALW. Various manufacturers have pledged their assistance in making the studies effective, and the General Electric Co. has supplied each student their FM instruction booklet, as well as service notes applying to current G-E FM receivers.

**COMMERCIAL MICROWAVE** relay circuits are being installed for the first time, officials of Raytheon Manufacturing Co. announced last month.

The microwave links, which will represent the first commercial use of such relay circuits, will operate between the Canadian Marconi Montreal office and two other points, Yamacaiche, about 35 miles away, and Drummondville, 100 miles distant.

Installation of the new circuit follows experimental work by Raytheon on its New York-Boston microwave circuit. The company is carrying on extensive propagation studies, looking toward the elimination of noise through use of high-power magnetron units.

**FCC'S LATEST MEMBER** is Commodore Edward Mount Webster, who was formerly in charge of Safety and Special Services for the Commission.

Commodore Webster has been in the communications field from the time of his graduation from Coast Guard Academy in 1909 to the present. He served as assistant chief engineer of the FCC from 1938. Like his former chief, Ewell K. Jett, now also a Commissioner, he is an independent in politics, and has never voted.

**VLADIMIR K. ZWORYKIN,** leading American television engineer, received two signal honors during the past two months. The first, award of the Potts medal of the Franklin Institute, occurred March 3. On March 7, RCA's president David Sarnoff announced that Zworykin had been elected Vice President and technical consultant of the RCA Laboratories, where he has done much of his important work.

Besides his achievements in the field of television and the electron microscope, Dr. Zworykin has been interested in other branches of the electronic art, and during the war directed research in the development of aircraft fire control, infra-red tubes for the sniperscope and snooperscope, television guided missiles and improvement of radar systems. He is now directing work on an electronic calculator which he believes may make possible accurate meteorological predictions and ultimate control of weather.

**IGNITION INTERFERENCE** in television and high-frequency radio receivers can be eliminated, a joint committee of the Radio Manufacturers Association and the Society of Automotive Engineers reported last month. The committee made four recommendations:

1. Locate the high-tension coil to permit an 8-inch or shorter lead from coil to distributor.
2. Keep primary electrical wiring metal rods and conductive tubing as far from high-tension wiring as possible.
3. Use a 10,000-ohm suppressor in the distributor-to-coil high-tension lead.
4. Use a 10,000-ohm suppressor at each spark plug.

The Automobile Manufacturers Association has adopted the recommendation in principle, and has asked all bus, truck and car manufacturers to begin immediately to prepare their vehicles to meet the recommended tolerable interference limits by Jan. 1, 1948, but asked that installation of resistors be deferred until tests now under way have been completed.

# MONTHLY REVIEW

## the Radio Technician

**TAXATION ON TELEVISION** in public places will not be levied, the Bureau of Internal Revenue announced last month, putting an end to earlier rumors.

Under the law, the tax applies to all establishments which provide entertainment "other than instrumental or mechanical music." An answer of the Bureau to an inquiry by a New Jersey collection official made it appear that television was therefore considered taxable, but the Bureau later formally stated that television is not "live" entertainment and therefore not subject to tax.

**MAGNETIC WIRE RECORDERS** plus radio-phonograph combinations were placed on the market for the first time last month by a Chicago department store and mail-order house. Price of the combination, described as a low-cost item, is in the order of $170, and comprises a straight record player (without record changer) a superheterodyne radio and the magnetic recorder.

**MICROWAVE DIATHERMY** equipment was released for the first time to the medical profession last month, a Raytheon report states. The apparatus operates at 2,450 mc, almost 100 times higher than the present 27-mc diathermy band.

Diathermy investigators, including Dr. de Forest, have suggested that extremely high-frequency treatments might be especially valuable, but have been hampered by lack of suitable equipment.

The new *Microtherm* u.h.f. waves are directed at the patient like a beam of light, eliminating electrodes or "pads" which have to be strapped on. Due to its faster absorption than lower frequencies, less power is required, and a small portable unit can be used.

The FCC has made available the frequency band of 2400 to 2500 megacycles for industrial and medical applications. Use of the magnetron oscillator at these frequencies will not give rise to the objectionable radio interference which has been so common with the older type of diathermy.

**ELECTRICAL UNIT CHANGES** will be introduced January 1, 1948, the Bureau of Standards announces. The electrical units of the "international" system will be superseded by those of the "absolute" system derived from the fundamental mechanical units of length, mass and time.

The changes will not be great enough to be noticeable in most practical measurements, but will affect those of high precision. The new values as compared with those now recognized by the United States are:

| | | |
|---|---|---|
| 1 international ohm | = | 1.000495 absolute ohms |
| 1 international volt | = | 1.00033 absolute volts |
| 1 international ampere | = | 0.999835 absolute ampere |
| 1 international coulomb | = | 0.999835 absolute coulomb |
| 1 international henry | = | 1.000495 absolute henries |
| 1 international farad | = | 0.999505 absolute farad |
| 1 international watt | = | 1.000165 absolute watts |
| 1 international joule | = | 1.000165 absolute joules |

New units for the measurement of light will be introduced at the same time, according to the Bureau of Standards.

**FIRST ALL-RADAR** airway will be installed in Alaska, the Army Air Forces announced last month.

The AAF will use "racon" type radar navigational beacons at Shemya, Adak, Anchorage, Ladd Field (Fairbanks) Nome, Fort Randall and Point Barrow, providing radar coverage over the entire Alaskan airways system.

**AUSTIN C. LESCARBOURA,** one of the earliest editorial associates of the Gernsback publications, last month received from the Republic of France the order of *Officier de l'Instruction Publique*. The honor is in recognition of technical and literary services rendered for many years past.

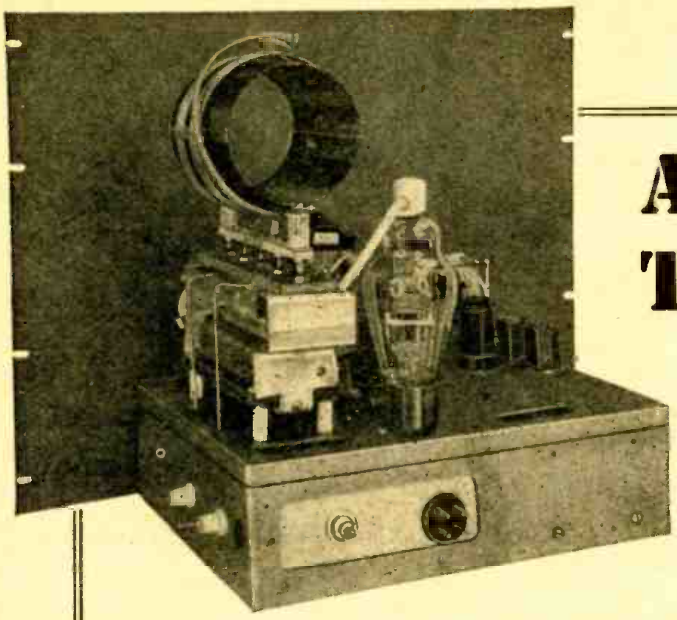
Mr. Lescarboura was one of the first

managing editors of the original Gernsback magazine, MODERN ELECTRICS, and was later managing editor of *Scientific American* and editor of *Popular Science Monthly*. He has written and edited a number of books on radio subjects, and is a frequent contributor to technical publications both in the English and French languages. As correspondent for the Physics Department of the University of Lyons, he has kept that faculty in touch with the progress of radio-electronic science in America. More recently he has acted as consultant for visiting members of the French Mission for Industrial Production. He holds a second French decoration, *Officier d'Académie*, awarded for services to France and the Allies during World War I.

**COLOR TELEVISION** is not yet ready for commercial exploitation, the Federal Communications Commission decided last month. The FCC decision came after several hearings in which Columbia Broadcasting System led the proponents of immediate color television and RCA spoke for those who believe color is not yet ready for the public. Both sides backed their arguments with showings of color television.

"The commission cannot escape the conclusion," the FCC said in a fourteen-page decision, "that many of the fundamentals of a color-television system have not been adequately field-tested, and that need exists for further experimentation."

Television broadcasters and manufacturers interpreted the ruling as giving a green light to black-and-white television and some predicted that greatly expanded production would result almost immediately.



# AN ECONOMY TRANSMITTER

## This 225-watt transmitter can be built for only $16

By R. F. SCOTT, W2PWG

A STAND-BY transmitter was needed to keep W2PWG on the air while rebuilding the regular rig. A little thought, plus careful selection of parts and use of those already on hand, produced this 225-watt c.w. transmitter at a cost of a little more than 7 cents a watt.

The panel and the coil turret were purchased at amateur net cost. Four crystals, an 811, three 500-watt tank coils, and the tank tuning condenser—purchased at bargain prices from government surplus stocks—brought the total cost to slightly over $16.00. All other parts were resurrected from the junk box.

Three stages are used in the transmitter. A 6C5 Pierce oscillator simplifies operation by eliminating both tuning in the oscillator circuit and neutralization of the buffer-multiplier stage. Any one of four crystals may be switched into the oscillator circuit from the front panel. A 50-μμf mica condenser across the grid leak provides sufficient regeneration to give trouble-free oscillator operation even with the most sluggish crystals.

### The buffer stage

The 6L6 buffer-multiplier is capacity-coupled to the oscillator. Parasitic suppressors, Rsp, in the grid and screen grid leads consist of 6 to 8 turns of No. 16 enamel wire wound around a 50-ohm, 1-watt resistor. The plate of the 6L6 is series fed through a Barker & Williamson Type 2A band-switching turret. This stage is tuned by a 140-μμf receiving type variable condenser controlled by a knob on the front panel. The knob on this control should be a good electrical insulator with its setscrew well removed from possibility of physical contact with the operator. The turret permits the 6L6 to work as a buffer when working "straight-through" and as a multiplier on 40, 20, 15, or 10 meters. With this arrangement and a suitable crystal, W2PWG hopes to be one of the first signals on the proposed 15-meter ham band when it is officially opened.

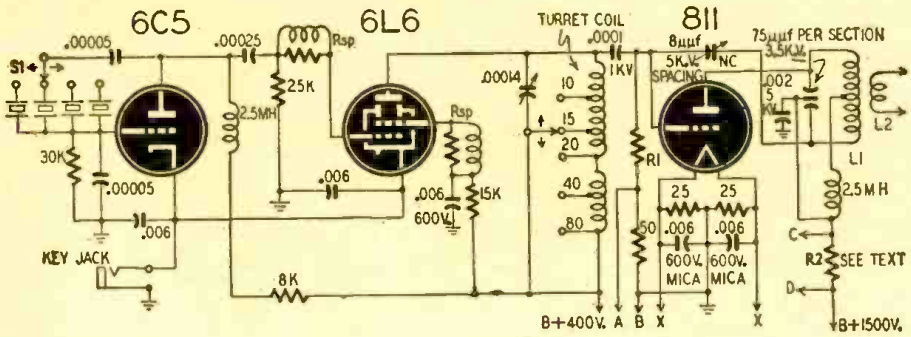
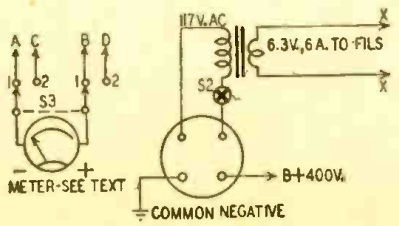



Fig. 1—Schematic of the economy transmitter. Bandswitching is used on the buffer and plug-in coils on the output tank. The 4-prong socket is a male receptacle for the a.c. line supply to the filament transformer, also the low-voltage leads from the pack. The 1,500-volt lead is brought in separately.




### Final amplifier stage

The 811 was chosen as a final amplifier because it has a reasonably high plate dissipation factor (55 watts), can be driven by the 6L6—even when quadrupling—and its high-mu characteristics permit operation without fixed bias although preceding stages are keyed. Other triodes, such as the HK54, T55, T40, TZ40, and 812, can be used with minor changes in voltages and circuit constants. The 811 draws 35 ma grid current through its 3,200-ohm grid leak to produce 112 volts of operating bias with 1,500 volts on the plate. If the plate voltage is reduced to 1,250 or 1,000 volts, the grid leak R1 should be replaced with a 2,500-ohm, 10-watt unit.

A series-fed, plate-neutralized tank circuit is used. The rotor and stator of the tuning condenser are connected to the high-voltage lead and the r.f. is bypassed to ground through a 0.002-μf, 5,000-volt condenser. The tuning condenser was originally a 160-μμf, single section unit with 3,500-volt spacing between its plates. The present connection reduces the required condenser spacing by about 50 percent. It was salvaged from a Type A-27 phantom antenna unit formerly used with Army radio sets SCR-193 and SCR-506, and converted to split-stator connection by removing the center stator plate and cutting a ⅜-inch gap in the center of each stator connecting bar. It is mounted on ½-inch standoff insulators to insulate it from the chassis.

The tank coils used in this rig are available at most radio surplus stores. They are fitted with special terminal blocks which will not fit standard jack bars. Substitute bars may be made by drilling properly spaced holes in ¼-inch bakelite or mycalex strips and mounting shallow banana jacks in the holes. The assembly is then mounted on the frame of the condenser with L-shaped brackets.

The neutralizing condenser NC has its rotor connected to the grid of the 811

and its stator to the bottom end of the tank coil to prevent the operator from coming in contact with high voltage. An insulated knob is used to avoid r.f. burns.

## Special construction features

The 9 x 12 x 3-inch chassis permits all parts to be mounted without crowding. Four sockets are mounted in the left front corner. Two of these are for oscillator and buffer, the other two for crystals. Each octal socket will hold two crystals if they are mounted in the new type holders—most surplus stock crystals are. Five symmetrically spaced holes are drilled in the front skirt of the chassis for mounting the key jack and the crystal, and the band-changing, meter and filament switches.

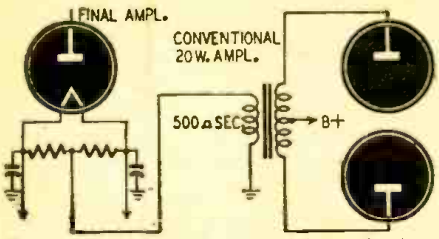


Fig. 2—A simple cathode modulation hookup.

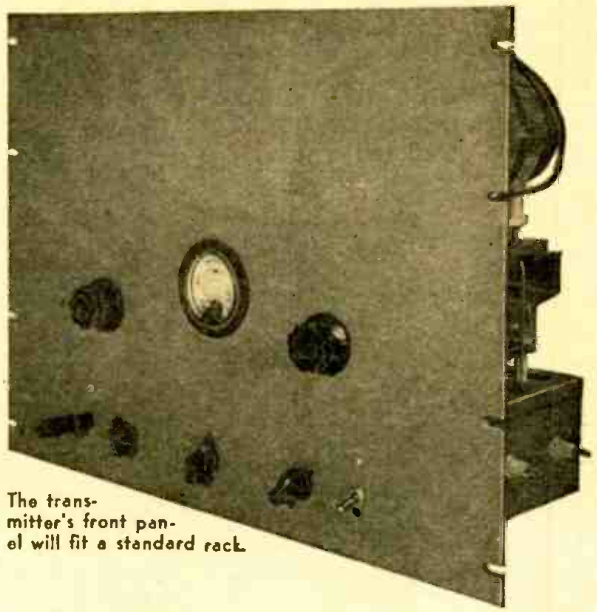
A 4-prong socket in the rear skirt is the input terminal for a.c. leads to the filament transformer and the common ground and low-voltage connections. The positive high-voltage line enters the chassis through a ceramic feed-through insulator.

The internal shunt was removed from an old 3-ampere meter, which was then found to have an 8-ma movement. A shunt was wound to give a 90-ma full-scale deflection. When the meter switch, S-3, is in position 1, it is connected across a 50-ohm, 1-watt resistor in the 811 grid return, making it possible to read the grid current without opening the circuit. To read plate current, the meter is switched across R2, a shunt wound to give 300-ma deflection. With the meter used, the shunt consisted of about 2 feet of No. 22 enameled wire. Almost any available meter may be used if shunts are wound to provide the required range or ranges.

## Tuning and tuning coils

The transmitter is connected to a 400-volt, 100-ma. power supply for the oscillator and buffer stages and to 1,500 volts for the final amplifier. The filaments are allowed to preheat for a few seconds and plate voltage is applied to the oscillator. A key in the cathode circuits of the low-power stages is closed and the final amplifier neutralized by conventional methods with the grid current meter indicating neutralization.

After neutralization, high voltage is applied to the final amplifier and the antenna coupling is adjusted to draw 150 ma of plate current. Under these conditions, the grid current is between 30 and 35 ma and the power output approximately 170 watts. When operating straight through, it may be necessary to detune the buffer to avoid overdriving the final grid. With active crystals and a high-C buffer tank circuit, it is often possible to excite fully the final grid on 10 meters with the oscillator operating on 80. For 15-meter operation, the 6L6 may be used as a tripler with 40-meter crystals in the oscillator.


The transmitter's front panel will fit a standard rack.

If manufactured coils are undesired or unavailable, coils may be wound from data given in the table below. In this event separate plug-in coils are wound for the buffer stage.

BUFFER COIL TABLE

| BAND | TURNS | WIRE SIZE | WINDING SPACE |
|---|---|---|---|
| 80 | 30 | No. 22 en. | 1½ inch |
| 40 | 15 | No. 22 en. | 1¾ inch |
| 20 | 8 | No. 16 en. | 1¾ inch |
| 15 | 5½ | No. 14 en. | 1½ inch |
| 10 | 3 | No. 12 en. | Spaced to hit band with low C. |

The 10-meter coil is air-wound and self-supporting. The others are wound

*(Continued on page 73)*

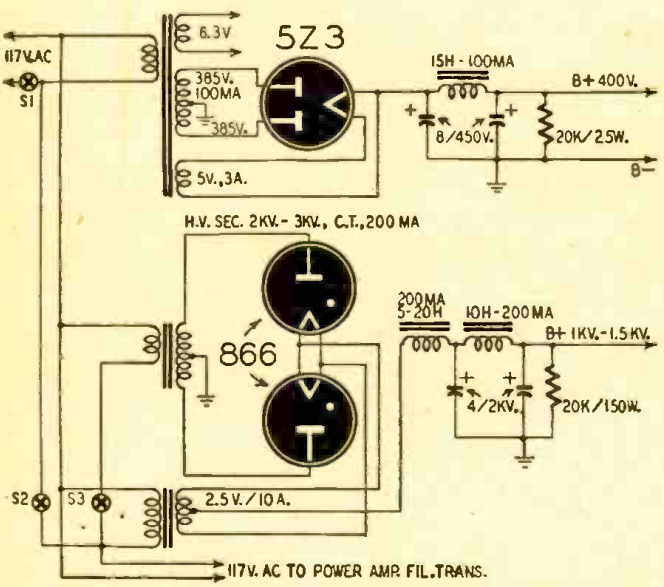
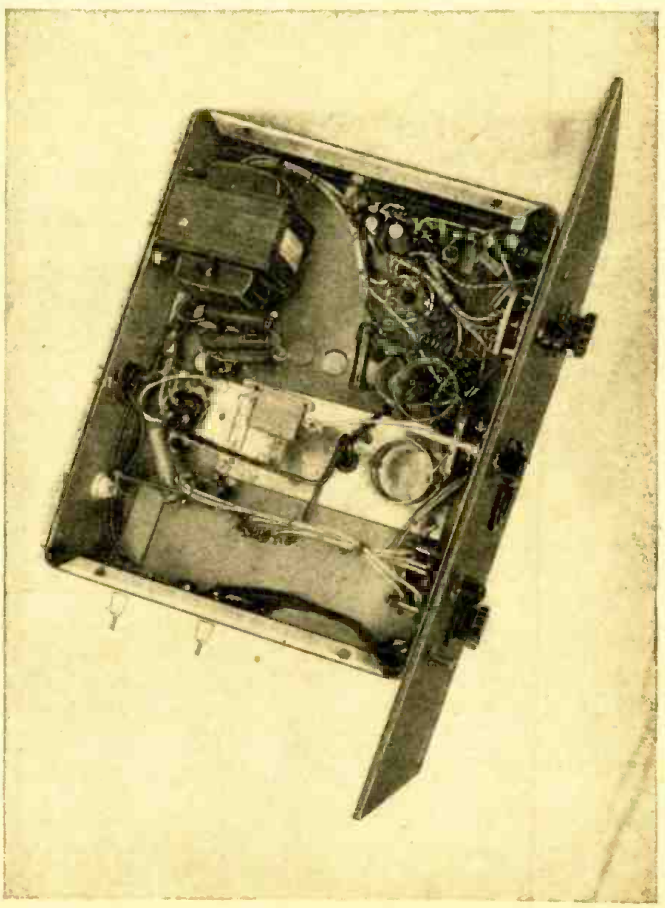


Fig. 3, above—The power supply used for the standby transmitter. Right—Underchassis view shows filament transformer, buffer coils.



# Efficient Test And Repair Bench

By C. A. BROWN*

THE radio service bench has always been the object of many discussions, arguments and opinions. Scores of articles have been published on what should constitute a radio service bench. We built up several experimental benches and installed them in a radio service shop. The reactions of radio technicians and customers alike were carefully noted, and those ideas which did not meet with their approval, were weeded out. We came to the following conclusions:

1. A radio service bench must be more than just a bench. It must be a place to test any electronic device efficiently. The test equipment must be permanently mounted to do away with dangling wires, cumbersome connections, and other haphazard devices. Instruments must be placed so they can be easily read, either standing or sitting. Lighting must be glare-free.

A slightly tilted panel, with a satin white finish, made of a nonconducting material, which is strong but easily cut and drilled, was found most suitable. At the top of this panel a fluorescent light is mounted.

*Servelux Mfg. Co., Grand Rapids, Michigan

2. One must have a place to perform any operation the radio or other electronic device needs. The space must be large enough to accommodate several radios at once, or a large multiple-unit job, and still have ample room to maneuver. The surface must be smooth, easily kept clean, and nonconducting. Battleship linoleum was chosen as the ultimate in top surfaces.

3. The problem of where to keep tools. Certainly not just anywhere, especially not on the working surface where they are always under the thing you are working on. That goes also for those bottles of speaker cement, solvent, contact cleaner, etc. A tool and chemical rack has been incorporated in the instrument panel, in a smooth basic design, not tacked on. It is an integral part of the equipment. The parts storage problem has been licked too. Two large, deep cabinets of drawers form the supports for the working surface and the instrument panel. These drawers are of varying depths and are compartmented. There is a drawer for special tools, those not used in every job, but very important when needed. Besides being compartmented these drawers are labeled as to specific values and form a perpetual inventory of parts. Two tray drawers in the front edge of the working surface receive parts removed from radios, such as bolts, nuts, knobs, dial glasses and pointers.

4. Here are two problems very often overlooked: The radio service unit must be at least semi-portable and should be constructed so instruments can be easily connected to the power line and easily serviced.

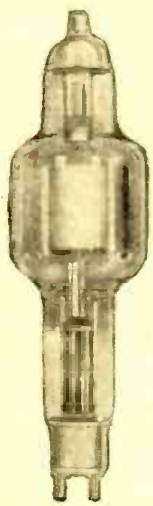
The instrument panel can be cut and drilled for any instrument, and power outlets for instruments are provided in

(Continued on page 74)

# King of Tube Checkers

COVER FEATURE

THE increasing use of kenotrons has increased in turn the need for equipment with which they may be tested. The kenotron is a high-vacuum rectifier, especially built for high voltages. Ratings are from 40,000 to 150,000 volts, with outputs from 100 ma to ¾ ampere. One of the most important uses of kenotrons is for the concentration of uranium for development of atomic energy. They are used in the electromagnetic plant at Oak Ridge, Tennessee, one of the largest units of the atomic project.



G-E kenotron GL-411, a 150,000-volt tube.

Power supplies for this uranium-concentration equipment were especially designed, and special tubes had to be developed for them.

Naturally a checker to test and measure the characteristics of these tubes became a necessity. The instrument on our cover is that tester.

This equipment, developed by the General Electric Co. to check their high-voltage kenotrons, subjects the tube under test to a continuous series of impulses of various duration and magnitude. The operating cycle of the equipment is completed in 60 seconds, and consists of 6 5-second intervals, 3 seconds of 60-cycle impulses, followed by 2 seconds of continuous voltage application; a 17-second rest period, followed by 2 seconds of 800- to 1500-cycle impulses, with the remaining 6 seconds as a rest period. This cycle is repeated automatically for the specified test time and for the conditions of voltage and current required.

During this test a tube which is normally rated at 20,000 watts plate dissipation receives impulses of a maximum of 50 kilovolts and 75,000 watts. The tube must withstand these impulses without change in the tube current and without excessive arc-backs.

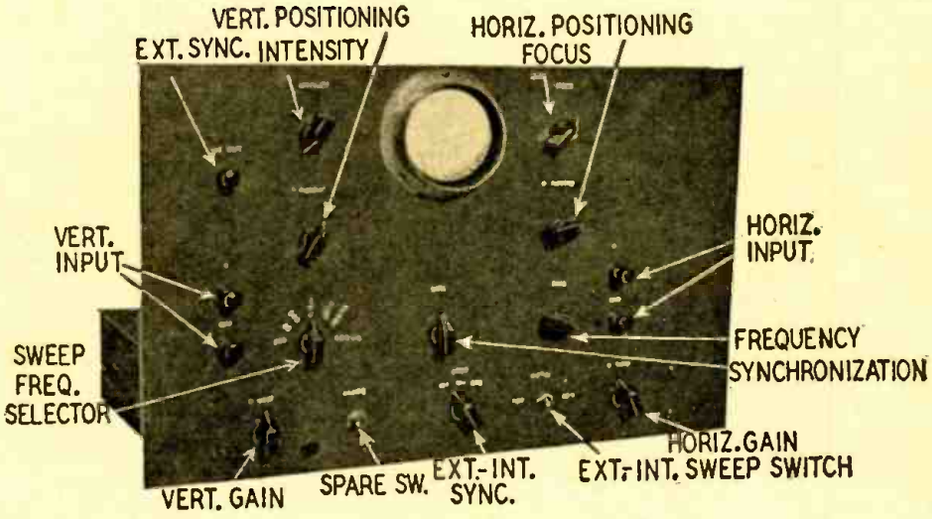
The test cycle is automatically controlled by the timing switch mounted on the inside test panel. The operating controls and meters are all mounted on this control panel which is located so that the operator can observe the tube during the test period.

The high voltage required for the test is obtained from two 6-tube rectifier units mounted in the back of the test cage. These rectifiers may be placed in series or in parallel, depending upon the conditions required for test. These

(Continued on page 74)

# Easy-To-Build Oscilloscope

**By B. W. SOUTHWELL**




All controls and input and output connections are clearly marked in the photograph above.

THE 3-inch oscilloscope diagrammed in Fig. 1 uses a single-stage 6J7 in the horizontal and the vertical amplifier. This single tube provides ample amplification for a cathode-ray tube of the size used. The gain of the horizontal and vertical amplifiers is in the order of 30.

The cathode-ray tube, together with its amplifiers and gas-triode horizontal sweep generator, is built on a 12 x 17 x 3 inch chassis. The front panel is 12 x 19½ x ⅛-inch steel. The power supply was originally built on the right side of the scope chassis, but it was later rebuilt on a separate 7 x 15 x 3-inch chassis because the transformers' magnetic field was strong enough to influence the electron beam between the deflection plates and the fluorescent screen. This magnetic interference was very bothersome and interfered with interpretation of patterns on the screen. Magnetic fields cause depositioning, relative tilting of the deflection axes, and other spurious deflections, and can magnetize the cathode-ray tube electrodes.

Looking at the front-panel view, the controls are: top left, intensity control; directly below it, vertical positioning; top right, focus control; below it, horizontal positioning. Below the vertical position control and going from left to right are the sweep-frequency selector switch, synchronization and frequency controls. The bottom row contains the vertical (Y-axis) gain, toggle switch (not connected, for future use), sync selector switch (3-pole, single-throw for internal, 60-cycle, and external), single-pole, double-throw toggle switch for horizontal sweep (internal or external), and horizontal (X-axis) gain. To the left of the intensity control is external sync binding post. Below it are the vertical input binding posts. Horizontal input binding posts are on the right-hand side of panel.

The 3AP1 cathode-ray tube is located in a horizontal position midway between the intensity and focusing controls. The tube is enclosed in a stovepipe shield of 3-inch diameter which extends to its base. The pipe shield is supported at the panel end by insertion into a snug-fit hole in the panel and by a piece of 5/16-inch brass rod, drilled and tapped and fastened to the pipe and chassis at the tube base end. The cathode-ray tube measures 3-1/16 inches in diameter across the face and hence will not fit into the shield at the front. The shield should be lined with a strip of sponge rubber ½ inch wide and 3/16 inch thick at the front-panel end to form a shock-absorbing mount for the 3AP1. A flange 3⅛ inches in diameter and 1 inch deep projects in front of the panel over the protruding tube, and serves both as a protection and as a light shield. For details of construction of shield see Fig. 2.

Fig. 3 is the dimensional diagram of the support for the 3AP1 tube socket. The bakelite panel for making direct connections to vertical or horizontal deflection plates is a great convenience when working with d.c. or high-frequency applications. The tube socket support itself is constructed of 16-gauge galvanized sheet metal.

## Amplifiers and sweep circuits

All wiring in deflection amplifiers together with the filament supply of the 3AP1 are run through shielded wire to minimize a.c. pickup. An extra tube socket was installed for the incorporation of an external Z-axis (blanking) amplifier at a later date. A portion of the signal on the plate of the 884 gas triode is fed through a 50-μμf condenser (1,000 volts working) to the intensity grid to blank out the return trace of the beam during its tracing of a pattern. This is internal blanking. This signal is opposite in polarity to that at the plate of the horizontal amplifier. Peaking coils containing 55 turns of No. 34 enameled wire, wound on a ½-inch bakelite form, are inserted in the plate circuits of the horizontal and vertical amplifiers to prevent loss of the high frequencies. Peaking inductances are used to compensate for the decrease

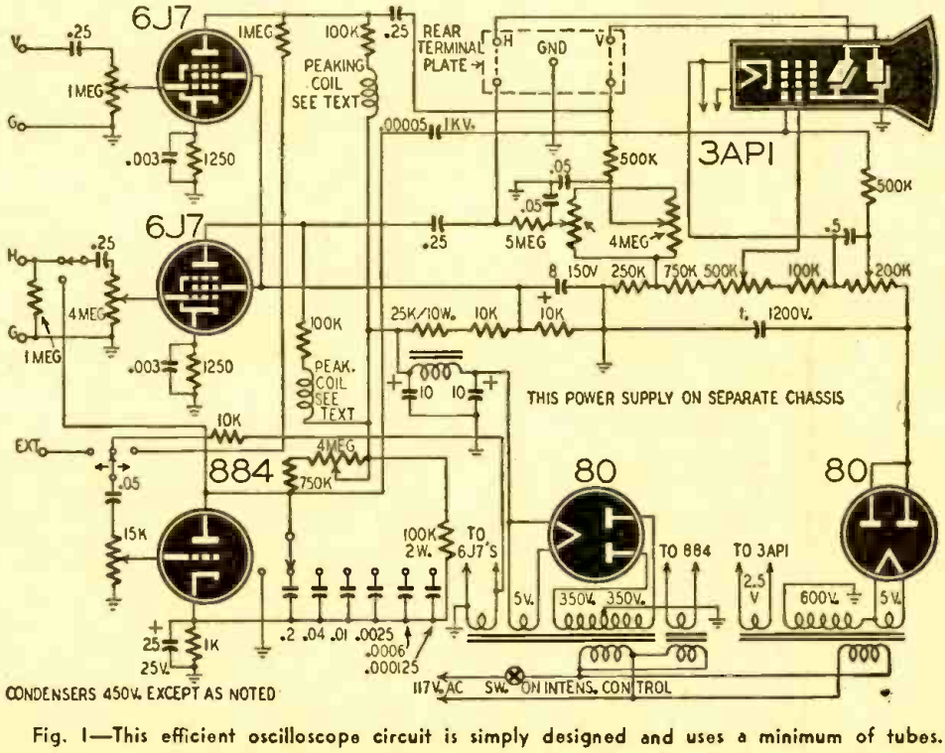



Fig. 1—This efficient oscilloscope circuit is simply designed and uses a minimum of tubes.

in plate-load impedance with frequency. Too large an inductance for a given resistance will cause nonuniform gain as a result of peaking in the network response at some frequencies. Too small an inductance will not give maximum band width for uniform response.

The vertical or Y-axis amplifier should reproduce faithfully square waves from 10 to at least 100,000 cycles/sec. For perfect square-wave reproduction an infinitely wide band of frequencies must be passed without attenuation or relative phase shift. A square wave is analyzed in terms of its harmonic content, taking the repetition rate as fundamental. The horizontal or X-axis amplifier should be capable of reproducing a linear sweep of saw-tooth voltage up to 100,000 cycles/sec. A wave form resulting from a nonlinear sweep

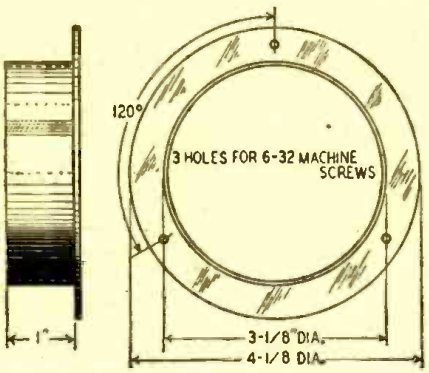


Fig. 2—How the light shield is constructed.

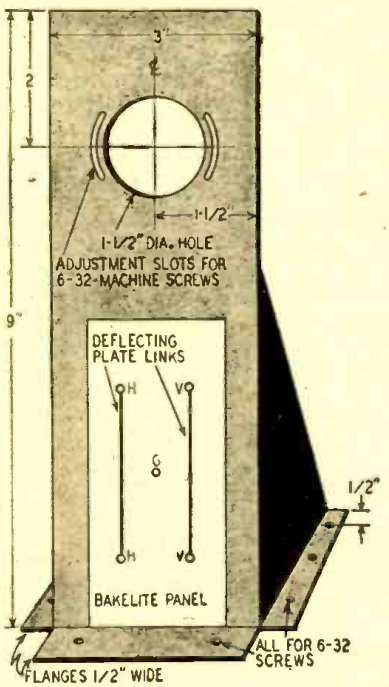


Fig. 3—Rear support of the cathode-ray tube.

is shown in Fig. 4. Pattern is bunched together at one end. A saw-tooth sweep gives a deflection linearly proportional to time. A sinusoidal sweep is used for phase and frequency determination. The horizontal and vertical amplifiers should have phase characteristics of identical nature.

The horizontal amplifier may be switched to amplify either the linear time-base signal from the 884 sweep oscillator or any externally provided signal.

The linear time-base horizontal sweep has 7 changes of frequency in rough steps. These are approximately:

Position 1—Sweep off
Position 2—20 to 70 cycles
Position 3—60 to 250 cycles
Position 4—220 to 950 cycles
Position 5—900 to 3,200 cycles
Position 6—3,000 to 11,500 cycles
Position 7—10,000 to 33,000 cycles.

In series with the switch arm controlling these steps is a 4-megohm potentiometer which permits a fine frequency adjustment over each frequency position range of the 7-position rotary switch. The sweep circuit proper utilizes a grid-controlled 884 gas-triode tube in a synchronized relaxation oscillator. The sweep condensers are connected from plate to cathode of the 884 separately by a rotary selector switch for the determination of sweep frequency desired. The condenser is allowed to charge up to a potential determined by the breakdown potential of the tube. This voltage output, which consists of saw-tooth waves (see Fig. 5) from the

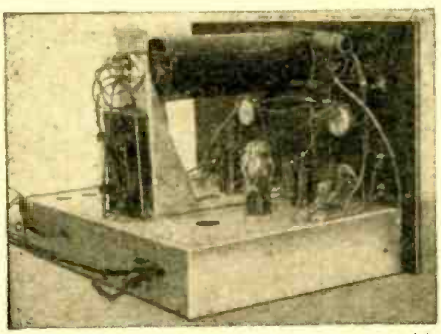

How the tube looks in its stove-pipe shield.

plate of the 884, is coupled to the grid of the horizontal amplifier to be amplified before reaching the horizontal plates of the 3AP1.

## Synchronization and positioning

A portion of the output of the 6J7 vertical amplifier tube is coupled to the grid of the sweep tube to provide synchronization to maintain a stationary pattern on the screen of the cathode-ray tube. Synchronization provides for 180-degree phase shift. Oversynchronization (sync-control potentiometer advanced too far) results in a poor wave form. Figs. 6 and 7 show properly synchronized and over synchronized patterns.

A single-pole, 3-throw switch on the panel provides for internal synchronization in position 1. Position 2 switches in 60-cycle or line frequency through a 10,000-ohm, ½-watt resistor connected to the ungrounded side of the filament leads. A separate filament transformer is required for the 884 tube as the filament is not grounded on one side. Position 3 connects the grid of the 884 discharge tube to the external sync binding post on the front panel.

Horizontal and vertical positioning of the pattern is obtained through a voltage divider circuit using two 4-megohm potentiometers. These potentiometers apply a positive or negative voltage to the free deflection plate of each pair. As the electron beam in a cathode-ray tube consists of negative charges of electricity, it can be readily seen that, by applying a positive or negative voltage to either deflecting plate, the spot position on the screen can be controlled. The intensity control controls the brilliancy of the pattern by applying to the control grid of the 3AP1 a greater or lesser negative voltage.

The power supplies are conventional. One 80 operates as a full-wave rectifier supplying 250 volts. The other 80 operates with plates tied together as a half-wave rectifier. The output voltage of this half-wave supply is 850-900 volts.

Scope applications and patterns are too numerous to cover completely in this article, so a brief resumé of some of the more commonly encountered wave forms will be given. It is general practice when observing wave forms to use several waves on frequencies of 1,000 cycles and above.

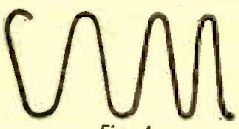


Fig. 4
Wave form caused by non-linear sweep.


Fig. 5
The correct saw-tooth sweep wave form.


Figs. 6 and 7
Good and bad synchronization.

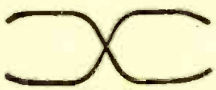


Fig. 8
Vertical to horizontal frequency 1:2.

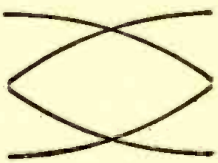


Fig. 9
Vertical to horizontal frequency 1:4.

## Some oscilloscope applications

Fig. 8 shows the pattern obtained when vertical frequency is half the horizontal sweep frequency. For example, a signal of 60 cycles is applied to the vertical plates and a saw-tooth wave of 120 cycles to the horizontal plates. Fig. 9 shows a pattern with vertical frequency one quarter that of the sweep frequency. When the vertical signal frequency is 3 times the sweep frequency, 3 complete wave forms will appear.

By switching the horizontal amplifier

*(Continued on page 90)*

# MULTIVIBRATORS

By O. B. MITCHELL

THE multivibrator offers more possibilities for practical application in the field of electronics than possibly any other circuit, so it is desirable that we make its acquaintance. This simple circuit played an important role in the design of radar and other wartime electronic devices.

Let us consider the basic multivibrator schematic of Fig. 1. The circuit con-

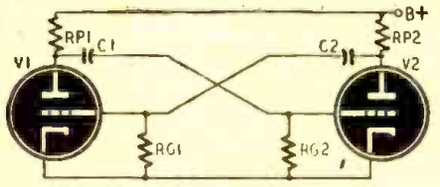



Fig. 1—The standard multivibrator circuit.

sists of a 2-stage amplifier with the output of V2 fed back into the grid of V1. Due to the phase reversal of 180 degrees in each stage, the feedback voltage is in phase with the original impulse on V1 grid. Thus, the circuit satisfies the conditions necessary for oscillation—amplification with positive feedback.

If we examine the multivibrator


Fig. 2—Form of multivibrator plate current.

plate-current wave form of Fig. 2, we will better appreciate its possibilities. The current makes rapid excursions from one stable condition to a second stable condition. These rapid excursions produce a highly distorted output wave, which makes possible the many applications of the circuit.

To many radiomen, the multivibrator is primarily a useful means of generating harmonics for frequency measurements. It is the most practical means

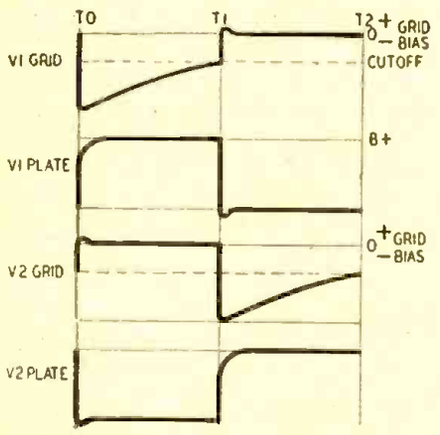



Fig. 3—Analysis of voltage over one cycle.

of generating 10-kilocycle calibration points. This technique has been adequately covered in technical radio publications and will be touched on but briefly in this article.

In Fig. 3 the circuit operation is graphically illustrated by a time-plot analysis. If what is taking place on the grid and plate of V1 or V2 were observed with a cathode-ray oscilloscope, the oscillogram would be similar to the wave of Fig. 3. The vertical lines T0, T1, and T2 are time designations, and intersect points on each of the waveforms occurring simultaneously.

## Analyzing the multivibrator

Assume that at a given instant T0 the grid of V1 goes slightly negative, causing a positive increase in the plate *voltage* of V1. The positive increase is applied to V2's grid through C1, causing its plate voltage to drop. V1 grid is now driven far below cut-off by the negative pulse fed back from V2's plate through C2. All of the preceding action takes place instantaneously at T0.

The grid of V1 is held below cut-off by the negative charge of C2, which must leak off through RG1. During the interval from T0 to T1, the discharge of C2 takes place, and the circuit remains stable. The actual length in seconds of this time is approximately the product of RG1 x C2. This portion of the cycle ending at T1 is known as the *slow-phase* action.

Another action occurring during the first half-cycle of operation is known as the *rapid phase*. At T0, when the grid of V1 is driven below cut-off, the plate voltage of V1 would ordinarily be expected to rise immediately to the B-plus value. As seen from Fig. 3, this is not the case, since the plate voltage tapers off exponentially as it rises. This phenomenon is caused by the charging of C1 through the grid circuit of V2. The charging path of C1 consists of RG2 in parallel with the internal grid-cathode impedance of V2. At the time V2 grid is in the positive region, this impedance is low in comparison to RG2. Therefore, C1 charges rapidly as the grid is driven positive. This charging phenomenon of C1, during the first half-cycle, is called the *rapid-phase* part of the operation.

When the voltage on the grid of V1 rises above the point of cutoff (T1), the first half-cycle of the multivibrator operation is completed. V1 now begins to conduct, and the plate voltage drops, driving the grid of V2 below cut-off. The remainder of the second half-cycle is identical to the first half, with V1 and V2 exchanging places, so to speak. From T1 to T2 the grid of V2 is below cut-off and is held there by the charge on C1. RG2 now provides the discharge path for the second slow phase. Note that since V2 is now cut off, the internal grid-cathode impedance is extremely high and doesn't affect the discharge time of C1. V1 grid goes through the rapid phase on this half-cycle since this grid is positive at T1.

The grid of V2 reaches its cut-off point at time T2, as determined by RG2 x C1. At this time, the original half-cycle will repeat itself, and oscillation will continue as long as power is applied to the circuit.

One complete cycle of oscillation takes place during the time from T0 to T1. The total length of this time, or the period of one cycle of operation, is equal to the sum of the two slow phases of operation. These in turn are determined by the RC constant of the grid circuits of V1 and V2. The frequency of the self-oscillatory multivibrator is determined by the equation $f$ equals $1/t$, where $f$


Fig. 4—Synchronized multivibrator circuit.

equals frequency in cycles per second and $t$ equals time or period of one cycle. In our case $t$ approximately equals (RG1 x C2) plus (RG2 x C1). Actually, other factors are involved, but the above method is satisfactory for approximation.

## Controlled multivibrators

If the circuit of Fig. 1 is triggered by an external impulse approximately equal, or harmonically related, to the natural frequency of the multivibrator, the circuit will oscillate in synchronism with the applied frequency. When this circuit is triggered, the frequency output of the multivibrator may be very accurately controlled by the exciting frequency. Either harmonics or subharmonics of an exciting frequency may be generated in this manner.

It is common practice to employ a 100-kilocycle crystal oscillator as the exciting frequency for a 10-kilocycle multivibrator harmonic generator. Such a combination, as shown in Fig. 4, provides accurate calibration points every 100 kilocycles throughout practically the entire useful radio spectrum.

In many electronic applications, it may be desirable to employ a multivibrator that will not oscillate unless it

*(Continued on page 58)*

# Home-built Sound Effects

## Simple equipment makes realistic sounds

"I WAS alone' whispers a husky voice from the radio. 'It was late at night. Through the fog came the faint swish of small waves, and a distant vessel hooted mysteriously. I slipped cautiously into an alleyway.' The voice ceases. Lapping water and a foghorn blend with the tinkling of a channel buoy. Footsteps ring sharply against the stones . . ."

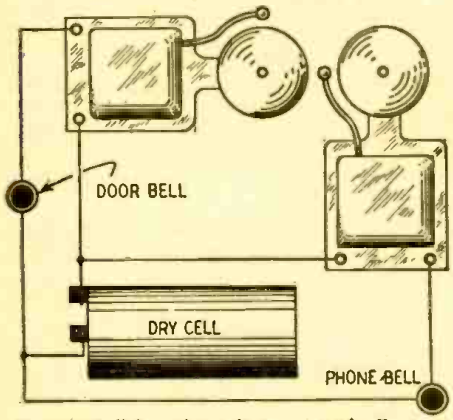


Fig. 1—Bell board produces several effects.

So commences a recent book* which tells how to make the sound effects for home recordings, excerpts from which are printed in this article. In the studio, the authors explain, an ingenious sound effects technician has flipped his fingers in a pan of water, blown a wooden whistle, struck a metal plate with a tack hammer, and marched along in a single spot, getting nowhere. Amplification and suggestion have converted the sounds to a waterfront scene.

Sound effects are to radio what seasoning is to food—without them it would sink into meaningless monotone, and many types of presentations would become impossible. Many of these effects are achieved very simply, and with apparatus which can be constructed by the home recorder or the small experimental studio operator.

Bells are among the commonest sound effects. A bell board is shown in Fig. 1. These two bells will serve you well as telephone bells, doorbells, riveting machines, buzzers, and rattlesnakes. Mount the bells on the board so the clapper of one will strike both gongs when that bell is rung. It becomes a telephone. The other can be used for doorbells.

All sorts of other bells, such as clock bells, dinner gongs, and school bells can be made with bowls and cake tins to be found around the house. A useful pair of bells appears in Fig. 2. One of these is a ¼ x 6 x 10-inch metal plate. The other is a piece of small pipe bent into a U-shape. Both are hung from a bar with leather thongs (never with wire).

The U-shaped bell is particularly useful where a quick clang is needed. The plate can be used for a variety of effects, depending on how it is struck and with what. Strikers can be bought from a music store, and are referred to as xylophone mallets, chime hammers, soft-hard mallets, and felt mallets. All are useful, and can be supplemented by a tack hammer and an ordinary pencil with an eraser.

Carry the eraser-tipped pencil around the house and strike flower vases, brass bowls, ash trays, and other objects. Every house is full of bells and chimes and gongs! If not enough are available, short lengths of brass or iron pipe may be hung by thongs with the two bells already described. By cutting pipes to various lengths, any desired pitch can be obtained.

A good ear and a little imagination will help to audition household objects for sound effects. The microphone gives them their realism; unamplified they may not display their real character. All the effects depend on the mike, and in many cases on special placement of the mike. Once the ideal effect is produced, do not depend on getting exactly the same layout of mike and instrument, the same technique and the same amplification, at a future date when you may need it. *Record your effects*—then you will have them when you need them.

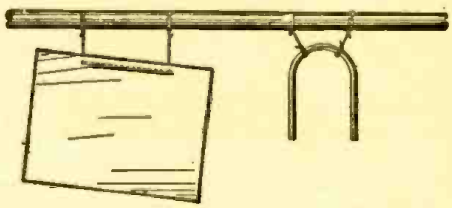


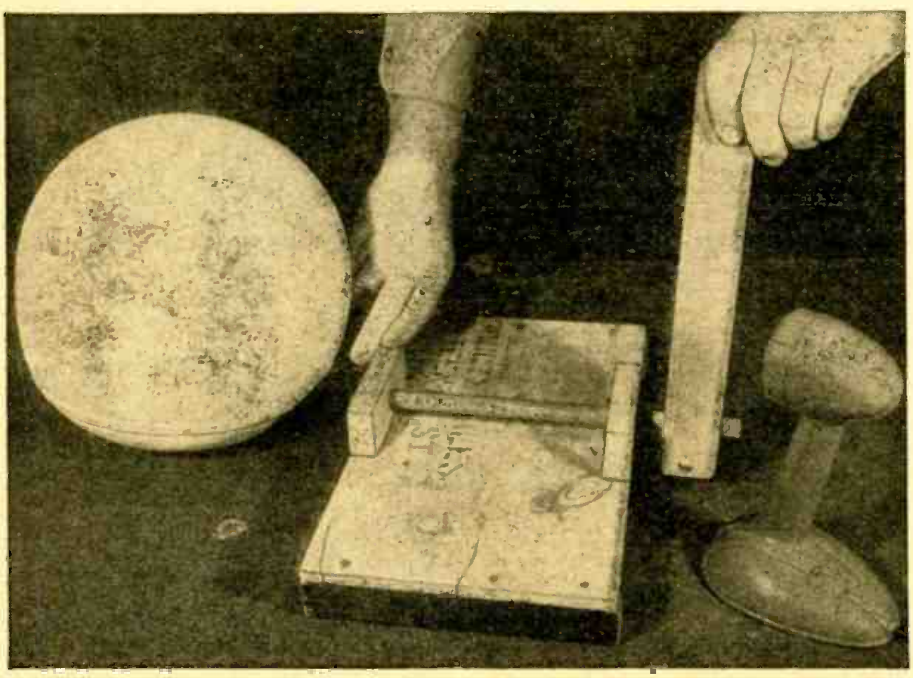
Fig. 2—Two of the most useful bell effects.

### Squawks, squeaks, and gripes

Time was when the first sound heard when you turned on your radio was the opening or closing of a "screechy door."

Produced by the squeak board illustrated in Fig. 3 and one of the photographs, this equipment can be used also to imitate the creaking of a ship's timbers, rusty hinges, and other sounds. To build it, you need one board, ½ x 8 x 14 inches (plywood is best); one board, 1 x 2 x 20 inches; one piece of stock, 1 x 1 x 16 inches; one ½-inch dowel, 12 inches long; one 8/32 machine screw, 1½ inches long, with washer and screw to fit.

The drawing explains the construction. The trick is to drill the hole in C so the dowel fits tightly, and to drill the hole in D so it fits loosely. A nail is used to hold the dowel firm in C. Piece F is put on the dowel and turned till the saw-cut is up. The cut is filled with powdered rosin, and the board A rotated till the rosin is worked well into the dowel and its socket in F. Then the


At left is the "thunder ball," used also for explosions. The squeak board is seen at right.

*How to Create Sound Effects for Home Recordings, by Ed Ludes and Hallock B. Hoffman. The Castle Press, Pasadena, Calif.

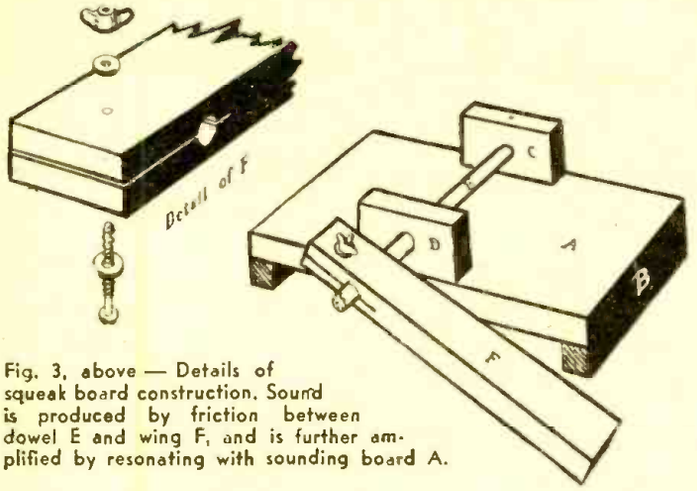



Fig. 3, above — Details of squeak board construction. Sound is produced by friction between dowel E and wing F, and is further amplified by resonating with sounding board A.

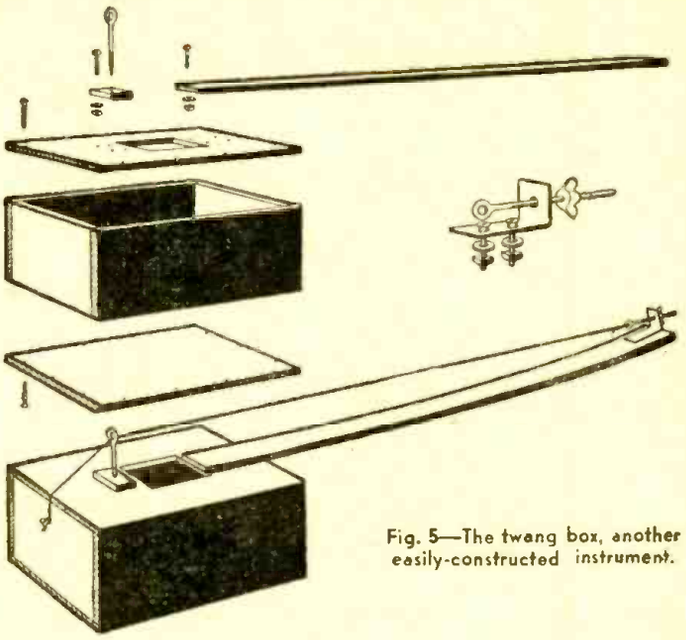


Fig. 5—The twang box, another easily-constructed instrument.

screw is adjusted for the desired range of notes.

An ear-splitting squeal can be made with the simple device shown in Fig. 4. The points of the nails should be bent forward *ever so slightly*—toward the point of the triangle. Put the block on a piece of glass at least 8 inches square, held off the table by a couple of strips under its edges. (The squeal-block can be used also on a window.) Try running

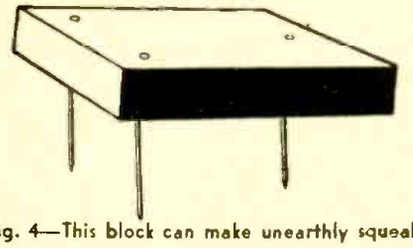


Fig. 4—This block can make unearthly squeals.

it over a smooth, unpainted piece of metal, for the squeal of automobile braked-skidding.

## The twang or squeal box

The box of the instrument is 4 x 8 x 10 inches. The top is made of ¼-inch plywood; the remainder may be made of ½-inch wood or plywood. The neck is of ¼ or 3/16-inch plywood, 2 inches wide and 2½ feet long. The string is No. 8 piano wire. Fig. 5 explains all construction details.

To make squeaks, the string is bowed with a violin bow. The pitch is varied by pressing down on the end of the neck. Twangs are made by plucking the wire, tuning the string with the eyebolt at the end of the neck to produce a medium sound. For best results, the box should be secured to the table with a C clamp, which will leave both hands free to produce sound.

The twang box is well shown in the photo. Note especially the position of the mike, which is very important. With all sound effects, great variations can be produced by slightly changing the mike position. Experiment!

Other sound machines may be made very easily. Wind is produced with an electric fan motor and a block with 4 dowels inserted and firmly fastened into it. See Fig. 6.

To produce thunder or an explosion, use a half-teaspoon of BB-shot in a basket-ball bladder. This is shown in the photo of the squawk board. Hold the bladder between the hands and snap wrists sharply, so the shot is thrown from the bottom and then falls back on it. For an explosion, one snap will usually be enough. For thunder, snap, then roll the shot gently around the inside by tilting the bladder.

A rattlesnake also is imitated with BB-shot. Put about half a teaspoonful of shot in the cellophane wrapper of a cigarette package. Attach to the clapper of a doorbell (with the gong removed), and push the button.

A small chamois-skin sack of cornstarch is used to make footsteps in the snow. Hold the bag in both hands, near the microphone, and squeeze it with the thumbs, alternately, in walking rhythm. The effect is extremely realistic.

Rain is produced with a large piece of tissue paper, some scotch tape, a supply of salt or sugar, and two cardboard boxes. The drawing (Fig. 7) is completely self-explanatory. By making the tissue-paper slide flatter or steeper, the rain may be made hard or gentle. The steeper the slide, the faster the salt moves and the harder the rain seems.

For a railway locomotive, two blocks of wood, about 3 x 4 inches each, the surface of each covered with rough sandpaper, are used. Rubbing the faces together, close to the microphone, will produce a convincing train.

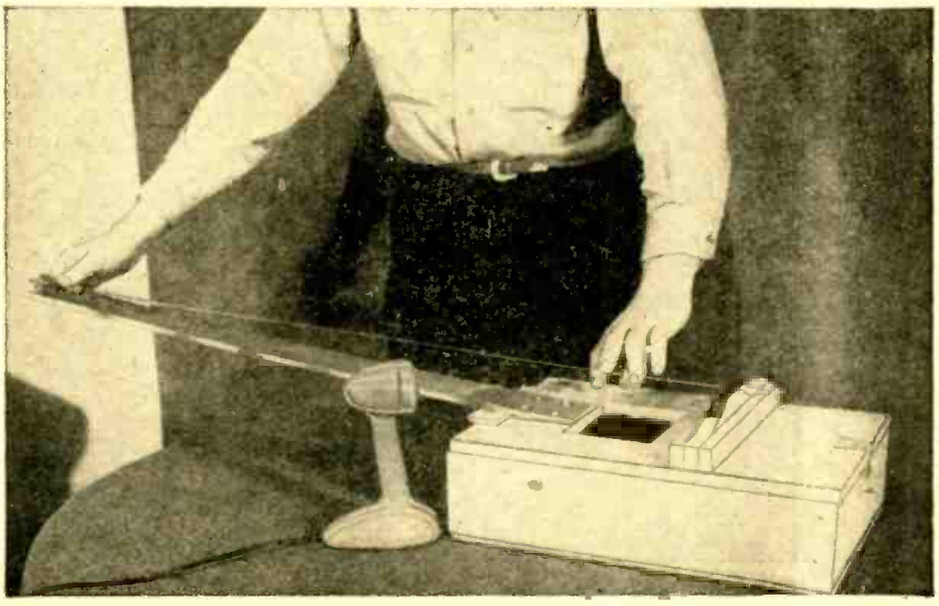
Fire is produced by twisting a piece of cellophane before the mike. Water, or waves, can be produced with another handful of BB-shot in a thin oval cardboard box such as a man's hat box. Hold the box at the ends and tilt it slowly so the shot rolls around on the bottom, near the outside edge.

## Things are what they seem

An early sound-effects story tells of the attempts of one studio to imitate the sound of water being poured from a pitcher into a glass. The BB-shot could not produce a convincing sound. Crumpling a newspaper was no good. Everything in the sound-man's repertoire was tried without effect. Finally someone suggested pouring water from a pitcher into a glass . . . !

Here is a lesson for the amateur sound-effects man! Hammer a piece of board with an ordinary hammer, and you are carpentering. For sawing, use

*(Continued on page 88)*



Construction and use of the twang box can be easily understood from the photograph above.

# SPEEDY A. C.-D.C. SERVICING

## *A few short-cuts in midget radio repair*

**By JOHN BOWLES**

THE a.c.-d.c. radio is the most frequent visitor to the service shop. Not only is it the commonest type of radio, but many parts are often weakened by heat in the smaller and less well-ventilated a.c.-d.c. midgets.

The first cost of these sets is so low that the customer is unwilling to pay a great deal to have them repaired. The question then is: how can the serviceman make any money servicing these receivers?

The answer is—turn out more sets per day! Perhaps you are already turning out all you possibly can. But by using a few good short cuts, these small sets can really be serviced much faster.

The larger part of the time used in servicing a set is spent finding the trouble. Therefore the main concern is to locate the fault as quickly as possible. Then the job can be completed quickly.

Defective tubes cause the majority of a.c.-d.c. set failures. Burned-out filaments cause the most trouble. To find them—remove the chassis from the cabinet. Usually little can be done without this. Turn the bottom of the chassis up to get at the tube bases. Plug in the set and switch it on. The leads of an a.c. voltmeter capable of reading the full line voltage are placed across each tube filament in turn. (See Fig. 1.) When the voltmeter reads approximately full line voltage, it is across the open filament. Replace the tube.

This same test may be used for open ballasts or series line resistors.

In some cases the rectifier tube fails

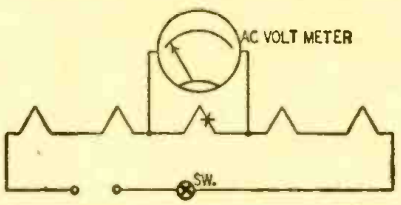



Fig. 1—A quick way to find an open filament.

without the filament opening. Often this can be determined just by looking at the tube. A bluish or pinkish glow between the elements indicates a shorted filter condenser or an overload due to some other cause. Usually this has already damaged the tube.

Microphonic or noisy tubes can be found by tapping them lightly or they may be moved around slightly. If a blast of noise or a squeal is produced, it is best to replace with a new tube. Repeat the tapping or movement with the new tube. This tells the story quickly.

### Filter condenser troubles

Faulty filter condensers come second in causing a.c.-d.c. set failures. Open condensers occur as frequently as shorted ones. If the set has a bad hum, chances are that one or more of the filters are open. The quickest way to check is to connect another condenser across the circuit. You know this method, of course. You also know that it is tedious. It is extremely hard to touch the correct points with the leads. They slip off, causing shock, or perhaps a disastrous short. This difficulty can be overcome by making a filter condenser test box. Five 8-μf. condensers are connected as shown in Fig. 2. A test cord is brought out with polarized markings. The capacities are additive by throwing the toggle switches, in steps of 8 μf.

Test first across the input filter. If the hum does not stop and the volume increase, try it across each of the other filters in turn.

If one part of a multisection condenser block is bad, it is always wise to replace the entire pack.

The quickest way to find a shorted filter condenser is to take an ohmmeter reading between the cathode of the rectifier tube and the chassis. A reading of less than 1,000 ohms would indicate that the filters were shorted. In some a.c.-d.c. sets the speaker field across the rectified voltage supply has a resistance as low as 1,000 ohms. For these sets this reading may be expected. The quickest way to find out which condenser is causing the trouble is to cut the positive leads, one at a time, until the ohmmeter reading increases.

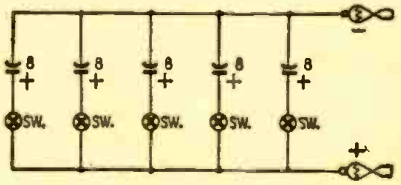



Fig. 2—Substitution box for filter tests.

### Faulty paper condensers

By-pass condensers are another source of trouble in a.c.-d.c. sets. Placing another condenser across the suspected one, or across each one in the set, is slow. The job can be speeded up by using a by-pass condenser check box. Five condensers, with a selective switch and a pair of leads mounted in a small box can test the usual sizes. The capacities are .0001, .00025, .01, 0.1, and 0.5 μf. A rotary switch with at least 5 contacts is needed. The leads may be brought out to test prods or alligator clips. Refer to Fig. 3 for details.

This test box may be used to check capacities other than those contained in it. If a 0.25-μf condenser is to be checked, the 0.1- or 0.5-μf test condenser can be used. Results may not be perfect, but you can determine whether or not the condenser is open.

*(Continued on page 77)*


Test panel and service bench constructed by pupils of the Electric Shop, Dover (N.H.) High School. Power panel supplies 117 volts, 6 volts for farm and rural sets, and 2 volts.

# ANTENNA PRINCIPLES

## Part VI—Directive arrays with metal-screen reflectors

By JORDAN McQUAY

THE reflector elements considered in our previous article on the subject were single pieces of rod or tubing, dipole-like in construction and slightly longer than the radiating dipole.

A prominent characteristic of u.h.f. waves is that they are reflected by almost any type of metal screen, object, or surface. The metal functions much as an ordinary mirror when light waves impinge on it.

Thus, when desired, the dipole-like reflector element can be replaced by a metal screen or surface of suitable area, properly spaced behind the radiating dipole. Length of the metal screen or surface should be such that the reflector extends about a half wavelength beyond the extremities of the radiating

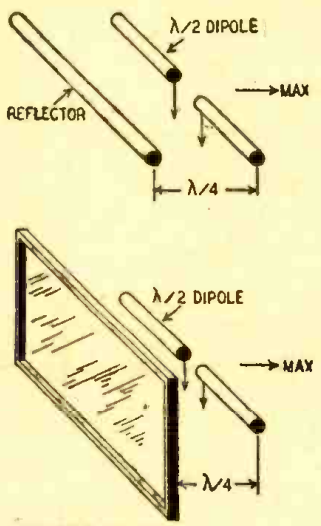



Fig. 1—The reflector may be a flat screen.

dipole. Height of the metal screen or surface is not critical, but should be at least half the length of the reflector. See Fig. 1.

At u.h.f. operating wavelengths of less than 1 meter, the metal reflector need not be a solid surface. It may be perforated with holes no larger than λ/8. Or the reflector may employ a screen of wire mesh, again providing that openings are no larger than λ/8. Many types of ordinary fencing material are satisfactory for the construction of reflectors for arrays.

Metal-screen reflectors are spaced in the same manner as the dipole-like reflectors. The reflectors are not connected to the electrical circuit, since their operation is parasitic in nature, as in the case of rod or tube reflectors.

Typical uses of metal-screen, wire, or mesh reflectors are shown in Fig. 1, and photos A, B and C.

### Phased arrays

The simple horizontal arrays previously described provide various amounts of directivity of the field intensity pattern in the horizontal plane. The vertical plane also is unidirectional, but the pattern of radiation is extremely wide and not too useful.

Such arrays are adequate for low-power or limited-range applications, where extreme directivity in both horizontal and vertical planes is not required.

But for high-power operation, extreme directivity in both planes, and general increased efficiency—upright and much larger arrays (consisting of many radiating dipoles) are used for the transmission and reception of u.h.f. waves.

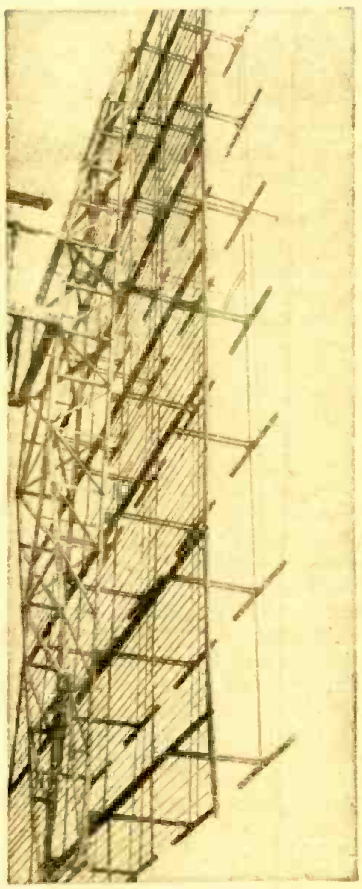
Included in this group of important microwave antennas are: The broadside array, the colinear array, the billboard array. Differences in the arrays are primarily those of arrangement and number of radiating dipoles.

In general, the half-wave dipoles are constructed of conventional metal rod or tubing. They may be center-fed or end-fed, but all dipoles must be fed in phase—by suitable spacing and arrangement of feed or transmission lines.

The dipoles are arranged within *the same plane* with respect to the earth. They may be stacked parallel, or mounted end-to-end. The position of all dipoles within that plane determines the polarization of the u.h.f. waves being transmitted or received. Horizontal polarization—used in most u.h.f. applications—is obtained by mounting the dipoles in a horizontal position. For vertical polarization, the dipoles are mounted vertically.

For unidirectional operation, individual and separate reflector elements can be used behind each radiating dipole.

It is more practical and efficient to use a reflector screen, particularly if there are a large number of dipoles. Such a nonresonant reflector is easier and cheaper to construct, and provides a better broad-band response than a resonant reflector.



*Photos by U.S. Army Signal Corps*

Photo A—Billboard antenna's screen reflector.

The wire mesh of the reflector is often made the main support of the entire array by mounting the radiating dipoles on quarter-wave metallic insulators which are short-circuited at the reflector screen. This rigidity of construction permits use of larger, heavier radiating dipoles—in turn providing oper-

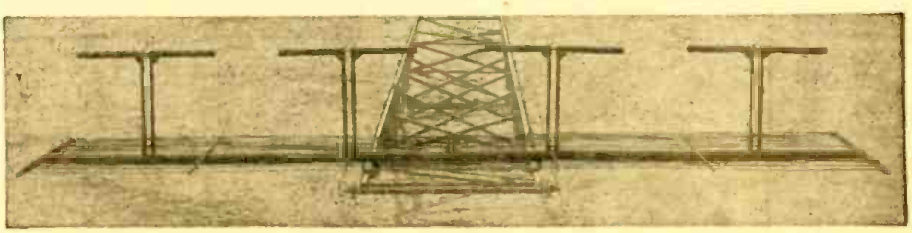


Photo B—A simple horizontal four-element colinear array with a wire-screen reflector.

Photo C—High-elevation 32-element billboard.

ation over a broader band of frequencies.

Directors are seldom used with large, phased arrays. This is mainly because of mechanical difficulties of construction. Any added benefit of directivity can be equaled—if not surpassed—by careful design and arrangement, spacing, and phasing of dipoles.

## Broadside array

When any number of half-wave dipoles (or *pairs* of half-wave dipoles) are stacked one above the other in parallel, the result is known as a *broadside array*. It is essentially an arrangement in *height*, and may consist of two or more dipoles.

Vertical spacing between parallel dipoles should be close to a half-wave length. To preserve phase relationships without unnecessary lengths of transmission line, polarity is reversed between alternate dipoles as shown by antennas A and B in Fig. 2. Thus the array is fed with equal currents in the same phase.

The broadside array is used to obtain extreme directivity in the *vertical* field. Sharpness of the radiation pattern in the vertical plane is primarily a function of the number of stacked dipoles. The greater the number of dipoles, the greater the directivity in the vertical plane with no regard for the horizontal plane.

This relation is illustrated by antennas A and B and their relative radiation patterns in the *vertical* field, where antenna A provides greater directivity and greater power gain. This is an outstanding characteristic of the broadside array.

## Colinear array

When any number of half-wave dipoles are placed end-to-end along a horizontal line, the result is known as a colinear array. It is essentially an arrangement in *width*, and provides extreme directivity in the *horizontal* field. Typical example of the colinear array is shown in Fig. 2.

Quarter-wave stubs are used between adjacent dipoles. Thus current is in phase in each radiating section of the array.

Sharpness of the radiation pattern is primarily a function of the number of half-wave radiating dipoles arranged in a horizontal line. The greater the number of dipoles, the greater the horizontal directivity—with no regard for the vertical directivity pattern.

This relation is shown in Fig. 2 by antennas C and D with their relative radiation patterns plotted in the horizontal plane, where antenna C provides greater directivity and consequent increase in power gain.

This is the outstanding characteristic of the colinear array.

## Billboard array

When a considerable number of half-wave dipoles are arranged geometrically *both in height and width*, the result—a combination of the broadside and colinear types—is known as a *billboard array*.

It may consist of 4 *or multiples of* 4 dipoles. Some months ago when radar contact was made with the moon, Signal Corps engineers used a billboard array consisting of 64 half-wave dipoles. Another arrangement is shown in Photo B. In general, the greater number of dipoles in a billboard array, the greater the power gain and directivity.

Vertical spacing between parallel dipoles is about a half wavelength, and feed points along the transmission line (Fig. 2) are chosen to place the dipoles a half-wave apart. By reversing connections on alternate dipoles, they are effectively fed in phase.

The billboard array exhibits many directional characteristics of both the colinear and broadside arrays. It combines the directivity and power gain of antennas A and C—resulting in an extremely narrow, directional beam in the horizontal field of intensity. It also exhibits similar high directivity in the vertical plane. But, except for radar and certain types of navigational equipment, the horizontal field of intensity is of prime importance.

## Feeder systems

Maximum efficiency of the u.h.f. antenna system requires a low-loss, nonradiating feeder system between the output of the transmitter and the actual antenna array and between the array and the input of the u.h.f. receiving equipment.

At fairly low frequencies in the u.h.f. band—from 300 to 600 megacycles—it is possible to use rigid, spaced, open-wire transmission line. Such feeder lines consist of metal tubing. They must be nonresonant, otherwise leakage current will damage the insulators.

Polystyrene can be used for all insulators, attached to the feeder line at voltage nodes. However, a much more satisfactory insulator is the metal stub support, or metallic insulator, which also helps keep the feeder line rigid. A stub support is a quarter-wave section of line, short-circuited at one end by any kind of metal frame or surface. The opposite end—connected to the line—represents a very high impedance. Thus no energy is lost through use of such an insulator at ultra-high frequencies.

The feeder line is matched to both antenna array and the transmitter output, with matching stubs placed anywhere along the feeder line.

The principal disadvantage of the open-wire feed line is a sporadic tendency to radiate because of the spacing between conductors. U.h.f. feeder lines must be nonresonant. The best remedy is to employ a concentric line or coaxial cable.

The concentric line may contain ceramic or polystyrene insulators between inner and outer conductors. Often the line is sealed shut after injecting an inert gas. This prevents collection of moisture inside the concentric line and thus raises the breakdown voltage.

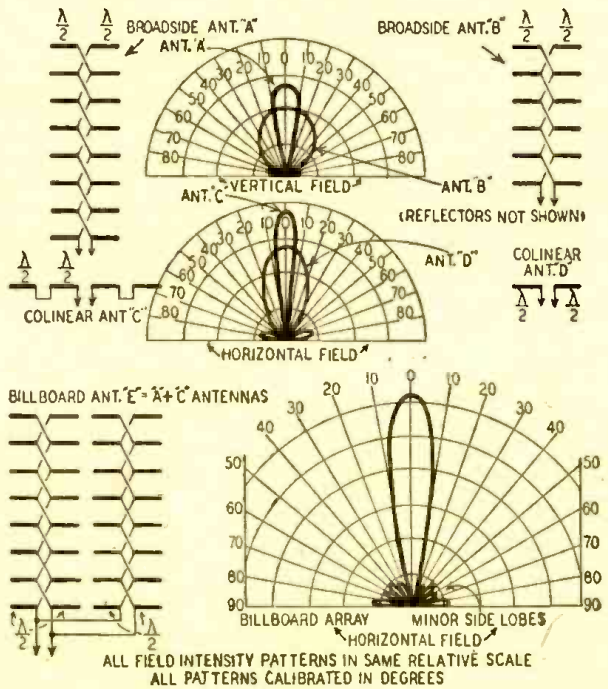



Fig. 2—Showing how characteristics of broadside and colinear arrays are combined in the billboard to give excellent sharpness and gain.

# A SMALL RECORDING STUDIO

## Part III—Cutters, volume level indicators and compensation circuits

**By J. C. HOADLEY**

WITH the equipment described in Part I of this article on hand, it is necessary to connect the different units in such a way that a maximum of fidelity and utility may be obtained.

Fig. 1 is a block diagram of a typical recording layout. This is a basic setup which may be added to from time to time. It consists of several studio microphones, a recording amplifier with level indicator and monitor speaker (or phones), dual recording tables with playback pickups, a high-quality playback speaker, receiver, and switches to perform the switching operations required for maximum usefulness.

The most important considerations are to connect the cutters to the amplifier properly and to connect—between the cutters and the amplifier—suitable networks which control the cutter's characteristics in order to provide the best possible recording.

First, it is necessary to match the impedance of the cutter so frequency response will be smooth and distortion low. There are several types of recording heads and their connections vary. If you have chosen a crystal type, you can connect it to the amplifier in various ways. We will assume the use of a push-pull recording amplifier, as it is markedly better than a single-ended one for recording and not much more expensive. We will further assume the use of either triodes or beam tetrodes with sufficient negative feedback as output tubes.

### Connecting the cutter

Fig. 2 shows two methods of connecting a crystal cutter. For a constant-amplitude recording characteristic, we omit Rx or Ry, because the crystal cutter has a uniform stylus displacement with constant applied input voltage within its frequency range. It is necessary, with a conventional crystal cutter such as the Brush RC-20, to reflect not over 4,000 ohms to the cutter. It is desirable to reflect a lower impedance, of the order 2,500 to 3,000 ohms. This

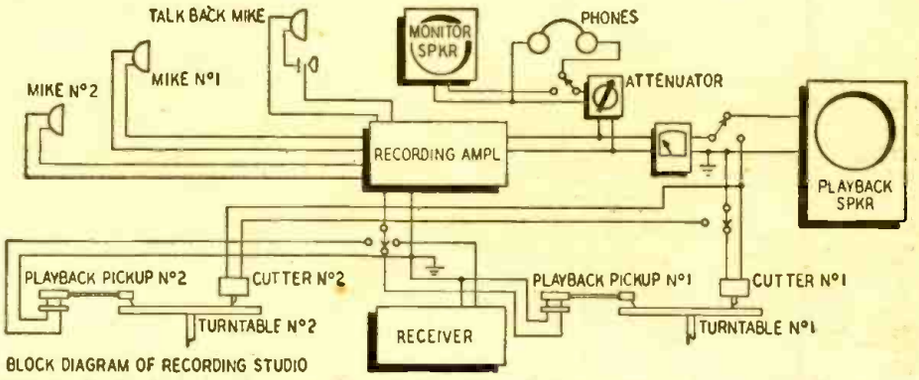



Fig. 1—Block diagram of a recording studio with sufficient equipment for professional work.

happens to be the plate-to-plate output impedance of push-pull 2A3's, so we do not need a special output transformer for these tubes. We can connect the cutter as shown in Fig. 2-a.

To cut commercial modified constant-velocity recordings (similar to shellac pressings), we must insert Rx in Fig. 2-a. As the crystal presents a capacitive impedance, this constitutes an RC network. Voltage across the crystal will decrease with frequency above a certain turnover frequency. This frequency will be determined by Rx and the crystal's capacity. The RC-20 crystal's internal capacity is 0.007 μf at 100 cycles. Therefore, for this type crystal to provide a turnover frequency of 500 cps, in Fig. 2-a Rx would equal 44,000 ohms. For other turnover frequencies, consult the Brush technical bulletin No. 291 which is supplied with this cutter.

In Fig. 2-b, the transformer T2 matches the crystal to a 500-ohm line, and for constant amplitude recording should have a secondary impedance of 3,000 to 4,000 ohms. For a commercial constant-velocity recording characteristic with a turnover frequency of 500 cps, the transformer should have a secondary impedance of 22,000 ohms and Ry also should have a value of 22,000 ohms.

These recording characteristics may

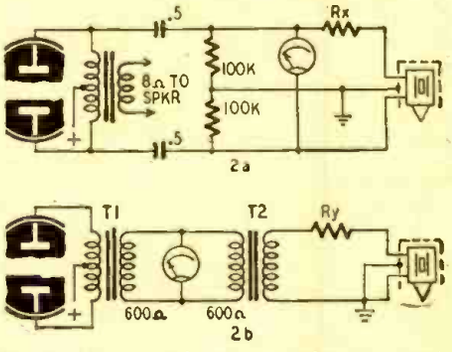



Fig. 2—How crystal cutter may be connected.

be modified for special purposes by varying the frequency response of the recording amplifier with frequency controls or external equalizers. It is conventional to emphasize the high-frequency response in constant-velocity recording. The high frequencies are

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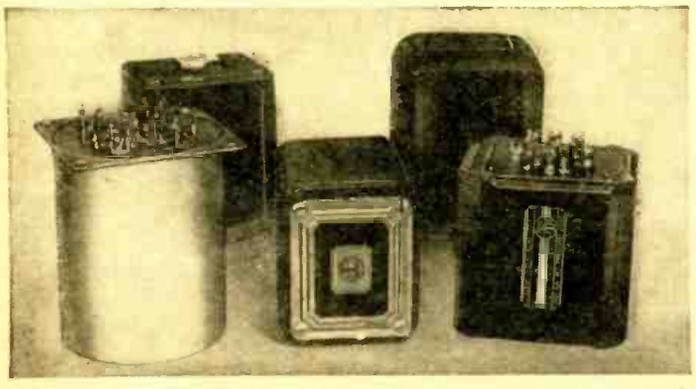


Typical specimens of high-quality recording and playback apparatus.

# TELEVISION FOR TODAY

## Part XII – High and low-voltage power supplies

By MILTON S. KIVER

A TELEVISION receiver, because of its construction, requires two types of power supplies. All the tubes, with the exception of the cathode-ray tube, are low-voltage units. Hence, all of these circuits can be bunched together and supplied from the same source. This is generally a conventional power supply capable of supplying the required current. A commercial unit is shown in Fig. 1.

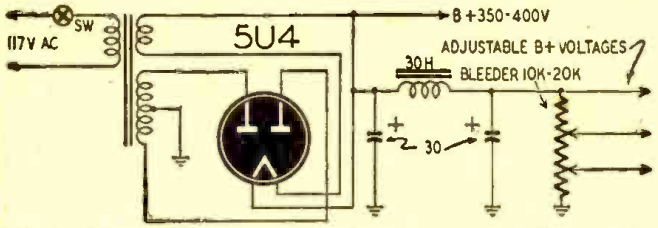



Fig. 1—A conventional power supply suited to low-voltage circuits.

The high-voltage unit must be capable of supplying 5,000 to 7,500 volts. However, the current drain is extremely small—generally not more than 750 microamperes. This permits modification of the component values in the high-voltage unit to result in a relatively small and compact assembly. Fortunately, the small current drain permits the use of half-wave rectification with very little filter difficulty.

Filtering is accomplished by a "brute force" unit (one with large series elements and relatively small shunt condensers). When the voltage reaches the values called for in television, extreme care must be exercised that the energy in the filter condensers does not exceed 1 joule, since this is sufficient to kill most people on contact. Energy storage varies directly with capacitance; consequently, the smaller the capacity, the better. The smaller capacitance is also economical. However, filtering ability of a condenser decreases directly with decreasing capacity. Hence, a compromise value is used. A typical high-voltage circuit is shown in Fig. 2.

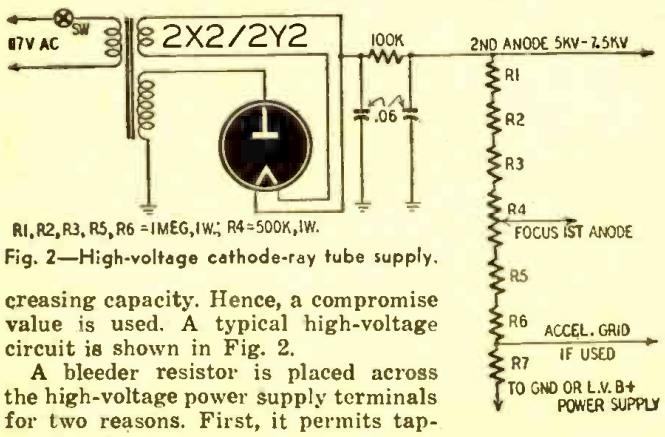



Fig. 2—High-voltage cathode-ray tube supply.

A bleeder resistor is placed across the high-voltage power supply terminals for two reasons. First, it permits tapping off voltages for the focusing (first) anode and the accelerating electrode. Second, *it discharges the condensers when the set is turned off.* Since the voltage is high and the current low, the bleeder resistance must be high. Values between 4 and 10 megohms are normal. The low current drain permits the use of 1-watt resistors, at 1 and 2.2 megohms. The resistors are series-connected, as in Fig. 2, and taps or suitable potentiometers are inserted at the appropriate voltage points.

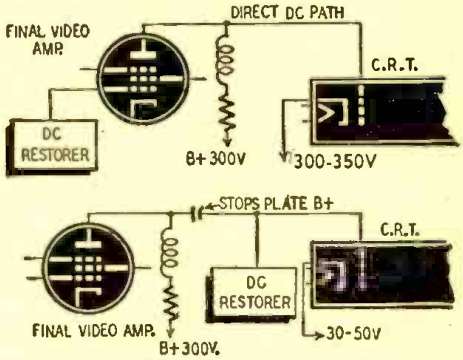
The only difference between a high-voltage supply designed for electrostatic deflection tubes and that used for electromagnetic deflection is in the centering system which must be provided for the deflection plates. The necessary circuit was shown in the preceding article of this series. These controls are placed as close to the second anode potential as possible, since the deflection plates are physically located near the second anode in the cathode-ray tube. A large difference in voltage between the deflection plates and the second anode would slow down the electrons in the beam and distort the image.

The centering controls provide a method of varying the d.c. voltage between the two plates of each set. The electron beam, in passing between the plates, is subjected to the electric field caused by the voltage difference and shifted accordingly. If the electron beam does not require this additional shifting in order to reach the center of the screen, the centering voltage can be reduced to zero volts difference *between* the plates. Note that the centering is accomplished by the voltage difference between each set of plates and not by the polarity or value of this voltage with respect to the cathode.

In electromagnetic deflection, the centering controls receive their voltages from the low-voltage power supply. By controlling the amount and direction of the current through the coils, we can alter the position of the beam as it appears on the screen.

One final word about the power supply of Fig. 2. Many manufacturers connect the negative end of the high-voltage supply to some positive point on the low-voltage unit, instead of directly to ground. As a result of this connection, every point on the high-voltage unit is raised by an amount equal to the potential at the point of attachment. Why this is done can be understood best by reference to Fig. 3.

In Fig. 3-a, the control grid of the cathode-ray tube is directly connected to




Figs. 3-a and 3-b—How voltage may be gained attaching to positive of low-voltage supply.

the plate of the final video amplifier. This places a high positive voltage on the grid of the cathode-ray tube and necessitates an even greater positive voltage on the cathode. The positive voltage on the control grid comes from the low-voltage power supply. The required positive voltage for the cathode can come either from the low-voltage supply, or by tapping up on the high-voltage bleeder chain. If we tap up on the high-voltage bleeder chain, we decrease the positive potential of each of the other elements in the cathode-ray tube. The effective voltage of these other elements is measured from the cathode of the tube, not ground. Hence, in this latter method, two hundred to three hundred volts of the high-voltage supply is used only to counteract the positive control-grid voltage and not for accelerating the electron beam.

If we connect the negative end of the high-voltage unit to the B-plus of the low-voltage supply, then the cathode can be placed at the lowest point in the high-voltage bleeder chain, or even at some lower positive voltage in the low-voltage unit. This permits complete utilization of the high voltage.

If the control grid is not subjected to the d.c. potential of the preceding video

*(Continued on page 50)*

# Multi-Station Intercoms

## Part III—Intercom installation and maintenance

By RICHARD H. DORF

IN the last two articles we discussed the construction of two types of intercommunication master stations and three types of switching systems. This part will deal with the problems of installing and maintaining intercom networks.

Whether custom-built units or factory-built commercial jobs are to be used, the initial step is to appraise the requirements of the particular installation. Each user's needs should be carefully tabulated.

The principal question is whether to use a master-to-master or a master-to-remote system. In installations which consist of only two stations, this problem answers itself, since it would be foolish to use two masters. In other cases there is always the consideration of cost versus utility.

In a home, for example, where a person in any room may want to call a person in any other room, the master-to-master system is almost obligatory. If the user wants communication only between each of several master bedrooms and the kitchen, however, the less expensive master-to-remote setup can be used, with the master in the kitchen.

In a typical factory installation, the production manager may want to be able to call each of several assembly rooms; that would permit use of the cheaper intercom system. But if communication were needed among several executives, master-to-master would be indicated.

Where master-to-master is decided upon, a choice must be made—where the custom-built units are used—of either the 3-tube or the 1-tube master. Either will perform very satisfactorily, and in operation there is no difference. However, with the 1-tube masters, failure of any station amplifier will incapacitate that station entirely. With the 3-tube amplifier the station will still be able to hear calls, even though its amplifier is dead. In this case, the choice is one of price versus reliability.

It is always necessary to confer with the buyer of the system, to explain all these factors, and then to base the final choice upon his informed decision.

The next consideration is the physical layout of the area to be covered. Fig. 1 shows block diagrams of an installation with five stations. Examination will show that Fig. 1-a obviously uses less connecting cable. The installation shown in Fig. 1-b would be justified only if some barrier such as a stone wall, body of water, etc., prevented the more economical cabling route.

The usual method of connecting each station to the cable is through a junction box. A standard black-crackle finish steel box, 4 x 4 x 2 inches, was conveniently made into such a junction box (see drawing). A terminal strip with the required number of lugs (1 more than the total number of stations) is fastened to the inside of the box. The holes required for entry and exit of the cable are made, and the box is screwed to the baseboard as near as possible to the location of the station unit.

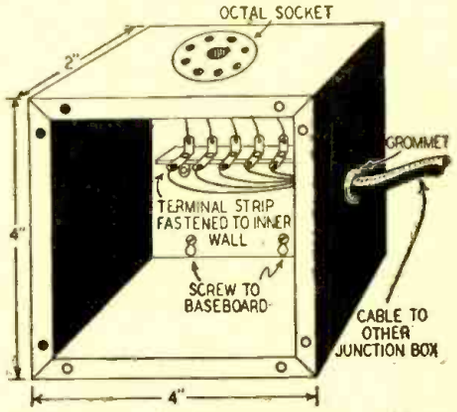
In the box pictured, a standard 8-contact tube socket is mounted in the upper wall. Under the chassis of the station unit is a 6-lug terminal strip, to which one end of a 6-wire cable is soldered. The other end is soldered to an 8-prong plug, which fits into the junction-box socket. The socket is wired to the junction-box terminal strip, as is the cable which runs between stations. With this arrangement, the station unit can be removed for cleaning or repair by simply pulling out the a.c. plug and the cable plug. No unsoldering or tampering is necessary.

Another factor which makes the use of junction boxes almost imperative is the difficulty of cutting into or splicing multiwire cables. A junction box should be used at any place in the system where the cable must be tapped. It is entirely practical—as an alternative—to mount a socket on the rear apron of the amplifier chassis and plug a cable from the junction box into that. The difficulty is that the plug will usually jut out unpleasantly from the rear of the cabinet.

**Richard H. Dorf was born in New York City in 1921. Being thrown several feet after inserting a hairpin in the a.c. wall socket at the age of 5 started his interest in electricity. Progressed through model train control systems and model stage set lighting setups to audio amplifier construction. Has been announcing and handling programs at New York radio stations since the age of 17. Spent 3½ years in the Air Forces as communications officer, teaching radio and maintaining airborne v.h.f. equipment. Now is programming FM station WMGM.**

**About eight hours a day are spent on his hobbies, audio, radio, and good music. Specializes in the design and construction of audio equipment, including recording systems, but creates a bit of r.f., too, now and then, with the call W2QMI.**

Several manufacturers make intercom cable with almost any desired number of conductors. This cable is color-coded




Junction boxes simplify maintenance problems.

(a necessity) and usually cloth-insulated. It is very satisfactory for all indoor installations, but actually *any*

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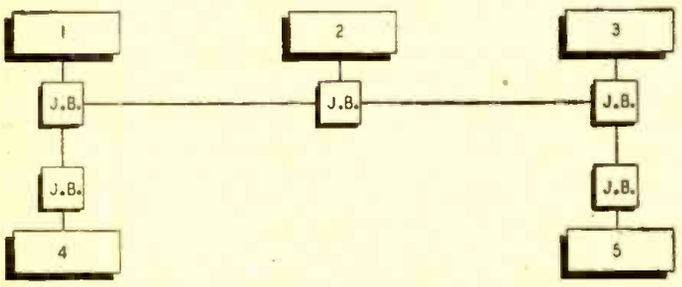


Fig. 1-a—Economically-wired intercom system.

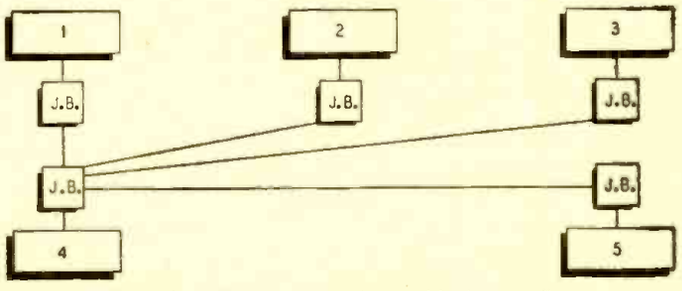


Fig. 1-b—Wiring system due to blocking walls.

# Canberra's Mobile Radios

## *Firemen and plumbers respond to radio calls*

Central control station of Canberra's municipal mobile radio net.

SOMETHING has gone wrong with the main fuses in your house. You report to the electricity people by 'phone, and almost before you've had time to put the instrument down, there's a ring at the door, and a man has come to do the job.

It sounds like a housewife's dream, doesn't it? But in Canberra, Australia's planned capital, it often happens. And not only with the electricians, but with the plumber and the ambulance, the police and the men who repair refrigerators and other mechanical appliances.

The Government department that is landlord of most of Canberra's houses and which provides all the normal services, uses radio communication with its service vehicles just as police departments do in other cities. An electrician, for instance, who has just finished a job, doesn't go straight back to his base. He tunes his radio to find out if there's another job in the immediate neighborhood. The department has been astonished to find how often there is.

It all came about because of the big forestry projects that have their headquarters in the capital. The country round about is wild and set among rugged hills, and it was difficult for forestry patrols to keep in touch with each other and with their base.

### Readymade sets lacked power

R. G. Fowler, radio engineer to the department, fitted up a few cars with small imported commercial sets, and the problem was solved. There was only one difficulty. The little sets had a short range and the patrols worked over wide areas, so cars were often out of range of the base station. Because of war demands, no further units were obtainable. Fowler set about designing and making his own.

The result was even better than he had expected. His sets, although worked off car batteries with vibrator units, and not much bigger than a car radio, had a range that far exceeded anything that could have been bought. Forest patrols often speak to each other across forty-mile skyline distances, over thickly-wooded hilly country, unfavorable for radio communication.

Shortly after the successful trials of the first sets, the department realized that radio control could be usefully applied to all the ordinary services. After the road and bridge maintenance cars had been fitted, Fowler turned to the water and sewerage services, and the electrical and mechanical fitters.

Now the police, fire brigade and ambulance services are having their turn, and soon every emergency that can happen to Canberra people will be dealt with swiftly and efficiently by radio. Incidentally, the department has found that by being able to go straight to his next job, the average serviceman saves as much as forty miles of driving each day.

Ordinary citizens have also had reason to be glad of the service. Recently some hikers were lost for days in the densely wooded country outside the capital. When they were eventually found by airplane, the pilot radioed messages that were relayed to forestry cars working in the vicinity. The wanderers were soon picked up. Had it not been for speedy radio service, help might have arrived too late.

### Radio electrician's helper

Some weeks earlier, an electrical maintenance man, installing a wind-powered battery charger up on the Bag Range, damaged some of his essential equipment in an accident.

Bag Range is a wild place, almost inaccessible, and to reach it, he'd been obliged to transfer all his gear, including the radio, on to a mule-drawn sledge, and drag it for miles. The sledge capsized and all his equipment rolled down

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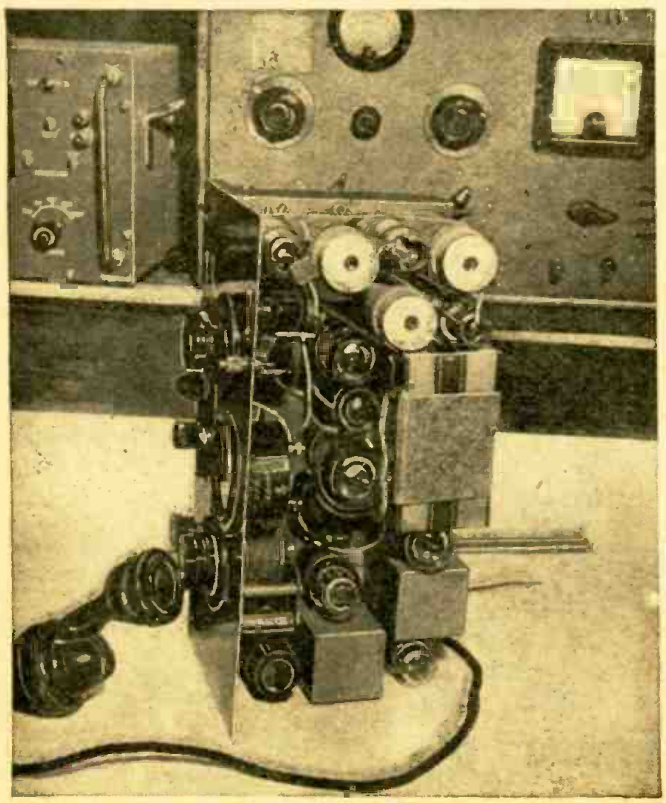
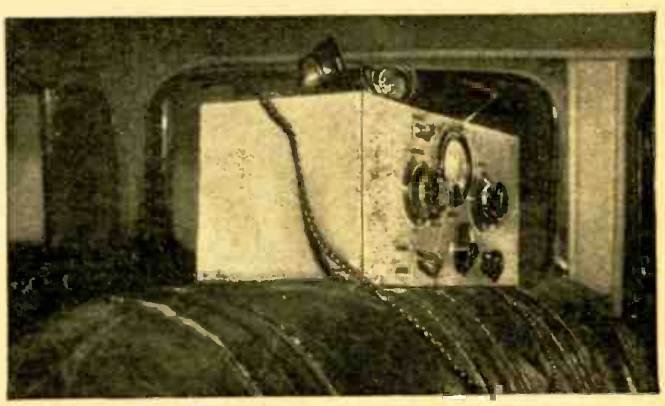




Above—The large transceivers are conveniently installed as shown. Left—Top view of transceiver unit. The B-battery is inside the case.

# WORLD-WIDE STATION LIST

**Edited by ELMER R. FULLER**

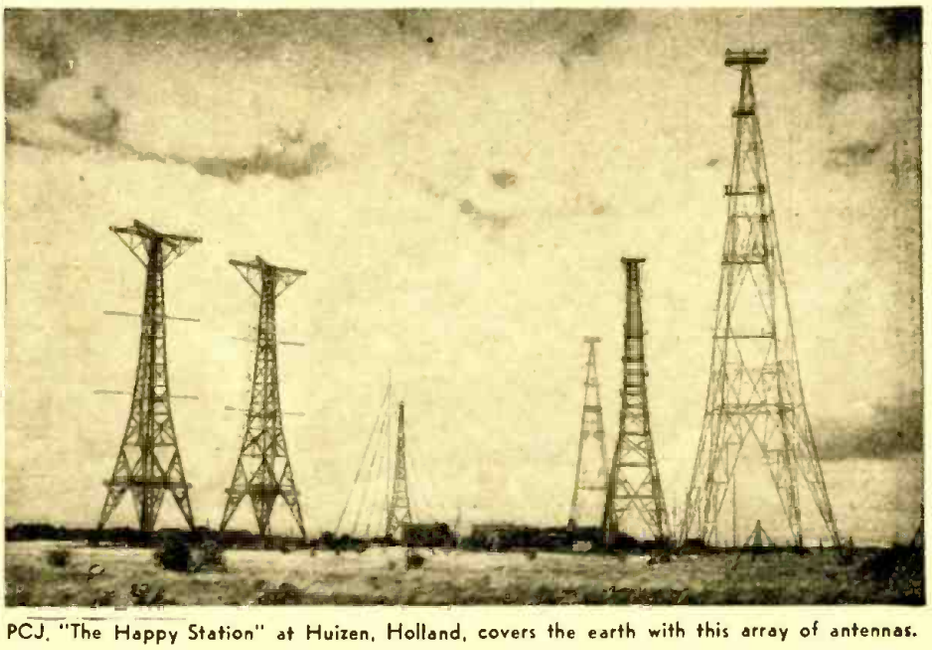
CONDITIONS have been improving in the past few months and perhaps some good dx will be heard one of these days. Sun spots have been bothering at times, but there have been a few good days. The Australians have been heard very fine business on 15.200 mc from 0200 to 0400 hours EST; and in foreign-language broadcast on 15.230 mc and 15.310 mc from 0230 to 0345 hours. Ponta del Gada in the Azores is being heard from 1700 to 1900 hours on 4.845 mc and puts in a very good signal, on this new frequency. PGD in the Netherlands gives the news in English at 2300 hours except Saturday on 6.020 mc. Ceylon is still being heard Sundays from 1330 to 1530 hours to England on 7.190 mc, coming in at a very convenient time.

Dx on the ham bands has also been very good at times. Several countries have been heard on 10 and 20 meters including G6WT in England, as well as G2MF, G2BB, G3BK, G3IY and G8JB. From Scotland GM8MN and GM4AN. Denmark was heard via OA6PX. Several hams have been heard from Germany on 10 but notably D4ACD, who seems to be on most of the time. PAHS has also been heard several times from the Netherlands as was LA4FB from Norway. D4ARN is also heard often from Germany. On 20 meters we have numerous reports of the following: G6BY and G6AY from England; XE1A and XE1CK from Mexico; EI6G from Ireland; VO2AF from Newfoundland; YV5ADX and YV5AE from Venezuela; HK3BF from Colombia.

Listening Post Certificates will be in the mails by the time that you have read this, but more observers' services could be used. We never can have too many reports. The more we have, the better picture of conditions we can print. Send your requests for further information to the Shortwave Editor, c/o RADIO-CRAFT, 25 West Broadway, New York 7, New York. We would especially like to hear from oms, yls, and xyls from overseas. So until next month, best of luck and lots of fb dx. All time is given in 24-hours EST.

| Location | Station | Freq. | Schedule |
|---|---|---|---|
| **ALASKA** | WXFD | 12.250 | 1800 to 0100 |
| **ALBANIA** | | | |
| Tirana | ZAA | 7.850 | 1400 to 1800 |
| **ALGERIA** | | | |
| Algiers | | 6.040 | 1230 to 1800 |
| Algiers | | 9.540 | 1230 to 1700 |
| Algiers | | 11.830 | 0030 to 0300; 1200 to 1800 |
| **ANDORRA** | | 5.980 | 0500 to 1900 |
| **ANGOLA** | | | |
| Benguela | CR6RB | 9.160 | 1330 to 1430 |
| Louanda | CR6RA | 9.470 | 0115 to 0230; 0630 to 0745; 1400 to 1530 |
| **ARGENTINA** | | | |
| Buenos Aires | LRS1 | 5.980 | 1800 to 2300 |
| Buenos Aires | LRY1 | 6.090 | 0545 to 0715; 1800 to 2100 |
| Buenos Aires | LRY1 | 9.680 | 1600 to 1630 |
| Rosario | LRR | 11.880 | 0600 to 1800 |
| **AUSTRALIA** | | | |
| Brisbane | VLQ2 | 7.210 | 0230 to 0830 |
| Brisbane | VLQ | 7.240 | 1500 to 1900 |
| Melbourne | VLQ | 9.580 | 1100 to 1200 |
| Melbourne | VLG3 | 11.710 | 0100 to 0145; 0230 to 0345 |
| Melbourne | VLA4 | 11.770 | 1100 to 1200; 1530 to 1830; 2345 to 0045 |
| Melbourne | VLG6 | 15.230 | 2100 to 2300 |
| Perth | VLW7 | 9.520 | 0530 to 1030; 1700 to 2045 |
| Shenparton | VLC8 | 7.280 | 1015 to 1045 |
| Shepparton | CLR | 9.510 | 1620 to 1900; 2045 to 0220 |
| Shenparton | VLC6 | 9.610 | 0830 to 1200 |
| Shepparton | VLB2 | 9.680 | 0900 to 1100 |
| Shepparton | VLC7 | 11.840 | 0800 to 0915 |
| Shepparton | VLC4 | 15.310 | N. American beam, 2045 to 2145; 0010 to 1145; Asiatic beam, 1730 to 1800; Philippine beam, 1900 to 1915 |
| **AUSTRIA** | | | |
| Vienna | | 7.160 | 0000 to 0200; 0600 to 0800; 1000 to 2030 |
| Vienna | | 9.820 | 2245 to 2030 |
| Vienna | | 12.210 | 1145 to 2030 |
| **AZORES** | | | |
| Ponta del Gada | | 4.040 | 1700 to 1900 |
| Ponta del Gada | | 11.090 | 1500 to 1600 |
| **BELGIAN CONGO** | | | |
| Leopoldville | OTC | 9.380 | 0000 to 0200; 1045 to 1600 |
| Leopoldville | OTC | 9.740 | 1300 to 2015 |
| Leopoldville | OTC | 11.720 | 0530 to 0730 |
| Leopoldville | OTC | 17.770 | 0500 to 0930; 1130 to 1215 |
| **BOLIVIA** | | | |
| Cochabamba | CP40 | 6.510 | 1930 to 2200 |
| Lopaz | CP49 | 6.770 | 0700 to 0900; 1100 to 1200; 1730 to 2100 |
| **BORNEO** | | | |
| Balikpapan | | 9.120 | 0700 to 0935 |
| **BRAZIL** | | | |
| Belem | PRC5 | 4.860 | 0600 to 1100; 1530 to 2000 |
| Fortaleza | PRE9 | 6.100 | 1530 to 2100 |
| Rio de Janeiro | ZYC8 | 9.610 | 1500 to 2200 |
| Rio de Janeiro | PRL7 | 9.720 | 0430 to 0600; 1415 to 1445; 1500 to 2100 |
| Rio de Janeiro | PSH | 10.220 | 1700 to 1800 |
| Rio de Janeiro | PRL8 | 11.720 | heard at 0500 |
| Sao Paulo | ZYB7 | 6.090 | 1600 to 1950 |
| **BRITISH GUIANA** | | | |
| Georgetown | ZFY | 6.000 | 0545 to 0745; 0945 to 1145; 1415 to 1945 |
| **BRITISH SOMALILAND** | | | |
| Hargeisha | | 7.130 | 0800 to 1030; 1200 to 1300 |
| **BURMA** | | | |
| Rangoon | | 6.040 | 0030 to 0230; 0645 to 0830; 2100 to 2145 |
| **CANADA** | | | |
| Calgary | CFYP | 6.030 | 0730 to 0100 |
| Edmonton | CJCA | 9.540 | 0815 to 0200 |
| Montreal | CFCX | 6.000 | 0700 to 2315 |
| Montreal | CBFW | 6.090 | 0730 to 1945; 2000 to 2400 |
| Montreal | CKLO | 9.630 | 1600 to 1800 |
| Montreal | CKCX | 15.190 | 0800 to 1200 |
| Montreal | CKNC | 17.820 | 0830 to 1500 |
| Toronto | CFRX | 6.070 | 0600 to 2345 |
| Vancouver | CKFX | 6.080 | 0930 to 0300 |
| Vancouver | CBRX | 6.160 | 0900 to 0200 |
| Winnipeg | CJRD | 6.150 | 2200 to 0300 |
| Winnipeg | CKRX | 11.720 | 1000 to 2000 |
| **CANAL ZONE** | | | |
| Quarry Heights | | 2.390 | 0530 to 0700; 1000 to 2305 |
| **CANARY ISLANDS** | | | |
| Santa Cruz | EAJ43 | 7.570 | 0630 to 0800; 1100 to 1200; 1230 to 1800 |
| **CEYLON** | | | |
| Colombo | | 3.390 | 0600 to 1200 |
| Colombo | | 6.070 | 0715 to 1200; 1930 to 0545 |
| **CHILE** | | | |
| Santiago | CE1174 | 11.740 | 1700 to 2400 |
| Santiago | CE1180 | 12.000 | 0600 to 0800; 1600 to 2300 |
| **CHINA** | | | |
| Canton | XTPA | 11.650 | 0400 to 0915 |
| Chungking | XGOY | 7.150 | 0630 to 1130 |
| Chungking | XGOY | 9.650 | 0630 to 1030 |
| Chungking | XGOA | 9.730 | 0900 to 1030 |
| Chungking | XGOY | 11.900 | 0500 to 0630; 1045 to 1145 |
| Goochow | XGOL | 10.000 | 0400 to 1000 |
| Kwelyang | XPSA | 7.010 | 2330 to 0030; 0430 to 0900 |
| Shanghai | XGRS | 11.690 | 0300 to 0930; 1830 to 2400 |
| **COLOMBIA** | | | |
| Armenia | HJFH | 4.880 | 0600 to 2200 |
| Barranquilla | HJAB | 4.780 | 1700 to 2255 |
| Bogota | HJCA | 4.850 | 1900 to 2200 |
| Bogota | HJCH | 4.890 | 1800 to 2200 |
| Bogota | HJCW | 4.910 | 0645 to 1115; 1600 to 2315 |
| Bogota | HJCQ | 4.950 | 1000 to 1400; 1700 to 2300 |
| Bogota | HJCX | 6.020 | 0700 to 0800; 1400 to 2315 |
| Bogota | HJCD | 6.160 | 0700 to 0800; 1600 to 2330 |
| Bogota | HJCT | 6.200 | 1000 to 1400; 1800 to 2315 |
| Bogota | HJCF | 6.210 | 1700 to 2360 |
| Cartagena | HJAP | 4.920 | 0600 to 1300; 1700 to 2200 |
| Cartagena | HJAE | 4.960 | 1600 to 2230 |
| Cali | HJED | 4.820 | 1900 to 2300 |
| Cucuta | HJBB | 4.810 | 1700 to 2200 |
| Medellin | HJDE | 6.140 | 1100 to 2300 |
| **COSTA RICA** | | | |
| San Jose | TIRH | 6.150 | 2130 to 2400 |
| San Jose | TIPG | 9.610 | 0700 to 2330 |
| **CUBA** | | | |
| Camaguey | COJK | 8.720 | 2000 to 0030 |
| Havana | COBZ | 6.040 | 0800 to 2300 |
| Havana | COCD | 6.130 | 0700 to 2400 |
| Havana | COCW | 6.330 | 0600 to 2400 |
| Havana | COCO | 8.700 | 0700 to 2330 |
| Havana | COCQ | 8.830 | 0530 to 0030 |
| Havana | COBZZ | 9.030 | 0700 to 0100 |
| Havana | COBQ | 9.230 | 0800 to 1200; 2000 to 2200 |
| Havana | COCX | 9.270 | 0700 to 0030 |
| Havana | COBC | 9.380 | 0700 to 2400 |
| Havana | COBL | 9.830 | 0715 to 0045 |
| Havana | COCY | 11.740 | 0630 to 0100 |

*(Continued on page 79)*



PCJ, "The Happy Station" at Huizen, Holland, covers the earth with this array of antennas.

# RADIO DATA SHEET 346

## GENERAL ELECTRIC FARM RADIO

### MODEL 280

### SPECIFICATIONS

OPERATING FREQUENCIES:

| | |
|---|---|
| Broadcast Band | 540-1710 kc. |
| Shortwave Band | 5.8-18.3 mc. |
| I.f. Amplifier | 455 kc. |

POWER OUTPUT:

| | |
|---|---|
| Undistorted | 0.15 watt |
| Maximum | 0.27 watt |

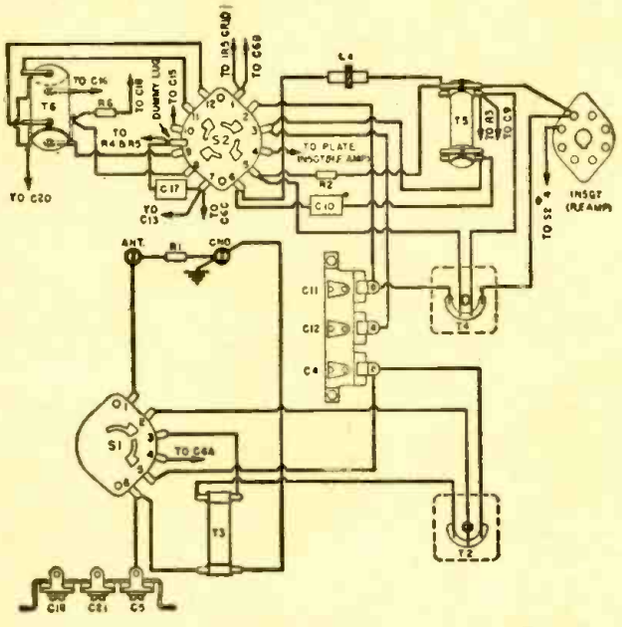
R.F. STAGE GAINS:

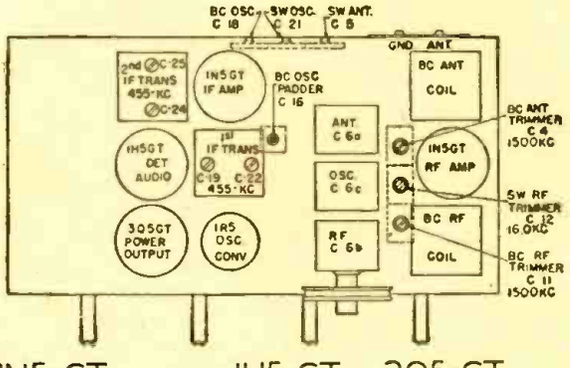
| | |
|---|---|
| Antenna post to 1N5-GT r.f. grid | 3 at 1000 kc. |
| 1N5GT r.f. grid to 1R5 | 10 at 1000 kc. |
| 1R5 grid to 1N5-GT i.f. grid | 46 at 1000 kc. |
| 1R5 grid to 1N5-GT i.f. grid | 60 at 455 kc. |
| 1N5-GT grid to 1H5-GT i.f. diode plates | 80 at 455 kc. |

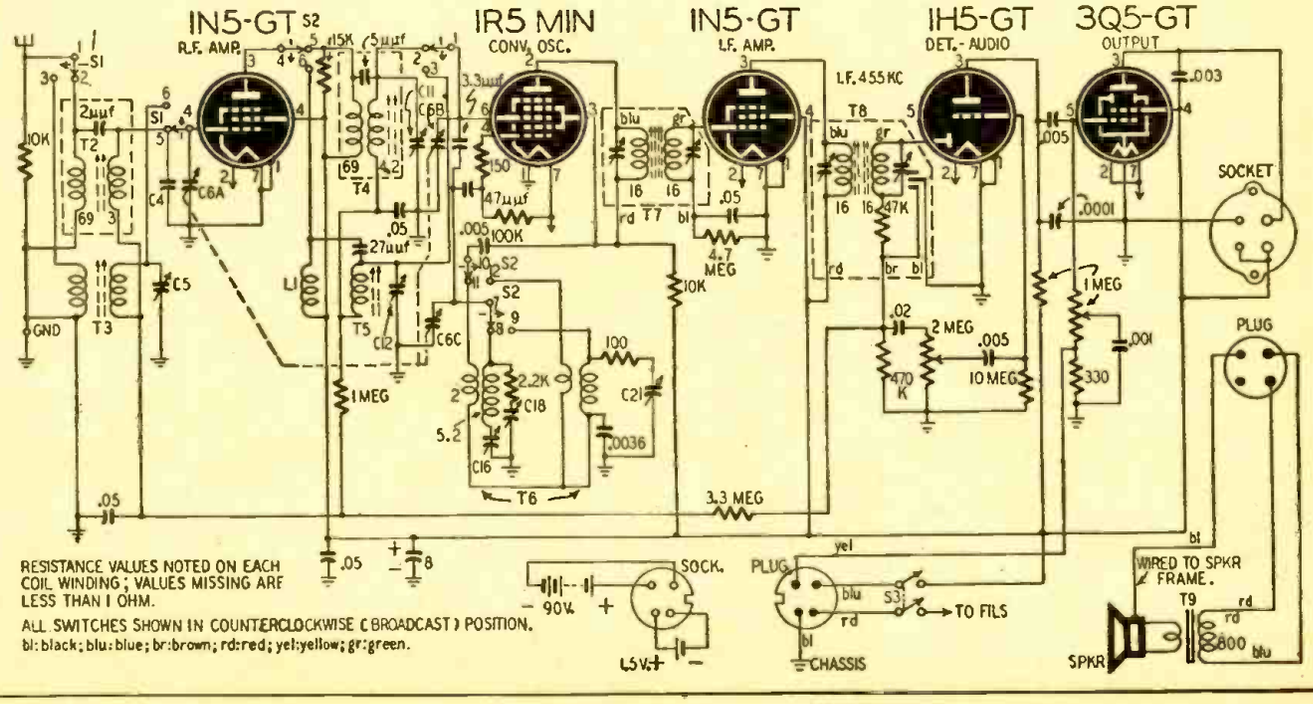
ALIGNMENT CHART

| Step | Connect Test Oscillator To | Test Oscillator Setting | Pointer Setting On Radio | Adjust For Max. Output |
|---|---|---|---|---|
| 1 | 1N5GT r.f. grid in series with .05 mfd. | 455 kc | "BC" Band 550 kc | 1st i.f. transformer trimmers |
| 2 | 1R5 conv. grid in series with .05 mfd. | 455 kc | "BC" Band 550 kc | 2nd i.f. transformer trimmers |
| 3 | 1N5GT r.f. grid in series with .05 mfd. | 1710 kc | H.f. End | C18 (osc.) |
| 4 | 1N5GT r.f. grid in series with .05 mfd. | 1500 kc | 1500 kc | C11 (conv.) |
| 5 | 1N5GT r.f. grid in series with .05 mfd. | 600 kc | 600 kc | * **C16 (osc. padder) |
| 6 | Antenna Post in series with 200 mmf. | 1500 kc | 1500 kc | C4 (r.f.) |
| 7 | 1N5GT r.f. grid in series with .05 mfd. | 18.3 mc | H.f. End | C21 (osc.) |
| 8 | Antenna post in series with 400 ohms | 16.0 mc | 16.0 mc | * C12 and C5 (Conv. and r.f.) |

*Rock gang condenser when making alignment.
**Repeat steps 3 and 4 for best results.



# Start Your Own RADIO SERVICE SHOP

$99.50 $179.50 $350.00

Choose one of these 3 GREAT NEW DEALS

**Includes TEST EQUIPMENT, TUBES, PARTS, TOOLS**

*3 complete going-in-business packages. (If necessary they can be changed to suit your needs.)*

There never was a better opportunity than now to start a profitable business of your own. No fuss, no worry. Here's everything you need. Details upon request. Write, wire or phone!

## Featherweight Miniature TEST INSTRUMENTS

**Compact — Accurate — Priced Right!**

- Jeweled Meter • Range Selector Switch
- All multipliers bridge tested for 1% accuracy
- Zero adjustment—built in batteries
- Molded bakelite case only 3-15/16" x 2-7/8" x 2"

### MODEL 450A
**Volt—Ohm—Milliammeter**

A fine instrument having a sensitivity of 1000 ohms per volt.
Ranges: Volts DC, 0-5/10/50/500/1000;
Mills DC, 0-1;
Ohms full scale, 0-5000/50,000/500,000;
Ohms center scale, 30/300/3000.

**NET** complete with batteries **10.90**

### MODEL 451A AC-DC
**Volt—Ohm—Milliammeter**

A dependable instrument of wide utility—sensitivity 1000 ohms per volt.
Ranges: Volts AC, DC, and Output Ranges, 0-10/50/100/500/1000;
Ohms full scale, 500,000.
Ohms center scale, 7200.

**NET** complete with batteries..... **14.90**

### MODEL 451B
Same instrument as above but has 2500 ohms per volt sensitivity.

**NET** complete with batteries..... **16.60**

### MODEL 452A
**Volt—Ohmmeter**

A superb instrument—100 microampere meter gives 10000 ohms per volt sensitivity.
Ranges: Volts DC, 0-10/50/100/500/1000;
Ohms full scale, 0-2000/20,000/200,000/2 Megs;
Ohms center scale, 30/300/3000/30,000.

**NET** complete with batteries..... **14.90**

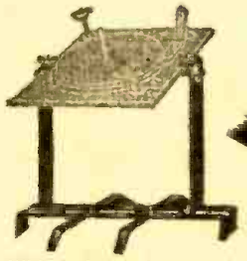
### MODEL 312
**Volt—Ohm—Milliammeter**

An economy pocket meter featuring a 2" moving vane meter.
Reads: AC-DC volts, 0-25/50/125/250;
Mills AC-DC, 0-50;
Ohms, 100,000;
mfd. .05-15.
Jacks provide range selection.

**NET** Complete with cord and plug..... **6.75**

**TEST LEADS** (Removable Needle Points)..... **.59**
Excellent for above instruments.

## TURNTABLE STAND



**$3.91**


**With each stand we send a stroboscope free.**

All steel—adjustable—holds turntable 15" above bench—tilts to any position—speeds work—saves time—prevents damage to parts—pays for itself on first job—you need several at this low price.

## PHILCO BEAM OF LIGHT

Selenium cell only, no holder, postpaid... **$1.80**
(Puts new life into Philco Changers)
Sapphire needle only, no-mirror, postpaid **$1.20**

## SHORT WAVE RECEIVERS

| | |
|---|---|
| Hallicrafters S-38 | $47.50 |
| S-40 (Replaces S-20R) | 89.50 |
| SX-42 (Replaces SX-28A) | 275.00 |

## SELENIUM RECTIFIERS

Direct permanent replacement for 117Z6—117Z3 etc. No filament—no socket—no trouble.

1 to 5 net **1.08** 6 to 49 net **98c** 50 or more net **90c**

## SLIDE RULE DIALS

Crowe No. 534—direct ratio drive—antique bronze escutcheon 2⅝" x 4"—pointer travel 3¾".
NET with pilot lamp bracket... **$1.74**

## V. M. AUTOMATIC CHANGER

A Two Post Changer with well-made mechanism—plays 10" or 12" records intermixed. Low pressure crystal pickup. Size 14" x 14". Packed two to a factory-sealed carton, factory guaranteed.

**SPECIAL EACH 15.95** CARTON OF TWO **29.95**

## TRANSVISION Television Kit

- Proven Circuit
- 7" Picture Tube
- Pre-tuned RF
- Special Antenna
- 100% Complete

Famous Television Kit as advertised by *Transvision, Inc*, complete with all tubes, panel, everything—now available from our stock. Another Radio Supply "First"..... **$159.50**

When ordering, specify station channels needed.

## JEWELLED PILOT LIGHT ASSEMBLIES

- Candelabra screw base for 110 volt lamp.
- Mount in 1" hole.
- Lamps removable from front of panel.
- Available marked 1-2-3 or 4 on back of lens.

YOUR CHOICE net **19c**

Include full remittance with orders of $3.00 or less. Include 25% deposit with all C.O.D. orders of $3.00 or more. Prices subject to change without notice.

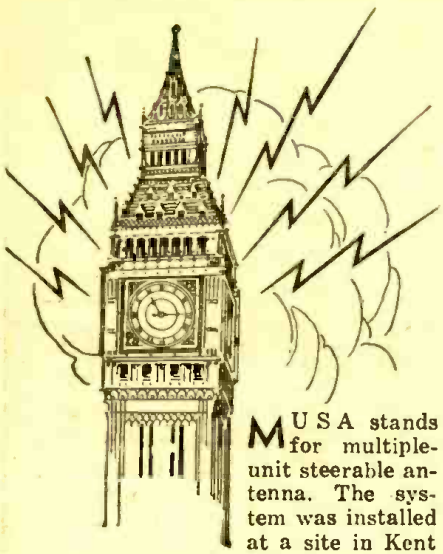
**SEND FOR FREE CATALOG**

# RADIO SUPPLY & ENGINEERING CO., Inc.

125 SELDEN AVE. DETROIT 1, MICH.

# Transatlantic News

## *From our European Correspondent, Major Ralph Hallows*



MUSA stands for multiple-unit steerable antenna. The system was installed at a site in Kent by the British General Post Office to ensure at all times and all seasons distortion-free and fading-free reception of telephonic transmissions from the United States. The quality of these, as relayed to all parts of Britain by the BBC, is now excellent.

The principle of Musa is theoretically quite simple. With a high-frequency transmission, the vertical angle of arrival of the wave trains at the receiving antenna varies constantly owing to rapid changes in the under surface of the F-layer. At any instant there is a particular vertical angle at which incoming signals are at their strongest. But wave trains may be (and probably are) arriving simultaneously at other angles. Fading occurs when there is a phase difference between wave trains arriving at different angles after traversing paths of different lengths. A fruitful source of distortion is the more or less rapid change of polarization of a transmission which may occur during reflection by the F-layer. By making use of superdiversity reception, Musa responds at every instant *(A)* to the signal, whatever its arrival angle, which has the greatest amplitude, and *(B)* to the signal that has undergone the smallest change in polarization.

This is accomplished by what amounts to making the narrow major lobe of the receiving antenna's vertical polar diagram sweep rapidly and continually through a wide arc. The receiver accepts only the best signal at any instant, rejecting all others.

Our Musa station works with the transmitter at Lawrenceville, N. J. Frequencies of the order of 19.82, 14.59, 9.87, 7.55, and 5.08 mc are used, the particular one in operation at the moment depending on the optimum for the state of the sunspot cycle, season of year, and time of day.

The Musa receiving equipment consists of 16 rhombic antennas, spaced at regular intervals over a distance of two miles on the great-circle path to Lawrenceville. These antennas are connected to the receiving apparatus by 16 co-axial transmission lines, the lengths of which depend on the distance between individual antenna systems and the receiving set. The 16 signals are combined after introduction of appropriate phase shifts. These phase shifts cause the major lobe of the vertical polar diagram of the whole antenna system to swing up and down, constantly changing the angle of elevation.

The system is equipped with calibrated cathode-ray tube display units to measure accurately both the optimum wave-angle and the field strength. Records of these have been made at quarter-hourly and hourly intervals ever since the station opened in July, 1942, and are available to both radio engineers and ionospheric physicists.

### Russian radio and television

At the moment the USSR claims that big advances in both radio and television have been achieved by Russian scientists. Large-scale plans to extend broadcast services of both kinds are also under way. Twenty-five television stations, it is announced, shortly will be in operation, 21 in European Russia and the rest in Siberia. It is known that work on color television has been going forward for some time, and the latest report is that a color transmitter working in Moscow has a service area with a 75-mile radius. Much attention is being paid to both land-line and radio links between main television and v.h.f sound transmitters and relays sited at considerable distances away. FM has been adopted to a large extent, particularly for the coverage of big cities, where man-made static due to electrical machinery presents almost insuperable problems with AM. How much of all this is fact and how much wishful thinking it is impossible to say. One must however, bear in mind that Russia is the home of many first-rate radio physicists and radio engineers and that almost unlimited funds are available for research and development on approved lines.

### FM in Britain

As I have already reported, our BBC has been making experimental FM transmissions on 45 and 90 mc for some time. The conclusions reached as a result of extensive trials are (1) that FM is superior to AM for v.h.f. relays in the quality obtainable and in freedom from interference; (2) that it has also advantages over any form of pulse modulation; (3) that horizontal polarization is very much better than vertical for suppressing the effects of interference. The BBC has now decided to start regular FM broadcasts from a full sized transmitter as soon as it can obtain delivery of the apparatus. A 25-kw transmitter has been ordered from the Marconi Wireless Company. Where it will be erected is still a secret. My guess is that the selected site will be on high ground in one of our midland districts.

### Meteors and radio

I was much interested to see a reference to this subject in the February number of RADIO-CRAFT because some very important and interesting work has been done on it. One of the most puzzling problems in radio is the continued existence after dark of the ionized E-layer. If the recombination rate of its atoms is calculated, this should be complete and the reflecting properties of the layer brought to an end very soon after sundown unless something happened to prevent deionization. During the showers of meteors last October from the Giacobini-Zinner stream it was established that each left a trail of ionized air from which radar echoes could be obtained. Recent work by four separate teams of physicists, working under the direction of Sir Edward Appleton and using a variety of methods,

*(Continued on page 73)*

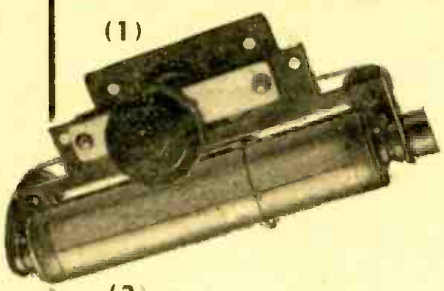

*Suggested by Grego Banshuck, New York City*

"There must be a fire in the television studio."

# NEW FRENCH RADIO PARTS

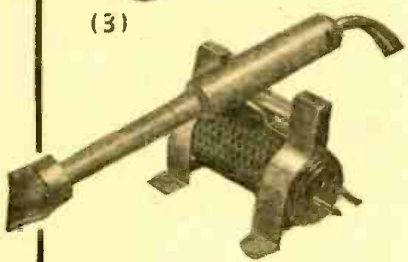
**By E. AISBERG**
Editor *Toute la Radio*

(1)



(2)

(3)



(4)

THE Frenchman is essentially an individualist—that is why France is an artisan's country. The radio industry proves this rule. There are about 50 big radio manufacturers and approximately 200 medium-sized ones. Besides these, one counts literally thousands of small constructors who compete—often successfully—with the big brands.

These small firms occupy themselves largely with assembling receivers from standard components found readymade in commerce. Their artisans do not actually manufacture any of the elements which go into the set. Yet from these readymade parts they design a great variety of receiver models.

From this one understands the great importance of the parts manufacturer to the French radio industry. The post-war shortages, particularly in tubes and all components that require copper, has had a very serious effect on the small constructors. They have had to buy everything they could find—without being too particular about quality. The black market therefore naturally flourishes in the radio field, as it does, alas, in many others, for official allotments give the manufacturers only a small part of the material they need.

What is remarkable under such conditions is that the parts manufacturers have made real efforts to better the quality of their material, even though they know in advance that anything will sell. This is an encouraging sign which proves that the moral stability of the French has not been broken by the trials of the war years.

All this was proved at the recent *Exposition Professionelle des Pièces Detachées* (Professional Radio Parts Show) held at Paris in February, 1947. Not many technical novelties were featured there. The Show was rather characterized by a better quality of material and also that the material was more readily available. We did see, however, a few original items which presage the new tendencies of the day.

In the domain of high-frequency coils, the specialists have presented superheterodyne "blocks" (1) which contain all the tuning and oscillator coils with trimmers, padding condensers, etc., grouped around the switch. These blocks —which are very compact—facilitate construction of the receivers. Most of them have the three usual frequencies: long waves 1,000 to 2,000 meters, medium waves 200 to 600 meters, short waves 10 to 50 meters. Nevertheless, one sees also blocks with higher frequencies. These are generally in the short-wave bands which are again divided into two or three sub-bands. One also finds blocks having a number of spread-bands in the 20, 25, 30, 40, and 50-meter bands.

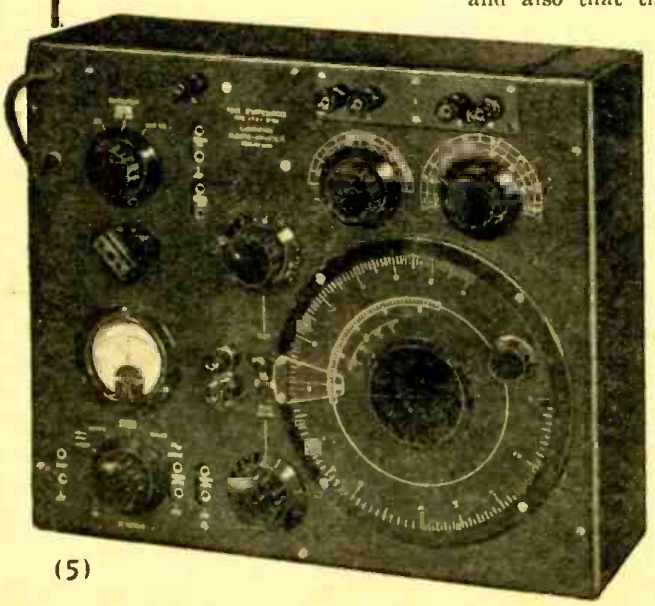
The variable condenser scales are becoming longer and longer. The style usually shows a horizontal dial, more or less slanted backward, placed at the lower part of the receiver.

One constructor exhibited a dial composed of a luminous tube which carries a number of scales (2). Change of ranges is effected by turning the luminous tube around its axis so that the listener always sees the scale of the corresponding frequency band. The pointer is a ring encircling the tube, which is moved along as the set is tuned.

An interesting novelty is presented by an oscillating quartz crystal (3) whose frequency remains rigorously stable in spite of temperature variations. The support of the quartz has a bi-metal (thermostatic metal) armature which flexes more or less, depending on the temperature. The deplacement of this armature with the temperature variation modifies the thickness of the air space of the quartz mounting. Thus variations of frequency which would otherwise have been caused by temperature changes, are compensated by variation of the air space.

An amusing economizer of electric current for a soldering iron (4) was another item which drew attention.

*(Continued on page 68)*



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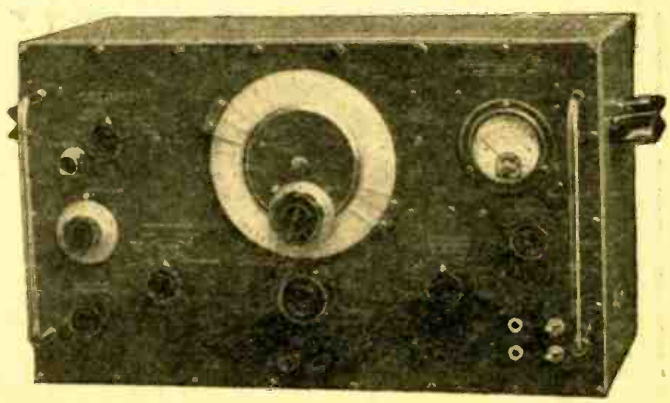
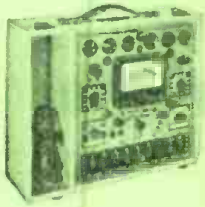


(6)

# Chicago Parts Show

The 1947 Radio Parts Show at the Hotel Stevens in Chicago chalked up the unprecedented advance registration of 2054. This marks it definitely as predestined to be the most successful parts show held. Of the 2,054 registrants, 885 are member exhibitors, 39 are guest exhibitors, and 489 are members of the National Electronic Distributors Association (NEDA).



The new operating plan of the show, used this year for the first time, confines attendance during the first four days to distributors, exhibitors, and manufacturers who operate through distributors. On Friday, May 16, the show is being thrown open to radio servicemen, amateurs, engineers, and the general public. Exhibitors have been requested to have attendants on hand Friday who can be particularly helpful to these groups.

Program for the show:

SATURDAY AND SUNDAY, May 10 and 11—Organization meetings and sales meetings.

MONDAY, May 12—NEDA Day—No sales meetings to be allowed.
Breakfast sponsored by NEDA for member exhibitors and NEDA members.
12:00 noon—Luncheon meeting of members of sponsoring groups of the show corporation.
7:00 p.m.—Keynote dinner for entire industry, featuring Bill Cunningham, noted sports writer and radio commentator, as guest speaker.

TUESDAY, WEDNESDAY, AND THURSDAY, May 13, 14, and 15—No sales meetings to be allowed on these days. Attendance in Exhibition Hall to be confined to members of sponsoring manufacturers, their booth attendants, and their sales representatives and distributors.
Exhibition Hall open from 10:00 a.m. to 6:00 p.m.

FRIDAY, May 16—Open House Day—Radio servicemen, amateurs, engineers, and the general public will be admitted to the Exhibition Hall without registration. Exhibition Hall open from 10:00 a.m. to 6:00 p.m.

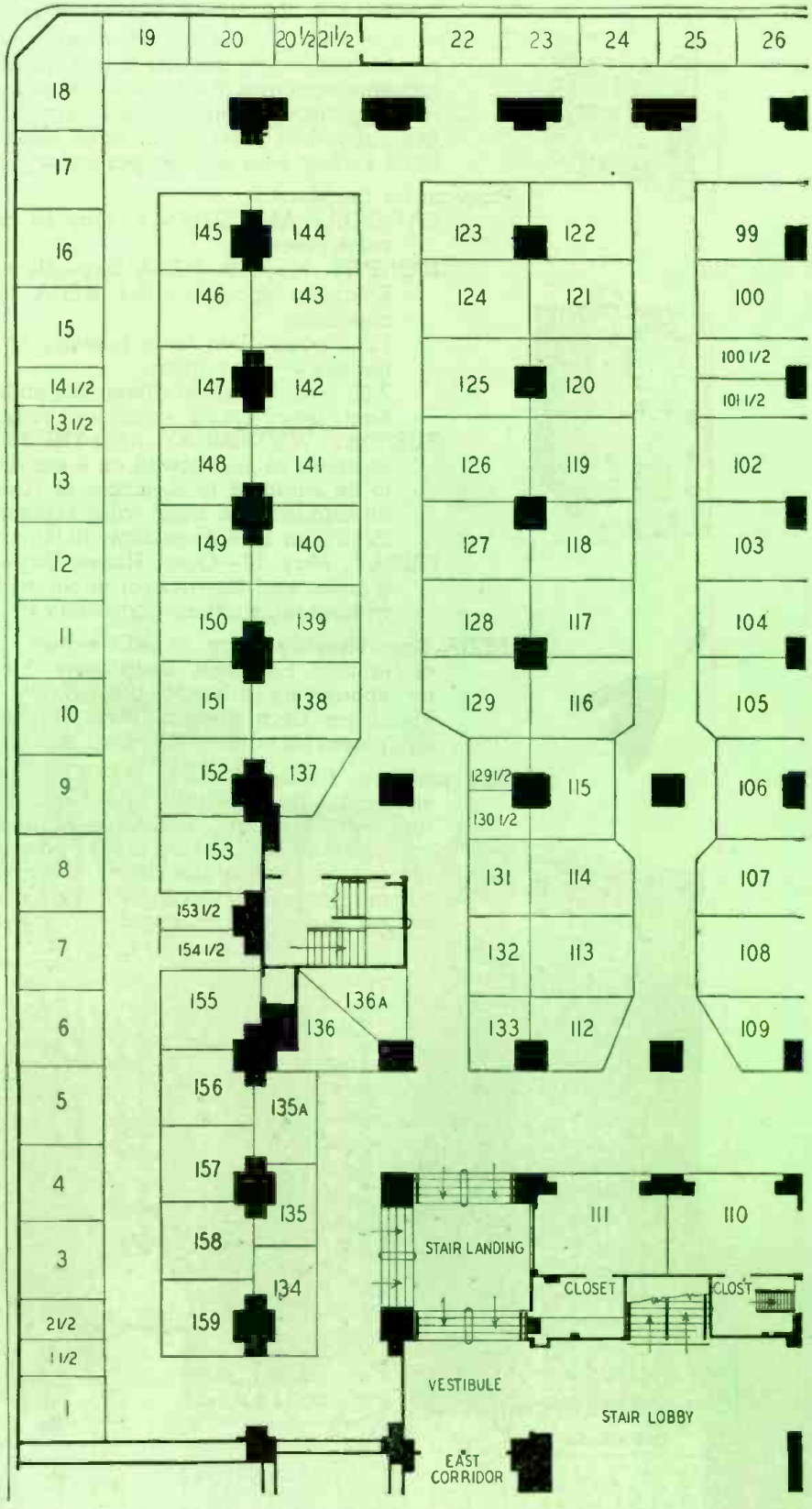
NEDA Day, Monday, May 12, will feature a breakfast for manufacturer guests of National Electronic Distributors Association members and a luncheon for sponsoring organizations (Radio Manufacturers Association, Sales Managers Club Eastern Division, Association of Electronic Parts and Equipment Manufacturers, and National Electronic Distributors Association).

The products displayed cover the whole gamut of radio components, sound equipment, and special types of radio systems. Home and auto receivers, home phonographs, hearing aids, and health and diathermy equipment not regularly handled by radio parts and electronic equipment distributors are not exhibited at the show. However, intercommunicators, special and communications receivers, PA amplifiers, and record changers designed for use in commercial sound systems are shown.

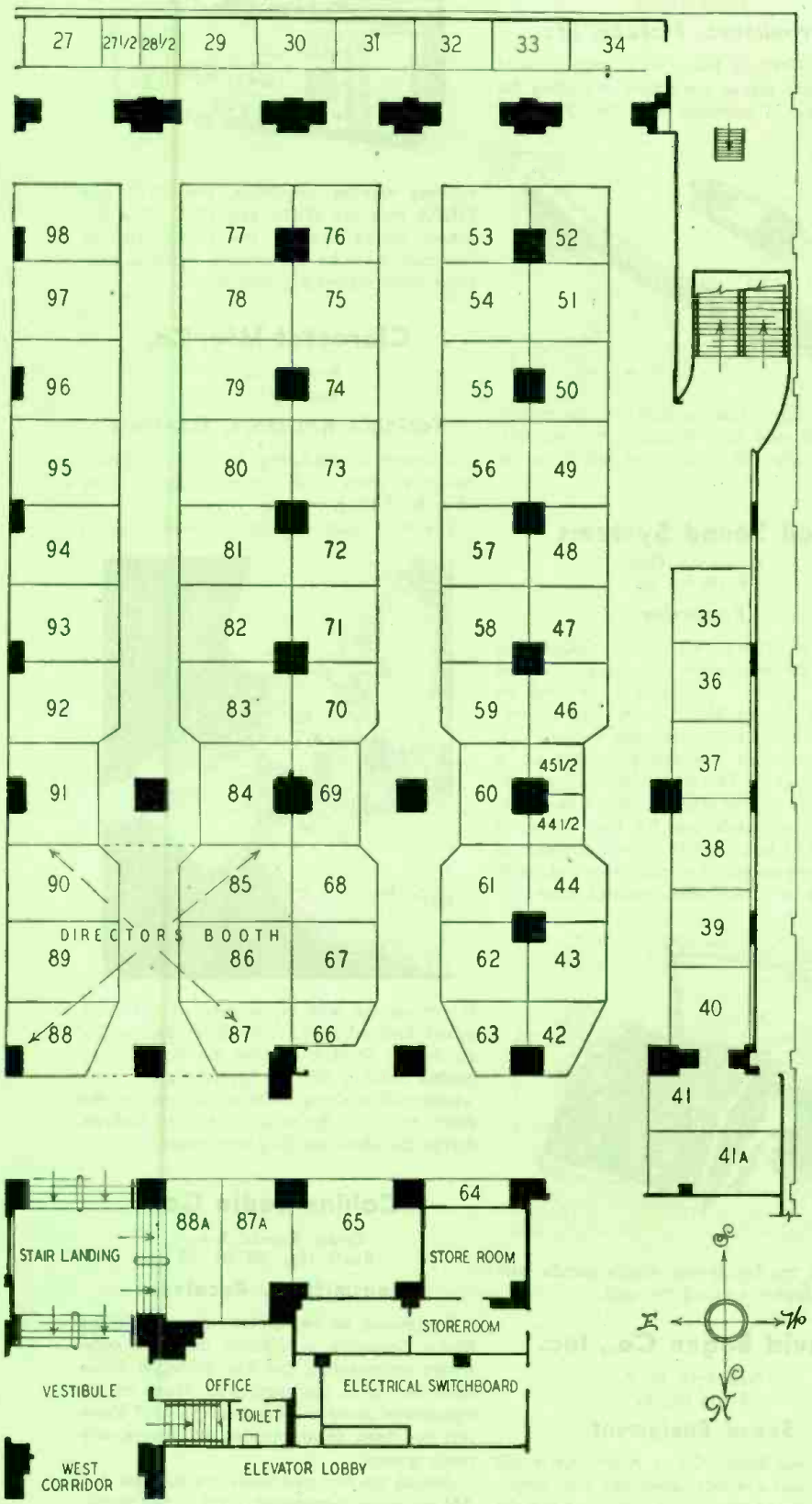
## LIST OF EXHIBITORS

| Company | Booth |
|---|---|
| Advance Electric & Relay Company | 47 |
| Aerovox Corporation | 85 |
| Alliance Manufacturing Company | 123 |
| Alpha Metals, Inc. | 144 |
| Alpha Wire Corporation | 125 |
| American Coil & Engineering Co. | 116 |
| American Condenser Company | 41A |
| American Microphone Company | 4 |
| American Phenolic Corporation | 65 |
| American Radio Hardware Co., Inc. | 75 |
| Amperex Electronic Corp. | 67 |
| Amperite Company | 60 |
| The Astatic Corporation | 95 |
| Atlas Sound Corporation | 23 |
| Audio Devices, Inc. | 148 |
| Barker & Williamson | 77 |
| Belden Manufacturing Company | 128 |
| Bell Sound Systems, Inc. | 66 |
| Bliley Electric Company | 78 |
| Boland & Boyce, Inc. | 154½ |
| David Bogen Co., Inc. | 40 |
| William Brand & Company | 13 |
| British Industries Sales Corp. | 112 |
| Bruno Tools | 76 |
| Brush Development Company | 118 |
| Bud Radio, Inc. | 39 |
| Burgess Battery Company | 34 |
| Burlington Instrument Co. | 22 |
| Caldwell-Clements, Inc. | 20½ |
| Camburn, Inc. | 143 |
| Allen D. Cardwell Mfg. Corp. | 134 |
| Carron Manufacturing Company | 57 |
| Centralab | 68 |
| Chicago Transformer Division | 11 |
| Cinaudagraph Speakers, Inc. | 3 |
| Clarostat Mfg. Co., Inc. | 124 |
| Condenser Products Company | 153 |
| Continental Carbon, Inc. | 150 |
| Cornish Wire Company, Inc. | 48 |
| Cowan Publishing Corp. | 130½ |
| Croname, Incorporated | 84 |
| Dial Light Co. of America, Inc. | 109 |
| Drake Electric Works, Inc. | 61 |
| Dumont Electric Corporation | 12 |
| Duotone Company, Inc. | 20 |
| Eastern Electronics Corp. | 111 |
| Eckstein Radio & Television Co. | 29 |
| Eitel-McCullough, Inc. | 14 |
| Electric Soldering Iron Co. | 58 |
| Electronic Engineering Co. | 62 |
| Electronic Laboratories, Inc. | 56 |
| Electro Products Laboratories | 81 |
| Electro-Voice, Inc. | 15 |
| Electrovox Company, Inc. | 122 |
| The Erwood Company | 105 |
| Federal Telephone & Radio Corp. | 64 |
| Freed Transformer Corp. | 113 |
| General Cement Mfg. Co. | 96 |
| General Electric Company | 32 |
| General Industries Company | 110 |
| General Transformer Corp. | 63 |
| Guardian Electric Mfg. Co. | 51 |
| The Halldorson Company | 37 |
| The Hallicrafters Company | 86 |
| Hammarlund Manufacturing Company | 90 |
| Hardwick, Hindle, Inc. | 36 |
| Herlec Corporation | 9 |
| Hickok Electrical Instrument Co. | 142 |
| Hytron Radio & Electronics | 91 |
| Indiana Steel Products Co. | 38 |
| Industrial Condenser Corp. | 141 |
| Insuline Corp. of America | 114 |
| International Resistance Company | 88A |
| Jackson Electrical Instrument Co. | 98 |
| Jackson Industries, Inc. | 156 |
| J-B-T Instruments, Inc. | 5 |
| Jensen Manufacturing Co. | 44 |
| J. F. D. Manufacturing Co. | 117 |
| E. F. Johnson Company | 73 |
| Kenyon Transformer Corp., Inc. | 6 |
| Kings Electronics Company | 94 |
| Lectrohm, Incorporated | 132 |
| Lenz Electric Manufacturing Co. | 104 |
| P. R. Mallory & Company | 106 |

# "1947 Radio Parts and Conference and



# Electronic Equipment Show" Floor-Plan




## LIST OF EXHIBITORS

| Company | Booth |
|---|---|
| John Meck Industries, Inc. | 133 |
| Meissner Manufacturing Co. | 93 |
| Merit Coil & Transformer Corp. | 52 |
| James Millen Mfg. Co., Inc. | 33 |
| Milwaukee Stamping Company | 136A |
| National Company, Inc. | 147 |
| National Union Radio Corp. | 10 |
| Newcomb Audio Products Co. | 7 |
| Ohio Tool Company | 135 |
| Ohmite Manufacturing Co. | 74 |
| Operadio Manufacturing Co. | 139 |
| Oxford Radio Corporation | 59 |
| Panoramic Radio Corp. | 115 |
| Park Metalware Co., Inc. | 136 |
| Par-Metal Products Corp. | 24 |
| The Parts Jobber, Inc. | 28½ |
| Permo, Incorporated | 41 |
| Philmore Manufacturing Co. | 119 |
| Potter & Brumfield Mfg. Co. | 53 |
| Precision Apparatus Co., Inc. | 152 |
| Premax Products Division | 18 |
| Price Electric Corporation | 145 |
| Pyramid Electric Company | 157 |
| Quam-Nichols Company | 140 |
| Racon Electric Company, Inc. | 158 |
| Rad-El-Co. Manufacturing Co. | 87A |
| Radiart Corporation | 79 |
| Radio City Products Co., Inc. | 8 |
| Radio Corporation of America | 135A |
| Radio-Craft | 21½ |
| The Radio Craftsmen, Inc. | 25 |
| Radio & Electronic Jobber News | 45½ |
| Radio Essentials, Inc. | 99 |
| Radio & Television Weekly | 129½ |
| The Rauland Corporation | 83 |
| The Recordisc Corporation | 27 |
| Recoton Corporation | 26 |
| Reiner Electronics Co., Inc. | 35 |
| Rek-O-Kut Company | 55 |
| Resistors, Incorporated | 70 |
| John F. Rider, Publisher, Inc. | 120 |
| Howard W. Sams & Co., Inc. | 31 |
| Walter L. Schott Company | 71 |
| Shur-Antenna-Mount, Inc. | 42 |
| Shure Brothers | 87 |
| McMurdo Silver Company | 138 |
| Simpson Electric Company | 149 |
| Mark Simpson Mfg. Co., Inc. | 46 |
| SNC Manufacturing Co., Inc. | 72 |
| Snyder Manufacturing Corp. | 30 |
| Solar Manufacturing Corp. | 92 |
| Special Products Company | 103 |
| Spirling Products Company | 159 |
| Sprague Products Company | 89 |
| Standard Transformer Corp. | 88 |
| Stromberg-Carlson Company | 108 |
| Supreme Instruments Corp. | 102 |
| Sylvania Electric Products | 50 |
| Talk-A-Phone Company | 151 |
| Technical Appliance Corp. | 19 |
| Telex, Incorporated | 131 |
| Thordarson Electric Co. | 126 |
| Trimm, Incorporated | 100 |
| Triplett Electrical Instrument | 121 |
| Tung-Sol Lamp Works, Inc. | 107 |
| The Turner Company | 49 |
| United Catalog Publishers | 27½ |
| United Transformer Corp. | 1 |
| University Loudspeakers | 16 |
| Utah Radio Products Div. | 97 |
| Vaco Products Company | 82 |
| Vertrod Corporation | 69 |
| Ward Leonard Electric Co. | 127 |
| Ward Products Corporation | 80 |
| Waterman Products Company | 101 |
| Webster-Chicago Corporation | 155 |
| Webster Electric Company | 137 |
| Weller Manufacturing Company | 43 |
| Westinghouse Electric Corp. | 17 |
| Weston Electrical Instrument | 54 |
| Wirt Company | 146 |
| Workshop Associates, Inc. | 129 |
| Ziff-Davis Publishing Co. | 44½ |

# Radio Items on Exhibition

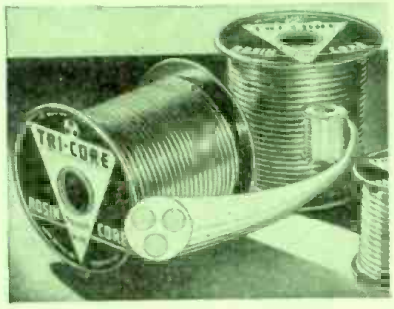
## Alpha Metals, Inc.

Brooklyn, N. Y.
Booth No. 144

### *Tri-Core Solder*

Tri-Core, a solder with three independently filled cores of pure rosin flux, is the chief exhibit of Alpha Metals.

A continuous supply of high-grade non-corrosive rosin flux is always present in Tri-Core solder, since the three cores are completely independent of each other. With these three cores, occurrence of "dry" sections in more than one core at a given point is mathematically unlikely, making Tri-Core more efficient and less wasteful than the usual single-core solder.




## American Coil & Engineering Co.

Chicago, Illinois
Booth No. 116

### *Transformers, Reactors, Etc.*

American Coil and Engineering Co. is exhibiting a line which includes all types of small and medium transformers, reactors, chokes, and autoformers, as well as r.f. coils and transformers.

## American Condenser Co.

Chicago, Illinois
Booth No. 41A

### *Plastic Capacitors*

American Condenser Co. announces its small Amcon plastic capacitor. Measuring only 2⅛ inches high and with a diameter of only 1⅜ inches, this new unit is specifically intended for top chassis mounting, where space is extremely limited. Self-insulating because of its molded plastic case, the unit resists high temperatures and has a wide climatic range.

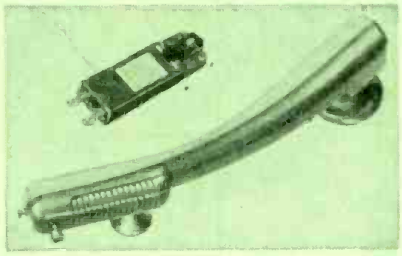
Working voltage of these capacitors is 600, they are tested at 1800 volts. Other Amcon capacitors include tubular and metal-cased (bath-tub) units and 1600-volt vibrator capacitors.

## The Astatic Corporation

Conneaut, Ohio
Booth No. 95

### *Microphones, Pickups, Etc.*

Astatic Corp. is featuring a large line of pickups and pickup cartridges, including the new Nylon I-J cartridge and the QT (quiet



talk) cartridge. Phonograph pickups include Models 400 and 508. A line of microphones, featuring the 600-, 820-, and 840-S, is on exhibition.

## Bell Sound Systems

Columbus, Ohio
Booth No. 66

### *Recorder*

The Bell Model RC-47 RE-CORD-O-fone provides for permanent recording of sound from any source. It records 12 minutes on a 10-inch disc at 33-1/3 r.p.m. (the equivalent to four 12-inch commercial records). It copies a 12-inch commercial record on a 10-inch blank at 78 r.p.m. One central control permits instant selection of all functions: recording, playback and PA use. Plugging in a pair of headphones allows operator to judge every setup. The unit is entirely self-contained in a two-piece, portable case cov-

ered with tan leatherette which blends with the rich brown tone of the unit

## David Bogen Co., Inc.

New York, N. Y.
Booth No. 40

### *Sound Equipment*

The David Bogen Co. is exhibiting a full line of sound systems, intercoms and amplifiers. Featured among the amplifiers are the G050 and G0125 boosters—to be used with

existing smaller amplifiers, the PU10 and PU20A and the GX50 and G50. The SM school sound system, the LC-LA DeLuxe intercom, and the SA paging systems comprise other interesting exhibits.

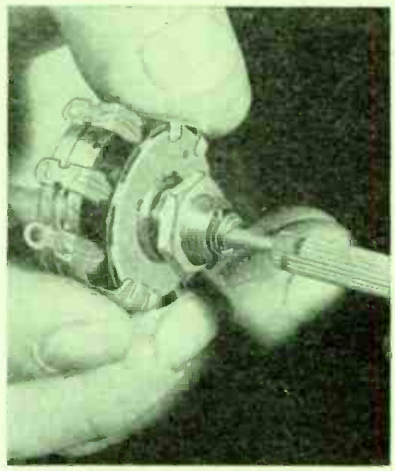
## Clarostat Mfg. Co.

Brooklyn, N. Y.
Booth No. 124

### *Variable Resistors, Controls*

Clarostat is exhibiting its line of variable resistors, pads, and controls, featuring the new Ad-A-Shaft system.

The Ad-A-Shaft controls are being stocked



in conjunction with an assortment of flatted, round, knurled, and double-flatted shafts. The tip of the shaft slips into the hole in the control bushing until the keyway is engaged, whereupon a sharp blow on the end of the shaft, or hitting the shaft on a hard surface, drives the shaft securely into place.

## Collins Radio Co.

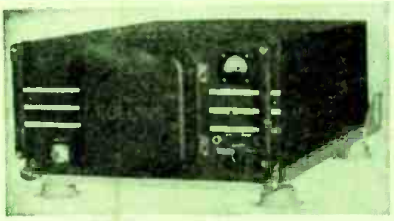
Cedar Rapids, Iowa
Booth Nos. 80, 89, 90

### *Transmitters, Receivers*

Equipment to be shown by the Collins Radio Company is divided into five categories representing the five principal fields of endeavor of the company. Much of the equipment being exhibited in the 1947 show has not been shown previously before any radio group.

Among the featured items are the new 20T AM broadcast transmitter (1,000 or 500 watts), the 3-kw FM broadcast transmitter, the 30K

and 32V ham transmitters, the 75A amateur receiver, and the 188 aircraft transmitter-receiver. Speech input consoles, turntables,



railroad entertainment systems, and amateur equipment occupy important places in the exhibit.

## Electronic Laboratories, Inc.

Indianapolis, Ind.
Booth No. 56

### *Intercommunicators, Etc.*

Electronic Laboratories exhibits a line of both war and postwar developments. Among the items featured is a combination radio and intercommunicator. The master unit is a 6-tube radio as well as intercom, and slave stations may be added up to the num-

ber of four. Other Utiliphone intercommunicators will be exhibited.

## Federal Telephone & Radio Corporation

Newark, New Jersey
Booth No. 64

### *Selenium Rectifiers, Etc.*

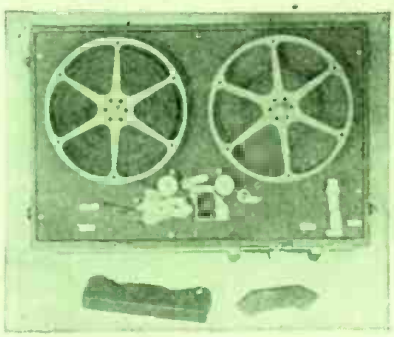
Leading the list of Federal's products is the miniature selenium rectifier, which replaces all conventional receiver rectifier tubes, and represents one of the first real advancements made in home radios since the end of the war. Its improved features are longer life, more immediate rectification, improved efficiency, higher current rating, smaller size, and elimination of the power transformer in some circuits. This minature type selenium rectifier offers manufacturers and servicemen a new source of profit and makes available to the amateur a component that will both improve the performance of his equipment and cut down his costs.


Wire and cable for television and FM, battery chargers, and d.c. power supplies are other exhibits at the Federal booth.

## Indiana Steel Products Co.

Chicago, Illinois
Booth No. 38

### *Magnetic Recorder*



Indiana Steel Products is featuring the Hyflux magnetic tape recorder. Hyflux is a finely divided magnetic material with qualities that compare favorably with those of Alnico. Tests now being made with the recorder indicate that besides being a high-fidelity musical recorder, it may be adapted to the following uses: recording audio signals or pulses of any duration or wave length; seismograph investigation; memory record for electronic calculating machines; retention of telegraph signals; multiple single-tone reception (as in electronic organs); control signals for industrial machinery; and continuous advertising or announcing equipment.

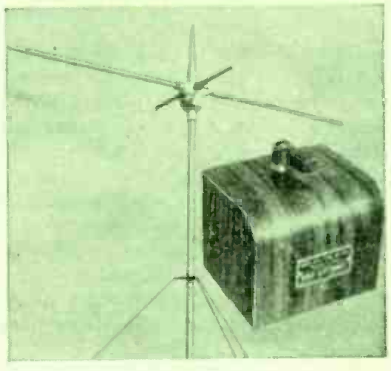
## Kings Electronics Co.

Brooklyn, N. Y.
Booth No. 94

### *Roto-Beam Antenna*

Kings Electronics announce its Roto-Beam antenna for television reception.

The antenna covers all the television bands and rotates either clockwise or counterclockwise through 360 degrees, giving optimum reception from stations in any direction. It is operated by a rugged 24-volt motor, which is controlled by a d.p.d.t. spring-loaded switch located in the control box at the set. Neither snow, sleet, nor rain affect the operation and efficiency of the antenna, as it is completely weatherproofed, with a neoprene de-icing skirt completely surrounding the head.



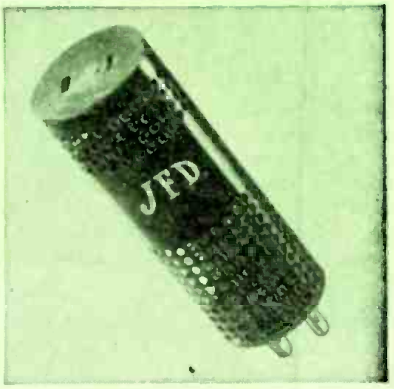
## J. F. D. Manufacturing Co.

Brooklyn, N. Y.
Booth No. 117

### *210-110-Volt Ballasts*

The J.F.D. Co. is featuring a new step-down resistor ballast, designed to enable operation of 110-volt radios on 220-volt circuits, common in foreign countries.

These ballasts come with American, British and Continental male plugs; the female sockets are American. They may be used with radios, electric razors, fluorescent fixtures, phono-radio combinations,



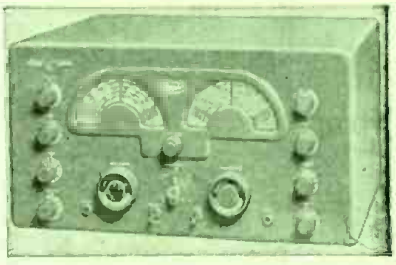

electric clocks, electric blankets and other electrical appliances.

## The National Co.

Malden, Mass.
Booth No. 147

### *Communications Receiver*

A new post-war communications receiver for amateur use, the NC-173, is exhibited by the National Company.



The new NC-173 is a 13-tube superheterodyne model with a calibrated band spread covering the 6, 10-11, 20, 40 and 80 meter amateur bands. Its frequency range extends from 540 to 31,000 and from 48,000 to 56,000 kilocycles for both amplitude-modulated phone reception.

Outstanding among the special features of the new National receiver is the automatic volume control, which is operative for both phone and c.w. reception. In addition the S-meter on the NC-173 will also work on both phone and c.w.

Voltage regulated circuits give the NC-173 a minimum of drift and the pitch of code characters does not change appreciably over extended periods of listening time. An additional feature is a new adjustable threshold noise limiter.

## Pyramid Electric Co.

Jersey City, N. J.
Booth No. 157

### *Capacitors*

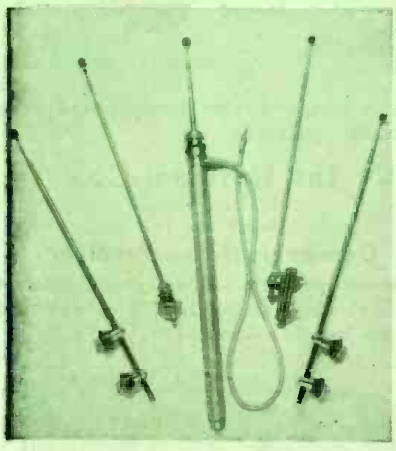
Pyramid's main display is the "Twist-Mount" Capacitor, an ultra-compact, metal-sealed, easy-to-mount dry electrolytic unit. Each of these units is supplied with metal and bakelite mounting plates.

## Rad-El-Co Mfg. Co.

Cleveland, Ohio
Booth No. 87AA

### *Auto Aerials*

Rad-El-Co is exhibiting a new concealed type of automobile aerial in two models. The FM-3 is a 3-section aerial extending to 55 inches; the FM-4 a 4-section aerial which extends to 72 inches. The antenna in the center of the photo is the FM-4; it is flanked by other antennas made by the same manufacturer.



## Stromberg-Carlson Co.

Rochester, N. Y.
Booth No. 108

### *Sound Systems, Etc.*

Stromberg-Carlson is displaying at the show its new standard sound systems, three new centralized systems for schools, new amplified intercommunicating systems, new intercommunicating telephone designs, a new line of reproducers and reproducer housings, as well as its complete line of universal amplifiers, record amplifiers, power amplifiers, pre-amplifiers, Alnico V cone speakers, and microphones.

Among the featured items are the Model 750 and Model 1200 sound systems (the latter for schools), the Model 33 amplifier, and the Stromberg-Carlson intercommunicating system.

## Sylvania Electric Products

New York, N. Y.
Booth No. 50

### *Test Equipment*

Three new additions to Sylvania's line of test equipment are exhibited for the first time at the Chicago Radio Parts Show.

The 7-inch oscilloscope type 132, the audio oscillator type 145, and the signal generator type 150 are shown in handmade models. Announcement of the availability dates on these new pieces of test equipment also is being made at the show.

The new 7-inch oscilloscope is designed for general purpose use by laboratories and radio service dealers. The new audio oscillator and signal generator has unusual stability, wide coverage, and a high degree of accuracy. The signal generator also possesses several novel calibration features.

## Telex, Incorporated

Minneapolis, Minn.
Booth No. 131

### *Headset, Pillow Speaker*

The Telex Monoset is designed to reduce head fatigue and ear pressure for operators who wear headsets for long periods. Weighing only 1.2 ounces, it uses two stethoscope-like tubes that end in clear plastic ear tips, and a single magnetic unit.

The standard unit has an impedance of 128 ohms per receiver and a sensitivity of 18 dynes per square centimeter for 10 microwatt input per receiver. The miniature plug-in cord attachment and the durable plastic insulated tinsel cord are made of the finest materials.

The Telex pillow speaker is a flat plastic electromagnetic sound generating unit designed to reproduce sound normally when placed under a pillow or cushion, giving the listener a private loudspeaker. It is a low-impedance unit designed to work from the secondary of the output transformer, and is supplied with a closed-circuit jack, permitting it to be hooked up in the output circuit so that the regular speaker is cut out when the pillow speaker is plugged in.

## The Turner Co.

Cedar Rapids, Iowa
Booth No. 49

### *Noise-Cancelling Microphone*

A new hand microphone, designed for use in factories, machine shops, railroad yards, aircraft, and other places where background noise prevents intelligible communication with standard equipment, is being exhibited by The Turner Company. The Model 15D-NC cancels out background noise, permitting only close talking speech to be transmitted. It is a hand-held dynamic microphone, housed in a tough, lightweight alloy case finished in gunmetal enamel. The 15D-NC is available in 50, 300, 500 ohms or high impedance.

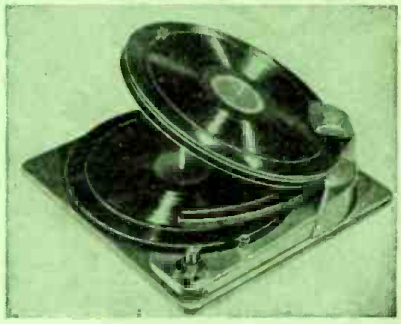
## Webster-Chicago Corp.

Chicago, Illinois
Booth No. 155

### *Recorder, Record Changers*

Webster's leading exhibits are its Model 80 wire recorder and Model 70 record changer. Model 80 wire recorder is an all-purpose, self-contained portable magnetic wire recorder and player. It consists of a simple, efficient wire-transporting mechanism, recording amplifier, playback amplifier, and 5¼-inch speaker built into a compact carrying case. Furnished complete, ready to play with microphone, power cord, and a supply spool of wire.

The Model 70 is a single-post, cushioned spindle intermex record changer. Simple in operation, it provides automatic or manual playing of both 10- and 12-inch records intermixed or in full stacks of either size, or individually. Home recordings, children's records, or "inside out" records up to the 12-inch size may be played manually.



# JOBBERS AND DEALERS DIRECTORY
## FOR READERS OF RADIO-CRAFT

This list of Radio Jobbers and Dealers has been compiled as a service to RADIO-CRAFT readers. The magazine is sold by the stores listed below where they are displayed on counters and shelves for your convenience. At these stores you will also be able to buy standard parts, sets and every other product of the radio and electronic industry.

### ALABAMA

*Decatur*
Radio & Tel. Sup. Co.
717 Bank St.

*Dothan*
Hand Wholesale Radio & Refrig.
707 S. Oates St.

*Tuscaloosa*
Allen & Jemison Co.

### ARIZONA

*Phoenix*
Radio Specialties & Appl.
401 W. Jackson

### ARKANSAS

*Fort Smith*
Packard Radio Co.
205 Garrison Ave.

*Texarkana*
Lavender Radio Sup. Co.
Ash at 4th Sts.

### CALIFORNIA

*Fresno*
Jack C. Arbuckle
1427 Broadway

*Hollywood*
Hollywood Radio Sup., Inc.
5521 Hollywood Blvd.
Yale Radio Electric Co.
6616 Sunset Blvd.

*Long Beach*
Fred S. Dean Co.
969 American Ave.
Scott Radio Supply
226 Alamitos Ave.

*Los Angeles*
General News Agency
326 W. 5th St.
Papel Bros.
2639 E. 4th St.
Radio Tel. Sup. Co.
1509 So. Figuero St.
Electric Supply Co.
149 - 12th St.

*Sacramento*
E. M. Kemp Co.
115 R. St.
Sacramento Elec. Sup. Co.
711 Capitol Ave.

*San Bernardino*
George D. Bagley Co.
1216 D St.

*San Diego*
Harold W. Burt Radio-Electronic
4162-64 Park Blvd.
Electronic Equip. Distr.
1228 2nd Ave.
Western Radio & Elec. Co.
1415 India St.

*San Francisco*
Associated Radio Dist.
1251 Folson St.
San Francisco Radio & Supply Co.
1284 Market St.

*San Jose*
Frank Quement Wholesale Radio
156 W. San Francisco St.

*Santa Ana*
Radio & Tel. Equip. Co.
207 Oak St.

*Oakland*
Electric Supply Co.
149 - 12 St.

### COLORADO

*Denver*
McGee Radio & Elect. Co.
1330 Broadway
Radio Products Sales Co.
1237 16th St.
Western Electronic Lab. Co.
913 18th St.

*Grand Junction*
Radio & Electronics Supply Co.
418 South 7th St.
Variety Electric Co.
601 Broad St.

### CONNECTICUT

*Bridgeport*
Coastal Radio Service Co.
1559 Stratford Ave.
R. C. Scell & Co., Inc.
84 Elm St.
L. N. Waldhaus
1132 Norman St.

*Hartford*
R. G. Scell & Co.
317 Asylum St.

*New Britain*
United Radio Supply
53 E. Main St.

*New Haven*
Congress Radio & Battery Co.
207 Congress Ave.

*Rockville*
Alfred C. Denson
38 Park Place

### DELAWARE

*Wilmington*
Radio Electric Service Co.
4th and Tatnall Sts.

### DISTRICT OF COLUMBIA

*Washington*
Capitol Radio Wholesalers
2120 14 St. N. W.
Intercommunications Co.
2027 Nichols Ave. S.E.
Kenyon Radio Supply Co.
2214 14th St. N.W.
Sun Radio
938 N.W. F St.

### FLORIDA

*Jacksonville*
Radio Parts Co.
712 Main St.
Thurow Distr. Inc.
15-17 E. Church St.

*Miami*
Thurow Distr. Inc.
420 S.W. 8th Ave.

*Orlando*
Thurow Distr. Inc.
131 South Court St.

*St. Petersburg*
Welch Radio Supply
408 9th St. So.

*Tallahassee*
Thurow Distr. Inc.
213 E. Tennessee St.

*Tampa*
Thurow Distr. Inc.
134 S. Tampa St.

*West Palm Beach*
Thurow Distr. Inc.
308-310 So. Olive Ave.

### GEORGIA

*Augusta*
Presswood Electronics Co.
727-29 Reynolds St.

*Columbia*
Radio Sales & Svce. Co.
1326 First Ave.

*Macon*
Guy White Radio
604 Mulberry St.

### ILLINOIS

*Benton*
Lampley Radio Co.
812 N. McLeansboro St.

*Danville*
Allen Electric Co., Radio Supply
109 N. Hazel St.

*Decatur*
York Radio Distr. Co.
801-805 N. Broadway St.

*Chicago*
Allied Radio Corp.
833 W. Jackson Blvd.
American Parts, Inc.
610 W. Randolph St.
Concord Radio Corp.
901 W. Jackson Blvd.
Electronic Distributors
620 W. Randolph
Lake Radio Sales Co.
615 W. Randolph St.
Radio Shack
630 W. Randolph St.
Radolek Co.
601 W. Randolph St.
Schuh Radio Parts
1253 Loyola Ave.

*East Moline*
C. L. Swanson Radio Laboratory
933 15th Ave.

*Goreville*
Century Supply Co.
Main St.

*Rockford*
H. & H. Electronic Supply
510 Kishwaukee St.
Mid-West Associates
506 Walnut St.

*Springfield*
Harold Bruce
303 E. Monroe
Wilson Supply Co.
108 Jefefrson St.

*W. Frankford*
Radio Hospital
1107 E. Main St.

### INDIANA

*Anderson*
Seybert's Radio Supply
19 E. 12th St.

*Evansville*
Castrup's Radio Sup.
1014 W. Franklin St.
Montoux Auto & Machine Co.
517 Locust St.

*Gary*
Cosmopolitan Radio Co.
524 Washington St.

*Hammond*
Stanton Radio Supply
521 State St.

*Indianapolis*
Rodefeld Co.
614 N. Capitol

*Richmond*
Rinehart Inc.
511-513 Main St.

*South Bend*
Commercial Sound & Radio Co.
534 E. Colfax Ave.

*Terre Haute*
Terre Haute Radio
501 Ohio St.

### IOWA

*Council Bluffs*
World Radio Labs

*Des Moines*
G. W. Onthank Co.
11th & Cherry

*Dubuque*
Boe Distributing Co.
498 N. Grandview

*Fort Dodge*
Ken-Els Radio Sup. Co.
111 So. 12 th St.

*Sioux City*
Dukes Radio Co.
114 W. 4th St.
Power City Radio Co.
513 7th St.
Sioux City Radio & Appliance Co.
313 Fifth Street

*Waterloo*
Ray-Mac Radio Supply
324 W. 4th St.

### KANSAS

*Pittsburgh*
Pittsburg Radio Sup. Co.
103 N. Broadway

*Topeka*
Acme Radio Supply
516 Quincy St.

*Wichita*
Interstate Distr. Inc.
1236 E. Douglas
Radio Supply Inc.
1125-27 E. Douglas

### KENTUCKY

*Lexington*
Kentucky Radio Supply Co.
519 Georgetown St.

*Louisville*
Peerless Electronic Equip. Co.
912-914 So. Second St.

*Newport*
Apex Distributing Co.
506 York St.

*Owensboro*
Central Electronics Supply
203 W. 4th St.

### LOUISIANA

*Lafayette*
Radio-Electronic Sup.
1419-21 Cameron St.

*Monroe*
Hale & McNeil
381 Pine St.

*New Orleans*
Wm. B. Allen Supply Co.
916-918 W. Claiborne Ave.
Radio Parts Inc.
807 Howard Ave.

*Shreveport*
Koelemay Sales Co.
327 Market
Radio Supplies Inc.
2408 Line Ave.

### MAINE

*Bangor*
Radio Service Lab.
45 Haymarket Sq.

*Portland*
Maine Electronic Supply Corp.
13 Deer St.
Radio Service Lab.
45 A Free St.

### MARYLAND

*Baltimore*
Henry O. Berman Co., Inc.
12 E. Lombard St.
D. & H. Dist. Co.
31 E. Lee St.
Royal Radio
941 Penna. Ave.
Wholesale Radio Parts Co. Inc.
311 W. Baltimore St.

*Cumberland*
Cumberland Radio Wholesalers
143 N. Centre St.

### MASSACHUSETTS

*Boston*
Hub Cycle&Radio Co., Inc.
596 Commonwealth Ave.
Sager Electrica. Sup. Co.
201 Congress St.

*Lawrence*
Hatry & Young of Mass. Inc.
639 Essex St.

*Melrose*
Melrose Sales Co.
407 Franklin St.

*New Bedford*
C. E. Beckman Co.
Commercial St.

*Springfield*
Springfield Radio Co., Inc.
405 Dwight St.
Springfield Sound Co.
147 Dwight St.

*Worcester*
Radio Maintenance Supply
19-25 Central St.

### MICHIGAN

*Ann Arbor*
Purchase Radio & Camera Shop
605 Church St.

*Berkley*
The J. M. Morel Co.
1949 Woodward Ave.

*Detroit*
M. N. Duffy & Co.
2040 Grand River Ave.
Electronics Inst. Inc.
21 Henry at Woodward
Radio Center
2530 East Davidson
Radio Electronic Supply
1112 Warren West
Radio Specialties
456 Charlotte St.
Radio Supply Co.
6724 Michigan Ave.
Radio Supply & Eng. Co.
129 Selden Ave.
Westside Radio Supply
6724 Michigan Ave.

*Flint*
Radio Tube Mdse. Co.
508 Clifford
Sheldon Radio & Appliance
2914 N. Saginaw St.

*Jackson*
Fulton Radio Supply Co.
707 S. Blackstone St.

*Lansing*
Electric Products Sales Co.
427 E. Michigan Ave.

*Muskegon*
Industrial Electric Supply
1839 Pack St.

*Saginaw*
Orem Distributing Co.
801 E. Genesee Ave.
Radio Parts Co.
234 S. Second St.

### MINNESOTA

*Duluth*
Lew Bonn Co.
228 E. Superior St.
Northwest Radio
109 E. First St.

*Minneapolis*
Lew Bonn Co.
1211 LaSalle Ave. So.
Northern Radio Lab.
3927 East Lake St.
Radio Electric Supply
2451 Nicollet Ave.
Ron's Radio Supply
4001 Bryant Ave., So.

### MISSISSIPPI

*Jackson*
Cabell Electric Co.

*Meriden*
Radio Supply Co.

### MISSOURI

*Cape Girardeau*
Suodakum Electronic Supply Co.
902 S. Spring St.

*St. Joseph*
Acme Radio Supply
110 N. 9th St.

*St. Louis*
Napper Radio Co.
3117 Washington

*Springfield*
Harry Reed Radio & Supply Co.
833-37 Boonville Ave.

### MONTANA

*Butte*
Geo. Steel & Co.
126 W. Broadway

*Great Falls*
Geo. Lindgren Co.
109 Central Ave.

### NEBRASKA

*Lincoln*
Hicks Radio Co.
1422 "O" St.

*Omaha*
Alco Radio Inc.
4011 Cuming St.
All-State Distr. Co.
2857 Farnum St.
H. C. Noll Co.
226 Harney St.
Omaha Appliance Co.
18th & St. Mary's
Radio Equipment Co.
2820-22 Farnum St.

**See Other Side For Additional Listings**

*(Continued)*

## NEW JERSEY

*Bridgeton*
Joe's Radio Shop
67-69 S. Pearl

*Camden*
Radio Electric Service Co.
513 Cooper St.

*Hackensack*
Trade Radio Service Co.
10½ Morris St.

*Newark*
Continental Sales Co.
195-197 Central Ave.
Radio Wire Telev. Inc.
24 Central Ave.

*Phillipsburg*
Carl B. Williams Co.
154 South Main St.

*Red Bank*
Bradleys Radio Service
Newman Springs Rd.

*Trenton*
Allen & Hurley
25 South Warren St.

## NEW YORK

*Albany*
E. T. Taylor Co.
465 Central Ave.

*Binghamton*
Broome Dist. Co.
221 Washington St.

*Brooklyn*
Electronic Equipment Co. Inc.
1460 Bushwick Ave.
Green Radio Distr.
482 Sutter Ave.
Hornbeam Distributing Co.
1639 Bedford Ave.

*Buffalo*
Buffalo Radio Supply
219 E. Genesee St.
Dymac Inc.
2329-31 Main St.
Scheller Radio Co.
269 Oak St.
Standard Electronics Dist. Co. Inc.
1497-1501 Main St.

*Cortland*
C. A. Winchell
37 Central Ave.

*Croton-on-Hudson*
WRO Radio Laboratory
6 Hamilton Ave.

*Elmira*
Fred C. Harrison Co.
108 W. Church St.

*Hempstead*
Standard Parts Corp.
235 Main St.

*Jamaica*
Harrison Radio Corp.
172-31 Hillside Ave.
Norman Radio Dist.
94-29 Merrick Rd.
Peerless Radio Dist. Co.
92-32 Merrick Rd.

*Jamestown*
Johnson Radio & Electronic Equip.
48-50 Harrison Ave.

*Mount Vernon*
Davis Radio Dist. Co.
66-70 E. 3rd St.

*New York City*
Adson Radio
221 Fulton St.
Arrow Radio
82 Cortlandt St.
Beam Radio
165 Nagle Ave.
Bronx Wholesale Radio
470 E. Fordham Rd.
Blan Radio
64 Dey St.
Douglas Radio Supply Co.
128 Greenwich St.
Eagle Radio
84 Cortlandt St.
Electronic Marketers Inc.
120 Greenwich St.
Federated Purchaser Inc.
80 Park Place
Grand Central Radio
124 E. 44th St.
Harrison Radio Corp.
12 W. Broadway
Harvey Radio Co.
103 W. 43rd St.
Highridge Radio Television & Appl.
340 Canal St.
B. Lar
210 Greenwich
Milo Radio & Electronics
200 Greenwich St.
National Radio Dist.
899 Southern Blvd.
Niagara Radio Sup. Corp.
160 Greenwich St.
Newark Electric Co.
224 Fulton St.
Newark Electric Co. Inc.
250 W. 55th St.
North Radio Co., Inc.
172 Washington St.
Radio Wire Telev. Inc.
100 Sixth Ave.
Radionic Equipment Co.
170 Nassau St.
Risco Electronics
22 Warren St.
Sun Radio
122 Duane
Wilco Radio Dist.
383 E. 138th St.

*Olean*
Wanamaker & Redstone
413 Third Ave.

*Poughkeepsie*
Chief Electronics
104 Main St.

*Rochester*
Hunter Electronics
258 East Ave.
Masline Radio & Electric Equip.
192-196 Clinton Ave. N.
Rochester Radio Sup. Co.
114-118 St. Paul St.

*Syracuse*
Broome Dist. Co.
912 Erie Blvd. E.
Stewart W. Smith Inc.
325 E. Water St.
Syracuse Radio Supply
238-40 W. Willow St.

*White Plains*
Westchester Electronic Sup. Co.
333 Mamaroneck Ave.

## NORTH CAROLINA

*Charlotte*
Henry V. Dick & Co. Inc.
311 E. 5th St.

*Goldsboro*
Signal Radio Supply
124 S. James St.

*Raleigh*
Supreme Radio Suppliers
103 W. Hargett St.

*Winston-Salem*
Dalton-Hege Radio Sup. Co.
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*Fargo*
Fargo Radio Service
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Radio Equipment Co.
624 2nd Ave. N.

## OHIO

*Ashtabula*
Morrison's Radio Supply
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*Akron*
Brighton Sporting Goods Corp.
110 E. Market St.

*Cincinnati*
Chambers Radio Supply
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Herrlinger Dist. Co.
15th & Vine St.
Holub & Hogg
500 Reading Rd.

*Cleveland*
Northern Ohio Labs.
2073 W. 85th St.
Radio Surplus Co.
648 Prospect Ave.
Strong, Carlisle & Hammond Co.
2801 St. Clair Ave.
Winteradio Inc.
1468 W. 25th St.

*Columbus*
Electronic Supply Corp.
219 N. 4th St.
Whitehead Radio Co.
120 East Long St.

*Warren*
Radio Specialties
136 S. Pine St.

*Dayton*
Standard Radio & Elect. Prod.
135 E. 2nd St.

*Kent*
Kladag Radio Labs.
105 W. Erie St.
Ferguson Radio Inc.
14553-51 Madison Ave.

*Marion*
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*Steubenville*
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210 Cherokee St.
Hausfield Radio Supply
230 N. 4th St.

*Toledo*
Lifetime Sound Equip. Co.
911-913 Jefferson

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*Lawton*
Reynolds Radio Supply
909½ C Ave.

*Oklahoma City*
Electronic Supply Co.
212 N. W. 10th St.
Radio Supply Inc.
724 N. Hudson, Box 597

## OREGON

*Portland*
Appliance Wholesalers of Oregon
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Harper-Meggee
1506 N.W. Irving

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*Altoona*
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Kennedy Radio Supply
1500 Fifth Ave.

*Beaver Falls*
Reliable Motor Parts Co.
1700 7th Ave.

*Euston*
Radio Electric Service Co.
916 Northampton St.

*Erie*
Jordan Electronic Co.
201 W. 4th St.
Warren Radio
12 & State Sts.

*Harrisburg*
D. & H. Distributing Co., Inc.
311 S. Cameron St.

*Lancaster*
Eshelman Supply Co.
110 N. Water St.

*Philadelphia*
A. G. Radio Parts Co.
3515 N. 17th St.
Almo Radio
509 Arch St.
Flanagan Radio Corp.
N.E. Cor. 7th & Chestnut
Herbach & Rademan Co.
522 Market St.
M. & H. Sporting Goods Co.
512 Market St.
Radio Electric Service Co.
7th & Arch Sts.
3145 North Broad St.
5133 Market St.
Warner Radio Co.
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632 Grant St.

*Scranton*
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Fred P. Pursell
550 Wyoming Ave.

*Sharon*
Helges Bros. Inc.
1344 E. State St.

*York*
J.R.S. Distributors
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1071 Union Ave.
Radio & Electronic Supply Co.
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Shobe Inc.
1117 Union Ave.

*Nashville*
Frost Electric Inc.
1922 West End Ave.

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410 S. Jackson

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*Dallas*
All-State Dist. Co.
2405-07 Ross Ave.
R. C. & L. F. Hall Inc.
2123 Cedar Springs
Southwest Radio Sup.
1820 N. Harwood

*Fort Worth*
Ft. Worth Radio Sup. Co.
1201 Commerce
The Electronic Equip. Co.
301 E. 5th St.

*Galveston*
R. C. & L. F. Hall Inc.
1803 Tremont

*Houston*
R. C. & L. F. Hall Inc.
1306 Clay St.
Sterling Radio Prod. Co.
1602 McKinney

*Laredo*
Radio & Electronics Supply Co.
1219 Lincoln St.

*Lubbock*
R & R Supply Co. Inc.
706 Main St.

*Port Arthur*
Lapham Radio Co.
309½ Procter St.

*San Antonio*
Mission Radio Inc.
814 So. Presa St.
Tom Hopkins Radio
324 Nacogdoches St.
R. L. Ross Co.
118 7th St.
South Texas Radio Supply Co.
445 E. Commerce

*Tyler*
Radio Service Supply Co.
111 University Place

*Waco*
The Hargis Co., Inc.
1305 Austin Ave.

## UTAH

*Ogden*
Ballard & Carter Co.
203 24th St.

*Salt Lake City*
O Laughlin's Radio Supply Co.
113 E. Broadway
Radio Supply Co.
45 E. 4 South

## VIRGINIA

*Norfolk*
Ashman Distributing Co.
807 Granby St.
Radio Parts Dist. Co.
128 W. Olney Rd.
Radio Supply Co.
711 Granby St.

*Richmond*
Johnston Gasser Co.
1402 E. Main St.

*Roanoke*
H. C. Baker Sales Co.
19 W. Franklin Rd.
Leonard Electronic Supply Co.
106 Second St. S.W.

*Salem*
Richie Radio Supply
306 E. Main St.

*Staunton*
Southern Electric Corp.
14 E. Johnson St.

## WASHINGTON

*Bellingham*
Waitkus Supply Co.
110 Grand Ave.

*Seattle*
Harper-Meggee
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Western Electronic Supply Co.
2609 First Ave.

*Spokane*
Columbia Electric & Mfg. Co.
P. O. Box 1441 S.

*Tacoma*
C. & G. Radio Sup. Co.
123 Wall St.
714 St. Helens Ave.
A. T. Stewart Co.
743 Broadway
Wible Radio Supply
909 Tacoma Ave.

## WEST VIRGINIA

*Clarksburg*
Tronton Radio Co.
791-93 W. Pike St.

*East Charleston*
Hicks Radio Supply
10 Virginia St.

*Parkersburg*
John A. Cox Radio Supplies
554 7th St.

*Wheeling*
General Distributors
21 10th St.

## WISCONSIN

*Appleton*
Valley Radio Dist.
518 N. Appleton St.

*Chippewa Falls*
Bushland Radio Spec.

*Green Bay*
Neslo Electronic Dist.
312 N. Chestnut

*Hudson*
J. H. Larson Co.
109 Walnut St.

*LaCrosse*
Stark Radio Supply Co.
131 S. 6th St.

*Madison*
Satterfield Radio Supply Inc.
326 W. Gorham St.

*Manitowac*
Harris' Radio Company
115 No. 10th St.

*Milwaukee*
Acme Radio Supply Corp.
510 N. State St.
Acme Radio Supply
310 W. State St.
Central Radio Parts Co.
1723 W. Fond du Lac Ave.
Electro-Pliance Dist. Inc.
2458 W. Lisbon Ave.
Electronic Supply Corp.
436 W. State St.
Taylor Electric Co.
112 N. Broadway

*Racine*
Standard Radio Parts Co.
1244 State St.

## WYOMING

*Casper*
Golden Power Oil & Supply Co.
260 S. Center

*Cheyenne*
Houge Radio & Supply Co.
2008 Carey Ave.

## CANADA

Radio Supply Co. Ltd.
Grd. Floor McLeod Bldg.
Edmonton, Alberta

Western Radio Supply Co.
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Hamilton, Ontario

Delroy Sales Ltd.
203 Rideau St.
Ottawa, Ont.

Electronic Supply Co. (Ottawa Ltd.)
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Ottawa, Ont.

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amplifier plate (as in Fig. 3-b) the cathode needs only 30 to 50 volts. Under these circumstances, the end of the high-voltage unit may be grounded directly, since the 30 to 50 volts bias needed is negligible in comparison to the remainder of the voltage.

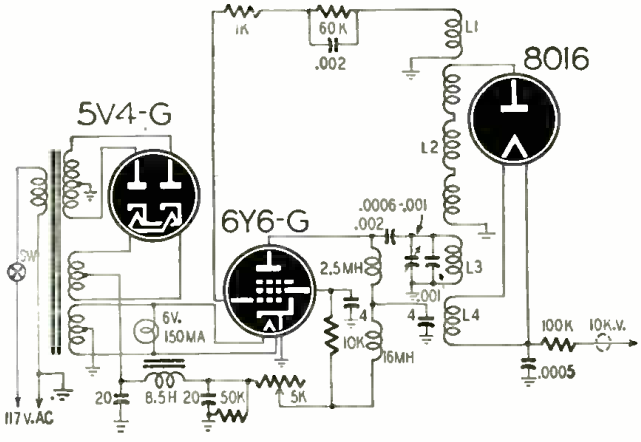



Fig. 4—An r.f. power supply. The filament also operates on r.f.

## R. F. power supplies

As we increase the voltages of the high-voltage supply, the cost and the bulkiness of the unit also increases, but at a much greater rate. Projection tubes, which require voltages as high as 27,000, would—if the previous conventional design were followed—lead to a unit far out of proportion to the rest of the set. Two types of power supplies promise at least partial relief from the cost and bulkiness of the conventional supply. Both units develop high-frequency voltages, which are rectified to obtain the d.c. high voltage. The formation of the voltages, however, differs considerably in each system.

The first type of r.f. power supply is shown schematically in Fig. 4. A 5V4-G full-wave rectifier operating from the 60-cycle line supplies the 300 to 350 volts necessary to drive the 6Y6-G oscillator tube. The oscillator itself is a conventional tuned plate, untuned grid tickler coil arrangement. The secondary coil L2 contains more turns than the tuned primary, and steps up the oscillator voltage to approximately 10 kv. Voltage step-up is set at half maximum obtainable to provide high efficiency and good voltage regulation.

The feedback coil L1 is coupled to L2 instead of L3 directly, for greater stability. See Fig. 5. The oscillator tube is biased for Class C operation, resulting in relatively low plate loss and greater efficiency. The 6Y6 (or 6L6) beam power tube can develop 15 watts of power with 80 per cent efficiency at 350 volts, The screen-grid voltage is made self-regulating by a series resistor, and during operation varies from approximately 65 volts at no load to 120 volts at full load.

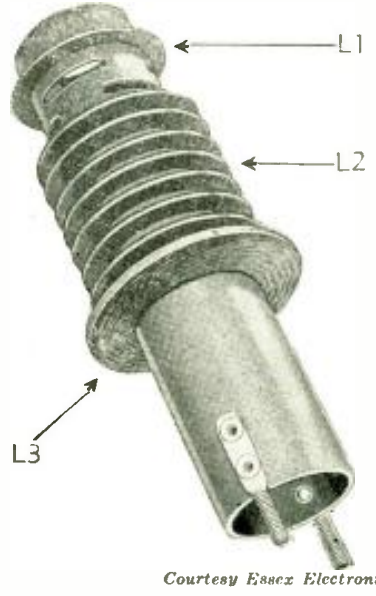
The high-voltage rectifier is a half-wave unit employing an especially designed 8016 tube. Standard high-voltage rectifiers, such as the 2X2 and 2V3-G, require considerable heater power (3.1 watts for the 2X2 and 12.5 watts for the 2V3-G). The 8016, however, takes only 0.25 watt. This can be supplied directly from the oscillator. At the relatively high frequency of the oscillator, approximately 300 kc, a 500-μμf condenser and a 100,000-ohm resistor provide filtering.

The second high-frequency power supply is based on an idea conceived by P. T. Farnsworth about 1930. Only recently, however, has a good practical model been evolved. The voltage induced in any inductance is governed by the relationship

$$e_1 = L\frac{di}{dt}$$

As the time interval $dt$ is made smaller, $e_1$ becomes greater. In the horizontal deflection coils, the retrace interval $dt$ is quite small and a large pulse of voltage is produced. By rectifying the pulse, voltages to 30 kv can be obtained.

A circuit schematic of an "inductive kick" power supply is shown in Fig. 6. The horizontal-sweep amplifier, an 807, is driven by the saw-tooth voltages which are developed in the preceding sweep oscillator. The saw-tooth plate current of the 807, flowing through a portion of the transformer T1, develops a large inductive pulse during the retrace period. Two 8016 rectifier tubes are connected in cascade across the full primary. These tubes rectify the pulses




*Courtesy Essex Electronics*

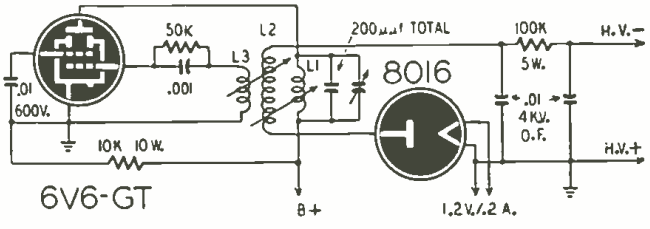
Fig. 5—The high-voltage step-up transformer.

*(Continued on page 69)*

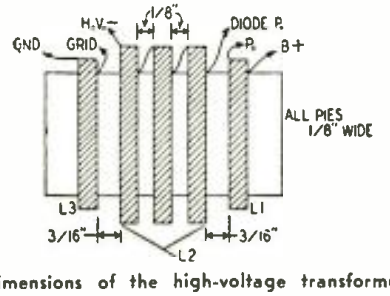
# HIGH VOLTAGE POWER SUPPLY

## *A 2,000-volt r.f. low-current unit*

THE high-voltage, low current power supplies required for operation of cathode-ray tubes in large oscilloscopes and in television receivers are costly. High-voltage insulation in power transformers and filter condensers adds to the bulk and weight of the supply. An r.f. power supply is less cumbersome and more economical. This advantage increases in proportion to the output voltage. An interesting r.f. power supply was designed experimentally by the Amalgamated Wireless Valve Co. (Australia). This circuit uses a 6V6-GT in a self-excited tuned-plate oscillator circuit operating at a frequency of approximately 1 megacycle. The frequency of operation is determined by the inductance of the output coil L2, tuned by its distributed capacity and the stray capacity of the circuit wiring. The plate circuit is resonated to the operating frequency by L1 tuned by parallel fixed and variable capacities totaling 200 μμf. The grid coil L3 provides sufficient feedback voltage to the grid to sustain oscillations.




Circuit of the r.f. high voltage supply. Coil system is shown below.




Dimensions of the high-voltage transformer.

The r.f. voltage in the plate coil is transferred to L2 with a step-up ratio of 8.3 to 1. This produces about 2000 volts which is applied to the high-voltage rectifier. This voltage is rectified in a half-wave circuit and filtered in an RC filter consisting of a 100,000-ohm resistor and two 0.01-μf 4,000-volt oil-filled condensers. Although an 8016 rectifier is shown, an 879, 2Y2, or a 2X2 may be used with changes in the filament transformer.

After the coil has been wound, it closely resembles the harmless oscillator coil of a broadcast receiver. This appearance should not be deceiving because the high voltages across L2 are sufficient to cause serious injury or DEATH.

The core of the coils is a polystyrene rod ¾ inch in diameter and about 1½ inches long. The secondary winding consists of a total of 500 turns of No. 9/44 Litz wire wound in three pies to prevent high-voltage breakdown between turns. The feedback and plate windings, each consisting of 60 turns, are pie-wound on opposite ends of L2. All dimensions are given in the figure.

The coils should be shielded with a coil shield that will allow *at least* ½-inch spacing from the nearest conductor. All leads should be kept as short as possible and sharp bends in the high-voltage wiring should be avoided to prevent power losses through corona discharges.

The high-voltage output of the unit may be adjusted roughly by varying the screen-grid voltage of the oscillator tube. Precise adjustments are made with the tuning condensers across L1.

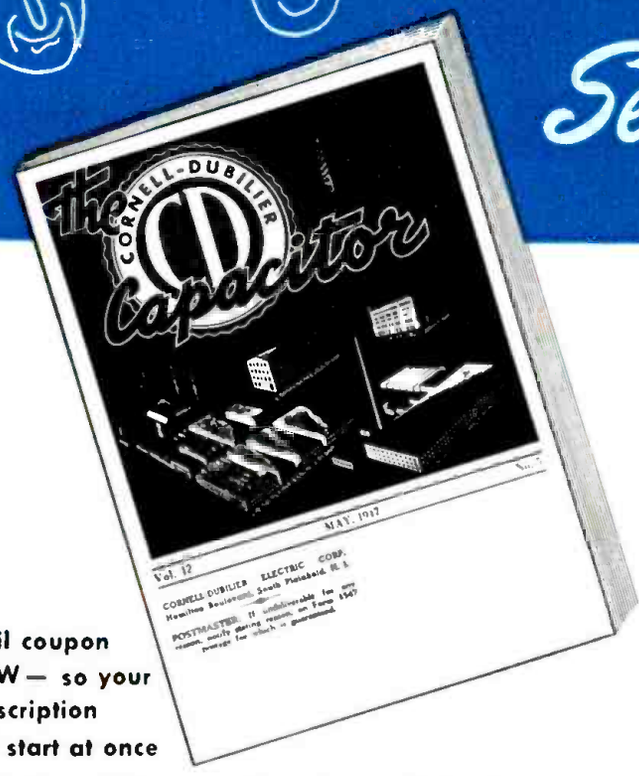
The positive output of this circuit is grounded. If grounded negative is required, 4,000-volt insulation should be used on the filament transformer, or a battery, well insulated from ground, may be employed.

This circuit appeared in the January-February, 1946, issue of *Radiotronics Technical Bulletin*, published in Australia.

### RADIO TERM ILLUSTRATED


**Signal Generator**
*Suggested by: W. H. Althouse, Bainbridge, Ohio*

# Servicemen...

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## A 300-OHM FOLDED DIPOLE

The folded-dipole antenna has definite advantages over the straight dipole. It covers a wider frequency range and its impedance is increased to 300 ohms so that it can be connected directly to standard 300-ohm transmission line. However, it is a more elaborate antenna than the straight dipole, and is more difficult to make.

The construction of a folded dipole may be considerably simplified without sacrifice of efficiency by using a length of 300-ohm line for the antenna itself. Many amateurs are using such an antenna for receiving and transmitting on high-frequency bands, and the same design makes a very effective FM or television receiving antenna. Only about 5 feet of line is necessary for the new FM band which is now being incorporated in many receiver models. Reception is at least as good as with a straight dipole, and it is often much more convenient to match to the 300-ohm line.

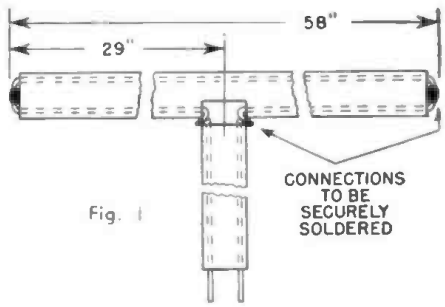


Fig. 1

Fig. 1 shows how the antenna is made. The 300-ohm twin-lead transmission line may be type K-1046 (Federal Telephone and Radio) which is especially suitable because of its flexibility, weather-resistance, and very low loss. A 58-inch length of line is shorted at both ends after stripping the insulation as shown. The ends are twisted and soldered. Then one of the conductors

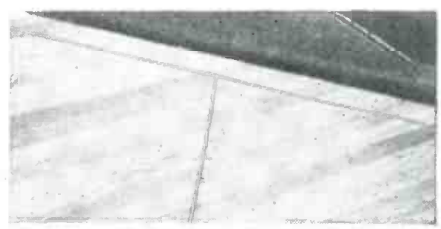

*Photo courtesy Federal Telephone and Radio Corp.*

Dipole is installed on the floor under a rug.

is cut at its center and the insulation stripped to expose the two ends which are soldered to the transmission line. The distance between the two ends is equal to the distance between conductors of the twin lead. All connections should be lacquered after soldering.

The folded dipole should be erected as high as possible and away from obstructions. It is mounted to any suitable insulator such as wood and is supported at the two shorted ends. In some cases sufficient signal strength may be available to use an indoor antenna. The folded dipole then can be placed under a rug or behind furniture, as shown in the photo.

new

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# TECHNOTES

. . . . SPARTON MODEL 667

When the full-wave output i.f. transformer opens or burns out it is almost impossible to get replacements. I use a standard 456-kc i.f. transformer with its secondary loaded with two 1-megohm resistors in series. A tap at the junction of the resistors provides a source of a.v.c. voltage. The resistors load the transformer sufficiently enough to permit it to be tuned to 345 kc.

GEORGE E. BROWN,
*Lonaconing, Md.*

. . . . ZENITH 6DO30E

On this set, the tuning condenser is insulated from the chassis by mounting it on the dial. The dial sometimes permits the condenser to sag and make contact with the chassis at the rear, causing the set to stop playing. This may be cured by cementing a piece of sponge rubber to the chassis just under the rear of the tuning condenser.

HAROLD L. BLISS,
*Francesville, Ind.*

. . . . AIRLINE 04BR511A AND 04BR512A

Persistent audio oscillation and feedback that does not respond to ordinary methods can be cured by replacing the 12SQ7 tube. Try several tubes. It will not be necessary to discard the offending tube, as it will usually work well in other sets.

ARTHUR L. JOHNSON,
*Hutchinson, Kansas*

. . . . SMALL COMBINATIONS

Cabinets of many table model combinations are constructed so that needles and other trash can slide between the player panel and the cabinet wall and fall into the speaker assembly, lodging between the voice coil and the pole piece. This often causes a loss in volume and distortion. After cleaning the speaker, make a cover of light cloth and place it around the speaker. This protects the speaker from dust and other foreign matter. (A speaker cover of this type is standard equipment on many European sets.)

McCLESKEY RADIO CO.,
*Baton Rouge, La.*

. . . . SPEAKER REPAIRS

When replacing speaker cones, it is often difficult to remove dirt and filings from around the pole piece. I find it helpful to take a piece of scotch tape and probe around the pole piece. Foreign matter will adhere to the sticky side of the tape, leaving the air gap nice and clean.

JEROME COOPERMAN,
*New York, N. Y.*

. . . . EMERSON 1940-1941 MODELS

Many of these models use 25AC5 output tubes which are difficult to replace. I tie the No. 3 and No. 4 pins together at the socket and use a 25A6. No other changes are necessary since the filament voltages and currents are identical.

CHESTER T. MARTOWICZ,
*New York, N. Y.*

# new

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## MULTIVIBRATORS

*(Continued from page 25)*

is triggered externally. The previously described circuit may be "locked in" by an external source, but will continue to function when the excitation is removed. Fig. 5 illustrates a single-ended or one-kick multivibrator. The name is derived from the fact that such a circuit will complete one cycle of operation with each triggering pulse. When the triggering pulse is removed, the oscillation ceases.

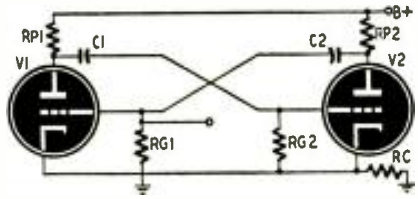


Fig. 5—Circuit of a one-kick multivibrator.

Fig. 5 is similar to Fig. 1, with one exception. In Fig. 5, V1 is normally cut off while in Fig. 1 both tubes are normally at zero grid bias. In the latter circuit, bias for V1 is provided by the voltage drop across RC caused by V2 current. V2 is conducting because the grid is connected directly to the cathode through RG2. Due to this bias, V1 will remain cut off whenever V2 is conducting and oscillation will stop.

### The one-kick multivibrator

Fig. 6 is a time-plot analysis of one-kick multivibrator operation. The resting potential on the plate and grid of each tube is indicated on each oscillogram by a dot. A positive pulse is applied to the grid of V1, which is normally below cut-off. The following operation is almost identical to the second half-cycle of the circuit in Fig. 1. V2 grid is driven below cut-off by the multivibrator action and the cathode bias on V1 disappears, since V2 is no longer conducting. The charge on C1 leaks off through RG2, and, at T1, V2 begins to conduct, once again completing the cycle. Current flows through RC and the resulting voltage drop biases V1 grid below cut-off as before. The circuit will remain in this original condition until another positive triggering pulse is applied to V1 grid.

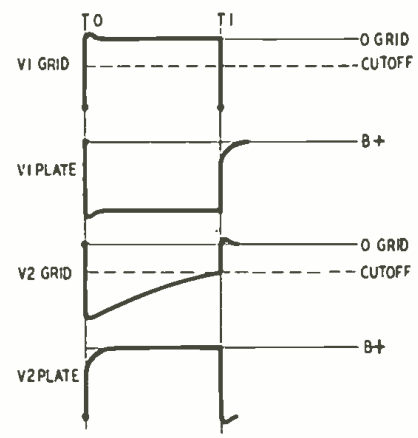


Fig. 6—Analysis of one-kick vibrator action.

From Fig. 5 it is seen that only one slow phase is present in the one-kick-multivibrator operating cycle. This slow phase is determined by the RC grid constants of the tube that is cut off during the cycle.

The one-kick multivibrator provides, among other uses, a method of producing pulses of a definite frequency and time duration. For example, in a certain electronic application it is desired to operate a pair of thyratron mercury-vapor rectifier tubes for 500 microseconds and have them inoperative for 1,000 microseconds. Such regulation is easily accomplished by the one-kick multivibrator. The positive pulse from the plate of V2, as shown in Fig. 5, is applied to the thyratron grids, causing the tubes to conduct for length of time from T0 to T1. This time is limited to

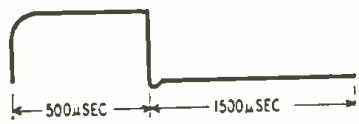


Fig. 7—The multivibrator as pulse generator.

the required 500 microseconds by adjusting RG2 and C1. The necessary wave form is shown in Fig. 7. The total length of the pulse would be 2,000 microseconds, since the negative portion would be 1,500 microseconds. By again referring to formula: $f$ equals $1\lambda t$, we find $f$ must equal 500 pulses per second for our purpose. This will be the frequency of the triggering pulse applied to the multivibrator.

The preceding example illustrates only one of the many possible applications of the multivibrator to electronic circuits. Additional similar applications for industrial and other uses should suggest themselves.

From a more conventional point of view, the multivibrator, as employed in cathode-ray sweep circuits, is of practical interest. This circuit provides one of the better means of producing a high-speed sweep. Such a sweep voltage is required in the television receiver. Fig. 8 illustrates a variation of a multivibrator-type sweep generator that is suitable for extremely high-speed sweep applications. This circuit operates like that of Fig. 5.

Between triggering pulses, while V2 is cut off by the voltage drop across RC, sweep condenser C charges to B-plus

*(Continued on page 96)*

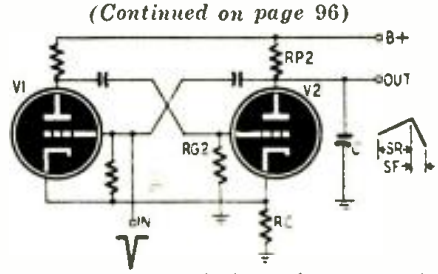


Fig. 8—Adaption to high-speed sweep circuit.

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# New Radio-Electronic Patents

By I. QUEEN

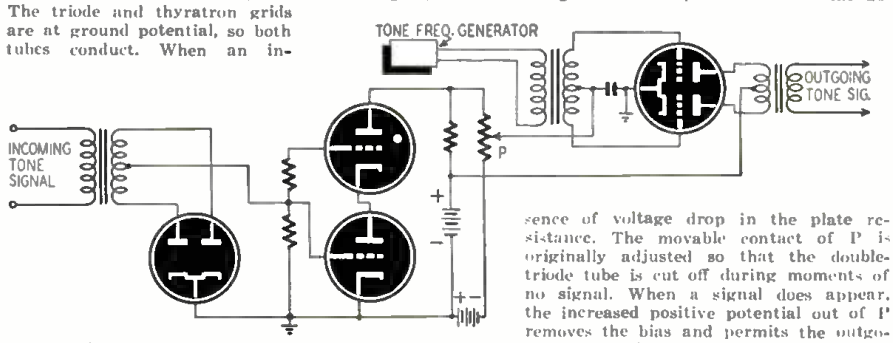
## TELEGRAPH REPEATER

William E. Simpson, S. Ozone Park, N. Y.
Patent No. 2,404,754

It is often necessary to receive high-speed telegraph signals on one channel and transmit them on a different channel. This may be done electronically with the circuit shown.

Assume first that no signals are coming in. The triode and thyratron grids are at ground potential, so both tubes conduct. When an incoming signal appears, the output of the full-wave rectifier is applied to the grids as a negative voltage, cutting off both tubes. The triode allows the thyratron to de-ionize rapidly because both tubes are in series.

During the time that the thyratron is cut off, the voltage drop across potentiometer P is higher than during conducting periods, due to the absence of voltage drop in the plate resistance. The movable contact of P is originally adjusted so that the double-triode tube is cut off during moments of no signal. When a signal does appear, the increased positive potential out of P removes the bias and permits the outgoing tone signal to be transmitted. This system allows keying of the local generator rapidly and in accordance with the incoming telegraph signal.




## RADIOTELEGRAPH A.G.C.

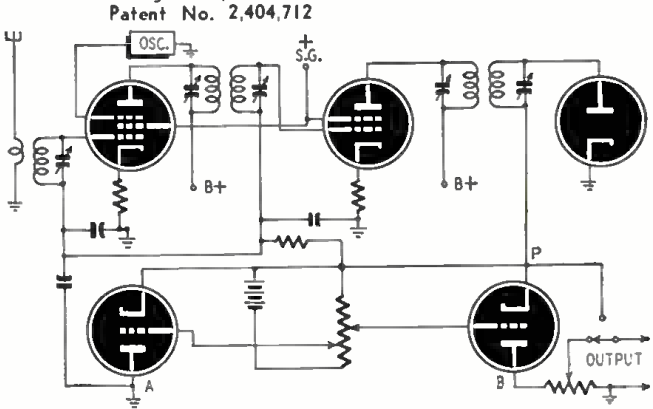
R. Lee Hollingsworth, Riverhead, N. Y.
Patent No. 2,404,712

The requirements for automatic gain control circuits are different for code reception than for "phone." In the former case a sudden burst of static or increased signal strength may block the receiver and cause the loss of the first few characters of a high-speed code transmission. Also, the charge on the condensers of an a.g.c. system leaks off during spaces between signals so that the gain of the receiver varies.

The difficulties are eliminated in the circuit shown. The signal is heterodyned, amplified and rectified in a conventional three-stage circuit. Note, however, that the amplifier grids are isolated unless either tube A or B conducts. These tubes have special functions.

The detector output flows through B and develops an a.g.c. voltage at point P. B conducts only when a signal is received, and may be adjusted for delayed a.g.c. Tube A is adjusted to be cut off without signal input. It conducts only when a *powerful* signal or surge of static appears. During these intervals the tube bypasses current and prevents the receiver from blocking.

Due to amplifier grid isolation, this receiver maintains its sensitivity without regard to the length of spaces between signals.




## TIME-INTERVAL MEASUREMENT

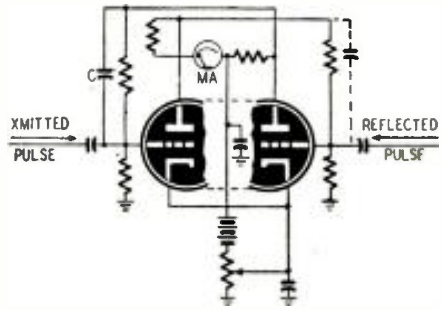
William S. Wilson
(Assigned to Radio Corp. of America)
Patent No. 2,412,111

This circuit greatly simplifies the equipment needed to measure short time intervals between pulses. It may be required, for example, to measure the interval between a transmitted pulse from an aircraft and that of the echo received from ground (as used in altimeters to determine the height of the airplane above ground).

Two triodes are used in a multivibrator circuit. They may be in separate envelopes or a single unit such as a 6J6. Transmitted pulses are applied to the first grid as negative potentials through a coupling condenser. Such a pulse cuts off plate current and causes the voltage to rise sharply. The abrupt change produces a positive voltage on the second grid and therefore increases the plate current of the second tube and causes a sudden decrease of plate voltage. This negative pulse is fed back to the first grid through a voltage-dividing network, charging the condenser C and thus maintaining the tube at cut-off.

The echo pulse is applied to the second grid. It causes plate cut-off and produces a positive pulse which also affects the first grid. The first tube then returns to its normal conducting state and is ready to receive the next pulse.

A d.c. voltmeter measures the plate voltage of the first tube. It assumes an average indication and therefore measures the time during which the first tube is cut off. The shorter the time between transmitted and reflected pulses, the shorter the interval during which there is a high plate voltage, and therefore the lower the average voltage reading. Note that no condenser is used in the plate circuit of the first tube. The second grid is affected by the weak reflected pulse and not by a charge left on a condenser.



# Long-distance Television is twenty years old

*At the 1927 demonstration, Dr. Herbert E. Ives explained the television system developed in Bell Telephone Laboratories.*

APRIL 7 is a notable day in communication history, for on that day in 1927 was the first demonstration of television over long distances. Large-scale images were flashed from Washington, D.C., by wire and from Whippany, N.J., by radio to a public demonstration in New York City. "It was," said a newspaper, "as if a photograph had suddenly come to life and begun to smile, talk, nod its head and look this way and that."

That was the first of many public demonstrations, each to mark an advance in the television art. In 1929 came color television, and in 1930 a two-way system between the headquarters buildings of A. T. & T. and Bell Laboratories. When the first coaxial cable was installed in 1937, television signals for 240-line pictures were transmitted between Philadelphia and New York and three years later 441-line signals were transmitted. By May, 1941, successful experiments had been made on an 800-mile circuit.

End of the war brought a heightened tempo of development. Early in 1946 began the regular experimental use of coaxial cable for television between New York and Washington, and a few months later a microwave system for television transmission was demonstrated in California.

Transmission facilities will keep pace as a great art advances to wide public usefulness.

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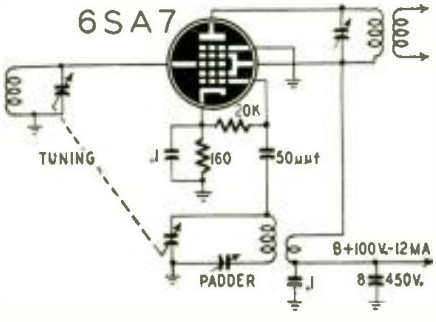
## MIXER CIRCUIT

*I would like to replace the 6A7 oscillator-mixer in my receiver with the single-ended 6SA7. Will you kindly draw a circuit showing how this tube may be used without electron-coupled oscillator coils? — O.G.F., Oakland, Calif.*

**A.** The 6SA7 may be used with your present oscillator coil. Connections are shown in the drawing.




## COIL DATA

*I would like to have coil-winding data for a superhet receiver tuning from 18 to 42 mc. I am using a 6SK7 r.f. stage, and a 6SA7 oscillator-mixer. I have some ¾-inch low-loss forms that I would like to use.—J.W., Tripp, S. Dak.*

**A.** Here is the coil data that you desire. It is designed to cover the range you require when using 450-μμf condensers and a 456-kc i.f. stage.

The secondary of the antenna coil consists of 3½ turns of No. 14 enamel wire spaced to cover about ¾ inch. The primary is 1 turn of No. 28 d.c.c. wire interwound with the secondary. The detector coil secondary is identical with that of the antenna coil. The primary of this coil consists of 2 turns of No. 28 d.c.c. interwound with the ground end of the secondary. The secondary of the oscillator coil consists of 3½ turns of No. 14 enamel spaced to ¾ inch with a 4-turn plate winding of No. 36 s.s.c. interwound.

It is not an easy task to wind and track three stages over this band. It will be necessary to experiment with the spacing of the grid windings to get good tracking throughout the range.

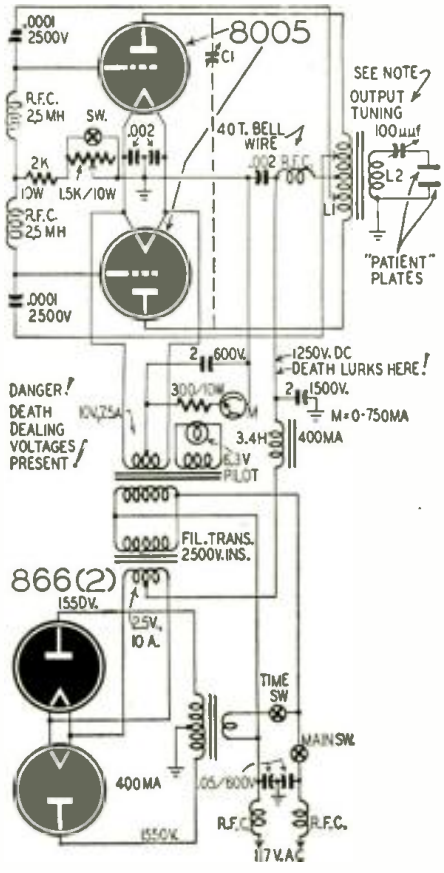
## RADIO-THERAPY CIRCUIT

*Please print a diagram of a diathermy or radio-therapy machine such as the one described by Dr. Lee de Forest in the August 1943 issue. This should be powerful enough to produce artificial fever and the frequency should be variable between 5 and 18 meters.—J.J.S., Sharon, Pa.*

**A.** A radio-therapy circuit is shown to the right. When properly adjusted, the power will be approximately 300 watts.

As in the case of most circuits of this nature, some experimenting is necessary to obtain the best results. The grid and cathode resistors and the grid excitation taps should be adjusted for optimum performance.

L1 consists of 15 turns wound on a 2½-inch form spaced to 4 inches. L2 is wound with 4 turns spaced to 1¼-inch long. This coil should be well insulated and placed on the inside of L1. Both coils are wound with ⅛-inch copper tubing.




## THREE-TUBE RADIO

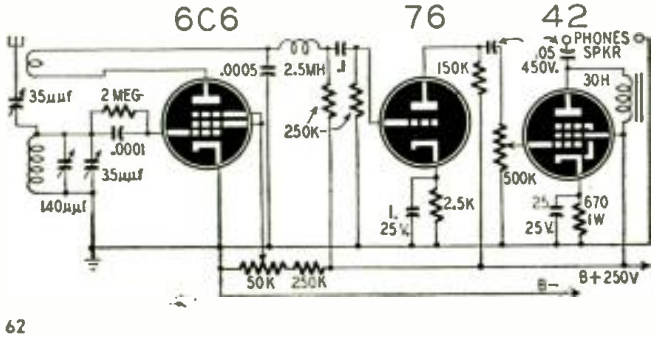
*Kindly print a circuit of a three-tube regenerative receiver using a 6C6 detector, 76 first audio, and 42 or 6F6 output stage. I have standard plug-in coils for use with a 140-μμf tuning condenser, a small magnetic speaker, and a 250-volt power supply.—L.J.S., Donora, Penn.*

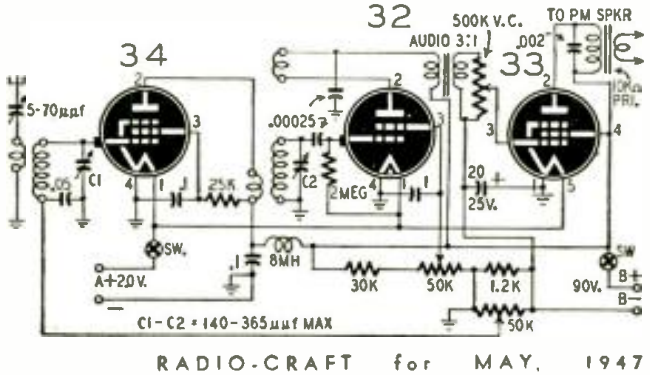
**A.** Here is a circuit that should meet your specifications. Regeneration is controlled in the 6C6 screen grid circuit. If band spread is desired, a 35-μμf trimmer may be connected across the main tuning condenser as shown.

## SET FOR 2-VOLT TUBES

*Please print a circuit of a small receiver using a t.r.f. amplifier, a regenerative detector, and a power amplifier stage. I have a 32, a 33 and a 34. —G.A.S., St. Michael, B. W. I.*

**A.** This circuit uses the tubes you specify. Regeneration is controlled in the screen-grid circuit of the detector and the r.f. gain in the grid return on the 34. Standard four-prong coils are used in the r.f. stage and six-prong in the detector circuit.



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The ideal way of indicating the position of rotary beams, wind indicator, etc. (400 cycle). Line cord and instructions for 110 VAC operation furnished.—Cat. No. SM-100. 2 for $3.95

## R44/ARR-5 HIGH FREQUENCY

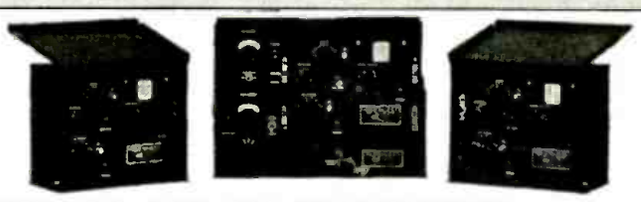
receiver. Patterned after S-36A by Hallicrafters. Receives FM and AM signals in the spectrum between 28 and 145 megacycles. Circuit has 14 tubes including voltage regulator for high frequency oscillator. Has two position selectivity control. Contains no internal power supply. Has acorn tubes RF., Osc., and Mixer. Complete with components for power supply including transformer, choke, filter condensers, and rectifier tube. ..... $100.00

**ALL ORDERS F.O.B. DETROIT**

**MINIMUM ORDER — $2.00**

**Mich. Sales add 3% Sales Tax**

*Write for* ***FREE*** *Bulletin*



## NEW BC 223 AX TRANSMITTER

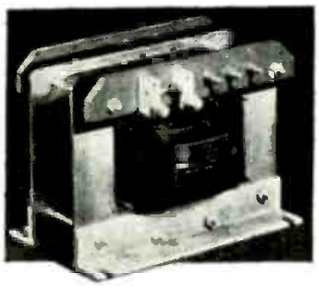
801 Oscillator and 801 Power Amplifiers, 2-46 Modulators and 1-46 Speech Amplifier 4 Xtal Frequencies and Master Oscillator on selector switch. 10 to 30 watts output. Tone Voice or C. W. Mod. Ideal for 80 meter band. Comes with 3 coils TU 17A 2000-3000 Kc. TU 18 3000-4500 Kc. TU 23 3500-5250 Kc. Black wrinkle case. Includes 2 separate cases to store extra coils. Frequencies chart and tubes included, packed in original cases, less crystals at this low price. $29.95

## BC 654 TRANSMITTER & RECEIVER

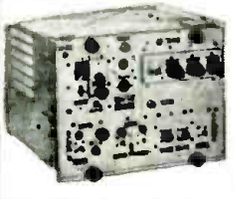
Frequencies range 3800-5800 Kc.—calibration every 10 Kc.—with crystal oscillator checked every 200 Kc.—power output 17 watts, voice or CW. Less tubes ..... $7.95

## 1 KW MODULATION TRANSFORMER

$14.95 BUY NOW AND SAVE

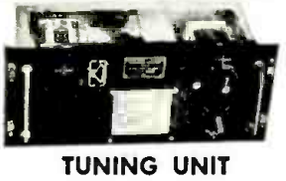


RCA modulation transformer is conservatively rated at 550 Watt audio to modulate that new KW rig.
Really rugged construction with protective flashover gaps, which are adjustable. Terminals and gaps are mounted on a "Mycalex" terminal board. The laminations that make up this transformer are of high audio quality and are extremely thin, making it impossible for the core to "chatter or talk."
Audio Watts—550 Sec. #1—450 Mils Sec. #2—80 Mils Turns Ratio—Pri: Sec. #1-1:1 Pri: Sec. #2-5:1 Pri: Sec. #2 Tap—25:1.
Impedance Ratio—Pri: #1-1:1 Sec. Pri: Sec. #2-23:1 Pri: Sec. #2 Tap—625:1.
DC Resistance—Pri: 135 ohms Sec: #1, 112 ohms; Sec. #2, 99 ohms.
Transformers insulation tested: Pri. 8000V.; Sec. #1-11,000V.; Sec. #2-2000V. to the rest of the coils and core. Primary center-tapped for Class "B" modulators. Secondary #2 will carry 80 Mils to modulate screens of beam power or screen grid tubes. Primary will match any Class "B" tubes up to 10,000 ohms plate to plate, such as 810's, 75T's, 8005's, ZB120's, 203's, HY51Z's, 211's, 813's, 828's, 805's, 203Z's. Size 9½" wide, 7½" deep, 7¼" high. Heavy channel iron mounting brackets. Weight approx. 40 lbs. Catalog number MT-100.



## BN IFF Transmitter & Receiver

Transmitter and receiver. The famous boat anchor, widely used on 144 MC band. Shipping weight 100 lbs. Your price, less tubes and powertransformer. $14.95



## TUNING UNIT

Turning Unit BC 375. Approx. 65 M.M.F.D. cond., coils, RF chokes dials, ass't'd mica condensers 2500 WVDC. over $50.00 in parts. Cat. No. TU-101 ..... $3.75

## BUTTERFLY CONDENSERS

Type B—frequency range 300 to 1000 megacycles to be used with 368AS door knob tube. Cat. No. BC-2.

95c ea.

## DYNAMOTOR

$9.95

Power supply—inputs 6 or 12 V, output 300 VDC at 160 MA, mounted on base with circuit breakers, relays, interference filter and two 10 ft. cables. U. S. Govt. surplus. Cat. No. DM-101.

## TUBES

| | |
|---|---|
| 813 | 5.45 |
| RK60 | 1.25 |
| VT127 | 2.95 |
| VR150 | .69 |
| 829 | 2.45 |
| 872 | 1.95 |
| 211 | 1.45 |
| 368AS | 4.95 |

IT4
3S4
IS5
6SL7
3Q4
IR5
6SN7
6SA7

**59¢ each**

## HOT SPOT SPECIALS

Ass't resistors ½ watt fully insulated, in popular ohmages. Cat. No. R-5—per 100 ..... $1.49

Ass't mica condensers, Cat. No. C-12—per 100 ..... $1.95

Wafer sockets, 4-5-6-7 and 8 prong. Cat. No. WF-4—per 100 ..... $2.95

12" Utah P. M. Speaker, Alnico #5 with 6F6 output transformer. Cat. No. ST-100 ..... $6.95

Ass't knobs push on wood and plastic. Cat. No. KP-100—per 100 ..... $1.95

6J4 ..... $1.50 6J6 ..... 95c

Johnson sockets #210-25W. Cat. No. JS-210 ..... 49c

955-9004 tubes. Cat. No. T-99 ..... 65c

Sockets for acorn tubes. Cat. No. AT-10 ..... 19c

8-8 MFD 350 WVDC, 20 MFD 150 WVDC. round can. Cat. No. RC-88 ..... 69c

Hallicrafter volume knobs—SX 28 .. 15c

Pots—screw driver shaft, 2 meg., 1 meg., 150M, 50M, 25M, 5M, 2M, 200 ohm—ea. ..... 29c

A 144 MC Radar Osc., uses 15 E or Hy 75. Enclosed silver plated tank with variable coupling. Complete less tube ..... $3.95

Jacks PL 55, PL 68 ..... 15c

Powdered iron slug with Isolantite coil form to match, ideal for broad tuning E.C.O. ..... 25c

Powdered iron ½ slug ..... 10c

1 Meg. Shallcross Acra—Ohm wire wound resistors ±1w 89¢

# HERSHEL RADIO CO.

5249 GRAND RIVER DETROIT 8, MICHIGAN

20% DEPOSIT REQUIRED ON ALL C.O.D. ORDERS

# NEW RADIO·ELECTRONIC DEVICES

## FLAW DETECTOR

General Electric Co.
Schenectady, N. Y.

The new GE flaw detector can continuously detect and count holes, weak spots, and conducting paths in thin materials, such as paper, sheet rubber, sheet mica, varnished cloth, plastic materials, and enamel films on wire during manufacturing processes. It can be applied to sheet materials up to 0.025 inch thick moving as fast as 450 feet

per minute and to wire moving up to 100 feet per minute.

It consists of an electrode assembly through which an adjustable voltage is applied to the material undergoing test, and an electronic circuit which indicates the flow of current through the material when a flaw passes under the electrode.

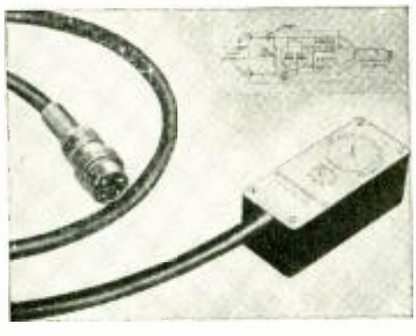
The detector can be made to sound an alarm, operate a recorder, or shut down the manufacturing process when flaws are encountered, and can be arranged to indicate when flaws exceed a given total.—RADIO-CRAFT

## HIGH-FREQUENCY PROBE

Alfred W. Barber Laboratories
Flushing, N. Y.

The Model 29 high-frequency probe is designed with an input capacity of ½ to 1 μμf, which extends its useful range to 500 mc.

It is designed to replace the standard



probe used with the Model VM-27 v. t. v. m. It has one-tenth the sensitivity of the standard probe. Consequently, all measured voltages are ten times the indicated values. With the new probe, the Model VM-27 voltmeter has full-scale ranges of 10, 30, 100, 300 and 1000 volts.—RADIO-CRAFT

## D.C. RELAYS

Leach Relay Co.
Los Angeles, Calif.

The new Type 7064-534 relay is a light-weight solenoid d.c. type.

Designed for feeder type planes and small personal aircraft. It is capable of operating at altitudes up to 50,000 feet and at temperatures between minus 54 C and plus 71 degrees C.

Designated Type 7064-534, this relay is supplied with intermittent duty coils for motor starting applications. Type 7064-534-C has duty coils for battery switching, motor control, aircraft and marine radio switching and lighting.

Contacts are made of special silver alloy, are ⅜ inches diameter, and rated at 100 amperes at 12 volts d.c. or 75 amperes at 24 volts d.c. Contact arrangement is s.p.s.t., double break, normally open. Dependent upon the voltage and operating requirements, the coils have a resistance of from 9.5 ohms to 110 ohms. On intermittent duty, coils consume approximately 15.12 watts and 5.23 watts for continuous duty. Each relay weighs approximately 8½ ounces. —RADIO-CRAFT

## SIGNAL TRACER

Feiler Engineering Co.
Chicago, Illinois

The TS-2 and TS-3 are battery and a.c.-operated signal tracers, respectively, with jacks for attaching phones, r.f.

or audio output meters. The TS-2 uses two 1T4 and one 3Q4 tubes; the TS-3, two 1T4, one 6K6-GT and one 6X5-GT.

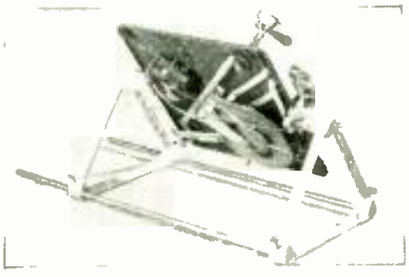
Speaker is a 5-inch PM dynamic (for both models). The probe is 1 inch in diameter, 4⅜ inches long, made of aluminum. It houses the miniature tube, isolating network and associated circuits for the special detector-amplifier. Cable is 3 feet long, heavy rubber-covered.

Size of both models, 8 x 11 x 6 inches. Weight of TS-2 with batteries, 5½ lbs.; of TS-3, 10½ lbs. Case is steel in brown iridescent finish, with beige control panel.—RADIO-CRAFT

## CHASSIS RACKS

Aetna Radio Service
Chicago, Ill.

The *Changerak* and *Chasirak* are chassis racks for record changers and small radios respectively.



The Changerak is quickly adjustable to any size record changer, locks positively in any position, and permits normal operation of the unit while in the rack. The changer may be left in the rack till final delivery, which will prevent damage or change in adjustments.

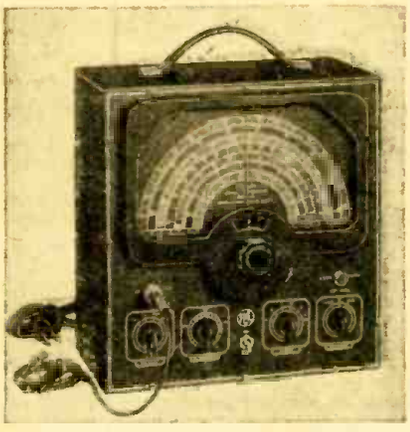
The Chasirak is a small sheet-metal device into which a midget chassis can be clamped quickly. Large radios may be handled by using two Chasiraks.

—RADIO-CRAFT

## SIGNAL GENERATOR

Premier Electronic Laboratories
New York, N. Y.

The Model 570 Signal Generator puts out modulated or unmodulated r.f. on fundamental frequencies from 75 kc to 50 mc, and up to 150 mc on harmonics. The 6J5 oscillator, with air trimmers, feeds into one section of a 6SN7 which is used as a buffer amplifier. The a.f.



oscillator, using the remaining half of the 6SN7, provides 400-cycle modulation with less than 5-percent distortion. Provision is made for applying external audio modulation to the r.f. signal. The power supply operating from a 117-volt a.c. line, uses a 6X5 rectifier.

The dial is direct-reading with a knife-blade pointer driven by a spring-loaded vernier knob. A smaller dial, geared to the main pointer, helps to provide reset calibration accuracy up to 0.5 percent to 1,600 kc and 1 percent on higher frequencies.—RADIO-CRAFT

## MARKED RESISTORS

Ohmite Manufacturing Co.
Chicago, Ill.

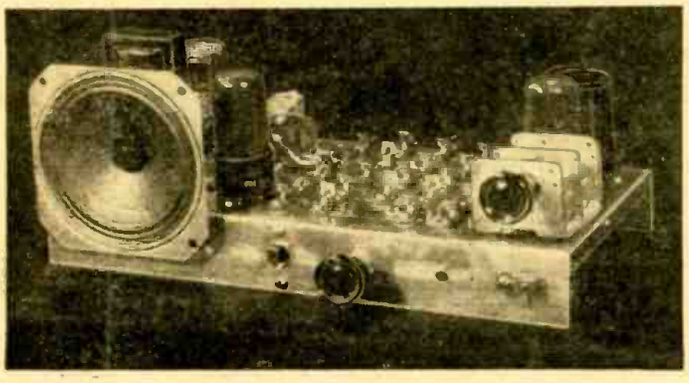
In addition to RMA color coding, these insulated fixed resistors are now individually marked with resistance and wattage for quick, positive identification.

Little Devils are small—size of the ½-watt is only ⅜-inches long by 9-64th-inch diameter—the 1-watt, only 9-16-inch long by 7-32-inch diameter—the 2-watt, 11-16-inch long by 5-16-inch diameter.—RADIO-CRAFT

## ELECTRONICS KIT

Deer & Taylor Co.
Berkeley, California

The Magi-Klips experimenter's kit consists of a chassis on which is mounted a 4-inch PM speaker with output transformer, a 50L6 power amplifier tube, a 35Z5 rectifier tube, a plate circuit relay, a 2-gang tuning condenser, a 12SL7 twin-triode tube and a tuning coil socket. A number of extra resistors and condensers are supplied, as well as two plug-in coils.



Leads from the components are run out to 24 Fahnestock clips, making a large number of combinations possible. Among the circuits which can be made up are a regenerative receiver, home broadcaster, code practice oscillator, photoelectric relay, signal tracer, and remote control relay.—RADIO-CRAFT

## TUBE TESTER

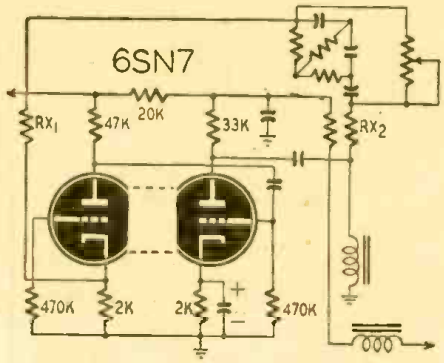
Triplett Electrical Instrument Co.
Bluffton, Ohio

The Model 2425 tube tester provides transconductance readings through a simple measurement directly proportional to Gm and a properly calibrated measuring instrument. No possibility of grid overloading. Short and open tests of every tube element. Gas tests of all tubes.

Metal case, 10 x 10 x 5¾ inches with tan hammered enamel finish, brown trim. Removable cover.—RADIO-CRAFT

## RECORDING AMPLIFIER

In perusing my article: "Small Recording Studio, Part I" I find the resistor values in the 6SN7 voltage amplifier are incorrect as printed. I am enclosing a correct circuit diagram for the amplifier, together with an additional feedback resistor for use if a builder encounters oscillation in the tone control circuit. Rx1 and Rx2 should be from 20 to 30 thousand ohms each.




Good results will follow installation of Rx2 whether there is oscillation in the circuit or not. It should then be about 25,000 ohms.

J. C. HOADLEY,
*West Newton, Mass.*

---

If a television receiver refuses to work well, ten to one the fault is a poor antenna installation, say television service experts.

*Sensational Value!*

# BUILD YOUR OWN VOLT-OHM MILLIAMMETER!!


The model KT 20 kit provides *all* components, including meter, panel, cabinet, resistors, condensers, tip jacks, control, selector switch, copper oxide rectifier, precut wires—in fact every component and part needed to complete the unit.

**THE KIT COMES COMPLETELY ASSEMBLED.** Can be wired in 15 minutes. Components and circuit guaranteed to meet the following specifications:

4 A.C. VOLTAGE RANGES: 0-15/75/300/1500 volts.
4 D.C. VOLTAGE RANGES: 0-15/75/300/1500 volts.
2 A.C. CURRENT RANGES: 0-15/150 MA.
2 RESISTANCE RANGES: 0-10,000 ohms; 0-1 Megohm.

Complete kit including all parts assembled and ready for wiring, circuit diagram, easy-to-follow instructions and detailed operating data for the completed instrument.

*Only* **$9.50**

## *The New Model B-45* SIGNAL GENERATOR

Self-modulated—provides a highly stable signal. RF frequencies from 150 Kc. to 12.5 Mc. on Fundamentals and from 11 Mc. to 50 Mc. on Harmonics. Modulation is accomplished by gridblocking action—equally effective for alignment of amplitude and frequency modulation as well as for television receivers. Self-contained batteries. All calibrations are etched on the front panel.

**Complete, ready to operate ..... $27.75**

## *The New Model 670* SUPER-METER

A Combination VOLT-OHM-MILLIAMMETER plus CAPACITY REACTANCE INDUCTANCE and DECIBEL MEASUREMENTS.

D.C. VOLTS: 0 to 7.5/15/75/150/750/1500/7500 Volts
A.C. VOLTS: 0 to 15/30/150/300/1500/3000 Volts.
OUTPUT VOLTS: 0 to 15/30/150/300/1500/3000 Volts.
D.C. CURRENT: 0 to 1.5/15/150 Ma: 0 to 1.5 Amperes.
RESISTANCE: 0 to 500/100,000 ohms; 0 to 10 Megohms.
CAPACITY: .001 to .2 Mfd., .1 to 4 Mfd. (Quality test for electrolytics).
REACTANCE: 700 to 27,000 Ohms; 13,000 Ohms to 3 Megohms.
INDUCTANCE: 1.75 to 70 Henries; 35 to 8,000 Henries.
DECIBELS: −10 to +18, 10 to +38, +30 to +58.

The Model 670 comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 5½" x 7½" x 3".

**$28.40**

## *The New Model CA-11* SIGNAL TRACER

Simple to operate . . . because signal intensity readings are indicated directly on the meter!

★ SIMPLE TO OPERATE—only 1 connecting cable—NO TUNING CONTROLS.
★ HIGHLY SENSITIVE—uses an Improved Vacuum Tube Voltmeter circuit.
★ Tube and resistor-capacity network are built into the Detector Probe.
★ COMPLETELY PORTABLE — weighs 5 lbs. and measures 5" x 6" x 7".
★ Comparative Signal Intensity readings are indicated directly on the meter as the Detector Probe is moved to follow the Signal from Antenna to Speaker.
★ Provision is made for insertion of phones.

The Model CA-11 comes housed in a beautiful hand-rubbed wooden cabinet. Complete with Probe, test leads and instructions ..... **$18.75**

## *The New Model 450* TUBE TESTER

Speedy operation—assured by newly designed rotary selector switch which replaces the usual snap, toggle, or lever action switches.

SPECIFICATIONS:

★ Tests all tubes up to 117 volts. ★ Tests shorts and leakages up to 3 Megohms in all tubes. ★ Tests both plates in rectifiers. ★ New type line voltage adjuster. ★ Tests individual sections such as diodes, triodes, pentodes, etc., in multi-purpose tubes. ★ Noise-Test — detects microphonic tubes or noise due to faulty elements and loose internal connections. ★ Uses a 4½" square rugged meter. ★ Works on 90 to 125 volts 60 cycles A.C.

EXTRA SERVICE—May be used as an extremely sensitive condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute ..... **$39.50**

**OUR POLICY**

- We do not advertise any unit which is not available for *immediate shipment* from stock.
- Less flowery adjectives, more detailed specifications.
- All units are sold subject to one year guarantee except when components are damaged through misuse.
- We do not solicit orders for any unit that does not meet our requirements for accuracy and honest value. Any item purchased from us is sold with the understanding that it may be returned for full refund after a 10-day trial.

**20% DEPOSIT REQUIRED ON ALL C.O.D. ORDERS**

**GENERAL ELECTRONIC DISTRIBUTING COMPANY**
**98 PARK PLACE, Dept. R. C. 5 NEW YORK 7, N. Y.**

## NEW FRENCH RADIO PARTS

*(Continued from page 40)*

When you put the iron on its support a contact opens which puts an open-wound resistor in series with the heating element. The current decreases, remaining just sufficient to maintain the temperature of the iron.

### Measuring apparatus

Contrary to the practice of previous years, measuring apparatus and test equipment was exhibited at the Parts Show. Before the war France was much behind in this domain. But the technicians have done a very fine job in this field, and the measuring apparatus now presented compares well with foreign production. We particularly noted an impedance bridge—(5) on page 40—which permits the measuring of all the inductors and capacities over a very large range. The leading feature of the instrument is a potentiometer of which the diameter is 7½ inches and which makes it possible to obtain precision results.

The 7½-inch potentiometer described below.

Another highly interesting apparatus is a universal generator—(6) on page 40—which covers radio frequencies 50 kc to 50 mc with an output variable from 1 μv to 1 v, six different modulation frequencies and the possibility of functioning as a multivibrator to facilitate alignment of receivers.

To sum up, the French Radio Industry, despite all difficulties, is developing favorably.

## ANOTHER SPECIALIST

Specialization in radio has reached such a level that even radio thieves are specializing, if a last month's report emanating from Britain is to be believed.

According to a story in the *Scottish Radio Trade Digest*, an unemployed truck driver, Robert A. Fisher of Norwich, stole a receiver from one radio shop and sold it to another dealer. Returning a couple of days later, he sold the dealer an electric iron, then on leaving left the door open so the bell would not ring. Returning a few minutes later, while the dealer was busy in the back of the shop, he re-stole the radio and decamped.

Specialization in crime does not go unrewarded. The brand-conscious thief was captured and sentenced to 12 months in jail. The cell is *not* to be radio-equipped.

and convert them into the necessary high voltage. A pair of parallel tubes are placed across the deflecting coils to damp out any oscillations after the retrace period. A centering control is contained in the same circuit. It functions as previously described.

Note that this power supply does not depend upon oscillations in the transformer (since none occur), but only on the high voltage which is developed during the retrace interval. In 1 second, 15,750 of these peaks occur. The problem of filtering these from the final d.c. output voltage can be readily solved by the addition of a 500-μμf condenser and a bleeder resistor.

### A voltage doubler circuit

Cascading rectifier tubes to obtain the desired high voltage is not usually attempted in conventional units. In the circuit of Fig. 6, the 8016 tubes are connected so that their plates receive the same potential, at the same time, from the primary of T1. If we trace the flow of current through the first 8016, we find that the electrons flow down through the primary, through the low-voltage power supply to ground, and then up through C1 to the cathode of the 8016. In this way, C1 becomes charged to essentially the peak voltage of the retrace pulse appearing across the primary of T1. The polarity of the voltage across C1 is as indicated, with the ground end negative and the other plate positive. Let us assume that this peak voltage is 5,000 volts. Actually it


*(Continued from page 50)*

may be higher, depending upon the design of T1.

The plate of the second 8016 also receives the same pulse potential. Under the impetus of this force, electrons flow through the tube, down through the resistor R1, through C2, and back to the tube. Current flows until the condenser C2 is charged to the peak applied voltage. Note the polarity of the charge across C2. If a connection is made to the cathode end of C2, the voltage existing between this point and ground is the sum of the peak voltages of C1 and C2. Since they are series aiding, 10,000 volts is available between point *A* and ground. A bleeder resistor chain from point *A* to ground will make available additional voltages for the focusing and accelerating electrodes of the cathode-ray tube. Separate filament windings for the 8016 tubes are necessary because of the different d.c. potentials on each. In this instance, under the conditions assumed, each differs by 5,000 volts from the other.

For projection tubes, it is customary to design T1 for a peak pulse voltage of 7,500 volts. Then, four 8016's are connected in cascade, and the output potential is 4 × 7,500, or 30 kv.

Typical voltage regulation curves for the two types of high-frequency power supply are shown in Figs. 7 and 8. According to the standards of conventional low-voltage 60-cycle units, the regulation of the high-voltage supplies is not good. However, the current requirements of the cathode-ray tube are small and the variation in current during op-

*(Continued on page 78)*

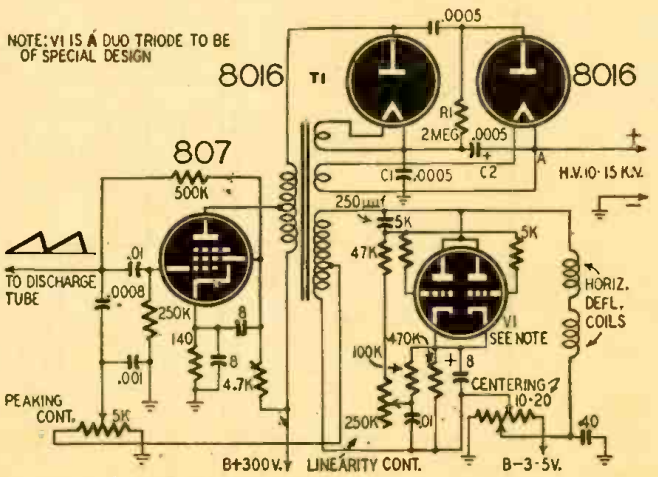
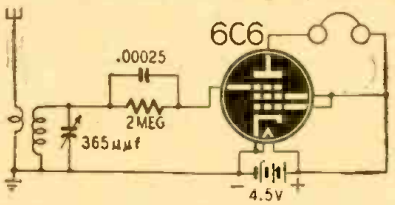



Fig. 6—An "inductive-kick" type of voltage-doubling power supply.

# RADIO-ELECTRONIC CIRCUITS

## LOW-VOLTAGE RECEIVER

Here is a circuit of a low-voltage receiver that I find to be sensitive and selective. I have applied a positive voltage to the control and screen grids and use




the suppressor as the control grid. In this way, the set works with only 4.5 volts on the various elements.

EMMITT A. BARNES, *Gulfport, Miss.*

(This is a type of space-charge detector. Performance may be improved by using a 6-volt battery.—*Editor*)

## CARRIER TRANSCEIVER

I get good results with the following 4-tube carrier-current transceiver. The transmitter is a 6SJ7, suppressor-modulated by a 25L6. For receiving, a 6SJ7 regenerative detector works into the 25L6, which has a pair of headphones switched into its plate circuit. A 50-mh r.f. choke and a pair of 500-μμf condensers prevent r.f. voltages from entering the a.f amplifier and power supply.

The transmitting coil consists of 160 turns of No. 28 enamel wire on a 1½-inch form with a tap taken off at 50 turns from the bottom end. All of the receiver coils are wound on a common 1½-inch form with No. 32 enamel wire. The grid coil L2 is wound with 300 turns and covered with a thin layer of tape or waxed paper. L4 has 100 turns wound over the grid end of L2, and the tickler L3 has 75 turns wound close to the ground end of L2.

Bias for the suppressor grid is supplied through a 220,000-ohm resistor and a bias battery. The battery voltage may be adjusted by listening to the signal on another transceiver and adjusting for highest modulation strength with least distortion.

H. O. NORTHERN, *Chattanooga, Tenn.*

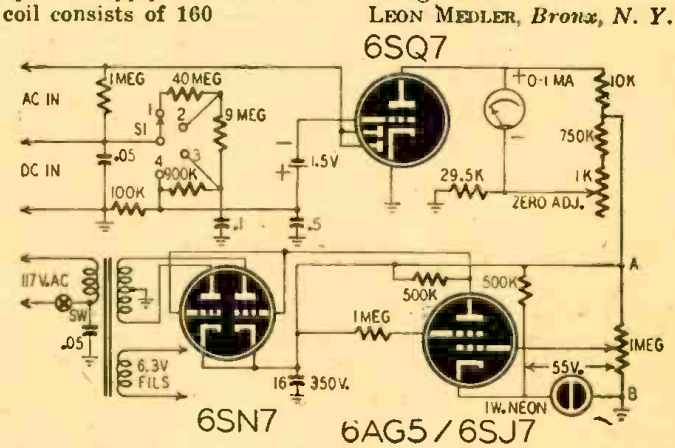
## A.C.-D.C. V.T.V.M.

Here is a circuit of a vacuum-tube-voltmeter that I have found useful for measuring a.c. and d.c. voltages up to 500 volts. A 6SN7, a 6AG5, and a 1-watt neon lamp are used in a voltage-regulated power supply, and a 6SQ7 acts as meter amplifier and rectifier.

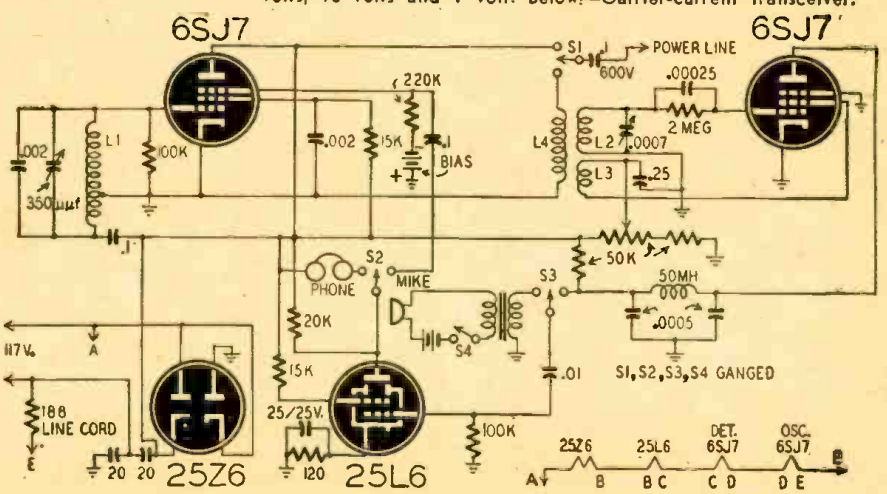
The 6SN7 is connected as a grid-controlled rectifier with its grid voltage derived from the output of the supply. Any changes in the output voltage are neutralized by changes in the internal resistance of the rectifier. A 6AG5 was used as the voltage regulator, but a 6J7, 6K7, and similar tubes can be used with equal results. The bias on these tubes is critical and should be adjusted to give 250 volts between A and B.

When the ranges are changed, the meter should be brought to zero by adjusting the 1,000-ohm control with the leads shorted together.

LEON MEDLER, *Bronx, N. Y.*

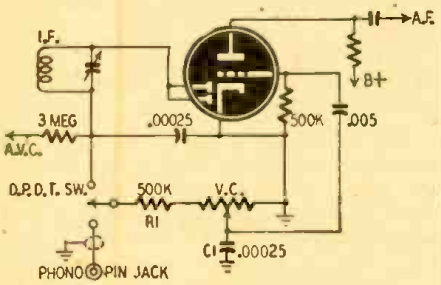



Above—The v.t.v.m. Ranges are—from points 1 to 4—500 volts, 100 volts, 10 volts and 1 volt. Below—Carrier-current transceiver.



## ADDING A PHONO PICKUP

Many commercial radios are fitted with phono input jacks that connect directly to the grid of the first a.f. stage without a volume control. These sets are rewired as shown. R1 (50,000 to 500,000 ohms) decreases the phono input to approximately the same level as the output of the detector and the 0.00025-μf r.f. filter condenser between the arm of the volume control and ground serves as a high-frequency scratch filter.

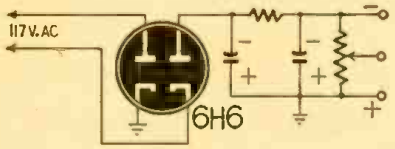



In some sets, the volume control is the entire detector load. In this instance, a 500,000-ohm resistor may be connected in the hot lead of the phono input circuit.

FRED W. RODEY,
*Berwyn, Ill.*

## SAFETY POWER SUPPLY

Here is a system that I use to obtain d.c voltages from an a.c. line without using a transformer or having one side of the line connected directly to the chassis—undesirable in many applications. It is useful in supplying fixed bias for amplifiers and transmitters and other applications where up to 120 volts is required.




The filter constants will depend on the amount of filtering required.

In the circuit shown, the chassis is positive. The polarity may be reversed by reversing the connections to each diode section. Any double diode such as a 25Z6, 50Y6, or 117Z6 may be used as long as the correct heater voltage is applied. The 6H6 may take its heater voltage from the 6.3-volt line of an amplifier or transmitter and will work well in circuits where its current ratings are not exceeded.

JOHN A. DEWAR,
*Bancroft, Ont., Canada*

## CLEANING CONDENSER PLATES

Condenser plates of the present-day radio are so closely spaced that we can no longer use the old stand-by (a pipe cleaner) for cleaning them.

Wash between the plates with white gasoline, using a soft-bristled brush. A good absorbent photographic blotting paper, cut into strips about ½ inch wide, is then passed between each pair of condenser plates. This absorbs the unevaporated gasoline along with any dirt which may be present.

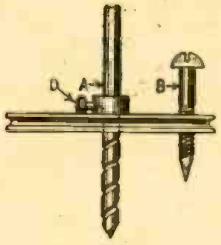
C. J. WHITTON,
*Denison, Texas*

# TRY THIS ONE

## NOVEL CIRCLE CUTTER

An efficient circle cutter for light metal and wood can be made from a pulley from an old Atwater Kent radio. These pulleys were used to gang two or more variable condensers mounted on the panel.

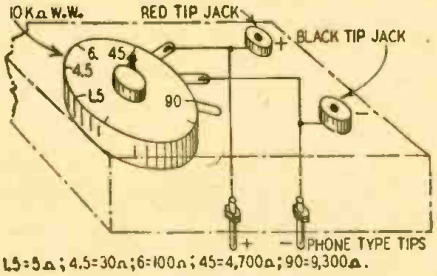
A ¼-inch twist drill is inserted in the center hole and the set screws tightened to hold it in position. A small bolt, selected to make a tight fit in one of the holes near the outer rim of the pulley, is ground to a triangular point for cutting. One nut is run up on the bolt before it is inserted in the hole and another is run up from the bottom to hold the bolt in place. The length of the bolt can be adjusted by changing the position of the two nuts. If a larger pulley is available, the bolt may be placed in holes drilled at different distances from the center so that several sizes of holes may be drilled.




JOHN HAYNES,
*Doe Run, Missouri.*

## BATTERY TESTER

I have constructed a convenient load for testing dry batteries. It consists of a 10,000-ohm potentiometer housed in a small box fitted with pin terminals or phone tips along its bottom edge. The tips are spaced so that they will fit into the voltage jacks of the tester. Pin jacks, for test leads, are mounted in the top of the box. The dial of the potentiometer is calibrated directly in standard battery voltages. Resistance values are shown in figure below.




L5=5Ω; 4.5=30Ω; 6=100Ω; 45=4,700Ω; 90=9,300Ω.

| *Standard Voltage* | *Resistance Ohms* | *Current Ma* | *Min. Service Voltage* |
|---|---|---|---|
| 1.5 | 5 | 300.0 | 1.2 |
| 4.5 | 30 | 150.0 | 3.6 |
| 6.0 | 100 | 60.0 | 4.8 |
| 45.0 | 4,700 | 9.6 | 36.0 |
| 90.0 | 9,300 | 9.7 | 72.0 |

The table also gives the normal current that is drawn from batteries under load and the minimum service voltage. This voltage is 80 percent of the normal value, and is the discard point.

WILLIAM B. THORNE
*St. John, N.B., Canada*

## REPLACEMENT TRANSFORMERS

Replacement power transformers with 6.3-volt filaments are often hard to find. Distributors sometimes have a large stock of power transformers with 2.5-volt filament windings. These may be used instead by connecting one side and the center tap of the 2.5-volt winding in series—aiding with the 5-volt rectifier winding to give 6.25 volts. Other transformers are designed for use with 1.5-volt tubes. These can be made to give the necessary filament voltage by connecting the 1.5-volt and 5-volt windings in series. In either case, the rectifier tube may be replaced with a 6X5 or similar tube.

CARL G. BLANYER,
*Houston, Texas*

## PROTECTING DRAWINGS

When constructing a piece of apparatus from a schematic drawing which you do not want marred and wish to save, it will help if you cover the diagram with a sheet of tracing paper tacked to your workbench or held on a clip board. In this way connections may be crossed off on the tracing paper as they are wired and the drawing will remain clean. This is especially helpful when building several copies of the same circuit, as the paper can be changed easily and always may be checked against the original schematic.

PAT CLEMENS,
*Columbus, Ohio*

## NEW SIGHT FOR MAGIC EYE

Life can be restored to electron-ray indicator tubes such as 6U5, 6G5, and 6E5, provided the filament is in good condition. Rotate the tube slowly over the flame of a candle for about 3 minutes and allow it to cool slowly in an area free from cold drafts. The tube will glow more brightly, though not as brightly as a new tube.

Other types of tubes can be given a new lease on life in the same manner.

JOHN POTTER,
*Lebanon, Conn.*

## AN ECONOMY TRANSMITTER
*(Continued from page 21)*

on 1½-inch, low-loss forms. The 10-meter coil is 1½-inch in diameter and may be mounted on an old tube base.

AMPLIFIER COIL TABLE

| BAND | TURNS | WIRE SIZE | WINDING SPACE |
|---|---|---|---|
| 80 | 30 | No. 16 en. | 4 inch |
| 40 | 20 | No. 12 tin. | 3½ inch |
| 20 | 10 | No. 12 tin. | 3½ inch |
| 15 | 8 | No. 12 tin. | 3 inch |
| 10 | 6 | No. 10 tin. | 3 inch |

These coils are center tapped and wound on ceramic forms 2½ inches in diameter. The link coils L2 are wound with well-insulated wire around the center of L1. The number of turns is adjusted to load the final amplifier fully with a low-impedance line attached.

### Phone operation

If low- or medium-mu tubes are used in this circuit, they may be cathode-modulated with only 20 watts of audio power. Any conventional amplifier supplying this power may be used if its output transformer has a 500-ohm secondary. This is connected in series with the filament center tap and ground as shown in Fig. 2. If the audio quality is mushy, the filament by-pass condensers should be reduced to .003 or .002 μf.

Any power supply capable of giving the correct voltages with good regulation may be used. Fig. 3 shows the one actually employed with this transmitter. Switch S-1 is the exciter switch, S-2 filament switch for high-voltage rectifiers and S-3 the plate power switch. The switches are interlocked so that high voltage cannot be applied to the 866's till the filaments are hot.

With a little ingenuity and a well-stocked junk box, the average ham can duplicate the performance of this rig at similar or perhaps lower cost.

## TRANSATLANTIC NEWS
*(Continued from page 38)*

has shown that the ionization of the E-layer—on which nighttime long-distance medium-wave reception depends — is maintained by the arrival of meteors and meteoric dust in the upper atmosphere. Analysis of the radar echoes shows that meteors and meteoric dust would produce exactly the effects observed. The work done also clears up another point which had up to now never been satisfactorily explained. Every dx fan knows by experience that the behaviour of the E-layer is much less liable to eccentricities in the latter part of the night. This is because, wherever he may be, an observer is after midnight on the forward side of the earth as it moves along its orbit. When you walk fast through rain your face becomes wetter than your back because it is driving into the stream of raindrops. Similarly the forward side of the earth receives more meteors and meteoric dust than the other and the E-layer covering it is more strongly affected by their arrival.

## A WATER WATTMETER

Accurate microwave measurement with a high-frequency water calorimeter, which indicates r.f. power in terms of temperature rise of water through which v.h.f. waves are passed, is revealed by the Polytechnic Institute of Brooklyn.

The newly-invented device is important with the increasing use of very high frequency radiation in airplane approach-control, television, radar, and frequency modulation broadcasting.

It will enable engineers to improve the design of high-frequency equipment for specific distances because it accurately measures the power of the radiation.

## KING OF TUBE CHECKERS

*(Continued from page 22)*

units are designed to provide a maximum of 100,000 volts and 1 ampere.

In switching such high voltages, it was necessary to develop a special means of applying and disconnecting the power to the tube under test. This unit consists of a double-sphere gap. The spheres are adjustable to obtain the desired voltage breakdown value. The triggering voltage for this sphere-gap switch is obtained from a separate rectifier unit which provides approximately 50 kilovolts to the center sphere to initiate the arc discharge.

During the operating cycle the arc is turned on and off at 60-cycle and approximately 1000-cycle rates. After the arc is initiated by the triggering gap, it will continue as long as voltage is applied. To stop the arc discharge and remove voltage from the tube, a stream of high-pressure air is directed at the sphere gap by an automatic switch at the instant it is desired to remove voltage.

All these high-power arcs of course develop an excessive din. To reduce the noise as much as possible, a special soundproof box is mounted around the sphere gap. The high-voltage supply to this test equipment has a solid metal enclosure installed to protect the operating personnel from harmful X rays originating from the rectifier tubes. The maximum number of safety devices must be installed for the protection of the operator.

## EFFICIENT TEST AND REPAIR BENCH

*(Continued from page 22)*

the rear. Four duplex receptacles in the base of the instrument panel have been placed in the most logical positions. The soldering iron plugs into an outlet under the working surface so the iron can be used anywhere on the unit without dragging the cord under or over obstacles. Outlets in the rear of the panel for instruments bring up the total to eight. All wiring is shielded and can be grounded.

5. Last but by far the least of our problems is to incorporate all of these ideas into an attractive piece of equipment. The Ser-V-Lux is a smooth, streamlined, custom-built unit, finished in a soft white duco set off with satin finished aluminum trim and hardware.

We have used two of these units for eighteen months in an actual radio service business, and the results are beyond expectation. Business has increased and the comments of customers are highly satisfying.

●

More than 300,000,000 phonograph records were manufactured in 1946, according to Wm. C. Speed of Audio Devices, Inc. This figure, Mr. Speed says, triples the pre-war output. He predicts a larger output for 1947.

## CANBERRA'S MOBILE RADIOS

*(Continued from page 34)*

a hillside. The idea of making the whole laborious journey again was heartbreaking. He decided to ask for help through his radio, which had come through unscathed. He contacted headquarters, and planes were sent to biscuit-bomb him with supplies, with which he was able to finish the job.

There are two control stations. At Mount Stromlo, the Commonwealth Solar Observatory, is a small 50-watt transmitter, keeping constant touch with the widely-spread forest patrols. A 500-watt station in Canberra controls Mount Stromlo and also keeps in touch with the engineers maintaining roads and bridges and with all the vehicles that work about the town itself.

### The main control station

The network call sign is VJA6, and control is carried on from the Canberra power station, some hundreds of yards from the main transmitter, to which it is connected by remote control. The main transmitter is a crystal-controlled unit, operating on 2.86 megacycles, and consists of a 6L6 oscillator, link-coupled to two 805's, link-coupled to tuned feeders, current feeding a full-wave antenna approximately 120 feet in height.

The 805's are operating under 1,580-volt plate-modulated conditions, and have no difficulty in putting a 500-watt signal on the air. Filaments are in "stand-by" at all times, permitting immediate operation by remote control at the power station. The modulated output is obtained from two 805's in class-B, working in 1250-volt conditions. Power supply is from the mains.

The main receiver has a crystal-controlled oscillator frequency and uses the transmitter antenna. The output can be switched from the speaker to a T-filter network (1000 cycles), operating an electric relay and bell-call system. This power supply also comes from the mains.

Cars carry a transceiver unit, whose transmitter sections consist of an 1F5 crystal oscillator (2.86 megacycles), capacity-coupled to a plate-modulated, shunt-neutralized twin triode, 1J5G, used as a single triode. There are approximately 200 volts at the plates, and the output is approximately 2 watts.

The modulator section consists of a carbon microphone feeding a 1F5, and transformer-coupled to a 1J6G in class-B, working at about 160 volts. A 1,000-cycle generator is incorporated, to permit transmission of the call note.

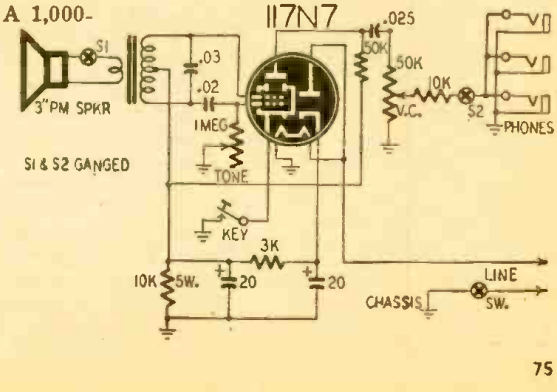
The receiver section is crystal-controlled and has a reflexed i.f. stage and grid-leak detector, with a 1F5 operating at around 150 volts, driving a midget speaker. The power supply of the whole transceiver is from a 6-volt storage battery and a vibrator.

The cars have fishing-rod aerials for general use. These give satisfaction up to approximately twelve miles, after which it is necessary to use the sectionalized thirty-foot pole provided, which permits operation over a distance of fifty miles.

## CODE OSCILLATOR

Presented herewith is a circuit of a code-practice oscillator that can be used with a speaker or several pairs of headphones. It uses the amplifier section of a 117N7 as a Hartley oscillator, using a push-pull output transformer as the inductance. A 1-megohm variable grid leak provides variable tone control. No volume control is used on the speaker, but one may be added if desired. Jacks are provided for several pairs of phones, which are connected in parallel. A volume control in the output circuit sets the volume level to the phones.

CALVIN SMITH,
*North Troy, N. Y.*



Coast-to-coast television will become a reality before the end of 1948, say Bell Telephone engineers, who report that nearly three-quarters of their transcontinental co-axial cable is "under ground."

## TECHNOTES

*(Continued from page 56)*

. . . . GE LB530

If the battery charges too slowly or refuses to take a charge, check the control switch for high-resistance contacts in the a.c. or charge positions. Poor contacts here will hamper charging action. Replace the switch or clean and tighten its contacts.

OTTO WOOLLEY
*Colo. Springs, Colo.*

. . . . STROMBERG 65 and 66

In these and other Stromberg-Carlson models using wired remote-tuning systems, the armature of the on-off relay on the main chassis sometimes sticks because of residual magnetism in the cores. To restore operation, remove the coils and file down the cores so that there will be a 1/32-to 1/16-inch air gap between them and the armature, which will then rest on the insulating washers. File the faces at an angle so that they will be parallel to the armature. This will not shorten the core too much.

WILLIAM FORD, JR.,
*Chicago, Illinois*

(If troubled with residual magnetism, why not demagnetize the core in an a.c. field?—*Editor)*

. . . . G.E. MODEL TC-3 TUBE TESTER

In the January 1947 issue of RADIO-CRAFT there was a Technote regarding the tube short indications given on the Model TC-3 and TC-3P tube testers. This is a situation which has arisen with the development of newer tubes having a high plate-to-cathode capacity.

The model TC-3 tube checker was originally engineered for high sensitivity on the four short test positions. Because of this high sensitivity, tubes with very slight base or interelectrode leakage will, at times, indicate a direct "shorted" condition. For all practical purposes, however, these same tubes will perform satisfactorily in the average radio receiver.

If it is desired to reduce the sensitivity of the short test in the Model TC-3, the following modification may be made:

Withdraw the equipment from the case by removing the twelve nickel-plated screws from the edges of the panel. Solder a 1-megohm, ½-watt resistor directly across the tubular paper condenser which is wired to the test switch. The capacity of this condenser varies in different production models from .01 to .005 μf but it should be easily located since it is the only tubular condenser on the test switch. Replace the equipment in the case.

This modification will cause the "short" indicator to glow with a resistance of approximately 250,000 ohms or less present in tested tubes. Key positions and index settings will not be affected by this modification.

R. H. RUDOLPH,
*General Electric Co.*

## SPEEDY A.C.-D.C. SERVICING

*(Continued from page 28)*

Leaky or noisy by-pass condensers can be found by moving them around while the set is operating. This may be best done with an orange stick or insulated rod. (A screw driver might slip off and cause a short.) Any condenser

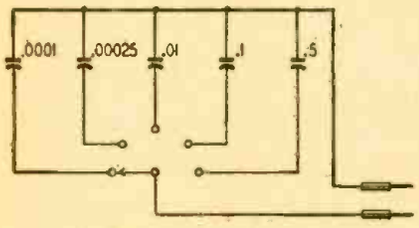



Fig. 3—Substitution box for r.f. capacities.

that causes the slightest noise should be replaced.

### Checking the volume control

Volume control trouble is one of the easiest faults to find. Move the knob up and down. If the control is faulty, there will be a noisy burst from the speaker. Turn the knob slowly, from minimum to maximum position. Scratching noise, or points where the set cuts out completely, may be noticed.

If you think that the control is the cause of the set being completely dead, connect "hot" and center lugs. If the set begins to play when the control is shunted, you know that it is open. This test works for most circuits, but fails for some.

### Quick resistor tests

Someone has said, "There is only one simple way of testing a resistor—with a multirange ohmmeter." Here is another quick, very effective, method of testing the small resistors in a set. The set is turned on and a station tuned in. The leads of a multimeter, turned to the highest d.c. voltage range, are put across the suspected resistor. The voltage selector switch is turned down the scale, stopping at each position to note

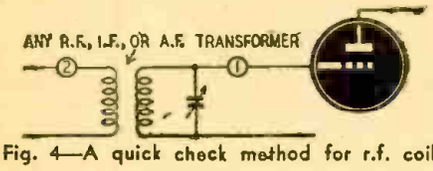



Fig. 4—A quick check method for r.f. coils.

if there is any improvement in the set's performance. Of course the meter is watched to see that it is not driven off scale.

This test is the same as the substitution method. The various resistors of the multimeter are shunted across the resistor in question.

### Open or shorted coils

Much time is used up checking r.f., a.f., and i.f. coils for continuity or winding resistance with an ohmmeter.

Here is a faster way of finding the trouble, one that actually shows the working condition of the coil instantly. Your finger serves as the test instrument. Be very careful not to touch more than one part of the circuit at a time. It is especially important to watch the other hand. It should not contact the chassis or any other part of the set. There is danger of shock. Touch the moistened finger to the grid of the tube following the coil under test. If the circuit is working properly between that point and the speaker, a loud, clear click will be heard. Next touch the primary terminal of the coil, the one connected to the plate of the preceding tube. A loud, clear click here indicates that the coil is working perfectly. Refer to Fig. 4 for the points to be touched.

In a.c.-d.c. midgets with dynamic speakers an open field coil often causes trouble. It is an easy matter to check the field strength. Hold a small screw driver in front of the cone, within about ¼ inch of the pole piece. If the screw driver is strongly attracted, the field coil is O.K.

One of the best ways to check a magnetic speaker is to have a small test speaker with long flexible leads mounted on the service bench. If small alligator clips are provided on the leads, the test speaker can be connected quickly in parallel with the one in the set. The set speaker cone can be held in tightly with the hand to prevent it from operating.

Common sense is the greatest aid to speedy servicing. Note symptoms and make first the tests which seem most likely to apply in the particular case.

eration is limited. In a sense, the relatively poor regulation is advantageous, since it decreases the possibility of fatal injury to anyone accidentally touching the high-voltage terminals. For the serviceman, it is suggested that the following be committed to memory:

*All high voltages must be turned off before any work is done on a television receiver.* High-voltage terminals do not have to be touched to prove fatal; the voltage can span small distances. The only safe method of repairing a high-voltage unit is by substituting components or by resistance measurements.

## NEW PIEZO CRYSTAL

In past years the use of quartz and Rochelle salt crystals has been well established and is now well-known. A new crystal known as ADP (ammonium dihydrogen phosphate) has been used in some war-time electronic devices.

The new crystal is free from non-linear response and hysteresis effects and is unusually stable with temperature, often a weakness of piezoelectric crystals. Furthermore, it cannot dehydrate like Rochelle salt.

ADP is stable at temperatures as high as 100°C as contrasted with the limit of 55°C for Rochelle salt. It is also effective at low temperatures, although it shatters at the extreme low of –125°C. In the normal range, ADP has a larger electromechanical coupling than other crystals, a measure of its effectiveness.

## WORLD-WIDE STATION LIST

*(Continued from page 35)*

| Location | Station | Freq. | Schedule |
|---|---|---|---|
| Santa Clara | COHI | 6.450 | 0700 to 2345 |
| Santiago | COKG | 8.950 | 1830 to 2325 |
| **CURACAO** | | | |
| Willemstad | PJCI | 7.250 | 1130 to 1230; 1630 to 2130 |
| **DENMARK** | | | |
| Copenhagen | OZF | 9.520 | 1330 to 1800 |
| **DOMINICAN REPUBLIC** | | | |
| Ciudad Trujillo | HIIN | 6.240 | 1600 to 2230 |
| Ciudad Trujillo | HIIZ | 6.310 | 1600 to 2255 |
| Monsignor Nouel | HI2T | 6.480 | 1600 to 2400 |
| Santiago | HIIA | 6.190 | 1600 to 1800 |
| **ECUADOR** | | | |
| Ciudad Cuenca | HC5EH | 3.930 | 1800 to 2230 |
| Quito | HCJB | 4.100 | 1800 to 2230 |
| Quito | HCJB | 6.280 | 1800 to 2230 |
| Quito | HCJB | 9.960 | 0545 to 0845; 1200 to 2230 |
| Quito | HCJB | 12.440 | 0600 to 1000; 1400 to 2330; Sundays, 0700 to 1630; 1700 to 2200 |
| Quito | HCJB | 15.110 | 0500 to 1200; 1330 to 2230 |
| **EGYPT** | | | |
| Cairo | JCPA | 7.190 | 1500 to ?; 2230 to 2400; 0200 to 0300 |
| Cairo | SUX | 7.860 | 1200 to 1600 |
| **ENGLAND** | | | |
| London | GRR | 6.070 | 2300 to 0030 |
| London | GSL | 6.110 | 1500 to 1745; 1900 to 0030 |
| London | GRW | 6.150 | 1445 to 1500; 1900 to 2215; 2330 to 2345 |
| London | GRM | 7.120 | 1145 to 1215; 1445 to 1515 |
| London | GSW | 7.230 | 0100 to 0115; 0130 to 0330; 0600 to 0645; 0700 to 0730; 0745 to 0900; 1045 to 1130; 1230 to 1430; 1530 to 1715 |
| London | GWI | 7.250 | |
| London | GSU | 7.260 | 0030 to 0200; 0630 to 0645; 0700 to 0800; 0815 to 0900; 1045 to 1300; 1320 to 1700; 2345 to 2400 |
| London | GRJ | 7.320 | 0000 to 0015; 0645 to 0700; 1045 to 1815 |
| London | GSC | 9.580 | 1100 to 1315; 1330 to 1415; 1430 to 1530; 1615 to 2300; 2345 to 0030 |
| London | GRY | 9.600 | 1230 to 1600; 1800 to 2230; 2300 to 0030 |
| London | GWO | 9.620 | 0045 to 0120; 0200 to 0300; 0600 to 0630; 0700 to 0900; 1045 to 1400; 1700 to 2030 |
| London | GVZ | 9.640 | 0100 to 0500; 1500 to 1730; 1800 to 2230 |
| London | GRH | 9.820 | 1215 to 1600; 1700 to 2300 |
| London | GRG | 11.680 | 0600 to 0645; 0700 to 0900; 1000 to 1130; 1145 to 1200; 1230 to 1430; |
| London | GVW | 11.700 | 0600 to 0715; 0830 to 1015; 1130 to 1600; 1800 to 2230; 2300 to 0030 |
| London | GSD | 11.750 | 1215 to 1600; 1615 to 1200 |
| London | GSN | 11.820 | 2200 to 0030; 0100 to 0500; 1030 to 1430; 1700 to 2030 |
| London | GVX | 11.930 | 0515 to 0530; 0600 to 0630; 0700 to 0730; 0745 to 0000 |
| London | GRF | 12.090 | 2300 to 1615; 1700 to 2030 |
| London | GWG | 15.110 | 0000 to 0400; 0600 to 1015; 1100 to 1315; 1500 to 1600 |
| London | GSO | 15.180 | 2300 to 1200; 1230 to 1745 |
| London | GSI | 15.260 | 0400 to 0430; 1030 to 1400 |
| London | GWR | 15.300 | 0600 to 0900; 1045 to 1330; 1400 to 1430; 1700 to 1800 |
| London | GSP | 15.310 | 2345 to 0030; 0100 to 0500; 0600 to 0815; 1200 to 1315; 1615 to 1845 |
| London | GRD | 15.450 | 0100 to 0500; 0600 to 0700; 1700 to 1845 |
| London | GVP | 17.700 | Middle East beam, 0600 to 1115; 1200 to 1600 |
| London | GRA | 17.710 | New Zealand and Australian beam, 0600 to 0815 |
| London | GVQ | 17.730 | 0100 to 0500; 0800 to 1215 |
| London | GSQ | 17.790 | New Zealand beam, 0500 to 1030 |
| London | GSV | 17.810 | 0100 to 0400; 0500 to 1430 |
| London | GRQ | 18.020 | 0100 to 0500; 0830 to 0845; 0900 to 1430 |
| London | GVO | 18.080 | 1030 to 1245; 1300 to 1500 |
| London | GSH | 21.470 | 0500 to 1215 |
| London | GSJ | 21.530 | Indian beam, 0500 to 0815 |
| London | GST | 21.550 | 1030 to 1130 |
| London | GRZ | 21.640 | Central American beam, 0600 to 0900 |
| London | GVT | 21.750 | 0100 to 0500; 1030 to 1130 |
| London | GSK | 26.100 | 0615 to 1000 |

●

An American shortwave broadcast foundation, financed largely by Federal funds, is proposed by Secretary of State Marshall to stimulate broadcasting to foreign countries.

## MULTI-STATION INTERCOMS

*(Continued from page 33)*

cable with the required number of conductors will do just as well. Twisting of the wires is unnecessary and shielding is an added expense that yields no advantage. (Other sound men may dispute that statement.—*Editor)*

For outdoors, the cloth-covered cable is not usable. Ideally, weatherproofed wire such as that used by the telephone company would be best, but, so far, the author has never seen any multiwire cable of that type. Practically the only type available and feasible is rubber-covered. Use the best grade, in which each conductor is covered with color-coded rubber, with a heavy over-all live-rubber sheath. If there is a shield beneath the sheath, use it as the common lead, but if possible, save money by getting unshielded cable with the proper number of conductors.

Cable should be kept off the ground as much as possible, since soil is chemically bad for rubber. It can be suspended between trees, but, if there is any tendency for the tree to sway in the wind, be sure to leave plenty of slack. If it can be fastened along the top of a high fence, that is ideal. Outdoor installation is tedious, and hazardous if not done right, so run cable as much as possible indoors.

Indoors, running the cable is just a matter of keeping it out of sight and possibility of damage as much as possible. If feasible, running it along mouldings is better than on baseboards. Vacuum cleaners, carpet sweepers, and other such instruments are lethal to cable if they tangle with it.

Methods of going through doors and windows are varied. A hole right through the window frame or doorjamb in an inconspicuous spot will often suffice. One good tip is to find the telephone cable, if possible, and follow it. Usually, if the telephone cable is at all large, the holes through which it travels are large enough to allow the intercom cable to be squeezed through too. If it is necessary to enlarge any of these holes slightly, use the utmost care, as most telephone companies are singularly unfriendly toward anyone who damages their cable.

After the cable has been laid, it must be connected to the junction boxes. Make a tabulation of the code colors and assign each a number. Connect each color to the correspondingly numbered box terminal. If the same type of cable is used to connect each station to the junction box, the color code will be complete for the whole installation.

Servicing intercoms is very easy. If a station fails to operate, the first thing

is to check whether the cable has been damaged, or the amplifier is bad. If the tubes light, take a station from another location and substitute it for the suspected one. If it fails to work, the cable must be gone over.

To check the cable electrically, remove the plugs of all stations from their junction boxes, and check terminals with an ohmmeter for shorts. To find opens quickly, short any two conductors at one location and see if an ohmmeter across the corresponding terminals of another station shows the short. Repeat this until the trouble is located.

The amplifiers are much less complicated than ordinary radios, and servicing them is therefore a simpler problem. Since there are very few components in any of them, the most trouble will be found in tubes and filter condensers. Always check the outgoing cable connections in each amplifier unit. If possible, a miniature cable clamp should have been used in assembling them to keep the cable and a.c. cord from being pulled.

A final touch, which will add a professional air and inspire trust, is the preparation of a small instruction manual. Two pages or so will suffice. Manipulation of the controls should be explained clearly and inclusion of information about the privacy and versatility of the system is good advertising. If the person who makes and installs the system does not intend to service it, a paragraph or two headed "For the Serviceman" will help him understand the units. A schematic of the amplifiers and remotes should always be included, together with cabling information.

Speaking of advertising, it is always a good idea to install a cable with enough conductors to accommodate the maximum number of stations allowable with a particular system, even though that number may not be in use. Invariably, purchasers are highly pleased with intercoms after they become accustomed to using them, and often they decide to add more stations. If the cable is already large enough, it need only be tapped or extended to add units, but if not, entirely new cable will be needed.

## CORRECTION

On the Question Box page of the February 1947 issue the values of C1, C2 and C3, in the intruder alarm, were not shown. C1 is a 1-μf paper condenser with a working voltage of at least 450. C2 and C3 are identical units connected in a voltage dividing network. Each is made by connecting a 500-μμf mica condenser in parallel with a 500-μμf variable trimmer. A 2-gang variable of large capacity might be used for each of these.

We thank Mr. Lewis P. Lane, of Ojia, Calif., for calling our attention to the omitted values.

## CODE OSCILLATOR

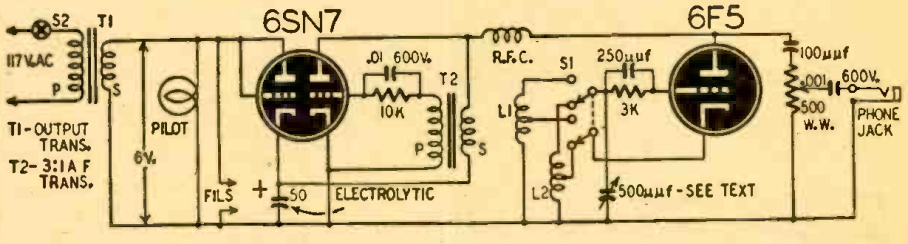
Upon reading about Mr. Gnessin's very unique code practice oscillator in the June, 1943, issue of RADIO-CRAFT, I was determined to discover if such a hookup would work on the radio frequencies as well as the audio. The result of this experimenting is a midget signal generator for i.f. and r.f., covering from approximately 450 to 1800 kc.

Many diagrams of signal generators were studied before any attempt was made to make this one. A small yet efficient oscillator was desired. The smaller signal generators were all a.c.-d.c., and this type of unit was undesirable as there is always the possibility of shorting out the line in aligning another a.c.-d.c. set. Other designs used a bulky power transformer to avoid this setup. This again was undesirable because of the space a power transformer would require. The only way out seemed to be by the use of 6 volts on the plates of the various tubes.

First, an audio oscillator similar to the one in RADIO-CRAFT was constructed. A 6SN7 was used in this part of the circuit. After this section was completed and tested, construction of the r.f. end was started. The r.f. oscillator consists of a 6F5 triode, hooked up similarly to an electron-coupled oscillator.

The set is tuned by means of a midget condenser with its two sections connected in parallel. This was done to give greater frequency range. A double-pole double-throw switch changes the oscillator from high to low frequency. The 500-ohm potentiometer gives adequate attenuation. A phone jack provides for the feeding of the output to a shielded greater frequency range. A double-pole cable. The i.f. coil has 150 turns of No. 30 enamel wire and the broadcast coil 90 turns of No. 28 enamel. Both are close-wound on 1½-inch forms and tapped one-third the distance from the bottom.

The entire unit was built into a cigar box measuring 5½ x 9 x 2½. The a.f. part was put in the bottom of the box, leaving the top for the r.f. section. By careful planning, the components can easily be made to fit in a cigar box of average size. This signal generator has been used for quite some time and has never given the least bit of trouble during the whole period.—*Bernd Falk*



## A SMALL RECORDING STUDIO

*(Continued from page 31)*

boosted on the recording and de-emphasized when the disc is played back. The de-emphasis reduces the scratch, resulting in a quieter recording.

### Volume level indicators

With a crystal cutter of the type described, the signal voltage required in Fig. 2-a is 50 r.m.s. volts and in Fig. 2-b, 150 r.m.s. volts. This voltage is read with an a.c. voltmeter across the amplifier output. This voltmeter should have a flat frequency characteristic over the audio range and should not materially load the output circuit. If the meter is connected across a 600-ohm line, as in Fig. 2-b, it may be a commercial db or v.u. meter, calibrated in decibels or volume units, respectively. (Zero db equals 600 milli-watts from a 600-ohm circuit.) The v.u. meter is calibrated in volume units and is carefully designed to follow the average audio level. It is also calibrated in some cases, in db.

In the interest of economy, an output level indicator may be made by connecting a d.c. milliammeter and a rectifier. The rectifier may be a copper-oxide or a vacuum-tube diode, or a 1N34 germanium crystal diode may be used. To make the meter follow the average level, a capacitor may be connected across the rectifier load, or a sensitive meter used

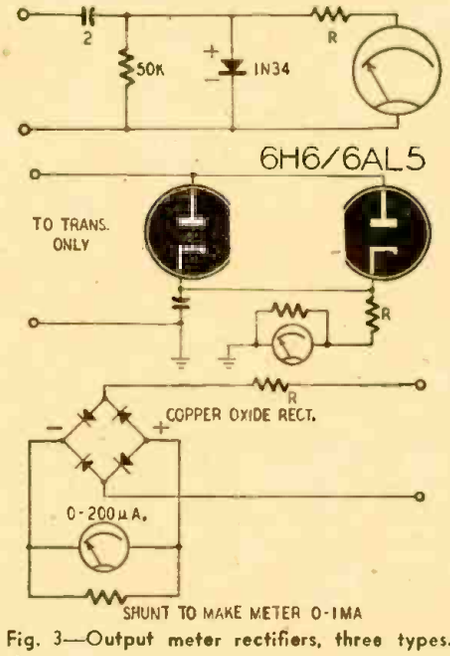
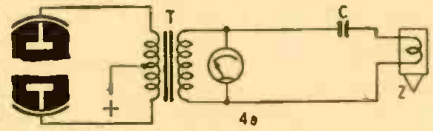



Fig. 3—Output meter rectifiers, three types.

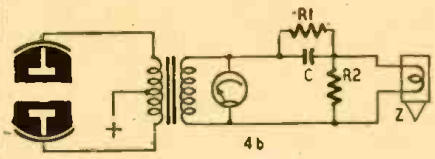
with a heavy shunt, or both. Fig. 3 shows several output meter circuits. Figs. 2 and 4 show their proper con-

*(Continued on page 84)*

nection in the circuit. The resistor R should be great enough to prevent damage to the 1-ma meters. For Fig. 2-a, 150,000 ohms and, for 2-b, 50,000 ohms, would be a safe first approximation. Transformers used in coupling the amplifier to a cutter or speaker must be of the highest quality in order to reduce distortion to a minimum and to provide a wide frequency response. This is particularly true when the output tubes are beam tetrodes with or without negative feedback. A high order of negative feedback cannot be applied around a poorly designed transformer.




4a




4b

| | | |
|---|---|---|
| CUTTER IMPEDANCE | 8Ω | 500Ω |
| VALUE C MOD. CONSTANT VELOCITY | 40μf | .5μf (10,000 cps) |
| VALUE C CONSTANT AMPLITUDE | 2μf | 2μf (10,000 cps) |

4c

Fig. 4—Compensating network considerations.

One of the photos shows a collection of high-quality transformers capable of the highest fidelity.

### Compensating networks

When the cutter is of the magnetic type, the connection may be as seen in Fig. 4.

A magnetic or dynamic cutter has a natural constant-velocity characteristic —the stylus amplitude varies inversely with frequency. If the output is adjusted for the correct stylus amplitude at 1,000 cycles, the resultant amplitude at 50 c.p.s. would be so great as to cut into the next groove, and so it is conventional to limit the amplitude of the stylus motion. This is done by connecting a network between the amplifier and the magnetic cutter to impart a constant-amplitude characteristic below a certain turnover frequency. This frequency is usually near 500 c.p.s.

The network consists, in its simplest form, of a series-connected capacitor as shown in Fig. 4-a. The impedance of the transformer is chosen to match the impedance of the cutter. With C connected as shown, its reactance at a very high frequency will be so low as to constitute, effectively, a short circuit and cease to exist electrically. At some frequency, its reactance will increase to a point

where it is equal to the impedance of the cutter. At this point the voltage across the cutter will be reduced by a factor of 2 (6 db). As the frequency decreases, less and less voltage is impressed across the cutter and more and more across the capacitor C.

The slope of this decrease in cutter voltage with frequency will be approximately 6 db per octave, which is correct to impart a constant-amplitude characteristic to the cutter stylus.

The value of C determines the point at which the transition from constant velocity to constant amplitude takes place. If a very high frequency is chosen for the turnover point—10,000 c.p.s., for example—the cutter becomes a constant-amplitude device below that frequency and will record in the same manner as a crystal. The value of C will be found in the table in Fig. 4-c.

It is possible to vary the effect of this series condenser by shunting it with a resistance of the proper value. For instance, the value of R1 may be selected so that in the circuit in Fig. 4-b, the cutter becomes a constant amplitude device down to some predetermined low frequency, and then becomes constant-velocity again. This would result in a bass-boost cutting characteristic which would be effective if a record is to be played on a turntable with appreciable rumble, as the playback amplifier can be adjusted to reduce its low-frequency response and this would in turn reduce the playback turntable rumble.

If the cutter has serious peaks in its response curve, it might be feasible to reduce this effect by shunting the cutter with a resistor such as R2 in Fig. 4-b. This would have the effect of damping the peaks in the cutter's response and also reducing the effects of these changes being reflected back into the network and the output tubes. Of course, the impedance of the cutter for calculating C is the parallel combination of R2 and the cutter. The impedance of the cutter at some frequency is usually supplied by the manufacturer.

In low-impedance output circuits, it may be necessary to use electrolytic capacitors for *C*, due to the impractical size of the large values. There is no d.c. polarization voltage, so two electrolytic condensers of twice the necessary capacity can be connected in series opposing; that is, the plus terminal of one connected to the plus terminal of the other, and the two negative terminals used to connect the resultant capacitor in the circuit.

### Power limitations

It is worth while noting that too much bass boost, with a magnetic cutter, may result in the driven reed hitting the pole pieces. Also, the travel on a magnetic cutter becomes nonlinear with extreme stylus motion. It is therefore unwise to exceed the manufacturer's rated input level.

The crystal cutter can be ruined by the application of too high a voltage. If there is danger of the application of too high voltage to a crystal, a protec-

*(Continued on page 89)*

## INSTALL A WAVE TRAP!

By OLIVER PARSONS

A VERY annoying and frequent trouble is encountered in almost all low-priced commercial receivers, especially since the advent of multitude of radio range transmitters located along the constantly expanding airways systems in this country. On tuning in stations, especially near the low-frequency end of the dial, we encounter squeals, whistles and "da-dit, da-dit," or "dit-da, dit-da," in an unending stream, sometimes so strong that the received station's music or speech is completely garbled, or its entertainment value destroyed.

This type of interference is recognized by every good service man as the signal put out by the nearest airways beacon transmitter leaking through the mixer stage into the i.f. amplifier, which is probably peaked on the beacon's frequency.

One way to get rid of it, the oldest and easiest way when it works, is to detune the i.f. stages from the original frequency and peak them at least ten kilocycles away from the interfering signal. That's fine if the oscillator circuit of the set has a low-frequency padder that will allow for re-tracking. But remember that it is sometimes necessary to remove the i.f. much farther than ten kilocycles, to get rid of the unwanted interference. Many cheap sets, however, are designed to track with a specially cut oscillator tuning condenser section at the i.f. recommended by the manufacturer. Throwing the i.f. off this frequency, therefore, causes the set to function poorly or—in many cases—not at all.

The most logical and most efficient method of eliminating this interference is to insert a wave trap in the antenna circuit of the receiver or in the grid circuit of the mixer stage. The old way of doing this was to simply disconnect the aerial lead where it joined the set antenna post and connect a coil and condenser in a parallel-tuned circuit in series with the antenna and the set. (Fig. 1) This left exposed leads—including the antenna coil which was generally unshielded — which picked up sufficient signal to make the hookup practically worthless. On the other hand there is generally little room left in the average set to install a wave trap on the chassis where the leads may be short and the installation shielded sufficiently to get maximum results.

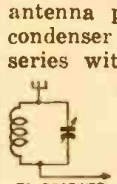


Fig. 1

This calls for some ingenuity on the part of the radio man. Many small sets have the antenna coil mounted on top of the chassis near one corner with quite a bit of space above the coil and the top of the cabinet. In these cases inductive coupling may be used without the necessity of even making an electrical connection. Simple wave traps are constructed of one coil of an old i.f. transformer with a suitable trimmer con-

denser across it and mounted as close to the grid end of the coil as possible and cemented in place with coil cement freely applied. (Fig. 2). Being duolateral wound, they take up little space and will fit the end of most solenoid-wound antenna coils. The i.f. coil should be from an old transformer of the same frequency as that of the set in which it is used.

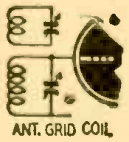



Fig. 2

If the antenna coil of your set is in an inaccessible place or is a duo-lateral coil wound on a wooden core, it may be impossible to couple the wave trap inductively to it. The next best bet is to wire the wave trap in series with the grid circuit of the antenna stage. Break the connection between the grid coil and condenser and the grid prong of the mixer tube or the r.f. tube (whichever is the antenna stage in the set) and connect the wave trap in series, as shown in Fig. 3. If fairly heavy tinned copper wire is used and the leads kept short and direct, no trouble should be experienced with extra wiring capacity in the circuit.

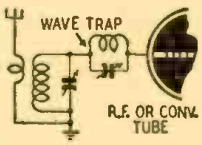



Fig. 3

To adjust the wave trap for maximum efficiency, connect a standard signal generator to the antenna and ground connections of the set, set it to the frequency of the interfering signal, which will usually be the intermediate frequency of the set. Adjust the output of the signal generator to a value high enough to be heard clearly in the set speaker or cause a good deflection on an output meter across the secondary of the speaker output transformer. Adjust the trimmer condenser on the wave trap until a MINIMUM of sound is heard in the speaker or a MINIMUM deflection is obtained on the meter.

This adjustment should be fairly critical or sharp and should reduce the signal from the generator to a very low value, sometimes causing it to disappear at the original signal level from the generator. In this case turn up the generator level control until a reading is obtained and continue to adjust for MINIMUM response.

To get sufficient rejection of the unwanted signal and to trap a frequency band only as wide as the unwanted signal, the wave trap circuit must have a *high Q*. The trimmer condenser should have good quality mica and good insulation at its terminals. Also the ratio of capacity of the trimmer to the inductance of the coil must be high enough to get good circulating currents in the trap circuit at the frequency of the unwanted signal. The usual i.f. coil has a good enough set of characteristics to pass the requirements for the coil but the Q of the trap circuit can generally be raised by removing a few turns from it and using a 15-75 μμf condenser to tune it, thus raising the Q of the entire trap circuit.

*(Continued on page 96)*

## HOME-BUILT SOUND EFFECTS

*(Continued from page 27)*

a saw. Any noisy tool will record well, and the sound can be bigger than life if amplified.

To turn on the lights, use an electric switch. Taking the telephone receiver

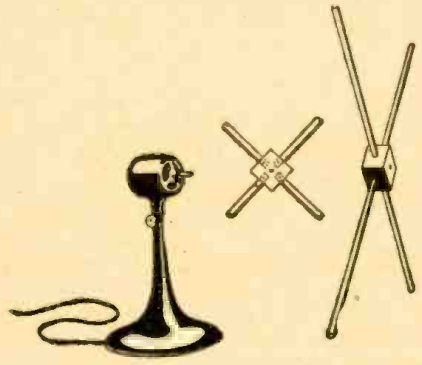


Fig. 6—A fan motor and dowels make wind.

off the hook and replacing it is very convincing if done close to the mike. To strike a match, a special trick increases the effect. Strike the match about 4 inches from the mike, then quickly move it very close to catch the flaming noise as the head burns.

### Making our noises work

For the radio workshop or the "home-broadcaster," what to do with the various noises he has recorded presents no problem. Others may be embarrassed with a wealth of canned sounds. As a

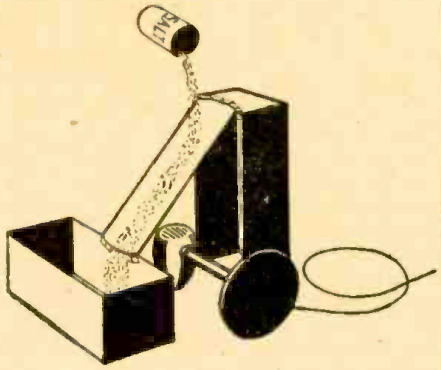


Fig. 7—Rainmaking is easy with this machine.

suggestion, amateur plays may be improved by properly used sound, amplified or recorded. The modern "radio script" type of play can be immensely heightened in interest if genuine radio-type sound effects are used. Enthusiastic sound-effects recorders have even used the sounds as a subject for an evening's entertainment, making a guessing game with prizes for participants naming the greatest number of effects correctly. It is surprising indeed how many sounds may be misinterpreted if the listener's mind is not directed by the contextual material.

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Airlines are testing a "block signal" method which will light a red or green light on the pilot's instrument board, telling him whether or not he may enter the next "section" of the airway.

## SMALL RECORDING STUDIO

*(Continued from page 85)*

tive circuit should be provided. Neon bulbs connected in series can be placed across the crystal so that, in the presence of too much voltage, the bulbs will fire and their resultant low resistance will protect the crystal cutter. The small ¼-watt neon bulbs have a firing voltage of approximately 70 volts. It is essential that the bulbs do not fire during the application of normal cutter driving voltage, or distortion will result.

In the final analysis, what is really expected of a cutter is a recording which, when played back, sounds as like the original material as possible. Each recording setup requires individual attention to obtain the best results of which it is capable. Each set of requirements and conditions is different; it rests on the user to take maximum advantage of the equipment he has so that he may produce good recordings.

### VIBRATOR AMPLIFIER

This six-volt battery-powered amplifier is very compact and is easily constructed on a 7¼x5¼x2¼-inch chassis.

It uses a pair of push-pull 6V6 beam-power pentodes driven by a cascade connected 6SC7. A push-to-talk switch on the microphone reduces the drain on the storage battery when the amplifier is on stand-by operation.

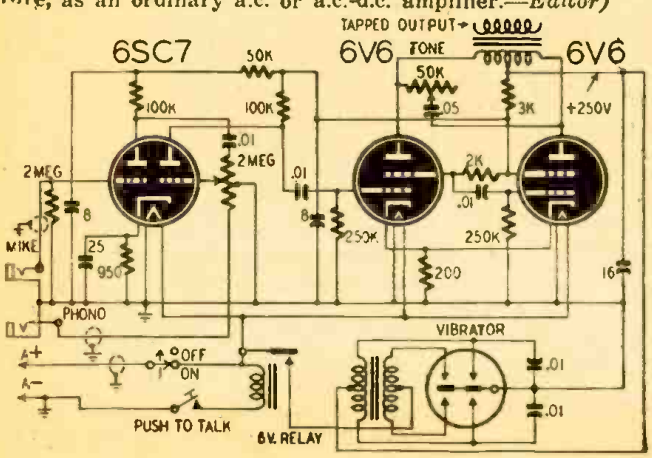
The 6SC7 is connected in a standard cascade circuit with a fader-mixer in the grid circuit of the second half of the tube. This permits gradual switching from microphone to phono pickup.

A novel phase inverter is used. A 2000-ohm loading resistor is inserted in the screen grid lead to one of the 6V6's. This grid is capacity-coupled to the control grid of the other 6V6. With 250 volts on the screen grids of Class AB1 6V6's, the screen current for each tube swings from 2.5 ma at no signal to 6.5 ma at maximum signal. This variation in screen current is converted to variable voltage drop across the 2000-ohm resistor. The grid of the second 6V6 gets its excitation from the variable screen voltage. This phase inversion system makes it possible to take full advantage of the 6SC7's amplification.

The power supply uses a synchronous vibrator feeding into a resistance-capacity filter. A push-to-talk switch closes the low-voltage circuit through the coils of a relay, made from an old vibrator.

*—Edgar Dunn, Johannesburg, South Africa*

(This amplifier is worth trying without the vibrator feature, as an ordinary a.c. or a.c.-d.c. amplifier.—*Editor)*








**In a British form of "printed radio" the circuits are deposited in grooves on plastic plates. The inventor claims that 180 sets per hour can be made by the process.**

## EASY-TO-BUILD OSCILLOSCOPE

*(Continued from page 24)*

to external sweep and applying a sinusoidal signal to the horizontal binding posts on the front panel and another voltage of different frequency to the vertical amplifier, various patterns called *Lissajou figures* will be obtained. These figures are helpful for frequency calibration or comparison.

To obtain a trapezoidal pattern for determining the percentage of modulation of an amateur transmitter, the connections to the rear panel should be made as shown in Fig. 10. Fig. 11 shows

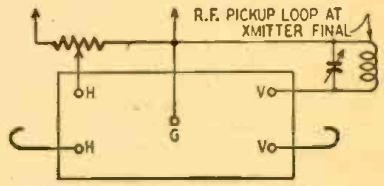



Fig. 10—Connections for modulation tests.

some trapezoidal patterns.

In Fig. 11-a we have the standard pattern for 100 percent modulation. Fig. 11-b shows overmodulation and 11-c a condition of less than 100 percent modulation. Patterns similar to 11-d are due to phase shift in the speech amplifier.

The value of an oscilloscope in servicing receivers was shown fully in two articles *(The Scope—A Repair Tool.* January and March RADIO-CRAFT).

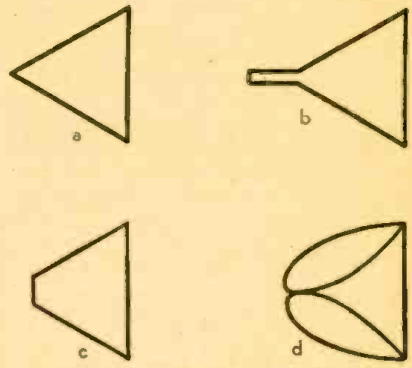



Fig. 11—A few more common Lissajou figures.

After having built and become familiar with the operation of a scope and its capabilities as an instrument, anyone having one will discover new uses for it daily.

## Radio Thirty-Five Years Ago

In Gernsback Publications

**HUGO GERNSBACK**
*Founder*

| | |
|---|---|
| Modern Electrics | 1908 |
| Electrical Experimenter | 1913 |
| Radio News | 1919 |
| Science & Invention | 1920 |
| Radio-Craft | 1929 |
| Short-Wave Craft | 1930 |
| Wireless Association of America | 1908 |

Some of the larger libraries in the country still have copies of ELECTRICAL EXPERIMENTER on file for interested readers.

Interesting Radio Articles in the May, 1913 issue of the ELECTRICAL EXPERIMENTER.

A Treatise on Wireless Telegraphy, by *Hugo Gernsback.*

The Quenched Spark Gap, by *H. Winfield Secor.*

Building Large Spark Coils, by *Hugo Gernsback.*

The Vacuum Detector, by *H. Winfield Secor.*

How to Make a Loud-Speaking Telephone.

The Tuft's College Wireless Society. 35-mile Transmission with Half-Inch Spark Coil.

### 400 MILLION U.S. RADIOS?

*(Continued from page 17)*

during the next decade we can confidently look forward to a future in which there will be between 400 and 500 million radio sets of various types in this country. Even this will not be final saturation; because by the end of 10 years several new types of radio receivers—for instance television combined with radio sound sets, and many others—will have made their appearance.

Add to that replacements of obsolete radios and even the most pessimistic radio man must admit that saturation in this country is—for practical purposes—distant and unreal.

---

Six American railroads were using either carrier or high-frequency radio by the middle of the past summer. Most frequent use has been in freight service.

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### TELEVISION "ORGAN"

*Suggested by Grego Banshuck, New York City*

# COMMUNICATIONS

## AN INSTRUCTOR LOOKS AT RADIO-CRAFT

*Dear Editor:*

Why do I buy RADIO-CRAFT? It cannot be because it is "too darned technical" for my pocketbook knows that I prefer the technical magazines. Having been in the radio field as an engineer for well over forty years I would have no interest in a magazine that catered too much to the screwdriver and plier type of serviceman.

My interest in RADIO-CRAFT is solely that of a teacher interested in seeing how others attempt to inform, and to instruct, the mixed audience of RADIO-CRAFT. When some of the instructors "talk down" to their audience they are sloppy and careless, but most of them give us something very well worth reading, and prepare their material with great care.

Your policy seems sound when I think of where your magazine fits into the present picture. During the war I thought you were a bit short of proofreaders; and that you were compelled to fill space with articles that were thrown together without care, but as things return to normal you should be able to select material with more discrimination. In general, sketches thrown together with parts missing or not properly identified are very provoking, even when one has no intention of using the material; they must be still more annoying to those who would build what is imperfectly shown and described in the article.

RADIO-CRAFT does not go to extremes. It very obviously keeps the rank beginner in mind at times, but its policy indicates to me that it believes that the beginner wants to grow.

THOMAS J. MACKAVANAGH,
*Washington, D. C.*

## MILD DEFENSE OF AMERICAN RECEIVERS

*Dear Editor:*

Stavride's letter from Greece in the January issue was very interesting. Distance and the outsider's viewpoint lends a novel, discerning and honest air to the criticisms. However, there is usually more than one side to any problem in this cockeyed world of ours.

1. What is meant by the "best" American prewar sets? Does Mr. Stavrides include $1,200 Scotts or $600 Philcos or $700 Spartons in his "best" category? I would very much like to hear a "good" European set with better frequency response than those receivers.

2. Degenerative feedback must not be regarded as a magic cure-all. How is a resistance-capacity loop or degeneration in a cathode leg to compensate for nonlinear phase-shift, audio frequency-modulation, transient and complex intermodulation distortion in audio systems? Real quality is obtained not by phony "bass boost" or high-frequency cut-off and phase shifting "tone-controls" but by using low-mu triodes in push-pull; video-circuit type low- and high-frequency peaking circuits; direct coupling; $100 to $200 loudspeakers, flat from 30 to 15,000 cycles; and $30 to $50 laboratory standard output transformers flat from 20 cycles to 20 kilocycles. Such circuits are really wide-band and high-fidelity, but cost money—real money—and cannot be attained with a dollar's worth of condensers and resistors.

3. American receivers must use higher intermediate frequencies of necessity. This reduces various cross-modulation, harmonic, and difference-frequency interference effects from other American communication bands. Lower i.f.'s might improve gain but are impractical in the United States.

4. Cost and psychological factors are as important here as in Greece. Labor and material difficulties—real or imaginary—present a serious problem to American design engineers. It's a sad aftermath of a still sadder war and is to a large extent inevitable.

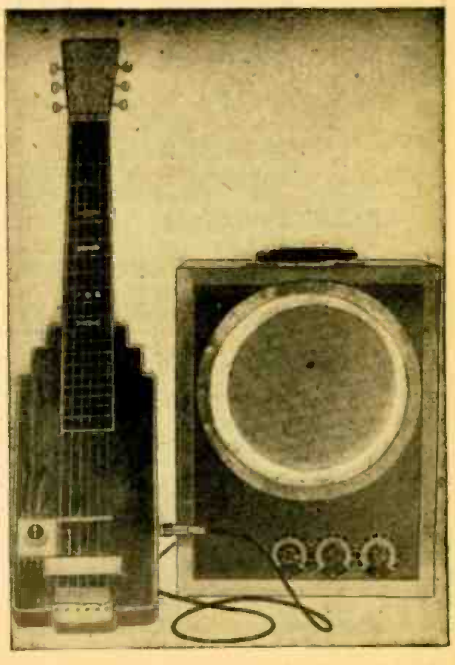
TED POWELL,
*Maspeth, New York*

## THE GUITAR WORKS WELL

*Dear Editor:*

I have had such good luck with the Electric Guitar I made from instructions in your (1946) *Radio Electronics Reference Annual* that I am enclosing a photo of the complete project.

"EL" GRIMSHAW,
*North Andover, Mass.*



Wire so fine that 1,000 feet of it reeled on a spool is invisible to the naked eye is reported by the Westinghouse Lamp Division. The wire was ordered by the Bell Telephone Laboratories for a new amplifier tube.

## CONSIGNMENT COMING?

*Dear Editor:*

We are expecting some of the radio tube manufacturers to begin consigning tube stocks to radio shops, as was the practice before the war.

This will be a direct blow to all the better radio shops throughout the country, who have had to purchase their tubes outright during the war, many of them at black-market prices. It will also greatly stimulate the backyard mechanic and the number of new shops opening up over the country. It will also increase the price of tubes and parts to us all, for the manufacturer and jobber will naturally lose money on many of these consignment accounts, which must be made good by those that are able to keep going.

It would be well for the shop owners to fight such a plan by any manufacturer or jobber and voice their objections to their respective jobbers.

We will not use a tube that is being distributed on the consignment plan, and we will not do business with a jobber who is consigning tubes, if there is one we can find who does not.

G. E. RENFROE,
*Southern Radio Service,*
*Thomasville, Ga.*

## BRICKBATS AND BOUQUETS

*Dear Editor:*

I have read your magazine for many years, but gradually it is becoming worse and worse as far as the amateur radioman, experimenter or set builder is concerned. Its only interest is to the serviceman or technician. Therefore you are just *out* one more subscriber.

G. L. RUIZ,
*(No address)*

*Dear Editor:*

I have the following bouquets and brickbats for your magazine.

I find the Question Box, Radio Electronic Circuits, and Try This One! departments very interesting. I feel, however, that you publish too many audio amplifier circuits in this department. Very satisfactory amplifiers can be designed by the experimenter from readily available information (tube manuals, books, etc.).

JOSEPH E. STEMBEL,
*Kentland, Indiana*

(We have felt there is not enough available material on sound and amplifiers. What do other readers think?—*Editor)*

*Dear Editor:*

I think your paper is swell but let's have a little more on how to build radio equipment and a little less on the subject of commercial and war radio equipment and the like. Thanks.

PETER MERRICK,
*Hollyburn, B. C.*

# INDEX TO ADVERTISERS



## RADIO SCHOOL DIRECTORY
(See Page 96)

# BOOK REVIEWS

**RADIO OPERATING QUESTIONS AND ANSWERS, by Arthur R. Nilson and J. L. Hornung, Eighth Edition. Published by McGraw-Hill Book Co. Stiff cloth covers, 5 x 8 inches, 434 pages. Price $3.50.**

The new edition of this standard work supplies specimen answers to questions asked in U. S. Government radio operator examinations, as did the former editions. There are three appendices, covering radio abbreviations, radio regulations, radio laws, and—a new feature in this issue—the American Standards Association's authorized graphical symbols for radio and electronic equipment. All schematics in the book have been redrawn to conform to the new A.S.A. radio-electronic symbols.

**ATOM SMASHERS, A Story of Discovery, by Raymond Francis Yates. Published by Didier. Stiff cloth covers, 5½ x 8½ inches, 182 pages. Price $2.00.**

A story of man's exploration of the atom, written in the most popular style, this narrative begins with Democritus and continues to the experiment at Los Alamos.

The style is one that will be appreciated by juvenile readers as well as adults. Several highly scientific pieces of apparatus, such as the Wilson cloud chamber and the cyclotron, are so easily described that the reader not only understands them, but fails to realize that the subject is difficult.

The book is illustrated with numbers of good photographs and drawings, well placed to explain the subject.

**ESTABLISHING AND OPERATING AN ELECTRICAL APPLIANCE AND RADIO SHOP. Prepared by Donald S. Parris and Associates, under the direction of H. B. McCoy, United States Department of Commerce. Published by the Superintendent of Documents, Government Printing Office. Paper covers, 6 x 9 inches, 199 pages. Price 35 cents.**

This is one of a series of small business manuals prepared for the use of veterans and former employees of wartime civilian organizations. It assumes that the reader is already a skilled radioman and does not concern itself with purely technical features of maintenance and servicing. The 19 chapters range from selecting a location to credit management and the special problems of expansion. Coverage of all angles of the small radio business is so complete that the established as well as the beginning radio dealer or serviceman might well make use of the book, with profit to himself.

**SELECTING AND OPERATING A BUSINESS OF YOUR OWN, by Gustav E. Larson, Robert H. Johnson, and Walter Magnus Teller. Published by Prentice-Hall, Inc. Stiff cloth covers, 6 x 8½ inches, 364 pages. Price $3.00.**

While only 9 pages of the book directly concern the man who plans to start an electrical appliance and radio repair shop, the radio repairman or would-be radio repairman may well find interesting the three chapters on small business in general. It is also interesting to compare the prospects and problems of other small businesses with those of radio repairing.

The space given to starting an electrical and radio business is so small that the treatment is necessarily rather general, but some specific cost estimates are given. The bibliography is interesting, as it must have been made up by compiling the books on the author's desk at the moment. Three magazines are mentioned, but all are largely concerned with appliances rather than radio servicing.

*(Continued on page 96)*


*Suggested by Grego Banshuck, New York City*

"I want 100,000 radios to give away on our radio show—
If you can build them for 50c each."

## MULTIVIBRATORS

*(Continued from page 58)*

through RP2. At the instant V1 is triggered by a negative pulse, V2 grid is driven positive. V2, of course, conducts heavily, and C discharges through the low-impedance plate-cathode path of V2. This voltage change occurs rapidly, depending on C and V2's plate impedance.

There are numerous other practical applications to which the multivibrator circuit may be adapted. No attempt has been made to describe all of them.

## BOOK REVIEWS

*(Continued from page 95)*

**MOST-OFTEN-NEEDED 1946 RADIO DIAGRAMS and Servicing Information, by M. N. Beitman. Published by Supreme Publications. Heavy paper covers, 8 x 10½ inches, 192 pages. Price $2.00.**

More than 300 schematics of 1946 model receivers are printed in this book. Many of the diagrams are accompanied by complete service and alignment data. In some cases parts lists and replacement data are given, and there is also a certain amount of information on record changers.

The book is carefully compiled, and in spite of the large amount of material, excellent utilization of available space has made it possible to print all the diagrams large enough to be easily read in practically all cases.

## INSTALL A WAVE TRAP!

*(Continued from page 87)*

R.d.f. beacon signals leaking through the i.f. of the set are not the only headaches encountered in the way of interference of this type in sets with no preselection before the mixer stage. In the "good old days" of ham radio operation on the 160-meter band, some owners of small, and not-so-small, radios got very wrathful with the unfortunate amateur whose signals the second harmonic of his receiver local oscillator were converting to the i.f. of his set, with the result that several favorite programs were completely spoiled by strong "Ham chatter." Now that the 160-meter band and adjacent frequencies are being used for *LORAN* and local police radio services, the interference in most localities hasn't let up much.

This type of interference calls for almost the same treatment as the i.f. leak-through type. The only difference is that this new interference is of a higher frequency and calls for a wave trap tuned to that frequency and efficient enough to reduce the unwanted incoming signal to a level that will not be amplified by the i.f. amplifier of the set. In addition, see that the grid circuit of the mixer stage from the wave trap to the grid of the tube is sufficiently shielded.

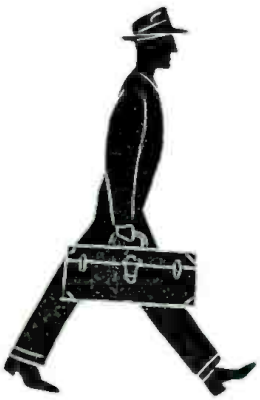
# NEXT MONTH

## IN RADIO MAINTENANCE

*June Issue*


### *Test Equipment Maintenance*

The first of a series of three big articles on maintaining your own test equipment. Every Serviceman knows the importance of keeping his test instruments properly calibrated and in good condition—and this series of articles will help you do just that. Read about preventive maintenance on Tube Testers, VTVM, Oscillographs, Multimeters, Signal Generators, etc. . . . How often they should be calibrated . . . How to service them and the equipment needed for best results . . . A discussion of laboratory techniques of fine adjustments . . . Hints and kinks . . . meter peculiarities . . . Replacement parts, etc. Your test instruments can mean the difference between success and failure of your business . . . This series of articles will be a valuable reference for your service library!



### *Television Receivers*

Part of a series by Mortan Scheraga, Television Editor for RADIO MAINTENANCE. Mr. Scheraga describes completely each of the sections in a television receiver and its component parts . . . Alignment, Maintenance and Repair are thoroughly covered . . . In Metropolitan areas, television receivers are already in wide use and smaller communities will soon have them. The public will demand competent repair and maintenance of these new sets, and the Serviceman who knows his television is assured a successful career. Follow television in RADIO MAINTENANCE and be prepared!

### *When the customer isn't right!*

What to do to keep good customer relations. Have you ever had a customer say that your price is too high compared to others? Or that this repair job should be free because you fixed the same radio only a month previously? Find out how some of the leading servicemen in the country handle these difficult situations brought on by some customers. The most frequently encountered problems of customer relations were boiled down into ten questions and each is answered by a different service organization. Read these answers in the June issue, and they will help you meet awkward problems with tact and assurance, and keep all of your customers happy!

*And in addition you'll find*

- **THE RADIO SERVICE BENCH**
- **SERVICE MEN'S ACTIVITIES**
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- **THE LATEST THING IN RADIO**

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## *June Issue*

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### *You'll feel this way too!*

Although I am a comparative newcomer to the radio servicing field, I felt, as many other servicemen must have, that what our trade needed was a publisher who would devote a magazine entirely to the radio serviceman. After receiving only one copy, I am more than pleased with RADIO MAINTENANCE and wish to thank your organization in all sincerity for doing a great job.

J. M.
Chicago, Ill.

This is my first subscription to your magazine and as long as it continues to have such fine articles, you can count on me as a subscriber. It is the answer to a technician's prayer, and any one who misses your magazine is missing valuable material.

W. L. B.
Berkeley, Calif.

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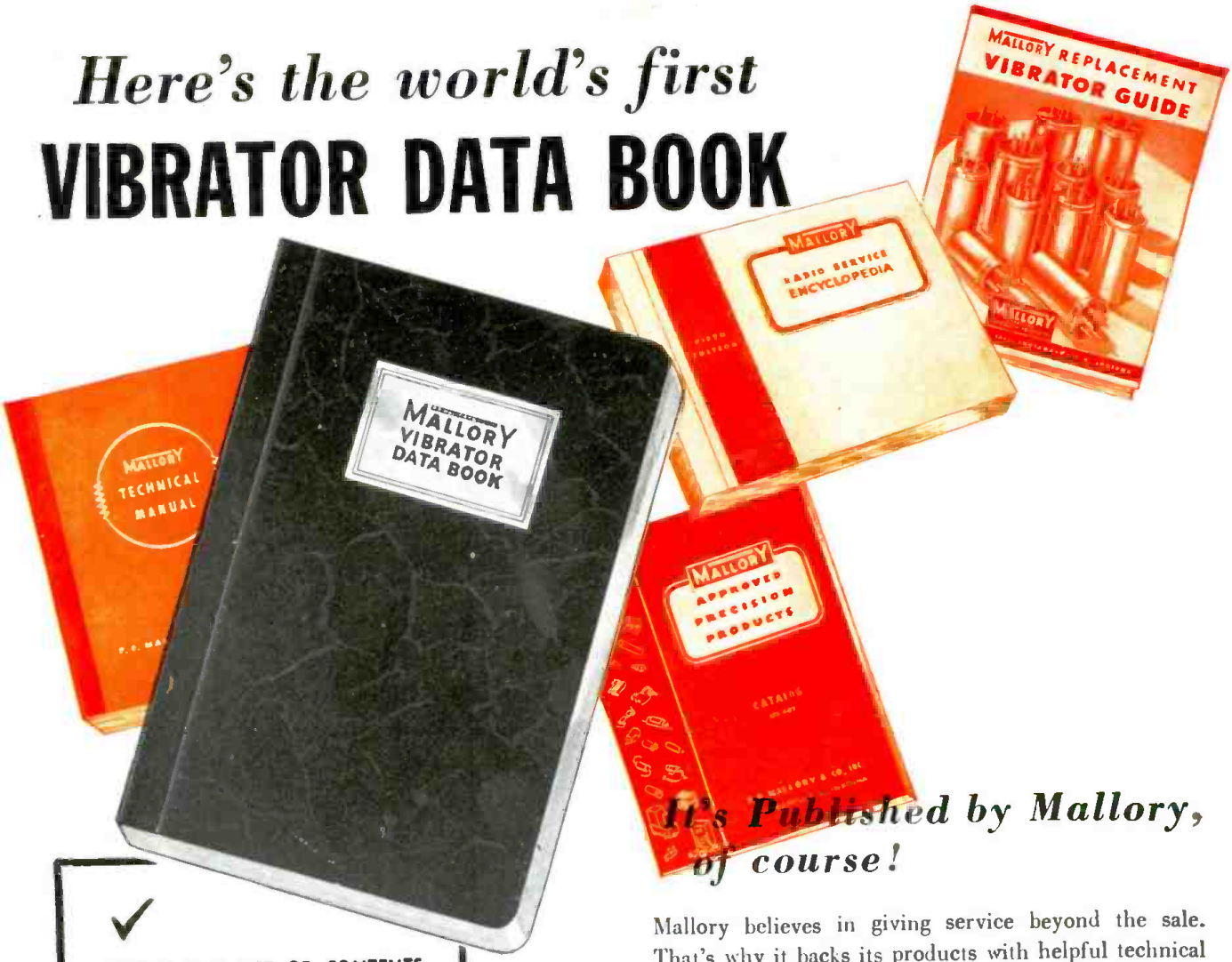


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