

New Methods to Improve Your Hi-Fi

# POPULAR ELECTRONICS

MARCH  
1957

35  
CENTS

## "Why I Chose a Career in Electronics"

Delores Startzel, AT3, U. S. Navy

- *New Use for Infrared Light*
- *Beep Out FM Commercials*
- *Voices "Command" New Circuit*
- *Build Electronic "Stethoscope"*



E-27-115312-18  
LOUIS HOFFART  
18108 WINDWARD  
CLEVELAND OHIO



# TEST 5 TUBES in 4 SECONDS each... ACCURATELY!

WITH THE NEW ADVANCED ENGINEERED

## precise MODEL 116

### Gm. & Em. ULTRAFAST TUBE & TRANSISTOR TESTER



Completely  
NEW!

PRECISE MODEL 116K in kit form **\$69.95**  
 PRECISE MODEL 116W factory wired **\$119.95**  
 Incl. Carrying Case & Cover

Servicemen know the Precise Model 111 (the winner in an independent survey) easily rates "the finest tube tester in the field" at any price, BUT FOR AN ON THE JOB QUICK-TEST... the fastest, most accurate is the PRECISE Model 116. What's more you test tubes the foolproof method inherent in the famous Precise Model 111.

Did you ever wish you could plug in 5 of the same type tubes at once and check each one individually by rotating a switch? YOU CAN WITH THE PRECISE MODEL 116—Plug in 5 IF tubes and let them heat up at once and then check each one separately by rotating the TUBE BANK switch. ACTUALLY CHECK 5 TUBES IN 20 SECONDS, 4 SECONDS PER TUBE.

The Precise Model 111 taught the lesson that IF amplifier tubes (like the 6BC5 or 6AU6) should be tested for Gm (mutual transconductance) while the power amplifiers (like the 6L6) should be tested for Em (emission)—that's ULTRAFAST Model 116 test! It checks each section of each tube separately... by rotating the FUNCTION SWITCH... each triode of a dual triode is checked individually... each diode and the triode of a duo-diode-triode is separately tested and not lumped as in other testers... and a pentode is tested as a pentode—not a diode. TRANSISTORS, SHORTS, GAS, LIFE, Em, Gm etcetera can be tested with the PRECISE Model 116.

You can inexpensively extend the Precise Model 116 to test filament current, etc. The Model 116 gives an accurate, ultra-fast (3 basic knobs for testing) check of television tubes!

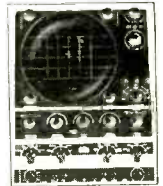
No Surplus—An etched panel—beautiful Moleskin covered wood carrying case and specially simplified instructions makes the PRECISE MODEL 116 THE FINEST FAST-CHECK TUBE TESTER AND DOLLAR EARNING TRAVELING COMPANION A TV SERVICEMAN EVER HAD.

Order NOW to insure early delivery.

SEE YOUR LOCAL DISTRIBUTOR FOR PROOF OF WHAT WE OFFER—OR WRITE US FOR DOCUMENTARY RESULTS OF AN INDEPENDENT SCIENTIFIC SURVEY.



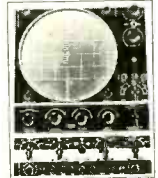
THE FAMOUS MODEL 111  
 111K ..... \$79.95  
 111W ..... \$139.95  
 Incl. Carrying Case & Cover



THE FIRST LOW PRICED  
 3" COLOR SCOPE  
 300K ..... \$99.95  
 300W ..... \$199.50



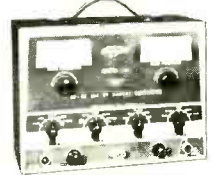
LOW PRICED 5" SCOPE  
 315K ..... \$49.95  
 315W ..... \$84.95



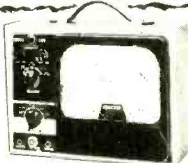
THE FIRST AND ONLY  
 8 1/2" COLOR SCOPE  
 308K ..... \$129.50  
 308W ..... \$229.50



LOWEST PRICED  
 WIRED 4 1/2" VTVM  
 909K ..... \$25.98  
 909W ..... \$37.50



RF-AF-BAR GENERATOR  
 with pre-assembled\* head  
 630K ..... \$39.95  
 630A\* ..... \$38.95  
 630W ..... \$53.95



THE FINEST VOLT. REG.  
 7" VTVM KIT  
 9071K ..... \$35.95  
 9071W ..... \$49.95



LOW PRICED RF SIGNAL GENERATOR  
 "BEST BUY" IN GEN. FIELD  
 610K ..... \$23.95  
 610K pre-assembled head ..... \$28.95  
 610W ..... \$39.95



UNIV. AF, SINE, SQ, & PULSE GEN  
 635K ..... \$33.50  
 635W ..... \$52.50

Prices slightly higher in the West. Prices and specifications subject to change without notice.

PTAK \$2.95  
 PTAW \$4.25

SEE THE MANY MORE PRECISE INSTRUMENTS AND PROBES AT YOUR DISTRIBUTOR TODAY!

## precise DEVELOPMENT CORP.

2 NEIL COURT, OCEANSIDE, NEW YORK, U.S.A.

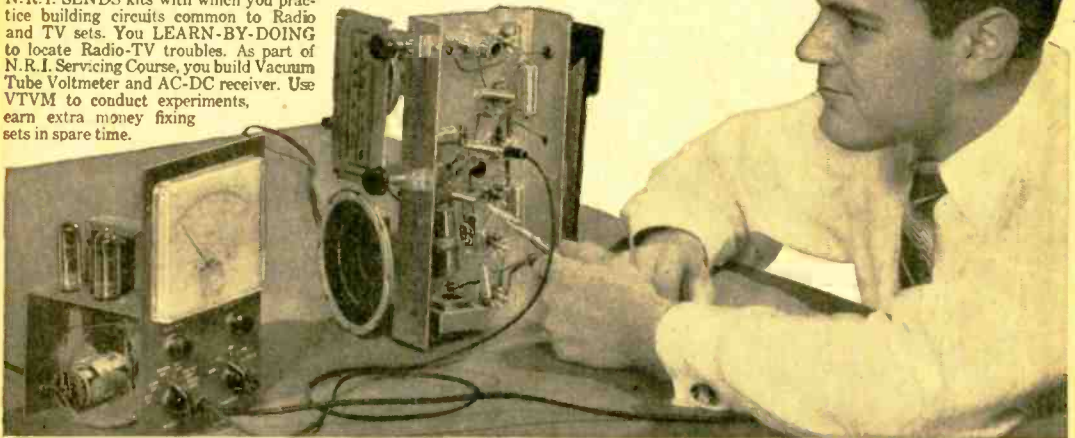
WRITE FOR CATALOG PE 3-7



# Learn Radio-Television

## Servicing or Communications by Practicing at Home in Spare Time

N.R.I. SENDS kits with which you practice building circuits common to Radio and TV sets. You LEARN-BY-DOING to locate Radio-TV troubles. As part of N.R.I. Servicing Course, you build Vacuum Tube Voltmeter and AC-DC receiver. Use VTVM to conduct experiments, earn extra money fixing sets in spare time.



**RADIO-TV BROADCASTING** (see above) offers important positions as Operators and Technicians. **RADIO-TV SERVICING Technicians** (see below) needed in every community. Their services are respected, their skill appreciated.



## Fast Growing Field Offers You Good Pay, Success, Bright Future



**J. E. SMITH**  
Founder

Bigger than ever and still growing fast. That's why Radio-TV has special appeal to ambitious men not satisfied with their job and earnings. More than 4,000 Radio and TV stations. More than 150 million home and auto Radios, 40 million TV sets. Color TV promises added opportunities. For the trained man, there are good jobs, bright futures in Radio-TV Servicing or Broadcasting.

Training PLUS opportunity is the ideal combination for success. So plan now to get into Radio-TV. The technical man is looked up to. He does important work, gets good pay for it. Radio-Television offers that kind of work. NRI can supply training quickly, without expense of going away to school. Keep your job while training. You learn at home in your spare time. NRI is the OLDEST and LARGEST home study Radio-TV school. Its methods have proved successful for more than 40 years.

### Added Income Soon - \$10, \$15 a Week in Spare Time

Soon after enrolling, many NRI students start to earn \$10, \$15 a week in spare time fixing sets. Some pay for their training and enjoy extra luxuries this way. Some make enough to start their own Radio-TV shops. NRI training is *practical*—gets quick results. Easy to understand, well illustrated lessons teach you basic principles. And you LEARN-BY-DOING by practicing with kits of equipment which "bring to life" things you study.

### Find Out What NRI Offers

NRI has trained thousands for successful careers in Radio-TV. Study fast or slow—as you like. Diploma when you graduate. Mail coupon now. Paste it on a postcard or mail in envelope. **ACTUAL LESSON FREE.** Also 64 page catalog that shows opportunities, shows equipment you get. Cost of NRI courses low. Easy terms. **NATIONAL RADIO INSTITUTE, Dept. 7CD4, Washington 9, D. C.**

### N.R.I. TRAINED THESE MEN FOR SUCCESS



"I was repairing Radios by 10th lesson. Now have good TV job." **M. R. LINDEMUTH,** Fort Wayne, Ind.



"Doing spare time repairs on Radio and TV. Soon servicing full time." **CLYDE HIGGINS,** Waltham, Mass.

"I had a successful Radio repair shop. Now I'm Engineer for WHPE." **V. W. WORKMAN,** High Point, N. C.



"There are a number of NRI graduates here. I can thank NRI for this job." **JACK WAGNER,** Lexington, N. C.



### VETERANS Approved Under G. I. Bills

## SEND FOR BOTH FREE

**National Radio Institute**

Dept. 7CD4, Washington 9, D. C.

Mail me Sample Lesson and 64-Page Catalog FREE. (No salesman will call. Please write plainly.)

Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_

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

Approved Member National Home Study Council



POPULAR ELECTRONICS is published monthly by Ziff-Davis Publishing Company, William B. Ziff, Chairman of the Board (1948-1953), at 64 E. Lake St., Chicago 1, Ill. Entered as second class matter August 27, 1934 at the Post Office, Chicago, Illinois. SUBSCRIPTION RATES: One year U.S. and possessions, and Canada \$4.00; Pan-American Union countries \$4.50, all other foreign countries \$5.00.

# POPULAR ELECTRONICS

## CONTENTS

### FEATURE Articles and Electronic Developments

A "Wave" in Naval Electronics.....	H. H. Fantel	39
More Than Meets the Ear.....	Rafe Gibbs	41
ON THE AIR with the Civil Air Patrol.....	Wayne Winters	43
Young Scientist's Project.....		45
Lissajous Had a Figure for It.....	Howard Burgess	63

### ELECTRONIC Build-It-Yourself Projects

Infrared Photocell System Uses Invisible Light Beam	Harvey Pollack	47
Kit Builder's Korner.....		50
Transistorized Audio Photometer.....	Luis Vicens	55
Power Supply Made from Filament Transformers	Frank H. Tooker	56
The 21 SPECIAL.....	William I. Orr	58
Subminiature A.C. Power Supplies.....	Frank H. Tooker	62
You'll Amaze Your Friends with an Electronic "Detectoscope"	Louis E. Garner, Jr.	74
Transistorized "Command" Circuit.....	Lester Banks	78
Transopic Experiment No. 16—Loudspeaker Metronomes	Louis E. Garner, Jr.	83

### AUDIO and Hi-Fi Features

Double-Duty Crossover.....	Robert J. Murray	53
How to Beep Out FM Commercials.....	Donald L. Stoner	67
Hi-Fi and the ELECTRONIC CROSSOVER.....	Norman Eisenberg	71
Sound Impressions.....		88

### Miscellaneous Electronic News

Growing "Whiskers" on Metal.....		42
Improved Panelescent Lamps.....		42
Organist at Work?.....		42
Turntable Rotates Autos.....		42
Doggone Electronics.....		57
Where Are We?—Ask D.R.T.....		57
Atom Rays Poison Parts.....		66
Lost Chords Found—Electrically.....		66
Watch That Radio!.....		66
Calling All Cows!.....		70
How Hard Does Champ Punch?.....		70
Mobile Selling.....		70
Tiny Portable.....		70
New V.H.F. Listing.....		98

(Also see page 6 for DEPARTMENTS)

Cover photo by Maynard Frank Wolfe  
Oscilloscope by Knight-Kit

Copyright © 1957 by Ziff-Davis Publishing Company.  
All rights reserved.

Average Net Paid Circulation 240,151

MARCH

1957

VOL. 6—NUMBER 3

**Publisher**  
**OLIVER READ, W1ETI**

**Managing Editor**  
**OLIVER P. FERRELL**

**Technical Editor**  
**CHARLES S. TEPPER**

**Feature Editor**  
**NORMAN EISENBERG**

**Associate Editors**  
**HANS H. FANTEL**  
**MARGARET MAGNA**

**Contributing Editors**  
**H. BENNETT** **L. E. GARNER, JR.**  
**H. S. BRIER** **H. POLLACK**  
**J. T. FRYE** **R. P. TURNER**

**Art Editor**  
**ALFONS J. REICH**

**Art and Drafting Dept.**  
**J. A. GOLANEK** **M. WHELPLEY**  
**W. K. VAHLING** **J. A. ROTH**

**Advertising Director**  
**L. L. OSTEN**

**Advertising Manager**  
**WILLIAM G. McROY**

**Midwest Adv. Manager**  
**JIM WEAKLEY**

**Western Adv. Manager**  
**JOHN E. PAYNE**



Member  
Audit Bureau of  
Circulations



**ZIFF-DAVIS**  
**PUBLISHING COMPANY**  
**W. B. ZIFF (1898-1953) FOUNDER**

Also Publishers of  
**RADIO & TELEVISION NEWS**  
Editorial and Executive Offices  
366 Madison Ave., New York 17, N.Y.  
MU 7-8080

**President**  
**B. G. DAVIS**

**Vice-President**  
**H. J. MORGANROTH**

**Vice-President**  
**M. FROELICH**

**Vice-Pres. & Circ. Dir.**  
**M. MICHAELSON**

**Secretary-Treasurer**  
**G. E. CARNEY**

**Art Director**  
**AL GRUEN**

**BRANCH OFFICES**  
**CHICAGO (1)**  
64 E. Lake St., AN 3-5200  
**LOS ANGELES (14)**  
215 W. 7th St. (Room 412)  
Trinity 8043

**SUBSCRIPTION SERVICE:**  
All communications concerning subscriptions should be addressed to Circulation Dept., 64 E. Lake St., Chicago 1, Ill. Include your old address as well as new—enclosing if possible an address label from a recent issue of this magazine. Allow at least 4 weeks for change of address.

**CONTRIBUTORS:**  
Contributors are advised to retain a copy of their manuscripts and illustrations. Contributions should be mailed to the New York Editorial Office and must be accompanied by return postage. Contributions will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Any copy accepted is subject to whatever adaptations and revisions are necessary to meet the requirements of this publication. Payment covers all author's, contributor's and contestant's rights, title, and interest in and to the material accepted and will be made at our current rates upon acceptance. All photos and drawings will be considered as part of material purchased.

POPULAR ELECTRONICS





THESE MEN ARE GETTING PRACTICAL TRAINING

# IN ELECTRICITY

—ELECTRONICS

*On Real:*



**A.C. and D.C. MOTORS  
GENERATORS  
SWITCHBOARDS  
CONTROLLERS  
WIRING JOBS  
APPLIANCES  
ELECTRONIC UNITS**

*(Shown at left—Instructor explaining operation and testing of a large Motor Generator in our A.C. Department.)*

# AND TELEVISION-RADIO

*On Real:*

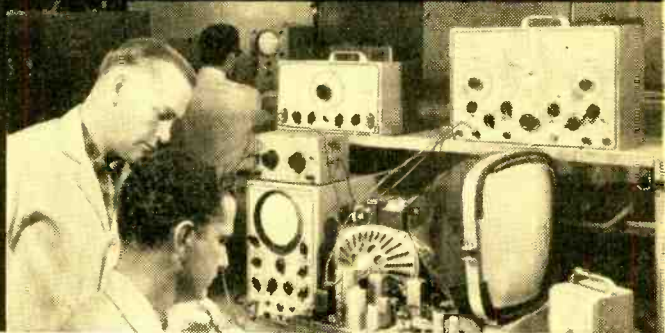
**TELEVISION SETS  
RADIO RECEIVERS  
F.M.**

**(Frequency Modulation)  
ELECTRONICS**

**RECORD CHANGERS  
AUTO RADIOS**

**PUBLIC ADDRESS Systems**

*(Right — Instructor helping students check the wiring and trace circuits of television receivers.)*



## Train in the great SHOPS of COYNE

**Largest, Oldest, Best Equipped School Of Its Kind In The U. S.**

Whether 17 or up to 45 years of age, prepare for your future now. Don't be satisfied with a "No Future" job. Train the Coyne way for a better job in a field that offers a world of opportunities in the years ahead.

**FINANCE PLAN** Enroll now, pay most of tuition later. Part-time employment help for students.

**WE TRAIN YOU IN CHICAGO** on real equipment. Trained instructors show you how, then you do practical jobs yourself. No previous experience or advanced education needed.

**CLIP COUPON NOW** for big new illustrated Coyne book "Guide to Careers in ELECTRICITY and TELEVISION-RADIO". No obligation; no salesman will call. Get vital facts now! **Training in Refrigeration and Electric Appliances can be Included.**



*Mail Coupon for  
Big Free Book*

Training Offered  
to VETERANS  
and  
MON-VETERANS  
Alike

**B. W. COOKE, President  
COYNE ELECTRICAL SCHOOL**

500 S. Paulina St., Chicago 12, Ill. Dept. 37-71H

Send **FREE** book and details of all the training you offer. This does not obligate me and no salesman will call. I am especially interested in:

- ELECTRICITY-ELECTRONICS
- TELEVISION-RADIO

NAME .....

ADDRESS .....

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

B. W. COOKE, Pres. **COYNE** FOUNDED 1899  
**ELECTRICAL SCHOOL**

A TECHNICAL TRADE INSTITUTE OPERATED NOT FOR PROFIT  
500 S. PAULINA STREET, CHICAGO, Dept. 37-71H  
ELECTRICITY ★ RADIO ★ TELEVISION ★ REFRIGERATION ★ ELECTRONICS

March, 1957

I JUST SAW AN  
ADVANCE PROOF  
OF THE NEW BOOK...



**TRANSISTOR  
APPLICATIONS  
VOL. II**

**IT'S TERRIFIC!  
WATCH FOR  
IT!**

**ON SALE NEXT MONTH**

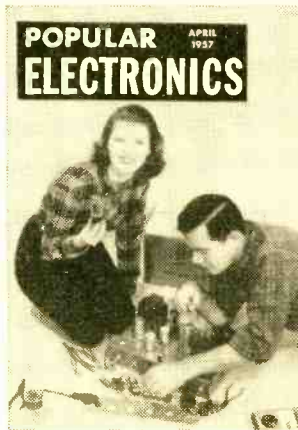


*Excellence in Electronics*  
**RAYTHEON MFG. CO.**  
Receiving and Cathode Ray Tube Operations  
Newton 58, Massachusetts

**DEPARTMENTS**

Carl & Jerry.....	John T. Frye	10
Letters from Our Readers.....		24
Tools and Gadgets.....		30
Tips and Techniques.....		32
POP'tronics Bookshelf.....		34
McWatts.....	Carl Kohler	36
The Transmitting Tower.....	Herb S. Brier	80
Transistor Topics.....	Lou Garner	82
Tuning the Short-Wave Bands.....	Hank Bennett	84
After Class.....		85

**COMING NEXT MONTH (APRIL)**



(ON SALE MARCH 19)

Electronic "thought control" is the theme of our lead article. For centuries dictators have been searching for ways and means to suppress the desire for freedom of speech and action. Unfortunately, electronics may provide the answer. The human brain can be controlled by introducing known wave patterns—some waves upset physical stability, others cancel emotions, and still others nullify thoughts about freedom and initiative. "Bio-control" is a word you will be hearing more about—should World War III ever occur.

We will also publish a detailed article on hi-fi amplifier kits, material on how to build a loudness control and to construct an electronic house lighting control unit, plus many other exciting articles.

**IN THIS MONTH'S  
RADIO & TELEVISION NEWS**

(March)

- Before You Call for Service—Check Your Own Hi-Fi System
- Adding an FM Tuning Indicator
- Why Do Amplifiers Sound Different?
- Birth of the Electron Tube Amplifier
- Turntable Speed Problems



Lafayette

# CAMERA DIVISION

Direct Imports  
YOU SAVE  
Importer's profits

SAVE  
33 1/3-50%



~~49.50~~ Value!

Special  
only  
23.50



**PORTABLE 35MM TABLE VIEWER & PROJECTOR**

Use it as a table viewer or wall projector at home—school—club—sales meeting. Projects a sharp direct view image from color or black and white 35MM slides onto a self-contained 5/8" x 5/8" ground glass screen, or, if you wish, project your slides on a light-colored wall or projection screen and enjoy a 10 sq. ft. picture with the same sharp focus. Magazine holds 36 slides that change with the flick of a lever. Compact steel case with carrying handle measures 10" x 7" x 3 1/2" deep. With standard 100-watt projection bulb, F3.5 lens, projection mirror, view screen, on-off switch, line cord and instructions. For 105-115V. AC-DC.

F-276—Shg. wt. 5 lbs. ....Net 23.50

## COMPLETE STEREO CAMERA

- With Flash Unit
- 3D Viewer—Frames
- Leather Case—Straps

Takes 16 single pictures or 8 stereo pairs in color or black and white. Uses standard 127 film. Matched, coated 45MM fixed focus lenses with F9 and F16 stops. Built-in flash synchronization. Shutter cocking lever prevents double exposure. Light weight body covered with black leatherette and trimmed with brushed aluminum. Genuine leather Eveready case with straps. Shpg. wt., 3 lbs.

F-178—Complete Camera and Kit Net 9.95

Frames for Stereo Viewing.

F-210—Pkg. of 12 .....Net .39

## TWIN-LENS FOCUSING REFLEX

Two F3.5 Coated Lenses  
9 Speeds: to 1/200 Sec!

Precision, coupled focusing of fast F3.5/80 coated lenses with stops to F22, give excellent definition. Built-in flash synchronization (standard PC terminal) and standard cable release socket. Shutter speeds: 1/200, 1/100, 1/50, 1/25, 1/10, 1/5, 1/2, 1 sec. and bulb. Flip of finger erects or closes hood of ground glass viewer with magnifier. Also has built-in sports finder. Rugged, all metal covered case has tripod socket. Takes 12, 2 1/4 x 2 1/4 pictures from standard 120 roll film. Shpg. wt. 4 lbs.

F-205—Less Case .....Net 19.49

F-206—Leather Eveready Case .....Net 3.95

F-207—Above outfit with Collapsible

Flash Gun .....Net 26.39



## EXCLUSIVE 35MM CAMERA WITH COUPLED RANGE FINDER LAFAYETTE "RANGEFINDER 35"

9 Shutter Speeds . . . to 1/300 Second!

Check these features and compare Lafayette's price with any other brand. Fast F2.8 coated lens and extra-wide lens aperture for brilliant, sharper full color or black and white pictures even in poor light. Sight and focus through combined range-view finder. Fully synchronized at all speeds for class F, M and electronic flash. Speeds from 1 sec to 1/300th. Rapid advance sets shutter, counts exposure and transports film. Built-in delayed action timer. Automatic exposure counter and film stop. Hi-speed rewind with folding lever. Standard accessory shoe on top-film type indicator. PC flash terminal. Takes 20 or 35 exposures. All metal body with brushed chrome trim, black leatherette covering. Shpg. wt., 3 lbs.

F-196—Camera, less Case .....Net 34.95

F-197—Leather Eveready Case .....Net 3.95

F-198—Outfit above with Folding BC Flash Gun .....Net 41.85

Lafayette Radio 165-08 Liberty Ave.  
DEPT 1B JAMAICA 33; N. Y.

Please ship following:

- |  |  |
|--|--|
| <input type="checkbox"/> 35mm Viewer 23.50 | <input type="checkbox"/> Stereo Outfit 9.95      |
| <input type="checkbox"/> REFLEX 19.49      | <input type="checkbox"/> CASE 3.95               |
| <input type="checkbox"/> 35mm Camera 34.95 | <input type="checkbox"/> Outfit w/Gun 26.39      |
| <input type="checkbox"/> FLASH GUN 3.99    | <input type="checkbox"/> COMPLETE CATALOG (FREE) |

I am enclosing \$.....

Send C.O.D. I enclose 20% deposit

NAME .....

ADDRESS .....



EXCLUSIVE

F2.8 LENS

Reg. Value  
~~49.50~~

Only 34.95

## FOLDING BC POCKET FLASH

Unique, pocket size flash gun that folds like a fan to 4" x 2". Efficient 4 1/2" diameter metal reflector has pebbled finish to eliminate hot spots. B-C combination for surefire and high voltage. Molded battery case with built in test lamp, bulb ejector and extension socket. Has adjustable standard shoe to fit all flash accessory clips. Uses standard bayonet base flash bulbs. Exposure guide built-in on rear of case. With cord for PC fitting and condenser. Shpg. wt. 1 lb.

F-209—With Leather Case .....Net 3.99



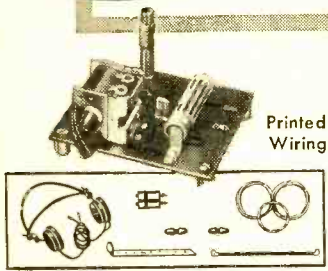
100 SIXTH AVE.  
NEW YORK, N. Y.

BOSTON 10, MASS. 110 Federal St.  
NEWARK 2, N. J. 24 Central Ave.  
PLAINFIELD, N. J. 139 W. Second St.  
BRONX 58, N. Y. 542 E. Fordham Rd.

**BUILD THE  
BEST  
AND SAVE!**

**you get the most for your money when you build  
ALLIED'S own knight-kits**

- ★ You get maximum value for your kit dollar
  - ★ You get advanced design and top performance
  - ★ You get easiest-to-follow instructions for assured success in the finished equipment
  - ★ You get premium quality parts
  - ★ You get exclusive new features
- BUY WITH CONFIDENCE FROM THE PIONEERS IN ELECTRONIC KITS**



Printed Wiring

**Fascinating knight-kit  
TRANSISTOR RADIO KIT**

**Model S-765** Experiment with the marvel of transistors! Printed circuit mounting board simplifies assembling. Just mount components, solder a few connections and enjoy excellent AM broadcast reception. Compact; fits in palm of your hand; operates from single penlight cell that lasts for months. Complete with all parts, transistor and penlight cell. Easy to assemble. Shpg. wt., 2 lbs.

**Model S-765.** Net only. . . . . **\$4.35**

**S-266.** Accessory kit; 4000 ohm double headphones and all parts for outdoor antenna. Net. . . . . **\$3.15**

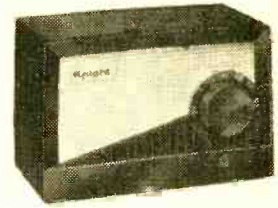


**knight-kit "SPACE-SPANNER"  
BANDSWITCHING RECEIVER KIT**

**Model S-243** All-new 2-band receiver, easy to build—a great value. Band-switch selects thrilling short wave, including amateur, aircraft, police and marine radio (6 to 18 mc), and standard broadcast. Highly sensitive regenerative circuit. Has 4" PM speaker and beam-power output for strong volume. Kit includes calibrated panel, punched chassis, all parts and tubes (less cabinet). Easy to build. 7 x 10 1/2 x 6"; for 110-120 v. 50-60 cycle AC or DC. Shpg. wt., 4 1/2 lbs.

**Model S-243.** Net only. . . . . **\$15.95**

**S-247.** Matching cabinet for above \$2.90



**knight-kit "RANGER II"  
AC-DC SUPERHET RADIO KIT**

**Model S-735** Build this top quality table model radio at low cost! Tunes full AM broadcast, 540 to 1680 kc (includes police calls). Features Alnico PM dynamic speaker; automatic volume control; sensitive Superhet circuit; handsome plastic cabinet. Easy, step-by-step assembly. Complete with punched chassis, all parts and tubes, speaker and smartly styled bakelite cabinet (6 x 9 x 5"). For AC or DC. Shpg. wt., 8 lbs.

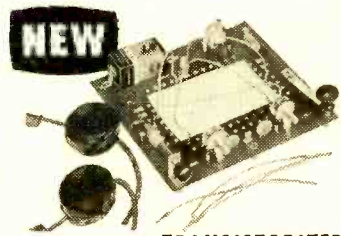
**Model S-735.** Net only. . . . . **\$17.25**



**knight-kit TWO-WAY  
INTERCOM SYSTEM KIT**

**Model S-295** Easy to build—ideal for home or office. Consists of Master and Remote unit, each with press-to-talk switch. Remote can be left "open" for distant answering or baby-sitting. In "closed" position, Remote remains private, but can be called and can originate calls. High-gain 2-stage amplifier and 4" PM speakers. With tubes and 50-ft. cable. (Up to 200-ft. may be added.) Each unit 4 3/4 x 6 1/2 x 4 3/8"; antique white finish. For AC or DC. Easy to assemble. 7 lbs.

**S-295.** Net only. . . . . **\$14.75**



**knight-kit TRANSISTORIZED  
ELECTRONIC 10-IN-1 LAB KIT**

**Model Y-299** Sensational—work with transistors! Assemble the basic parts once, then complete project after project (10 in all), just by plugging leads into proper jacks on printed-circuit board—no wiring changes needed. Make the following: AM radio; amplifier; wireless broadcaster; code practice oscillator; electronic timer, switch, flasher; voice-operated, capacity-operated and photoelectric relays. Includes all parts, 2 transistors, battery, headphone, instructions for projects. 3 lbs.

**Model Y-299.** Net only. . . . . **\$15.45**

**IDEAL KIT FOR THE HAM**

**Model S-255** only  
**\$38.95**

**knight-kit 50-WATT  
CW TRANSMITTER KIT**

Compact, value-packed, low-power rig. 50 watts input to 807; 6AG7 oscillator takes crystal or VFO; bandswitching covers 80, 40, 20, 15, 11-10 meters; pi matching network eliminates separate antenna tuner; clean cathode keying of oscillator and final; excellent TVI suppression; meter reads plate or grid of final. With all parts, tubes, wire, solder and instructions (less key and crystal). 8 1/4 x 11 1/4 x 8 3/4". 18 lbs.

**Model S-255.** Net only. **\$38.95**

order from **ALLIED RADIO** 100 N. WESTERN AVE., CHICAGO 80, ILL.



# YOU BUILD THE BEST AND SAVE MORE WITH **knight-kits**



**knight-kit**  
**VTVM KIT**  
 with printed  
 circuit board  
 Model F-125  
**\$24.95**  
 only

Easy to build. Reads peak-to-peak, 1% resistors. Balanced-bridge push-pull circuit; 4 1/2" meter, 200 microamp. Ranges: AC peak-to-peak volts, 0-4-14-40-140-400-1400-4000; AC rms v. and DC v., 0-1.5-5-15-50-150-500-1500; ohms, 0-1000-10K-100K, 1-10-100-1000 megs; db scale, -10 to +5. Zero-center scale; direct-reading db scale; polarity reversing switch. Ready to build. 7 1/4" x 5 1/4" x 4 1/2". 6 lbs.

Model F-125. Net only. . . . . **\$24.95**

F-126. High Voltage Probe. . . . . **\$4.75**  
 F-127. High Frequency Probe. . . . . **\$3.45**



**knight-kit**  
**20,000 OHM/VOLT**  
**VOM KIT**  
 Model F-140  
**\$29.50**  
 only

Low cost 32-range VOM. Features 4 1/2" 50-microampere meter; 1% precision multipliers; 2% accuracy full-scale deflection. Ranges: AC, DC and output volts, 0-2.5-10-50-250-1000-5000; Resistance, 0-2000-200,000 ohms and 0-20 meg; DC ma, 0.1-10-100; DC amps, 0-1-10; Decibels, -30 to +63 (6 ranges). Black bakelite case, 6 3/4" x 5 1/4" x 3 3/4". Ready to build. 5 lbs.

Model F-140. Net only. . . . . **\$29.50**



**knight-kit**  
**'IN CIRCUIT'**  
**CAPACITY**  
**CHECKER KIT**  
 Model F-119 only **\$12.50**

Remarkable unit checks capacitors while they're still wired in the circuit! All you do is press a button—and the "magic eye" shows opens and shorts. Tests opens and shorts on capacitors of 20 mmf or greater, even if in parallel with a resistance as low as 50 ohms. Complete; ready to build. 5 lbs.

Model F-119. Net only. . . . . **\$12.50**

**FREE CATALOG**  
 Write for our special supplement featuring dozens of other KNIGHT-KITS, including Test Instruments, Hobbyist Kits and Amateur Kits. Send for it!

## BUILD YOUR OWN QUALITY HI-FI AND SAVE!



**knight-kit LINEAR-DELUXE**  
**BASIC 25-WATT HI-FI**  
**AMPLIFIER KIT**

Custom quality at very low cost. For use with any tuner or preamp with full set of controls. Deluxe features: Chrome-plated chassis; potted transformers and chokes; printed circuit wiring board; balance and damping controls. **Output:** 25 watts. **Response:** +0.5 db, 10 to 120,000 cps at 20 watts. **Distortion:** 0.15% at 25 watts. **Speaker Outputs:** 4, 8 and 16 ohms. 6 1/4" x 14 x 9". With all parts, tubes, instructions; ready to build. Shpg. wt., 27 lbs.

Model S-755  
 only **\$44.50**

Model S-755. Net only. . . . . **\$44.50**  
 S-759. Metal enclosure for above; black finish. . . . **\$4.25**

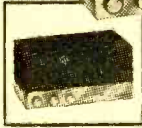


**knight-kit 10-WATT**  
**ECONOMY HI-FI AMPLIFIER KIT**

True Hi-Fi at lowest cost. Only 0.5 volt drives amplifier to full 10 watts output! **Response:** +1 db, 30 to 20,000 cps at 10 watts. **Distortion:** less than 0.5% at 10 watts. Chrome-plated chassis is punched for preamp kit listed below. Matches 8-ohm speakers. With tubes, all parts, easy instructions. 7 x 13 x 6" Shpg. wt., 14 lbs.

Model S-753  
 only **\$23.50**

S-235. Preamp kit (for magnetic cartridges) . . . . **\$3.10**  
 S-757. Metal enclosure for above; black finish. . . . **\$3.95**



**knight-kit 20-WATT**  
**LOW COST HI-FI AMPLIFIER KIT**

Delivers deluxe Hi-Fi sound. Includes built-in preamp; inputs for magnetic cartridges, etc.; record compensator; bass and treble controls, etc. **Response:** +1 db, 20-20,000 cps at 20 watts. **Speaker Outputs:** 4, 8, 16 and 500 ohms. Chrome-plated chassis, 7 1/2" x 13 x 8 3/4". With all parts, tubes and easy instructions. 23 lbs.

Model S-750  
 only **\$35.75**

Model S-750. Net only. . . . . **\$35.75**  
 S-758. Metal enclosure for above; black finish. . . . **\$4.15**



ALL PRICES NET F. O. B. CHICAGO • EASY TERMS AVAILABLE

# ALLIED RADIO

ALLIED RADIO CORP., Dept. 079-C7  
 100 N. Western Ave., Chicago 80, Ill.

OUR  
 36th  
 YEAR

Ship me the following KNIGHT-KITS:

Quantity	Description	Model	Price

\$ \_\_\_\_\_ enclosed. For parcel post, include postage (express is shipped collect).

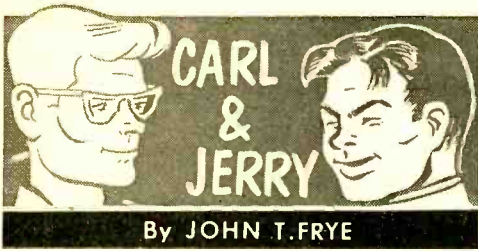
Send me your FREE Supplement covering all Knight-Kits.

Name \_\_\_\_\_

Address \_\_\_\_\_

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

**ORDER NOW** →



## Secret of Round Island

"HEY, JER, I didn't know flying a kite could be so much fun!" Carl remarked, as he let the tugging kite string pull his relaxed arm up and down in front of him. "This is as big a kick as flying model planes and less nerve-racking. We've sure got a perfect day for it, too—just look at her sail."

"The pull of a big box kite like that one does give you a thrill," Jerry agreed, leaning back on his elbows and letting his eyes follow the graceful curve of the kite string out over the water of the lake and up to the kite, which was sailing gallantly against the blue March sky. "Let out a little more cord, though. I want the kite directly over Round Island when I push the button on this radio-control unit and

trip the shutter of the camera up there in the kite."

"Why do you want a picture of the island out there?" Carl asked as he obediently let out some more line from the dangling ball of string wound figure-eight fashion on a stick so that the kite did a wild dance in mid-air.

"No particular reason. I just wanted to take a bird's-eye view of *something*, and Round Island in the middle of the lake seemed as good a subject as any. Then, too, I've always been curious to know what the center of that island looks like. None of us has ever been able to climb those rock walls that rise straight up from the narrow strip of sand around the base to get a good look-see."

"Think the camera will work?"

"Natch! How can it miss? When I push this button, the little remote-control receiver up there will close the relay contacts. This will actuate the tiny solenoid, whose short stroke will pull away the bit of Bakelite propping up the shutter lever. Finally, the rubber band will pull that lever down. Presto! One aerial picture on film!"

"Yeah," Carl said sarcastically at this recital of a Rube Goldberg chain of events. "How can it miss? Well, you may as well

## Twelve Years of Superiority

# The ALTEC 604 DUPLEX®

Since its introduction in 1945 the Altec 604 coaxial loudspeaker has been considered the finest single frame loudspeaker in the world. The 604 Duplex has become the quality listening standard in the majority of recording studios and broadcast stations. And, since the beginning of the home high fidelity market, it has led the field in popular acceptance. More than 95% of all the 604 Duplexes built are still in service today.

The reasons for the marked superiority of the speaker are surprisingly simple. Conceived originally as a professional quality standard, the 604 was designed in a straight-forward manner and at the time of its introduction incorporated many features new to the industry. Continuing research has resulted in the constant improvement of this speaker but it is interesting to note that these basic design features have not yet been changed; the 604 remains superior and many of the features built into the 604 more than 12 years ago are now being promoted in the high fidelity industry as "new developments" and "industry firsts."

Let's examine the 604C Duplex in detail, analyzing the design features which have made it famous.

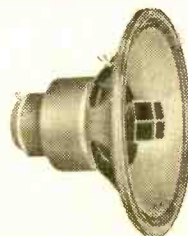
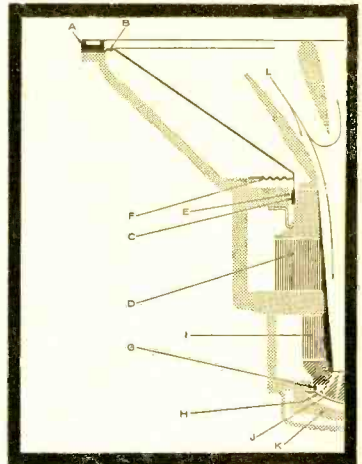
### BASS SECTION

- (a) Outer edge of loudspeaker cone held by clamping ring for better positioning.
- (b) Viscous anti-reflecting compliance damping.
- (c) Edge-wound, well-insulated copper ribbon voice-coil for high efficiency.
- (d) 4.4 pound Alnico V ring magnet.
- (e) Deep voice coil gap for homogeneous flux density and low distortion.
- (f) Annular spider and viscous damping provide low 40 cycle resonance and avoids acoustic self resonances.

The Altec 604 Duplex was a truly revolutionary development 12 years ago and with its many improvements still displays a marked degree of engineering superiority and performance throughout the entire range from 30 to 22,000 cycles noticeably superior to that of any other single frame loudspeaker. Ask your dealer for a listening comparison with any other units. We are sure you will hear the superiority that has made the Duplex famous for 12 years.

### TREBLE SECTION

- (g) Edge-wound 1.75" voice-coil for high efficiency.
- (h) Integral aluminum alloy diaphragm and tangential compliance for low mass.
- (i) 1.2 pound Alnico V ring magnet.
- (j) Dual-annular machined phasing plug.
- (k) Mechano-acoustic loading cap provides proper back loading of the aluminum diaphragm.
- (l) Professional-type true exponential multi-cellular horn for smooth 40° by 90° distribution.



The 604C including network \$165.00



Dept. 3P,  
1515 S. Manchester Ave., Anaheim, Calif.  
161 Sixth Avenue, New York 13, New York



**LET DeVRY TECH PREPARE YOU IN  
SPARE TIME AT HOME AS AN**

# **ELECTRONICS TECHNICIAN**



**NO PREVIOUS TECHNICAL EXPERIENCE  
OR ADVANCED EDUCATION NEEDED!**

Laborers and bookkeepers, store clerks, shop men, farmers, salesmen — men of nearly every calling — have taken the DeVry Tech program and today have good jobs or service shops of their own in Electronics. You don't have to quit your present job. If you are 17 to 55, see how you may get yourself ready for a future in the fast-growing Electronics field.

Whether you prepare at home or in our well-equipped Chicago or Toronto Laboratories, you get sound, basic training in both principles and practice. At home, you use educational movies. You build actual circuits and test equipment. You read simple directions, follow clear illustrations. When you finish, you are prepared to step into a good job in an excitingly different field. You may even start a service shop of your own. Mail coupon for free facts today.

### **Live-Wire Employment Service**



Puts you in touch with job opportunities—or helps you toward a better position in the plant where you are now employed.

### **Draft Age?**

We have valuable information for every man of draft age; so if you are subject to military service, be sure to check the coupon.

### **A SAMPLE LESSON**

See for yourself how DeVry Tech trains you for real opportunities in Electronics. We'll also give you a free copy of an interesting booklet, "Electronics and YOU."

# **FREE**



"One of North America's Foremost Electronics Training Centers"



Accredited Member  
of National  
Home Study Council

## **DeVRY TECHNICAL INSTITUTE**

CHICAGO 41, ILLINOIS

FORMERLY

**DEFOREST'S TRAINING, INC.**



**AN INDEX  
to a  
BETTER JOB,  
A BRIGHTER  
FUTURE**

Electronics

Radar

Guided  
Missiles

Television

Micro-Waves

Communications

Radio

Industrial  
Electronics

Computers

Automation  
Electronics

Remote Control  
Systems

Broadcasting

Your Own  
Service Shop

### **MAIL TODAY FOR FREE FACTS**

#### **DeVry Technical Institute**

4141 Belmont Ave., Chicago 41, Ill., Dept. PE-3-N

Please give me a FREE Sample Lesson and your booklet,  
"Electronics and YOU."

NAME \_\_\_\_\_ AGE \_\_\_\_\_

Please print

STREET \_\_\_\_\_ APT. \_\_\_\_\_

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

Check here if subject to military training.

#1090 DeVry Tech's Canadian Training Center is located at  
626 Roselawn Avenue, Toronto 12, Ontario

# Judge for yourself!...



## SAVE MORE! SERVICE BETTER! EMC TEST EQUIPMENT

extra features ... • PRECISION CONSTRUCTION  
• ADVANCE DESIGNS • LOWEST PRICES

### NEW! Model 905-6A Battery Eliminator, Charger & Vibrator Checker

This combination housed in single sloping metal case, is a MUST for auto radio service. Features continuously variable voltage output ... automatic overload relay-self resetting ... in either 6 or 12 volt operation ... checks all 6 and 12 volt vibrators.



Model 905-6A (Comb.) ..... \$67.90 Wired  
\$44.90 Kit Form

Model 905 Battery Eliminator  
and Charger (only) ..... \$37.50 Wired  
\$28.90 Kit Form

### NEW! Model 906 Vibrator Checker

Compact metal case unit. Checks both interrupter and self-rectifier type for proper starting point, as well as quality of operation. Reads condition of vibrator on "Bad-Good" scale of plastic front meter. Checks both 6 and 12 volt vibrators.



Used with any battery eliminator, such as Model 905.  
Model 906 ..... \$31.80 Wired  
\$17.05 Kit Form

### NEW! Model 210 Transistor Checker

Checks all PNP and NPN Transistors. Measures gain in 3 ranges. Measures leakage on 2 color "Poor-Good" scale. Supplied complete with batteries. Checks diodes.



Model 210 ..... \$10.95 Wired  
\$7.95 Kit Form

Yes, tell me more, send me—FREE—a detailed catalog of the complete EMC line.

NAME \_\_\_\_\_

STREET \_\_\_\_\_

CITY \_\_\_\_\_

STATE \_\_\_\_\_

PE-3

# EMC

Electronic Measurements Corp.  
625 B'way • New York 12, N. Y.  
Ex. Dept. 370 B'way, N. Y. 13

## Carl & Jerry (Continued from page 10)

push the button and find out. As near as I can judge, the kite is right over the middle of the island."

JERRY PUSHED the button on the little transmitter, and Carl immediately started winding in the several hundred yards of twine holding the kite. Sure enough, when the kite settled gently to the ground in front of them, the shutter control of the little box camera had been pulled down by the rubber band. The boys quickly collapsed the folding kite, mounted their bicycles, and started for home to develop the roll of film.

"We've got something, anyway," Jerry said an hour or so later as he held the strip of developed negative up to the light.

"Looks a lot like a fried egg," Carl observed disparagingly, peering over Jerry's shoulder.

The film was quickly dried and placed in the enlarger, and a short time afterwards the blown-up print loomed up at them out of the developing pan. It soon became apparent that the "fried egg" of the negative was actually a surprisingly clear and sharp picture of Round Island as seen from above. A dark fringe of vegetation around the rim of the island and a bare white area in the center gave it the look Carl had noticed in the reversed negative picture.

"Must have been a pond in the center of the island at one time," Carl observed, as they studied the still-wet picture. "Hey, look over here at the edge of the bare area! There are a couple of men."

"You're right!" Jerry said in astonishment. "And here's their boat pulled up on the sand on the far side of the island. What do you suppose they're doing? That thing between them with what looks like a stovepipe sticking out of it resembles an outdoor oven ... but what a funny place for a picnic!"

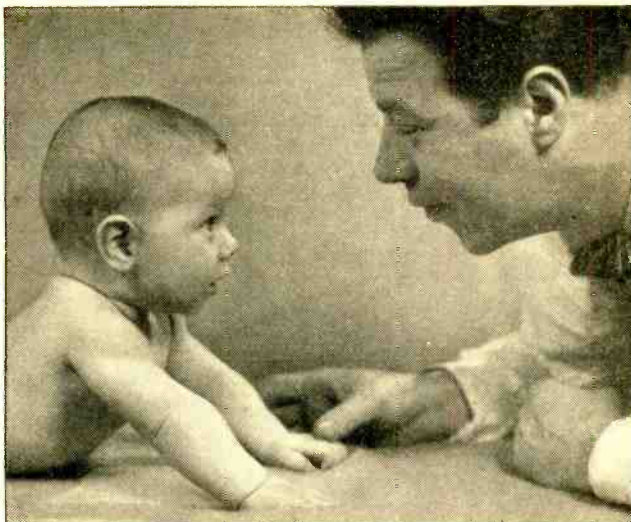
"Let's go out there tomorrow morning and see what's cooking on that outdoor oven," Carl suggested impulsively. "If those guys can get into the middle of the island, so can we. We'll borrow a boat from a friend of Dad's who lives on the lake front, row clear around to the back side of the island where their boat is beached, and find out how they got in there."

"It's a date; see you about eight," Jerry agreed.

NINE O'CLOCK the next morning found Carl plying the oars of the small boat as it moved across the mirror-still waters



# YOUR MOVE, DAD!



The first frantic months of fatherhood are over. You have time now to really enjoy the new baby—and time to really think ahead.

There's plenty to think about. And lots to plan for. What kind of a Dad will you be? What kind of a provider?

One thing's sure: now you've got to earn more money! About \$500 a year more, to start with. *But how?*

Try doing what some five thousand new fathers did last year. Start preparing yourself for a better job—at home, in your spare time. *Enroll with I.C.S.*

Most of these new fathers already have job promotions, fat pay boosts. One writes, "I've

jumped five years in one." Another reports, "I'm making \$125 more a month."

There's no magic in I.C.S. Just sound, practical, step-by-step training. And a *method* that makes it possible to master any subject as rapidly as your time and ability permit.

You have 257 courses to choose from. Business. Technical. Engineering. All job-related. All keyed to everyday problems. Let us send you a *free sample lesson* together with two valuable books—(1) opportunities in your field and (2) "How to Succeed." No obligation—except the new one you have as a father.

The famous I.C.S. coupon is right here. *And it's your move!*

**For Real Job Security—Get an I. C. S. Diploma!**

**I. C. S., Scranton 9, Penna.** Member, National Home Study Council

## INTERNATIONAL CORRESPONDENCE SCHOOLS



BOX 06949B, SCRANTON 9, PENNA.

(Partial list of 257 courses)

Without cost or obligation, send me "HOW TO SUCCEED" and the opportunity booklet about the field BEFORE which I have marked X (plus sample lesson):

- |  |   |  |  |   |
|--|---|--|--|---|
| <p><b>ARCHITECTURE and BUILDING CONSTRUCTION</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Air Conditioning—Refrig.</li> <li><input type="checkbox"/> Architecture</li> <li><input type="checkbox"/> Architectural Interiors</li> <li><input type="checkbox"/> Building Contractor</li> <li><input type="checkbox"/> Building Estimator</li> <li><input type="checkbox"/> Building Maintenance</li> <li><input type="checkbox"/> Carpentry and Mill Work</li> <li><input type="checkbox"/> Heating</li> <li><input type="checkbox"/> Painting Contractor</li> <li><input type="checkbox"/> Plumbing</li> <li><input type="checkbox"/> Reading Arch. Blueprints</li> </ul> <p><b>ART</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Cartooning</li> <li><input type="checkbox"/> Commercial Art</li> <li><input type="checkbox"/> Fashion Illustrating</li> <li><input type="checkbox"/> Magazine Illustrating</li> <li><input type="checkbox"/> Show Card and Sign Lettering</li> <li><input type="checkbox"/> Sketching and Painting</li> </ul> <p><b>AUTOMOTIVE</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Auto Body Rebuilding</li> <li><input type="checkbox"/> Auto Elec. Technician</li> <li><input type="checkbox"/> Auto-Engine Tune Up</li> <li><input type="checkbox"/> Automobile Mechanic</li> </ul> | <p><b>AVIATION</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Aeronautical Engineering Jr.</li> <li><input type="checkbox"/> Aircraft &amp; Engine Mechanic</li> </ul> <p><b>BUSINESS</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Advertising</li> <li><input type="checkbox"/> Bookkeeping and Accounting</li> <li><input type="checkbox"/> Business Administration</li> <li><input type="checkbox"/> Business Correspondence</li> <li><input type="checkbox"/> Public Accounting</li> <li><input type="checkbox"/> Creative Salesmanship</li> <li><input type="checkbox"/> Federal Tax</li> <li><input type="checkbox"/> Letter-writing Improvement</li> <li><input type="checkbox"/> Office Management</li> <li><input type="checkbox"/> Professional Secretary</li> <li><input type="checkbox"/> Retail Business Management</li> <li><input type="checkbox"/> Sales Management</li> <li><input type="checkbox"/> Stenographic-Secretarial</li> <li><input type="checkbox"/> Traffic Management</li> </ul> <p><b>CHEMISTRY</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Analytical Chemistry</li> <li><input type="checkbox"/> Chemical Engineering</li> <li><input type="checkbox"/> Chem. Lab. Technician</li> <li><input type="checkbox"/> General Chemistry</li> <li><input type="checkbox"/> Natural Gas Prod. &amp; Trans.</li> <li><input type="checkbox"/> Petroleum Engineering</li> <li><input type="checkbox"/> Plastics</li> <li><input type="checkbox"/> Pulp and Paper Making</li> </ul> | <p><b>CIVIL, STRUCTURAL ENGINEERING</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Civil Engineering</li> <li><input type="checkbox"/> Construction Engineering</li> <li><input type="checkbox"/> Highway Engineering</li> <li><input type="checkbox"/> Reading Struct. Blueprints</li> <li><input type="checkbox"/> Sanitary Engineering</li> <li><input type="checkbox"/> Structural Engineering</li> <li><input type="checkbox"/> Surveying and Mapping</li> </ul> <p><b>DRAFTING</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Aircraft Drafting</li> <li><input type="checkbox"/> Architectural Drafting</li> <li><input type="checkbox"/> Electrical Drafting</li> <li><input type="checkbox"/> Mechanical Drafting</li> <li><input type="checkbox"/> Mine Surveying and Mapping</li> <li><input type="checkbox"/> Plumbing Drawing and Estimating</li> <li><input type="checkbox"/> Structural Drafting</li> </ul> <p><b>ELECTRICAL</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Electrical Engineering</li> <li><input type="checkbox"/> Electrical Maintenance</li> <li><input type="checkbox"/> Electrician</li> <li><input type="checkbox"/> Contracting</li> <li><input type="checkbox"/> Lineman</li> </ul> <p><b>HIGH SCHOOL</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Commercial</li> <li><input type="checkbox"/> Good English</li> <li><input type="checkbox"/> High School Subjects</li> <li><input type="checkbox"/> Mathematics</li> </ul> | <p><b>LEADERSHIP</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Foremanship</li> <li><input type="checkbox"/> Industrial Supervision</li> <li><input type="checkbox"/> Leadership and Organization</li> <li><input type="checkbox"/> Personnel-Labor Relations</li> </ul> <p><b>MECHANICAL AND SHOP</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Gas—Electric Welding</li> <li><input type="checkbox"/> Heat Treatment</li> <li><input type="checkbox"/> Metallurgy</li> <li><input type="checkbox"/> Industrial Engineering</li> <li><input type="checkbox"/> Industrial Instrumentation</li> <li><input type="checkbox"/> Industrial Supervision</li> <li><input type="checkbox"/> Internal Combustion Engines</li> <li><input type="checkbox"/> Machine Design-Drafting</li> <li><input type="checkbox"/> Machine Shop Inspection</li> <li><input type="checkbox"/> Machine Shop Practice</li> <li><input type="checkbox"/> Mechanical Engineering</li> <li><input type="checkbox"/> Quality Control</li> <li><input type="checkbox"/> Reading Shop Blueprints</li> <li><input type="checkbox"/> Refrigeration</li> <li><input type="checkbox"/> Sheet Metal Worker</li> <li><input type="checkbox"/> Tool Design</li> <li><input type="checkbox"/> Toolmaking</li> </ul> <p><b>RADIO, TELEVISION</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Industrial Electronics</li> <li><input type="checkbox"/> Practical Radio TV Eng'ing</li> <li><input type="checkbox"/> Radio and TV Servicing</li> <li><input type="checkbox"/> Radio Operating</li> </ul> | <ul style="list-style-type: none"> <li><input type="checkbox"/> Television Technician</li> </ul> <p><b>RAILROAD</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Air Brake Equipment</li> <li><input type="checkbox"/> Car Inspector</li> <li><input type="checkbox"/> Diesel Engineer &amp; Fireman</li> <li><input type="checkbox"/> Section Foreman</li> </ul> <p><b>STEAM AND DIESEL POWER</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Combustion Engineering</li> <li><input type="checkbox"/> Diesel—Elec.</li> <li><input type="checkbox"/> Diesel Eng'g</li> <li><input type="checkbox"/> Electric Light and Power</li> <li><input type="checkbox"/> Stationary Fireman</li> <li><input type="checkbox"/> Stationary Steam Engineering</li> </ul> <p><b>TEXTILE</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Carding and Spinning</li> <li><input type="checkbox"/> Colton, Rayon, Woolen Mfg.</li> <li><input type="checkbox"/> Finishing and Dyeing</li> <li><input type="checkbox"/> Loom Fix'g</li> <li><input type="checkbox"/> Textile Des'g</li> <li><input type="checkbox"/> Textile Eng'g</li> <li><input type="checkbox"/> Throwing</li> <li><input type="checkbox"/> Winding and Weaving</li> </ul> <p><b>MISCELLANEOUS</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Domestic Refrigeration</li> <li><input type="checkbox"/> Marine Engineering</li> <li><input type="checkbox"/> Ocean Navigation</li> <li><input type="checkbox"/> Professional Engineering</li> <li><input type="checkbox"/> Short Story Writing</li> <li><input type="checkbox"/> Telephony</li> </ul> |
|--|---|--|--|---|

Name \_\_\_\_\_ Age \_\_\_\_\_ Home Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_ Working Hours \_\_\_\_\_ A.M. to P.M. \_\_\_\_\_

Occupation \_\_\_\_\_

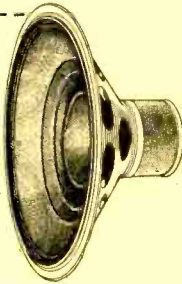
Canadian residents send coupon to International Correspondence Schools, Canadian, Ltd., Montreal, Canada. . . . Special tuition rates to members of the U. S. Armed Forces.

## You can have the finest sound reproduction throughout all frequency ranges without distortion

You will hear a remarkable difference in the clarity of Norelco \*Full Response Speakers. In a single speaker, twin-cones reproduce low frequencies, middle range, as well as the higher frequencies extending beyond the audible range—without distortion.

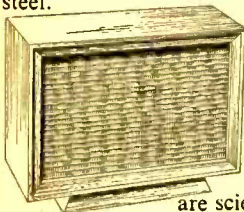
*Norelco FRS*

speakers are available  
5", 8" or 12" sizes in  
standard impedance.  
Priced from \$6.75 to \$59.98  
Blue prints are available for the  
do-it-yourself enclosure builder.



### WHY ARE NORELCO FRS SPEAKERS SO EXCEPTIONAL?

They have incorporated a number of technical refinements which are evident the moment you listen. The air gap has been made long so that the coil is completely enclosed in an even magnetic field at all times. A copper ring has been fitted into the deep air gap to keep the voice coil impedance constant over the whole frequency range; this avoids incorrect matching. High flux densities are obtained through the use of "Ticonal" magnet steel.



Norelco FRS Improved Boss  
Reflex Enclosures are available  
in three sizes; FRS Enclosures  
I, II and III. Priced  
from \$33.75 to \$119.95.

Norelco speaker-matched enclosures are scientifically designed acoustical boxes which enhance the exceptional tone qualities of FRS speakers; bringing out their true performance values.

Norelco FRS Speaker Enclosures are available in three sizes to match the characteristics of the speaker in use. Supplied in either mahogany or blond, these enclosures incorporate a removable base permitting the enclosures to be placed horizontally or vertically to suit any room arrangement or decor.

ADD TO . . . and improve any  
sound system with **Norelco®**

\*FULL RESPONSE SPEAKERS

Write today to Dept. N. 3 for brochures  
and prices of these unique speakers.

**NORTH AMERICAN PHILIPS CO., INC.**  
100 E. 42nd Street New York 17, N. Y.



## Carl & Jerry (Continued from page 12)

of the lake toward the deserted shore of Round Island.

"It's a good thing we did our kite-flying yesterday," Jerry observed from where he lolled comfortably on the rear seat studying a print of the picture they had taken the previous day. "There's not a breath of air stirring, and that's something for March. If you'll pull in here, we should land just about where that boat was yesterday."

Their boat pulled up on the narrow beach. One boy started in one direction along the sand while the other went the opposite way in search of some means of climbing the sheer rock wall that rose some 75 feet from the edge of the water. Jerry had gone scarcely a hundred yards when he heard Carl calling. He hurried back down the strip of sand and found his chum busily engaged in pulling a pile of dry brush away from a narrow opening in the cliff.

"Here's how they got in," Carl said; "look at those footprints in the sand! I can see daylight on the other end of this natural tunnel through the rock. Come on. Let's find out what's in there."

"Maybe we'd better be a little quiet about it," Jerry whispered as they started edging their way along the crevice. "Those fellows may still be there; and if they went to all this trouble to be alone, maybe they don't want company."

**T**HE TUNNEL was not more than a couple of hundred feet in length, and the boys soon found themselves standing at the other end. The center of the small island was shaped like the inside of a bowl. Around the sharply sloping edge, brush and small trees were growing, but the flat bottom of the bowl was a circular expanse of white sand.

"No one here . . . but there's that outdoor oven we saw," Carl exclaimed, pointing to the right of the tunnel exit. "There's still a fire going in it, too; so those fellows must not have been gone long."

The boys walked over to a strange array of barrels, jugs, kettles, and stacked firewood almost concealed in the edge of the brush.

"Hey, Jer, look at the big tank coil in this barrel of water!" Carl called. "It's made of copper tubing and looks like it would handle a couple hundred kilowatts in a transmitter."

Jerry did not answer. He was too busy noting the rusty pipe that brought cold water from a spring up in the brush down into the barrel. He also noted the flexible



It's New! Send for this

**FREE**

booklet today!

see what  
the rapidly  
expanding field of

**ELECTRONICS**

offers you:

- BETTER JOB
- BETTER PAY
- PROMOTION
- GREATER SECURITY
- GREATER CONFIDENCE
- BETTER LIVING FOR YOU AND YOUR FAMILY



All these benefits can be yours if you act now! Take that first big step this minute—No obligation whatsoever!

**TAKE A MINUTE TO MAIL THIS COUPON FOR FREE BOOKLET!**

**CAPITOL RADIO ENGINEERING INSTITUTE**

ECPD Accredited Technical Institute Curricula. Founded 1927  
Dept. 123-D 3224 16th St., N.W., Washington 10, D. C.

Please send me your course outline and FREE Illustrated Booklet "Your Future in the New World of Electronics"... describing opportunities and CREI home study courses in Practical Electronics Engineering.

- CHECK FIELD OF GREATEST INTEREST
- Practical Radio Electronics Engineering
  - Broadcast Radio Engineering (AM, FM, TV)
  - Practical Television Engineering
  - Practical Aeronautical Electronics Engineering

Name \_\_\_\_\_ Age \_\_\_\_\_

Street \_\_\_\_\_

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

Check:  Home Study  Residence School  Korean Veteran

To help us answer your request intelligently, please give the following information:

EMPLOYED BY \_\_\_\_\_

TYPE OF PRESENT WORK \_\_\_\_\_

SCHOOL BACKGROUND \_\_\_\_\_

ELECTRONICS EXPERIENCE \_\_\_\_\_

IN WHAT BRANCH OF ELECTRONICS ARE YOU MOST INTERESTED? \_\_\_\_\_

# It Won't Come Off!



All recording tape is coated with magnetic oxide. This coating rubs off ordinary tapes in use, and forms a harmful deposit of abrasive dust on the recording head. Unless the head is constantly cleaned, the collection of abrasive eventually wears it out. After a few playings, the tape loses enough coating to alter its original frequency response characteristic.

WITH TAPE MADE BY THE EXCLUSIVE



**irish**

BRAND

**FERRO-SHEEN  
PROCESS**

**The Oxide Will  
NOT Rub Off!**

The irish FERRO-SHEEN process of tape manufacture anchors the oxide coating to the base inseparably and much more smoothly. The entire vicious cycle of shedding and abrasion of recording head and tape is eliminated, resulting in longer life for both tape and head and improved frequency response.

**THERE'S AN irish  
FERRO-SHEEN TAPE  
FOR EVERY  
RECORDING REQUIREMENT:**

**irish GREEN BAND**  
On 1.5-mil acetate base.

**irish SHAMROCK**  
On 1.5-mil pre-selected  
premium-quality acetate base.

**irish LONG PLAY**  
On 1-mil Mylar base.

**irish DOUBLE PLAY**  
On 0.5-mil Mylar base.

**irish SOUND PLATE**  
On super-tough 1.5-mil Mylar base.



If not available at your local dealer's, write direct to:  
**ORRADIO INDUSTRIES, INC., Opelika 1, Ala.**  
Export Division: Morhan Exporting Corp., N. Y. C.  
In Canada: Atlas Radio Corp., Ltd., Toronto

**Carl & Jerry** (Continued from page 14)

piece of pipe leading from one end of the "tank coil" to a connection on top of the close-fitting cover of a large boiler over the fire of the outdoor oven. Finally he sniffed the air and eyed speculatively the earthen jug sitting beneath the open bottom end of the copper coil which emerged through a water-tight fitting near the bottom of the barrel. A clear fluid dripped from the coil into the open mouth of the jug.

"If you've got a cold, why don't you use your handkerchief?" Carl demanded somewhat irritably, as Jerry continued his audible sniffing.

"I've not got a cold, but I am getting an idea," Jerry retorted. "Take a good deep breath and tell me what the smell of this place reminds you of."

Carl obeyed and then said promptly: "Passing the doors of the saloons on Third Street on a warm summer evening."

"Your nose has a good memory," Jerry applauded. "This has to be a liquor still. The sour-smelling stuff in those barrels must be mash. Both the smell of the still and the small amount of smoke created by burning bone-dry wood stay cupped up in this depression and can't be detected from the outside."

"And dig that booby trap over the mouth of the tunnel," Carl said, pointing to a bunch of rocks restrained behind a log on the steep side of the bowl just above the tunnel opening. One end of the log was prevented from slipping by a short length of wood braced between it and a niche in the rocky slope. A strong rope was fastened to this piece of wood and led down to the floor of the basin. "With a slick set-up like that, there's no telling how long this thing has been in operation. Those two guys must be rich by now."

"If they don't want company, all they have to do is yank that rope and a miniature rockslide comes down and seals off the tunnel," Jerry said admiringly. "Which reminds me—we had better get out of here *muy pronto*. Those fellows may come back any minute, and it's just possible they'd take a dim view of our snooping around. Let's hightail it back to town and tell the sheriff about all this."

**THEY STARTED** back through the tunnel, Carl leading the way, and had almost reached the other end when Carl suddenly halted and went into reverse so quickly that he flattened Jerry's nose against a bony shoulder blade.

"What's the idea?" Jerry demanded, dabbing at his nose and then peering at



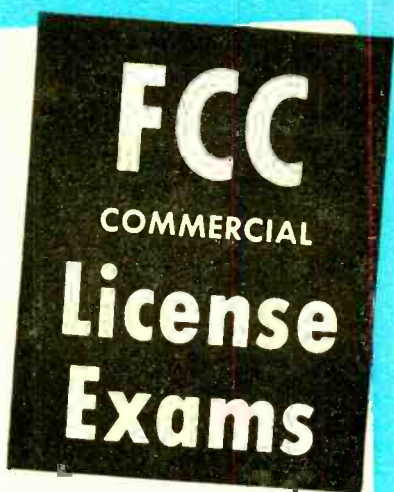
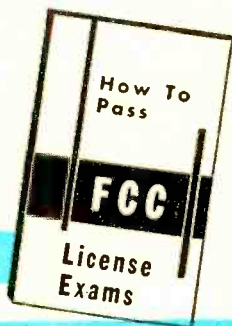


CARL E. SMITH, E. E.  
President



Accredited by National  
Home Study Council

# How to Pass



Get your FCC License  
Quickly!

We Guarantee to train you until you receive Your FCC License

## Get all 3 FREE

CLEVELAND INSTITUTE Training results in success with commercial FCC examinations — easily — and quickly. Here's Proof:

Name and Address	License	Time
Walter Eggers, Pacific Grove, Calif.	1st	12 weeks
Paul Reichert, West Salem, Ohio	2nd	10 weeks
Harold Phipps, LaPorte, Indiana	1st	28 weeks
John H. Johnson, Boise City, Okla.	2nd	12 weeks
James Faint, Johnstown, Pa.	1st	26 weeks

(Names and addresses of trainees in your area sent on request)

Cleveland Institute training results in job offers like these:

### Radio Operators & Technicians

American Airlines has openings for radio operators and radio mechanics. Operators start at \$334.53 per month. Radio mechanic's salary up to \$1.99 per hour. Periodic increases with opportunity for advancement. Many company benefits.

### Electronic Technicians

Convair Electronics Department: Radio and Radar Mechanics, Electronics Technicians, and Junior Engineers are wanted for a special program on fire control development and installation. Beginning rate: \$365 and up.

And our trainees get good jobs

### Electronics Technician

"I am now employed by the Collins Radio Company as a Lab Technician. (This job was listed in your bulletin.) I have used the information gathered from your course in so many ways and I know that my training with Cleveland Institute helped me a great deal to obtain the job."

Charles D. Sindelar, Cedar Rapids, Iowa

## CLEVELAND INSTITUTE OF RADIO ELECTRONICS

4900 Euclid Bldg. Desk PE-23 Cleveland 3, Ohio



MAIL COUPON TODAY

### Cleveland Institute of Radio Electronics

Desk PE-23, 4900 Euclid Ave., Cleveland 3, O.

Please send Free Booklets prepared to help me get ahead in Electronics. I have had training or experience in Electronics as indicated below:

- |   |   |
|---|---|
| <input type="checkbox"/> Military           | <input type="checkbox"/> Broadcasting       |
| <input type="checkbox"/> Radio-TV Servicing | <input type="checkbox"/> Home Experimenting |
| <input type="checkbox"/> Manufacturing      | <input type="checkbox"/> Telephone Company  |
| <input type="checkbox"/> Amateur Radio      | <input type="checkbox"/> Other _____        |

In what kind of work are you now engaged?

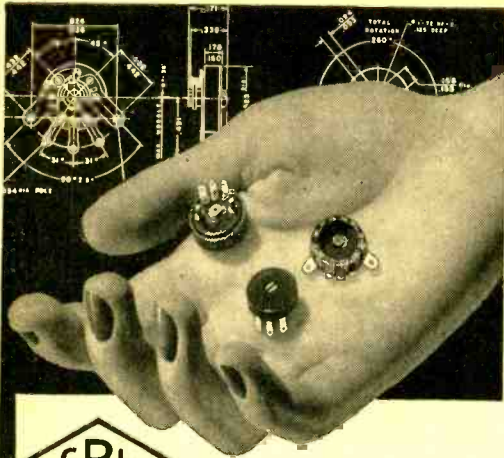
In what branch of Electronics are you interested?

Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_







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

Special Tuition Rates to Members of Armed Forces



## Model B16 Miniature Radiohm®

*A control that fits the tight spots*

-  Design this compact, versatile control into your next receiver, pocket radio or any application where you want the most for your money in a miniature control.
-  Originally designed for hearing aids, so you know they're compact.
-  Comes complete with removable knobs.  $\frac{23}{32}$ " diameter with knobs.  $\frac{5}{8}$ " diameter with knobs removed.
-  Rated at  $\frac{1}{10}$  watt. Resistance range, 500 ohms to 5 megohms.
-  Can be furnished with or without built-in switch. Rated at — 6.5 amps at 1.5 V.D.C. or .2 amps at 45 V.D.C.
-  Not a laboratory curiosity. Over 6,000,000 now in use where space and weight are problems, and where only the best will do.

See your Centralab distributor for these B16 Radiohms and many other fine controls. Send coupon below for free catalog showing Centralab's complete line of electronic components.

# Centralab

A DIVISION OF GLOBE-UNION INC.  
994C E. Keeffe Ave., Milwaukee 1, Wisconsin

Send me free Catalog.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

## Carl & Jerry (Continued from page 16)

his fingers in the dim light to see if there was any blood.

"Shut up and back up!" Carl hissed. "Two guys are just getting out of a boat out there—real Dogpatch-looking characters, too."

Jerry needed no further prodding. In a matter of seconds, the boys were back inside the bowl looking vainly about the steep sides for a possible place of concealment.

"Come on; grab this rope and help me pull," Jerry said suddenly, as he picked up the end of the rope leading to the trigger of the booby trap. "Maybe we can slow them down a little."

Both boys heaved on the rope, but the log did not budge. "Harder!" Carl urged as the growling voices of the men issuing from the nearby mouth of the tunnel grew louder. With a desperate effort, the two lunged in unison and the prop flew from beneath the log, sending both boys sprawling in the sand. Rocks clattered down over the opening and piled up until it was almost entirely closed.

Still sitting on the sand, the boys stared in fascination at the narrow opening that was still left between the top of the rock pile and the top of the tunnel. Suddenly two glaring, bloodshot eyes appeared in this opening and looked coldly down at the boys.

"What do you young punks think you're doing?" a grating voice demanded.

"Just hunting mushrooms," Carl said, without the least intention of being funny. As he explained later, he felt someone should say *something*; and that was the first thing that came into his mind. It didn't improve the situation much.

"We'll mushroom *you!*" the grating voice promised, as a hairy, dirty hand reached forth to clear away the rocks.

**I**N ALMOST a single motion, Carl sprang to his feet, grabbed up a rock the size of a baseball, and let fly at the hand. His aim was not too good, and the rock whammed against the stone wall; but the hand was instantly snatched back.

Jerry quickly got the idea, and the two boys kept up a steady fire of rocks at the opening every time a head or hand appeared.

"Aw, Bill," a second voice drawled, "let's quit fooling around. Let's just drag back some of the rocks from this side so the pile will cave in and we can get at those rock-chucking little devils."

"I declare, Hank, you *are* a brainy one!" Bill said admiringly; and from the sounds



# Know how to choose YOUR LOUDSPEAKER SYSTEM

for true  
**HIGH FIDELITY**  
enjoyment!



- Use this latest guide and catalog for quick facts and easy understanding of the all-important loudspeaker. Tells you what to choose and why—for true high fidelity reproduction in your home music system. Explains how E-V multiple-way speaker systems and folded-horn enclosures give you full range reproduction in proper musical balance. Provides the background you need to make your own selection regardless of how much or how little you want to spend. Also shows you how you can start modestly and easily make additions to achieve the ultimate in high-fidelity listening pleasure.

Manufacturers of High-Fidelity Speaker Systems, Amplifiers, FM-AM Tuners, Ultra-Linear Cartridges and Microphones

## Electro-Voice®

### Get this helpful book now!

Because the loudspeaker system is so vital in determining the quality of reproduction you finally hear...it will pay you to read this interesting and colorful new Electro-Voice catalog-guide. Contains the widest selection of true high-fidelity speaker systems, enclosures and enclosure kits—to suit your musical taste, space, decor and budget.

Look and listen...  
for your own satisfaction

**WORTH MANY DOLLARS TO YOU!**

Only 25c brings you this new Catalog and Guide postpaid.

Send for it today!

ELECTRO-VOICE, INC., BUCHANAN, MICHIGAN

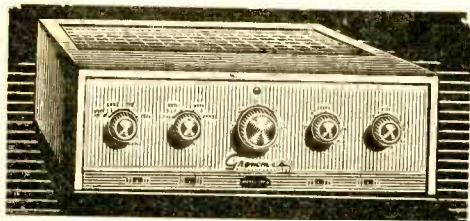
Please send Catalog No. PE-117 "Guide to High-Fidelity Loudspeaker Systems." 25¢ enclosed to cover handling cost.

Name \_\_\_\_\_

Address \_\_\_\_\_

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

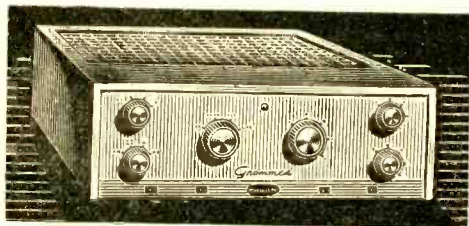
# BEST BUY IN HI-FI *Grommes*



## 10PG 10 Watt Hi-Fi Amplifier

New styling, full set of controls, exceptional flexibility. Features modern feedback circuitry, record compensator, loudness control, wide range bass and treble controls, rumble and scratch filters, six inputs including tape head. Freq. Response:  $\pm 0.5$ -DB. 20 to 20,000 CPS. Distortion: 2% harmonic and 3% intermodulation at 10 watts. In Charcoal Gray and Brass.

Net Price **62<sup>50</sup>**



## 15PG 12 Watt Hi-Fi Amplifier

All new deluxe 15PG features the most advanced circuitry, highest quality components, greater flexibility of controls. Provides feedback throughout, separate turnover and roll-off record compensators, new loudness control, wide range bass and treble controls, rumble and scratch filters, six inputs including tape head. Freq. Response:  $\pm 0.5$ DB. 20 to 30,000 CPS. Distortion: 1% harmonic and 2% intermodulation at 12 watts. In Charcoal Gray and brass.

Net Price **72<sup>50</sup>**

## 20PG 20 Watt Hi-Fi Amplifier

All new, with all the features of the 15PG plus higher power in the output stage. Freq. Response:  $\pm 0.5$ DB. 15 to 30,000 CPS. Distortion: 1% harmonic and 2% intermodulation at 20 watts.

Net Price **89<sup>50</sup>**

See your High Fidelity Dealer or write

**Grommes** Division of Precision Electronics, Inc.  
Dept. P-3, 9101 King St., Franklin Park, Illinois  
Send Free Hi-Fi Equipment Brochure

Name.....  
Street.....  
City.....Zone.....State.....

## Carl & Jerry (Continued from page 18)

they heard, the boys soon realized that the men were putting the plan into action.

"Our goose is about cooked," Carl said desperately. "You'd better think of something, and fast!"

Jerry glanced wildly about for a moment and then threw down the rocks in his hands and began to scoop up damp leaves from around the overflow of the barrel.

"Keep throwing rocks through that hole to slow them down all you can," he told Carl as he opened the door of the furnace, tossed the leaves on top of the glowing bed of coals, and slammed the door shut. Then he ran around and closed the butterfly damper in the stovepipe that served as a chimney. In a few seconds, dark gray smoke was leaking from every crevice of the furnace. Suddenly Jerry opened the damper, and a puff of smoke shot up into the still air. Instantly he closed the damper, left it shut for a few seconds, and then opened it again. A second puff of smoke followed the first.

Carl, who had been watching this performance in popeyed wonder, now realized what his companion was trying to do. The three round puffs of smoke were followed by three longer columns, and then three more short puffs were allowed to escape.

"SOS," Carl spelled out to himself, automatically continuing to toss rocks at the opening. "Oh, brother, what a long shot that is! Probably no one in miles can read



... In almost a single motion, Carl sprang to his feet, grabbed up a rock, and let fly at the hand that was reaching from the tunnel opening ...

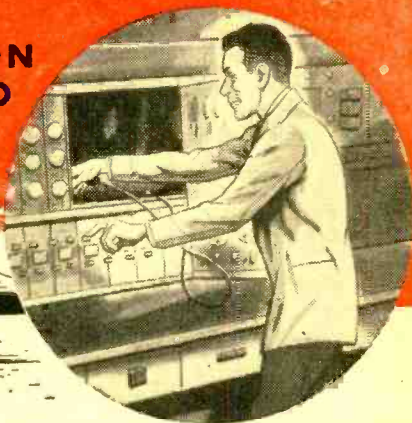
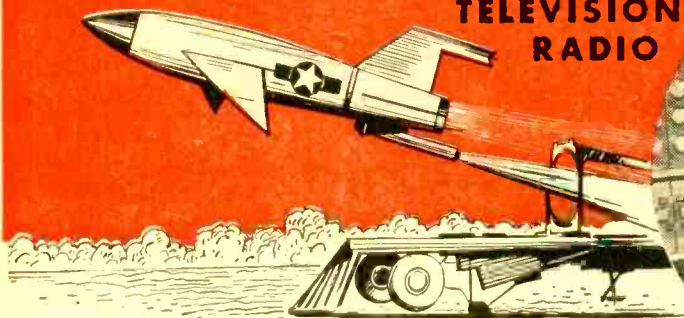
Always say you saw it in—POPULAR ELECTRONICS



Join the Thousands of Central-Trained Technicians  
Now Enjoying **HIGH-PAY CAREERS** in...

# GUIDED MISSILES—AUTOMATION

**ELECTRONICS  
TELEVISION  
RADIO**



## Outstanding Employment Opportunities Open to Central Graduates!

No matter what you're doing now . . . whether you've ever had previous technical experience or not, you can begin right now to prepare for a great career in these fascinating, rewarding fields!

Capitalize on the fact that Central's nationally recognized, proven training methods, top instructors and long record of educational achievement have put Central-trained men in high demand throughout America! . . . that Central's graduates are periodically interviewed and employed by many of the Country's foremost industrial giants and leading employers of electronics specialists. Hundreds of radio and TV stations look to Central as a reliable source for competent, thoroughly trained technicians . . . and the nation's major airlines and aircraft manufacturers have hired hundreds of Central-trained technicians for important communications and electronics positions.

### 3 Proven Training Plans

**1. HOME STUDY COURSE** (with 9 kits of equipment)—Qualifies you for diploma, FCC license exam, and a variety of electronics jobs (or transfer into advanced resident training).

**2. HOME STUDY—RESIDENT COURSE** (with 9 kits of equipment)—Home study, followed by short period of resident training. Qualifies you for diploma, FCC license exam, and a wide variety of positions (or continue with advanced resident training). An ECPD-accredited engineering technician program.

**3. FULL RESIDENT COURSE**—Qualifies you for Associate of Science (A.S.) degree and top-pay employment opportunities as Electronics Engineering Technician. An ECPD-accredited engineering technician program. Part-time employment opportunities available for students while training.

### How Central's "Progressive Plan" Will Pay Off for YOU!

Central's complete, accredited training is designed to get you the technical job you want . . . in the shortest possible time! Through Central's "Progressive Plan" of study, as you complete each phase of training your earning capacity goes higher! How far "up the ladder" you want to go is entirely up to you. A few short weeks of training prepares you for certain basic jobs. Then, with every additional phase of training you complete, you qualify for more advanced types of positions that command higher salaries. You can settle for any of a wide variety of well-paid, worthwhile jobs along the line . . . or you can use Central's complete training to advance right up to the top-level, top-pay positions! *Don't limit yourself!* Get the facts on Central's complete training. Mail the coupon today!

**VETERANS** Central offers courses approved under G. I. Bill

Mail Coupon for  
**FREE BOOK**

YOUR FUTURE  
IN  
ELECTRONICS

### CENTRAL TECHNICAL INSTITUTE

Dept. A-37 1644 Wyandotte St.  
Kansas City 8, Missouri

Tell me more about how you can qualify me for a high-pay Electronics career.

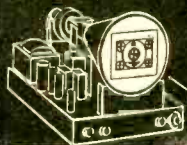
Name.....Age.....

Address.....Phone.....

City, State.....County.....

If Korean vet., give approx. discharge date.....

# Make Your Own PICTURE AND PATTERN VIDEO GENERATOR



*EASILY  
at LOW COST*



MODEL 950

## **B&K DYNA-SCAN** PICKUP and RF GENERATOR

Simply connect the *Dyna-Scan* "950" to any properly modified 10-inch television receiver. The picture tube of the TV set then becomes your external flying spot scanner tube. This combination produces a composite video and sync signal that operates any standard TV receiver on any VHF TV channel. Enables you to reproduce any pattern or picture from a positive slidefilm transparency, on any number of TV receivers—or you can transmit your own messages typed or written on clear acetate.



Can be used with a single monitor or fed into a master antenna system or community antenna system.

Supplied with Indian Head, White Dot and White Line test patterns, and one clear acetate.

Model 950. Sturdy metal ham-mertone finished case. Fully fused. Operates on 110-120 volts, 60 cycle AC. 6 ft. RF cable. Size: 3 1/2 x 10 1/2 x 5 in. Net wt. 5 lbs.

NET \$69.95

B&K MANUFACTURING CO.  
3726 N. SOUTHPORT AVE.  
CHICAGO 13, ILLINOIS



Please send Dyna-Scan Bulletin No. 950-B

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

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

smoke signals in any fashion, let alone standing on end!"

But Jerry stuck at his smoke signals because he could think of nothing else to do. Carl kept throwing rocks into the opening, and now and then a yowl of pain or a curse told that he had scored a hit; but the men continued working away at the rock pile on their side, and an ominous settling of the rocks now and then proved that their plan was working. Suddenly the whole top of the pile rolled down into the tunnel, leaving the mouth of the tunnel half revealed. The boys could clearly see the two men gathering up rocks and preparing to rush the entrance.

"Come on, Jer," Carl yelled, as he grabbed a jagged chunk of stone in each hand. "They'll probably get us, but let's give them some lumps before they do!"

"Hold it, all of you!" a strange voice boomed from the tunnel. Peering past the figures of the men, the boys could see the familiar outline of the sheriff silhouetted against the light. A drawn revolver was in his hand.

In a few minutes, he had herded the men out into the basin of the island, where a strange posse waited. The sheriff's deputy was first, but behind him were a scoutmaster and eight rather small boy scouts.

**A**N EXPLANATION was quickly forthcoming. The boy scouts had been on the lake in a couple of boats on their way to an overnight camping site. Seeing the smoke signals, they correctly interpreted them as a call for help, and the scoutmaster went ashore to telephone the office of the sheriff. A radio call was sent out to the sheriff and his deputy, who luckily were patrolling nearby. Then the law officers joined the boy scouts, and circled the island until they spotted the two boats pulled up on the shore. Since the men had been in such a hurry to find out who had discovered their secret still that they did not take time to replace the brush across the tunnel opening, it was easy to locate.

As the sheriff and his deputy prepared to conduct the handcuffed moonshiners back to the boats, a small bespectacled boy scout stood squarely in front of Jerry and stared up into his face. "Were you the one who sent the smoke signals?" he asked.

"Why, yes, I guess I was," Jerry said modestly, preparing to be overwhelmed with fulsome praise.

"That was pretty sloppy spacing," the boy scout said curtly, as he turned on his heel and stalked away.



(Mr. Ray Snyder  
Gen. Mgr. Coyne  
Book Publ. Div.)



# You Get This Valuable Book

# FREE

Just For Examining  
**COYNE'S NEW 7 VOLUME SET**

## "Applied Practical Radio-Television" ON 7 DAYS FREE TRIAL!

Yes, this big new book, "150 Radio-TV Picture Patterns & Diagrams Explained," is yours FREE! Up-to-the-minute, practical book gives complete 11 x 22" Schematic Diagrams on leading models of Radio and TV sets, with full instructions on how to read and use diagrams. Also analysis of TV servicing; trouble-shooting patterns. It's yours as a FREE gift for asking to see Coyne's great new 7-book set, "Applied Practical Radio-Television"!

### Gives You Money-Making "Know-How" On TRANSISTORS! COLOR TV! SERVICING!

Coyne's new set gives you all the answers to servicing problems—quickly! For basic "know-how" that's easy to understand, you'll find everything you want in volumes 1 to 5, which contain over 5,000 practical facts and data. Cover every step from principles to installing, servicing, trouble-shooting and aligning all types of radio and TV sets. Includes latest data on COLOR TV and TRANSISTORS. Volume 6, our NEW TECHNICAL DICTIONARY, helps you quickly understand terms, symbols, abbreviations. For speedy on-the-job use, you get Volume 7—Coyne TELEVISION CYCLOPEDIA—covering today's TV problems in A-B-C order, cross indexed. Use 7-volume TV-RADIO LIBRARY free for 7 days. Get Picture Pattern-Diagram Book FREE!



**Vol. 1—Application of TV-Radio Principles.** 300 pages—resonance, tuning, amplifiers, oscillators, etc.

**Vol. 2—Radio, Television & FM Receivers.** 403 pages—rectifiers, high frequency, short wave, FM, antennas.

**Vol. 3—Radio-Television Circuits.** 336 pages—power tubes, decoupling, distortion, photo-tubes, phase inverters, etc.

**Vol. 4—Latest Instruments for Servicing.** 343 pages—all types of testing instruments; their use in servicing.

**Vol. 5—TV Servicing & Trouble Shooting Manual.** 400 pages—servicing of all TV sets, UHF, boosters, color TV printed in 4 colors, transistors, etc.

**Vol. 6—TECHNICAL DICTIONARY:** 300 pages. Over 4,000 definitions of terms, symbols, abbreviations used in Radio-TV, Electronics, Electricity.

**PLUS TV CYCLOPEDIA—**quick answers to all TV problems in A-B-C order, 900 pages, illustrated. Hundreds of facts on servicing UHF, transistors, installation, alignment and more.

### ACT NOW . . . SEND NO MONEY!

Just mail coupon for 7-book set on 7 days free trial. Book of 150 TV-Radio Patterns & Diagrams will be included. If you keep the set, pay \$2 in 7 days and \$2 per month until \$24.50 plus postage is paid. (Cash price \$22.95). Or return Library at our expense in 7 days and owe nothing. Either way, Radio-TV Diagrams Book is yours to keep, FREE! Offer limited. Act NOW!

### FREE BOOK • FREE TRIAL COUPON

Mr. Ray Snyder, General Manager  
Educational Book Publishing Division  
COYNE ELECTRICAL SCHOOL  
500 S. Paulina St., Dept. 37-PE, Chicago 12, Ill.

O.K. Mr. Snyder! Send new 7-book set "Applied Practical Radio-TV" for 7 days FREE TRIAL per your order. Include TV-RADIO Patterns & Diagrams Book FREE!

Name  Age

Address

City  Zone  State

Where Employed

Check here if you want Library sent C.O.D. You pay post-man \$22.95 plus C.O.D. postage on delivery. 7-day money-back guarantee.

## COYNE ELECTRICAL SCHOOL

(Educational Book Publishing Division)

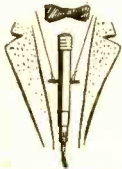
500 S. Paulina St., Dept. 37-PE Chicago 12, Illinois

## what kind of microphone do you need?



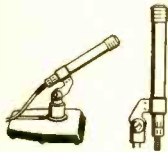
**a hand held microphone?**

*The Slendyne "535"*



**a lavalier microphone?**

*The Slendyne "535"*



**a desk or floor stand microphone?**

*The Slendyne "535"*



**a dual-impedance microphone?**

*The Slendyne "535"*



**a microphone with on-off switch?**

*The Slendyne "535"*

The Slendyne can be transferred from one application to another—in seconds—without disconnecting the cable.

The Slendyne "535" is an omnidirectional dynamic probe microphone with a frequency range of 60 to 13,000 cps.

It is a rugged unit, designed to provide fine-quality performance for years—without deviation from its original critical standards. **List Price \$70.00**

**SHURE**

*The Mark of Quality*

Microphones ~ Electronic Components

**SHURE BROTHERS, INC.**

214 Hartrey Avenue • Evanston, Illinois

# LETTERS FROM OUR READERS

## Answers! Answers!

■ Information on Meissner Model 9-1065 recorder (requested in January by M. Ralph Berke) can be found in the Howard W. Sams Photofact Set 3, folder 15.

TERRY SANDGEAF  
Century Electronics  
Blue Island, Ill.

■ Model T spark-coil capacitors (requested by J. K. Williams, January issue) can be from 0.002 to 0.008  $\mu$ fd.

ROBERT SCHAFFER  
Butler, Pa.

■ Model T spark-coil capacitor values range between 0.1  $\mu$ fd. and 0.5  $\mu$ fd. They can be removed by sliding open the door on the coil and digging it out of the sealing compound.

EDWARD ENGELKEN  
San Antonio, Texas

## Here's an Oldie

■ Can any of your readers give me some information on the National FB7 receiver? I was given one a few months ago without a wiring diagram or instruction sheet.

SKIP CLARK  
212 E. Belle Terrace  
Bakersfield, Calif.

## More Possible Projects

■ You can do us serious tape recordists a big service by publishing details on a heavy-duty de-gausser and a high-gain 4 or 6 channel mixer.

PHIL BASKIN  
Brooklyn, N. Y.

■ How about a converter to tune in the police calls around 156 mc.?

JOHN R. COPE  
Wichita, Kansas

■ As a potential radio-control enthusiast, I would like to see some new ideas, new applications, etc., of control circuitry. I am working with an escapee to take candid camera shots in wild-life scenes. This should be radio-controlled.

R. RUSSELL  
Lowell, Mass.

■ I would be exceptionally interested in an electronic chronograph—something that would measure speeds of 500 to 5000 feet per second.

WILLIAM KINTER  
Uniontown, Pa.

*These are a few of the projects that are being worked on by our staff. All of the above will probably appear in late spring issues.*

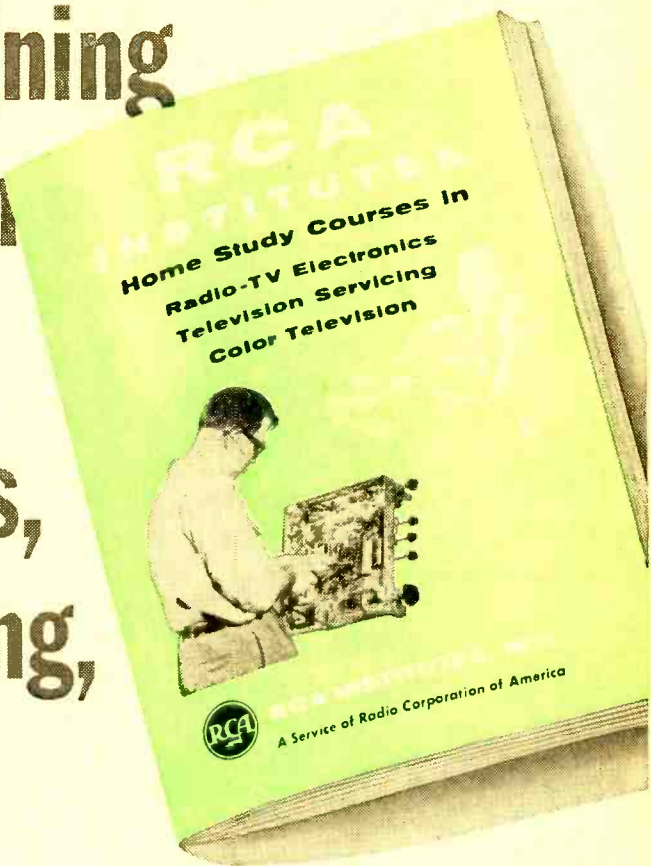
## Proximity Detector for Trucks

■ Mr. Maurice L. LaRose's suggestion about the use of a proximity detector circuit for parking cars or trucks (October, 1956, "Letters to the Editor," p. 28) would be feasible using present-day knowledge. May I point out my invention covered by

*(Continued on page 28)*



**RCA** offers you the  
 finest training  
 at home in  
**Radio-TV**  
 electronics,  
**TV servicing,**  
**Color TV**



**SEND FOR THIS FREE  
 BOOK NOW!**



**RCA INSTITUTES, INC.**

**A SERVICE OF RADIO CORPORATION of AMERICA  
 350 WEST FOURTH STREET, NEW YORK 14, N. Y.**

*In Canada — RCA Victor Company, Ltd.,  
 5001 Cote de Liesse Rd., Montreal 9, Que.*

The instruction you receive and equipment you get (and keep) will start you on your way. Pay-as-you-learn. You pay for only one study group at a time. This 52 page book contains complete information on Home Study Courses for the beginner and the advanced student.

RCA Institutes, Inc., Home Study PE-37  
 350 West Fourth Street New York 14, N. Y.  
 Without obligation, send me FREE CATALOG  
 on Home Study Courses in Radio, Television  
 and Color TV. No salesman will call.

Name .....  
 Address .....  
 City ..... Zone ..... State .....

Please Print

**VETERAN  
 DISCOUNT**

March, 1957

25

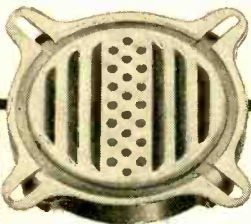
*You can't buy a  
"sweeter" tweeter!*

NEW! Isophon

# ELECTROSTATIC TWEETERS

- Better performance in higher frequencies (7000-20000 cycles)
- Extremely low cost
- Compact, space-saving
- Easy installation for single output and push-pull amplification
- Remarkable brilliancy of sound

**DID YOU SEE** Popular Electronics, Sept., Page 91.  
Read the reviews on the excellent performance of these tweeters!



**ST HB7 \$2.99**

Diam. 2.76"  
Thickness: 0.55"

**ST H 5/16 \$3.99**

Size: 1.97" x 6.30"  
Thickness: 0.787"

Schematics Showing  
simple installation  
supplied with each  
tweeter

For literature and name  
of nearest distributor,  
write to:

**ARNHOLD CERAMICS, INC.**  
1 East 57th Street, New York 22, N. Y.

## Now You Can TEST CONDENSERS In Your Set

UNDER WORKING CONDITIONS—Also Selenium Rectifiers



Quickly, Accurately Checks:  
• Paper, Mica, Ceramic Capacitors  
• Electrolytics • Selenium Rectifiers  
• Continuity • AC/DC Voltages  
• Flashbulbs • NOT A KIT  
**\$9.95** postpaid, net. Complete,  
ready to operate.  
**MONEY BACK GUARANTEE!**

**FREE** Set of leads with each CAP-  
PACITEST for Limited  
Time!

**CAPACITEST**, with thousands already in use, is improved,  
compact, does a giant job to avoid call-backs  
and save you time and money. Tests Selenium Rectifiers! Checks  
condensers at 150 V., the approx. working voltage in radio or TV  
sets. Meters won't give this type of check since applied voltage  
is 20 V. or less. Accurately, quickly shows open, shorted or inter-  
mittent capacitors and leaky electrolytics.

Compact: 4"x4"x2", Lightweight, for bench or tool kit.

Order direct from mfr. Send  
\$3 deposit with C.O.D.'s.  
Save PP & COD fees. Send  
\$9.95 & we'll pay postage.

**The BARJAY Co.**  
145 W. 40 St., New York 18, N. Y.

FOR THE FINEST ELECTRONIC WORK

## USE...NEW KESTER TV-RADIO SOLDER

Kester TV-Radio Solder consists of  
"Resin-Five" Flux-Core Solder,  
with an activated Rosin Flux that  
does a perfect job on all metals. Of  
course, "Resin-Five" is absolutely  
non-corrosive and non-conductive.  
Also available on 1 lb. spools - see  
your dealer.

**FREE**—Kester's 16 page booklet  
"Soldering Simplified." Write for  
your copy today.

**KESTER SOLDER COMPANY**  
4275 Wrightwood Avenue, Chicago 39, Illinois  
Newark 5, New Jersey, Branford, Canada



**ENGINEERING  
DEGREE IN  
27 MONTHS**

B.S. Degree, Aeronautical, Chemical,  
Civil, Electrical, Mechanical,  
& Electronic Eng. (inc. Radio &  
TV). B.S. degree in 36 mo. in  
Math., Chem., Physics, Prep.  
courses. Low rates. Earn board.  
Large industrial center. Students  
from 48 states, 21 countries. De-  
mand for grads. G.I. appr. Enter  
Mar., June, Sept., Dec. Catalog.  
2337 E. Washington Boulevard  
Fort Wayne 2, Indiana

**INDIANA TECHNICAL COLLEGE**

## WANTED ELECTRON TUBES

Top dollar paid for new transmitting, industrial  
and special purpose types. Submit list.

L. CIVIN, 192—10B 64th Ave., Fresh Meadows 65, N. Y.



### Top Pay Jobs in TV-ELECTRONICS-RADIO

High pay, opportunity, prestige, security  
at all yours, as a qualified Electronics  
Technician! Get your training NOW in the big, recog-  
nized shops, Labs, and TV-Radio Studios at National  
Schools in Los Angeles, foremost since 1905. Here  
you work with latest Electronics equipment—pro-  
fessionally installed—finest, most complete facilities  
offered by any school. Expert, friendly instructors.  
Personal attention. Graduate Employment Service.  
Help in finding home near school. Part time job while  
you learn. Mail coupon NOW, TODAY... for full  
information.

#### NATIONAL SCHOOLS

National Schools Dept. RX2G-37  
4000 So. Figueroa Los Angeles 37, Calif.  
Send Free Electronics Opportunity Book Today

Name \_\_\_\_\_ Age \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_

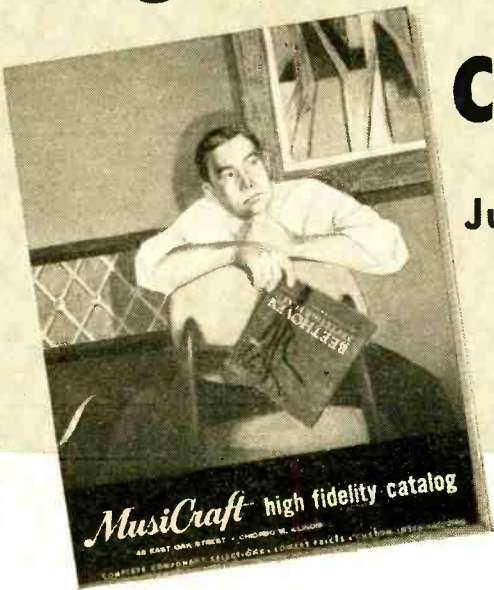
Always say you saw it in—POPULAR ELECTRONICS



Send for MusiCraft's

FREE

# high fidelity catalog



Just off the press!

Jam-packed  
with latest  
hi-fi values!

Here's a *special* high fidelity catalog that you'll find particularly useful, because we have included *only* equipment which we at MusiCraft consider the *best*—from the standpoint of *compatibility* and stable operating efficiency—in every price range.

Page after page pictures the newest high fidelity equipment with detailed information about characteristics and specifications.

Whatever you want—whatever you need—speakers, tuners, amplifiers, turntables, “do-it-yourself” kits, etc.—MusiCraft's new catalog features all the top quality components from leading manufacturers.

Send now for your free copy of the new **MUSICRAFT HIGH FIDELITY CATALOG**:

**MusiCraft**

48-B East Oak Street  
Chicago 11, Illinois  
Delaware 7-4150

name \_\_\_\_\_

address \_\_\_\_\_

city \_\_\_\_\_ zone \_\_\_\_\_ state \_\_\_\_\_



**20  
YEARS  
OLD!**

*He's already an*

**ELECTRONICS  
ENGINEERING  
DESIGNER**

Out of high school just 2 years ago, this young man has already started a fascinating, highly rewarding career in electronics engineering. No matter whether you are now 18 years old—or 28—a 26-month Embry-Riddle education will prepare you for a quick start in this lucrative professional field.

Electronics Engineering Design course concentrates on essential technical studies and practical projects. With the aid of top flight Embry-Riddle instructors you'll master many absorbing fundamentals...Microwaves and Radar, Servomechanisms, Industrial Electronics and Television, to mention a few of the subjects.

The demand for trained engineers is greater than the supply—and will be for years! So take the first step now—mail this coupon. And remember, study and play in Miami's perfect year-round climate is stimulating and exciting.

FOUNDED 1926



Training  
Authorized  
under  
G.I. Bills

**Embry-Riddle**

*International*  
**SCHOOL OF AVIATION**

MAIL THIS COUPON TODAY

**DEAN OF ADMISSIONS Dept. 47**  
Embry-Riddle School of Aviation, Miami 30, Florida

Without obligation, please send **FREE** and postpaid full particulars.

- ELECTRONICS ENGINEERING DESIGN**
- AERONAUTICAL ENGINEERING DESIGN**

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

Address.....

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

I am a (check one)  Veteran  Non-Veteran

**Letters**

(Continued from page 24)

patent 2,708,746 for an approach signal system with self-adjusting controls. This could be developed further and I would appreciate hearing from interested parties.

JOSEPH D. SHAW  
Cincinnati 29, Ohio

**Kind Words**

■ Seth Robbins and I have just completed the "Junkbox Parts Checker" (August, 1956, p. 83) and find that it works FB. I used a Minibox and Seth used a plastic chassis.

Publish more of Carl Kohler; his stories are immensely enjoyed by one reader—at least!

JIM BOYK  
Toledo, Ohio

■ I have just completed the "Mini-Horn" (December, 1956, p. 71) and can report that it is a welcome addition to my portable record player.

WILLIAM GROSS  
Cumberland, Md.

■ I built the "Mini-Horn" and found the sound to be surprisingly good when using two 5" speakers. Enlarged the "Mini-Horn" by 50%, used two 8" speakers, and found that it was terrific. Wonder if anyone else has tried that?

MIKKEL SALUSOO  
Toronto, Ont.

■ Your *After Class* discussion in the January issue on quartz crystals was well worth the cost of a year's subscription. I collect articles and books on thermoelectric phenomena. Are there other readers with a like interest?

HERMON E. COTTER  
15766 Blackstone  
Detroit 23, Mich.

■ In looking through past issues of POP'tronics, I was pleased to see your fine article on tape-sponding (August, 1956). I became a member of World Tape Pals after reading your 1955 article and have received many interesting tapes.

ANDREW SPRANKLE  
Leechburg, Pa.

**More Assistance Needed**

■ Perhaps some one can help me find parts for my wind direction and speed indicator (Signal Corps ML-204B). I particularly need a mast (ML-206A) and wind transmitter (ML-203B). This complete unit is called the AN/GMQ-1.

E. SIELER  
Lambertville, Mich.

**Good Question**

■ Is there provision for a Citizens band in Canada similar to that in the United States? I'm speaking of the one around 465 mc.

ROY SMYTH  
Toronto, Ont.

*Can any of you Canadian readers come forth with the necessary dope? What about RC in Canada, as well as voice-operated Citizens band equipment?*

-30-



# BIG BUD 16 RADIO

Reg. U.S. Pat. Off.

## CIRCUITS AT HOME

with the New Improved 1957  
PROGRESSIVE RADIO "EDU-KIT"

only  
**\$19.95**



### A Practical Home Radio Course

Now Includes  
TESTER, SOLDERING IRON, HIGH FIDELITY, SIGNAL TRACER, CODE OSCILLATOR, PRINTED CIRCUIT SIGNAL INJECTOR

- No Knowledge of Radio Necessary
- No Additional Parts or Tools Needed
- Excellent Background for TV

### NOW! FREE TOOLS WITH "EDU-KIT"

### WHAT THE "EDU-KIT" OFFERS YOU

The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kits are designed to train Radio & Electronics Technicians, making use of the most modern methods of home training. You will learn radio theory, construction practice and servicing.

You will learn how to build radios, using regular schematics; how to wire and solder in a professional manner; how to service radios. You will work with the standard type of punched metal chassis as well as the latest development of Printed Circuit chassis.

You will learn the basic principles of radio. You will construct, study and work with RF and AF amplifiers and oscillators, detectors, rectifiers, test equipment. You will learn and practice code, using the Progressive Code Oscillator. You will learn and practice trouble-shooting, using the Progressive Signal Tracer, Progressive Signal Injector, Progressive Dynamic Radio & Electronics Tester, & the accompanying instructional material.

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build 16 Receiver, Transmitter, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for Television.

Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the complete price of \$19.95. The Signal Tracer alone is worth more than the price of the entire Kit.

### THE KIT FOR EVERYONE

You do not need the slightest background in radio or science. Whether you are interested in Radio & Electronics because you want an interesting hobby, a well paying business or a job with a future, you will find the "Edu-Kit" a worth-while investment.

Here is an excerpt from a letter that we received from Loren DePriest, 1496 4th St., Mansfield, Ohio: "I have spent many pleasant hours in constructing the radios from the schematics in your book, and have learned a great deal from them. Being as I am interested in Radio, I consider the money spent for your course as a wise investment. I have learned more from your course by actually doing than I did from an expensive course."

Many thousands of individuals of all ages and backgrounds have successfully used the "Edu-Kit" in more than 79 countries of the world. The "Edu-Kit" has been

carefully designed, step by step, so that you cannot make a mistake. The "Edu-Kit" allows you to teach yourself at your own rate. No instructor is necessary.

The "Edu-Kit" is also used for courses of study, extra-curricular activities, industrial personnel training and rehabilitation. The "Edu-Kit" is used by Jr. High Schools, High Schools, Technical Schools, Jr. Colleges, Colleges, Universities, Industrial firms, Rehabilitation Hospitals, Boards of Education, U. S. Govt. agencies, United Nations Educational, Scientific and Cultural Organizations (UNESCO), Veterans Administration, and numerous adult, radio and young peoples' groups and clubs. The "Edu-Kit" is also popular with servicemen throughout this country and abroad.

Designed for universal use, the "Edu-Kit" operates on your regular house electric current, whether AC or DC.

### PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern principle of "Learn by Doing." Therefore you construct, learn schematics, study theory, practice trouble-shooting—all in a closely integrated program designed to provide an easily-learned, thorough and interesting background in radio. You begin by examining the various radio parts of the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will enjoy listening to regular broadcast stations, learn theory, practice testing and trouble-shooting. Then you build a more advanced radio, learn more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a professional Radio Technician.

### THE "EDU-KIT" IS COMPLETE

You will receive all parts and instructions necessary to build 16 different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic and paper dielectric condensers, resistors, tie strips, coils, hardware, tubing, punched metal chassis, Instruction Manuals, etc.

In addition, you receive Printed Circuit materials, including chassis, chassis, special tube sockets, hardware and instructions. You also receive a useful set of

tools, a professional electric soldering iron, and a self-powered Dynamic Radio & Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, in addition to F.C.C.-type Questions and Answers for Radio Amateur License training. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a Fidelity Guide and a Quiz Book. You receive all parts, tools, instructions, etc. Everything is yours to keep.

### FREE

Hi-Fi, Radio & TV Servicing Manuals on request (see coupon below)

### SERVICING LESSONS

You will learn trouble-shooting and servicing in a progressive manner. You will practice repairs on the sets you construct. You will learn symptoms and causes of troubles in home, portable and car radios. You will learn how to use the professional Signal Tracer, the unique Signal Injector and the dynamic Radio & Electronics Tester. While you are learning in this practical way, you will be able to do many a repair job for your friends and neighbors, and charge fees which will far exceed the price of the "Edu-Kit." The professional Consultation Service will help you with any technical problems you may have.

J. Statafi, of 25 Poplar Pl., Waterbury, Conn., writes: "I have repaired several sets for my friends, and made money. The "Edu-Kit" paid for itself. I was ready to spend \$240 for a Course, but I found your ad and sent for your Kit."

### FROM OUR MAIL BAG

Ben Valerio, P. O. Box 21, Magna, Utah: "The Edu-Kits are wonderful. Here I am sending you the questions and also the answers for my friends, and made money. The "Edu-Kit" paid for itself. I was ready to spend \$240 for a Course, but I found your ad and sent for your Kit."

Robert L. Shuff, 1534 Monroe Ave., Huntington, W. Va.: "Thought I would drop you a few lines to say that I received my Edu-Kit, and was really amazed that such a bargain can be had at such a low price. I have already started repairing radios and phonographs. My friends were really surprised to see me get into the swing so quickly. The Troubleshooting Tester that comes with the Kit is really swell, and finds the trouble if there is any to be found."

### CONSULTATION SERVICE

One of the most important aspects of the "Edu-Kit" is the Free Consultation Service which we provide. Our staff of experts carries on an extensive correspondence with students in all parts of the world, concerning all phases of electronics. We welcome and encourage students to send us their problems, whether related to any of the material covered in the "Edu-Kit" course, or encountered in other experiences in the field of electronics.

### UNCONDITIONAL MONEY-BACK GUARANTEE

ORDER DIRECT FROM AD  
RECEIVE FREE BONUS RESISTOR KIT WORTH \$5

- Send "Edu-Kit" Postpaid. I enclose full payment of \$19.95.
- Send "Edu-Kit" C.O.D. I will pay \$19.95 plus postage.
- Send me FREE additional information describing "Edu-Kit." Include FREE value Hi-Fi, Radio and TV Servicing Literature.

Name \_\_\_\_\_  
Address \_\_\_\_\_

PROGRESSIVE "EDU-KITS" INC.  
497 Union Ave., Room 530D, Brooklyn 11, N. Y.

### FREE EXTRAS

- SET OF TOOLS • RADIO & ELECTRONICS TESTER • ELECTRIC SOLDERING IRON • TESTER INSTRUCTION MANUAL • HIGH FIDELITY GUIDE • QUIZZES • TELEVISION BOOK • RADIO TROUBLE-SHOOTING BOOK • MEMBERSHIP IN RADIO-TV CLUB: CONSULTATION SERVICE • FCC AMATEUR LICENSE TRAINING • PRINTED CIRCUITRY



## TRANSISTOR MANUAL HAS THE FULL STORY

What they are—How they work—Where they are used

Every ham, hobbyist, technician, dealer needs it. You will find this new Transistor Manual is one of the most handy, easy-to-read, useful books on the subject. It tells you about all kinds of transistors—and how to use them. You are brought fully up to date by one of the world's most experienced manufacturers of transistors and other semiconductor products.

The 60 fact-packed pages, illustrated with diagrams, sketches, and circuits, contain these seven important sections—

- Basic Principles of Semiconductors
- How Transistors Are Constructed
- Transistor Applications
- Specifications on G-E Transistors
- Registered RETMA Transistor Types
- Transistor Circuit Diagrams
- Cross Reference Chart for Transistorized Radios

Rush your order for this invaluable transistor book now. Only 50¢. Send coupon, or obtain at your G-E Tube Distributor. Not available in bookstores. *General Electric Co., Semiconductor Products, Electronics Park, Syracuse, N. Y.*

General Electric Company  
Semiconductor Products Dept., Section S8137  
Electronics Park, Syracuse, New York  
Send me the new General Electric Transistor Manual—50¢ remittance is enclosed.

NAME .....  
ADDRESS .....  
CITY ..... STATE .....

*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**

# TOOLS and GADGETS



## FIVE-INCH OSCILLOSCOPE KIT

Wiring time can be kept to a minimum with the Knight-Kit 5" oscilloscope kit,



and assembly is simplified by the use of a printed circuit board and laced wiring harness. Designed for general-purpose use with AM, FM, TV receivers and other high-frequency applications, the scope has a sweep range from 15 to 150-

000 cps in four steps. Its vertical sensitivity is 25 r.m.s. millivolts/inch; horizontal sensitivity, 70 r.m.s. millivolts/inch.

Detailed instructions and diagrams come with the kit, which is supplied complete with all tubes including the CRT and steel case with disappearing handle. Price, \$49.50. (*Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.*)

## PUSH-BUTTON PROPANE TORCH

Shown in the photo is a giant Bernz-O-Matic propane torch with jet blast flame.

Using a self-sealing, propane gas-filled cylinder, it operates on a push-button principle and produces a large flame which maintains a consistent maximum temperature of 2010-2050° F. The flame is ignited by a steady-burning pilot light.



Possible applications for this king-size device include: heavy-duty brazing; burning tent caterpillars; spot weed killing; disinfecting seed flats; destroying gophers, moles and the like. The new torch is priced at \$7.90, the propane gas cylinder at \$1.89. (*Otto Bernz Co., Rochester, N. Y.*) -30-



**GREATEST  
ADVANCE IN  
SHOP-METHOD  
HOME TRAINING**

# EARN MORE MONEY... GET INTO TELEVISION ELECTRONICS - RADIO

**Learn ALL 8 PHASES in ONE MODERN HOME-STUDY COURSE**  
At Home - In Spare Time

## YOU GET ALL THIS NEWEST PRACTICAL EQUIPMENT

- Parts to build a modern TV set, including all tubes plus a large screen Picture Tube
- Parts to build a powerful Superhet Receiver, standard broadcast and short wave
- Parts to conduct many experiments and build Continuity Checker, RF Oscillator, TV Circuits, Audio Oscillator, TRF Receiver, Signal Generator
- A Valuable Professional Multitester



**19 BIG KITS  
YOURS TO KEEP**

## YOUR NATIONAL SCHOOLS TELERAMA COURSE COVERS ALL 8 PHASES

- |                                    |                                |
|------------------------------------|--------------------------------|
| 1. TELEVISION, INCLUDING COLOR TV  | 5. PREPARATION FOR FCC LICENSE |
| 2. RADIO, FM AND AM                | 6. AUTOMATION                  |
| 3. INDUSTRIAL ELECTRONICS          | 7. RADAR AND MICRO WAVES       |
| 4. SOUND RECORDING AND HI FIDELITY | 8. COMMUNICATIONS              |

### YOU ARE NEEDED IN THE TELEVISION-ELECTRONICS-RADIO INDUSTRY!

You can build a secure future for yourself if you get into Electronics NOW! Today's shortage of trained technicians creates tremendous opportunities. National Schools Shop-Method trained technicians are in constant and growing demand for high-pay jobs in Broadcasting and Communications, Electronic Research, Servicing and Repair, and many other branches.

— many other materials and services — consultation privilege with our qualified staff, and Graduate Employment Service. EVERYTHING YOU NEED for outstanding success in Electronics.

Let National Schools, a Resident Technical School for over 50 years train you for today's unlimited opportunities in electronics! Our Shop Method trains you to be a MASTER-TECHNICIAN. Completely up to date, developed by experienced instructors and engineers, your Telerama Course will teach you all phases of the industry quickly, clearly and correctly. You can master the most modern projects, such as Color TV, printed circuits — even prepare for FCC License without taking a special

course. You can handle sales, servicing, manufacturing, or make good money in your own business. SEND FOR FACTS TODAY!

**EARN AS YOU LEARN.** Many of our students earn their entire tuition and more in Spare Time jobs we show them how to do while learning.

**YOU GET EVERYTHING YOU NEED** — Clear, profusely illustrated lessons, shop-tested manuals, modern circuit diagrams, practical job projects — all the valuable equipment shown above

### RESIDENT TRAINING AT LOS ANGELES

If you wish to take your training in our Resident School at Los Angeles, the world's TV capital, start NOW in our big, modern Shops, Labs and Radio-TV Studios. Here you work with latest Electronic equipment — professionally installed — finest, most complete facilities offered by any school. Expert, friendly instructors. Personal attention. Graduate Employment Service. Help in finding home near school — and part time jobs while you learn. Check box in coupon for full information.



**FREE!** Fully illustrated "Career" Book in TV-Radio-Electronics. PLUS actual sample lesson — yours at no cost, no obligation. CLIP COUPON NOW... MAIL IT TODAY!



MEMBER

## APPROVED FOR G.I. TRAINING NATIONAL SCHOOLS

4000 S. FIGUEROA ST., LOS ANGELES 37, CALIF.  
187 N. LA SALLE ST., CHICAGO 1, ILL.  
IN CANADA: 811 W. HASTINGS ST., VANCOUVER, B. C.

## NATIONAL SCHOOLS

TECHNICAL TRADE TRAINING SINCE 1905  
LOS ANGELES 37, CALIFORNIA

GET FAST SERVICE — MAIL NOW TO OFFICE NEAREST YOU!

NATIONAL SCHOOLS, DEPT. R2C-37  
4000 S. FIGUEROA ST. OR 187 N. LA SALLE ST.  
LOS ANGELES 37, CALIF. CHICAGO 1, ILL.  
Rush free TV-Radio "Opportunity" Book and sample lesson. No salesman will call.

NAME \_\_\_\_\_ AGE \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

Check if interested ONLY in Resident School training at Los Angeles  
VETERANS: Give date of Discharge \_\_\_\_\_

# KITS! KITS!

HERSHEL'S KITS ACCLAIMED BEST!

ALL KITS CONTAIN THE FINEST ASSORTMENTS. OVER 10,000 SOLD!

- 30 TUBE SOCKETS
- 2½-lbs of HARDWARE
- 15 ROTARY SWITCHES
- 10 Electrolytic Condensers
- 40 Radio & TV KNOBS
- 40 BY-PASS Condensers
- 60 CARBON RESISTORS
- 60 MICA CONDENSERS
- 100 SET SCREWS
- 8 1N22 XTAL DIODES
- 50 Ceramic Condensers
- 15 Variable Condensers (Air and Mica)
- 50 RF CHOKES
- 20 POWER RESISTORS
- 1 Phono Motor 115 Vac.
- 50 TERMINAL STRIPS
- 200 ft. HOOK-UP WIRE
- 1 TRANS. 6.3V-110 Vac.
- 5 Meissner Plug-In COILS
- 5 PILOT PANEL LITES
- 50 FUSES 3AG UP
- 1 Meter Rectifier O-1MA.
- 1 IGN. COIL 3V-15,000 VSEC.
- 25-Ft. Phono-Mike Cable
- 3 SELENIUM RECTIFIERS (65 MA, 110V.)
- 1 PHOTO Electric CELL

**YOUR CHOICE ANY KIT LISTED IN THIS AD 97c**

- 10 STRAIN INSULATORS
- 1 TELEGRAPH KEY
- 5 MICRO SWITCHES
- 75-Ft. 300 OHM TV LEAD-IN
- 25 TV STAND OFFS
- 24 SHOCK MOUNTS
- 1 PHONO XTAL with NEEDLE
- 1 PIX TUBE BRIGHTENER
- 3 CONDENSERS (500 MMFD 20,000 Volt)
- 100 Ft. of SPAGHETTI
- 1 RCA Flyback Trans.
- 10 BATHTUB CONDENSERS
- 10 GRAIN WHEAT LAMPS
- 5 RADIO-PHONO CHASSIS
- 4 LOOP ANTENNAS (RADIO)
- 1 PHANTOM ANTENNA A-62
- 100 SPRINGS (RADIO-PHONO)
- 5 RADIO NOISE FILTERS
- 25-Ft. RG-58/U COAXIAL CABLE with PLUGS
- 2 Powerful ALNICO 5 Magnets

## All New MYSTERY PACKAGE of ELECTRONIC PARTS



Worth \$40.00  
Our Price **\$3.95**  
Ship Wt. 20 lbs.

It's the surprise of your life! 20 pounds of BRAND NEW usable GOVT. surplus. The ideal gift for pens, etc.

### OIL CONDENSER \$1.65



2 MFD. 3000 VDC. Pyranol-Oil w/ Mount-Brackets. in 3000 VDC. 1-1 Mfd. removed from equip. 4 3/4" x 4 3/4" x 2 1/2"

### ARC-5 COMMAND TRANSMITTER \$8.95



7 to 9.1 Mc. Brand New in Cartons. With Tubes.  
Hottest Buy in the Country

TERMS: Cash with order or 25% DOWN—BALANCE C.O.D.  
ALL PRICES NET F.O.B. DETROIT MINIMUM ORDER \$2.00

TYler 8-9400  
**HERSHEL RADIO CO.**  
5249 GRAND RIVER Detroit 8, Michigan

# TIPS and TECHNIQUES

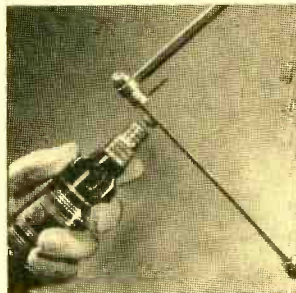


## GROUNDING REDUCES HUM

Hum and noise in radio receivers and audio amplifiers can sometimes be eliminated or reduced by grounding the chassis to a steam radiator or water pipe. However, such a ground should never be applied to the chassis of an a.c.-d.c. set. This is because one side of the 115-volt circuit is grounded by the utility company. A ground applied to the chassis which is sometimes connected internally to one side of the power line would short-circuit the 115-volt service if the power plug were inserted into the wall socket the "wrong" way. Depending on the set circuitry, the on/off switch—or even the tubes—may burn out before the building fuse lets go. Moral: Never place an a.c.-d.c. receiver on a radiator or other grounded surface. Even with a plastic cabinet, a ground may be picked up by the chassis screws protruding through the bottom. —E.F.C.

## BETTER STARTING CUT FOR SAWING

The blade of a scroll saw will start into the work without jumping the line if two or three teeth at the starting end are thinned down with a hand grinder or file. Just grind the sides of the teeth to remove the set and to bring them to a very keen knife edge. —K.M.



## CHECKING YOUR TV ANTENNA

Instead of climbing to check your television antenna for broken connections, loosened brackets, etc., use a pair of field glasses to spot trouble.

Here's another method of checking the antenna: disconnect the antenna lead from the set. With the set on, touch first one wire of the lead and then the other to one of the binding posts. The picture and sound should be of equal value or strength (Continued on page 96)

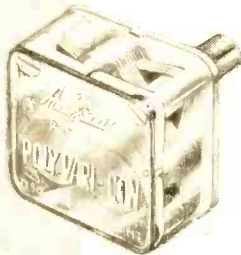


# Argonne

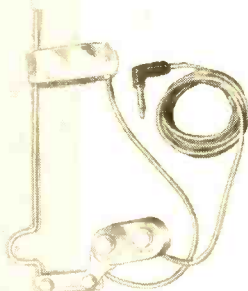
## TRANSISTOR TRANSFORMERS

— Over 81 Types —  
and other SUBMINIATURE COMPONENTS

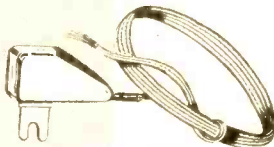
Now Available from Your  
LOCAL DISTRIBUTOR



VARIABLE CAPACITORS



GUITAR MICROPHONES



HARMONICA MICROPHONE



### FLAT FERRITE TAPPED ANTENNA COILS

5-1/4" L., 13/16" W.,  
3/16" Thick

AR-66—For use with  
AR-93 "Poly-Vari-Con".  
AR-67—For use with  
123 mmf. variables.  
AR-68—For use with  
365 mmf. capacitors.

2-5/8" L., 3/4" W.,  
3/16" Thick

AR-69—For use with  
variables up to 211 mmf.  
AR-70—For use with  
variables up to 365 mmf.  
List Price, Any Model..... 1.65

### SUPERHET AND TRF VARIABLE CAPACITORS "POLY-VARI-CON"

THE SMALLEST VARIABLE  
CAPACITORS IN THE WORLD!

1 GANG—5/8" x 1-1/16" Square TRF.  
10 to 365 mmf.

AR-94.....List Price 2.25

2 GANG—5/8" x 1-1/16" Square  
Superhet. Ant: 13 to 211 mmf. Osc: 11  
to 101 mmf.

AR-93.....List Price 3.25

3 GANG—13/16" x 1-1/16" Square  
Superhet. Ant. or RF: 11 to 235 mmf.  
Osc: 11 to 111 mmf.

AR-88.....List Price 5.00

### GUITAR PICKUP MAGNETIC MICROPHONE

COMPLETE WITH SEPARATE  
TONE AND VOLUME CONTROLS

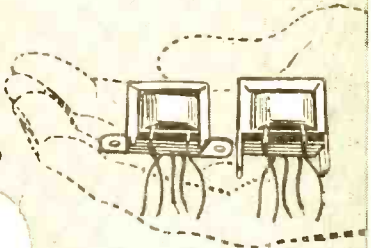
High impedance contact type microphone  
mounts easily under strings of guitar with-  
out special attachments. While mounted,  
microphone unit can be raised or lowered  
easily on rod to create varying tonal  
effects. Supplied with 8 ft. cable and  
attached standard sized phone plug for  
connection to amplifier.

AR-35.....List Price 16.60

### HARMONICA PICKUP MICROPHONE

Crystal contact microphone with high out-  
put. It can be connected to any PA sys-  
tem, or the audio section of phonograph  
or radio. Microphone bracket slips un-  
der screw on bass end of harmonica and  
leads connect to amplifier system. Sup-  
plied with 7 ft. shielded cable.

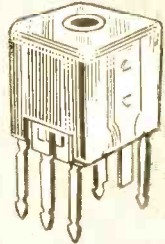
AR-18.....List Price 4.95



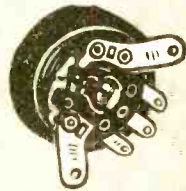
TRANSFORMERS



EARPHONES



IF COILS



VOLUME CONTROLS



MINIATURE SPEAKERS

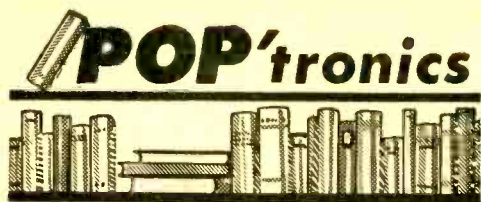
WRITE FOR FREE LITERATURE ON ARGONNE PRODUCTS  
IF COILS • TRANSFORMERS • MICROPHONES • EARPHONES  
TEST EQUIPMENT • LOOPSTICKS • SPEAKERS  
PHONO CARTRIDGES • PHONO PICKUP ARMS

# Argonne

## ELECTRONICS MFG. CORP.

27 THOMPSON STREET • NEW YORK 13, N. Y.

# POP'ronics



## BOOKSHELF

"PICTORIAL MICROWAVE DICTIONARY" by V. J. Young and Meredith W. Jones. Published by John F. Rider Publisher, Inc., 116 West 14th St., New York 11, N. Y. 116 pages. Soft cover. \$2.95.

What would you do if told to make a "coho"? . . . and after that, to check the "squitters" because some radar operators were complaining about excessive "fruit"? Unless you're in the know, you'd better head for the nearest dictionary. But even that probably won't be of much help, for these terms are part of the new microwave language that's springing up around us.

To unravel some of these unusual terms, Young and Jones have prepared a fairly good dictionary with adequate explanations of most of the unusual microwave phrases. Your reviewer differs with the authors on their interpretation of "scatter propaga-

tion," but this single error is one of omission rather than commission.

*Recommended:* to students and technicians going into industrial plants, and armed service personnel wanting to know more about u.h.f. equipment.

### Free Literature Roundup

Attractive 8-page brochure describes Bozak speakers and enclosures, presents the case for infinite baffle systems. Copies are available at dealers; or write to R. T. Bozak Sales Co., Box 966, Darien, Conn.

Latest equipment for radio, electronics, and TV is described in 172-page catalog. Write to Burstein-Applebee Co., 1012-14 McGee St., Kansas City 6, Mo., for a copy.

Hi-fi components, including many kits, are listed and illustrated in carefully prepared catalog, available from MusiCraft, 48 East Oak St., Chicago 11, Ill.

"In the Groove" and "How Good Is Your Arm" are the provocative titles of two interesting booklets dealing with phono pickups and tone arms respectively. Write to Fairchild Recording Equipment Co., 10-40 45th Ave., Long Island City 1, N. Y. for copies.

-30-

## INDUSTRIAL ELECTRONIC— AUTOMATION TECHNICIANS Desperately Needed!



Never in history has there been such a tremendous demand for Electronic technicians at the servicing, maintenance and assistant Engineering level, in all fields of electronics. Industries, Businesses, large and small are turning to Electronically controlled machinery . . . AUTOMATION!

Whether it's a Robot airplane, an automobile plant with an integrated line of machines, a Sensing Device, Computing System or Communications—each re-

quire electric power applied through automatically controlled processes. This means there are positions open at all levels and phases for Electronic Technicians.

- TOP PAY
- UNLIMITED OPPORTUNITY
- SECURE FUTURE

Bailey electronic students learn Industrial Television on specially designed equipment such as this panelboard, which is a multiple camera and screen control. The Bailey Electronic course includes an outstanding comprehensive program in radio and TV receiver servicing.

Let us send you FREE, without obligation, complete details of our Resident Electronic Training Program—originated by Bailey Schools—acclaimed by Electronic Engineers. See how you save time as you learn-by-doing with intensive laboratory work on the most recently developed Electronic equipment, plus classroom required physics, mathematics, etc.


We help you find part time work while in our school—help place you with America's leading companies after graduation. Act now—mail coupon today!

VETERAN APPROVED

**Bailey Technical Schools**  
1626 S. Grand • St. Louis 4, Mo.

### MAIL TODAY

Please mail immediately this free booklet without obligation.

FREE BOOKLET 

Name \_\_\_\_\_

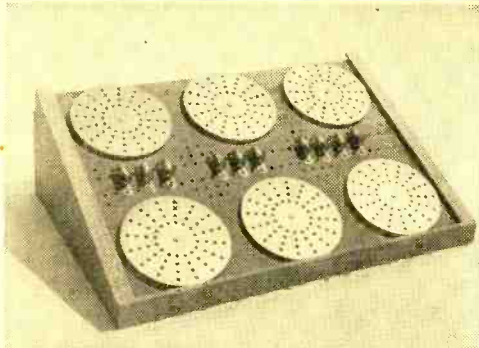
Address \_\_\_\_\_

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





# New! A MACHINE THAT COMPOSES MUSIC



Actual tune composed on GENIAC

**COMPUTES, "REASONS"  
PLAYS GAMES**

**GENIAC  
ELECTRIC BRAIN**

## BUILD IT YOURSELF in a few hours!

Yes, you build any one of 33 exciting electric brain machines in just a few hours by following the clear-cut, step-by-step directions given in a thrilling booklet! No soldering required . . . no wiring beyond your skill! GENIAC is a genuine brain machine—not a toy. The only logic machine kit that not only adds, subtracts, etc., but presents the basic ideas of cybernetics, Boolean algebra, symbolic logic, automation, etc. So simple to construct that even a twelve-year-old can make a machine that will fascinate people with advanced scientific training! With the special circuitry of GENIAC, the Electric Brain Construction kit, you can compose tunes automatically. These new circuits were never available before!

**OVER 400 COMPONENTS AND PARTS.** Circuits operate on one flashlight battery, and the use of ingeniously designed parts makes building circuits one of the most fascinating things you've ever done! You set up problems in a variety of fields—and get your answers quicker than you can set them up! Play games with the machine—nim, tic-tac-toe, etc.—and pit your brain against its logic! Solves puzzles in a few seconds that would take you hours without the aid of the machine. You actually see how computing and problem-solving is analyzed with algebraic solutions transferred directly into circuit diagrams.

**YOUR COST FOR GENIAC KIT:** only \$19.95 postpaid. The 1957 Model GENIAC KIT contains: (1) a complete 200-page text, "Minds and Machines"—a basic introduction to computers. (2) "How to Construct Electrical Brains At Home"—a fully illustrated text book on basic computer design theory and circuits with specific instructions for building circuits. (3) Wiring Diagram Manual. A special booklet with full scale diagrams that you can tear out and place on your work bench for easy assembly. (4) Beginners' Manual. Starting from scratch, the manual adds fifteen extra experiments, thoroughly tested using GENIAC components to teach the basic symbols of electric circuits. (5) Over 400 components and parts.

So—mail the coupon for your GENIAC today! Your money back if not delighted!

### Some Firms and Institutions that have ordered GENIAC:

Allis-Chalmers  
Remington-Rand  
International  
Business  
Machines  
Wheeldex Mfg. Co.  
Manuel Missionary  
College

Walter V. Clarke  
Associates  
Barnard College  
Westinghouse  
Electric  
Phillips  
Laboratories

General Insurance  
Co. of America  
Lafayette Radio  
Rohr Aircraft Co.  
Albert Einstein  
Medical College  
Naval Research  
Laboratories

Los Angeles  
Public Schools  
Kansas State  
University  
Duke University  
Coral Gables  
Bell Telephone  
Laboratories

K1—Only

**\$19.95**

(Add \$1.00 W. of Miss.  
\$2.00 Outside U. S.)

## UP TO DATE?

Is your knowledge of these new technical fields rusty? Perhaps you never had time to study them but need to now. Write for free information about our new, modern, low-cost courses. Work at your own speed at home. Check those that interest you.

### PHYSICS

- High School Physics
- Part 1—PIA
- Part 2—PIB
- College Physics
- Part 1—P2A
- Part 2—P2B

### ELECTRONICS

- Television P3A
- Radio P3B
- Radar—Theoretical P3C1
- Radar—Practical P3C2
- Musical Instruments P3D

- Acoustics Hi-Fi P4
- Nuclear Physics P5
- Analog Computer C3
- Digital Computer C2
- Memory Storage C1
- Construction of Robots PS7

### MATHEMATICS

- Trigonometry
- Algebra
- Solid Geometry
- Calculus
- Statistics

### CHEMISTRY

- High School
- College
- Analytic
- Qualitative
- Quantitative
- Organic
- Physical

### BIOLOGY

- High School
- Human Biology
- Zoology
- Botany
- Genetics

### PSYCHOLOGY

- Normal PS1
- Child PS2
- Abnormal PS3
- Mental Hygiene PS4
- Aptitude Test PS5
- Rapid Reading PS6
- Construction of Robots PS7

Please send me GENIAC Kit. \$19.95 (Add \$1.00 West of Mississippi or \$2.00 Outside U. S.)

**OLIVER GARFIELD CO., Dept. PE-37A, 31 Broadway, New Haven, Conn.**

Name..... Age..... Occupation.....

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

THE "Chief" OF TRANSMITTERS  
WRL'S MODEL 90

**Globe Chief Kit**

Only  
**\$500**  
per mo.

Pay \$5.00 Down

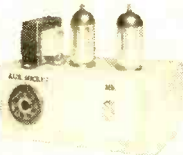
Cash Price:  
**\$49.95**



A 90 watt Xmtr. (75 watts for novice use). Completely band-switching, 160-10M. Built-in, well-filtered power supply. Pi-Net matches most antennas, 52-600 ohms. Modified Grid-Block keying for max. safety. Provisions for VFO input and operation. Fully shielded for TVI-reduction. Easy to assemble; kit contains complete simplified manual, pre-punched chassis, and all parts with wires pre-cut and pre-tinned. Completely wired: \$64.95.

**THE WRL Printed Circuit Screen Modulator Kit** Only **\$13<sup>95</sup>**

Designed for use with WRL Globe Chief; may be used with Heath AT-1, Johnson Adventurer, Knight 50 watt, etc. Permits radio-fone operation of CW Xmtr. at min. cost. Self contained. All connections to Xmtr. included. Detailed assembly manual.



**THE WRL Printed Circuit TRANSISTOR CODE OSCILLATOR**

Pleasant audio tone. Screw terminal input key; output jacks receive standard phone tips. Complete with two pen cell batteries and detailed instructions.

Only **\$3<sup>95</sup>**



Write for complete information on WRL's Globe Scout Xmtr. and Globe Spanner Beams,

and the latest list of  
**Reconditioned Eqpt.**  
with Factory-New Guarantee

Here's Just A Sample:

Hallicrafters S-38C	\$32.50
National NC-57	69.00
Johnson Adventurer	\$39.50
Heath AT-1	24.50



Send your free catalog.  
Please send complete info on the

PE-3

Name: \_\_\_\_\_

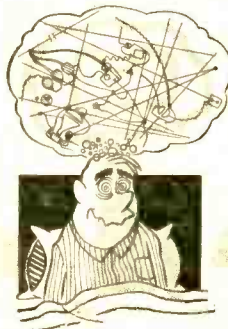
Address: \_\_\_\_\_

City & State: \_\_\_\_\_

**WORLD RADIO LABORATORIES**  
3415 West Broadway Council Bluffs, Iowa

**McWatts**

By CARL KOHLER

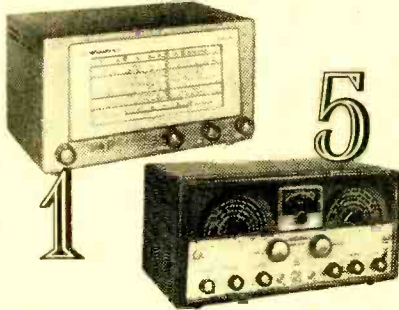




# 8 reasons why the world's most respected name in communications is **hallicrafters**

## model S-38D \$49.95

Wonderful starting point for the new amateur or short-wave listener. Same meticulous engineering found in all Hallicrafters equipment—at down to earth prices. Coverage: standard broadcast from 540-1650 kc. plus 3 short wave bands from 1650 kc. to 32 Mc.



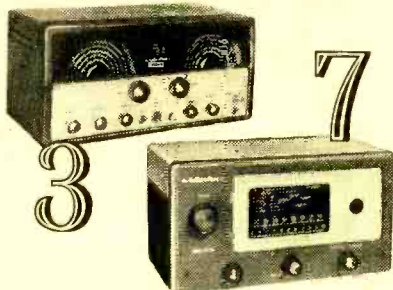
## model S-53A \$89.95

Has easy-read overseas dial with international stations indicated. Electrical bandspread and logging scale. Complete with 5 in. speaker, head-phone jacks plus phono-jack. Two stages of i.f. Coverage: standard broadcast from 540-1630 kc. plus four SW bands over 2.5—31 and 48—54.5 Mc.



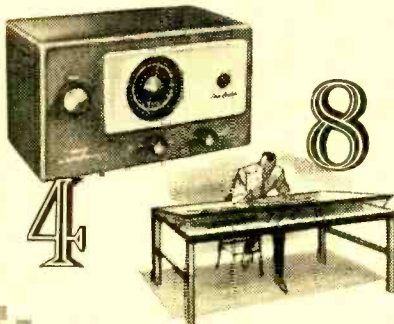
## model S-85, S-86 \$119.95

A superb receiver that pulls them in on 10, 11, 15, 20, 40 and 80 meter amateur bands. Over 1000° calibrated bandspread gives better selectivity on large easy-to-read dial. Features separate tuning condenser and built-in PM 5" speaker. Coverage: Broadcast band 540-1680 kc. plus three S/W bands 1680 kc—34 Mc. S-85 AC, S-86 AC-DC.



## model S-94, S-95 \$59.95

Advanced models that bring in emergency radio, police and fire calls. Newly engineered FM chassis provides low frequency drift and low noise figure. Modern styling with simplified control gives easy operating. Coverage: S-94—30 to 50 Mc; S-95—152 to 173 Mc.



## model SX-99 \$149.95

The best at its price with all features demanded by DX enthusiast. Has "S" meter, separate bandspread tuning condenser, crystal filter and antenna trimmer. Easy-read dial has over 1000° calibrated bandspread through 10, 11, 15, 20, 40, and 80 meter amateur bands. Coverage: standard broadcast 540-1680 kc. plus three Short-Wave bands 1680 kc-34 Mc.

## model S-102, S-106 \$59.95

The only inexpensive complete receivers for 2 and 6 meter bands. New models with all of Hallicrafters famous engineering. Have 7 tubes with rectifiers, built-in 5" PM speaker, low frequency drift, compact bandspread design, phone jacks. Coverage: S-102—143 to 149 Mc. in 2 meter band; S-106—49 to 55 Mc. in 6 meter band.

## model SX-104, SX-105 \$89.95

Two new high frequency crystal controlled/tunable receivers at low cost. First time available on single band receiver. Ideal for monitoring government marine, fire, police and other emergency frequencies. Coverage: SX-104—30 to 50 Mc.; SX-105—152 to 173 Mc.

**THE NEW ONE  
THAT'S ON THE  
DRAWING BOARD  
TODAY!**

# hallicrafters

where the best ideas in communications are born!

CHICAGO 24, ILLINOIS

Export Sales: Philips Export Co.  
100 E. 42nd St., New York 17, N.Y.

# FREE

1957  
**EICO**<sup>®</sup>  
CATALOG

**SAVES YOU 50% on your  
TEST INSTRUMENT & HI-FI COSTS**  
50 KITS & WIRED MODELS to choose from!

**EICO**<sup>®</sup> 84 Withers St., Bklyn. 11, N. Y.

Show me HOW TO SAVE 50% on Laboratory Precision test instruments & Hi-Fi. Send FREE catalog & name of neighborhood EICO Distributor. P-3

Name .....

Address .....

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

Occupation .....

Prices 5% higher on West Coast



Home, car, TV, appliance repairs:  
#540 NEW!  
REDI-TESTER  
KIT \$12.95  
WIRED \$15.95



VACUUM TUBE  
VOLTMETER  
#221  
KIT \$25.95  
WIRED \$39.95



NEW! PEAK-to-PEAK  
VTVM  
#232 & UNI-PROBE  
(pat. pend.)  
KIT \$29.95  
WIRED \$49.95



1000 Ohms/Volt  
MULTIMETER  
#536  
KIT \$12.90  
WIRED \$14.90

**PERFORMANCE-PROVED** by TV manufacturers, electronic schools and over 100,000 Servicemen. **OVER 1 MILLION** in use today!



5" PUSH-PULL  
SCOPE #425  
KIT \$44.95  
WIRED \$79.95  
Lowest-priced professional Scope



NEW! COLOR &  
BLACK-&WHITE  
5-MC TV  
SCOPE #460  
KIT \$79.95  
WIRED \$129.50



TUBE TESTER #625  
KIT \$34.95 WIRED \$49.95



#666  
NEW! DYNAMIC  
CONDUCTANCE  
TUBE &  
TRANSISTOR TESTER  
KIT \$69.95 WIRED \$109.95

**YOU BUILD EICO KITS in ONE evening,  
but — they LAST a LIFETIME!**



NEW! 20-WATT  
Ultra-Linear  
HIGH  
FIDELITY  
AMPLIFIER  
#HF20  
KIT \$49.95 WIRED \$79.95



NEW! HIGH  
FIDELITY  
PREAMPLIFIER #HF61  
KIT \$24.95 WIRED \$37.95  
with Power Supply:  
KIT \$29.95 WIRED \$44.95



NEW!  
60-WATT  
Ultra Linear  
HIGH  
FIDELITY  
POWER AMPLIFIER  
#HF60 with ACRO TO-330 OUTPUT XFMR  
KIT \$72.95 WIRED \$99.95



NEW!  
COMPLETE with  
FACTORY-BUILT  
CABINET-2-WAY  
HI-FI SPEAKER  
SYSTEM #HFS1  
\$39.95

**LATEST engineering • FINEST components • EASY instructions**



NEW!  
RF-AF SIGNAL  
GENERATOR #324  
(150 kc to 435 mc!)  
KIT \$26.95 WIRED \$39.95



TV-FM SWEEP  
GENERATOR  
#360  
KIT \$34.95 WIRED \$49.95



MULTI-SIGNAL TRACER #145  
KIT \$19.95 WIRED \$28.95



1000 Ohms/Volt  
MULTIMETER  
#556  
(4 1/2" METER)  
KIT \$16.90  
WIRED \$23.50

**EXCLUSIVE 5-WAY GUARANTEE on components, instructions, performance — and LIFETIME service and calibration!**



6V & 12V  
BATTERY  
ELIMINATOR &  
CHARGER  
KIT \$29.95 WIRED \$38.95



R-C BRIDGE & R-C-L  
COMPARATOR #950B  
KIT \$19.95 WIRED \$29.95



Test radio, hearing aid, flashlight, photo-flash, electronic equipment batteries:  
BATTERY TESTER  
#584  
KIT \$9.95 WIRED \$12.95

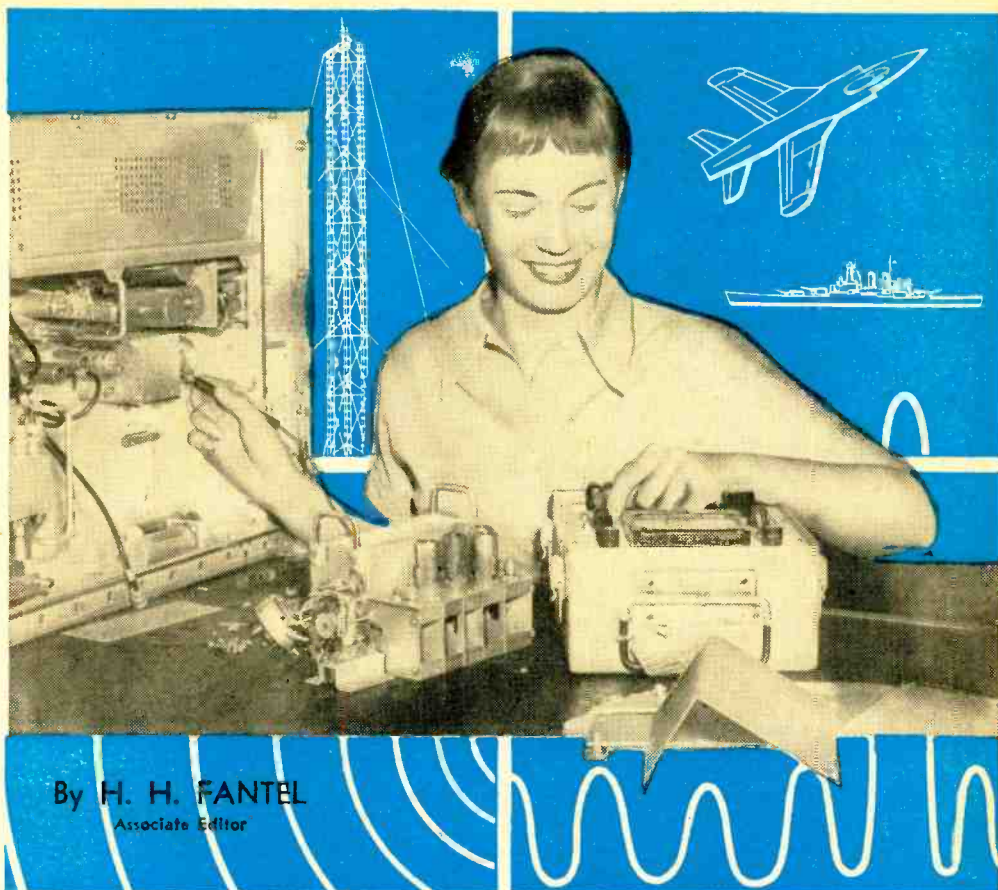


RETMA Res. Sub.  
Box #1100  
KIT \$5.95 WIRED \$9.95



RETMA Cap. Sub.  
Box #1120  
KIT \$5.95 WIRED \$9.95





By H. H. FANTEL  
Associate Editor

## A "WAVE" in Naval Electronics

**A** PERT REDHEAD with blue eyes flashes her winning smile from the cockpit of a Navy fighter aircraft, and reports: "Radar i.f. bandwidth okay on all stages." No, this is no Hollywood movie, but actual proof that things are changing fast for the Navy, for electronics—and for women.

Proof became tangible in the form of Delores Startzel, Aviation Electronics Technician, USN. Even an "old salt" like John Paul Jones himself would have uncrusted a bit at the sight of such a charming sailor. But what would really have set him up on his sea legs is the fact that Delores has been doing an expert technical job on fully equal terms with Navy men. Her career reflects dramatically two important trends: the awakening of women to the opportunities of electronics, and their growing participation in the armed services at levels of high technical respon-

sibility, qualified by thorough schooling.

**Double-Barrelled Pioneer.** Both in the Navy and in the field of electronics, Delores (Dee, for short) is somewhat of a pioneer. Of course, the WAVES have been a branch of the Navy for over a decade, yet they have had to sail against the blustery headwind of male prejudice. But by now it has dawned on even the most stubborn that men have no monopoly on brains. The female breakthrough on the technical front is a relatively recent development. In the Navy Electronics Training School at Memphis, Tenn., Dee was the only girl among more than a hundred marines.

Dee is proud to be among the first women doing advanced technical work in electronics. Like anything that smacks of engineering, electronics used to be an all-male preserve. But there just aren't enough qualified male technicians to take



**On the job,** our Wave traces through the stages of an intricate receiver (at left) with a VSM-29 frequency meter. On this month's cover, Dee runs checks on an oscilloscope. Below, she tackles with practiced skill that ultimate of all electronic instruments—the ubiquitous soldering gun.



care of the ever-increasing variety of electronic equipment in military and civilian life. Under the pressure of this need, the old barriers of sex prejudice are now caving in. The military and private industry are no longer just looking for women with soldering irons tied to their apron strings. Now they want girls to be equally handy with the slide rule, the spec sheet, and a quick deduction from a complex schematic.

Many women have the necessary keen intelligence for such work, but don't even realize it because they think of themselves as "feminine." Subconsciously they feel that having brains is like having pimples: they try to hide them or dry them up. Fortunately, the old saw that keen-minded women are unattractive no longer cuts any ice among intelligent men. Its teeth broke on the hard realities of modern life that make men and women equal partners in work and in marriage. Women who realize this no longer try to shrivel their brains. They feel free to make the most of their native intelligence and have it sharpened by thorough schooling. Electronics, since it requires more brain than brawn, seems a natural field for women's careers on the professional and semi-professional level.

Dee didn't want to go to waste. She wanted to train and use her abilities. But after the first year of college, her money gave out. Instead of heading for the usual dead end of an unskilled job, Dee looked into the technical training offered by the armed services. It offered an answer to the question of her future. With a bit of pay and plenty of technical savvy stowed away, a girl would have a better toe-hold on the world. Besides paid education, Dee, who comes from a small town in the state of Washington, wanted a bit of travel and adventure—so the recruiting posters made



plenty of sense to her. Always willing to take the next logical step, she enlisted.

**Boot Camp Ahoy!** The Navy did not immediately surrender to Dee's ambition. Like all recruits, she had to steer through the military purgatory known as "boot camp." Dee maintains tactful silence about "the senseless things that come with boot," realizing that it takes a tough dose of sheer barefaced drill and discipline to fit a former civilian into the military mold. For better or worse, that's part of the bargain. As a mature and understanding person, Dee accepts this discipline in the context of military life without letting it encroach on her democratic feeling of inner freedom as a person.

After boot camp, electronics was still a long way off. First came Airman Preparatory School at Jacksonville, Florida, where Dee studied flight fundamentals and aircraft maintenance, and was also trained to act in emergencies. She can handle a crash truck at disaster scenes, fight fires, and service automatic weapons. And if war ever comes to the front door, mindless of the neat distinction between combatant and non-combatant troops, communications specialist Dee can rattle off an unmistakable message in 50 caliber slugs.

**Electronics — At Last.** After basic training and long sessions of aptitude testing and counseling, Dee was finally admitted to the Navy school for Aviation

*(Continued on page 126)*





## More Than Meets The Ear

**D**OES A YOUNG FOX yipping at the moon have different sound effects than one yipping for its mother? Yes, it does—on recordings. Do sea gulls have a common “language”? Bill Cheney’s recordings give that impression—at least in the grooves. Is the human voice affected by a bodily system that is giving out—affected so minutely that the ear cannot detect the change, but the eye can by studying the markings on a record?

The shade of Sherlock Holmes would no doubt enjoy dropping in at the Seattle diggings of W. C. (Bill) Cheney, who might be called a “sound detective.” A manufacturer of custom-built furnaces and torches, in his spare time Cheney makes recordings—thousands of them. Then he studies the pattern of modulations or variations in the grooves. By applying a Sherlock-sized magnifying glass to recordings he has made of bird and animal sounds, and of human voices, Cheney has learned much.

Cheney’s machine shop, where he both lives and works, stands at the water’s edge of Puget Sound. Sea gulls prowl on the wing for food in the form of fish or floating waste just beyond his back doorstep. To Cheney, the squawking of the gulls makes sense. By peering through the magnifying glass at his recordings, he has found that gulls give forth certain sounds when hunting fish and other sounds when they are just having fun by gliding down air currents.

And the human voice. Let Cheney tell you about his experience with the late Barney Oldfield, famed auto racer:

“I had made various recordings of Barney speaking over the radio, and in 1946 I became intrigued by a new one. I noticed odd, irregular, saw-toothed markings. Something was wrong with Barney, I decided. A few days later, he died of a cerebral hemorrhage.”

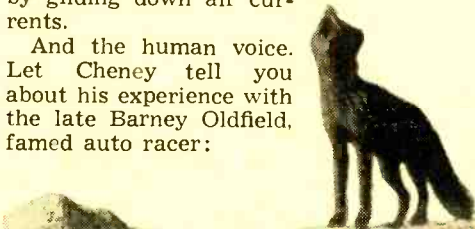
With his main recording machine, Cheney has etched for posterity such famous news broadcasts as the announcement of the Japanese attack on Pearl Harbor and the description of the Bikini atomic bomb tests. So that he won’t miss anything important, he has two other recorders ready to go at all times.

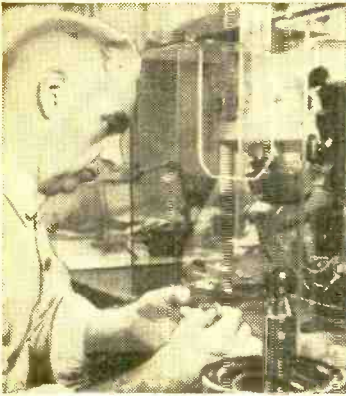
You might not be surprised to learn that although Cheney keeps a diary, it is not an ordinary diary such as you or I would keep. As Bill says: “I just talk into a recording machine and cut platters of experiences and thoughts I’ll want to recall in years to come.”

—Rafe Gibbs



**Bill Cheney** designed his own recording system—even built the cabinet from a Siberian walnut log he fished out of Puget Sound. The groove patterns of the thousands of recordings he has made in his spare time tell Bill a great deal about human, animal and bird life.



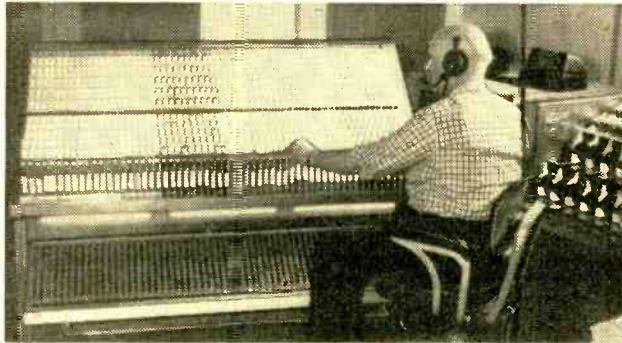


## Growing "Whiskers" on Metal

Adjusting probe fitted into plastic shield surrounding microscope (left) is Bell Telephone Laboratories metallurgist S. M. Arnold, who is studying growth of "whiskers" on metal samples. Whiskers are hairlike strands that literally grow on certain metals. Originally discovered as cause of short circuits in telephone equipment, whiskers are now cultivated in laboratory to help find means of "whisker-proofing" various metals used in critical circuit parts.

## Organist at Work?

Technician (right) is not looking for lost chord, but operating magnetic amplifier lighting control. Unit's 900 switches can be set up for 10 different scenes with 10 different intensities for each lamp. (Wide World Photo)

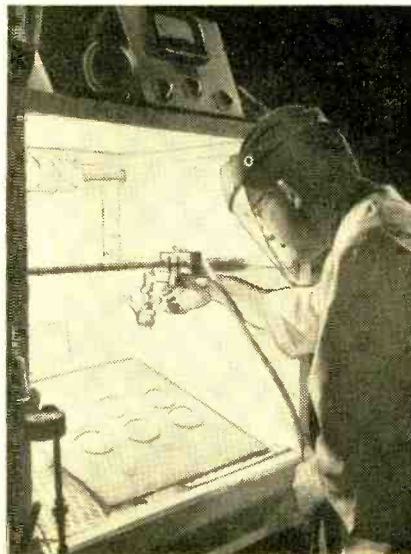


## Turntable Rotates Autos

An electronically controlled automobile turntable (left) is in use at the drive-in branch of Chicago's National Bank of Hyde Park. As car starts onto table, electric eye activates a yellow light for "slow." When in position, car triggers another electric eye which flashes a red "stop" signal. Finally, when car drives off table toward teller's window, a third electric eye turns on a green light to signal next customer. Table turns at pre-set timed intervals.

## Improved Panelescent Lamps

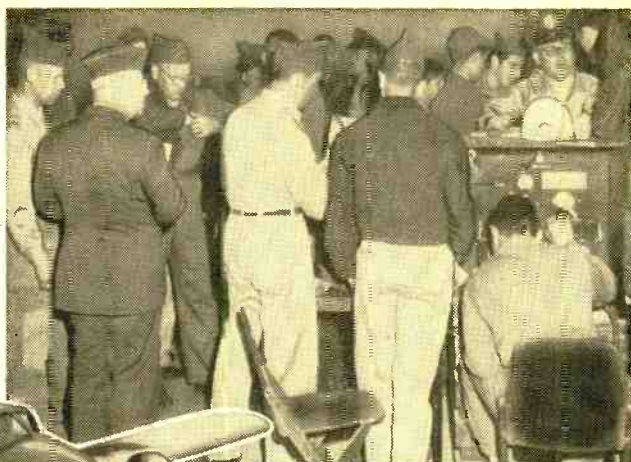
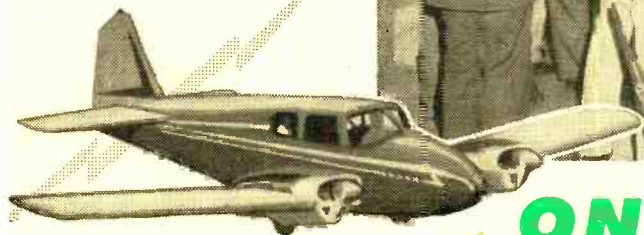
"Panelescent" is Sylvania's trade name for a device that provides light by the principle of electroluminescence—the excitation of certain phosphors placed in an electric field. The lamp—a thin luminous sheet that emits a soft, uniform glow—may be cut or stamped in any shape. After cutting, lamp receives coatings and firings (right). Tests (below) assure lamp will last 30,000 hours.





**By Wayne Winters**

Major, CAP



## ON THE AIR with the Civil Air Patrol

**O**NE EVENING last September a man slipped behind the wheel of his car in Albuquerque, New Mexico, switched on a radio receiver and transmitter, and before he could back out of the driveway was halted by the urgent call: "Thunderbird 39 to any Albuquerque CAP station."

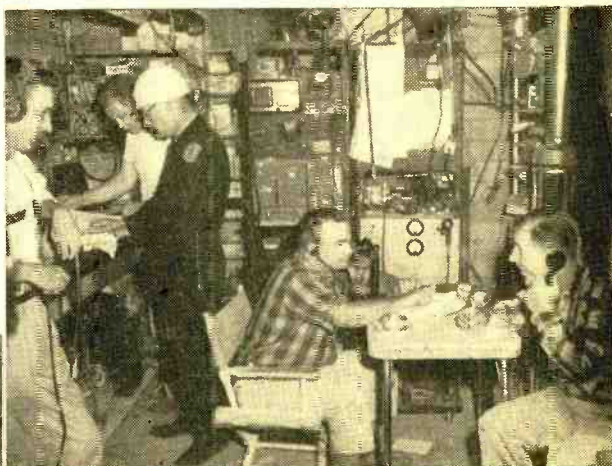
A quick reply to the Thunderbird (Arizona CAP station) operator brought no response, so switching off the car, the Albuquerque Civil Air Patrol member beat a hasty retreat to his house, fired up a 75-watt fixed station and, contacting Thunderbird 39, learned that the Arizona operator was worried about a plane overdue in

isolated Monument Valley in the Navajo Indian reservation, where there are no phones for a hundred miles.

A check with Civil Aeronautics authorities in Albuquerque brought the disturbing news that the pilot had left Albuquerque at 4:02 that afternoon in a light plane, estimating two hours en route to his Monument Valley destination and carrying four hours of fuel aboard. . . . Now it was exactly 8:00 p.m. The craft must be down somewhere in the dark desert that would test a flyer's courage even in daylight.

Moments later, this disquieting information crackled back to Thunderbird 39, and

**Cadet operator, below, works both high-frequency and very-high-frequency portable rigs at a practice mission. At top of page, another operator is shown handling traffic while numerous CAP personnel await further orders.**



**Control headquarters may be set up in any handy location to direct search and rescue operations. Above, the workshop of a communications officer was utilized during a flood mission.**

March, 1957

43



The CAP member at top of page is talking into a lightweight v.h.f. packet which he designed and built; his car is equipped with a high-frequency transmitter and receiver. Directly above is a typical father and daughter team; Cadet Carrie Hopkins of Albuquerque operates the radio while Lt. Col. Tom Hopkins makes a log entry. Anyone over 14 years of age can join the Civil Air Patrol ranks.

Albuquerque began preparations for an aerial search at dawn. . . . Yet an hour later, even as alternate airfields were being checked, the Monument Valley station came back on the air with the information that the pilot had landed at an emergency field and walked over the desert to his destination. Plane and passengers were safe.

**Two-way radio** plays a big part in the Civil Air Patrol, the organization which is charged with a large part of the search and rescue operations for missing aircraft. Some 10,000 stations, operating on frequencies "loaned" by the U. S. Air Force, are distributed over the 48 states, Hawaii, Alaska, District of Columbia and Puerto Rico. By far the greater part of these stations are installed in cars and trucks. Many "fixed" stations exist at airfields, CAP unit headquarters, homes, and business offices. Not a few planes, either CAP-owned or private aircraft belonging to members of the organization, are also equipped with two-way radios operating on CAP frequen-

cies. A number of walkie-talkie units are in the hands of ground rescue teams and prove invaluable in search operations to provide communications between aircraft flying cover, or to send information from a crash scene back to a base camp.

The radio equipment used in CAP activities varies from station-to-station and state-to-state. Some gear is supplied to the organization by the U. S. Air Force after it has been declared surplus. Other equipment is purchased by the various units from their own funds. Still more is the private property of individual members, not a few of whom are also "ham" operators.

In most cases power limitations are fairly low. A maximum of 400 watts output is provided for the one station in each state that is authorized to talk across state borders, while the various other units are allowed either 150 or 75 watts of power to the antenna. Most of the mobile units run from 10 to 50 watts, with center-loaded antennas being most common.

**Seven frequencies** are authorized as follows: Channel One, 2374 kc.; Channel Two, 2394 kc. (Freehold and Fort Monmouth, N. J., area only); Channel Three, 4325 kc.; Channel Four, 4507.5 kc.; Channel Five, 4585 kc.; Channel Six, 5500 kc. (one watt only); Channel Seven, 148.14 mc. An eighth channel, which will be in the v.h.f. band somewhere close to the amateur two-meter frequency, is planned.

Until the last three or four years, almost all CAP traffic was carried on the high frequencies with Channels Four and Five predominating. Now the use of v.h.f. Channel Seven is encouraged and an increasing number of stations have added v.h.f. equipment to supplement the h.f. gear. This frequency is especially valuable where short-range transmissions and air-to-ground communications are needed.

Civil Air Patrol transmitters must be crystal-controlled. Their operators must hold restricted radiotelephone licenses or higher. The operation of the stations must conform to all of the FCC regulations concerning frequency tolerances, type of emission, etc. Accurate logs are required of each station's operation.

All Civil Air Patrol communications operations are carefully regulated. "Hamming" is discouraged and an excessive amount of idle chatter is not tolerated. Regular state-wide nets are scheduled at definite times each day during which traffic information is passed from headquarters to local units and between individual stations.

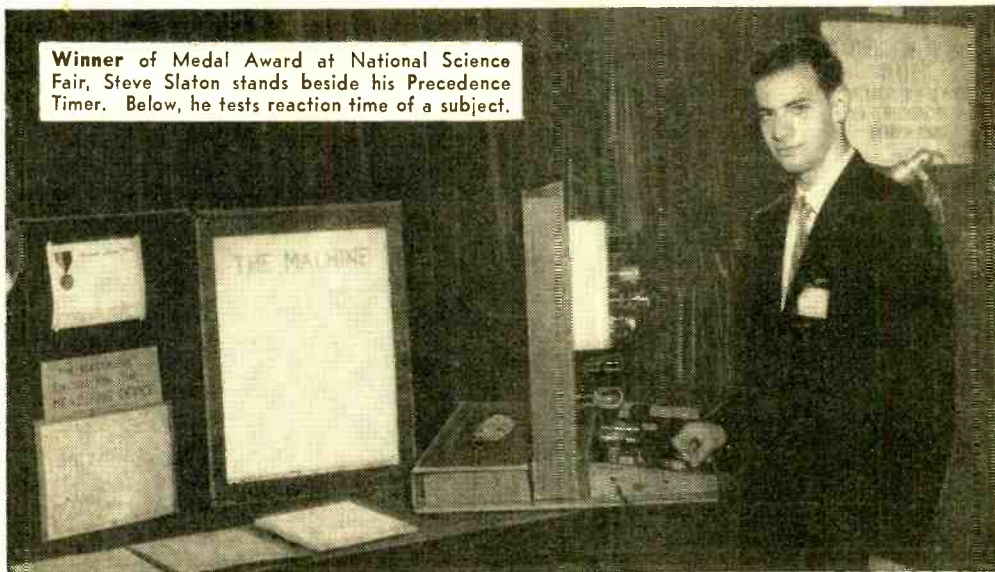
In case of an actual mission or an emergency, talking between states is permissi-

*(Continued on page 127)*



# Young Scientist's Project

Winner of Medal Award at National Science Fair, Steve Slaton stands beside his Precedence Timer. Below, he tests reaction time of a subject.



## Teenager wins fame with a timing machine that shows left-handers to be faster

MANY of electronics' important developments started as youthful experiments in basements and attics. In recent years, closer attention to the art has been paid by high schools, in whose physics laboratories inquisitive minds and nimble fingers can reach out to new horizons.

An outstanding example is the case of Steve Slaton. Two years ago, Steve—then 15—was a student at Forest Hills High School in Flushing, Long Island, N. Y. One day he surprised his physics instructor, Harvey Pollack, by saying:

"Why do you suppose there are so many top left-handed ball players in the big leagues? Considering that right-handed people outnumber left-handers in the general population by a large margin, it seems to me that 'lefties' are more numerous in baseball than they should be—unless, of course, southpaws have something that right-handers don't have."

Pollack—intrigued by his pupil's question but not very impressed with the relation of baseball to high school physics—suggested offhandedly: "Why don't you investigate it? Sounds like it might have possibilities."

Steve "investigated it"—and proceeded



to design and build an ingenious electronic device which won him nation-wide recognition as a budding genius as well as scholarships to Princeton University where he is now studying.

**Seeking the Answers.** The youthful scientist set out to find answers to the following questions:

1. Does natural "handedness" mean that a person reacts faster with the hand he favors?

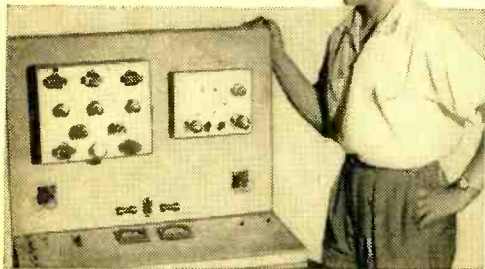
2. Do left-handers have faster reaction times than right-handers? Or is it the other way around?

3. If so, in either case, how much faster?

4. Does right-hand or left-hand reaction time depend on the kind of stimulus used in provoking the reaction?

After several weeks of work, research,

**Machine's** controls and indicators for judging split-second differences in reactions to stimuli.



and experimentation, Steve overcame his first problem: he designed a circuit that could tell which hand of a subject reacts first to a given stimulus. This circuit, built around the infinitesimal ionization time of a small thyratron radio tube, could determine the precedence of two almost simultaneous actions—even when the precedence of hand movement was as little as one microsecond! It would infallibly light a "right" or "left" lamp. The device could answer question 1 reliably!

Next, Steve worked out a circuit which would time the interval between stimulus and reaction accurately in terms of small fractions of seconds. He finally settled on an arrangement using the measurement of the charge time of a capacitor. To check his circuit, he got permission from the Fairchild Camera Corp., Jamaica, N. Y., to visit its laboratories and use its impedance bridge for measurements.

Once his figures were accurate, Steve built his timing device—a complex instrument in which a capacitor charges through a resistor in series with a regulated voltage supply. Its state of charge is read as a bias voltage on the grid of a home-made, built-in VTVM. Timing interval is controlled by a pair of fast-acting relays. By using a time-constant equation, and the

grid-transfer curve of the vacuum tube in the VTVM, Steve was able to translate current readings into precise time measurements. Now his machine could answer questions 2 and 3!

For question 4, Steve installed a clever light-and-buzzer switching arrangement that permitted him to provide any combination of aural and visual stimuli to provoke a hand-raising reaction.

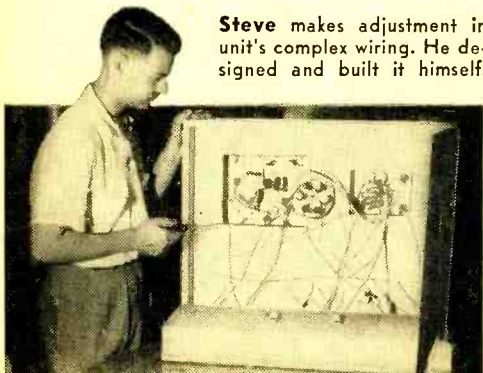
**Tests Lead to Success.** More than 800 students at Forest Hills—including the school baseball team—were tested on Steve's device over a period of eight months. They were tested in the morning, before classes, then later in the afternoon, after school, to determine if fatigue played a part in left- or right-handed response. The morning tests showed no significant differences between left-handed or right-handed people. However, the afternoon tests produced interesting results. Of the total number tested, about 15% showed a distinct precedence with one hand or the other. Normally left-handed students showed a preference for reacting first with their right hands, while normally right-handed students showed a preference for reacting with their left hands.

Most revealing were the results of the absolute reaction timing tests: these demonstrated that left-handed students are, on the average, 15% "faster on the draw" than right-handed students! In the course of these tests, it became apparent that the machine's use was not limited to right-handed or left-handed precedence timing. The device could be applied to any situation involving two events which appear to be simultaneous but actually are not. Thus, it points to a kind of instrument for making super-precise measurements of the actions and reactions of people as well as machines.

Devices like this are not new. But neither are they generally known. For a 15-year-old to design and build one from scratch—answering his own questions as he went along, solving equations he had never seen before, digging into texts advanced beyond his years, and even cutting his own panels and fashioning his own chassis—was something remarkable.

How remarkable it was can be judged by the fact that for his work Steve was awarded first prize in the New York City Science Fair of 1955. He then won a New York State scholarship as well as honorable mention in the Westinghouse "Talent Search" Contest and a Medal Award at the National Science Fair. In addition, he was named Regional Winner of a contest sponsored by The Young Scientists of America.

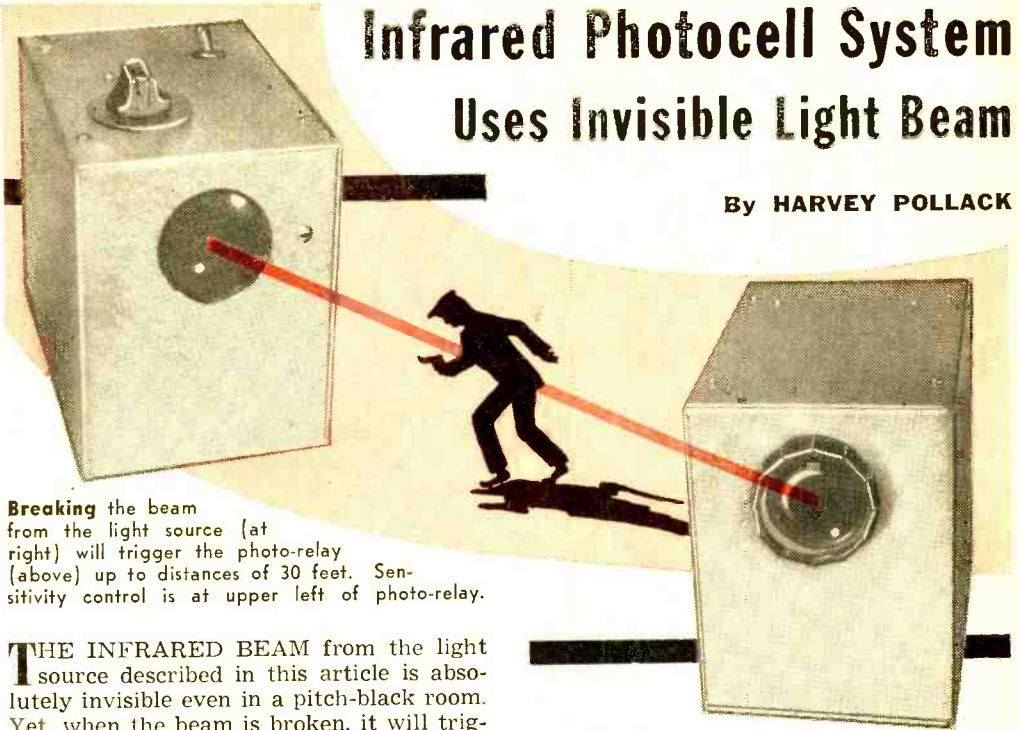
**Steve** makes adjustment in unit's complex wiring. He designed and built it himself.





# Infrared Photocell System Uses Invisible Light Beam

By HARVEY POLLACK



**Breaking** the beam from the light source (at right) will trigger the photo-relay (above) up to distances of 30 feet. Sensitivity control is at upper left of photo-relay.

**T**HE INFRARED BEAM from the light source described in this article is absolutely invisible even in a pitch-black room. Yet, when the beam is broken, it will trigger the transistor-solar cell relay at a distance of 30 feet.

This equipment is particularly adaptable as a secret burglar alarm, an invisible lamp-lighter in a child's room, or as a trigger for animal traps. It may also be used for door-openers, overhead garage-door controllers, annunciators in professional offices, and driveway floodlight controllers. Although the photocell amplifier is a.c.-operated, the current drain is so minute that a 22½-volt battery may be substituted for the power supply.

## CONSTRUCTION

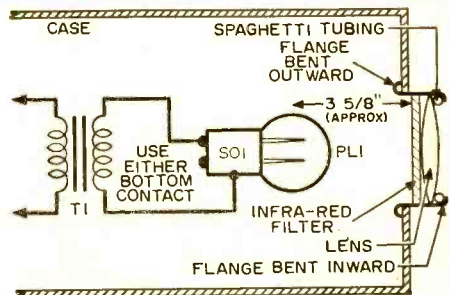
Both the photo-relay and the light source will fit into 4" x 5" x 6" aluminum boxes. Any type of case is suitable for the photocell amplifier since it generates no heat.

The automobile lamp used in the light source does give off heat but a metal cabinet dissipates it easily. No ventilation holes are necessary; thus, there are no light leaks to advertise the location of the source in a secret installation.

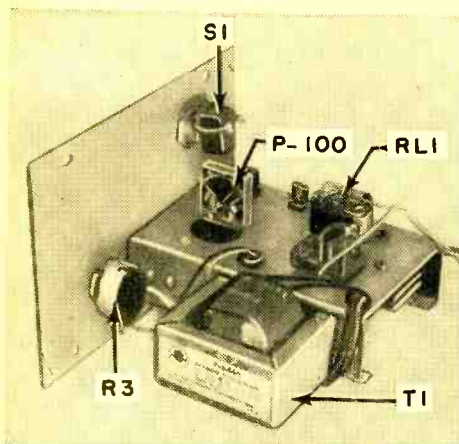
**Photo-Relay.** The chassis selected as the foundation for the relay unit measures 3" x 6½" x 1¼". The first step in the construction is to cut it down to fit the Mini-box. In the final adjustments, the chassis is slid into a position where the beam received by the photocell lens is focused sharply on the face of the solar cell.

A holding bracket is next on the construction list. It is 2" long and 1½" high, and is fastened to the front apron of the chassis by means of two small machine

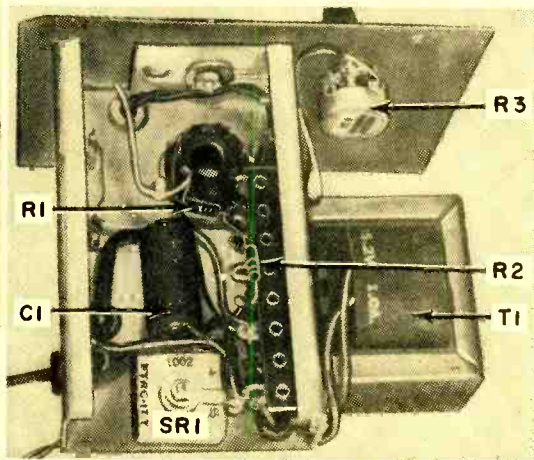
- PL1—6-volt auto headlight lamp, double filament, 32 cp each
- SO1—Auto headlight socket for double-filament lamp
- T1—Transformer, 117-volt primary, 6-volt at 6-amp. secondary (Thordarson 21F11)
- 1—4" x 5" x 6" grey hammertone aluminum cabinet (ICA #29812)
- 1—Galvanized iron battery clip, size #27
- 1—1½"-diameter lens, 3½" focal length, in plastic frame (Lafayette Radio Corp Catalog #F-46)
- 1—Infrared filter in adapter holder (Maurer MC-430—available from Barry Electronics, 512 Broadway, New York 12, N. Y.)



General layout, wiring and parts list for the infrared light source.



Completely wired chassis of the photo-relay. A seven-lug terminal strip supports the small resistors and serves as a tie strip for transformer wires, etc. Transformer T1 and sensitivity control R3 must be placed so that they do not obstruct the light beam path.



The above view of the photo-relay shows the transformer mounting clearly and the relative positions of R3, s.p.s.t. switch S1, and the Sigma relay, RL1. You can also see the front of the solar cell (P-100) which is plugged into holes #4 and #6 of the octal socket.

screws. It may be slotted to make chassis movable by drilling small holes side by side and using a file to clean up the lines, or by using a "nibbling" tool starting from a  $\frac{5}{16}$ " hole. The latter procedure was used in the model; it does a very neat, quick job.

Bear in mind, while laying out the chassis, that the light from the lens must have unobstructed passage to the face of the NATFAB solar cell. Assuming that you have purchased the lens specified in the parts list, a  $1\frac{3}{8}$ " hole should be punched in the front panel of the photo-relay case with its center about  $3\frac{1}{2}$ " from the bottom of the case. The lens is supplied mounted in a plastic frame which is used as a con-

venient support. With the lens held over the panel opening, locate the spot for the supporting screw that will go through the hole in the handle of the frame and drill a #27 hole at this point.

The wiring is straightforward, as shown in the schematic diagram. Wire lengths are not at all critical. Particular attention should be given to the voltage polarity on the transistors. Be sure that the minus lead of the power supply connects to the first transistor (*TR1*) collector through the resistors *R2* and *R3* and to the collector of the second transistor (*TR2*) through the relay coil.

This photocell alarm relay, originally designed as a burglar alarm, operates when

C1—4- $\mu$ fd., 150-volt electrolytic filter capacitor  
P-100—Silicon solar cell, equipped with prongs for mounting in octal socket (National Fabricated Products)

R1—22-megohm,  $\frac{1}{2}$ -watt carbon resistor

R2—8200-ohm,  $\frac{1}{2}$ -watt carbon resistor

R3—1-megohm linear taper potentiometer (Mallory U-54)

RL1—Sigma 4F relay, adjusted to pull in at 2 ma.

S1—S.p.s.t. toggle switch, 120-volt, 3-amp. type

SRI—65-ma., 117-volt selenium rectifier

T1—Transformer, 25.2-volt, 1-amp. secondary, primary 117 volts a.c. (Stancor P-6469)

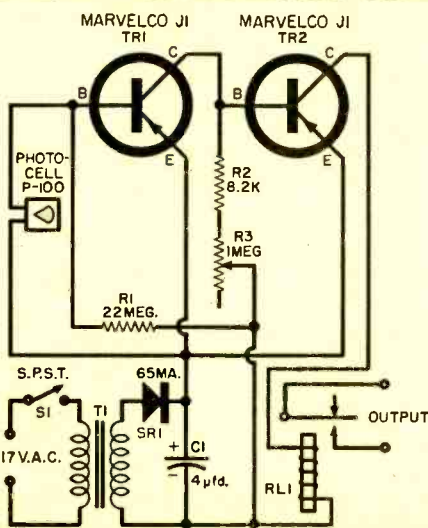
TR1, TR2—Transistor (Marvelco Type J1 or equivalents such as G.E. 2N76, G.E. 2N45, or RCA 2N109)

1—4" x 5" x 6" grey hammertone aluminum cabinet (ICA #29812)

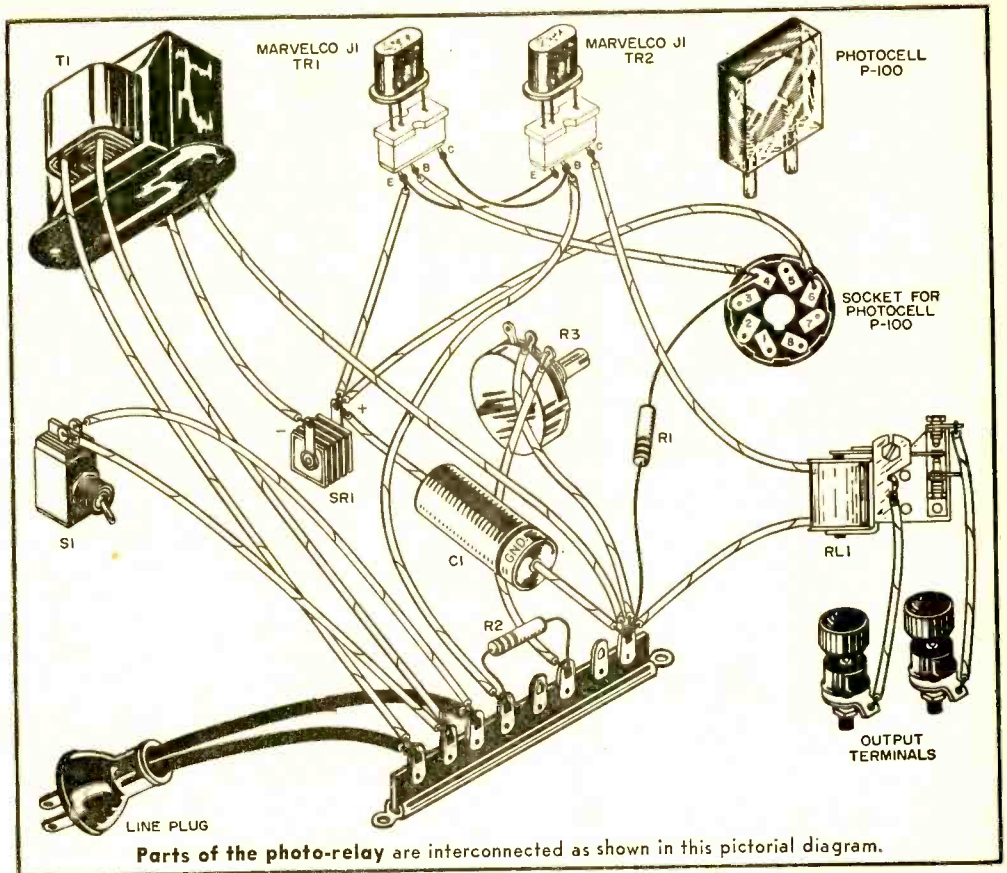
1—3" x 6 $\frac{1}{8}$ " x 1 $\frac{1}{4}$ " aluminum chassis, miniature open-end type (ICA 29080, cut down to fit)

1—1 $\frac{3}{8}$ "-diameter lens, 3 $\frac{5}{8}$ " focal length, in plastic frame (Lafayette Radio Corp. Catalog #F-46)

Schematic and parts list for the photo-relay.







the beam is interrupted by an intruder. For this kind of application, the *normally open* contacts are brought out to two insulated binding posts at the rear of the case. For the reverse action, the *normally closed* relay contacts may be brought out to the posts.

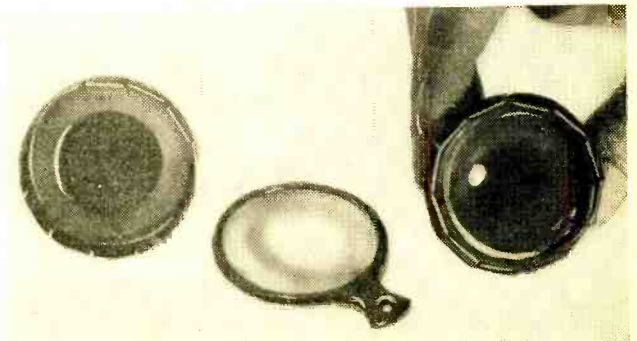
**Light Source.** The light source case contains the 6.3-volt, 6-ampere filament transformer and a double-filament 32-candlepower auto headlight lamp. The headlight socket is held between the jaws of a #27 battery clip so that either filament is  
(Continued on page 120)

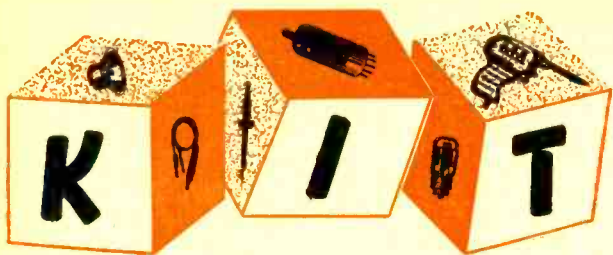
### HOW IT WORKS

An infrared light beam will develop a voltage across a NATFAB silicon cell. The current in the transistor (*TR1*) base-emitter circuit is very small and very little collector current flows. Bias on *TR1* is established by setting the control *R3*, and is adjusted so that the collector current of the second transistor, *TR2*, is too small to pull in the relay.

Interruption of the infrared beam removes the bucking voltage developed by the silicon cell. A current then flows through the base-emitter circuit of *TR1*, increasing the collector current. This current produces a voltage drop across the *R2-R3* combination which reduces the bias on *TR2*. Its collector thus passes enough current to pull in the relay armature.

**Assembly of the infrared optical system.** The frame of the lens (center) is snipped off with diagonal pliers, and the lens set into the flange of the infrared filter holder (left). A piece of spaghetti tubing, about 1/8" in diameter, is fitted around the edge of the lens, and the serrations of the flange are then bent inward to hold the lens in place (right).





## BUILDER'S KORNER

### Packard-Bell 5R1 Kit 540-1620 kc. Receiver



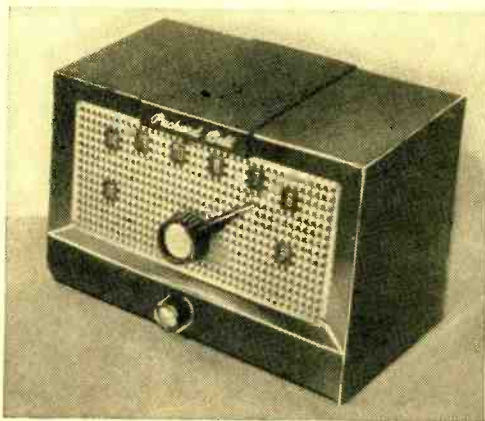
**O**KAY! OKAY! OKAY! We surrender! Here it is—at long last! A new monthly department devoted exclusively to the thousands of our readers who build electronic equipment from kits! You've been asking for this particular editorial treatment. According to your claims, it will assist you in making your selection of kits to build, trusting our judgment to bring to light any glaring deficiencies or assembly difficulties.

With the above thoughts in mind, we have designed "Kit Builder's Korner." Each month we will review two or more kits. Some of them will be brand-new, some will have been on the market for a while, and some will be mentioned because they are unusual. All of them will have been built by writers assigned to the POP'tronics staff, and all of them will meet our basic standards. We will be looking for utility, performance, lack of tricky wiring and, finally, dollar value.

Kits to be reviewed will not be chosen in any particular order. Editorial presentations will be made on the basis of reader requests. So, if you have a kit in mind, drop us a card and we will try to fit it in.

#### THE 5R1 KIT

The first report this month concerns the Packard-Bell Model 5R1 receiver kit, dis-



tributed by the Electronic Kits Supply Co., 1727 Glendale Blvd., Los Angeles 26, Calif.

Model 5R1 is a five-tube superheterodyne receiver, covering the AM broadcast band (540 to 1620 kc.). Miniature tubes are used throughout, including a 12BE6 converter, a 12BA6 i.f. amplifier, a 12AV6 detector-first audio, and a 50C5 power output tube, delivering a maximum of 1.7 watts to a 4" PM loudspeaker; d.c. voltage is supplied by a 35W4 half-wave rectifier.

Tube filaments are connected in series, with the set designed for operation from 110-120 volts a.c. or d.c. Power consump-



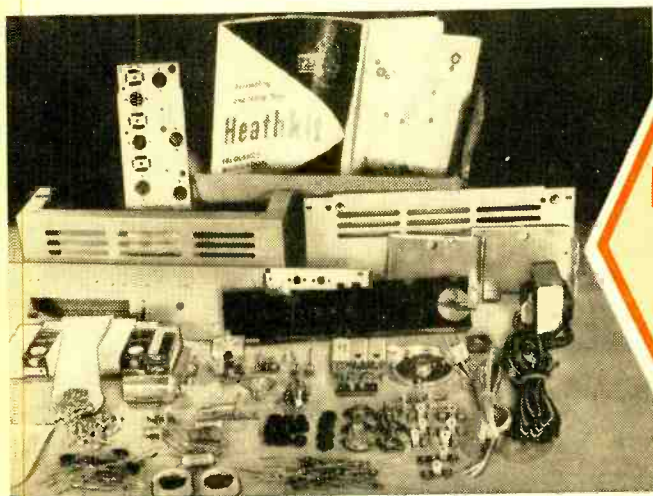
tion is 26 watts. A built-in loop antenna is employed, but provision is made for connecting an external antenna if you wish.

**Putting It Together.** There's nothing unusual about the circuit employed . . . it is a minor variation of the circuit used in building literally hundreds of thousands of a.c/d.c. five-tube superhet receivers . . . one so popular, in fact, that it is sometimes called an "All-American" circuit.

When you open the package, do not be

5R1) is a good idea. When the assembly is finished, the builder actually has a commercial receiver—something he can be proud to own and use. Outside appearance of the completed receiver and cabinet is attractive.

Instead of the usual "step-by-step" assembly instructions, simple experiments and tests are outlined for the builder to follow at various stages during wiring. Thus, this kit has real educational value . . . but



## Heathkit FM-3A Kit 88-108 mc. Receiver



The FM-3A is designed to fit same cabinet dimensions as the Heath WA-P2 preamp and BC-1 AM broadcast-band tuner. They may be stacked as shown.

surprised at the lack of small hardware. Very little will be needed. The i.f. transformers are "snapped" in place with clips, tube sockets have been pre-riveted in position, and a minimum of screws are used for mounting other parts. As a result, the mechanical assembly is quick and easy.

The pictorial diagram supplied is quite adequate and wiring is straightforward. No particular troubles should be met.

**Special Features.** There are several impressive things about this kit. First, assembling a kit around a standard, commercially available receiver (the Packard-Bell

without distracting from the fun of assembling a commercial receiver. You can skip these steps if you want and go right ahead with assembly, but for the student and learner, the tests represent a sort of extra "bonus."

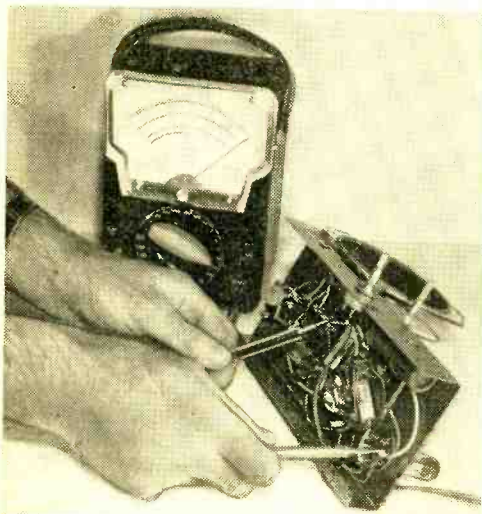
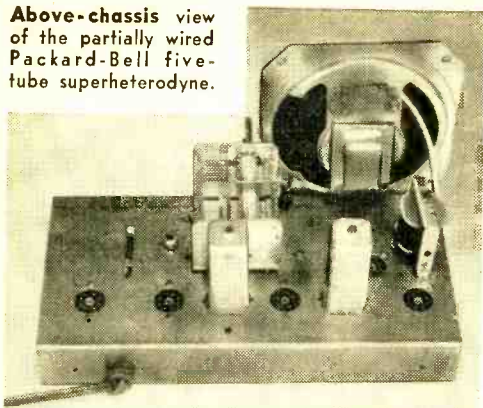
Finally, alignment is completely non-critical. In fact, the receiver will generally work when first turned on. Of course, the alignment of any superhet should be checked with a signal generator, but the Packard-Bell 5R1 requires relatively few adjustments. The i.f. transformers have already been "peaked" to maximum output at 455 kc., using a modulated r.f. signal; the oscillator trimmer has been peaked at 1620 kc., with the tuning capacitor plates open, and the r.f. trimmer has been peaked at 1500 kc., with the plates partly meshed.

**Comment.** The Model 5R1 kit is a good buy at the advertised price of \$11.95. It is suitable for the advanced worker who wants another home receiver . . . or as a "first superhet" project for a beginner who has cut his eyeteeth on a crystal set and a couple of one- or two-tubers.

### THE FM-3A KIT

Our second report is about the Heathkit FM-3A tuner. The FM-3A is the Heath Company's latest model frequency modulation tuner kit, superseding all of

**Above-chassis** view of the partially wired Packard-Bell five-tube superheterodyne.



**Point-to-point wiring** can be used below the chassis of the Model 5R1 receiver. A few checks with an ohmmeter will double-check your progress.

this company's previous models. Some refinements have been added and some deficiencies corrected. Automatic gain control has been built in and the oscillator is carefully stabilized by temperature-compensated components.

Model FM-3A uses a 6BQ7A in a sensitive cascode r.f. stage, followed by a 6U8 mixer and oscillator. Two i.f. stages with 6CB6 tubes drive a 6AL5 ratio detector. This all feeds a 6C4 audio stage with provisions for a hi-level or lo-level output. The rectifier is a 6X4. The FM-3A must be used with an external antenna—preferably one composed of 300-ohm twin-lead.

**Putting It Together.** The construction has been broken down into discrete sections consisting of first mounting the hardware (this took about 46 minutes) and then getting involved in the wiring. We earnestly recommend that the wiring be

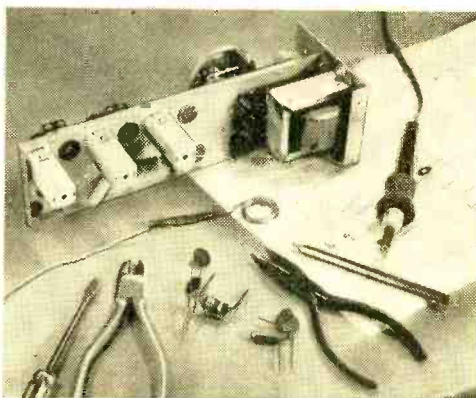
split up between several evenings. After about three hours, you find your work getting sloppy—and in an FM tuner that may mean trouble. Total wiring time here was 9 hours and 50 minutes.

The last phase is installing the dial plate and back plate with output jacks. Also included is the business of putting on the dial cord, which can be a maddening job—ask any radio-TV technician. You can win this battle in 10 minutes, but most likely it will take close to 30 minutes.

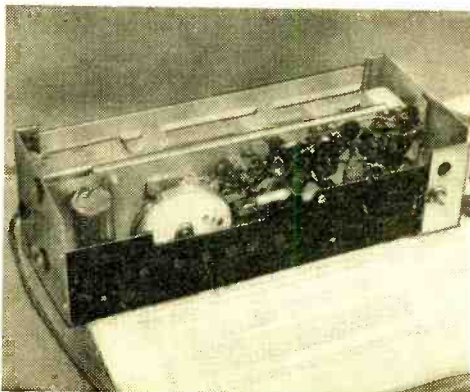
Putting on the top, bottom and front covers will take another 25 minutes, bringing the construction time to a grand total of about 11 hours and 30 minutes. This may be a little under par for the course, so don't be too exasperated if it takes you closer to 13 hours.

**Special Features.** We are impressed by the Heathkit packaging. It seems utterly miraculous that so many parts can be compressed into such a small box. But, it is done, and we dare you to try and reassemble their packaging.

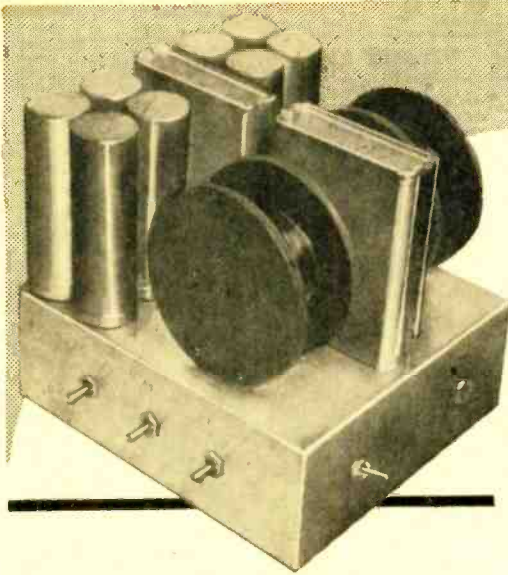
*(Continued on page 130)*



**The Heathkit chassis** is fashioned to permit access to all spots where wiring might be difficult. The constructor follows a step-by-step program to finish up with a completely wired receiver.







By ROBERT J. MURRAY, W1FSN

## Double-Duty Crossover

### Home-Built Network Serves in Hi-Fi Systems and Ham Communications

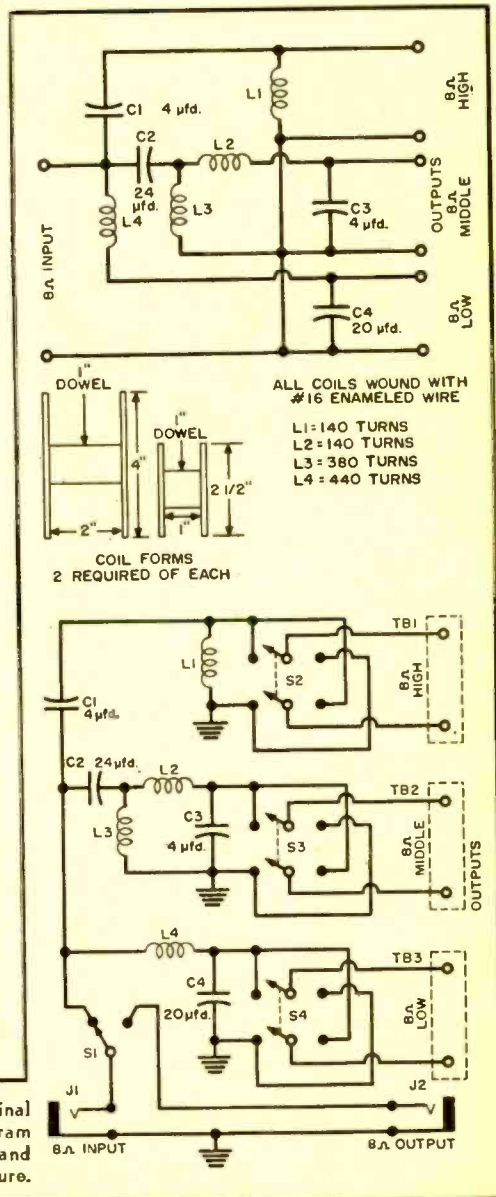
**M**ANY RADIO AMATEURS interested in hi-fi must often get their installations to do double duty as communications systems as well as radio phonograph setups. The conflicting requirements can be met by creating a three-way speaker system.

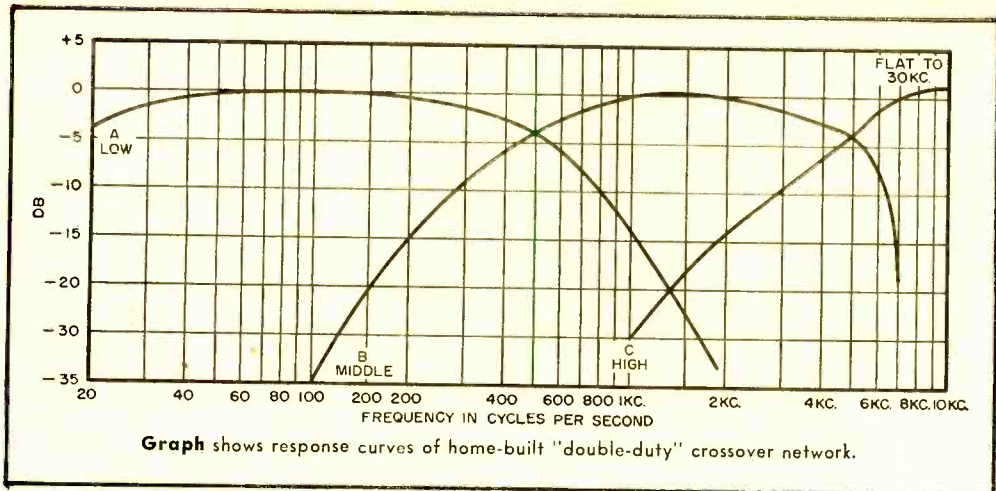
On hand was a National Horizon 20-watt amplifier and three loudspeakers—a 15" speaker in a suitable enclosure, a 10" speaker similarly enclosed, and a 5" cone tweeter.

**Dividing Network.** The first "must" was a dividing network for furnishing suitable crossover points so that each speaker would handle the frequencies for which it was primarily designed. Paper capacitors were chosen for this network because, as a rule, they tend to be more correct as to their indicated capacity than do electrolytics. Paper capacitors also maintain a more nearly uniform capacity.

Coils for the network were wound by hand. The spools for the coils were made from sections of an old broom handle, to whose ends plywood flanges were attached with brass wood screws.

The components were then wired to-



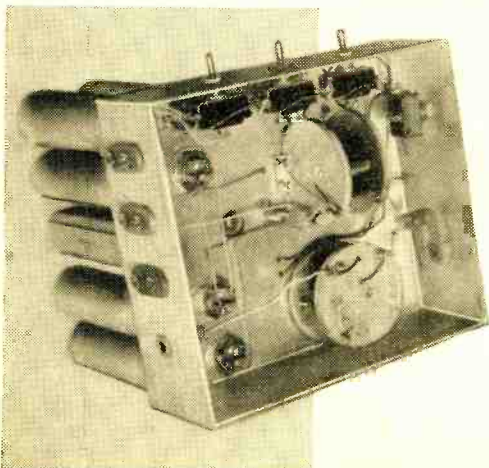


gether on a table top and the amplifier connected.

**Unexpected Effects.** Then came the inevitable messing around with placement of the speakers, phasing, and cutting speakers in and out of the circuit. The effects were duly noted and the network was then connected to the 8-ohm output of the HRO-60 communications receiver, more as an anticlimax than anything else.

This receiver, of course, is far from high fidelity—which is what we expected. But what we didn't expect was the effect that the speaker system provided in the readability of the various phone and c.w. signals in the presence of QRM and QRN by

**Under-chassis view** of crossover network. Coils are oriented as shown to prevent coupling between them. Note how toggle switches used for speaker phasing are mounted on chassis apron. Terminals for speaker connections are shown on left apron of chassis, with jack for 8-ohm output next to them. Jack for 8-ohm input is on opposite apron, together with S1. Functions of parts are given in text.



switching one or more speakers in and/or out of the circuit.

It was possible to compensate, with the various speaker combinations, for the characteristic of the received signal—be it high, medium or low or a combination of any of the above on phone work. With c.w., it was possible to place a signal into any of the speakers at will, to the detriment of QRM and QRN.

In the final version of the network, provision has been made to use any or all of the three speakers with the network's cutoff and crossover potentialities, or a separate "all-around" speaker for comparison purposes. While the unit cannot compare with the more selective crystal filter or low-frequency i.f. strings, it does contribute to much more intelligible communications work.

**Switching Gimmicks.** To make things somewhat easier for the uninitiated, the switches have been labeled "phono" so that various members of the household will not offend our golden ears by neglecting some of the audio spectrum when using the unit for playing records.

The three d.p.d.t. switches shown have an off-center position, so that any or all of the speakers can be switched in or out of the system. The reversing feature was included so that the phasing of the speakers could be changed for the benefit of the Doubting Thomas perfectionist, of which there is always one, who will swear that the speakers are not working in phase.

This unit can be made somewhat smaller by the use of lower working voltage capacitors. We used the 600-volt type because they are a handy value to have around—and who knows when a capacitor in the 75-watt rig might break down, making it necessary to snatch one for emergency replacement!



Front view of the "Audio Photometer." Note size comparison with conventional light meter shown at its right.



# Transistorized Audio Photometer

IN SCIENTIFIC RESEARCH, one of electronics' most important jobs is converting energy from one form to another so that it can be conveniently measured by standard instruments. Most electronic instruments use a meter as the indicating device. But here's a really off-beat instrument—a light meter or "photometer" which employs *sound* to indicate the light level. In use, light falling on a sensitive photocell is converted into an audible signal, heard from a subminiature loudspeaker. The more intense the light, the higher the frequency (pitch) of the audio note.

The "Audio Photometer" has many potential applications. You'll find such an instrument valuable for scientific demonstrations or as an electronic toy. An experienced photographer could learn to approximate his camera settings on the basis of the audio note heard, a paint salesman could use the instrument for demonstrating the difference in the "whiteness" of different samples, and so on.

**Construction.** Circuit details are given in the schematic diagram. Only standard, readily available components are needed, and neither parts arrangement nor lead dress is critical. You can follow the general layout of the model, as shown in the photographs, or make up a new layout.

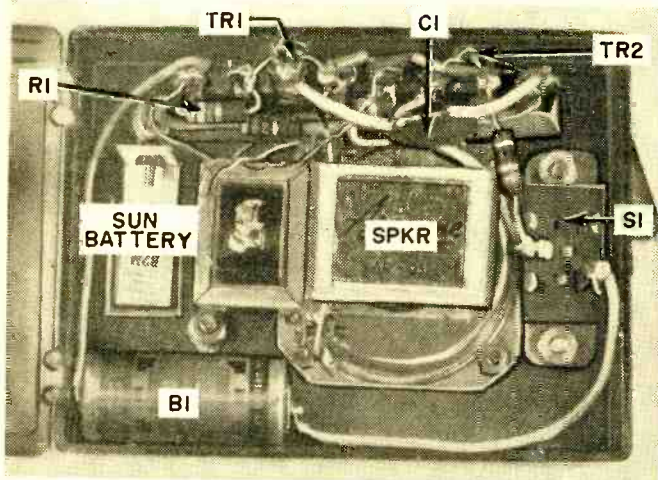
A transparent plastic case was used in assembling the model. You can obtain a professional appearance by spraying colored Krylon plastic on the *inside* of the case. A "window" for the selenium photocell may be made by covering a small area of the plastic with masking tape before spraying.

Construction and wiring are simplified by mounting all small components along an eight-position terminal strip. The transistors are wired permanently in position. You can use a similar scheme, or provide

## HOW IT WORKS

The audio photometer uses two *p-n-p* junction transistors as common-emitter amplifiers. The first stage is coupled to the second stage through capacitor *C2*. Output of the second stage is coupled back to the input of the first stage through capacitor *C1*, which supplies the in-phase signal feedback necessary to sustain oscillation. Unbypassed emitter resistors *R1* and *R4* raise the effective input impedances of their respective stages. Base bias for the second stage is supplied through *R3*.

In operation, the bias for the first stage is determined by the selenium Sun Battery connected between the base electrode and circuit ground. When the Sun Battery is dark, a low bias is applied to the first stage and the oscillator operates (multivibrates) at a low frequency. As more and more light falls on the photocell, the bias applied to the first stage increases, and the frequency of operation goes higher and higher.



Interior view of photometer, with small parts and transistors wired directly to terminal strip. See the schematic diagram and parts list at right.

separate transistor sockets. Make the connections to the battery by soldering leads directly to its terminals. Avoid overheating the battery.

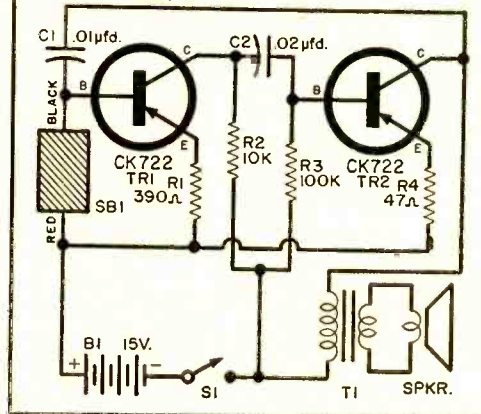
**Using the Photometer.** Hold the unit so that the light to be measured falls on the photocell. Close *SI*, and listen to the audio tone produced. The lower limit may be determined by operating the instrument in the dark. The upper limit may be determined by exposing the photocell to an extremely strong light . . . that is, by holding it close to a lamp bulb or by exposing it to full noon sunlight. Do *not* hold the unit close to a "spotlight" type bulb or other source of heat, however. Overheating the photocell, the transistors, or the battery would probably damage these components.

—Luis Vicens

### PARTS LIST

- BI—15-volt miniature battery (Burgess Y10)
- CI—0.01- $\mu$ fd. disc ceramic capacitor
- C2—0.02- $\mu$ fd. disc ceramic capacitor
- RI—390-ohm, 1/2-watt carbon resistor
- R2—10,000-ohm, 1/2-watt carbon resistor
- R3—100,000-ohm, 1/2-watt carbon resistor
- R4—47-ohm, 1/2-watt carbon resistor
- SI—S.p.s.t. slide switch
- TI—Transistor output transformer, 2000 ohms to 10 ohms (Argonne No. AR-96)
- Spkr—Subminiature PM loudspeaker, 10-ohm v.c. (Argonne No. AR-95)
- Sun Battery—Selenium cell (International Rectifier Corp. No. B2M)

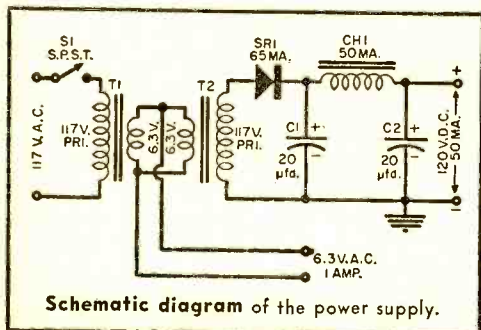
- TRI, TR2—Type CK722 transistor (Raytheon)
- 2—Transistor sockets
- 1—Perforated Bakelite board
- 1—Small plastic case
- 1—8-position terminal strip
- Misc. machine screws, nuts, soldering lugs, wire, solder, etc.



## Power Supply Made from Filament Transformers

You can build a good power supply that will deliver 120 volts d.c. at up to 50 milliamperes—as well as 6.3 volts a.c. at a conservative 1 ampere—from a couple of or-

dinary 6.3-volt filament transformers. One of these should be rated at about 3 amperes, the other at about 1.2 amperes. No rewinding of the transformers is necessary and, with the setup shown in the diagram, both outputs are isolated from the power line.



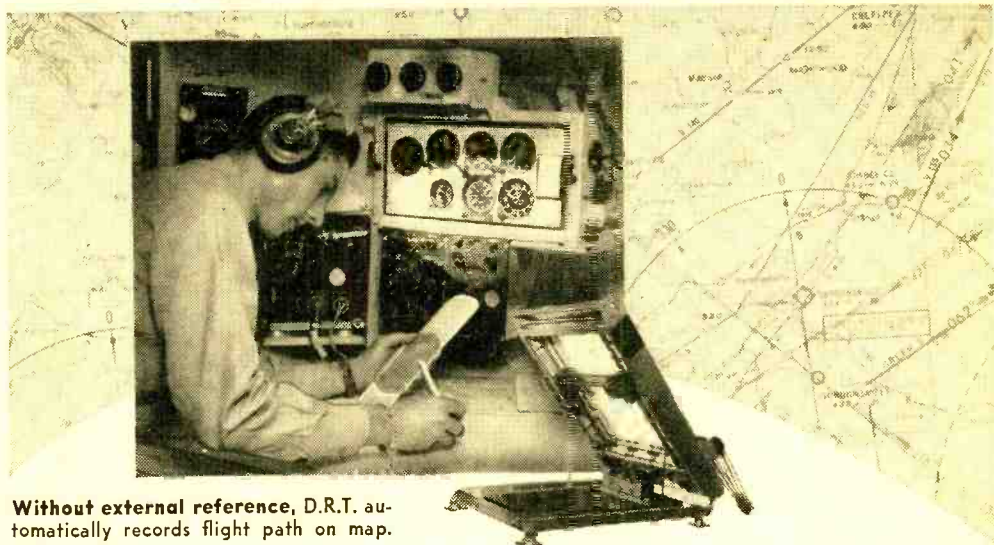
Schematic diagram of the power supply.

A voltage of 117 volts a.c. is fed to the primary of *T1*, the transformer rated at 3 amperes. The voltage is stepped down to 6.3 volts in this transformer and then fed to *T2*, the transformer rated at 1.2 amperes. It is stepped up to 117 volts again in *T2*, rectified by selenium rectifier *SR1*, and filtered by capacitors *C1* and *C2* and filter choke *CH1*. Heater power is tapped off at the 6.3-volt link between the two transformers.

—Frank H. Tooker



## Where Are We?—Ask D.R.T.



Without external reference, D.R.T. automatically records flight path on map.

With no radio beacon to guide them, sun or stars hidden, and no landmarks below, the Navy patrols flying over vast ocean areas have often felt literally as if they were between the devil and the deep blue sea. The sea, of course, is Navy men's eternal companion. But the devil that beset them in this kind of flying has just been kicked overboard by Servo Corporation's new Dead Reckoning Tracer, called "D.R.T." for short.

This new computing device always has a fast answer to the vital question: "Where are we?" No longer does the navigator need to make his long, involved computations while perhaps the plane heads for

nowhere and the fuel runs low. The D.R.T. marks the plane's course through the void as though it were letting out a string behind it.

Compass headings tilt, yaw and speed changes are sensed by gyroscopes, which respond to the plane's motion in all directions, and translate the motion into corresponding voltages. From these voltages, the D.R.T. draws a map of the plane's flight on an automatic plotting board.

Despite radio silence, clouded skies, and a criss-cross flight pattern, a single glance at the D.R.T. board will tell the navigator at any moment his present position and the quickest way to where he wants to go.

## Doggone Electronics

Modern house planning, which allows for everything from the children's play space to the electric dryer, has neglected one important need—a place for Fido. What with the disappearance of basements, and the use of carports instead of garages, there's no place at home for delicate dogs these days.

Bob Elmore of Tulsa, Oklahoma, an electronic technician, found the answer to this problem by creating an electronic doghouse, the latest thing in dog living, for his two toy Manchesters who get the shivers at temperatures below 75°.

Built of plywood with aluminum roofing, the doghouse has electronically controlled heat. Two wall heating elements and floor pads are controlled by three thermostats. One thermostat regulates the first unit, keeping the temperature at 80°. The sec-



ond thermostat and unit throw in extra heat in cold weather while the third thermostat serves as a fire alarm. Our picture shows Bob explaining this to one of the doghouse's inhabitants.—Phyllis Braunlich

Buttomed up and ready to go, the "21 Special" presents a clean and modern appearance. With it, you can work world-wide DX on the 21-, 27- and 28-mc. bands.



## The 21 SPECIAL

By

WILLIAM I. ORR, W6SAI

**Here's a 70-watt transmitter  
designed for today's Novice,  
tomorrow's General Class ham**

"WELL, Tommy, are you ready to start work on your 21-mc. rock-crusher tonight?" I asked the young Novice who circled into my driveway on his bicycle. "If you are, let's get to work!"

"Sure thing," replied Tommy, standing his bicycle against the fence and taking off his leg clips. "It's pretty hard to work DX with my 20-watt peanut whistle, even with the beam.\* Gee, I wonder how many of those watts actually reach the antenna. Not many, I'll bet."

"Oh, I'd say about six or seven, at the most. That transmitter has a 6L6-G doubling to 15 meters, and the efficiency isn't much over 30% or so. You're just a pip-squeak in the background noise. You really need a serious, TVI-proof transmitter with some real power instead of that toy." We walked into the garage workshop and I handed Tommy the schematic of the proposed transmitter. "Sit down on that stool, and I'll give you the story of the '21 Special!'"

Intended for the Novice or the newly licensed General Class amateur, the "21 Special" is capable of 70 watts input on the 21-,

27- and 28-mc. amateur bands. World-wide DX can be worked on these interesting, long-distance bands, and the "21 Special" is designed particularly for those amateurs who have had some experience in building their own equipment. It is completely TVI-suppressed, and delivers over 50 watts to the antenna on each of the three bands.

A 6AG7 (V1) harmonic oscillator employing inexpensive 7-mc. crystals is capacity-coupled to a 6146 (V2) beam tetrode, working as a class C amplifier. The correct harmonic of the crystal is selected by the resonant circuit C3-L2. In the plate circuit of V2 is a pi-network coupler capable of match-

No pictorial has been included with this article. We do not suggest that the Novice Ham construct this unit as his "first" transmitter. Before tackling such a project, the Novice should attempt to gain wiring experience and knowledge on how to tune up a transmitter. While the circuit is foolproof, a little extra know-how—principally gained through experience—should be sought first.

The Editors

\* See "A Beam and Tower for the 15-Meter Novice" which appeared in the November, 1956, issue, page 78.



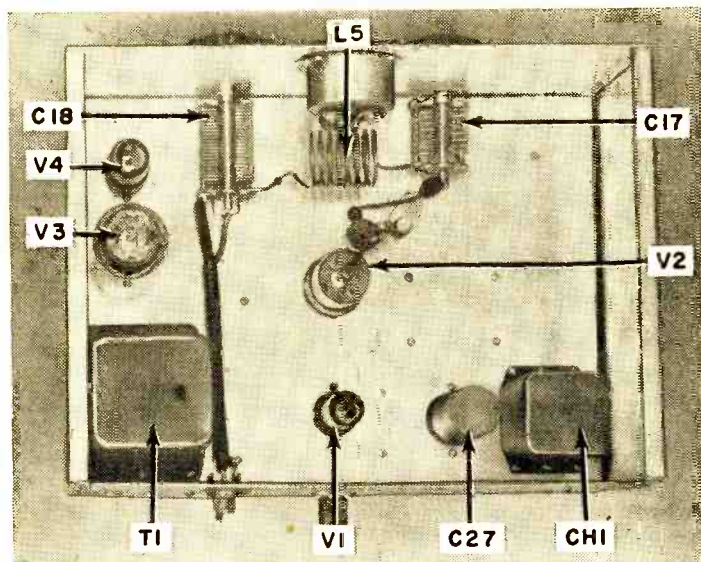
ing the amplifier to either a 52-ohm or a 75-ohm coaxial transmission line. The pi-network tunes from 20 mc. through 32 mc., eliminating the necessity of coil switching. Amplifier tuning is done by capacitor C17, and antenna loading is controlled by capacitor C18. Stable operation of the amplifier is insured by complete parasitic suppression in the grid and plate circuits (R4, L3 and R9, L4).

Plate power for both stages is provided by a dual-voltage supply utilizing a new Chicago-Standard transformer. The oscillator stage requires 300 plate volts, and the amplifier requires 600 volts. A 6AX5 (V4) is employed for the low-voltage rectifier, and a 5R4-GY (V3) is used for the high-voltage rectifier. For standby purposes, the two high-voltage circuits are broken by S3, permitting

the transmitter to come on as soon as the switch is closed.

Grid and plate current of the 6146 amplifier tube are measured by a unique multiplier circuit, permitting both readings to be made on a single 0-1 d.c. milliammeter. Full-scale reading of the meter in the grid (I<sub>g</sub>) position of S2 is 3 ma., and full-scale reading in the plate (I<sub>p</sub>) position is 200 ma. Normal grid current should read about 0.5 on the meter (1.5 ma.), and normal plate current should read about 0.6 on the meter (120 ma.).

You can achieve maximum TVI-suppression by placing r.f. filters in the main power leads to the r.f. stages, in the keying circuit, and in the 117-volt a.c. power line. Housing the transmitter in the new LMB shielded cabinet will provide complete shielding.

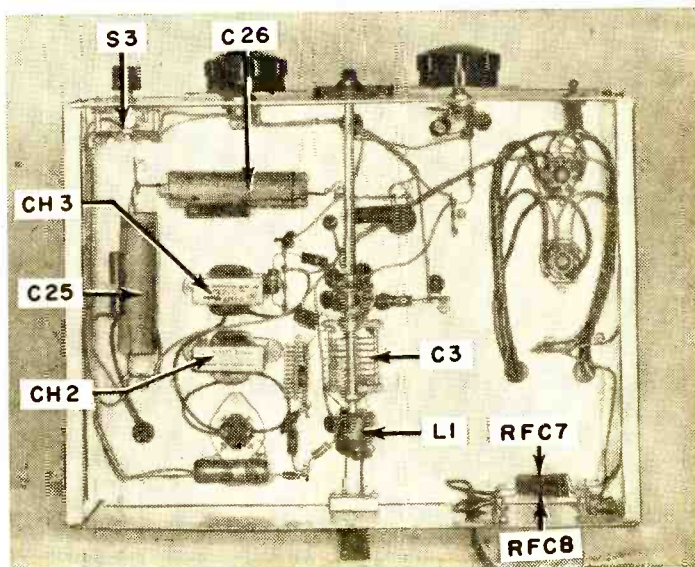


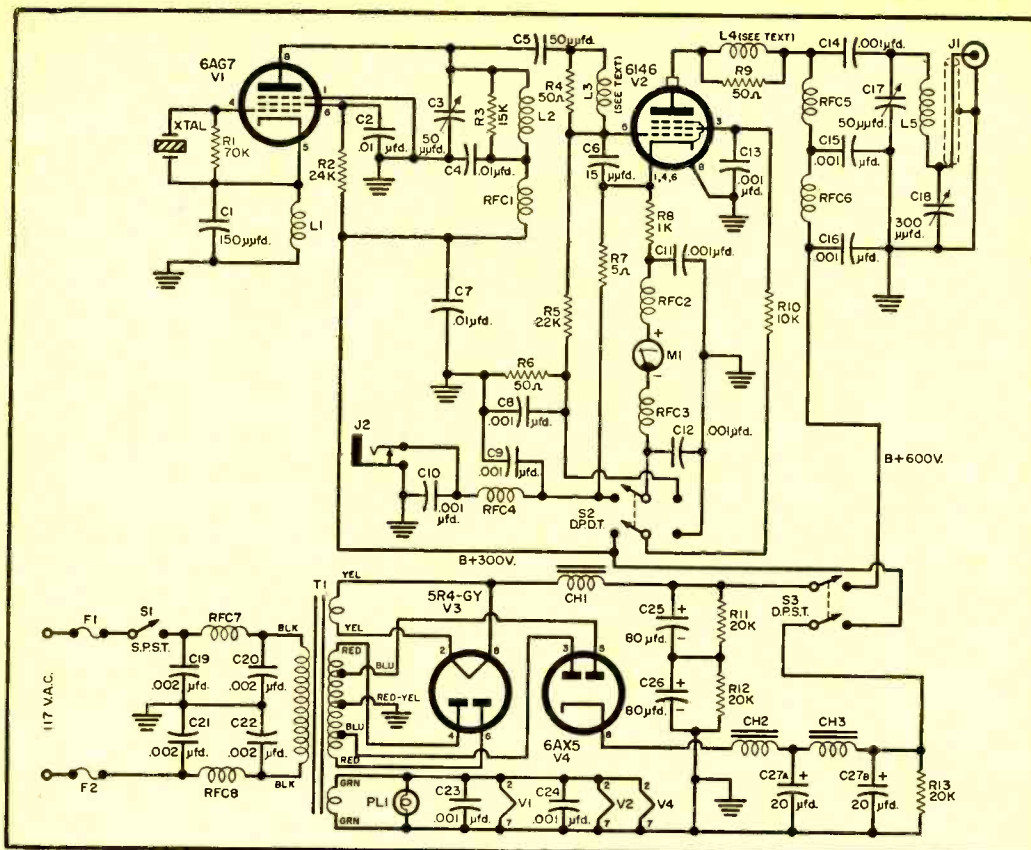
"No TVI, huh?" asked Tommy. "My present rig makes Jackie Gleason look like he's playing behind bars!"

"You may need a TVI filter in the coaxial antenna lead of the transmitter to prevent the harmonics from sneaking out that way; otherwise, the rig is as clean as a whistle. If you have a TV set that is near the transmitter, a high-pass filter in the antenna lead of the modulated milk bottle will keep your 21-mc. r.f. out of the innards of the set."

"Roger," said Tommy. "Sounds swell. Now, just

**Top and bottom** views of the chassis are shown in the photos above and at right, respectively. No effort has been made to economize on space nor is special shielding required to insure foolproof TVI-free operation. Principal components are identified to assist you in assembling the transmitter along the lines described in the text. The only really critical dimension is the spacing between the sockets of V1 and V2, as the oscillator tuning capacitor, C3, is mounted on spacers and long bolts through the socket mounting holes.





how do I go about putting the '21 Special together?"

Placement of the major components may be seen in the above- and below-chassis photographs. The only really critical dimension is the spacing between the two r.f. tube sockets, as the oscillator tuning capacitor, C3, is mounted on spacers and long bolts that pass through the socket mounting holes.

The power supply should be wired first, up to standby switch S3. When this section of the transmitter is completed, check the wiring and test the supply. Without the r.f. tubes, the high-voltage supply should measure about 800 volts, and the low-voltage supply about 350 volts. When the transmitter is in operation, these voltages drop to normal values.

Wire the filament circuits of the r.f. tubes next, and make the circuit grounds at each tube socket. Oscillator cathode coil L1 should be connected directly to pin 5 of the 6AG7 socket, and the 150- $\mu$ fd. capacitor, C1, wired across the leads of the coil. Wire the 15,000-ohm, 1-watt composition loading resistor, R3, directly across the oscillator plate coil, L2.

Then wire the 6146 stage. Note that capacitor C6 is connected directly between pin 4 and pin 5 of the 6146 socket, using very short leads. Other wiring of the amplifier

stage is straightforward. Coil L5 is air-wound from a length of No. 10 tinned copper wire. The spacing between the turns may easily be adjusted, if necessary. Coil L5 mounts directly between the stator of the plate tuning capacitor, C17, and the stator of the antenna loading capacitor, C18. Connect the antenna receptacle, J1, to C18 by a short length of 52-ohm coaxial cable. Ground the cable's shield to the chassis at each end.

Finally, wire S2 and the meter. Make a meter shield from the end of a tin can large enough to slip over the meter. Bend the edges of the can to fit flush against the panel of the transmitter. Then drill two holes in the end of the can to pass the meter studs, which are insulated from the can by a pair of rubber grommets. This simple but effective meter shield is held to the panel by three 4-40 machine screws. Mount chokes RFC2 and RFC3 on a two-terminal phenolic insulating strip soldered to the back of the can. Bypass capacitors (C11 and C12) for the meter leads should also be soldered to the can.

"That will go together easily," exclaimed Tommy. "A few evenings' work, and it should be ready to go on the air."

"Not so fast, young feller," I replied. "Let's take the tune-up process step by step before you go off half-cocked. You



**Schematic diagram** of the "21 Special" is given at left; parts list appears below. Maximum TVI-suppression is achieved in this well-designed transmitter by placing r.f. filters in the main power leads to the r.f. stages, in the keying circuit, and in the 117-volt a.c. power line.

- C1—150- $\mu$ fd. mica capacitor
- C2, C4, C7—0.01- $\mu$ fd. ceramic disc capacitor
- C3, C17—50- $\mu$ fd. variable capacitor (Bud MC-1863)
- C5—50- $\mu$ fd. mica capacitor
- C6—15- $\mu$ fd. ceramic disc capacitor
- C8, C9, C10, C11, C12, C13, C23, C24—0.001- $\mu$ fd. ceramic disc capacitor
- C14, C15, C16—0.001- $\mu$ fd., 1-kv. capacitor
- C18—300- $\mu$ fd. variable capacitor (Bud MC-1860)
- C19, C20, C21, C22—0.002- $\mu$ fd. ceramic disc capacitor
- C25, C26—80- $\mu$ fd., 450-volt electrolytic capacitor (Sprague TVA-1716)
- C27—20-20  $\mu$ fd., 450-volt electrolytic capacitor
- CH1—10-hy. @ 150 ma. choke (Chicago-Standard C-2335)
- CH2, CH3—7-hy. @ 50 ma. choke (Chicago-Standard C-1227)
- F1, F2—2-amp. fuse in 117-volt line plug
- J1—Coaxial receptacle (S0239)
- J2—Closed-circuit jack
- L1—8 turns of No. 16 wire, 1" diameter, 1/2" long (B&W 3015)
- L2—12 turns of No. 16 wire, 5/8" diameter, 1 1/2" long (B&W 3006)
- L3—3 turns of No. 18 enameled wire wound on 50-ohm, 1/2-watt resistor (R4)
- L4—3 turns of No. 18 enameled wire wound on 50-ohm, 1-watt resistor (R9)
- L5—8 turns of No. 10 wire, 1 3/8" inside diameter, 2" long
- M1—0-1 d.c. milliammeter, 55-ohm resistance (Triplett 221, 2" square)

- PL1—6.3-volt pilot light with holder (Johnson 147-300)
- R1—70,000-ohm, 1-watt resistor
- R2—24,000-ohm, 1-watt resistor
- R3—15,000-ohm, 1-watt resistor
- R4, R6—50-ohm, 1/2-watt resistor
- R5—22,000-ohm, 2-watt resistor
- R7—5-ohm, 1/2-watt resistor
- R8—1000-ohm, 1-watt resistor
- R9—50-ohm, 1-watt resistor
- R10—10,000-ohm, 2-watt resistor
- R11, R12, R13—20,000-ohm, 10-watt resistor
- RFC1—2.5-mhy. r.f. choke (National R-60)
- RFC2, RFC3—20 turns of No. 28 enameled wire close-wound on 1-megohm, 1/2-watt resistor
- RFC4, RFC6, RFC7, RFC8—20 turns of No. 18 enameled wire, close-wound, 1/2" diameter
- RFC5—2.5-mhy. r.f. choke (National R-100U)
- S1—S.p.s.t. toggle switch
- S2—D.p.d.t. slide type switch (Carling S-316)
- S3—D.p.s.t. rotary switch (Centralab 1404)
- T1—Transformer, to deliver 650 volts @ 150 ma., 315 volts @ 60 ma., 6.3 volts @ 3.5 amperes, and 5 volts @ 2 amperes; 117-volt primary (Chicago-Standard PC-8307)
- V1—6AG7 tube
- V2—6146 tube
- V3—5R4-GY tube
- V4—6AX5 tube
- Xtal—7-mc. crystal
- 1—9" x 11" x 15" TVI-suppressed cabinet (LMB #159-11)
- Misc. tube sockets, line cord, hardware, etc.

*don't want to rush into this project and blow up the whole works, do you?"*

Plug all the tubes in their proper sockets, and place S2 in the grid position. This removes screen voltage from the 6146 stage for tune-up purposes. Attach a 75-watt lamp bulb to the terminals of J1 to act as a dummy antenna. Open S3, and place C3, C17, and C18 at maximum capacity. Insert a 7-mc. crystal (frequency between 7031 kc. and 7082 kc. for the Novice 21-mc. region) in the crystal holder. Turn on S1. The pilot lamp should light, as well as all tubes.

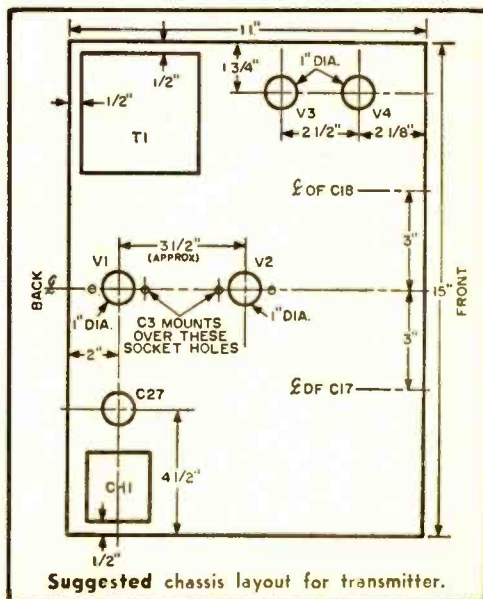
Close S3, and note that a reading should be observed on the grid meter as C3 is varied. Grid current should be observed at maximum and minimum settings of C3, corresponding to the third (21-mc.) and fourth (28-mc.) harmonics of the 7-mc. crystal. Set C3 near maximum capacity, keeping the meter reading below 0.6 ma.

Next, open S3 and switch S2 to the plate current position. Close S3, and adjust the plate tuning capacitor, C17, for minimum current. Capacitor C18 may be adjusted to bring the minimum plate current to 0.6 on the meter (120 ma.). Antenna loading and minimum plate current are both increased in value as the capacity of C18 is decreased. Always re-resonate C17 for minimum plate current after any adjustment is made to C18.

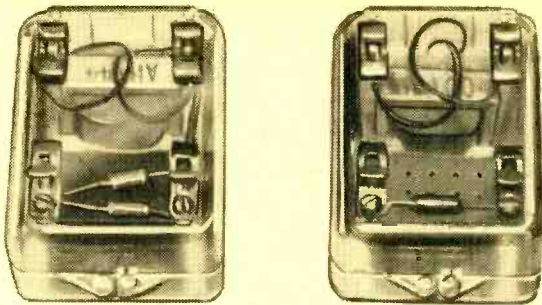
Now remove the lamp bulb, and attach the

transmitting antenna to J1. The amplifier should be retuned for proper loading with this new load. Plug a key in J2, and the transmitter is ready for operation on 21 mc.

*(Continued on page 118)*



**Suggested chassis layout for transmitter.**



**SUBMINIATURE**

## A.C. Power Supplies

**M**OST experimental transistor circuits use batteries as the power source. Since rectified and filtered a.c. will do the job just as well, why should this be so? The reason is obviously the *size* of the average a.c. power supply. Certainly there is little sense in designing and constructing a tiny transistorized device and then tripling its size just to accommodate an a.c. power supply. What transistor experiments have needed very badly for a long time is a transformer that is more in keeping with the size and requirements of transistors.

A transformer is a transformer and, when it comes right down to facts, the transformer doesn't care whether it's handling audio or dropping the 117-volt line potential down to a value that's more easily digested by transistors.\* Of the number of transistor audio transformers available, a few of those bearing the Argonne label meet the requirements nicely. Furthermore, they are miniature in size, and even in power supply applications they operate as cool as transistors themselves! The two power supply units to be described weigh only *two ounces* apiece.

Each of these power supplies is assembled in its own little plastic box. However,

you can incorporate either in your own transistorized device. Just locate the power supply components right in your gadget wherever there is space for them. In most applications, the few miniature parts will take up no more space than the batteries they are replacing. The transformers and capacitors used in these truly miniature power supplies are available from any distributor of Argonne products.

### Half-Wave Unit.

The schematic of this supply is shown in Fig. 1. It measures only  $2\frac{1}{4}'' \times 1\frac{3}{4}'' \times 1\frac{1}{4}''$ ;

yet the inside of the box is far from crowded. (If a suitable enclosure were available, the supply could be assembled to much smaller dimensions.) Its performance is depicted in the graph. Open-circuit output voltage is 11.5 volts. When current is drawn, the output voltage becomes a function of the load. Thus, 6 volts is available at 6.5 ma., and 3 volts at 14 ma.

(Continued on page 122)

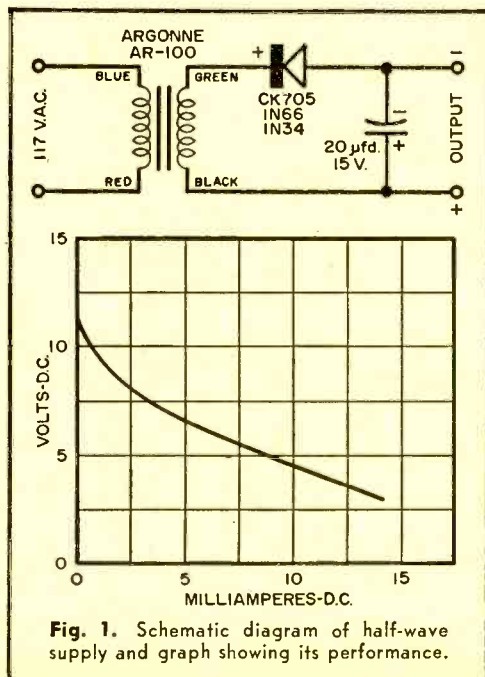
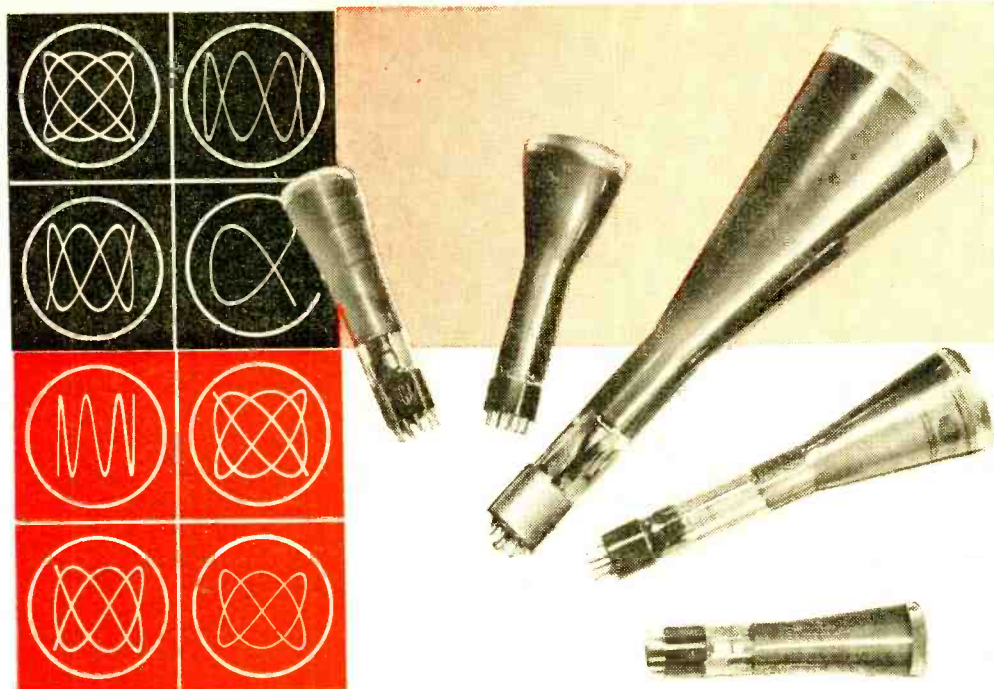


Fig. 1. Schematic diagram of half-wave supply and graph showing its performance.

\*Don't take just any audio transformer and slap 117 volts a.c. across it. There are a few catches involved: (1) the primary and secondary windings must be capable of handling their respective currents in the power application; (2) the primary impedance must be sufficiently high at 60 cycles to keep the no-load current at a minimum; (3) the iron core of the transformer must not run into saturation; and (4) the primary-to-secondary turns ratio must be such as to result in a secondary voltage which, after rectification and filtering, will be useful in transistor circuitry.





## Lissajous Had a Figure For It

**M**EN ARE TRADITIONALLY attracted by figures with curves. A certain Frenchman named Lissajous, who lived around 1855, was no exception. He became an exception when he found that he could control these "figures with curves" in a dark room. He discovered that light reflected from two flat, rapidly rotating mirrors formed simple wave patterns when projected upon a screen.

This discovery set in motion a chain of developments culminating in the modern oscilloscope. Lissajous patterns on the oscilloscope screen measure sound frequencies or the rotary speed of a motor, tell whether a transmitter is multiplying frequency properly, check phase shift and distortion in hi-fi equipment, calibrate audio signal generators, and do many other jobs.

The light source for Lissajous' mirror-generated patterns was a simple candle. In place of a candle, the modern oscilloscope contains an electron gun in the narrow neck of the tube. This gun shoots about 6,000,000,000 electrons per second in a concentrated high-velocity beam toward the face of the tube. When the impact of this beam strikes the chemically coated face of the tube, it converts its energy into light, forming a small luminous dot.

**Basic Traces.** In its travel toward the tube screen, the electron beam must pass

By HOWARD BURGESS

*Century-old light pattern now serves as electronic yardstick*

between two separate pairs of deflection plates capable of bending the path of travel. These correspond in their action to Lissajous' mirrors. An electrical signal or voltage applied to one set of the plates bends the beam up or down; a signal applied to the other set of plates bends the beam to the left or right, depending on the polarity of the signal. As the beam bends, the dot of light moves across the screen. Because it rapidly retraces its path and because the chemical used on the screen continues to glow for an instant after the dot has moved, the eye has the illusion of seeing a continuous and steady bright line rather than a fast-moving spot.

If different signals are placed simultaneously on each set of deflection plates, the beam makes a track like a Sunday driver. If the two signals have a fixed periodic re-

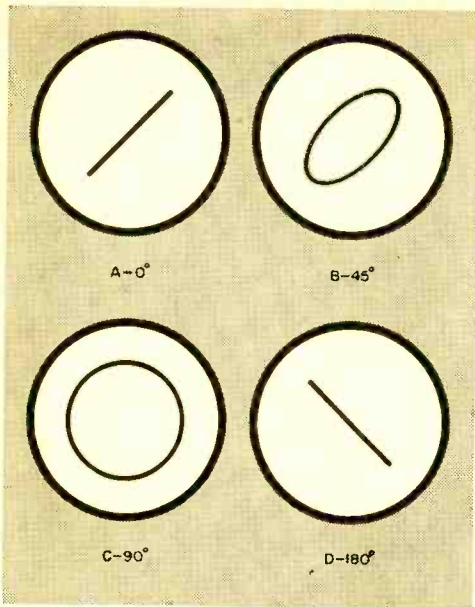
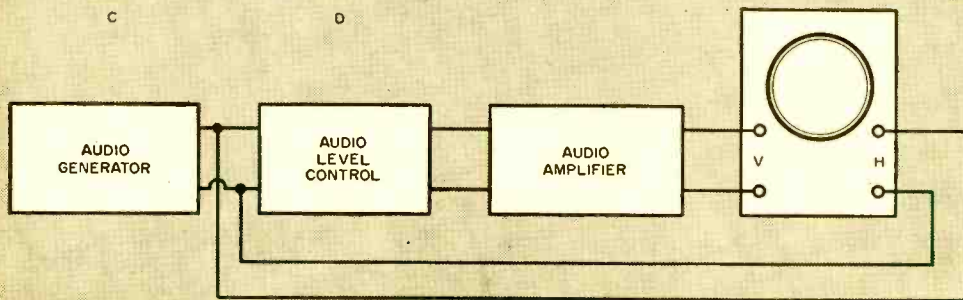
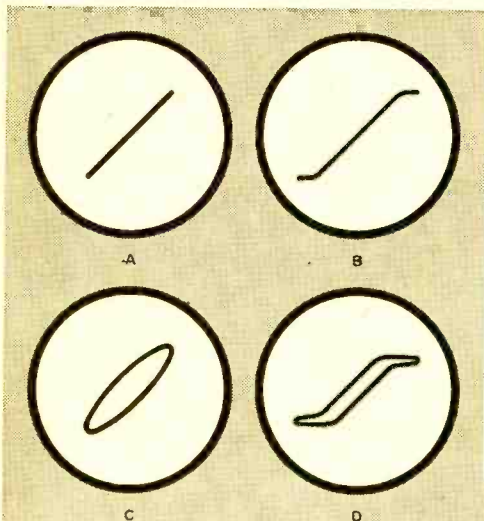


Fig. 1. Lissajous patterns representing phase relationships between two 60-cycle currents.

Fig. 2. Setup and test patterns for checking amplifier overload as described in the text.



relationship to each other, the pattern may seem like the "doodlings" of a lace designer, but to the experienced operator it will be a source of valuable information. These are still known as Lissajous figures.

Figure 1 is an example of the result obtained by putting a low value of line voltage on each set of deflection plates. In 1(A), the voltage on both sets of plates is in phase, that is, both are rising and falling at the same time and in the same direction. The result is a straight line. In 1(B), the rise and fall on one set of plates is lagging behind the rise and fall of the voltage on the other set, resulting in a curve. The trace and retrace curves together form an ellipse. The more one signal lags behind the other, the fatter grows the ellipse, until it turns into a perfectly round circle when the lag equals a quarter cycle. When one voltage lags behind the other in phase by 180°, a straight line results.

**Distortion Checks.** Closely related are the curves of Fig. 2. These represent simple tests for overloading in an audio amplifier. Most well-designed amplifiers, when fed increasing amounts of input signal, show little increase in distortion until a specific point is reached. Beyond this point, the distortion increases very rapidly. Any amplifier can be checked for this type of distortion with a simple setup as shown.

An audio signal source is used to drive both the amplifier under test and the horizontal plates of the oscilloscope. The output of the amplifier under test is used to drive the vertical plates of the 'scope. If there is no phase lag present in the amplifier, the pattern will be a straight line as in Fig. 2(A) and will increase in length as the input to the amplifier is increased. When the overload point is reached, the pattern will take on the appearance of 2(B). At this point distortion increases rapidly. Figures 2(C) and 2(D) indicate that phase shift is present in the system. In many cases it will be found that the amount of phase shift varies with a change of signal frequency.

**Frequency Measurement.** Perhaps the most widely employed Lissajous patterns



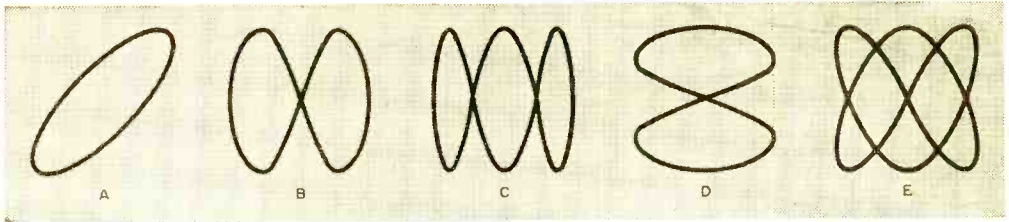
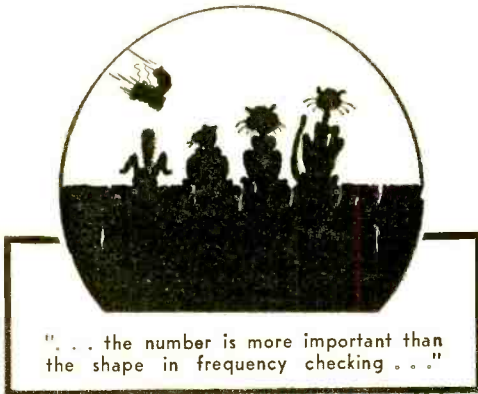


Fig. 3. The number of loops measures frequency by comparison with a known standard.



are those for frequency comparison. If separate signals of the same frequency are on the vertical and horizontal inputs to the 'scope, a circle or ellipse (depending on their phase relation) will be formed, as in Fig. 3(A). For each cycle, the spot will make one trip sideways and one trip up and down. For frequency comparison, a perfect shape is not important.

If the frequency on the horizontal input is left unchanged and the frequency input to the vertical input is exactly doubled, the result will be a pattern like that in Fig. 3(B). In this case, the beam must make two trips up and down for each one across

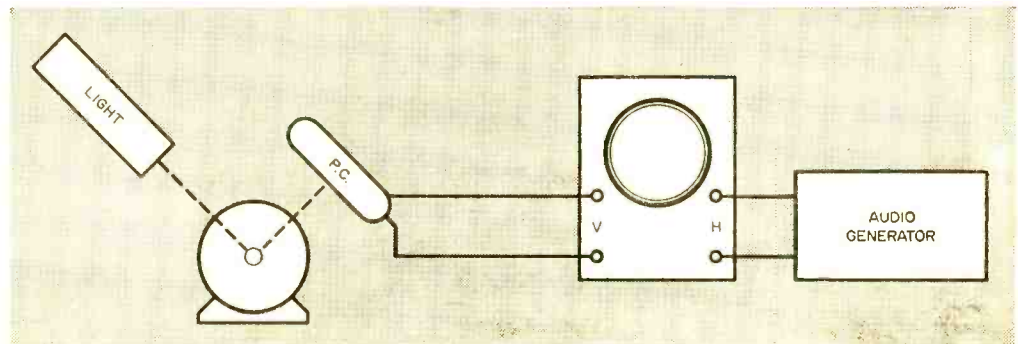
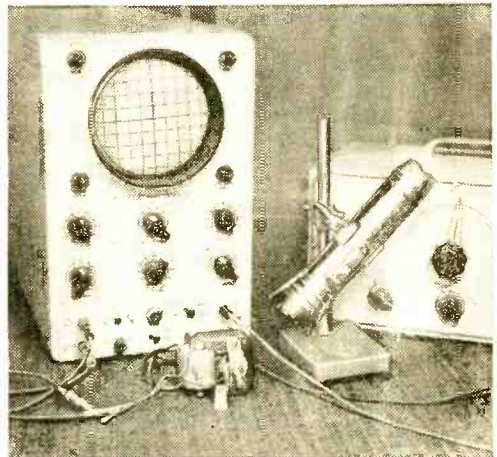
Fig. 4. For measuring the speed of a small motor, a self-generating type photocell is mounted on the white insulator (right), catching flashlight reflection from revolving shaft. This signal is then compared by the 'scope to audio generator frequency. Block diagram below shows setup for this test.

and back. If the frequency on the vertical deflection plates is made three times that on the horizontal plates, the pattern will be that of 3(C) because it must make three swings vertically for each one it travels horizontally.

Reversing the situation and reducing the frequency of the signal on the vertical plate to one-half of that on horizontal will give the pattern of Fig. 3(D). The spot now has time to make two trips across while traveling vertically once.

To get a usable pattern, the two frequencies being compared do not have to be exact multiples of one another. In Fig. 3(E), by counting the loops (or peaks), it is found that two horizontal excursions

*(Continued on page 116)*





## Lost Chords Found—Electronically

The strange instrument at left is no oriental oddity but a bit of electronic experimentation currently going on at the music department of the University of California in Los Angeles. Called "Harmona," the instrument uses tuned strings, struck with a piano hammer, as tone generators. The vibrations are picked up by electromagnetic coils and the resulting signal is run through a harmonic analyzer which picks out all the overtones. The overtones are then amplified to obtain a great variety of tonal blends. By re-combining the amplified overtones of a single note in different proportions, many unusual harmonies can be built up from the output of a single string. In this way, musical experimenters are now finding "lost chords" hidden in the complex overtone structures of a single note and are trying them out in new patterns of musical sound.

—Robert Franklin Ames

## Atom Rays Poison Parts

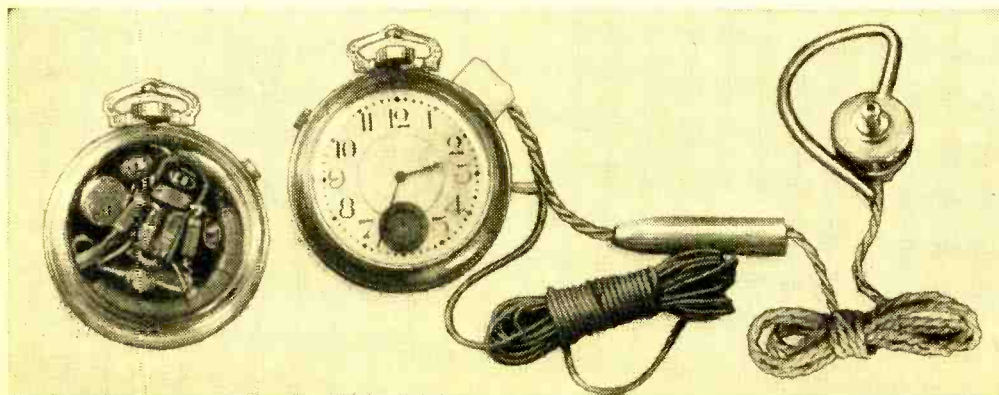
Unseen and unfelt, atomic radiation brings slow peril not only to living organisms but also to inanimate electronic components.

Exposed to radioactivity, transistors rapidly go dead. Wire insulation loses resistance in proportion to the radiation intensity. Natural rubber deteriorates very rapidly. Insulating materials, such as Teflon, silicon rubbers, and polyvinyls, all suffer damage. Oil-filled capacitors develop gas from the oil, which creates internal pressure and bursts their containers. Some resistors change value and the operation of gas-filled tubes becomes erratic. In some tubes the glass envelope cracks around the base; or the glass itself darkens, impairing the transparency of camera and display tubes.

Yet in the atom-powered submarines, ships and aircraft of tomorrow, electronic control equipment may have to work in radioactive surroundings. The U. S. Air Force therefore urges extensive research on the still largely unknown effects of nuclear radiation on electronic devices. It is hoped that such research will eventually lead to the development of components unaffected by radioactive environments.

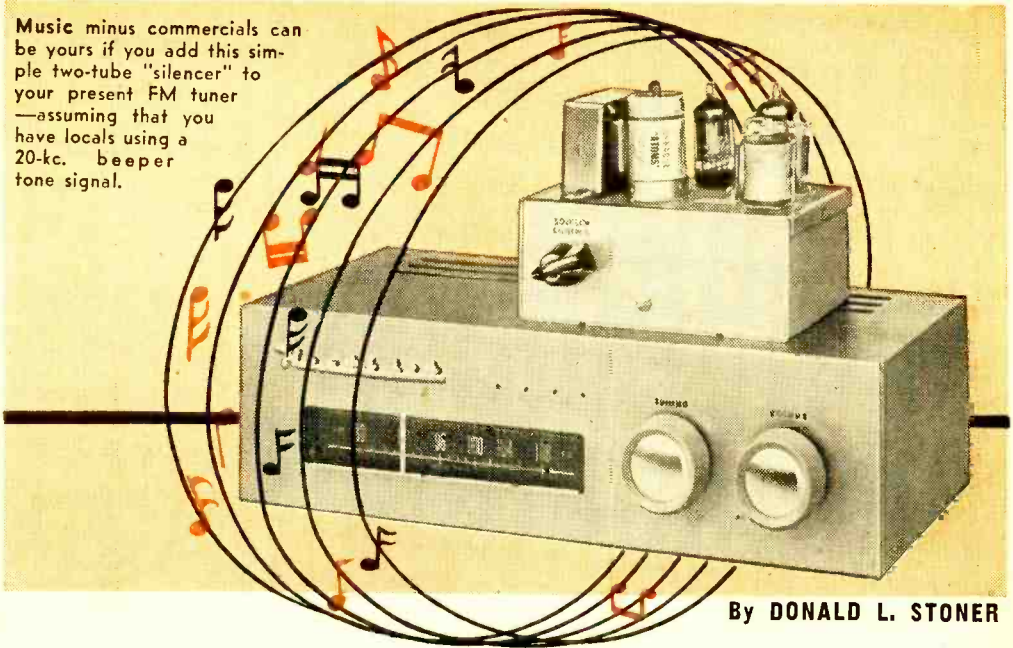
## Watch That Radio!

With miniaturization being the order of the day, it was inevitable that clock radios would eventually develop into watch radios. The one below uses three transistors and was made by Peter Dorsey, a watchmaker in Masontown, Pa., whose hobby is electronics. He designed a slug-tuned curved coil to conserve space. Most parts had to be hand-made and connected by a circular strip. Peter now plans to build an even smaller radio inside a wrist watch. In each case, the radio is to be listened to through the earpiece of a hearing aid.





Music minus commercials can be yours if you add this simple two-tube "silencer" to your present FM tuner —assuming that you have locals using a 20-kc. beeper tone signal.



By DONALD L. STONER

## How to Beep Out FM Commercials

**H**OW WOULD YOU LIKE to have 24 hours of continuous music in your home and never hear an announcer's voice insist that you use the sponsor's product? You've probably noticed that certain supermarkets, restaurants, etc., manage to play continuous music from an FM station. But did you know that you can have music minus commercials in your own home?

Many cities have FM stations that broadcast continuous music programs interspersed with short commercial announcements. Other stations broadcast music which is only interrupted by routine station call letter announcements. In many cities, such announcements can be easily removed by adding this "silencer" to your present FM tuner or receiver. The result is commercial-free music for those in your household.

Simply speaking, these 24-hour music stations broadcast a "beeper tone" to silence their receivers. Whenever an announcer turns on the microphone, the beeper tone automatically goes on. The commercial silencer amplifies this tone and uses it to trip a relay, which in turn shorts out the audio to the amplifier.

**Construction.** All components are mounted on an LMB 136 chassis box. Be sure to keep all leads as short as possible. Although the silencer handles no r.f. voltage, the audio voltage can sometimes be a bad actor and may result in feedback.

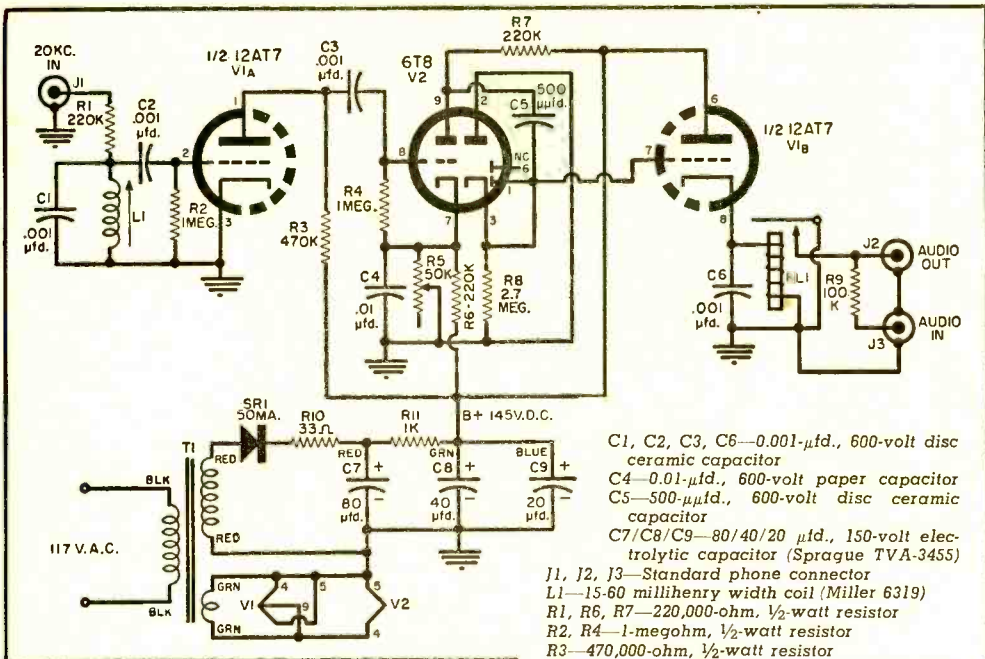
Drill out the chassis and mount all parts to check for proper clearance. The photos of the chassis should be used as a guide to mount components. Don't start wiring the unit until all components have been mounted. If you can locate a selenium rectifier (*SR1*) smaller than the author used, it

### HOW IT WORKS

Technically speaking, the 24-hour music stations broadcast a "beeper tone" to silence their receivers. Whenever the announcer turns on the microphone to make an announcement, the beeper tone is automatically turned on. This tone, or 20-kc. oscillation (approximate), is above the range of hearing. It is amplified in the commercial killer and used to operate an electronic relay which shorts out the audio to the amplifier. In addition to keeping the tone above the range of hearing, the modulation percentage is kept low to prevent any unpleasant sound in the speaker.

The 20-kc. signal is removed at the detector of the FM receiver, passes through a 220,000-ohm resistor *R1*, and is developed across the tuned circuit composed of *C1* and *L1*. The voltage is amplified in half of the 12AT7 (*V1a*) and passed on to the 6T8 (*V2*) where it is further amplified. The greatly amplified 20-kc. signal is fed to a full-wave rectifier\* (diode section of the 6T8) and is converted to direct current of a positive polarity. This voltage decreases the bias on the other half of the 12AT7 (*V1b*) which causes the cathode current to rise sufficiently to trip the relay. It, in turn, is used to short out the audio so that the radio will be silent whenever the 20-kc. tone is present.

Resistor *R5* is made variable so that the sensitivity of the relay will be correct. It should only trip when the tone is present and not on audio. Resistor *R9* is necessary to prevent the relay from shorting out the beeper tone.



C1, C2, C3, C6—0.001- $\mu$ fd., 600-volt disc ceramic capacitor  
 C4—0.01- $\mu$ fd., 600-volt paper capacitor  
 C5—500- $\mu$ fd., 600-volt disc ceramic capacitor  
 C7/C8/C9—80/40/20  $\mu$ fd., 150-volt electrolytic capacitor (Sprague TVA-3455)

J1, J2, J3—Standard phone connector  
 L1—15-60 millihenry width coil (Miller 6319)  
 R1, R6, R7—220,000-ohm,  $\frac{1}{2}$ -watt resistor  
 R2, R4—1-megohm,  $\frac{1}{2}$ -watt resistor  
 R3—470,000-ohm,  $\frac{1}{2}$ -watt resistor  
 R5—50,000-ohm carbon potentiometer (squealch control)  
 R8—2.7-megohm,  $\frac{1}{2}$ -watt resistor  
 R9—100,000-ohm,  $\frac{1}{2}$ -watt resistor  
 R10—33-ohm,  $\frac{1}{2}$ -watt resistor  
 R11—1000-ohm, 2-watt resistor  
 RL1—4000-ohm relay (Sigma 4F or equivalent)  
 SR1—25-50 ma., 150-volt selenium rectifier  
 T1—Power supply transformer, 117-volt primary, secondary 115 volts at 15 ma., 6.3 volts at 0.6 amp. (Triad R54-X)

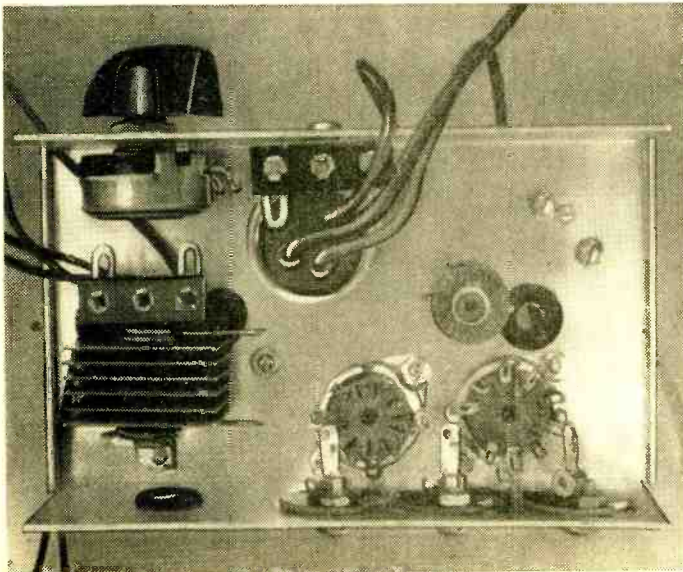
V1—12AT7 tube  
 V2—6T8 tube  
 1—Chassis (LMB #136)  
 2—9-pin miniature sockets  
 Misc. shielded cable, line cord and plug, and hardware as required

won't be necessary to make a mounting bracket like the one shown.

The power supply uses a minimum of components. Total current drain is only 5 ma. and the smallest selenium rectifier you can find will be adequate. No switch is included in the power supply circuit, because the a.c. outlet on the amplifier or tuner into which the silencer is plugged is energized when the units are turned on.

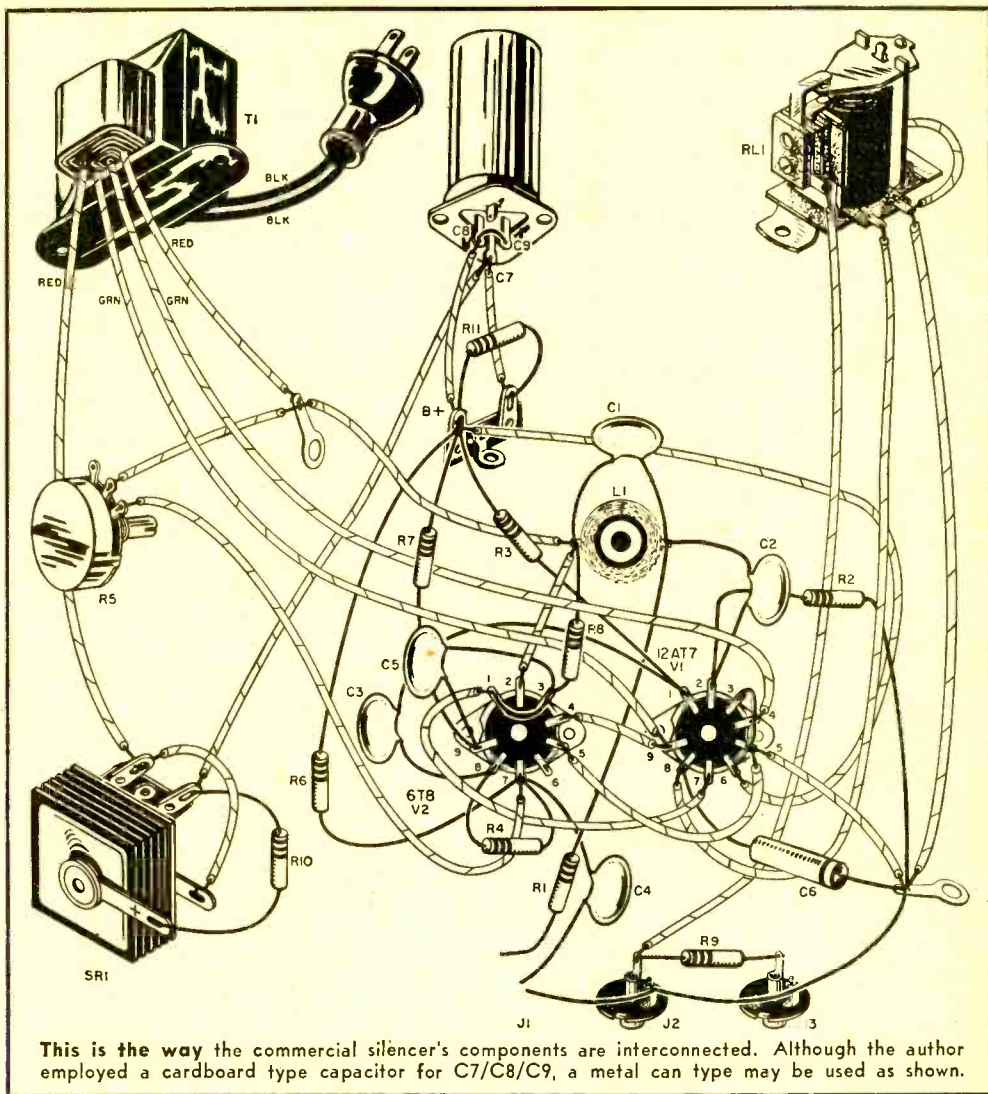
**Beeper Tone.** It is necessary to make an internal connection in the tuner to remove the beeper tone. It is taken off

**Schematic diagram and parts list for the silencer are given above.**



**Mount** the components as shown in the under-chassis view at left; wiring should not be started until they are all in place. Be sure to keep all leads as short as possible. You'll note the neat, uncluttered appearance of the chassis; the unit could be built right on the tuner chassis but it might not be possible to squeeze all the parts into the necessary space and not all tuners will have enough spare filament power to light up the tubes.

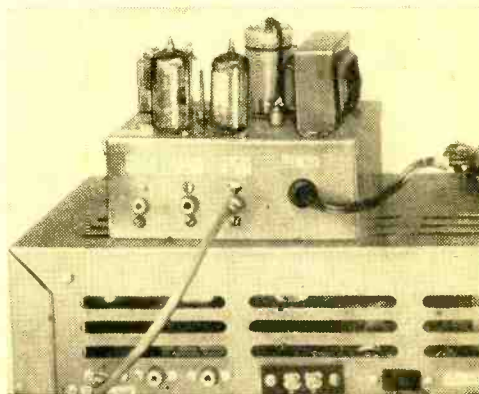




before the de-emphasis network. The de-emphasis network can be found by tracing back from the volume control to the detector. You will generally find a resistor with a value of 68,000 ohms for a discriminator circuit and 22,000 ohms for ratio detector circuits. The capacitor in both cases is usually 0.001  $\mu$ fd. A shielded cable should be connected to the resistor end without a capacitor to ground. The other end of the cable is attached to a phono-type connector on the rear apron of the tuner.

Because the Heath FM-3 is undoubtedly one of the most popular FM tuners, it is used as an example of a typical installation. The phono connector was installed to the left of the high and low-level audio connectors. Connect the center wire of the

*(Continued on page 119)*



Rear view of the silencer. Shielded cable goes from resistor end of the de-emphasis network in tuner to 20-kc. input connector on silencer.



## Mobile Selling

Car dealers who have taken to selling on wheels with the aid of mobile showrooms might profit from the example set by a Florida auto dealer who has installed a telephone in a demonstrator car (left).

Driving to the prospect's house, the salesman phones from the car and asks if anyone would care to see a new auto if it were parked just outside the front door. The reply is almost always "yes," the prospect thinking he now will have one less salesman to worry about. Then comes the startling statement: "Fine. I'm right outside."

The prospect's surprise generally turns to curiosity, and he comes out. Talk about "captive audiences!"

## Calling All Cows!

Cowboys of the Old West might not recognize the rider shown below, but he's a genuine cattle foreman who rides herd for the huge Colt Ranch in California. Hanging from his saddle is a radio transceiver; in his hand is the microphone used for sending voice messages over the range. Radio aids ranch work. (Wide World Photo.)



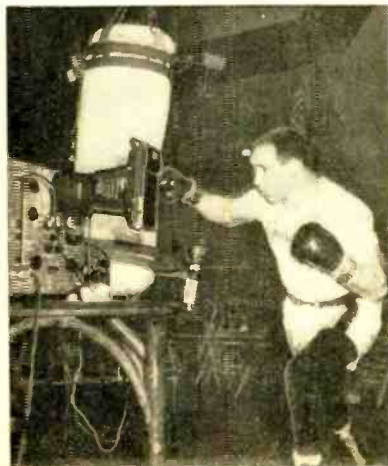
## Tiny Portable

Radical in design is Sylvania's "Thunderbird," an all-transistor portable receiver. The set measures 3 $\frac{3}{4}$ " high by 5 $\frac{5}{8}$ " wide by 6 $\frac{1}{4}$ " deep. It weighs less than 2 $\frac{1}{2}$  pounds with batteries. In "carrying



position," its top folds down to form a compact unit. When opened, the plastic-covered chassis is revealed. It plays in either position.

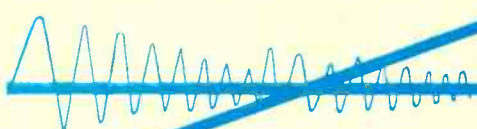
## How Hard Does Champ Punch?



Gene Fullmer hits heavy bag in training camp while the power of his punches is tested by special electronic and photographic device. Tests made with Fullmer wearing six-ounce gloves show that right-hand punch traveled at speed of 30.4 mph and carried force of 1260 pounds, left jab moved at 17 mph with force of 1035 pounds. (Wide World Photo.)



# hi-fi and the ELECTRONIC CROSSOVER



By Norman Eisenberg  
Feature Editor

## ***New type frequency divider uses separate power amplifiers for each speaker in multiple system***

**H**I-FI SOUND—big, clean, smooth, and wide-range—is best reproduced by a multiple speaker system in which a woofer puts out the lows and a tweeter furnishes the highs. Going a step further, the mid-range frequencies can be sounded by another speaker or “squawker.” In our January, 1957, issue (p. 70), we described how such speaker systems operate when audio frequencies are divided and channeled to correct speaker units. The device that does the job is a dividing—or crossover—network and is inserted between the power amplifier and the speaker system.

Crossover networks—if properly matched to carefully chosen speakers—can make for excellent response. Some of the finest-sounding speaker systems use them. But dividing networks have certain drawbacks.

First, there is the “noise” that may be introduced eventually by less-than-top-quality components. For instance, high-value capacitors of the paper variety are very expensive and not always used. Electrolytics can be substituted if selected with an eye toward possible deterioration and leakage. A defective electrolytic, however, may not only introduce noise but shift your crossover frequency from one that provides a correct balance to one that can throw off the speaker system.

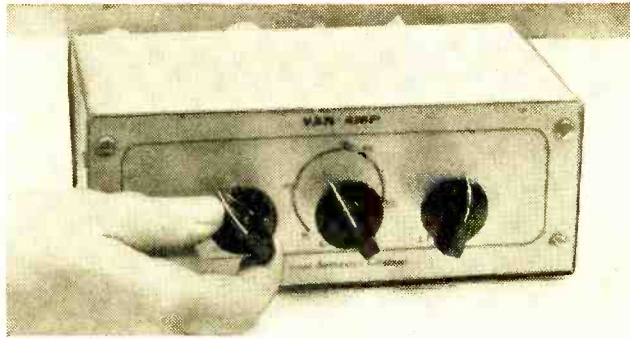
**Fixed** crossover points at 100, 200, 400, 700, 1200, 2000, and 3500 cps are provided in Heathkit Model XO-1 crossover (lower right) shown in use in hi-fi system with an Electro-Voice PC-1 as preamp-control unit. Available in kit form, the XO-1 nets for \$18.95 supplied direct from the Heath Company, Benton Harbor 15, Mich.

Secondly, networks made up of coils and capacitors must introduce some audio signal loss. Part of the total output of the amplifier is eaten up by the network as “payment” for the job it does. This is known as “insertion loss.” Neither the amount of noise nor the degree of insertion loss may be, in itself, very serious. The setup may still sound good. But there is a third network bugaboo that *can* become a serious limitation on sound quality and impair your enjoyment of programs.

**The Damping Problem.** By “damping,” we mean the ability of the amplifier to keep tight reins on the speaker. For sound faithful to the original, the cone must neither overshoot its mark nor keep jiggling after a sharp and sudden excursion. Good damping keeps the speaker motion strictly in step with the electric waveform arriving from the amplifier. Musically, this



**Compact** electronic crossover is Brociner's "Van-Amp." Crossover points are continuously variable from 90 to 1100 cps. Each channel has adjustable voltage gain. This unit uses two tubes and is powered by a selenium rectifier. Completely assembled, it nets for \$56.95. In kit form, its price is \$39.95.



means clear definition of every sound—no blur, no crackling—and sharp, exciting transients.

Damping depends partly on the design of the speaker itself and partly on the interaction between speaker and amplifier. The amplifier effectively "puts on the brakes" whenever the speaker cone zooms out of control. With a crossover network inserted between amplifier and speaker, the insertion loss of the network hinders the action of this self-correcting "feedback brake." In other words, it lessens the damping. But, once again, this drawback may be more than offset by the advantage of the multiple loudspeakers made possible by the crossover network.

A more serious damping difficulty stems from the fact that the speaker itself changes impedance with changes in frequency. Air loading and springiness of the cone suspension differ at low and high notes. These variations reflect back into the voice coil circuit in the form of impedance variations. This affects the damping and thus changes the tone quality of the speaker. The impairment is most pronounced at bass frequencies which need greater surges of undistorted wattage in

order for them to be faithfully reproduced.

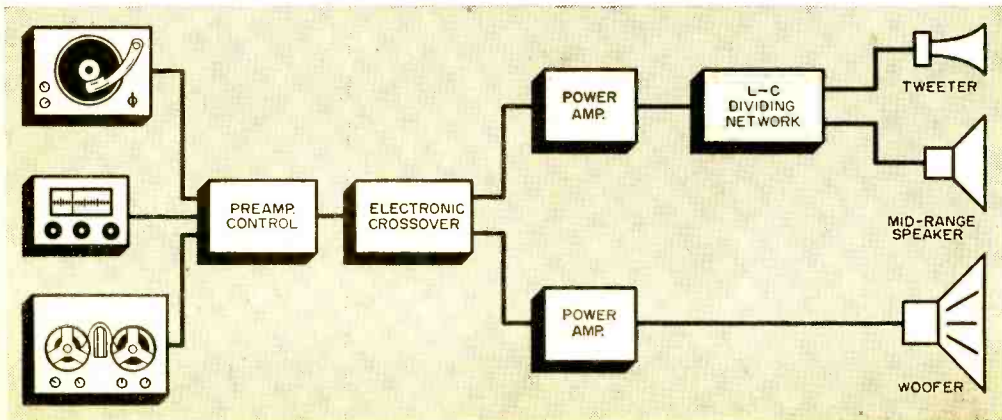
**Introducing the ECU.** For many listeners, the above considerations are not worth bothering about. But designers with ultra-critical listening tastes and an approach that puts no ceiling on hi-fi perfection have come up with a system that neatly sidesteps the damping problem.

Instead of using one power amplifier to feed a network and thence the speaker system, the new approach uses *two separate power amplifiers*—one feeding a woofer, the other a tweeter. Frequency division is made *before* the sound enters either power amplifier. What's more, instead of using an *RLC* network, this system uses an electronic crossover unit (ECU) to separate highs from lows.

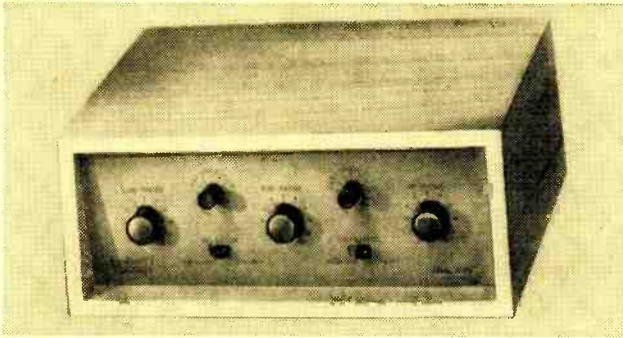
An ECU resembles an amplifier and has no signal insertion loss. Also, the ECU does not disturb the feedback setup between power amplifier and speaker. Thus, it permits optimum damping.

**Typical Setup.** In operation, the ECU is connected directly after the preamplifier. The input signal is divided and fed to individual power amplifiers. Each power amplifier, in turn, drives its own speaker—one for lows, the other for highs.

**Three-way speaker system using electronic crossover and LC dividing network.**







**Three-way** electronic crossover is provided by Colbert Model 3-CFD. Included is 10-watt power amplifier for use on mid-range or treble channels, but two more power amplifiers are needed to complete set-up. Device nets for \$154.50, is made by Colbert Laboratory, Inc., 160-09 Hillside Ave., Jamaica 32, N. Y.

Such a setup permits great flexibility in adapting individual speakers to handle their correct frequency ranges. Highs and lows are amplified separately and reproduced separately. This means that intermodulation distortion is virtually licked. Unstable loading conditions and problems of impedance matching are solved. The variety of crossover points provided by the ECU permits experimenting with whatever speakers you have until the best possible combination is achieved.

**Available ECU's.** One of the first commercially produced electronic crossovers is the "Van-Amp" ("Van" standing for "variable audio network") made by General Apparatus, a subsidiary of Brociner Electronics Corp., 344 East 32nd St., New York 16, N. Y. The Van-Amp is illustrated and described on page 72.

Another electronic crossover is the Heathkit Model XO-1, shown in use and described on page 71.

Newest ECU is the two-channel divider made by the Marantz Co., 44-15 Vernon Blvd., Long Island City 1, N. Y. Twelve crossover points, from 100 to 7000 cps are provided. Each channel has adjustable gain. The unit uses three dual-triode tubes and is powered by a remote supply. It nets for \$90.00.

**Further Refinements.** An ECU, such as one of those mentioned above, can be used as the basis for a three-way speaker system. One method would be to use two ECU's cascaded. A cheaper, but effective, method would be to combine the ECU with an LC network (see diagram on page 72). The ECU makes the first frequency division into bass and treble. The treble is then further split into two channels (mid-range and high) by the network.

To use the ECU in such a system, select a fairly low bass crossover point, say, 400 cycles. Everything below 400 cps is then fed to the woofer. Everything above 400 cps is fed to an external dividing network. The network then makes another division into mid-range and highs with a likely crossover

at, say, 4000 cps, depending on the particular tweeter used.

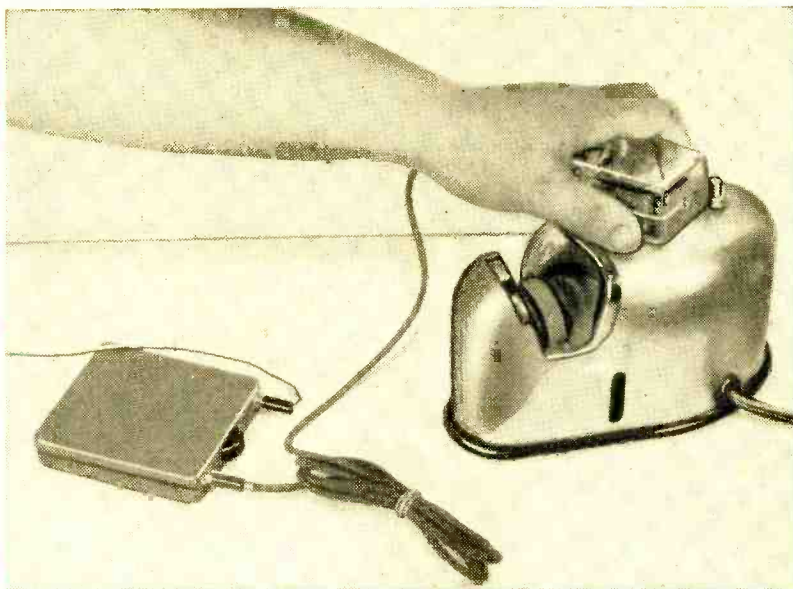
Such a system makes the best use of the natural advantages of both an electronic crossover and the LC network. By taking over the demanding job of bass crossover, the ECU delivers maximum undistorted power to the woofer for best bass reproduction. The network, designed to operate at about 4000 cps, can be built from relatively low-value and inexpensive capacitors. As a high-pass filter, it will not be called upon to handle excessively high wattages, but will deliver plenty of highs to a tweeter and help put a tonal sheen onto the sound you hear.

**Three-Channel ECU's.** At this point, someone will probably ask the inevitable question about an all-electronic crossover system for three channels—a unit that will furnish highs, mid-range, and lows for a three-way speaker system without any need to go through LC networks. Correctly designed and set up, it would provide unsurpassed frequency division for a three-way system.

Exactly such a unit is the Colbert "Three-Channel Electronic Frequency Divider," described and illustrated above.

Then there is the British-made "Tri-Channel Hi-Fi Sound System," marketed in the USA by the Ercona Corp., Electronics Div., 551 Fifth Ave., New York 17, N. Y. This sonic titan includes a three-channel preamp-mixer, three separate power amplifiers, and four speakers . . . in other words, three complete sound systems, minus program sources. This unit may not only be used as the ultimate of frequency division for multiple speakers, but can also serve as a bona fide, uncompromised stereophonic system. The sound it puts out can be heard to the tune of \$795.00!

Whether your hi-fi needs lead you to the ultimate in sound systems or to one of the more modestly priced units described, you'll find that an electronic crossover can furnish you with a new measure of thrilling, realistic sound.



## You'll Amaze Your Friends with an Electronic "Detectoscope"

By LOUIS E. GARNER, JR.

**Use of printed-circuit audio amplifier simplifies building of unusual listening device**

**I**F YOU'RE the typical electronics hobbyist, chances are you get just as much enjoyment out of assembling an instrument or gadget as you do out of using it. But one of your greatest thrills is the admiration of friends, relatives and neighbors, and their compliments on your handiwork.

Here's an instrument which is sure to impress even the most sophisticated of your friends . . . an electronic "detectoscope." With it, you can make a ticking watch sound like heavy industrial machinery . . . you can open tumbler-type combination locks as easily as if you knew the combination . . . and, under the proper conditions, you can listen to conversations in closed rooms—right through walls, doors and windows!

The electronic "detectoscope" is a modern "sound microscope" designed primarily for non-medical applications. Almost everyone who works with machinery or mechanical devices will find it helpful in his work . . . and the experimenter will have lots of fun using it and demonstrating it. Locksmiths and watchmakers can employ it in their delicate work . . . refrigerator, washing machine and appliance repairmen can identify obscure troubles with it . . . auto mechanics can track down rattles and unusual noises with it . . . and even detectives and policemen will find it useful.

Three separate units make up the com-

plete "detectoscope" assembly—an earphone, an amplifier, and a vibration pickup or transducer. If the word "transducer" is an unfamiliar one, simply remember that it is a device for changing energy from one form to another. Everyday examples of transducers are microphones and loudspeakers; these change sounds into electrical signals and vice versa. The transducer used here changes mechanical vibrations into electrical signals.

**Construction Hints.** Only standard, readily available components are used in the design of the "detectoscope." The schematic wiring diagram of the complete amplifier assembly is shown in Fig. 1. Heart of this assembly is a Centralab "Ampec" printed-circuit audio amplifier. This unit was chosen to simplify the construction and thus to make the project suitable for the advanced worker and the beginner alike.



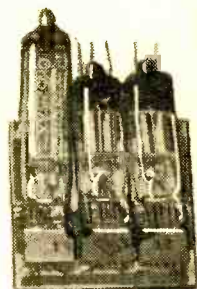
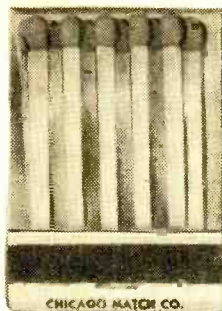
The "detectoscope" is being used in the photo at left to listen to the vibration of an electric knife sharpener. At right, the "Ampec" printed-circuit plate is compared in size with a book of matches.

Although the "Ampec" unit is smaller than a pack of book matches, it includes all the essentials of a complete three-stage audio amplifier, excluding only the input and output circuits, the gain control and the power supply. Input, output, gain control and power connections are made through nine wire leads.

Cement the "Ampec" amplifier plate to a small piece of perforated Bakelite measuring approximately  $2\frac{3}{8}$ " x  $1\frac{3}{4}$ ", which previously has been cut out and drilled to accept the gain control and power switch (R10 and S1) and a small bracket or "frame" which supports the input and output jacks (J1 and J2). The small "frame" may be cut out and bent from a scrap piece of aluminum or brass. Install eyelets in the Bakelite mounting board for the output load resistor (R8) and for the A and B battery connections.

If desired, the case may be a small plastic box; but there will be less chance of noise and hum pickup if a metal box is employed. You can use either a commercial aluminum case or an empty metal cigarette box, cough lozenge or tobacco container. The model was assembled in an empty container which originally held English-made cigarettes. If you use an empty box of this nature, you can give the final instrument a "professional" appearance by covering the box with a coat of glossy enamel or wrinkle varnish.

**Transducer Assembly.** The transducer consists of an inexpensive crystal or ce-

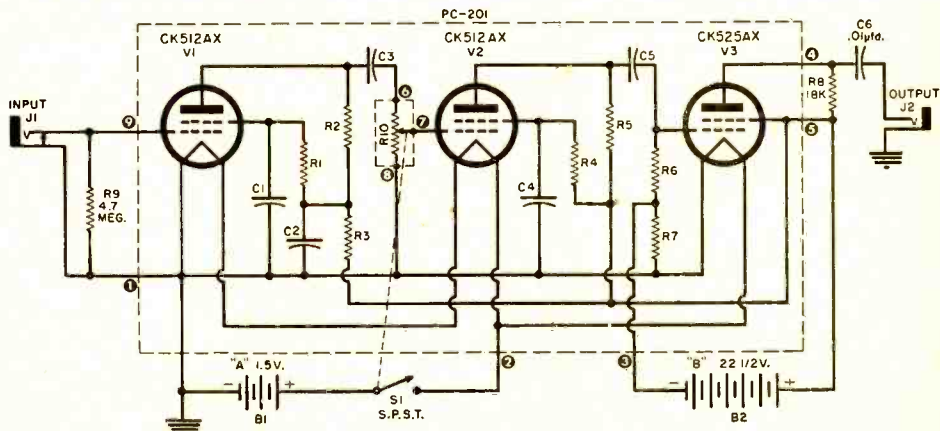


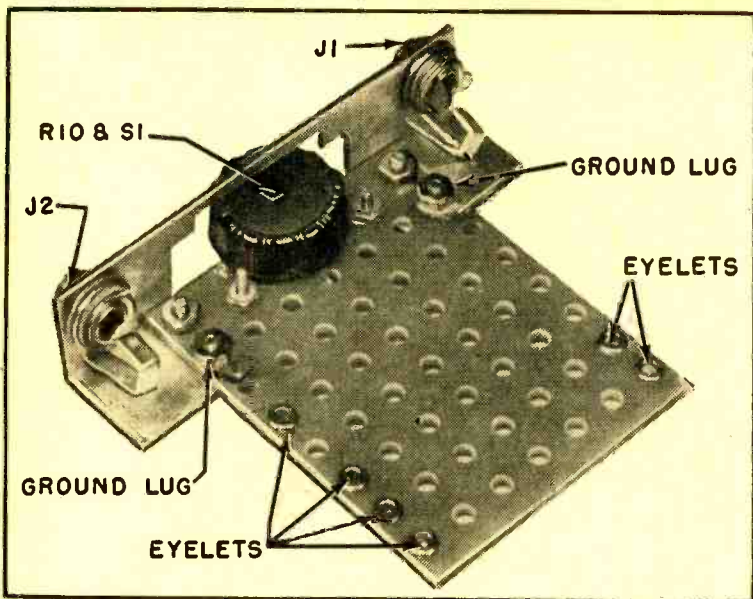
ramic phonograph cartridge. Mount it in a plastic or metal case and connect it to the amplifier proper with a short length of shielded single conductor cable, terminated with one of the subminiature Telex plugs.

In most cases, you can obtain good results with the phono cartridge alone. Occasionally, however, somewhat greater

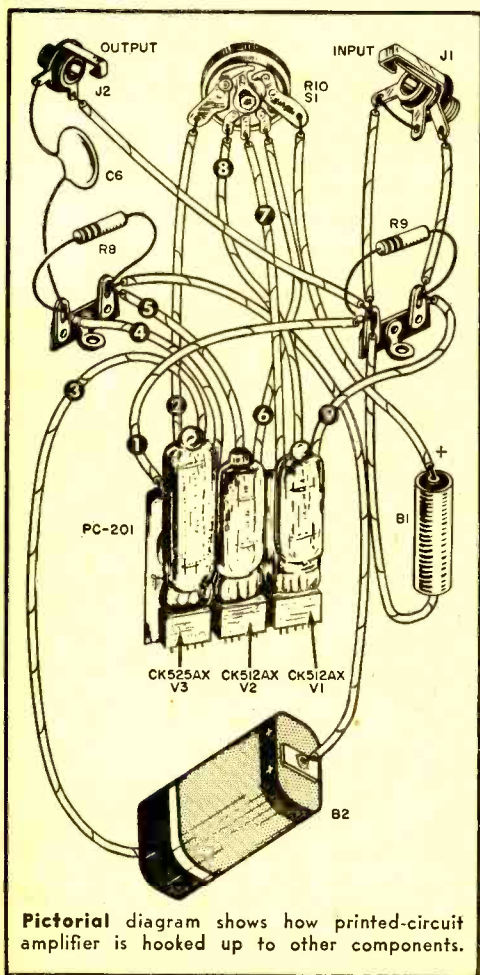
- PC-201—Printed-circuit amplifier plate, with tubes (Centralab "Ampec" Model PC-201)  
 B1—1.5-volt penlite cell (Burgess Type Z)  
 B2—22½-volt hearing-aid battery (Burgess Type U15)  
 C6—0.01-µfd. ceramic disc capacitor  
 J1—Miniature closed-circuit jack (Telex No. 3570)  
 J2—Miniature open-circuit jack (Telex No. 9240)  
 R8—18,000-ohm, ½-watt carbon resistor  
 R9—4.7-megohm, ½-watt carbon resistor  
 R10—Miniature potentiometer, with knob and s.p.s.t. switch, 5 megohms, audio taper (Centralab No. B16-228)  
 S1—S.p.s.t. switch (on R10)  
 1—Small metal case  
 1—Bakelite mounting board  
 1—Standard crystal phonograph cartridge, high-output type (Shure No. W78, Astatic No. L-72A, Lafayette Type PK-11, etc.)  
 1—Small plastic box  
 1—30' flexible single-conductor shielded cable, and small plug (Telex No. 9231)  
 1—Sensitive earphone, and small plug (Telex No. 9231)—accessory

Fig. 1. Schematic diagram of complete amplifier assembly. The portion of the circuit within the dashed line (except R10) is part of printed-circuit plate PC-201. See parts list above.





**Preliminary** assembly of the Bakelite mounting board, "frame" for the input (J1) and output (J2) jacks, gain control (R10), and the power switch (S1). Small eyelets are installed in board as connection terminals. Use either or both of the ground lugs shown for grounding the circuit in accordance with Fig. 1. The ground tie point in the pictorial diagram below should be connected to one of these lugs.



**Pictorial** diagram shows how printed-circuit amplifier is hooked up to other components.

sensitivity may be had by mounting a small weight in the needle chuck. The weight serves to increase the effective inertia of the crystal system and to make it more sensitive to vibrational forces. The amount of weight needed will vary with the exact type of phono cartridge used and with the type and size of case. For best results, you'll have to determine this value experimentally. The simplest weight is a short length of heavy wire which just fits the needle chuck.

Another possible modification in the transducer design is the addition of a probe. This may be desirable where you need to reach into tight corners or through gratings. You can make a suitable probe from a 4" to 8" length of steel rod. Attach the rod to the case using any mounting method you prefer, but make sure that the back of the rod rests against the phono cartridge to insure the best transfer of vibrational energy.

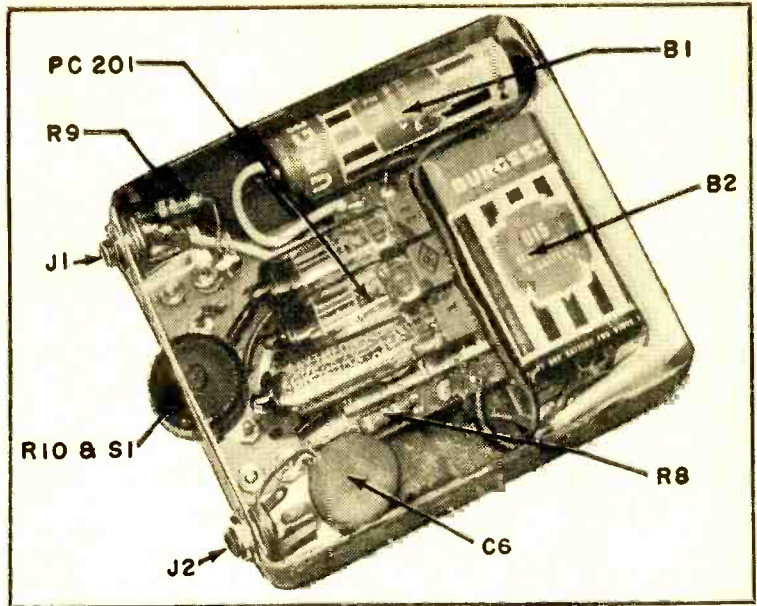
**Using the "Detectoscope."** Insert transducer plug into jack J1 and the ear-phone plug into jack J2. With the phone to your ear, hold the transducer on the equipment to be checked, making sure that either the crystal mounting screws or the metal probe (if one is provided) makes good contact with the equipment.

Turn the amplifier on and continue to rotate the gain control, gradually increasing volume until a comfortable listening level is obtained. *Do not use excessive volume*—you may overload the amplifier, with resulting distortion and poor quality, giving difficult-to-interpret signals.

Get a lot of experience. Try the instrument out on different types of equipment.



**Completed amplifier assembly** with A and B batteries in place and components identified. Connections to the PC-201 are made through nine wire leads which are identified by number on an instruction sheet furnished with the PC-201. Best results will be obtained if a metal case is used to house the complete amplifier. Because of compactness of unit, batteries will stay put without clamps.



Vibration pickup or "transducer" assembly; crystal phono cartridge is mounted in small plastic case.

Listen to the vibration sounds produced by washing machines, refrigerators, mixers, and other household appliances; listen to the vibrations produced by your auto when it's idling; listen to watches and clocks. If you plan to use the "detectoscope" as an aid in servicing mechanical equipment, you'll have to practice with it quite a bit. Only experience will teach you how to correlate various sounds with defects or misadjustments in the equipment you are repairing.

Since the amplifier assembly proper is essentially a high-gain audio amplifier, you can use it for many other applications. By replacing the transducer with a crystal microphone cartridge, you can make an effective hearing aid out of the instrument. A telephone pickup coil connected to the input provides you with a useful telephone amplifier. A simple tuned circuit connected to the input changes the instrument into a radio receiver (for details, refer to "Radios Made from Hearing Aids" in the May, 1956, issue of POP'tronics, page 52).

As you gain experience with the electronic "detectoscope," you'll be able to dream up dozens of other practical applications on your own.

-50-

## HOW IT WORKS

Audio signals obtained from the transducer and appearing across input resistor *R9* are fed directly to the grid of the first amplifier tube, *V1*. An amplified signal appears across the plate load resistor, *R2*, and is coupled through capacitor *C3* to gain control *R10*. The setting of this control determines what portion of the available signal is passed on to the second stage, *V2*.

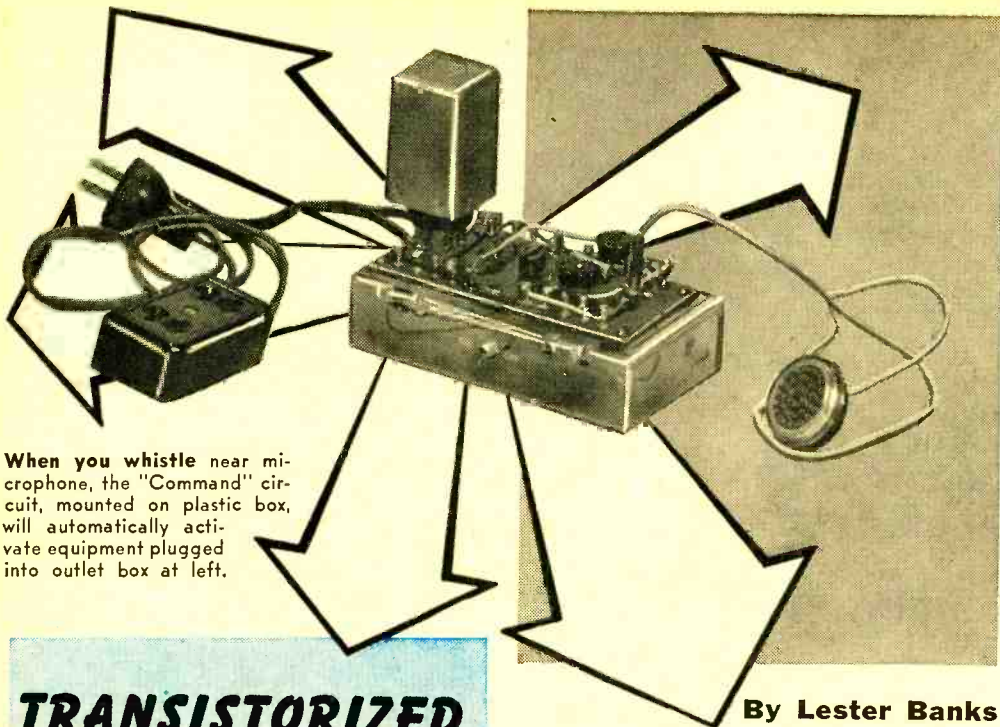
The first stage, *V1*, is decoupled from the rest of the amplifier through a "L" type filter network consisting of *R3* and *C2*. Screen voltage for this stage is provided by *R1*, bypassed by *C1*.

An amplified audio signal appears across load resistor *R5* of the second stage, *V2*, and is coupled through d.c. blocking capacitor *C5* to the grid of the output amplifier, *V3*, appearing across grid resistor *R6*. Screen grid voltage for *V2* is provided through screen resistor *R4*, bypassed by capacitor *C4*. Bias voltage for the output stage is provided by resistor *R7* in series with the B-lead. All the current used by the amplifier passes through this resistor, developing the necessary bias voltage for the output stage, *V3*.

The final output signal appears across the third stage's plate load resistor *R8*, where it is coupled through d.c. blocking capacitor *C6* to the earphone. Power to operate the amplifier is supplied by a single penlite cell serving as an A battery, and a 22½-volt hearing-aid battery serving as the B supply. The A battery is controlled by s.p.s.t. switch *S1*, mounted on the gain control.

Operation of the transducer involves a signal voltage developed by the piezoelectric crystal as the case vibrates around the crystal element, which resists this vibration by virtue of its own inertia. It is for this reason that adding weight to the crystal system through the needle chuck increases the sensitivity and output of the device . . . it simply increases the effective inertia of the crystal system.

Unfortunately, the weight that can be added is critical. If too much weight is used, the "damping" of the needle chuck will be insufficient, with the result that self-resonant vibrations will be set up in the crystal system every time it is excited externally—producing new sounds not present in the original signal. If too little weight is used, there will be little or no increase in sensitivity.



When you whistle near microphone, the "Command" circuit, mounted on plastic box, will automatically activate equipment plugged into outlet box at left.

## TRANSISTORIZED "COMMAND" CIRCUIT

By Lester Banks

device to be mounted in a radio ham transmitter or tape recorder.

Begin construction by mounting the transistor sockets, relay socket and transformer on the terminal board. In the model, the Telex T-42 interstage transformer was held to the board with du Pont Duco cement. The Sigma relay uses a standard 5-pin tube socket. Mounting of this socket was accomplished by running stiff wires from two terminals on either side of the board to pins 3 and 4. These wires serve the dual purpose of providing support for the relay and electrical connections to the relay.

I mounted my terminal board on a plastic box (it once held cigars) using several 1/4-40 nuts and bolts. Extra holes

**W**ANT TO PUT that loud whistle of yours to work? If so, then here's a good project that can be whipped together in a few hours. It has lots of uses around ham shacks, tape recording parties, model control events, magic demonstrations, etc.

Once you have it operating, you'll be surprised at the number and variety of places where you can use the "Command" circuit. Put it in a dark room, and when you come into the house, a whistle will turn on the lights. In a quiet residential area, you can hook it up to a garage door opener and the short toot on the horn will automatically turn on the motor to open the door.

The total cost of building this gadget is well under \$10. Although I have pictured it here as being built into a plastic case, it can obviously be constructed on a metal chassis or any convenient blank chassis space you have available.

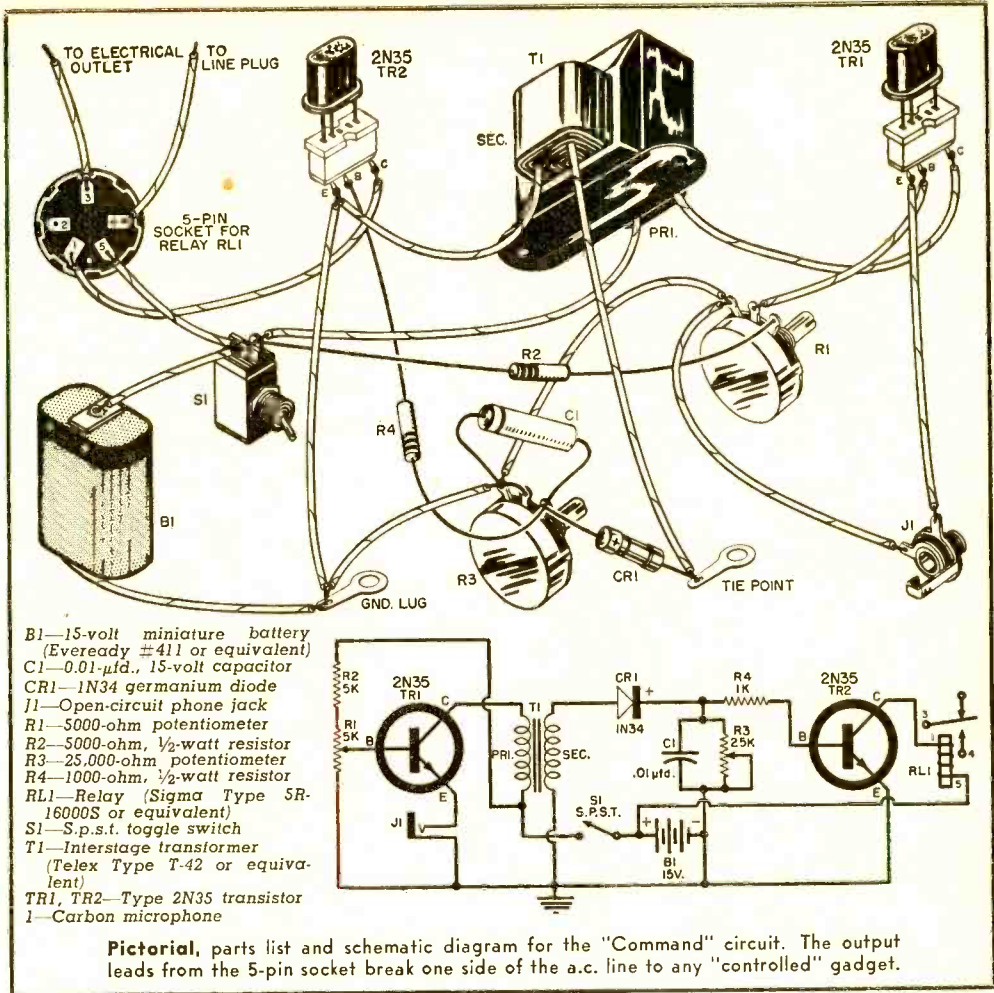
**Construction.** The "Command" circuit can be mounted on a single terminal board measuring 5 1/4" x 2 1/2". This size permits the

### HOW IT WORKS

An audio signal picked up by the microphone and fed through *J1* causes more current to flow in the emitter circuit of *TR1*. This increase is also observed by the collector and its associated wiring, *T1* and *R2*. From *T1*, the audio signal goes to diode *CR1* where it is rectified into pulsating direct current. Capacitor *C1* is charged by this voltage according to the resistance value of *R3*.

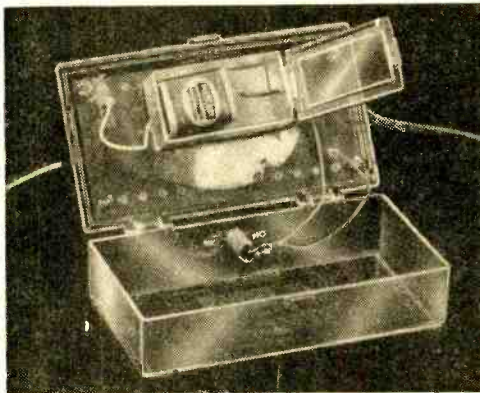
Before a signal is applied to the microphone, the current flowing through the collector of the second stage does not pull in the armature of relay *RL1*. Raising the voltage on the base of *TR2* increases the emitter current, and hence the collector current, while closing the relay. Holding action is governed by the time constant of *C1* and *R3*, since this capacitor must discharge through the base of *TR2*. Adjustment of *R3* will vary this hold-in time.





were drilled in the box to permit entry of the positive and negative leads from the circuit to the battery inside the box. The switch, *S1*, was mounted on the face of the plastic box.

Wiring is straightforward and presents



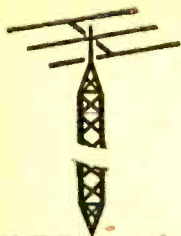
**Battery** is mounted inside another plastic box.

March, 1957

no unusual problems. Although the diagram calls for 2N35 transistors, it is possible to use others of the *n-p-n* variety, or even *p-n-p* transistors if the battery polarity is reversed. The only precaution that must be observed is not to exceed the rating of the Sigma relay. The contacts will easily handle about 200 watts, but will "freeze" at a higher current flow.

**Adjustment.** Putting the circuit into operation is also very simple; and once adjusted, it will remain so for a long time. Cover the microphone (do not disconnect it since that would disable the circuit) and adjust *R3* until relay *RL1* drops out of the "on" position.

Now uncover the microphone and set *R1* to the volume level of the voice or sharp sound that will activate the "Command" circuit. The relay should click in and out of operation depending on the setting of *R3*. After the volume level has been set, it is easy to go back and readjust *R3* to the desired holding time. —30—



# THE TRANSMITTING TOWER

Herb S. Brier, W9EGQ

**L**EARNING THE CODE well enough to pass the 5-wpm Novice code test or the 13-wpm General code test is the problem facing all prospective amateurs. Doing so requires a certain amount of time and effort, but it should not be as difficult as some people make it. All it takes is the patient following of tried and true methods of study.

Obviously, the first step in learning the code is to memorize the alphabet. The quickest ways to do this are (1) to teach it to yourself with the aid of a code chart and a code-practice oscillator, or (2) for two beginners to teach each other. Unfortunately, these are not the best methods, because they make building up receiving speed a slow process. Having learned the characters by their individual *dits* and *dahs*, you naturally try to copy them in the same manner. Up to a speed of about 5 wpm, this works fairly well, but at higher

speeds, there just is not enough time to count *dits* and *dahs*. As a result, your progress stops until, after many hours of practice, you learn to recognize the characters by their over-all sound.

Thousands of hams now on the air have learned the code in the above manner, in spite of its disadvantages; nevertheless, you will save much time by not looking at a code chart or touching a radiotelegraph key until you can receive the code fairly well. To accomplish this seeming paradox, you will need the help of a good instructor or of a recorded code course.

**Code Instruction.** In teaching you the code, the instructor will first announce the letter he is going to send, and will send it several times at a speed equivalent to about 15 wpm. Then he will send it another dozen times or so without the prior announcement. You should write down the letter (not the *dit-dahs*) every time it is sent.

The instructor will then introduce another letter in the same manner. Next, he will send first one letter and then the other at the 15-wpm speed, but with long pauses between them, for you to copy. This entire routine is repeated over and over again until you have learned all the characters.

Because each character is sent at a fairly high speed, you are forced to learn them by their over-all sound. You will undoubtedly protest that you would recognize them faster at a slower speed. But at this stage you are laying the foundation for rapid future progress, rather than trying to memorize the characters in the shortest period of time. Therefore, the instructor will not send them slower. Instead, he will repeat each one as often as necessary to allow you to get its sound firmly impressed in your mind and to establish the habit of writing down the correct letter every time you hear that sound.

To avoid the possibility of memorizing the letters by association with other ones, the instructor will introduce them to you in a mixed-up order. Assuming an hour per lesson, you should be able to learn about five characters per lesson; therefore, it will

*(Continued on page 105)*

THE RADIOTELEGRAPH CODE	
A ---	U ..---
B ....	V ...---
C .....	W ..---
D ..--	X ...---
E .	Y ..---
F ..---	Z ..---
G ..---	1 ..---
H .....	2 ..---
I ..	3 ..---
J ..---	4 ..---
K ..---	5 ..---
L .....	6 ..---
M ..	7 ..---
N ..	8 ..---
O ..---	9 ..---
P ..---	0 ..---
Q ..---	. ..---
R ..	. ..---
S ...	? ..---
T -	/ ..---
DOUBLE DASH .....	END OF MESSAGE .....
ERROR .....	INVITATION TO TRANSMIT .....
WAIT .....	END OF WORK .....



## HELP US OBTAIN OUR HAM LICENSES

In this section of the Transmitting Tower, the names of prospective amateurs requesting help and encouragement in obtaining their licenses are listed. To have your name listed, write to Herb S. Brier, W9EGQ, % POPULAR ELECTRONICS, 366 Madison Ave., New York 17, N. Y. Please print your name and address clearly. Names are grouped geographically by amateur call areas.

### K1/W1 CALL AREA

Ricky Littlefield, Box 7, Raymond, Me. (Code)

Richard Danziger, 55 Woodlawn Ave., Northampton, Mass. (Code and theory)

George MacLauchlan (14), Addison, Maine. (Code and theory)

John L. Heaton, Jr. (13), 201 Mystic Valley Pkwy., Winchester, Mass. (Code and theory)

### K2/W2 CALL AREA

George Laeske, 408 Center Ave., Bellmore, N. Y.

Emory Thompson III, 30 Esplanade, New Rochelle, N. Y.

Joseph Lofreddo, 79 Bregman Ave., New Hyde Park, N. Y. (Needs help in obtaining General Class license)

James Wendel, 28 Schuler Ave., Tonawanda, N. Y. (Code and theory)

Henry Weidman, 216 "C" Gibson St., Tonawanda, N. Y. (Code and theory)

Peter LaRoche, Thompsonville Rd., Monticello, N. Y.

Bill More (14), 333 Cedarwood Terrace, Rochester, N. Y.

Paul Markowitz, 389 17th Ave., Paterson, N. J. (Code and theory)

Allen Mout, 7 Brighton 4 Place, Brooklyn 35, N. Y.

K. Radziewicz, 846 Bergen St., Newark 12, N. J. Phone: BIgelow 3-4937. (Code and theory)

Robert Rogers, 24 Phillips St., Beacon, N. Y. (Code)

### K3/W3 CALL AREA

George Healey, Jr., 1051 Grand View Blvd., Lancaster, Pa. (Code and theory)

Joel Ballou, 200 So. Atlantic Ave., Pittsburgh 24, Pa.

Martin Hartig, 825 Exeter Hall Ave., Baltimore 18, Md. (Code and theory)

Mike Wood, 371 Case Ave., Sharon, Pa. (Needs help in General Class theory)

Louis Grossman, 611 W. Norwegian St., Pottsville, Pa.

Olen S. Terry, 296—3rd St., Beaver, Pa. (Code and theory)

Donald Zupon, 59-H Boone Drive, Turtle Creek, Pa. Phone: VA 3-6820.

Gary P. Sweeney (14), Upper Black Eddy, Pa. Phone: FErdale 2-2714. (Code and theory)

Alan Cohen, 6605 Sylvester St., Philadelphia 49, Pa. Phone: PIlgriM 5-9319. (Code and theory)

Bill Goodman (14), 114 E. Wayne Ave., Easton, Pa. (Theory)

Walter Bohlman, 32 Bridge St., Doylestown, Pa.

Jerry Naditch (13), 3226 Sequoia Ave., Baltimore 15, Md. (Code and theory)

### K4/W4 CALL AREA

John Cliburn, Rte. 2, Scottsville, Ky. (Code and theory)

D. W. Smith, 1024 Beecher St., S.W., Atlanta 10, Ga.

George Hines, 3721 Catalpa Ave., Knoxville, Tenn. Phone: 5-6224. (Code and theory)

Jacque White, 601 Highland Ave., High Point, N. C. (Code and theory)

Rhanor Gillette, 190 Little John Trail, Atlanta, Ga. (Code and theory)

James Green, 2124 E. 27th, Chattanooga, Tenn.

Terry Harmon (15), 301 DeRenne Dr., Savannah, Ga. (Code and theory)

Edgar Shrum (14), 210 Dixie Ave., Harrisonburg, Va. (Code)

### K5/W5 CALL AREA

Stan Champion, 6 Glendenning, Houston 24, Tex. (Code and theory)

L. E. Jacob, c/o Band Director, Nixon, Tex. Eddie Evans (15), 10017 Belts Dr., Albuquerque, N. M. (Code and theory)

### K6/W6 CALL AREA

Kurt Kroeger, 406 N. Fourth Ave., Arcadia, Calif. (Code, theory and regulations)

Michael DeLauder, 7923 Melita Ave., North Hollywood, Calif. Phone: ST 5-3955. (Code and theory)

### K7/W7 CALL AREA

E. W. Kangas, Box 165, San Jose Br., Bisbee, Ariz.

Laudio Doubrava (14), P.O. Box 7, Hubbard, Ore. (Code)

### K8/W8 CALL AREA

Fred N. Olmstead, 11942 Belle River Rd., Memphis, Mich. (Code and theory)

Edward Wilush, 122 Princess St., Campbell, Ohio. (Code and theory)

Eliot Friedman, 12948 Victoria, Huntington Woods, Mich. (Code)

Thomas A. Root, 608 Copeman Blvd., Flint 3, Mich. (Code)

William Tiep, 18 Rockingham Dr., Toledo 8, Ohio. (Code and theory)

Ronald Noffsinger, R.R. #1, Frankfort, Mich. (Code and theory)

Bruce Hunt, Benzonia, Mich. (Code and theory)

Matthew Holm, 712 Grand Traverse, Flint, Mich. (Code)

### K9/W9 CALL AREA

Jerry Janka, 1709 N. Moody, Chicago 39, Ill. Larry Plummer, Box 244, Kewanee, Ind.

Dale T. Hollaway, P.O. Box 357, Byron, Ill. Phone: BYron 4703. (Theory and regulations)

### K0/W0 CALL AREA

Thomas P. Gardner, 4144 Ettica Ave., St. Louis Park, Minn.

Jim Olmstead, 119 Third Ave., N.W., Hampton, Iowa.

Duane Nruachte, Caledonia, Minn. (Code)

Angelo Cossa, 7998 Raleigh Place, Westminster, Colo. Phone: HA 9-1470. (Code)

Bill Sokol, 4131 Lafayette Ave., Omaha 3, Nebr.

### VE AND OTHERS

Ross Duncan, 315 Kelvin Blvd., Winnipeg 9, Manitoba, Canada. (Code and theory)

Harold A. Benson, Rt. 1, Midland, Ont., Canada. (Code and theory)

Robert Moore, Chalet "San Ignacio," Carretera General, Cadiz, Spain.

To help prospective amateurs obtain their Novice licenses, the Radio-Electronics-Television Manufacturers Association offers a set of code records (recorded at a speed of 33 $\frac{1}{3}$  rpm) and a Novice Theory Course for \$10.00, postpaid. The complete course or more information on it is available from RETMA, Suite 800, Wyatt Bldg., 777 Fourteenth St., N.W., Washington 5, D. C.

# Transistor Topics

By LOU GARNER

OVER the past several months, a real "boom" in electronic construction has developed among home-builders, experimenters and electronics hobbyists. Last Christmas, electronic construction kits sold in unexpected numbers, with many of the kits going to individuals who had never before dabbled in electronics . . . newcomers to our ranks.

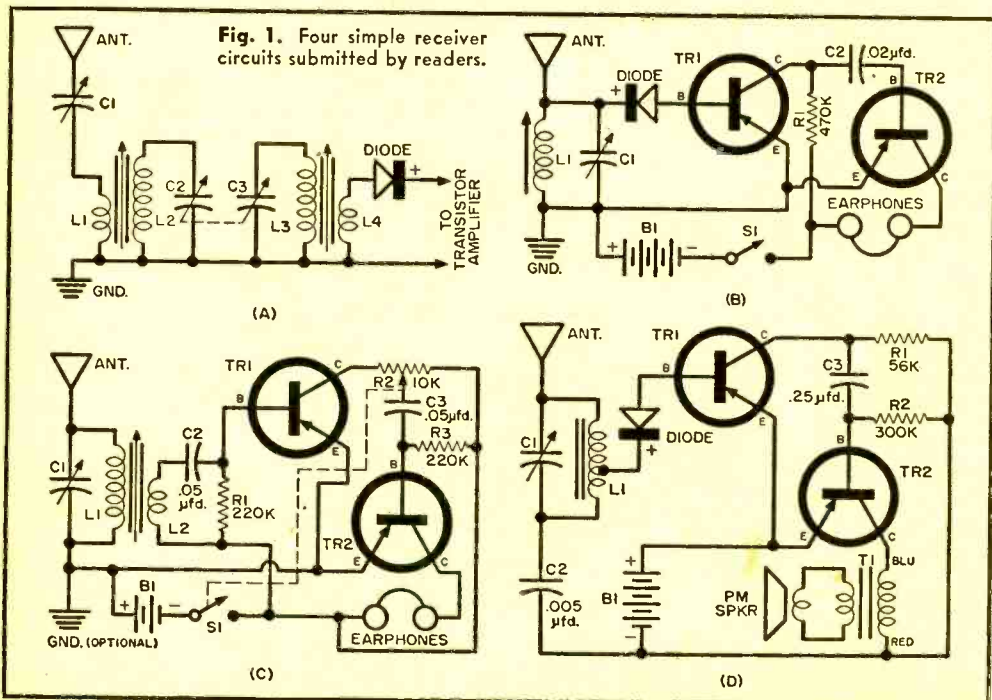
Contributing in a large part to the upsurge of interest in home-built electronic equipment has been our favorite component . . . the *transistor*. Transistor receiver and experimental construction kits led most other kits in popularity during the Christmas season and are continuing to sell in good numbers. And with summer not too far away, we can expect an increasing interest in transistorized portable radios and phonographs.

**Readers' Circuits.** Ever since the first days of radio or "wireless" transmission, when the "standard" receiver was a crystal detector and the more powerful transmit-

ters were Alexanderson alternators (giant high-frequency a.c. generators), receivers have been the most popular of construction projects with home builders and experimenters. This month we are featuring not one but *four* simple receiver projects, all submitted by our readers. Refer to Fig. 1 for circuit details.

**High Selectivity.** Sent in by Francis A. Ney of 22 Highland Ave., Flourtown, Pa., the circuit shown in Fig. 1(A) is basically a highly selective crystal receiver. With only moderate sensitivity, this circuit will give its best results when coupled to a long outside antenna (Francis uses a 100' antenna) and a good earth ground. Because of its good selectivity, the receiver is excellent for use in areas with several stations operating near the same frequency.

Capacitor *C1* is a 365- $\mu$ fd. variable unit used to "tune" the antenna circuit. *C2-C3* is a two-gang tuning capacitor; each section is rated at 365  $\mu$ fd. Coils *L2* and *L3* are  
(Continued on page 98)





# Transtopic

## Experiment No.

# 16

### Loudspeaker Metronomes

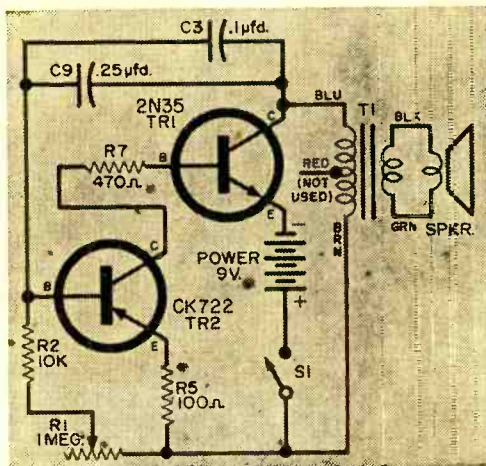
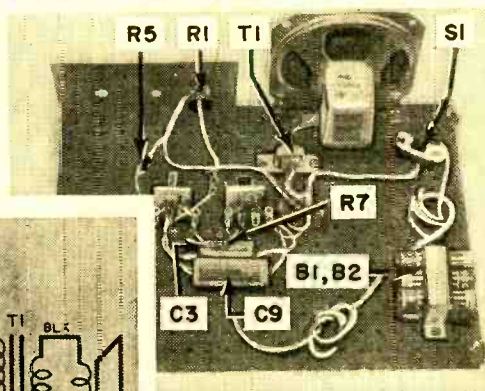
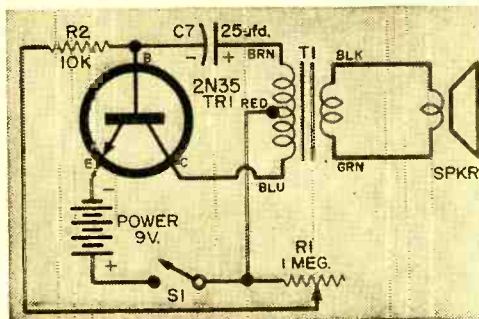
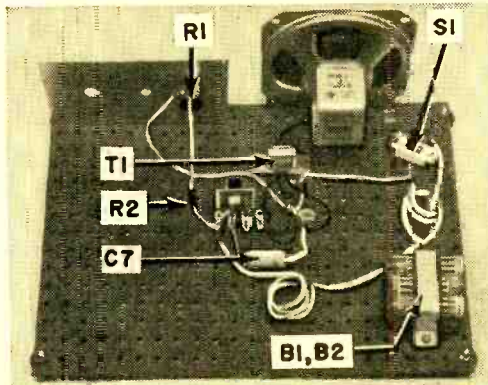
**T**HIS is another experiment in the series that started in the March, 1956, issue. The last experiment, No. 15, appeared on page 85 of the February issue.

Assembling a loudspeaker-operated metronome is a simple operation. You have a choice of two circuits.

The first circuit (shown at right) is an adaptation of the code oscillator project (Experiment No. 15). The major change has been to substitute a 25- $\mu$ f. electrolytic capacitor (C7) for the 0.25- $\mu$ f. capacitor (C9). This increases the RC time constant in the transistor's base-emitter circuit. The "KEY" is eliminated as well as the protective resistor, R5.

When you have completed the wiring and checked it, adjust R1 for the beat rate desired. You can change the range by changing C7—use a smaller capacitor for higher frequencies, a larger capacitor for lower rates.

If the one-transistor metro-



nome is not complex enough, you can adapt it to a two-transistor circuit. This modified circuit uses the *p-n-p* and *n-p-n* direct-coupled circuit arrangement. Again, the setting of R1 determines actual beat rate while the value of the feedback capacitors (C3 and C9) determines range.

—Louis E. Garner, Jr.

# Tuning the Short-Wave Bands

with Hank Bennett



**WHAT** is an SWL? What do you have to do to become an SWL? After you become one, then what? What advantages are there in being an SWL? Another important question often asked by our younger readers is: "Do I need an expensive receiver?"

An SWL is a *Short-Wave Listener*, or one who tunes the short-wave bands. The only requirements necessary for becoming



**Well-designed** listening post of Donald Larkworthy, Hales Corners, Wis. His equipment includes a S-40B, a BC-1066B, and an experimental receiver.

an SWL are an interest in radio, a receiver that is capable of tuning the s.w. bands, and a large quantity of patience and perseverance.

After you become a bit experienced, you may find it interesting to write to the stations that you hear, and, in turn, to receive their verification letters or cards. You may find it intriguing, as many SWL's do, to obtain your radio amateur operator's license, and to get on the air and talk to others via the radio waves.

**Advantages of SWL'ing.** What hobby could be more interesting than short-wave radio, with its magic and seemingly mysterious methods of being able to send human voices thousands of miles through space? In s.w. radio, the listener can learn about the peoples of other countries and continents, their customs and their policies. To high school students, it offers a chance for excellent workable lessons in languages as well as an opportunity to

learn the music and habits of people in far-distant lands.

The DX'ing hobby enables some to further themselves in life. It supplies the means of meeting new friends, a few of which will prove to be life-long ones. And, if nothing else, it provides countless hours of pleasure and relaxation.

**About Receivers.** No license is required to operate a receiver, and you don't have to own one that costs a small fortune. There are many relatively low-priced receivers on the market between \$60 and \$150 that are ideal for one who is new in the hobby. Later on, of course, if you wish to continue SWL'ing and feel that you can afford a better receiver, you'll find them in all price ranges.

A number of our teen-age readers have written to tell us how they earned the money necessary to purchase a new receiver. With even younger DX'ers (and there are many of them), obtaining a good receiver presents a problem. Before you talk your parents into investing a lot of money in a communications-type receiver, try DX'ing on an old radio that you have in your house. I'll bet that you can find one in your attic or storage room that your folks put there when TV came into being.

You youthful DX'ers will be surprised at  
(Continued on page 110)



**Stuart Fidler**, who operates from Jordan, N. Y., is a regular contributor to our short-wave column.



# AFTER CLASS

Special Information on Radio, TV,



Radar and Nucleonics

## SOME NOVEL GLOW LAMP CIRCUITS

VIRTUALLY EVERYONE has seen miniature glow lamps used as pilot lights . . . you may even have experimented with small neon lamps as relaxation oscillators in simple electronic metronomes and stroboscopes. But few people know that these startling little tubes can outperform vacuum tubes in certain specialized applications. Many huge computers rely on them.

The unique behavior of gas-filled glow lamps may be traced to the process of ionization. An inert gas like helium or argon is ordinarily non-conductive and emits no light. Even when a low voltage is applied across a pair of electrodes enveloped in an atmosphere of one of these gases, nothing seems to happen. But when the applied potential rises above a certain critical value, the gas ionizes suddenly, becoming a relatively good conductor.

**Characteristics.** Typical glow lamp characteristics are as follows:

(a) A glow lamp does not carry a substantial current until the voltage applied across its terminals reaches an ionization potential. This critical voltage depends upon the nature and pressure of the gas with which the bulb is filled. Most miniature bulbs utilize neon.

(b) After ionization, the gas becomes a good conductor and a large current can flow, unless limited by a series resistor.

(c) To extinguish the lamp, the voltage must be dropped well below the ionization potential.

(d) During normal conduction, the glow lamp maintains a fairly constant voltage across its terminals even though the source voltage changes appreciably.

(e) Ionization potential for a given glow lamp depends on the presence or absence of light, gamma rays and other types of radiation, electrostatic or electromagnetic fields.

(f) Glow lamps have a tendency to "run away." Once ionization has taken place, the current through the lamp attempts to increase without limit—unless a limiting resistor is connected in series with the lamp. This runaway characteristic results in an arc across the electrodes.

**Blown Fuse Indicator.** One of the most useful applications of the miniature glow

lamp type NE-2 or NE-51 appears in Fig. 1. It is shown connected across a fuse, protected from the runaway condition by a series-limiting resistor ( $R$ ). As long as the fuse is good, the lamp is extinguished. Should the fuse melt and open the circuit, the full potential across the neon bulb will cause it to glow.

To calculate the approximate resistance required for an NE-2 or NE-51 bulb in this circuit, use the following equation:

$$R = V_{f0}/0.0025$$

where  $R$  is the resistance in ohms and  $V_{f0}$  is the voltage across NE-2 with the fuse open.

**Dual Voltage Indicator.** Two miniature glow lamps may be connected as shown in Fig. 2 to serve as dual voltage indicators. Such an arrangement is especially useful in audio circuits to establish

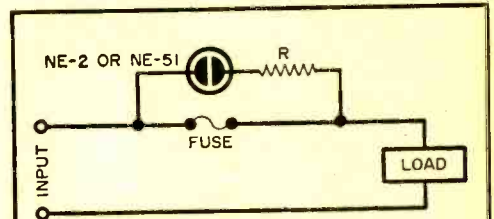


Fig. 1. Blown fuse indicator circuit.

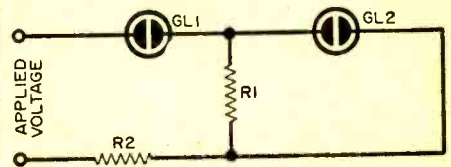


Fig. 2. Dual voltage indicator circuit using two NE-2 or NE-51 tubes.

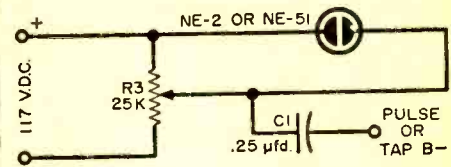


Fig. 3. Glow tube memory circuit.

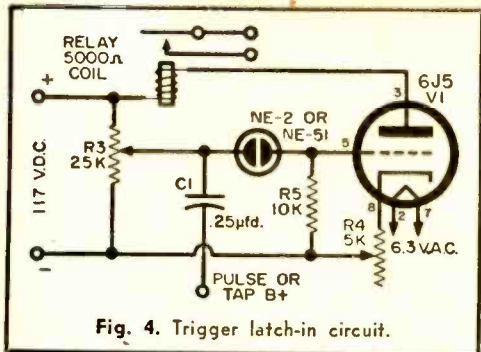


Fig. 4. Trigger latch-in circuit.

minimum and maximum voltages necessary for recording, monitoring, and playback.

GL1 glows each time the applied voltage reaches or exceeds about 70 volts, the rated ionization potential for these small lamps; resistors R1 and R2 comprise a voltage divider which is adjusted so that GL2 glows only when the applied voltage exceeds a higher value by some predetermined amount. The glow voltage for GL2 is set by choosing values for R1 and R2. Choose the voltage at which GL2 is to ignite and call this E. Then R1 and R2 may be approximately determined from the following equations:

$$R1 = E/0.0025$$

$$R2 = 50,000 - R1$$

For example, suppose that you want GL2 to glow when the applied voltage reaches 100 volts. GL1 will ignite at 70 volts as previously stated. So the approximate values for the resistors required are:

$$R1 = 100/0.0025 = 40,000 \text{ ohms}$$

$$R2 = 50,000 - 40,000 = 10,000 \text{ ohms.}$$

**Memory Circuit.** If R3 in Fig. 3 is adjusted to the point where the NE-2 just fails to ignite, i.e., at about 65 to 68 volts, a short negative pulse applied through the 0.25-µfd capacitor (C1) will cause the tube to ionize. Even when the pulse disappears, the tube will continue to conduct the cur-

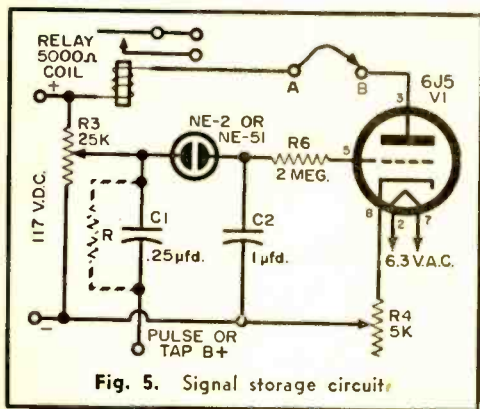


Fig. 5. Signal storage circuit.

rent as indicated by its sustained glow.

This phenomenon is explained by referring to characteristic (c) as given previously. The pulse raises the voltage applied to the glow lamp enough to trigger the ionization process; then, upon removal of the pulse, the voltage drops back to its former value of 65 to 68 volts. But the lamp is already ionized so that it does not extinguish since the applied voltage is now well over the *de-ionization potential*.

Thus, the glow lamp "remembers" that a pulse has been received and can impart this information to other circuits of a computer or data processor.

**Trigger Latch-In Circuit.** It is often desirable to have a short-lived pulse operate and latch in an ordinary relay. This is accomplished in the circuit of Fig. 4.

The 5000-ohm potentiometer (R4) is adjusted so that the plate current of the 6J5 is well below the point needed to pull in the relay with the glow lamp extinguished. It is assumed that R3 has been set as in the previous example (to about 65 volts or just below ionization potential for an NE-2 or NE-51). Now a pulse applied through C1 will ignite the glow lamp.

Current thus flows through R5 in such a direction as to make the grid more positive. Hence, the plate current increases and the relay pulls in. It remains that way until the neon lamp is extinguished, and is ready for the next pulse which again causes the latch-in operation.

**Signal Storage Circuit.** If the circuit in Fig. 4 is altered to include two more components (C2 and R6), the system becomes a signal storage circuit (see Fig. 5). Now an incoming pulse triggers the glow lamp for an instant, causing a stored charge to appear on the 1.0-µfd grid capacitor (C2). The polarity of the stored charge is such as to permit a relatively high plate current to flow in the 6J5 if point A is jumped or otherwise connected to point B within a few hours after the pulse is originally received.

This is a storage circuit which provides relay operation any reasonable length of time after acceptance of a pulse; the capacitor remembers the arrival of the pulse and transfers the information to the relay when the latter's circuit is closed. If the leakage across C2 is high, the pulse will be "remembered" only as long as the charge remains on the capacitor. This feature of eventual "forgetting" is also used in certain types of computers.

The reader's attention is called to resistor R in Fig. 5. If R is omitted, the storage circuit will react to pulses of slow repetition rate but not to rapidly recurring ones. This effect is due to the charge

(Continued on page 94)





NOW... there's a  
**GARRARD**  
 Auto-Manual  
 Record Changer  
 for every  
 hi-fi system



*World's Finest*  
 RECORD PLAYING EQUIPMENT  
 from Manual Players to  
 Professional Transcription  
 Turntables

New  
**RC 88**  
*Deluxe Changer*  
**\$54<sup>50</sup>**  
 net

Full manual and automatic positions. True-turret drive...uses no belts. 4-pole "Induction Surge" motor. Fool-proof Garrard Pusher Platform.



New  
**RC 121**  
*Mixer Changer*  
**\$42<sup>50</sup>**  
 net

Garrard's most compact, economical changer - fits any cabinet. Simpli-Mix Operation permits stacking all record sizes together. 4-pole motor. Manual position.



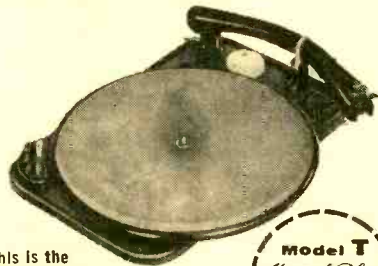
New  
**RC 98**  
*Super Changer*  
**\$67<sup>50</sup>**  
 net

All RC 88 features, including full manual position and true-turret drive, PLUS continuous + or - variable speed control on all 3 speeds.



**301**  
*Turntable*  
**\$89<sup>00</sup>**  
 net

Supreme in its class. Individual card gives performance measurements for each unit. Dynamically balanced cast aluminum turntable. Heavy-duty 4-pole shaded motor.



**Model T**  
*Manual Player*  
**\$32<sup>50</sup>**  
 net

This is the answer for a quality budget system. Incorporates all record playing features of the famed RC 80 record changer. 4-pole motor; automatic stop.

**MAIL THIS COUPON TODAY**

All Garrard and other B.I.C. components are illustrated and described fully in the B. I. C. High Fidelity Plan Book, a useful guide in planning any hi-fi system.  
 A quality-endorsed product of the B.I.C. Group



To: British Industries Corporation Dept. GC-357  
 Port Washington, N. Y.  
 Please send B.I.C. High Fidelity Plan Book.

Name \_\_\_\_\_  
 Address \_\_\_\_\_  
 City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

# Sound Impressions

**T**HE DISCOVERY of new musical personalities is one of the most exciting rewards for the hi-fi hobbyist and record collector. London Records' new International Label now brings us several outstanding discs of its French affiliate, Ducretet-Thomson. These releases frequently feature Desiré Inghelbrecht, an outstanding conductor of the Paris radio, and are recorded by M. Charlin, a French audio engineer with a distinctly personal touch.

Inghelbrecht's version of Debussy's *La Mer* (Ducretet DTL 93017) is a convincing evocation of the sea in its varying moods—alternating between dreamy mist, whipping storm, and sunlit brilliance. *Iberia*, on the flip side, is an orchestral reminiscence of Debussy's trip to Spain, pervaded by hints of fervid rhythm and flashes of sensuous melody, culminating in a finale of festive joy. M. Charlin, the recording engineer, achieved a true replica of the Paris orchestra's softly luminous sound.

A profound musical experience awaits you with Gabriel Faure's *Requiem* as recorded on Ducretet DTL-93083. Inghelbrecht brings forth this supremely beautiful music of quiet consolation with a tender reverence rarely heard in today's music making. The engineer's musical understanding prevented him from letting the vocal soloists obtrude into the acoustic foreground and thus mar the subdued atmosphere of this music. Instead, their

voices seemingly float in from some distant nowhere, weightless, hovering in the orchestral blend. Here we have a fine example of the engineer's entering into the spirit of the music. With his microphones and dials, M. Charlin leads us to the heart of the musical matter as surely as M. Inghelbrecht's baton.

**Triple-Threat Man.** Here at home, Leonard Bernstein does triple duty as composer, conductor and commentator in a venturesome series for Columbia.

The first saucy blare of his *Fancy Free* (Columbia CL-920) brashly announces his dramatic bite as a composer in the American idiom, as he leads the orchestra with assurance and verve through tricky rhythmic paces depicting three sailors on a spree.

In addition to conducting his own work, Bernstein leads the players on a snappy jaunt to Aaron Copland's *El Salon Mexico*, and into the imaginative realm of Darius Milhaud's *La Creation du Monde*. Copland picked up Mexican folk themes, weaving them into orchestral impressions of a big lively barroom in Mexico City. Milhaud uses the idiom of early jazz to suggest the languid "blues" of the yet undivided waters as well as the feeling of primeval force implicit in the title "The World's Creation."

The term "commentator" is hopelessly inadequate to describe what Bernstein does on *What Is Jazz* (Columbia CL-919). He explains, demonstrates, plays, sings, and cues performances by some of jazz's top personalities, including blues singer Bessie Smith and trumpeter Louis Armstrong. By the time he's through, you are amazed, delighted, and a lot wiser regarding the music and lyrics of jazz music in all its styles and variations. Originally performed for television's "Omnibus" show, *What Is Jazz* combines intelligent and brilliantly executed program material with the many mixings, dubbings, and other audio tricks at the command of the studio technician. The result is enlightening as a lecture and entertaining as a good show.

A somewhat similar production is Bernstein's musical explanation of Beethoven's *Fifth Symphony* (COL CL-918). On this record, he traces the numerous revisions made by Beethoven in his score until the master achieved the final themes, orches-

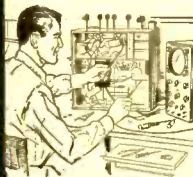
(Continued on page 94)



Leonard Bernstein has recorded two of his Omnibus television programs for Columbia Records.



# HEATHKITS . . . are fun to build, and you save by dealing directly with the manufacturer!



It's easy to follow simple step-by-step directions with large pictorial diagrams as your guide. You save labor costs and get more real quality for less money. Your greatest dollar value in fine kit-form equipment.

## BUDGET YOUR PURCHASE . . .

We invite you to take advantage of the HEATH TIME PAYMENT PLAN on any order amounting to \$90 or more. Just 10% down, and the balance in twelve easy monthly payments. Write for complete details.



*Largest selling VTVM  
in the world!  
. . . etched circuit board*

### HEATHKIT VACUUM TUBE VOLTMETER KIT

Sensitivity and reliability are combined in the V-7A. It features 1% precision resistors, large 4½" panel meter, and etched circuit boards. AC (RMS) and DC voltage ranges are 0-1.5, 5, 15, 50, 150, 500 and 1500. Peak-to-peak AC ranges are 0-4, 14, 40, 140, 400, 1400 and 4000 volts. Ohmmeter ranges provide multiplying factors of X1, X10, X100, X1000, X10K, X100K and X1 megohm.

MODEL V-7A

**\$24.50**

Shpg. Wt. 7 lbs.

\$2.45 DWN.

\$2.06 MO.



*New  
improved . . .  
full 5" size  
. . . etched  
circuit  
for only*

**\$42.50**

Shpg. Wt. 21 lbs.

\$4.25 DWN.

\$3.97 MO.

MODEL OM-2

### HEATHKIT 5" PUSH-PULL OSCILLOSCOPE KIT

This new and improved oscilloscope sells for less than the previous model. You can have a full 5" oscilloscope at the remarkably low price of only \$42.50. The OM-2 provides wider vertical frequency response, extended sweep generator coverage, and increased stability. Vertical channel is essentially flat to over 1 MC, and down only 6 DB at 1.5 MC. The sweep generator functions from 20 CPS to over 150 KC. Amplifiers are push pull, and modern etched circuits are employed in critical parts of the circuit. A 5BP1 cathode ray tube is used. The scope features external or internal sweep and sync, one volt peak-to-peak reference voltage, three-position step attenuated input, adjustable spot shape control, and many other "extras."



*Compact, portable . . .  
a favorite in the home  
and in the service shop*

### HEATHKIT HANDITESTER KIT

Measures AC or DC voltage at 0-10, 30, 300, 1000, and 5000 volts. Direct current ranges are 0-10MA and 0-100MA. Ohmmeter ranges are 0-3000 and 0-300,000 ohms. Sensitivity is 1000 ohms/volt. Features small size and rugged construction in sleek black bakelite case.

MODEL M-1

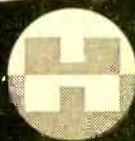
**\$14.50**

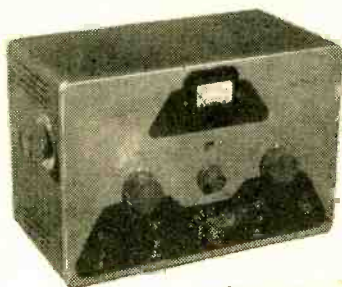
Shpg. Wt. 3 lbs.

\$1.45 DWN.

\$1.22 MO.

**HEATH COMPANY • BENTON HARBOR 10, MICH.**  
*A Subsidiary of Daystrom, Incorporated*





**BRAND NEW MODEL**

**HEATHKIT**

**CW TRANSMITTER KIT**

Here is a straight-CW transmitter that is one of the most efficient rigs available today. It is ideal for the novice, and even for the advanced-class CW operator. This 50 watt transmitter employs a 6DQ6A final amplifier, a 6CL6 oscillator, and a 5U4GB rectifier. It features one-knob band switching to cover 80, 40, 20, 15, 11 and 10 meters. It is designed for crystal excitation, but may be excited by an external VFO. A pi network output circuit is employed to match antenna impedances between 50 and 1000 ohms. If you appreciate a good signal on the CW bands, this is the transmitter for you!

MODEL DX-20

\$3.60 DWN.,  
\$3.02 MO.

**\$35<sup>95</sup>**

Shpg. Wt. 18 lbs.



MODEL SG-8

**\$19<sup>50</sup>**

\$1.95 DWN.,  
\$1.64 MO.

Shpg. Wt. 8 lbs.

**POPULAR WITH SERVICEMEN  
HEATHKIT**

**RF SIGNAL GENERATOR KIT**

Produces RF signals from 160 KC to 110 MC on fundamentals on 5 bands, and covers 110 MC to 220 MC on calibrated harmonics. Output may be pure RF, RF modulated at 400 CPS, or audio at 400 CPS. Prealigned coils eliminate the need for calibration after completion.



MODEL AR-3

**\$29<sup>95</sup>**

**HAM BANDS  
CLEARLY MARKED**

incl. Fed. Excise Tax  
(less cabinet)  
Shpg. Wt. 12 lbs.

\$3.00 DWN.,  
\$2.52 MO.

**HEATHKIT COMMUNICATIONS-TYPE**

**ALL BAND RECEIVER KIT**

This receiver covers 550 KC to 30 MC in 4 bands, and is ideal for the short wave listener or beginning amateur. It provides good sensitivity and selectivity, combined with good image rejection. Amateur bands clearly marked on illuminated dial scale. Employs transformer-type power supply — electrical bandspread — antenna trimmer — separate RF and AF gain controls — noise limiter — head-phone jack — and automatic gain control. Built in BFO for CW reception.

**CABINET:** Fabric-covered cabinet with aluminum panel as shown. Part 91-15A. Shipping wt. 5 lbs., \$4.95 incl. Fed. Ex. Tax, \$.50 dn., \$.42 mo.



**FULL SET OF COILS  
INCLUDED WITH KIT  
HEATHKIT GRID DIP  
METER KIT**

An instrument of many uses for the ham, experimenter, or serviceman. Useful in locating parasites, neutralizing, determining resonant frequencies, etc. Covers 2 MC to 250 MC with prewound coils. Use to beat against unknown frequency, or as absorption-type wavemeter.

MODEL GD-1B

**\$19<sup>95</sup>**

\$2.00 DWN.,  
\$1.68 MO.

Shpg. Wt. 4 lbs.

**HEATH COMPANY • BENTON HARBOR 10, MICH.**  
*A Subsidiary of Daystrom, Incorporated*





**EASY TO BUILD**  
**... A "LEARN-BY-DOING" EXPERIENCE**  
**HEATHKIT BROADCAST BAND**  
**RECEIVER KIT**

You need no previous experience to build this table-model radio. It covers 550 KC to 1620 KC and features good sensitivity and selectivity. A 5½" speaker is employed, along with high-gain miniature tubes and a new rod-type antenna. The power supply is transformer-operated. The kind of a set you will want to show off to your family and friends. Construction is simple. You "learn by doing" as the project moves along.

**CABINET:** Fabric-covered plywood cabinet as shown. Shipping Wt. 5 lbs., .50 dwn., .42 mo., part No. 91-9A. \$4.95 incl. Fed. Excise Tax.



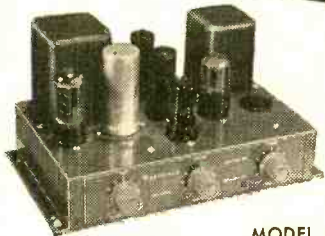
MODEL BR-2

**\$18<sup>95</sup>**

incl. Fed.  
Excise Tax  
(less cabinet)

\$1.90 DWN.,  
\$1.59 MO.

Shpg. Wt. 10 lbs.



incl. Fed.  
Excise Tax  
\$1.80 DWN.,  
\$1.51 MO.

MODEL A-7D

**\$17<sup>95</sup>**

Shpg. Wt. 10 lbs.

**REAL HI-FI PERFORMANCE**  
**AT MINIMUM COST**  
**HEATHKIT 7-WATT**  
**AMPLIFIER KIT**

This 7-watt amplifier is more limited in power than other Heathkit models, but still qualifies for high fidelity, and its capabilities exceed those of many so called "high fidelity" phonograph amplifiers. Using a tapped-screen output transformer, the model A-7D provides a frequency response of ± 1½ DB from 20 to 20,000 CPS. Total distortion is held to surprisingly low level. The output stage is push-pull, and separate bass and treble tone controls are provided.

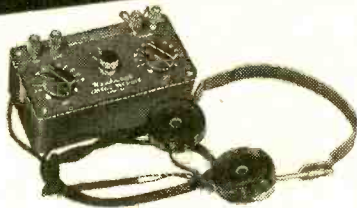
Model A-7E: Similar to the A-7D except that a 12SL7 tube has been added for preamplification. Features two inputs, RIAA compensation, and extra gain. \$20.35, incl. Fed. Excise Tax, \$2.04 dwn., \$1.71 mo.

MODEL CR-1

**\$7<sup>95</sup>**

incl. Fed.  
Excise Tax  
Shpg. Wt. 3 lbs.

\$.80 DWN.,  
\$.67 MO.



... INTERESTING PROJECT FOR ALL AGES

**HEATHKIT**  
**CRYSTAL RECEIVER KIT**

The crystal radio of dad's day is back again, but with big improvements! Sealed diode eliminates "cats whisker." Uses two high-Q tank circuits to tune 540 to 1600 KC. No external power required. Easy to build.

**FOR AMATEUR OR PROFESSIONAL**  
**PHOTOGRAPHERS**  
**HEATHKIT**  
**ENLARGER**  
**TIMER KIT**



MODEL ET-1

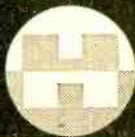
**\$11<sup>50</sup>**

Shpg. Wt. 3 lbs.

\$1.15 DWN.,  
\$.97 MO.

This is an easy-to-build device for use by photographers in controlling their enlarger. It covers the range of 0 to 1 minute with a continuously variable control. Handles up to 350 watts. Timing cycle controlled electronically for maximum accuracy.

**HEATH COMPANY • BENTON HARBOR 10, MICH.**  
**A Subsidiary of Daystrom, Incorporated**



**NEW EDGE-LIGHTED  
TUNING DIAL FOR  
IMPROVED READABILITY**

**HEATHKIT HIGH FIDELITY  
FM TUNER KIT**

This FM tuner can provide real hi-fi performance at an unbelievably low price level. Covering 88 to 108 MC, the modern circuit features a stabilized, temperature compensated oscillator, AGC, broad-banded IF circuits, and better than 10 UV sensitivity for 20 DB of quieting. A ratio detector is employed for high efficiency, and all transformers are prealigned, as is the front end tuning unit. A new feature is the edge-lighted dial for improved readability, and a new dial cord arrangement for easier tuning. Matches the models WA-P2 and BC-1. Easy to build.

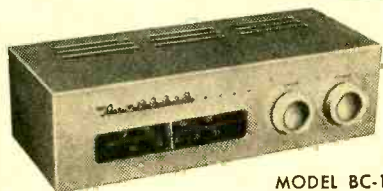


MODEL FM-3A

**\$25<sup>95</sup>**

*incl. Fed.  
Excise Tax  
(with cabinet)  
Shpg. Wt. 7 lbs.*

**\$2.60 DWN.,  
\$2.18 MO.**



MODEL BC-1

**\$25<sup>95</sup>**

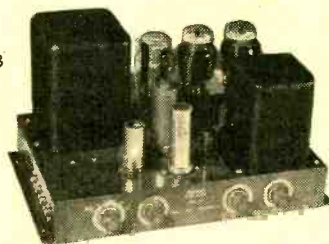
*incl. Fed. Excise  
Tax (with cabinet)  
Shpg. Wt. 8 lbs.*

**\$2.60 DWN.,  
\$2.18 MO.**

**NEW EDGE-LIGHTED TUNING  
DIAL. MATCHES MODEL FM-3A**

**HEATHKIT BROADBAND  
AM TUNER KIT**

The BC-1 was designed especially for high fidelity applications. It features a low-distortion detector, broad band IF's, and other characteristics essential to usefulness in hi-fi. Sensitivity and selectivity are excellent, and audio response is within  $\pm 1$  DB from 20 CPS to 2 KC, with 5 DB of pre-emphasis at 10 KC to compensate for station rolloff. 6 DB signal to noise ratio at 2.5 UV. Covers 550 to 1600 KC. RF and IF coils are prealigned, and the power supply is built in. Features AVC, 2 outputs, and 2 antenna inputs. Tuning dial is edge-lighted for high readability.



MODEL A-9B

**\$35<sup>50</sup>**

*Shpg. Wt.  
23 lbs.*

**\$3.55 DWN.,  
\$2.98 MO.**

**FULL 20 WATTS FOR PA  
OR HOME APPLICATIONS**

**HEATHKIT 20-WATT  
AMPLIFIER KIT**

This high-fidelity amplifier features full 20-watt output using push pull 6L6 tubes. Built-in preamplifier provides 4 separate inputs, selected by a panel-mounted switch. It has separate bass and treble tone controls, each offering 15 DB boost and cut. Output transformer is tapped at 4, 8, 16, and 500 ohms. Designed primarily for home installation, but used extensively for public address applications. True high-fidelity performance with frequency response of  $\pm 1$  DB from 20 CPS to 20,000 CPS. Total harmonic distortion only 1% (at 3 DB below rated output).

**HEATH COMPANY • BENTON HARBOR 10, MICH.**  
*A Subsidiary of Daystrom, Incorporated*



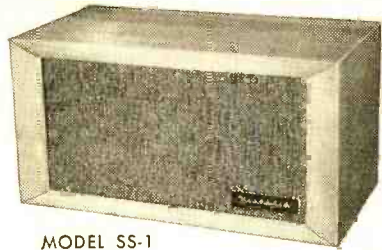


FEATURES GOOD LOOKS

AND HIGH PERFORMANCE

**HEATHKIT HIGH FIDELITY  
SPEAKER SYSTEM KIT**

The model SS-1 covers 50 to 12,000 CPS within  $\pm 5$  DB, and can fulfill your present needs, and still provide for the future. It uses two Jensen speakers and has a cross-over frequency of 1600 CPS. The speaker system is rated at 25 watts, and the impedance is 16 ohms. The enclosure is a ducted-port bass reflex type and is most attractively styled. It is easy to build and can be finished in light or dark stain to suit your taste.



MODEL SS-1

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

\$4.00 DWN.,  
\$3.36 MO.

Shpg. Wt. 30 lbs.



MODEL SS-1B

**\$99<sup>95</sup>**

\$10.00 DWN.,  
\$8.40 MO.

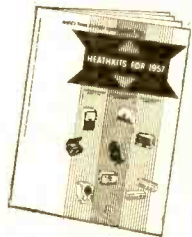
Shpg. Wt. 80 lbs.

ATTRACTIVE STYLING  
MATCHES MODEL SS-1  
HEATHKIT HIGH FIDELITY  
**RANGE EXTENDING  
SPEAKER SYSTEM KIT**

The SS-1B is designed especially for use with the model SS-1. It consists of a 15" woofer and a compression-type super tweeter to add additional frequency coverage at both ends of the spectrum. Cross-over frequencies are 600, 1600, and 4,000 CPS. Together, the two speaker systems provide output from 35 to 16,000 CPS within  $\pm 5$  DB. The kit is easy to assemble with precut and predrilled wood parts. Power rating is 35 watts, and impedance is 16 ohms.

**Free 1957 CATALOG**

Our new 56-page 1957 catalog describes more than 75 different kit models for experimenters, hams, students, engineers, industrial laboratories, etc. Send for your free copy now!



**HOW TO ORDER**

It's simple — just identify the kit you desire by its model number and send your order to the address listed below. Or, if you would rather budget your purchase, send for details of the Heath Time Payment Plan!

**ORDER  
BLANK**

**HEATH COMPANY • BENTON HARBOR 10, MICH.**

*A Subsidiary of Daystrom, Incorporated*

Name \_\_\_\_\_

Address \_\_\_\_\_

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

**SHIP VIA**

- Parcel Post
- Express
- Freight
- Best Way

Quantity	Item	Model No.	Price

Enclosed find  check  money order for \$\_\_\_\_\_. Please ship C.O.D.  postage enclosed for \_\_\_\_\_ lbs. On express orders do not include transportation charges — they will be collected by the express

agency at time of delivery. On parcel post orders include postage for weight shown. Orders from Canada and APO's must include full remittance. NOTE: All prices subject to change without notice.

POSTAGE

TOTAL

# POPULAR SAMS BOOKS FOR THE EXPERIMENTER • AMATEUR • TECHNICIAN



## USE THIS HANDY ORDER FORM

- Hi-Fi Handbook.** The new book for everyone interested in Hi-Fi design, selection and installation. Covers sound theory, distortion, loudspeakers, baffles, enclosures, amplifiers, pre-amplifiers, controls, etc. Invaluable hints on equipment selection, program sources, speaker location, etc. 240 pages, 5½ x 8½. . . . **\$3.00**
- Transistors.** The first complete, practical book on Transistors and their application in TV-Radio-Electronics. Explains theory, circuitry, installation, testing techniques and servicing. 100 pages; 5½ x 8½"; illustrated. . . . **\$1.50**
- So You Want to Be a Ham.** Shows you how to get your license and acquire equipment. Covers: Conquering the Code, Getting Your Ticket, Going on the Air, etc. 196 pages; 5½ x 8½"; illustrated. . . . **\$2.50**
- Basic Radio Manual.** Complete course covers theory, definitions, components. Includes section on actual projects that translate theory into practice. 248 pages; 8½ x 11"; illustrated. . . . **\$5.00**
- Basic TV Manual.** Covers all phases of TV set operation and design from picture tube to antenna. Includes project section demonstrating theory in action. 312 pages; 8½ x 11"; illustrated. . . . **\$5.00**
- Atomic Radiation, Detection and Measurement.** Helps you understand nuclear science and its applications. Covers circuitry and operation of all types of detection devices. 200 pages; 5½ x 8½". . . . **\$3.00**
- Electronic Metal Locators.** Explains how Metal Locators operate, describes commercial types, shows how to build locators. Describes uses in industry, for prospecting and for mine detection. Complete coverage of the subject. 124 pages; 5½ x 8½"; fully illustrated. . . . **\$2.50**
- Radio Receiver Servicing.** Covers all basic receiver types—gives time-saving hints for solving common troubles, such as dead set, weak set, noisy set, etc. 192 pages; 5½ x 8½"; illustrated. . . . **\$2.50**
- Tape Recorders.** Explains recorder theory, tape characteristics, how recorders work; covers motorboard mechanism, drive motors, volume indicators, bias oscillators, amplifiers, magnetic heads, equalization circuits. 176 pages; 5½ x 8½"; illustrated. . . . **\$2.75**

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

Order from any Radio & TV Supplier-Wholesaler, or mail to Howard W. Sams & Co., Inc., Dept. 14-C7, 2201 E. 46th St., Indianapolis 5, Ind.

Send books checked above. My (check) (money order) for \$..... is enclosed.

Name .....

Address .....

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

(outside U.S.A. priced slightly higher)

## Sound Impressions

(Continued from page 88)

trations, and rhythms that combine to give the listener a sense that his final version is as "right as rain." The reverse side of the disc contains a dramatic performance of the symphony—complete and uninterrupted—by the New York Philharmonic conducted by Bruno Walter.

**Balkan Surprise.** Hunting new talent for our turntables, Vanguard Records made a prize catch. Invading the far reaches of Yugoslavia with their sound truck, they discovered the Solisti di Zagreb, a chamber orchestra with an incomparable blend of sweetness and precision, zest and flexibility. Playing Mozart *Divertimenti* (Vanguard VRS-482), they can round off a pointed phrase without losing a feeling of sharpness. This sprightly music lends itself rewardingly to either casual listening for relaxation or concentrated listening for musical value. The size of the string orchestra—halfway between chamber music and symphony—is ideal for the average living room at moderate volume level, especially in this clear and vibrant recording.

**Southern Style Choirs.** Folk songs and other music of a regional character have lately been much worked over. Performance styles range from the natural, untrained voice of a young soloist accompanying himself on a guitar to the polished arrangements of professional choral groups.

A recent example of the latter style is *Songs of the South* (Columbia CL-860) done by the Norman Luboff Choir. The selections cover a scattered variety, designed to appeal to as many listeners as possible. Several of the renditions have a somewhat breathy, husky quality which, combined with the slow tempo, emphasizes the solid bass foundation of the Luboff group.

-30-

## After Class

(Continued from page 86)

which appears across *C1*, a charge which dissipates itself through the capacitor leakage. To make the circuit responsive to fast pulses, *R* may be added. The speed of reaction will then be governed by the size of *R*; the higher the resistance, the slower the action.

For the reader who wants to set up these circuits experimentally, it is suggested that the pulse be obtained directly from the power supply. By tapping the "pulse" end of *C1* on the B+ terminal, a sufficiently large surge current passes through the capacitor for the desired effect.

-30-



# Get Yours FREE... Today



AMAZING  
DFF\* TESTER  
CARD LETS YOU TEST  
NEEDLE AT HOME



FREE INFORMATIVE  
BOOK EXPLAINS FULL  
STORY OF NEEDLES  
AND UNCANNY DFF\*  
TELLS HOW IT WORKS



CAN TELL  
IF NEEDLE  
IS RUINING  
YOUR  
RECORDS

DON'T EVEN  
REMOVE NEEDLE  
FROM CARTRIDGE

ALL FREE  
FROM  
DUOTONE  
MAIL TODAY

INCREDIBLE - CAN SAVE WHOLE  
RECORD COLLECTION

*DUOTONE FIDELITY FOCUS*

**FREE** DUOTONE COMPANY INC.  
KEYPORT, NEW JERSEY

GLAD TO TAKE YOU UP ON YOUR  
FREE OFFER. PLEASE SEND BOTH  
DFF TESTER CARD AND DFF BOOK.

NAME \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

## BECOME A HAM

WITH THE GATEWAY TO

# amateur radio -



- ★ HOW TO BECOME A RADIO AMATEUR
- ★ THE RADIO AMATEUR'S LICENSE MANUAL
- ★ LEARNING THE RADIOTELEGRAPH CODE
- ★ OPERATING AN AMATEUR RADIO STATION

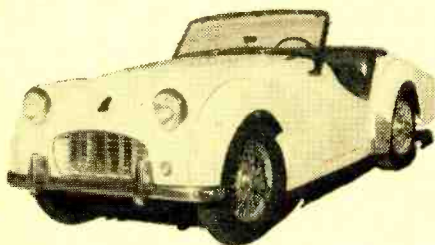
Starting out in amateur radio you will find these publications a necessary part of your reading and studying for the coveted amateur radio operator's ticket. Written in clear, concise language, they help point the way for the beginner. Tried and proven by thousands upon thousands of amateurs, these ARRL publications are truly the "Gateway to Amateur Radio."

Only **\$1.50** For All Four  
Postpaid Booklets

AMERICAN RADIO RELAY LEAGUE, Inc.  
West Hartford 7, Connecticut

Name.....  
Street.....  
City.....State.....  
Cash.....Check.....Money Order.....

RIDE HOME  
FROM THE  
PHOTO SHOW  
IN THIS NEW  
\$2625  
TRIUMPH TR-3!



Plan to attend the 11th Annual National Photographic Show at the New York Coliseum February 16 through 24. You'll see an exciting preview of all new photographic equipment and accessories on the market.

And, while at the show, be sure to visit POPULAR PHOTOGRAPHY Booth 64!

You could win the sleek Triumph TR-3 sports car pictured above, and ride home from the show in style. It's a car that combines sports car performance with family convenience . . . gets up to 30 miles per gallon . . . and can hit 110 mph! *Sports Cars Illustrated* calls the Triumph "the car that's unbeatable in its price class."

It can be yours free simply by entering the drawing at the POPULAR PHOTOGRAPHY booth at the photo show.

See you there!

**POPULAR PHOTOGRAPHY**

Booth No. 64

National Photographic Show

New York Coliseum

February 16-24, 1957



**WANT A BETTER JOB: BECOME AN  
ELECTRONIC ENGINEER**

ONLY 32 MONTHS TO EARN A BACHELOR OF  
SCIENCE DEGREE IN ELECTRONICS ENGINEERING  
Class enrollment limited to allow for individual instructions.  
Chartered by state of California. Nonprofit-nonsectarian, co-  
educational—established 26 years.

APPROVED FOR VETS—ENROLL NOW!

SEND FOR FREE CATALOG

**PACIFIC STATES UNIVERSITY**

1516 S. WESTERN AVE., Dept. M., LOS ANGELES, CALIF.

**Tips**

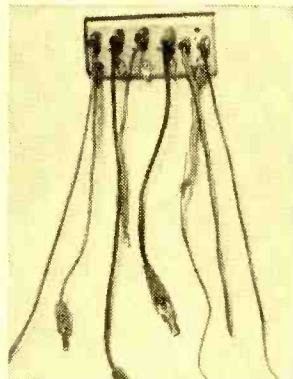
(Continued from page 32)

when either wire is touched to the binding post. (Be sure to use the same binding post.) If the picture and sound appear weaker for any single wire, the antenna is not pointed directly at the station, or there is either a broken or poor connection.

Still a third method of checking an antenna with folded dipole type elements is to use a continuity checker. With the lead disconnected from the set, check for continuity across the antenna leads. If no continuity shows, either a broken wire or connection is indicated. —C. A. P.

**STOWING TEST LEADS**

A good solution to the problem of stowing test leads out of the way without damage and still having them readily available is shown in photo. Short leads may be plugged into a vertical board mounted in a suitable location on the wall, but long leads should be hung from the ceiling straight down to prevent damage to the wire



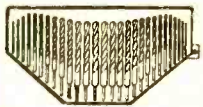
at the plug end, due to the weight of the wire. Use a No. 21 or  $\frac{9}{32}$ " drill for banana plugs, and a No. 46 or  $\frac{5}{64}$ " drill for pin type plugs. If fractional drills are used, the holes may have to be enlarged slightly, depending on the hardness of the block used. Either wood, plastic, or aluminum will make a good base. —C. R. E.

**RADIO INTERFERENCE  
IN TAPE RECORDERS**

Audio hobbyists and hi-fi fans sometimes find that their tape recorders and audio amplifiers pick up FM broadcast stations which interfere with the intended audio material to be recorded or amplified. In such instances, the equipment acts as though it had a built-in radio tuner, which is sometimes the case when the circuit constants are just right for radio reception. One remedy is to add a resistor of perhaps 10,000 ohms in series with the grid of the first stage. The resistor should be wired directly to the tube socket grid terminal or to the grid cap. Adding the resistor reduces the Q of the resonant circuit formed by the grid-to-cathode capacitance and the grid lead inductance. —E. F. C.



### Chrome Vanadium 29 Pc. DRILL SET



Specially made for speed drilling. In sturdy plastic tool roll. Finest alloy steel drills, hardened and precision ground to the sharpest, longest lasting cutting edge obtainable; will easily and cleanly bite through hardwoods, plastics, aluminum, iron and the toughest steels. Full jobber length. Sizes by \$6.49 64th from 1/16" to 1/2" ppd.

Also available with Turned Down Shanks to fit all 1/4" drills. In individual pocket roll. . . . . \$8.95 ppd.



### 60 Pc. SET WIRE GAUGE CHROME VANADIUM DRILLS

Top quality high test Chrome Vanadium Drills designed for speed drilling through toughest steels, woods, plastic, iron and aluminum. Precision ground, long lasting cutting edges. Nos. 1 through

60, A \$14.95 value—NOW \$5.40 Same set above available with Huot Index container. . . . . \$6.65

Also available 61-80 set of high quality drills, in plastic kit with marked pocket for each drill. . . . . \$2.50 All above drill sets plus 35¢ pp. & hdg.



### FINEST QUALITY Imported Precision Pliers

Flat Nose, Round Nose, Diagonal, End Cutting Nippers, 1 Side Flat-1 Side Round, Snipe, Combination For Jewelers, Optical Workers, Hobbyists. These German instruments are of deep-forged, heat-treated high quality tool steel, fabricated to most exacting specifications. All joints with right tension. Jaws meet perfectly to securely hold the most delicate objects in hard-to-reach corners and angles. Each plier is 4" long.

over ground, polished to smooth hard surfaces. Smooth working joints with right tension. Jaws meet perfectly to securely hold the most delicate objects in hard-to-reach corners and angles. Each plier is 4" long.

75¢ EACH. ALL 7 FOR \$5.00 ppd.

Minimum order \$1.00. Send Check or M.O. C.O.D. plus fee. Money Back Guarantee.

### SCOTT-MITCHELL HOUSE, INC.

Dept. 703, 611 Broadway, New York 12, N. Y.

# FIRST AID FOR TV SETS!

## TV DOCTOR



YOURS TO TRY 5-DAYS FREE!

An amazing, quick copyrighted method of locating and fixing TV troubles, written especially for the novice by H. G. Cisin, noted TV educator and author.

**TUBES CAUSE 80% OF TV TROUBLES!**  
"TV DOCTOR" shows you how to quickly locate and change all defective tubes with **COMPLETE SAFETY.**

Contains just the info needed to get started in TV servicing. Shows how to diagnose and remedy most TV troubles. This applies to all make TV sets, even RCA's, Philco's or 2000 models, old and new.

Nine money-saving fact-crammed illustrated chapters include ways to combat interference and ghosts, antennas, lead-ins, ion traps, UHF, Color TV, how to read schematics, how to replace picture tubes and practical hints for prospective servicemen.

**ONLY \$1—You'll say it's worth hundreds.**

**Rush Coupon** with your name & address. Enclose \$1; 5-days to read without risk or return for refund.

**FREE: STROBOSCOPE DISC with each TV DOCTOR.**

H. G. CISIN, Consulting Eng. (Dept. P-1), Amagansett, N. Y.

Enclosed find \$1. Rush TV DOCTOR and include FREE Stroboscope Disc.

Name .....

Address .....

City .....

Zone . . . State .....



# the MOST WANTED TONE-ARM

New AUDAX in KIT form—at HALF price!

accommodates **ANY MAKE** cartridge, including the famous **AUDAX Hi-Q7**

**AUDAX KT-12: KIT, \$14.55 NET**

Factory-assembled, \$24.00 NET

**AUDAX KT-16: KIT, \$17.55 NET**

Factory-assembled, \$30.00 NET

You do-it-yourself with no tools other than a nail-file or small screwdriver.



The new KT models exactly duplicate the Audax "Compass-Pivoted" transcription arm long recognized as top "blue chip." These new arms are the crowning achievement of a quarter-century of constant refinement and re-engineering of the very first commercial electronic pickup arm (Audax 1928) . . . to the *fewest possible parts*. It is this very *nth degree engineered simplicity* that makes the new KT arms possible.

Anyone can assemble a KT arm in about 10 minutes — and save 50%! The "Selector-Index" permits instant adjustment for any stylus-pressure. The newly-designed cartridge-housing enables checking of the all-important stylus-to-groove alignment at a glance.

No tone arm equals the new Audax KT — regardless of price! Read October 1956 "Popular Electronics," page 57. See the new KT arms at your dealer. (If shipped from New York City, add 40¢ for postage.) Fill out the coupon.

Fine audio-electronic apparatus for 35 years

# Audax

**AUDAX COMPANY**  
500 Fifth Avenue, New York 36, N. Y.

**AUDAX CO.,** 500-5th Ave., New York 36, N. Y. Attn: Mr. P.

Send FREE latest catalog & name of nearest dealer.  
 Send FREE \$1.00, 22-page "ELECTRONIC PHONO FACTS" by pioneer Maximilian Weil. I enclose 25c for handling & postage.

Name .....

Address .....

City .....

Zone . . . State .....

# COMING FEBRUARY 28!

Special Hi-Fi Feature  
Issue of RADIO &  
TELEVISION NEWS!



OVER 25 PAGES, NEW HI-FI AND  
AUDIO FEATURES INCLUDING:

- EVOLUTION OF TUBE AMPLIFIERS
- CHECKING YOUR OWN HI-FI SYSTEM
- DO AMPLIFIERS SOUND DIFFERENT?
- TURNTABLE SPEED PROBLEMS
- ADDING AN FM TUNER INDICATOR
- TRIPLE-CHANNEL HI-FI AMPLIFIER
- BUILDING YOUR OWN 8" SPEAKER CABINET
- DAMPING YOUR LOUDSPEAKER SYSTEM

PLUS—all the regular features of RADIO & TELEVISION NEWS on TV, servicing, amateur radio and electronic construction.

Buy your copy of March  
RADIO & TELEVISION NEWS!  
ON SALE FEBRUARY 28  
AT ALL NEWSSTANDS.



## Transistor Topics

(Continued from page 82)

standard ferrite broadcast-band antenna coils.  $L1$  consists of 27 turns of No. 28 enamel wire scramble-wound on  $L2$ 's form.  $L4$  is made up of 31 turns of No. 28 enamel wire scramble-wound on  $L3$ .

The receiver may be assembled on an old cigar box, in a plastic case, or on a standard metal chassis. Any standard crystal diode may be used for the diode detector . . . types 1N34, 1N34A, 1N66, or 1N295 are suitable. When assembling the receiver, make sure that  $L2$  and  $L3$  are loosely coupled; this is accomplished by mounting the two coils in parallel, with approximately  $\frac{3}{4}$ " separation, center to center.

With the construction finished, the *ANT.* and *GND.* may be connected. Although you can obtain satisfactory reception of stronger local stations simply by connecting a pair of high-impedance magnetic headphones to the receiver's "output" terminals, best results are obtained if you couple the set to a standard one- or two-stage transistorized audio amplifier. Coils  $L2$  and  $L3$  are adjusted at both the "high" and "low" frequency ends of the broadcast band (use local stations near these frequencies) to obtain proper tracking across the dial. After tuning in a station, adjust  $C1$  for best reception . . . its principal effect will be to reduce the volume of stronger stations . . . on weaker stations it will be set to near full capacity.

**Wide Reception.** Basically a crystal detector followed by a two-stage common-emitter transistor amplifier, the circuit given in Fig. 1(B) was submitted by Kurt Metzger, Jr., of 880 Granger Road, Orton-

## New V.H.F. Listing

In line with our article on listening to police calls (see December, 1956, issue, page 58), we note publication of a new listing of v.h.f. industrial radio systems. Entitled "Official Registry of Radio Systems in the Industrial Services," this volume features one listing by companies, and another by operating frequencies.

Stations include fixed and mobile units in such categories as power utility, petroleum and gas pipeline, low-power industrial, special industrial, forest products, relay press and motion picture, and v.h.f. maritime. The book lists for \$5.00 and is available from Communication Engineering Book Co., Radio Hill, Monterey, Mass.



# GET IN ON THE TV

# BOOM!



L. C. Lane, B.S., M.A.  
President, Radio-Television Training Association, Executive Director, Pierce School of Radio & Television.

## TRAIN FOR A TOP-PAY JOB AS A TELEVISION TECHNICIAN NO PREVIOUS EXPERIENCE NEEDED — study AT HOME in your SPARE TIME

Next to the atom and hydrogen bombs, the biggest noise being made today is by the booming radio-television-electronics industry.

Now, while the boom is on in full force, is the time for you to think about how you can share in the high pay and good job security that this ever-expanding field offers to trained technicians.

Just figure it out for yourself. There are more than 490 television broadcasting stations operating right now

and hundreds more to be built; more than 40 million sets in the country and sales increasing daily. Soon moderately priced color television sets will be on the market and the color stampede will be on.

All these facts mean that good jobs will be looking for good men. You can be one of those men if you take advantage of my training now — the same training that has already prepared hundreds of men for successful careers in the radio-television-electronics field.

No experience necessary! You learn by practicing with professional equipment I send you. Many of my graduates who now hold down good paying technician jobs started with only grammar school training.

If you have previous Armed Forces or civilian radio experience you can finish your training several months earlier by taking my FM-TV Technician Course. Train at home with kits of parts, plus equipment to build YOUR OWN TV RECEIVER. ALL FURNISHED AT NO EXTRA COST!

After you finish your home study training in the Radio-FM-TV Technician Course or the FM-TV Technician Course you get two weeks, 50 hours, of intensive Laboratory work on modern electronic equipment at our associate school in New York City, Pierce School of Radio & Television. NO EXTRA COST.

With our TV Studio Technician Course (Advanced training for men with previous radio or TV training or experience) I train you at home for an exciting top-pay job as the man behind the TV camera. Work in the TV studios or "on location" at remote pick-ups! Optional N.Y.C. additional training.

**RADIO-FM-TV  
TECHNICIAN  
TRAINING**

**FM-TV  
TECHNICIAN  
TRAINING**

**EXTRA LABORATORY  
TRAINING IN NEW  
YORK CITY AT  
NO EXTRA COST!**

**TV STUDIO  
TECHNICIAN  
TRAINING**

**YOU GET ALL  
THESE IN THE  
BASIC COURSE**

Super-Het  
Radio Receiver

AF-RF  
Signal Generator

C-W Telephone  
Transmitter

Public Address System  
Combination Voltmeter-  
Ammeter-Ohmmeter

**LEARN BY DOING**—As part of your training I give you the equipment you need to set up your own home service shop and prepare for a BETTER-PAY JOB. You build and keep a Television Receiver designed to take any size picture tube up to 21-inch, (10-inch tube furnished. Slight extra cost for larger sizes)... also a Super-Het Radio Receiver, AF-RF Signal Generator, Combination Voltmeter-Ammeter-Ohmmeter, C-W Telephone Transmitter, Public Address System, AC-DC Power Supply. Everything supplied, including all tubes.

**EARN WHILE YOU LEARN**—Almost from the very start you can earn extra money while learning by repairing radio-TV sets for friends and neighbors. Many of my students earn enough from spare time earnings to pay for their entire training... start their own profitable service business.

**FCC COACHING COURSE**—Qualifies you for Higher Pay! Given to all my students at NO EXTRA COST. Helps you qualify for the TOP JOBS in Radio-TV that demand an FCC license! Full training and preparation at home for your FCC license.

## VETERANS!

My School fully approved to train Veterans under new Korean G.I. Bill. Don't lose your school benefits by waiting too long. Write discharge date on Postage-Free card below.

SEE OTHER SIDE

CUT OUT AND MAIL TODAY! POSTAGE FREE!

**Yours  
FREE**

NO STAMP NEEDED!  
WE PAY POSTAGE!

Dear Mr. Lane: Send me your NEW FREE BOOK and FREE SAMPLE LESSON that will show me how I can make TOP MONEY in TELEVISION. I understand I am under no obligation.

(PLEASE PRINT PLAINLY)

Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_

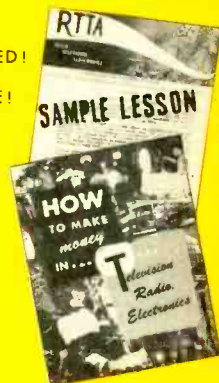
City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

I AM INTERESTED IN:

- Radio-FM-TV Technician Course
- FM-TV Technician Course
- TV Studio Technician Course
- Color-TV Course

(send me Color-TV Brochure only)

**VETERANS!**  
Write discharge date



**Radio-Television Training Association**

52 EAST 19th STREET • NEW YORK 3, N.Y.

Licensed by the State of New York  
Approved for Veteran Training

# There's a "POT of GOLD" waiting for YOU — at the end of this COLOR-TV servicing rainbow!

## Introducing RTTA's COLOR-TV TECHNICIAN COURSE

*(advanced training for men who have had radio and TV experience)*



Color television receivers will demand installation, set-up, adjustment and servicing by highly trained specialists—training and skill which you can acquire in your spare time, at home through RTTA's up-to-the-minute COLOR TELEVISION TECHNICIAN COURSE. All of the latest information and methods for the servicing and maintenance of all color TV receivers and equipment. Trains you thoroughly, accurately and reliably. You will be on a par with the best, anywhere! To qualify for this specialized training it is necessary to have had previous radio, television training or experience.

The step-by-step approach found so successful in teaching our Radio-FM-TV Course, FM-TV Technician Course and TV Studio Technician Course is used in this new, up-to-the-minute COLOR TELEVISION TECHNICIAN COURSE. With the RTTA way, you set your own pace for learning—as rapidly or as moderately as suits your own personal convenience. Lessons are written in easy-to-understand language that everyone can follow. They

are illustrated throughout enabling you to grasp the full meaning of concepts immediately.

The course begins with an introduction to the Laws of Color and defines the differences between the transmission and reception of black-and-white and of color television. Starting at the transmitter you are guided through the development of, and transmission of, the composite Color TV signal. With an over-all view of how the receiver functions each circuit is then analyzed. A knowledge of how Color TV circuits work, both as individual and as cooperative units in the receiver, prepares you for all future developments in the field of Color TV. You also receive thorough instruction on test instruments, alignment, as well as servicing. The RTTA Color TV Course features all of the latest information.

For a complete description of the course, send today for your FREE copy of the RTTA COLOR TV Course Brochure.

### SYLVANIA SELECTS RTTA's COLOR TELEVISION COURSE FOR ITS EDUCATIONAL PROGRAM

Service dealers throughout the U.S. will soon be able to learn Color Television from the best available information.

The selection of RTTA's COLOR TELEVISION COURSE by Sylvania Tube Division, one of the nation's top manufacturers of receiving tubes and picture tubes is an added assurance to you of the tremendous value of this course. We are proud of this endorsement by Sylvania. It indicates the outstanding merit of the RTTA course. We know that a company such as Sylvania which has earned its fine reputation over the

years through the high standard of its products and through leadership, would extend such recognition only after careful cooperation and examination by its staff of experts and engineers. They concluded that the RTTA course offers the best opportunity of studying Color Television on a practical basis—to learn the subject thoroughly.

The Color Television Technician Course is being made available to authorized Sylvania Dealers throughout the 48 states who are interested in expanding their knowledge and experience in Color TV servicing.



SEE OTHER SIDE

CUT OUT AND MAIL TODAY! POSTAGE FREE!

FIRST CLASS  
Permit No. 62058  
(Sec. 34.9, P. L. & R.)  
New York, N. Y.

#### BUSINESS REPLY CARD

No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY

RADIO-TELEVISION TRAINING ASSOCIATION

52 EAST 19th STREET, Dept. 56

NEW YORK 3, N. Y.

#### 14 THOROUGH LESSONS

- 1 AN INTRODUCTION TO COLOR
- 2 FORMATION OF THE COLOR SIGNALS
- 3 THE CHROMA SIGNALS
- 4 GENERAL OPERATION OF THE COLOR TELEVISION RECEIVER
- 5 PICTURE TUBES FOR COLOR TELEVISION RECEIVERS — PART I
- 6 PICTURE TUBES FOR COLOR TELEVISION RECEIVERS — PART II
- 7 DETAILED OPERATION OF THE COLOR TELEVISION RECEIVER
- 8 THE CHROMINANCE CHANNEL
- 9 COLOR TELEVISION CIRCUITS — PART I
- 10 COLOR TELEVISION CIRCUITS — PART II
- 11 ADJUSTING THE COLOR TV RECEIVER
- 12 COLOR TV TEST EQUIPMENT
- 13 TROUBLESHOOTING THE COLOR TV RECEIVER
- 14 SERVICING PROCEDURE

SEND FOR YOUR ENROLLMENT APPLICATION TODAY!



ville, Mich. With less selectivity than the first circuit, this receiver is suitable for use in areas with widely separated stations. According to Kurt, he has received local stations up to 50 miles away using only a 15'-long antenna.

All the components are standard and readily available through most suppliers. *L1* is a ferrite core Vari-Loopstick, *C1* a standard 365- $\mu$ fd. variable capacitor. Kurt used a 1N34 diode, but other standard diodes should work as well. Transistors *TR1* and *TR2* are Raytheon *p-n-p* Type CK722. *S1* is a simple s.p.s.t. toggle or slide switch; *B1* is a 22½-volt hearing aid B battery. Best results are obtained if high-impedance magnetic earphones (2000 ohms or more) are used.

**Refinements.** The circuit given in Fig. 1(C), while basically similar to Kurt's circuit, has several interesting refinements. Sent in by Thomas Finnell of 382 East 199th St., Bronx 58, N. Y., this circuit employs one transistor as a combination detector-amplifier and a second as a resistance-capacity coupled audio amplifier; the common-emitter circuit configuration is used in both stages. A step-down r.f. transformer (*L1-L2*) on the input provides a better impedance match to the transistor, thus improving selectivity, while a potentiometer (*R2*) is used between stages as a volume control.

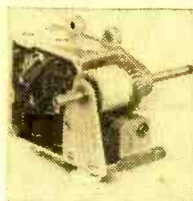
You can assemble this receiver on a small chassis, on a Masonite "breadboard," or in a wooden or plastic case. *C1* is a 365- $\mu$ fd. tuning capacitor, *L1* is a ferrite-core "loopstick" antenna coil. *L2* consists of 16 turns of litz wire, close-wound on top of *L1*. *TR1* is a Raytheon CK768 r.f. transistor, while *TR2* may be either a CK722 or CK721 unit (the latter will provide higher gain). The battery (*B1*) consists of two Burgess No. 7 penlite cells in series to supply 3 volts. S.p.s.t. switch *S1* is ganged to the volume control (*R2*). Base bias resistor *R3* should be chosen experimentally for maximum gain . . . while its nominal value is 220,000 ohms, you should try values from 100,000 to 500,000 ohms here. Use high-impedance magnetic headphones with this circuit.

While an antenna is required, a ground (*GND.*) is optional, depending on your location. According to Thomas, he picked up nine local (N. Y.) stations with good volume using the "finger stop" of a telephone dial as his antenna . . . and without a ground!

**Loudspeaker Output.** If you'd like to experiment with loudspeaker output, you might want to try the circuit shown in Fig. 1(D), sent in by Addison Nicholas, of

(Continued on page 104)

## Gear Reduction MOTORS



**DELCO 5069370** (Pictured at left.) 27 VDC Reversible PM Motor and Gear Assembly. In an aluminum case. Output speed is 80 RPM through a friction clutch to a double shaft— $\frac{1}{2}$ " x  $\frac{3}{4}$ " on one side,  $\frac{1}{4}$ " x  $\frac{1}{2}$ " on the other side. Complete Assembly Size:  $3\frac{3}{8}$ " x 2" x  $\frac{1}{4}$ " excluding shaft. Has built-in noise filter system. Weight: 1 lb. 5 ozs. **\$5.95**  
Price . . . . .

SAME MOTOR as used in above Assembly—Size:  $1\frac{1}{8}$ " x  $1\frac{1}{2}$ " x  $2\frac{1}{4}$ ". Weight: 4 oz. . . . . **\$3.95**

**General Electric 58A10AJ52**  
27 Volts @ .75 Amp. Gear reduction 145 RPM output on a  $\frac{1}{4}$ " x  $\frac{3}{8}$ " spined shaft. 14 oz. inch torque. Motor size:  $1\frac{3}{8}$ " x  $3\frac{1}{2}$ ". Weight: 8 ozs. (Pictured at right.) **\$4.95**

**General Electric 58A10AJ370**  
Gear reduction 250 RPM . . . . . **\$4.95**

**JOHN OSTER Shunt Motor B-9-1—27½ Volt DC @ .7 Amp. 5000 RPM.** Aluminum cased motor and gear assembly. Motor is flange mounted to gear case. Two gear reductions: 22 and  $5\frac{1}{2}$  RPM on  $\frac{1}{4}$ " x  $1\frac{1}{4}$ " shafts. Size:  $2\frac{3}{4}$ " x  $3\frac{3}{4}$ " x 7". Weight: 1 lb. 14 ozs. . . . . **\$3.95**  
Price . . . . .

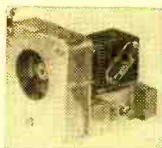


## MINIATURE BLOWERS

### MOTOR And BLOWER

**DELCO 5068571—27 Volt DC Reversible PM Motor, 6000 RPM, with Blower.** Overall Size, including Blower:  $2\frac{3}{8}$ " x  $2\frac{1}{4}$ " x 3". Weight: 9 oz. (Pictured at left.) **\$4.50**  
Price . . . . .

**DELCO 5069267—27 Volt DC 6000 RPM, 1.5 oz. inch torque, Reversible Shunt Motor.** Flange mounted. Size:  $1\frac{3}{4}$ " x  $2\frac{5}{8}$ " x 1". Flange:  $2\frac{1}{4}$ ". D. Shaft:  $\frac{1}{4}$ ". Blower Fan attached. **\$2.95**  
No. 10D267 . . . . .



**AC TO DC KIT—RECTIFIER KIT** to operate small DC Motors listed above. 115 Volt 60 cycle input; output 24 VDC 1.5 Amps. Complete with Rectifier Transformer, Wire, Terminals, Instructions, etc. . . . . **\$4.95**

**INDUCTION MOTOR—EMC 41314—110 Volt AC Induction Motor** with mounting feet. 1550 RPM through a gear reduction to 24 RPM. Right angle drive. Size: 4" x  $3\frac{1}{2}$ " x 7 $\frac{3}{4}$ ". Shaft size:  $5/16$ " x  $5/8$ " with removable Gear. Weight: 5 lb. 13 oz. **\$9.95**  
Price . . . . .

## POWERFUL MAGNETS

As pictured at right—Horseshoe Type—as used with Magnetron Radar Tubes. Ideal for locating hidden metals, lifting, and many other uses:

25 lb. Lift—Size:  $2\frac{1}{2}$ " x  $2\frac{1}{2}$ " x  $1\frac{1}{2}$ " . . . . . **\$2.95**  
75 lb. Lift—Size: 4" x  $3\frac{1}{2}$ " x 3" . . . . . **\$4.95**  
Assorted Magnets—Round and Square.  
 $1/4$ - $1/2$ -1 lb. . . . . 3 For **\$1.50**



## MINE-DETECTOR

**SCR-625—Famous Army Mine-Detector—For Prospectors, Miners, Oil Companies, Plumbers, etc.** Portable unit for locating all types of buried metal objects up to 24" or more, depending on size and ground condition. Detection by means of a cone. Operating weight approx. 15 lbs. Shipping weight approx. 40 lbs. Complete with batteries . . . . . **\$39.95**

## MICROPHONES and HEADSETS

### F-1 BUTTON CARBON MICROPHONE

As pictured at left—High Gain—May be used on desk, in car, in hand, or strapped to chest. Complete with on-off momentary switch.

**RS-38 Carbon Mic.—With PL-68 Plug.** New: **\$1.95**  
checked . . . . . Used: **\$2.50**  
**Sound Powered Mic. No cord—Used.** . . . . . **\$1.00**  
**HS-20 Headset—Hearing Aid type.** . . . . . Used: **\$1.50**  
**HS-18 Headset—4000 ohm . . . . . Used: \$1.95**  
**Sound Powered—One Headpiece only.** . . . . . Used: **\$1.00**  
**TS-10 Sound Powered Handset—Used.** . . . . . checked . . . . . **\$5.95**  
**TS-9 Handset—Push to talk switch—No Plugs.** . . . . . Used: **\$3.95** New: **\$5.95**  
**TS-13 Handset—Push to talk switch.** With PL-68 and PL-55 Plugs. . . . . Used: **\$5.95**

Address Dept. PE • 25% Deposit on C.O.D. Orders \$5.00 and over. • All Prices are F.O.B., Lima, Ohio

# FAIR RADIO SALES

132 SOUTH MAIN ST. LIMA, OHIO

# Lafayette's

## 4 AND 6 TRANSISTOR SUPERHET KITS POCKET AND HOME RADIOS FOR SPEAKER AND EARPHONE OPERATION

POCKET SIZE: 4" L x 3-5/16" W x 1" D BUILT-IN ANTENNA! REQUIRES  
NO EXTERNAL ANTENNA OR GROUND!

**KT-94**

Lafayette engineers have designed this fascinating 4-transistor superhet receiver kit in a unique and interesting form. It is, by itself, a completely self-contained, pocket sized personal portable set which operates a miniature earpiece so only you can hear; by plugging into the KT-94 kit listed below, it is instantly converted to a full 6-transistor home radio, complete with speaker for the entire family to enjoy. The set is completely subminiaturized and utilizes the new, radically different Argonne "Poly-Vari-Con" ultra miniature 2-gang variable condenser. You will be delighted with the truly subminiature parts, from the variable which measures only 1-1/16" square x 3/8" deep, to the tiny I.F.'s and electrolytics. The chassis measures only 4" L x 3-5/16" W x 1" D. You'll be amazed at its performance. Circuit features use of 4 transistors (2 high frequency and 2 audio type) plus a germanium diode, 2 I.F. stages and built-in high gain ferrite core and antenna. The result is a sensitive, stable and selective set covering the entire broadcast band. Requires no outside antenna or ground connection. The kit is furnished complete with transistors and all parts, including battery and chassis already drilled and punched. The earpiece and carrying case are accessory items, not supplied. All necessary pictorial and circuit diagrams are furnished with simple, easy-to-follow instructions. Shpg. wt., 2 lbs.



**19.95**

- KT-94 Kit ..... Net 19.95
- MS-311 LEATHER CARRYING CASE ..... Net 1.95
- MS-260 Super power dynamic earpiece ..... Net 3.95
- MS-278 Economy earpiece ..... Net 1.95

**KT-96**

## 2-TRANSISTOR CLASS B PUSH PULL OUTPUT STAGE KIT WITH SPEAKER SELF-CONTAINED IN BEAUTIFUL PLASTIC CASE.

• CONVERTS 4-TRANSISTOR KIT INTO A 6-TRANSISTOR HOME RADIO WITH SPEAKER

Add a completely transistorized push-pull audio stage to your 4 transistor receiver. Complete stage including speaker and case measures only 3" H x 2 3/4" W x 1 1/2" D. Plugs right into 4 transistor kit above. Converts your 4 transistor set to a 6 transistor plus diodes superhet receiver. Performance equal or superior to commercially wired sets selling at more than twice the price. Kit includes 2 transistors, 2 transformers, 2 1/2" PM speaker, pre-punched chassis, speaker case to hold entire stage, battery, hardware, instructions and diagrams. Shpg. wt., 1 lb.



**11.50**

KT-96.....Net 11.50

### FM-AM TUNER KIT

Basic FM-AM Tuner having outstanding specifications and delivering astonishing performance — all at a budget price in easily assembled kit form.

**34.95**

- AFC DEFEAT CIRCUIT WITH FRONT PANEL CONTROL
- FOSTER-SEELEY DISCRIMINATOR CIRCUIT
- GROUNDED GRID TRIODE AMPLIFIER
- 20-20,000 CPS RESPONSE

Choose this 7 tube compact high-fidelity FM-AM tuner whose characteristic features are found in units costing many times as much, and whose performance is unheard of at this low price. There are two front panel controls, a function control for AM, FM, PHONO, TV and a tuning/AFC defeat control. Features Armstrong FM circuit with limiter and Foster-Seeley discriminator. Simplified tuning with slide-rule dial and flywheel counter-weighted mechanism, high impedance phono input and high impedance audio output.

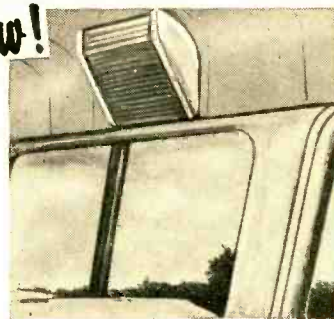
#### SPECIFICATIONS

**FREQUENCY RANGE:** FM 88-108MC, AM, 530-1650 KC. **ANTENNA INPUT:** FM, 300 ohms, AM Ferrite loopstick and high impedance external antenna. **DISTORTION:** Less than 1% at rated output. **FREQUENCY RESPONSE:** FM, +.5 db 20 to 20,000 cps, AM ±.3 db 20 to 5000 cps. **SENSITIVITY:** FM, 5 UV for 30 db quieting, AM, Loop sensitivity: 30 UV/meter. **SELECTIVITY:** FM, 200 KC bandwidth, 6 db down; 375 KC FM discriminator peak to peak separation, AM, 8 KC bandwidth, 6 db down. **IMAGE REJECTION:** 30 db minimum. **HUM LEVEL:** 60 db below 100% modulation. **TUBE COMPLIMENT:** 2-12AT7, 1-6BE6, 1-BA6, 2-6AU6, 1-6AL5 plus selenium rectifier. **SIZE:** 5 1/2" high x 9 3/4" wide x 9 1/2" deep (excluding knobs). **CONSUMPTION:** 30 watts. For 110-120V 60 cycle AC. Attractive etched copper-plated and lacquered finish. Less metal case. Shpg. wt., 9 lbs.

KT-100 A ..... NET 34.95  
ML-100.....Metal cage for above, Shpg. wt., 3 lbs. .... 5.00

### STATION WAGON REAR SEAT SPEAKER

**New!**



Now, rear seat passengers in your station wagon can enjoy car radio programs with equal pleasure. Good quality 6"x9" oval speaker mounted in luxurious ivory and gold housing, provides listening enjoyment of both music and voice. Rear seat speaker is quickly and easily installed. NO HOLES TO CUT. All wires, brackets and screws are hidden from view after installation. Installation kit includes mounting brackets, screws, switch, switch plate, nut and spacer, knob and wire leads.

CAR	YEAR	MODEL	Any Model Net, Each
Ford	52 thru 56	SB-41	<b>8.08</b>
Chevrolet	57	SB-42	
Plymouth	56	SB-44	
Pontiac	55 thru 57	SB-45	

100 SIXTH AVE. NEW YORK, N.Y.  
PLAINFIELD, N. J., 139 W. Second St. BOSTON 10, MASS., 110 Federal St.  
BROOKLYN 58, N. Y., 542 E. Fordham Rd. NEWARK 2, N. J., 24 Central Ave.  
Include postage with order.

Lafayette Radio 165-08 Liberty Ave.  
JAMAICA 33; N. Y.



# FREE!

## LAFAYETTE CATALOG



# ELECTRONIC CATALOG PACKED WITH MONEY SAVERS

Packed with the largest selection of Electronic, Radio and T.V. Parts, and equipment. PA, Hi-Fi systems, tubes, antennas, Transistor Kits, parts and components, Test Equipment, new build your own kits, tools, books, Microscope, drafting equipment, Binoculars, Telescopes, All Radio, TV and Ham supplies—All AT GREAT SAVINGS—For the economy minded servicemen, dealer, engineer and technician—CHUCK FULL OF BU'S! SEND FOR YOUR FREE COPY TO-DAY.

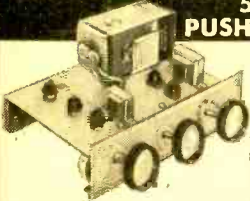
### 3 TRANSISTOR HI-FI PREAMPLIFIER KIT



New Lafayette Hi-Fi Pream Kit using new GE 2N190 quality audio transistors. Separate Volume, Bass and Treble controls. Frequency response 20-20,000 cps. Three phono and microphone. Provides low-noise, stable preamplification without hum and microphonics. Complete with all parts transistors, pre-purchased chassis, battery and detailed step-by-step instructions. Size 4 1/2" x 3 3/4" x 1 1/2". Shpg. wt., 2 lbs.

KT-117—Complete Kit.....Net 18.45

### 5 TRANSISTOR PUSH PULL AMPLIFIER KIT



- 1/4 WATT, CLASS B PUSH-PULL OUTPUT
- CRYSTAL AND MAGNETIC INPUT
- SEPARATE BASS AND TREBLE CONTROLS

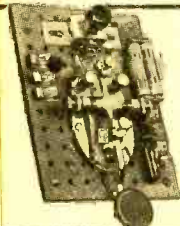
New 5 transistor audio amplifier for phono—microphones—tuners—etc. Excellent for the experimenter—student—or any one desiring a good transistorized amplifier.

Uses new G.E. 2N189 and 2N186A transistor. Inverse feedback for reduction of distortion. Transformer coupled driver and output stages. Complete with punched chassis, knobs, transistors, all parts and detailed instructions and diagrams.

KT-104—3.2 ohm output.....Net 22.95

KT-105—8 ohm output.....Net 22.95

### TRANSISTOR CODE PRACTICE OSCILLATOR KIT



For those interested in mastering the international code, an audio tone oscillator is essential. The circuit of this transistorized feedback oscillator has the simplicity of the neon glow, the signal strength of the vacuum tube, and requires only two penlite cells for weeks of service. It may be used for solo practice, or two may send and receive with the same unit. Kit comes complete with Transistor, Telegraph Key, Resistors, Condensers, Masonite Board, etc., and Schematic Diagram.

KT-72.....Net 2.99  
Cannon ECI—Single Headset.....Net 1.13

### 2 TRANSISTOR POCKET RADIO KIT



Packed into a 2 1/2" x 3 1/2" x 1 1/4" plastic case this two transistor plus crystal diode radio kit offers many surprises, utilizing a regenerative detector circuit with transformer coupled audio stage, gives you high gain and excellent selectivity. Pulls in distant stations with ease with more than ample earphone volume. Kit comes complete with two transistors crystal diode, loopstick, Arzooone transistor audio transformer, resistors, condensers, plastic case, etc. Including schematic and instructions.

KT-68A Complete Kit less earphone. 10.95

MS-260 New Super Power Dynamic Earphone. Ideal for Transistor Circuit Imp. 8000 ohm, D.C. 2000 Ohm.....3.95

### NEW POCKET AC/DC VOM MULTITESTER 2,000 ohm per Volt on AC & DC

• Completely wired — Not a kit  
Accurate VOM with a sensitivity of 2000 ohms per volt on both AC and DC. Single selector switch. 3" 160 amp. meter. Scales: DC Volts: 0-10-50-500-1000; AC Volts: 0-10-50-500-1000; Ohms: 0-10K, 0-1 Meg; DC Current: 500 ua and 500 ma; Decibel: -20 to +22; +20 to 36; Capacity: 25.0 mmf to .2 mfd and .005 to 1 mfd. Heavy plastic panel, metal bottom. 4 1/4" x 3 1/2" x 1 3/4". With batteries and test leads. Shpg. wt. 4 lbs.  
RW-27A.....8.95

### 3 TRANSISTOR SUPERHET POCKET RADIO KIT



- A TRUE POCKET SUPERHET RECEIVER—NO EXTERNAL ANTENNA!
- NO EXTERNAL GROUND!

A remarkable sensitive, super-selective pocket superhet receiver with astonishing performance over the complete broadcast band. Uses 2 high-frequency and one audio transistor plus efficient diode detector and features 2 specially matched IF transformers for maximum power transfer. The components are housed in a professional looking beige plastic case.

The receiver's appearance enhanced by attractive maroon and silver station dial. Sensitive built-in ferrite antenna eliminates need for external antenna. A designer's dream in a true pocket superhet receiver! Complete with all parts, transistors battery, case, dial and easy to follow step-by-step instructions. 4 1/2" x 2 1/2" x 1-1/16". Shpg. wt. 1 lb.

KT-116—Complete Kit, less earphone.....Net 16.95

MS-260—Super Power Dynamic Earphone.....Net 3.95

### 1 AND 2 TRANSISTOR POCKET RADIO KITS

#### ONE TRANSISTOR POCKET RADIO KIT—KT-97

- IDEAL FOR STUDENTS, HOBBYISTS AND EXPERIMENTERS

• PRE-PUNCHED CHASSIS FOR ADVANCEMENT TO 2 TRANSISTOR KIT  
Ideal, low-cost transistor pocket radio unit. Super-selective ferrite loop antenna permits good reception up to 50 mile radius with approx. 50 ft. antenna and good ground. Provisions for advancement to 2 transistor receiver. Complete Kit with simple detailed instructions. 3 3/8" x 2 3/8" x 1". Shpg. wt., 1 lb.

KT-97—Complete, less earphones.....Net 4.50

#### TWO TRANSISTOR POCKET RADIO KIT—KT-98

Contains all KT-97 components plus additional R-C coupled transistor stage for increased sensitivity and output. Complete with instructions. Shpg. wt., 1 lb.

KT-98—Complete 2 Transistor Kit, less earphone.....Net 5.95

MS-111—Crystal earphone for KT-97 and KT-98.....Net 1.49

MS-260—Super power dynamic earphone.....Net 3.95

### 20,000 OHM PER VOLT MULTITESTER SEMI KIT



A new kind of kit—the difficult work is already done—you wire in only a few multipliers and mount the battery holder to complete the unit. A fine high sensitivity (20,000 ohms per volt DC—5000 ohms per volt AC) instrument employing a 3" 40 microamp movement. Has 4 DC voltage, 4 AC voltage, 2 DC current, 3 resistance and 2 db ranges. Complete with test leads and detailed instructions. Size 3 3/8" x 4 3/8" x 1 3/8". Shpg. wt., 3 lbs.

KT-20—Kit.....Net 11.95

Lafayette  
Radio  
DEPT. 18

165-08 Liberty Ave.  
JAMAICA 33; N. Y.

SEND FREE  
CATALOG

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

ZONE \_\_\_\_\_ STATE \_\_\_\_\_

CUT OUT  
AND MAIL  
TODAY!



NEW! Mail Order Center ----->





**\$8 COMPLETE  
2 VOLUMES**

## TV TELLS HOW TO ANSWER RADIO AND TELEVISION QUESTIONS SERVICE LIBRARY

HERE IS LATE INFORMATION IN A HANDY FORM FOR RADIO AND TELEVISION REPAIRMEN, SERVICEMEN AND STUDENTS

AUDELS T.V. RADIO SERVICE LIBRARY—Over 1600 Pages—1085 Illustrations & Diagrams—1001 Important Facts & Figures on Modern T.V., Radio, Electronic Devices at your fingers ends. Highly Endorsed.

**INCLUDES TRANSISTORS**  
& Transistor Circuits, Rectifiers, Record Changers, P.A. Systems, Tape Recorders, Phonograph Pick-ups, F.M., Auto Radio; Radio Compass, Short Wave, Radar, etc.

**ASK TO SEE IT!  
IT WILL PAY TO KNOW—**

The Basic Principles—Construction—Installation—Operation—Repairs—Trouble Shooting, Shows How to get Sharp, Clear, T.V. Pictures. Install Aerials—How to Test. Explains Color Systems, Methods of Conversion, Terms, etc. Includes Ultra High Frequency—Valuable for Quick Ready Reference and Home Study.



Get this Information for Yourself  
**7 DAY TEST—PAY ONLY \$1 MO.**

**MAIL ORDER**

**AUDELS Publishers, 49 W. 23 St., New York 10, N.Y.**  
Mail AUDELS T. V. RADIO SERVICE LIBRARY (2 Volumes) \$8 on 7 days free trial. If O.K. I will remit \$1 in 7 days and \$1 monthly until \$8 is paid. Otherwise I will return them.

Name \_\_\_\_\_

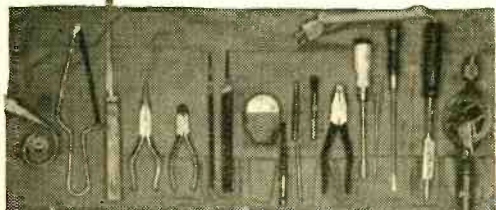
Address \_\_\_\_\_

Occupation \_\_\_\_\_

Employed by \_\_\_\_\_ PE3

# NOW! THE FIRST AND ONLY Complete RADIO TOOL SET

21 PC. INCL. CANVAS CARRYING CASE



for • HAMS • EXPERIMENTERS

→ • HOBBYISTS • ENGINEERS

**ONLY \$9.95**

POSTPAID  
Sorry no C.O.D.'s

**MERIT INTERNATIONAL COMPANY**

130 Brookline Ave. Boston 15, Mass.

## Transistor Topics (from page 101)

38 Peace Ave., Dalton, Mass. Essentially a simple diode detector followed by a two-stage capacity-coupled common-emitter transistor amplifier, this circuit features a tapped antenna coil (*L1*) and loudspeaker output.

Assembly and wiring are straightforward and non-critical. *L1* is a tapped "transistor" antenna coil, such as a Miller No. 2000 or Lafayette No. MS-166; *C1* is a 365- $\mu$ fd. variable capacitor. A 1N34, 1N66, CK705, 1N295, or similar general-purpose diode can be employed as a detector, while *TR1* and *TR2* may be any standard *p-n-p* audio transistors . . . suitable types are Raytheon CK722 or CK721, G.E. Type 2N107, General Transistor Types GT-34 or GT-222. Output transformer *T1* is an Argonne Type AR-138 to match to a 3.2-ohm speaker voice coil (use Type AR-137 if your loudspeaker has an 8-ohm voice coil). Almost any size PM loudspeaker may be utilized, but you'll find that the larger speakers (six inches and up in diameter) are more efficient. *B1* is a standard 6-volt battery (Burgess No. Z4); although no "on-off" switch is shown, one may be connected in series with either the positive or the negative lead of the battery.

Note that *no ground (GND.) connection is employed*, although an external antenna is desirable. Addison says that *C2* is somewhat critical . . . he found that a 0.005- $\mu$ fd. capacitor worked best here, but you may wish to experiment with other values.

In all four of the circuits shown, all resistors may be  $\frac{1}{2}$ -watt units while capacitors (other than the variables) may be either mica, ceramic, or paper units, with rated working voltages of 25 volts or more. The transistors can be soldered permanently in position or installed in standard sockets.

**New Booklets.** Lafayette Radio (165-08 Liberty Ave., Jamaica 33, N. Y.) has issued its second annual *Transistor Brochure*. Featuring most available transistors, all types of transistor components, many transistor kits, and considerable useful information, this is the most complete "transistor catalog" currently available . . . and it's FREE on request!

Raytheon Manufacturing Company (55 Chapel St., Newton 58, Mass.) now has two new booklets available. The *Transistor Guide* gives much general information about transistor selection and installation, plus a number of practical circuits, while a newly issued booklet for the Raytheon *Transistor Experimenter's Kit* features many circuits designed around the popular 2N295 diode, the CK768 r.f. and CK722



audio transistors. For information on these booklets, write directly to Raytheon.

**Product News.** Coming soon . . . a "Radio for your Ear." Called the "EARADIO," it is a self-contained transistorized super-heterodyne radio . . . a complete unit which can be attached to the ear . . . and makes for easy listening while traveling or at home.

Over four times as many transistors were sold in 1956 as in 1955. At the present rate of increase, transistor sales will equal (or exceed) vacuum tube sales in just a few more years. According to the experts in design and production of transistors, we can expect a 25-cent transistor by 1962!

The Jackson Electrical Instrument Company, Dayton 2, Ohio, has announced a new transistor code practice oscillator. Intended for code practice by amateurs, the unit includes special jacks for interconnecting two units to simulate station-to-station operation. With a few minor circuit changes, the instrument may also be used as a *monitor* for a c.w. transmitter.

A transistorized electronic megaphone is available from the Pye Corporation of America, 270 Park Ave., New York 17, N. Y. Called the "Transhailer," the unit has a maximum power output of 3½ watts,

and an over-all weight of only five pounds. With an operating range of ¼-mile, the instrument is manufactured in England.

That's it for now, fellows . . . see you next month.

Lou



## The Transmitting Tower

(Continued from page 80)

take about eight lessons to learn them all. In the process, you will have heard and written down each character 50 to 100 times, and, by the time you have learned the last one, you will probably be able to copy at a speed of about 8 wpm.

Next to having a private code instructor, undoubtedly the best way to learn the code is with the aid of a recorded code course. Such courses are available on 33½- and 78-rpm phonograph records, on magnetic tapes for reproduction on a standard tape recorder, and in the form of punched paper tapes for use on a special tape machine. The exact method of teaching the code varies from course to course, but it is similar to that described above.

**Speed Your Receiving.** Once you have memorized the code by any method, the only way to increase your copying ability



**NOW!** Take The "Headache" Out of TV Trouble Shooting

Amazing Handbook Helps You Accurately

**Pin Point TV TROUBLES  
IN 10 MINUTES**

**SAVES TIME . . .  
MAKES YOU MORE VALUABLE!**

Now for the first time—a practical procedure for spotting the cause of trouble in any TV set—FAST! Overcomes the most difficult, most time-consuming TV trouble shooting problems. There's no guesswork! Quick, simple tests tell you in which of 5 TV set sections to find the cause of the trouble. Fool-proof **Check Charts** help you locate the exact trouble spot at once, from as many as 700 possibilities. Not a book for the "tinkerer" or home owner who tries to fix his own TV set—IT'S A BOOK WRITTEN FOR TV SERVICEMEN TO SAVE TIME AND MONEY. The hours and aggravation it can save you on a single servicing job more than pays for this amazing handbook. Helps you make more money as an expert speedy TV trouble-shooter!

**NEEDED BY EVERY TV SERVICEMAN**

"Pinpoint TV Troubles in 10 Minutes" is one of the most valuable "tools" you can carry on a servicing call. Amazingly practical. Over 300 spiral bound fast reference pages with 50 time-saving Check Charts; dozens of important diagrams and tests; explanations of circuits and designs. Fits easily into your tool kit for handy on-the-job reference. Prepared and backed by the famous Coyne Electrical School.

**BRAND NEW!**



**DOES AWAY WITH  
GUESSWORK!**

**NOTHING LIKE  
IT BEFORE!**

**USE IT ON 7 DAYS FREE TRIAL!**

You must see this sensational new handbook to believe how much time it can save you—how it makes your days more productive and your work easier. Send no money, just the coupon. We'll rush your copy to you on FREE TRIAL. Try it yourself! Then, after 7 days either send only \$3.95 plus postage, or return the book and owe nothing. Take advantage of this no-risk offer NOW!

**MAIL COUPON NOW!**

Educational Book Publishing Division  
COYNE ELECTRICAL SCHOOL, Dept. 37-PP  
500 S. Paulina St., Chicago 12, Ill.

YES! Rush new TV trouble shooting handbook: "Pinpoint TV Troubles in 10 Minutes" for 7 days FREE TRIAL per your offer.

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

Address . . . . .

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

Check here if you are enclosing \$3.95. We pay postage. 7-day money back guarantee.

**COYNE ELECTRICAL SCHOOL**  
Educational Book Publishing Division  
500 S. Paulina St., Dept. 37-PP, Chicago 12, Illinois

# FIX TV SETS TWICE AS FAST!



## TV TROUBLE-FINDER GUIDES

**CUT TIME  
IN HALF on  
2 jobs out of 3**

Now! Handle television receiver troubles by easy picture analysis. Let these famous PIX-O-FIX Guides tell you what is wrong . . . then show exactly how to fix it.

Just turn the PIX-O-FIX dial until the picture in its window shows the same trouble symptoms (wavy lines, snow, no raster, "squeezing" distortion,

etc.) as the picture on the TV set you're repairing. PIX-O-FIX then tells the possible trouble causes and gives step-by-step repair instructions. It's as easy as that!

The two PIX-O-FIX units No. 1 and No. 2 cover 47 different television troubles . . . just about anything you're likely to be called on to fix. No. 1 identifies 24 of the most common troubles and gives 192 causes and 253 remedies. No. 2 covers 23 more advanced troubles not included in No. 1. Together, they are a comprehensive guide to quick "picture analysis" servicing of any TV set . . . AND THE PRICE IS ONLY \$2.00 FOR THE TWO. Use coupon.

# DON'T THROW OLD RADIOS AWAY!



**This giant book shows exactly how to fix old sets in a jiffy . . . without useless testing**

There's a "secret" to repairing old radios fast and profitably . . . and this big **RADIO TROUBLESHOOTER'S HANDBOOK** is it!

Just look up the old make and model you want to fix. This 3½ pound 744-page Ghirardi handbook tells what the trouble is likely to be . . . AND SHOWS YOU EXACTLY HOW TO FIX IT. No useless testing! No wasted time! Even beginners can handle jobs "slick as a whistle." *The only guide of its kind . . . cuts repair time in half!*

Included are common trouble symptoms and remedies for over 4,800 old models of home and auto radios and record changers. Actual case histories cover practically every model made by 202 manufacturers between 1925 and 1942—Airline, Apex, Arvin, Atwater Kent, Belmont, Bosch, Brunswick, Clarion, Crosley, Emerson, Fada, G-E, Kolster, Majestic, Motorola, Philco, Pilot, RCA, Silvertone, Sperton, Stromberg AND DOZENS MORE. Gives how-to-do-it data on SPECIFIC jobs—NOT general theory. Includes hundreds of pages of individual tube and component data, service short cuts, etc. Price \$6.95. 10-day free trial.

### USE COUPON TO ORDER

Dept. PE-37, Rinehart & Co., Inc.  
232 Madison Ave., New York 16, N. Y.

- Enclosed is \$2.00 for PIX-O-FIX Nos. 1 and 2. You guarantee to refund my money if I return them in 10 days.
- Send book **RADIO TROUBLESHOOTERS' HANDBOOK** for 10 days **FREE EXAMINATION**. If I like book, I will promptly send \$6.95 (plus postage) in full payment. Otherwise I will return book and owe you nothing. (SAVE! Send cash with order and we pay postage. Same 10-day Money-back Guarantee.)

Name \_\_\_\_\_

Address \_\_\_\_\_

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

is by regular practice, copying sending slightly faster than you can copy solidly. You can get this practice from an instructor or from a recorded code course, but you will probably obtain most of it from your short-wave receiver.

At almost any time of the day or night, you will find stations in the ham bands sending at speeds from 5 wpm and up. Also, W1AW, the ARRL headquarters station, transmits code practice every evening at 9:30 p.m., Eastern Time.\* On Sunday, Tuesday, Thursday, and Saturday evenings, transmissions start at 5 wpm and conclude at 13 wpm. On Monday, Wednesday, and Friday, they start at 15 wpm and conclude at 35 wpm.

W1AW transmits simultaneously on 1885, 3555, 7080, 14,100, and 21,010 kc. In general, the farther you are from Connecticut, the higher the frequency on which you will receive W1AW the best. You can identify it by "QST QST QST DE W1AW W1AW W1AW," repeated in code for five minutes before the start of the code-practice session.

When you get your Novice license, every contact you make will give you code practice for your General class license. However, do not depend on that entirely. Not all Novices send perfectly; therefore, still copy W1AW or other good sending regularly, in order not to forget how it is supposed to sound.

### News and Views

**Garin, KN2UML**, uses an AT1 transmitter and an "Ocean Hopper" receiver in conjunction with an antenna 40' high. In three months of operation, this combination has accounted for 100 contacts in 10 states. He uses no antenna coupler on the transmitter, but does find that an "Antenna Peaker" helps drag in the DX on the receiver . . . **Butch, WN3JJO**, has been on the air only two weeks, but has made 26 contacts in 14 states on 80 and 40 meters. He uses a borrowed B & W 5100 transmitter running a full pint (75 watts) feeding a 147' antenna. He will be on with his own converted ARC-5 transmitter as soon as he figures out how to hook it up . . . **Mike, WN7FKF**, thinks he has antenna problems, because he has worked only three states in three months. He uses an S-38D receiver and a 25-watt transmitter, but has a Globe Chief 90 on the way.

**Roger, KN2VJN**, has a gripe against hams who send: "R R R. Sorry OM, I missed your name, my report, etc. Please repeat." He asks: "Why don't they just say, 'Sorry I missed everything?'" I hope he lets us know, if he gets an answer. (Probably, however, operators who send "R" when they actually did not copy everything sent to them do not remember that "R" means "I copied 100%.") Rog has worked

\*See "W1AW Will Help YOU Become a Ham," in the January, 1957, issue of POPULAR ELECTRONICS, page 47.





# NOW The Short Cut to Learning You've Been Waiting for



## Learn "By Ear" with the DORMIPHONE

The Scientific Discovery That Works for You... Awake and Asleep

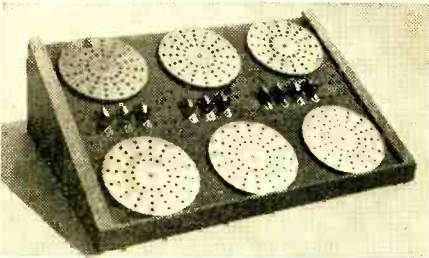
Now, at last, science gives you an easy shortcut to learning. With this amazing new tool, you "start" to learn while awake—then the university-tested Dormiphone takes over, continues the learning process for you while you go off to sleep. Do you want to learn a language—Memorize a speech—or an array of important facts, figures, formulas—Correct your speech—Break bad habits? The Dormiphone SAVES YOU TIME—EFFORT. So simple children benefit—so helpful and practical it is used by educators, psychologists, people of all ages, occupations all over the world.

### Break Down Barriers to Learning

Find out HOW the Dormiphonic Memory Trainer works FOR YOU—how it can help you learn anything in less time, without intensive self-application. Write for FREE Book, "A New Dimension in Learning," or call for FREE DEMONSTRATION—Get the Scientific Evidence Today.

MODERNOPHONE, INC.		Circle 7-0830	
292-037 Radio City, New York 20, N. Y.			
Gentlemen: Please send me your FREE Booklet. I am interested in learning more about the DORMIPHONIC Memory Trainer and what it can do for me. No obligation—no salesman will call.			
<input type="checkbox"/> If under 18, check here for Special Booklet A.			
NAME .....			
ADDRESS .....			
CITY .....		ZONE..... STATE.....	
My main interest in Dormiphonics is for:			
<input type="checkbox"/> Learning a Language	<input type="checkbox"/> Speech Improvement		
<input type="checkbox"/> Memorization	<input type="checkbox"/> Sleep Inducement		
<input type="checkbox"/> Habit Correction	<input type="checkbox"/> School or College Work		

## Can you think faster than this Machine?



GENIAC set up to do a problem in check valve research

Be careful before you answer. GENIAC the first electrical brain construction kit is equipped to play tic-tac-toe, cipher and encipher codes, convert from binary to decimal, reason (in syllogisms) as well as add, subtract, multiply and divide. Specific problems in a variety of fields—actuarial, policy claim settlement, physics, etc.—can be set up and solved with the components. Connections are solderless and are completely explained with templates in the manual. This covers 33 circuits and shows how new ones can be designed. You will find building and using GENIACs a wonderful experience; one kit user wrote us: "this kit has opened up a new world of thinking to me." You actually see how computing, problem solving, and game play (Tic-tac-toe, nim, etc.) can be analyzed with Boolean Algebra and the algebraic solutions transformed directly into circuit diagrams. You create from over 400 specially designed and manufactured components a machine that solves problems faster than you can express them.

### —MAIL THIS COUPON—

SCIENCE KITS, Dept. PE-37B, Oliver Garfield Company  
126 Lexington Avenue, New York 16, N. Y.

Please send me:

1 GENIAC Electric Brain Construction Kit and Manual.

\$19.95 (East of Mississippi) .....

\$20.95 (Elsewhere in United States) .....

\$21.95 (Outside the United States) .....

Returnable in seven days for full refund if not satisfied.

I enclose \$..... in full payment.

My name and address are attached.

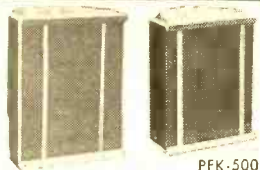
14 states in a month on the air with his 6146 and BC-454 and BC-455 receivers . . . **Tort, KNØHQW**, operates on 3725 kc., running approximately 15 watts to a 6J5-6V6 transmitter, feeding a long-wire antenna about 7' high. His receiver is a 3-tube Ocean Hopper. He has made 200 contacts in 16 states and has QSL cards from 14 of them . . . **Don, KN8CCO**, has worked 16 states, too, in three months of operation, mostly on 40 meters. Don's equipment includes an Adventurer transmitter at 50 watts and an NC-98 receiver. He will probably have his new 15-meter beam finished and in operation by the time he sees this in print.

Earl, KN8CFJ, who thought getting a Novice license at the age of 51 was unusual, inspired **Ed, K6OJQ**, to report that he was 71 when he obtained his General license. Who can beat that? K6OJQ has three ham grandsons, W6JEA, W6MLV, and K6SNN, and a son-in-law—about 52—who took his General examination in December. He operates on 75, 40, and 10 meters, using converted ARC-5 equipment . . . Earl's comments also stirred up **John, ex-8JX**, who operated "spark and c.w." in 1920 and 1921, to a renewed interest in ham radio at the "advanced" age of 52 . . . **Fred, KN9DGE**, runs 60 watts to a TR-75-TV transmitter feeding a long-wire antenna on 80 and 40 meters, and has two receivers—an HQ-100 and a BC-455. In about seven months of operation, he has made over 350 contacts in 21 states.

**John, KN5GXR**, puts the fairly rare state of Arkansas on 7175 kc. with 10 watts input to the "Sandwich Box" transmitter (described in POPULAR ELECTRONICS, March, 1956), and a BC-455 receiver. His states-worked total is nine, with eight confirmed. John has added bandspread tuning to the BC-455 receiver by the method described in POPULAR ELECTRONICS, December, 1955, by W1FSN for use with the SW-54. He mounted a 15- $\mu$ fd., midjet variable capacitor to the right side of the receiver and connected it in parallel with the oscillator section of the ganged tuning capacitor. To adjust it, the added capacitor is set to half capacity and the receiver dial tuned to the center of the Novice band. Then the antenna trimmer and the mixer trimmer (screwdriver adjustment on top of center section of ganged capacitor) are peaked for maximum receiver output. After this is done, the Novice band will occupy a good portion of the bandspread dial. Also, by judiciously removing plates from the capacitor, the band can be spread over the entire dial.

**John, K5ERJ**, has not wasted any time with his amateur license. In 3½ months on the air, he has made 732 contacts in 36 states and four countries. Equipment used in his station includes a DX-35 transmitter at 45 watts, an "all-band trap" antenna, such as described in the January, 1957, *Transmitting Tower*, and an SX-99 receiver. John also reports that his mother has just passed the Novice examination. I'll try to have details on that next month . . . **Dick, KN6TVC**, is another of the many Novices using the "Sandwich Box" transmitter with excellent reports. He thinks running flea power makes it more interesting when competing with the 50- and 75-watters. As he puts it: "I'm as proud of that little ras-





**pfK**  
pre-finished  
Kits



PFK-300

designed by Paul Klipsch

Now you need only a screwdriver to put together a furniture-finished Klipsch speaker enclosure, indistinguishable from factory-assembled Rebel 3, 4 or 5. Also available as conventional, unfinished kits.

Write for  
COMPLETE  
CATALOG!

- 36 pages
- 16 other hi-fi kits
- 29 equipment cabinets
- 4 matched speaker systems
- 20 hi-fi accessories



**cabinart**

**'57**

Cabinart

99 North 11th Street  
Brooklyn 11, N. Y.

largest manufacturer of cabinets and kits for hi-fi,  
a division of G&H Wood Products Co., Inc.

## SHOOT TV TROUBLE FAST

With H. G. Cisin's Copyrighted **RAPID "TV TROUBLE SHOOTING METHOD"**

Without experience or knowledge, this guaranteed new method of servicing TV sets enables you to **DIAGNOSE** TV troubles as rapidly as an expert. **NO THEORY—NO MATH**—you can locate all faults in record-breaking time regardless of make or model. **"TV TROUBLE SHOOTING METHOD"** is the most valuable aid to TV servicing ever written. Be a TV Trouble Diagnostician. Increase your present earnings. Open your own Profitable Business or get a high-paying skilled job.

*It's all in this book . . .*

**Nothing more to Pay—Nothing else to Buy**

Alphabetically listed are 85 picture troubles, over 58 raster and 17 sound troubles. By this unique copyrighted method you know **EXACTLY WHERE** the trouble is; plus step-by-step instructions, including 69 **RAPID CHECKS**, enabling you to find the faulty part.

**13 IMPORTANT PRELIMINARY CHECKS NEED NO INSTRUMENTS!** Of the 69 Rapid Checks, **OVER 65 ALSO REQUIRE NO INSTRUMENTS!** Rapid checks include emergency checks for distorted pictures, defective tubes including PIX tube, plus 57 others. **ALL EXPLAINED IN SIMPLE LANGUAGE. PERFORMED WITHOUT INSTRUMENTS. MANY CHECKS USE THE PICTURE TUBE AS A GUIDE.**

H. G. Cisin, the author, is the inventor of the AC/DC midjet radio. He licenses RCA, AT&T, etc. He has also trained thousands of technicians now owning their own prosperous TV service organizations or holding highly paid TV positions. His years of experience are embodied in this remarkable new book.

**Guaranteed Money Back in 5 Days if Not Satisfied!**

**ABSOLUTELY FREE** with each order: H. G. Cisin's newest book **"TV & RADIO TUBE SUBSTITUTION GUIDE."** Gives direct replacements of set and picture tubes. Most valuable servicing aid! **ACT NOW—get both books postpaid at cost of only one!**

**\$1** Post-paid

**RUSH COUPON NOW!**

H. G. CISIN, CONSULTING ENGINEER,  
Amagansett, N. Y.

Dept. P-24

Enclosed find \$1. Rush both books.

Name .....

Address .....

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

**COYNE offers**  
**LOW COST**  
**TELEVISION**  
**RADIO - COLOR TV**  
Training in  
Spare Time **AT HOME**



The future is **YOURS** in TELEVISION!  
A fabulous field—good pay—fascinating work—a prosperous future in a good job, or independence in your own business!

Coyne brings you **MODERN-QUALITY** Television Home Training; training designed to meet Coyne standards at truly lowest cost—you pay for training only—**no costly "put together kits."** Not an old Radio Course with Television "tacked on." Here is **MODERN TELEVISION TRAINING** including **Radio, UHF and Color TV.** No Radio background or previous experience needed. Personal guidance by Coyne Staff. **Practical Job Guides** to show you how to do actual servicing jobs—**make money early in course.** Free Lifetime Employment Service to Graduates.

**COYNE**  
**ELECTRICAL SCHOOL**

A TECHNICAL TRADE INSTITUTE OPERATED  
NOT FOR PROFIT  
506 S. Paulina Street, Chicago 12, Dept. 37-HT7

B. W. COOKE, Jr.,  
President



Coyne—the Institution behind this training . . . the largest, oldest, best equipped residential school of its kind. Founded 1899.

Send Coupon for Free  
Book

and full details,  
including easy  
Payment Plan.  
**No obligation, no  
salesman will call.**



**COYNE Television**  
**Home Training Division**

500 S. Paulina St., Chicago 12, Ill.  
Dept. 37-HT7

Send Free Book and details on how I can get Coyne Quality Television Home Training at low cost and easy terms.

Name .....

Address .....

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

cal as if it had cost me hundreds of dollars."

*Offers to Help Prospective Novices:* **Jeffrey Hammer, K2LCO** (15), 71 Foxcroft Rd., Manhasset, N.Y.; **Tom Wilson, W8EWK**, Secretary, Electronics Research and Development Association, 132 West Wilkins St., Jackson, Mich.

I hope to receive a report from you before the next deadline rolls around.

Herb, W9EGQ

## Tuning the Short-Wave Bands

(Continued from page 84)

what you can hear on old consoles and table model a.c.-d.c. sets. Try your hand with these receivers first. Build up a log of what you hear; send for a couple of verifications. After a while, your folks will begin to notice and appreciate your efforts and results; and before long you, too, may be the proud owner of a glistening new receiver that will literally open up a whole new world of DX'ing for you.

### Current Station Reports

The following is a resume of the latest reports. All times shown are Eastern Standard Time, and the 24-hour clock is used.

**Aden**—ZNR, Aden, can be heard with an Arabic xmsn opening at 1030 on 17170 kc. The program is mainly chanting. Signals are good but there is QRM from a dictation-speed Chinese station. (29)

**British Honduras**—The British Honduras Broadcasting Service, Belize, 3300 kc., opens daily at 1830 with "Greensleeves" signature tune and program preview. Programs noted are: light music, 1900; English news, 1930; commentary, 1940; Spanish news and talk, 1945; a play at 2000; light music from 2030; an interview session at 2045; BBC concert of classical music at 2100-2200. After a brief news bulletin and the program preview for the next day, s/off is at 2210. (61, 65)

**Canada**—One of the lesser heard Home Service stations is CJCA, Edmonton, 9540 kc. All-English, it is scheduled at 0800-0200. Other regional stations include: CFVP, *Voice of the Prairie*, Calgary, on 6030 kc. with 100 watts (this relay of CFCN operates at 1400-0200); and CKFX, 6080 kc., Vancouver, which is noted relaying CKWX at 0115 with a musical program. *Radio New Zealand*, 6080 kc., provides QRM on the latter station. (61, 70, 120)

**China**—*Radio Peking* currently carries English schedules as follows: at 2200-2230 on 17,745, 17,720, 15,350, and 15,115 kc.; at 0400-0430 on 17,835, 17,720, 15,350, 15,060, and 11,650 kc.; at 0930-1000 on 17,720 and 15,350 kc.; at 1100-1130 on 11,805 and 9700 kc.; at 1400-1430 on 11,650, 9765, and 7295 kc.; and at 1430-1500 on 9680 and 7080 kc. (4)

**El Salvador**—YSS, San Salvador, 9552 kc., can be heard at times at 1930-2300 with popular and classical music and all-Spanish language. News is noted at 2120. They often have "Panorama International" at 2040. (31, 44, 116)

## ALL TUBES UNCONDITIONALLY GUARANTEED FOR 1 YEAR

On orders of less than 100 tubes — 41¢ each

### BRAND NEW TV PICTURE TUBES

RCA and DUMONT Licensed

Partial Listing No dud required

Type	T.M. Price
10BP4	\$10.95
12LP4	12.95
12QP4	10.00
14CP4	15.25
15DP4	16.95
16DP4	18.50
16GP4	19.25
16KP4	17.00
16RP4	\$17.00
17BP4	19.00
17GP4	21.00
17LP4	18.00
19AP4	23.00
20CP4	24.00
21ALP4A	24.00
21EP4	24.00

Picture tubes  
F.O.B. PASSAIC, N. J.  
via Railway Express

### PRETESTED TUBES—INDIVIDUALLY BOXED

024	6AU6	6SH7	12BA6
1B3GT	6AU5GT	6SJ7GT	12BE6
1H5GT	6AV5	6SK7GT	12A27
1LC5	6AV6	6SL7GT	12BH7
1LN5	6AX4GT	6SN7GT	12BW7
1N5GT	6AT6	6SQ7	12SA7
1Q5GT	6AH4GT	6SR7	12SC7
1R5	6BA6	6T8	12SJ7GT
1S4	6BC5	6U8	12SK7
1S5	6BE6	6V3	12SL7GT
1T4	6BG6G	6V6GT	12SN7GT
1T5GT	6BJ6	6W4GT	12SQ7
1U4	6BK5	6W6GT	12SR7
1U5	6BK7	6X4	12ST6
1X2	6BL7GT	6X5GT	19BG6G
304	6B06GT	6Y6G	25B06GT
3S4	6BQ7	7C5	25L6GT
3V4	6BY5G	7C6	25Z5
SU4G	6BZ7	7E7	25Z6GT
SV4G	6C4	7F7	3505
5V3	6CB6	7F8	3505
6AB4	6CD6G	7N7	35L6GT
6AC7	6F6	12AL5	35W4
6AG5	6H6GT	12AT7	35Y4
6AG7	6J5GT	12AUG	35Z5GT
6AF4	6J6	12AU7	50A5
6AG6GT	6K6GT	12AV6	50B5
6AL5	6L6	12AV7	50C5
6AQE	6S4	12AX7	50L6GT
6ASS	6S8GT	12AX4GT	117Z3
6AT6	6SA7	12BY7	

Free Postage on all prepaid continental U.S.A. orders, 50¢ handling charge on all orders under \$5.00. 25% deposit on all C.O.D. Subject to prior sale.

# TUBE MART

DISCOUNT HOUSE

Prescott 3-0330

The Lokpet Bldg.

Passaic, N. J.



**French Guiana**—Radio Cayenne, 6231V kc., normally signs off at 1830 but on Saturdays and Sundays can be heard at 1915-1930V with music and French announcements. (29, 59)

**French West Africa**—Radio Dakar, Federal Network, 4893 kc., is using a new IS of eight notes played rapidly on a piano. This one opens in a Home Service xmsn at 0130 with recorded music, talk, religious program, and more recorded music. French language is used throughout this period. (61)

**Germany**—DDR, Deutscher Demokratischer Rundfunk, Berlin, 9730 kc., has English sessions daily except Sundays, parallel to 7150 and 6115 kc., at 1500-1530, 1630-1700, and 1730-1800. (44)

*The Voice of Germany*, Cologne, has replaced 11,795 kc. with 5980 kc. at 2030-2330 to N.A. with English news at 2130-2140. Both 5980 and 9640 kc. are heard very well. (4)

**Gold Coast**—Accra relays the BBC General Overseas Service until 1300 on 4915 kc., and at 1400-1715 on 3067 kc. (GK)

The Gold Coast B/C Service has recently been noted several times on 9615 kc. around 1500. The BBC news is relayed at 1500. QRM from VOA-Tangier on the same channel usually makes this one difficult to receive. (4)

**Haiti**—4VWI, 15,390 kc., Cape Haitien, is now heard with English broadcasts from 0800. The "Mailbag" at 0930 on Saturdays has been extended to 45 minutes. This is repeated on Monday at 2130 and on the following Saturday at 0500. 4VEH, Cape Haitien, is on a new frequency of 9630 kc. afternoons and can be heard at 1630 with "Listener's Post." Dual channels were announced as 17,845, 6106, and 1200 kc. (4, 82, 116)

**Indonesia**—*The Voice of Indonesia*, Jakarta, presents three English periods daily at 0600-0700 and 0930-1030 on YDB2, 4910 kc., and YDF6, 9710 kc., and at 1400-1500 on YDE, 11,770 kc., and YDF8, 9865 kc. (44)

**Iran**—EPB, Teheran, 15,100 kc., is often noted from 1500 to 1530 s/off with an English xmsn and good music programs. (25)

**Israel**—*The Voice of ZION*, 4XB31, Tel Aviv, 9008 kc., signs on at 1630 with English news; commentary to 1705; music to 1710; news summary to 1715 s/off. (127, AG, RS)

**Jamaica**—One of the few usually reliable English-speaking stations in the Tropical Band is *Radio Jamaica*, Kingston, on 4950 kc. This one can be heard often evenings with local broadcasts and BBC news relays. (RP)

**Japan**—*Radio Japan*, Tokyo, is noted at 1800-1830 on 17,825 and 15,235 kc. with English session to Eastern N.A. (HC)

The xmsn to Western N.A. is now heard one hour later, at 2330-0030, on 11,705 and 9525 kc. The 15,235-kc. outlet has been dropped for this xmsn. (JA)

**Luxembourg**—*Radio Luxembourg*, Junglinster, 6090 kc., is noted with music at 1700-1755, s/off at 1903, popular and light music with French announcements at 0100-0215. They identify every 15 minutes. (31, 59, 61, 65, 70)


**Lebanon**—The Lebanese B/C Station, Beirut, 8036 kc., opens at 1000 with IS, Arabic announcement, anthem, and English ID, and follows with English news. (29)

**Monaco**—*Radio Monte Carlo* is being heard

March, 1957

## LEARN **basic** electricity **electronics**

**THE EASY "PICTURE BOOK" WAY!**



**Just Released: The fabulous**

**ILLUSTRATED Training Course**

**now used by the U. S. Navy!**

**You Learn by Pictures!**

Over 25,000 Navy trainees have already learned Basic Electricity and Basic Electronics this easy, "Picture Book" way! Now, for the first time, YOU can master the basics of Electricity and Electronics with this *same* "Learn-by-Pictures" training course! Over 1,700 simple, easy-to-understand drawings explain every section—these "teaching" pictures actually make up more than half the *entire* course! No other Basic Electricity or Basic Electronics course in America uses this revolutionary illustrative technique! You learn faster and easier than you'd dream possible!

**A Complete Idea on Every Page**

Here's how this easy, illustrated course works: *every page* covers one complete ideal. There's at least one big illustration on that *same page* to explain it! What's more, an imaginary instructor stands figuratively at your elbow, doing "demonstrations" that make it even *easier* for you to understand. Then, at the end of every section, you'll find *review pages* that highlight the important topics you've just covered. You build a thorough, step-by-step knowledge at your own pace—*as fast as you yourself want to go!*

**Everyday English--A Course Anyone Can Understand**

Sponsored by the Navy to turn out trained technicians in record time, this modern course presents Basic Electricity and Basic Electronics in a simple way that *everyone* can grasp—*regardless of previous education!* Every phase is made *instantly* clear—explained in plain, down to earth English—with *hundreds* of easy-to-understand illustrations to help you!

**10 Complete Volumes**

Volumes 1 and 2 of "Basic Electricity" cover DC components and circuits; Volumes 3 and 4 cover AC components and circuits; Volume 5 covers AC and DC motors and machinery. Volume 1 of "Basic Electronics" covers Diodes and Power Supplies; Vols. 2 and 3 cover Amplifiers and Oscillators; Vols. 4 and 5 cover Transmitters and Receivers.

**Home Study Without Correspondence**

This course is so *different*, so *complete*—there's no need for the usual letter writing, question and answer correspondence! Learn at home—at your own pace!

**10 Day Examination--Money Back Guarantee**

Send today for these exciting new training courses—*you risk nothing!* When you receive the volumes, examine them in your own home for 10 full days. If, at the end of that time, you're not completely satisfied, simply return the books to us and we'll gladly refund your full purchase price! Total cost for either 5-volume course is only \$10.00! In Canada, prices approximately 5% higher.

**ORDER TODAY!**

**These books are sold by electronics parts jobbers and book stores. If YOUR dealer doesn't have these books, mail this coupon to us!**

**JOHN F. RIDER PUBLISHER, INC.**  
116 West 14th St., N.Y.C.

I have enclosed \$..... Please send me

5-vol. Basic Electricity set @ \$10.00 set

5-vol. Basic Electronics set @ \$10.00 set

Both sets. I understand I may return the books in 10 days, and receive a complete refund of the full purchase price if I am not satisfied.

Add state or city sales tax where applicable.

Name.....

Address.....

City & State..... PE-3

**avoid  
a costly  
mistake**

*in your high fidelity system*

turntable  
or  
record  
changer...  
which  
shall  
I buy?



send for this new **REK-O-KUT** booklet  
*colorfully illustrates...factually de-  
scribes...the important advantages of  
playing your records on a precision  
turntable!*

**FREE — SEND COUPON TODAY!**

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

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



**REK-O-KUT COMPANY, INC.**

38-01 Queens Blvd., Long Island City 1, N. Y. PE

on 3AM3, 7140 kc., in parallel with 3AM2, 6035 kc., at 0100/opening and at 0600 in French. The Billy Graham program is aired at 1705-1735. A German program follows to 1750; ID and s/off are at 1755 (sometimes runs to 1805). (29, 40, 44, 71)

**Mozambique**—Radio Clube de Mozambique, CR7BG, 15080 kc., has an excellent signal at 0000 s/on. Popular, L.A., and light music are featured at 0030-0100 with frequent identifications and a 4-note gong IS. The station left the air at 0100. It was also noted in another xmsn at 1300-1515. All-Portuguese language is used on both xmsns. (25, 61)

**North Vietnam**—The Voice of Vietnam, Hanoi, broadcasts an English session at 0945-1015 on 7410 kc. This program consists of news, music, and commentaries; good signal strength but some c.w.QRM. (TC)

**Norway**—LKW, Tromso, is operating on a new channel of 17,755 kc. at 0045-0300, 0515-0800 (Sundays at 0215-0945, 1030-1700) relaying the Norwegian Home Service. "Norway This Week" is noted Sundays at 1200-1230. (82, 100)

LKJ2, 9540 kc., Tromso, carries a program to N.A. daily at 2000-2100 in dual with LKQ, 11,735 kc. On Sundays, this xmsn is extended to 2120 for the only English program on these outlets. (112)

**Pakistan**—Radio Pakistan, Karachi, 15,335 kc., dual with 17,750 kc., beams a program to S.E. Asia daily from 1930 s/on. "Pakistan Call-

#### SHORT-WAVE ABBREVIATIONS

A—Approximate frequency  
BBC—British Broadcasting Corporation  
c.w.—Code  
ID—Identification; identity  
IS—Interval signal  
kw.—Kilowatts  
L.A.—Latin America (n)  
N.A.—North America (n)  
QRM—Station interference  
s/on—Sign on  
s/off—Sign-off  
V—Varies  
VOA—Voice of America  
xmsn—Transmission from station  
xmtr—Transmitter used by station

ing," in English, is noted at 2000. Native music is heard at 1930-2000 and to 2016 s/off. (44)

Another outlet from Karachi is 15,270 kc., heard with English news at 1415. (CC)

**Saudi-Arabia**—This country now uses Standard Time (EST plus eight hours) instead of sun time, so their broadcasts are now at fixed times instead of shifting a few minutes each day. The current Jidda schedule reads: Arabic at 2330-0045 on 3990, 5975, 9650, 9750, and 9875 kc., at 0630-0900 on 3990, 5975, 11,750, 11,850, and 11,950 kc., and at 1230-1445 on 3990, 5975, 9650, 9750, and 9875 kc.; Indonesian at 0930-1010 on 11,950 kc.; and Urdu for Pakistan at 1030-1110 on 11,950 kc. (100)

Other xmsns are noted on 17,787 and 15,129 kc. in Arabic from 0900 to 1045/close and again from 1230 to 1245/close in Arabic on 17,787 and 15,160 kc. (29, 31)

**South Africa**—SABC, Roberts Heights, 25,820 kc., is often heard at 1000-1015 with classical music, at 1015-1045 with talks, at 1100-1105 with news, and at 1105-1130 with music. The



ASSEMBLE YOUR OWN  
**WALKIE-TALKIE**  
RADIOPHONE



for as little as  
**\$6.98**  
plus accessories

Specifications: 1 to 5 mile range with 18-inch antenna and much more with directional beam antenna. Tunes from 144 to 148 mcs. High level amplitude modulation. Silver plated tank circuit and many other exclusive features assure maximum efficiency and long battery life. Fully portable—no external connections ever needed. Meets FCC requirements for general class amateur license. No minimum age requirement.

- The following components are all you need to assemble a complete walkie-talkie as illustrated. Factory wired and tested transceiver chassis complete with special dual tube ..... \$6.98  
High output carbon mike ..... \$1.49  
Miniature mike transformer ..... \$ .98  
Powerful alnico magnet headphone ..... \$1.25  
Strong 16 gauge aluminum case (8"x5"x2") with all holes punched, battery compartment, battery switch plus all hardware and fittings including 18" antenna ..... \$3.98  
Uses standard batteries available at your local radio store. All components except tubes guaranteed for one year. Include 5% for postage. COD's require \$2.00 deposit
- SPECIAL:** Limited quantity, brand new Western Electric telephone handsets ..... \$6.98  
Receiver impedance matching transformer for using handset with walkie-talkie ..... \$ .98

All orders immediately acknowledged

**SPRINGFIELD ENTERPRISES**

Box 54-E Springfield Gardens 13, N. Y.

**GOODBYE TO SHOUTING!**

Shout no more! Now, with a lightweight, self-contained University POWRPAGE, your voice is projected clearly, distinctly. The POWRPAGE is ideal for sporting events, coaching, boating, church bazaars, picnics...literally anything requiring portable soundcasting. Just press button and talk! No waiting for warm-up. Two different types for every need.

**MODEL PP-1** Uses seven standard flashlight cells. Stands free or hangs from any convenient structure. Microphone has long 11 ft. cable for complete freedom of movement. Completely weatherproof. *Greatest power and voice clarity in portable soundcasting!* \$69.75 User Net (less batteries)



**MODEL PP-2** Where maximum compactness and freedom of action are desired. Weighs only 4 1/4 lbs. Uses six ordinary "pencil" batteries, or may be powered directly from 6 or 12 volt D.C. of car or boat ignition system. Completely weatherproof. \$65.00 User Net (less batteries)



See your local electronic parts or marine distributor. For literature and further information, write Desk A55, University Loudspeakers, Inc., 80 So. Kensico Ave., White Plains, N. Y.

LISTEN

*University sounds better*



Abraham Marcus, co-author of famous best-seller "Elements of Radio" makes amazing offer!



**TRY MY TV and RADIO REPAIR COURSE FREE FOR 1 MONTH**

"If you haven't earned at least \$100 in spare time during that period you pay not a cent."

Here it is! The most amazing guarantee ever offered on any radio-TV course anywhere! We'll send you Abraham Marcus' course to use **FREE** for one full month! If in that time you haven't actually made \$100 fixing radios and TV sets, just return the books to us and pay not a penny!

Why do we make this sensational offer? First, because these books are so easy to use. They are written in the same clear, easy-to-understand language that made the author's "Elements of Radio" a 1,000,000-copy best-seller. Second, because these books get right to the point—tell you what to do in 1-2-3 fashion. For example, once you master the first few chapters of the TV book you are ready for business—ready to do service jobs in the field—jobs that account for over 80% of all service calls.

**DON'T WAIT!** You risk nothing when you send the coupon at right. You don't have to keep the books and pay for them unless you actually make extra money fixing radios and TV sets. Even when you decide to keep them, you pay on easy terms. Mail the coupon now.

**WHAT YOU GET IN THESE 3 GIANT VOLUMES**  
**ELEMENTS OF TELEVISION SERVICING.** Analyzes and illustrates more TV defects than any other book, and provides complete, step-by-step procedure for correcting each. You can actually SEE what to do by looking at the pictures. Reveals for the first time all details, theory and servicing procedures for the RCA 28-tube color television receiver, the CBS-Columbia Model 205 color set, and the Motorola 19-inch color receiver.

**RADIO PROJECTS.** Build your own receivers! Gives you 10 easy-to-follow projects, including crystal detector receiver—diode detector receiver—regenerative receiver—audio-frequency amplifier—tuned-radio-frequency tuner—AC-DC superheterodyne receiver—etc.

**RADIO SERVICING Theory and Practice.** Here is everything you need to know about radio repair, replacement, and readjustment. Easy-to-understand, step-by-step self-training handbook shows you how to locate and remedy defects quickly. Covers TRF receivers, superheterodyne receivers; short-wave, portable, automobile receivers, etc. Explains how to use testing instruments such as meter, vacuum-tube voltmeters, tube checkers, etc., etc.



**MAIL THIS COUPON**

Prentice-Hall, Inc., Dept. 5702-D1  
Englewood Cliffs, New Jersey

Please send me Abraham Marcus' TV & RADIO REPAIR COURSE (3 volumes) for 10 days FREE examination. Within 10 days I will either return it and owe nothing, or send my first payment of \$5.60. Then, after I have used the course for a FULL MONTH, if I am not satisfied I may return it and you will refund my first payment. Or I will keep the course and send you two more payments of \$5.60 a month for two months.

Name .....

Address .....

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

March, 1957

**PROGRESSIVE "EDU-KIT"  
SUPERLINEAR WILLIAMSON  
AMPLIFIER & PREAMPLIFIER**



only  
**\$28.95**



This complete 12 watt amplifier kit with built-in preamplifier is a combination for achieving brilliant high fidelity performance. Utilizing a superlinear push-pull output stage, this low price amplifier is comparable in power and reproduction to much more expensive units. Features high power handling capacity, wide response, distortion-free output. An excellent opportunity for budget-minded Hi-Fi enthusiasts to bring to his home up-to-date top-notch High Fidelity equipment. Simplified step-by-step instruction manual together with pictorial and schematic diagram enable the constructor to build this high quality amplifier without the necessity of electronic knowledge or special equipment.

- POWER OUTPUT...12 watts
- PEAK POWER...18 watts
- OUTPUT IMPEDANCES  
4, 8 and 16 ohms
- FREQUENCY RESPONSE  
±½ DB 40-15,000 C.P.S.  
below 10 watts
- TONE CONTROLS...±16  
DB at 50 and 10,000 C.P.S.
- INPUT LEVELS...Aux. 0.3

- volt Phono-6 millivolts
- RECORD EQUALIZATION  
LP, RIAA, and EUR
- CONTROLS...4: Function,  
Loudness, Bass, Treble
- DIMENSIONS...12½"  
wide, 4" high, 8½" deep,  
approx.
- FINISH...Rose Gold  
panel—black cabinet

**ORDER FROM AD—RECEIVE FREE BOOK  
ON HIGH FIDELITY**

Enclose \$28.95 plus \$2.00 for handling and shipping.

NAME .....

ADDRESS .....

**PROGRESSIVE "EDU-KITS" INC.**

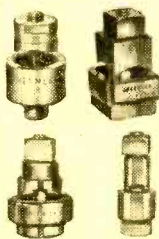
497 Union Ave., Dept. 201D, Brooklyn 11, N. Y.

**CUT  
CHASSIS  
HOLES  
FAST!**



**Smooth, accurate openings made in 1½ minutes  
\* or less with Greenlee Radio Chassis Punch**

Quickly make smooth, accurate holes in metal, bakelite, or hard rubber with a GREENLEE Chassis Punch. Easy to operate . . . simply turn with an ordinary wrench. Round, square, key, and "D" types . . . wide range of sizes to make openings for sockets, plugs, controls, meters, terminal strips, transformers, panel lights, etc. Assure perfect fit of parts and professional finish to every job. Write for descriptive literature. Greenlee Tool Co., 2383 Columbia Ave., Rockford, Ill.



9680-kc. outlet is noted with cricket games at 0930. (26, 31, 90, AF)

**South Korea**—HLKA, 11,925 kc., Seoul, is still heard with test program to Hawaii at 0130-0145 in English and Korean. HLKB, 7935 kc., Pusan, is noted at 0530-0550 with an English session. HLKA, 3911 kc., is tuned at 0700 in Korean and probably replaces the 2510-kc. outlet. AFKN, Homesteader, 6895 kc., relays the Armed Forces programs in English around 0700. (29, RB)

**Surinam** — PZC, Paramaribo, 15,406 kc., is noted with good signal and English news at 2030-2040, and in Spanish from 2045 to 2100 s/off. (25)

**Switzerland**—HER4, Berne, was noted with good signal in xmsn to Western South America from 2330 to 0000/close. A DX program is broadcast on the first Thursday of each

**SHORT-WAVE CONTRIBUTORS**

- Robert Bonner (RB), Lodi, Calif.
- Camilo Castillo (CC), Panama, R. P.
- Ha Chung-kwan (HC), Kowloon, Hong Kong
- Tom Conner (TC), Ashland, Oregon
- Austin Frazee (AF), West Point Pleasant, N. J.
- Anthony Gargano (AG), Philadelphia, Pa.
- Gerd Kreusslein (GK), Porz, Germany
- Ronald Pound (RP), Lovington, Ill.
- J. Art Russell (JA), San Diego, Calif.
- Robert Schwartz (RS), Brooklyn, N. Y.
- Brian Tandrow (BT), Northridge, Calif.
- Stewart West (J), Union, N. J.
- Peter Risse (23), Atlanta, Ga.
- Francis Welch, Jr. (25), Worcester, Mass.
- Floyd Backus (26), Richmond, Va.
- Phil Finkle (29), Burbank, Calif.
- Gordon Nelson (31), Inglewood, Calif.
- David Quarterson (40), Farrell, Pa.
- Anson Boice (44), New Britain, Conn.
- Grady Ferguson (59), Charlotte, N. C.
- John Beaver (61), Pueblo, Colo.
- Mary Iwai (65), Lombard, Ill.
- Bill Evans (70), Port Arthur, Ontario
- Joseph McGerard (71), New Britain, Conn.
- John Mann (82), Montreal, P. Q.
- Thomas Ivas (90), Chicago, Ill.
- Roger Legge (100), McLean, Va.
- Joel Whitaker, III (112), Indianapolis, Ind.
- Bob Jacobs (116), New York, N. Y.
- Bob Coomler (120), Los Angeles, Calif.
- Howard Kass (127), Brooklyn, N. Y.
- Tibor Gasparik (128), Cleveland, Ohio

month at 2045-2100 on HER3, 6165 kc., HER4, 9535 kc., and HER5, 11,865 kc. (112, BT)

**Tangier**—IBRA-Radio, Tangier, is now on a new channel of 8935 kc., replacing 15,020 kc.; and is noted in English at 1615-1645. The 11,515-kc. outlet runs in parallel. (4, 59, 82)

**Turkey**—This country can be heard well from TAU, 15,160 kc., in beam to British Isles and Europe at 1600-1645 in English. In parallel are TAS, 7285 kc., and TAP, 9465 kc. TAT, 9515 kc., has a N. A. program daily from 1815 s/on to 1900 s/off with news and music in English. (44 and many others)

**Vatican City**—Vatican Radio can be noted in English on 15,120 and 11,685 kc. at 1315-1330. The 9646-kc. outlet has a Slovak religious program at 1615-1650. The 15,120-kc. outlet does not carry French at 1345-1400. (25, 128)

**Windward Islands**—Windward Island B/C Service, Grenada, has moved from 17,800 to 17,805 kc. to avoid QRM from the VOA and is heard at 1700-2115 with 3390 kc. They have a request program Thursdays and Saturdays at 2030-2100. (23, 25, 26, 100)



# STANDARD LINE

MANUFACTURERS  
ORDERS INVITED  
EXPORT ORDERS  
INVITED

FEATURING  
FAMOUS FACTORY

# TUBES

Below Is A Partial List—Send For  
FREE Complete List and Order Form

0Z4	.42 5AT8	.79 6BK7	.75 7A4	.46 12J5	.39
1A7GT	.42 5J6	.59 6BL7GT	.74 7A5	.52 12L6	.59
1B3GT	.66 5T8	.48 6B6GT	.57 7A6	.44 12SA7	.47
1C5GT	.40 5U4G	.79 6B7GT	.79 7A7	.44 12S7	.54
1C6	.25 5UB	.57 6B7GT	.75 7A8	.44 12S7	.44
1C7G	.25 5V4G	.49 6BZ7	.57 7AU7	.69 12S7GT	.57
1D5GP	.42 5V6GT	.79 6C4	.36 7B5	.43 12SL7GT	.49
1H4G	.45 5X8	.38 6C6B	.50 7B5	.40 12SN7GT	.39
1H4G	.46 5Y3	.42 6C6GG	1.17 7B7	.42 12VGT	.59
1L6GT	.45 5Y4G	.44 6C6U	.79 7B8	.46 12W6	
1L4	.54 5Z3	.59 6D6	.47 7C4	.40 12X4	.36
1L6	.55 6A7	.46 6E5	.36 7C5	.41 14A7	.44
1LA4	.46 6A8	.44 6E5	.37 7C7	.44 14B6	.44
1LA6	.58 6A84	.66 6F6	.37 7E5	.44 14B7	.44
1LB4	.48 6AC7	.75 6H6	1.59 7E6	.44 19B6GG	.59
1LC5	.46 6AF4	.49 6J4	.38 7E7	.58 25BQ6GT	
1LC6	.56 6AG5	.68 6J5	.48 7F7	.74 25CA5	.79
1L05	.56 6AG7	.69 6J6	.38 7F8	.57 25CD6	
1LE3	.63 6AH4GT	.70 6K6GT	.38 7G7	.58 25CU6	1.29
1LH4	.46 6AH6	.53 6K7	.67 7N7	.64 25L6GT	.46
1LN5	.49 6AK5	.43 6L6	.59 7D7	.8 25W4GT	.36
1N5GT	.50 6AL5	.79 6N7	.39 7Y4	.59 25Z6	.24
1R5	.45 6AM8	.79 6O7	.70 7Z4	.40 27	.47
1S3	.50 6AN8	.45 6S4	.47 12A4	.59 35B5	.47
1T4	.46 6AQ5	.47 6S8GT	.75 12A6	.49 35C5	.46
1U4	.45 6AS5	2.25 6SA7	.47 12A85	.48 35L6GT	.38
1U5	.70 6AS7G	.38 6S8Y7	.40 12A85	.65 35W4	.40
1V2	.66 6AT8	.79 6S6	.42 12AT6	.42 35Y4	.38
2A3	.54 6AU4GT	.60 6S7	.42 12AT7	.58 35Z3	.40
2A7	.95 6AV5GT	.42 6S7	.49 12AUG	.41 35Z5GT	.38
2021	.50 6AUG	.79 6S7	.56 12AUG	.66 39/44	.47
3A4	.50 6AUG	.64 6S17GT	.56 12AV6	.64 50A5	.47
3A5	.52 6AV6	.38 6S7GT	.40 12AV7	.62 50B5	.44
3A15	.52 6AV6	.85 6S7	.40 12AX4GT	.62 50C5	.44
3AUG	.57 6AW8	.63 6S7	.85 12AX7	.67 50L6GT	.39
3B26	.57 6AX4GT	.56 6T4	.54 12B4	.45 80	.45
3BC5	.57 6AX5GT	.46 6T8	.79 12BA7	.59 84/6Z4	1.25
3BN6	.57 6BA6	.49 6U5	.79 12BA7	.45 117L7GT	1.25
3CB6	.55 6BC5	.89 6U8	.45 12B6	.59 117N7GT	1.25
304	.56 6BC8	.52 6V3	.39 12B7	.59 117P7GT	1.36
305GT	.46 6BD5GT	.45 6V6GT	.52 12B7	.79 117Z3	.61
354	.55 6BE6	.39 6W4GT	.38 12CA5	.74 12DQ6	
3V4	.75 6BF5	1.17 6W6GT	.38 12CA5		
4BQ7	.75 6BGG	.50 6X4	.38 12CQ6		
4BZ7	.79 6BH6	.46 6X5			
5AM8	.79 6BJ6	.67 6X8			
5AN8	.49 6BK5				
5A95					

- INDIVIDUALLY BOXED!
- GUARANTEED ONE YEAR!
- FACTORY BOXED • FACTORY IRREGULARS
- NEW JAN SURPLUS • EQUIPMENT TUBES

**ALWAYS 1000  
TYPES IN STOCK**

FREE POSTAGE! On All Orders  
Shipped In U.S.A., Territories and  
A.P.O.'s. Send 25c for handling on or  
ders under \$5.00. Please send approx  
postage on Canadian and foreign  
orders. Excess will be refunded.

Receiving Tubes Sent Parcel Post

## Thousands of TRADE-IN TV'S

Please Specify Console or  
Table Model When Ordering

10"	\$25.00
12"	\$30.00
14"	\$35.00
16"	\$42.00
17"	\$49.00
19"	\$56.00
20"	\$63.00
21"	\$70.00
24"	(when available) \$95.00
27"	(when available) \$129.00

Reconditioned By Factory  
Trained Technicians! Guaranteed To  
Be In Working Condition When You Receive  
Them!

Get yourself a second  
set or buy some for re-  
sale!

**FREE BONUS**  
two set coupler  
given with each set.

All TV's sent motor  
freight or Railway Ex-  
press F.O.B. our ware-  
house. Sorry, no A.P.O.  
shipments.

Standard Line  
**PICTURE  
TUBES**  
Guaranteed One Year

Any 10" Tube	.....	\$10.75
Any 12" Tube	.....	\$12.75
Any 14" Tube	.....	\$14.75
Any 16" Tube	.....	\$16.75
Any 17" Tube	.....	\$17.75
Any 19" Tube	.....	\$20.75
Any 20" Tube	.....	\$20.75
Any 21" Tube	.....	\$22.75

All Picture Tubes sent Rail-  
way Express F.O.B. our  
warehouse. Sorry, no A.P.O.  
shipments.

**FREE**  
12" TV SET  
with every re-  
ceiving tube or  
order of \$100.00 or  
more!

**Free**  
16" TV SET  
with every re-  
ceiving tube or  
order of \$200.00 or  
more!

**FREE**  
25 ASSORTED  
RESISTORS  
with every receiving  
tube order of \$6.00  
or more!

Bonus TV sets  
are shipped com-  
plete with cabinet  
and picture tube  
F.O.B. our ware-  
house. With slight  
adjustments and  
they can be re-  
stored like new.

We Are  
Not Selling  
Price—We  
Sell Only  
Quality

Remember —  
You Buy Quali-  
ty When You  
Buy Standard.  
Quality Never  
Shouts — It Al-  
ways Whispers

# STANDARD LINE

ELECTRIC COMPANY

432 HARRISON AVENUE, HARRISON, N. J. • Phone: HUmboldt 4-4997

# MEN WANTED: TO BABY-SIT WITH COMPUTERS

Someone has to take care of the Computers, feed them the right programs. Will it be you?

In the last decade a new profession has grown up which is recruiting members so rapidly that newspapers are crowded with job offers and firms often have to delay installations for want of trained service and operating personnel.

Few Universities give a full program in computer maintenance design, programming and theory. Yet the demand for trained people is obvious.

In this rapidly changing field there is room for people with ability who know computers, with or without benefit of college degrees.

The techniques are not difficult for people who understand electronics and are willing to work hard to learn.

No matter what your age, if you are intrigued by computers and want to work you will benefit from our comprehensive low-cost courses covering the whole range of computer technology.

We will send you free a booklet describing the training program which you can do at home at your own pace. You solve actual problems, assemble simple—or complex computers. You study programming and the methods of entering data in the latest computers.

Write now for an exciting introduction to computers in our free booklet.

**OLIVER GARFIELD CO., Dept. PE37C**  
31 Broadway, New Haven, Connecticut

Please rush me detailed information about your Comprehensive, low-cost computer training program.

I am interested in  
Analog Computers    Programming    Building small computers  
Digital Computers    Circuit Design    Computer Mathematics

My name .....

My address .....

Age ..... Occupation .....



## STEREOPHONIC RECORD PLAYBACK HEAD IN-LINE MODEL, TLD

For conversion, replacement, new equipment. Includes data, schematics for amplifiers, etc.

ORDER FROM:  
**NORTRONICS, INC.**  
1015 S. 6th Street  
MINNEAPOLIS 4 MINN.

\$19.05

Audio-  
ophile

## MOVING?

BE SURE POPULAR ELECTRONICS FOLLOWS YOU. PLEASE SEND YOUR CHANGE OF ADDRESS TO

POPULAR ELECTRONICS

CIRCULATION DEPARTMENT

64 E. Lake St.

Chicago 1, Ill.



## MORSE CODE

Learn Morse Code...

FAST...by Sound with

UNCLE SAM'S RECORDings

Code signals are transmitted at SLOW speed to allow you time to DUPLICATE them in DIDAH language or with whatever instrument you have to work with... also at FAST speed so that you will be FAMILIAR with how they SOUND when you hear them on the air.

Send ONLY \$1.25 for your 7 inch 45 RPM Record

Dealer and Jobber Inquiries Invited

UNCLE SAM RECORDings, Dept. D-3

59 E. Van Buren St.

Chicago 5, Illinois



ALWAYS  
READY

TO HELP YOU  
TO TEST YOU  
TO TEACH YOU

GIVES YOU  
MESSAGES TO  
DECODE

## Lissajous Had a Figure For It

(Continued from page 65)

were made for each three that were made vertically. The frequency on the horizontal plates is then two-thirds of that on the vertical.

Using this sort of frequency comparison, a home-built or commercial audio generator can be calibrated at a large number of points by using only the 60-cycle line current as a standard or one of the audio tones broadcast by the National Bureau of Standards on Station WWV. The table below shows a few of the cardinal points that can be calibrated by using 60 cycles as a standard. If the 600-cycle tone from WWV is used, all figures are multiplied by 10.

This same method serves the "ham" in checking the multiplying stages in short-wave transmitters. A signal picked up from the input of the stage to be checked is compared with a signal taken from the output of the same stage. The number of loops in the pattern indicates the number of times the stage is multiplying the frequency. Almost all of the common makes of oscilloscopes will operate in this manner up to 30 megacycles if the signal is applied directly to the deflection plates.

**Mechanical Tests.** The value of an oscilloscope is not limited to those interested in sound or electronics. For the hobbyist who would like to know the speed of small motors, perhaps one too weak to drive a mechanical tachometer, the scheme in Fig. 4 (page 65) is the answer.

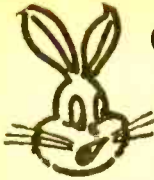
The shaft has been given a light coat of dull black paint or ink and a white spot of paint is dabbed on one side. When a flashlight or some other source of light

Horizontal Frequency (cps)	Vertical Frequency (cps)	Horizontal Peaks	Vertical Peaks
60	10	6	1
"	20	3	1
"	30	2	1
"	40	3	2
"	50	6	5
"	60	1	1
"	80	3	4
"	90	2	3
"	100	3	5
"	120	1	2
"	140	3	7
"	160	3	8
"	180	1	3
"	240	1	4
"	300	1	5
"	360	1	6
"	420	1	7

A few examples of calibrating audio frequencies (listed in "vertical" column) against the 60-cycle standard obtainable from the a.c. power line.

Always say you saw it in—POPULAR ELECTRONICS





# CHECK THESE "MARCH-MAD" VALUES!

## FREE!

ANY \$1 ITEM FREE  
WITH \$10 ORDER!  
THIS OFFER UNLIMITED!

YOUR DOLLAR ALWAYS BUYS MORE AT LEKTRON!

## LEKTRON'S FAMOUS



## DOLLARBUYS! EXCLUSIVE!

FREE! LEKTRON'S  
8-PAGE FLYER OF  
Bargains & Bonuses  
IN  
TRANSISTORS, SUBMINI-  
ATURE HOBBY PARTS &  
EQUIPMENT  
AUDIO • TOOLS •  
ELECTRONICS

**WIRE BY THE POUND** at scrap prices! Hundreds factory cut tinned hookup lengths. Ass'd. colors, sizes, stranding. 2 1/2 lbs. Reg. \$8. **K-171 \$1**

**SIX TIMING DEVICES**, Multi-gear'd gun mechanisms, timed for 3 secs. Hand wound, accurate. Reg. \$3 each. Wt. 1/2 lb. **K-116 \$1**

**SURPRISE PACKAGE!** Every kit an experimenter's dream! 100 useful hobby radio parts. Wt. 3 lbs. Reg. \$15. **K-122 \$1**

**4 MICROSWITCHES**, Sensitive, bakelite encased. Metal leaf, dime-size, too. Ass'd. contacts; 115 VAC. 10A. Reg. **K-155 \$1**

**60 PLUGS & RECEPTACLES**, Wide variety chassis, speaker, panel, audio, power types. Wt. 2 lbs. Reg. \$8. **C-14 \$1**

**12 POPULAR CONTROLS**, volume, bias, radio & TV types. Dual & switch, too. Pop. sizes, shafts. Up to 1 meg. Reg. **\$3 \$10**. Wt. 1 lb. **K-153 \$3**

**2 CARBON MIKE XFMRs**, 200 ohm to hi-imp. grid. Encased. 2" sq. Wt. 1 lb. Reg. **\$8 \$1**

**12 "TIP" JACKS**, ICA, Johnson, molded red & black types. Test equipment, panels, transistor radios. Reg. \$3. **C-17 \$1**

**THREE 6VDC RELAYS** for mobile, low voltage use. Operate on 4 to 12 VDC. SPST. 10A. Wt. 1 lb. Reg. \$3. ea. **C-18 \$1**

**15-PC. TOGGLE, JACK, BOX sets**, 9 bat handle toggle switches, 3 phone jacks, 3 alum. boxes, receptacles. Wt. 3 lbs. **C-19 \$1**

**15W HI-FI OUTPUT XFMR**, UTC PA series. Push-pull 616's to 4, 8 & 500 ohm secondaries. Encased. Wt. 3 lbs. Reg. **\$6 \$1**

**15 ERIE & CENTRALB TRIMMERS**, Ceramic, ass'd. values. Singles & duals. Wt. 1 lb. **K-105 \$1**

**3 OUTPUT XFMRs**, For 50L6 & 6V tubes to 3-4 ohm V.C. Wt. 2 lbs. Reg. \$8. **K-301 \$1**

**000-999 COUNTER**, Veeder Root reset type; direct drive. Lowest price anywhere! Hundreds of uses. Reg. \$6. **B-901 \$1**

**0-60 MIN. PHOTOTIMER**, Famous Rhodes "Mark Time." Built-in 115VAC micro-switch. Less knob & escutcheon. Wt. 1 lb. Reg. \$8. **C-21 \$1**

**SCOOP! TWO 7" LOOPSTICKS**, Heavy ferrite core, 5/8" dia. Extremely hi-Q. For superhets, transistors. Wt. 1/2 lb. **C-22 \$1**

**12 ROTARY & PANEL SWITCHES**, Single & double gangs, micro, power, push. A.C. Wt. 3 lbs. Reg. \$15. **K-139 \$1**

**BENCH VISE**, Heavy steel, w/ clamp type base, 1 1/2" jaws. Reg. \$2.50. **K-160 \$1**

**16 PRINTED CIRCUITS** on 8 x 16" boards. Design your own, many used! Wt. 1 lb. Reg. **\$5 \$1**

**4 SUB-MINI RECTIFIERS** designed for printed & transistor circuits. 1/2-wave. 1 x 3/8". Wt. 1/2 lb. Reg. **\$5 \$1**

**HOBBY TRANSFORMER**, 115 VAC, 60 cycle to 24V @ 3 Amps. Fil. transformer for shop, surplus gear, hobbyists. Wt. 3 lbs. Reg. \$8. **K-317 \$1**

**2 TRANSISTOR LOOPSTICKS**, Tapped, match trans. input impedance for better selectivity. **K-315 \$1**

**SUN BATTERY** & photo cell, 1 1/2" dia. Better than famed 22BM Reg. \$5. **B-670 \$1**

**125 RESISTORS**, Carbon, 1/2 to 10 meg. 40 values, 5 ohms to 10 meg. 5%, tool Reg. \$15. **K-164 \$1**

**2 TRANSISTOR COUPLERS**, Eliminate trans. & r/c coupled amp. stages. 100K imp., 5000 DC ohms; center tapped. Reg. 7/8" x 7/8". Reg. \$3. **B-739 \$1**

**3 LBS. HARDWARE**, 2000 pcs. ass'd. screws, springs, washers, etc. Reg. \$8. **K-104 \$1**

**G-E PREAMP KIT** for magnetic cartridges. Chassis, parts, diagram. Less 68C7 (88¢ extra). Wt. 1 lb. Reg. \$4.50. **K-103 \$1**

**100 CERAMIC CONDENSERS**, Ass'd. types, top makers. 30 values, color-coded. Discs, too. Reg. \$15. **K-152 \$1**

**4 CRYSTAL DIODES**, Most commonly used—1N34, 1N58, 1N38, 1N89 in poly bag. Reg. \$5. **K-303 \$1**

**100 COIL FORMS**, 15 types. Assorted sizes, insulation. Reg. \$15. **K-136 \$1**

**60 TUBULAR CONDENSERS**, 30 types, .0005 to 0.5mf to 1500V. Wt. 2 lbs. Reg. \$12. **K-145 \$1**

**70 TERMINAL STRIPS** and boards, 15 types, 4 to 20 screw and solder points. Wt. 1 lb. Reg. \$5. **K-141 \$1**

**70 RESISTORS**, Insulated IRC, 4-B, etc. 2 W. 10% & 5%. Wt. 1/2 lb. Reg. \$10.95. **K-141 \$1**

**70 MICA CONDENSERS**, 30 values: .00001 to .01 mf to 1000V. Silver, 5%, too. Wt. 1 lb. Reg. \$5. **K-146 \$1**

**60 STANDARD KNOBS**, Ass'd. colors, bakelite & plastic. Wt. 2 lbs. Reg. \$9. **K-143 \$1**

**30 POPULAR BULBS**, 1.1 to 6V, screw and bayonet types, miniature. Wt. 1/2 lb. Reg. \$2.40. **K-113 \$1**

**15 AC/DC LINE CORDS**, for clocks, motors, etc. 2-cond. w/ molded plugs. Wt. 1 lb. Reg. \$5. **K-149 \$1**

**10 "POLY" BOXES**, Ass'd. sizes, clear plastic hinged boxes w/ snap locks. Reg. \$2.50. **K-170 \$1**

**40 MINIATURE CONDENSERS**, Ass'd. miniature, subminiature, printed circuit types; Centralab, Sprague. **K-200 \$1**

**30 POWER RESISTORS**, WW, candohm, sandcoated vitreous. 15 values, 5 to 50W; 35 to 11000 ohms. Wt. 2 lbs. Reg. \$8. **K-309 \$1**

**30 PRECISION RESISTORS**, WW & carbon film. 30 values, 5¢ ohms to 1 meg; 1/2, 1 & 2W, 1% tol. Wt. 1/2 lb. Reg. \$2.1. **K-150 \$1**

**25 TUBE SOCKETS**, 4 to 11-pin miniatures, subminiatures, octals, zip-ins. Tube shields, too. Wt. 2 lbs. Reg. \$6.50. **K-154 \$1**

**10 ELECTROLYTICS**, PF & twist, tubular, rect. Ass'd. sizes, 8 to 500 mfd to 450V. Wt. 3 lbs. Reg. \$15. **K-142 \$1**

**8-PC. NUTDRIVER SET**, Plastic handle, 3/16, 7/32, 1/4, 5/16, 11/32, 3/8, 7/16" steel sockets wrenches in plastic case. Wt. 1 lb. \$3 value. **K-102 \$1**

**15-PC. TWIST DRILL SET**, 1/16 thru 3/4" by 64ths; in graduated plastic holders. Reg. \$4. **K-144 \$1**

**8 TRANSISTOR SOCKETS**, for sub-miniature tubes, too. Mica filled. Reg. \$3. **B-596 \$1**

**4 SILICON DIODES**, 1N21, two 1N22, 1N23. Reg. \$15. **K-148 \$1**

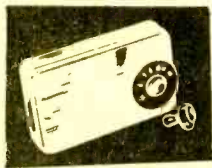
**40 SUBMINIATURE RESISTORS**, in poly box. 1/4" long! 20 values, 15 ohms to 10 meg. 1/5 W. Reg. \$5. **K-169 \$1**

**5000 OHM RELAY**, by Allied Control, 4PDT, for plate and control circuits. 15 mA. Reg. \$6.50. **K-311 \$1**

**MINI-METER BUY!** 1 1/4", round, 0 to 6 amps. AC. Chromed. For model railroads, power supplies, mobile. Reg. \$3. **K-132 \$1**

**5 ROLLS TAPE**, electrical, plastic friction, rubber. For home, shop or lab. Reg. \$2.50. **K-305 \$1**

ABOVE KITS AND ASSORTMENTS ONLY ONE DOLLAR EACH!



### LOOK! PERSONAL POCKET SUPERHET RADIO \$12.99 ONLY

COMPLETELY WIRED •  
READY TO PLAY! FULL  
GUARANTEE • BIG SET PERFORMANCE WITH NO  
EXTERNAL CONNECTIONS

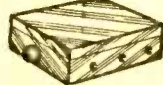
Amazing pocket radio, sold elsewhere for \$20-\$27. 5 1/2" x 3 1/2" x 1 1/2" molded ivory case fits easily into pocket. Built-in super sensitive ferrite antenna. Real big set performance: in volume, sensitivity, selectivity. Separate tuning & volume controls. Top craftsmanship. Hearing aid phone included. Broadcast band. Central frequencies plainly marked. 3 miniature tubes. Gift pack. Wt. 1 lb. GUARANTEED SATISFACTION. Order No. B-689. BATTERIES FOR ABOVE Order No. B-690. \$2.00 CARRYING CASE w/shoulder straps C-11. \$1.98

ORDER BY STOCK NUMBERS  
i.e., "ONE K-321" \$2.98"



New ordering procedure helps avoid errors, speeds delivery. Send check or M.O. including sufficient postage; excess returned. C.O.D. orders, 25% down. Rated. net 30 days. PE-3

MONEY BACK GUARANTEE OF SATISFACTION



### 3 EXCLUSIVE! TRANSISTOR RADIO KITS

**KIT #1—"SOLAR CELL"** Dual-powered, pocket size! Sensitive, ample volume. Sun Battery for daytime or electric light; Mercury Cell for night—outlasts regular batteries 5 times! MINUTES TO COMPLETE —ALL PARTS MOUNTED. Pre-drilled styrene cabinet, step-by-step instructions, hi-gain transistor, diode, latest loopstick permeability tuner, posts, jacks, wire, hardware. Wt. 3 oz. **\$5.88**

**KIT #2—"SOLAR"** Sun Battery powered. (Kit #1 less Mercury Cell) Order No. B-631. **\$4.98**

**KIT #3—"CELL"** Mercury Cell powered. (Kit #1 less Sun Battery.) Order No. B-632. **\$3.98**

#### DIODE RADIO KIT

Complete—w/pre-drilled cabinet, germ. diode, loopstick instructions. All parts mounted. Wt. 1/2 lb. Reg. \$3. **B-677 \$1**

#### 60 COILS AND CHOKES

20 different types, RF coils, chokes and slug-tuned coils for radio, TV and lab uses. Wt. 1 lb. Reg. \$15. **K-137 \$1**

# LEKTRON

SPECIALTIES

131-133 Everett Ave.

Chelsea 50, Mass.

March, 1957

117

Why let those good positions  
go to somebody else?

**LEARN AT HOME**

**MATH** for the Practical Man

**AMAZING NEW METHOD**

teaches you *QUICKLY, EASILY*

You need MATH to step into  
the hundreds of positions at  
**FAMILY-MAN SALARIES**  
In the Classified Ads daily!

Send today for the Math Course that can  
change your future! **FREE** for 10 days! Arith-  
metic, Algebra, Geometry, Trigonometry, Cal-  
culus—5 volumes, cloth-bound, 200 to 342  
pages each—**VALUE \$14.75**—with this ad,  
only **\$9.85** Just write your name and address  
in margin and send to: **D. VAN NOSTRAND**  
**COMPANY, Inc., Publishers—120 Alexander**  
**St., Princeton, N. J.** You'll learn Math easily  
—or return within 10 days without obligation.

PE3-57

## Shrinks Hemorrhoids New Way Without Surgery

Science Finds Healing Substance That  
Relieves Pain—Shrinks Hemorrhoids

For the first time science has found a new healing  
substance with the astonishing ability to shrink hem-  
orrhoids and to relieve pain—without surgery.

In case after case, while gently relieving pain,  
actual reduction (shrinkage) took place.

Most amazing of all—results were so thorough  
that sufferers made astonishing statements like  
"Piles have ceased to be a problem!"

The secret is a new healing substance (Bio-Dyne\*)  
—discovery of a world-famous research institute.

This substance is now available in *suppository* or  
*ointment form* under the name *Preparation H\**. Ask  
for it at all drug counters—money back guarantee.  
\*Reg. U.S. Pat. Off.



**college graduates  
get ahead faster!**

You see it in your own city. They have higher incomes . . . advance  
more rapidly. Grasp your chance for a better life. Industrial growth  
. . . automation . . . technical advances create career opportunities  
for engineers, accountants, management experts. Share rewards await-  
ing college-trained men. Important firms visit campus regularly to  
employ Tri-State College graduates. Start any quarter in this world-  
famed college. *Approved for veterans.*

**Bach. of Science degree in 27 months**

In Mechanical, Civil, Electrical, Chemical, Aeronautical, Radio (TV,  
Electronics) Engineering. In 36 months a B.S. in Business Administration  
(General Business, Accounting, Motor Transport Management  
majors). Superior students may accelerate. 36-week course in Drafting.  
*Intensive programs:* technical fundamentals stressed; comprehensive  
courses with more professional class hours. *Small classes:* personal-  
ized instruction. Enrollment limited to 1550. Preparatory courses.  
*Beautiful campus.* Well-equipped, new and modernized buildings and  
laboratories. Enter March, June, Sept., Jan. Earnest, capable students  
(whose time and budget require accelerated courses  
and modest costs) are invited to write Jean McCarthy,  
Director of Admissions, for catalog and book "Your  
Career in Engineering and Commerce."



**TRI-STATE COLLEGE**

3637 College Avenue

Angola, Indiana

118

(operated on direct current) is directed on  
the shaft, the light reflected from the white  
dot as the shaft revolves induces a voltage  
in a photocell. This signal, which consists  
of one pulse for each revolution of the mo-  
tor, is placed on one set of 'scope plates.  
If a signal from a calibrated signal source  
is placed on the other set of plates and ad-  
justed until a single loop pattern is formed,  
the revolutions per second of the motor  
tested can be read from the oscillator.

Almost any type of rotating machinery  
can be checked with this method by using  
the proper variation. The speed of a model  
airplane engine can be checked by shining  
the light through the rotating propeller to  
the photocell. Of course, the result must  
be divided by two, because the double blade  
of the propeller is generating two pulses  
for each revolution.

Another variation of this same method is  
the use of a microphone to pick up sounds.  
The sustained note of a musical instrument  
can be picked up and the resulting impulses  
used to energize one set of 'scope plates. If  
the second set of deflection plates is fed  
from a calibrated audio signal source, the  
frequency of tone picked up by the micro-  
phone can be determined with precision.

In using the Lissajous form of oscillo-  
scope display, several things should be  
remembered. The general shape of the  
pattern is not important for frequency  
comparison. Ignore odd ripples and bumps.  
The number of line-crossings or loops is  
what counts.

—50—

## The 21 Special

(Continued from page 61)

Never switch S2 to the grid current position  
when the key is open. The key should be  
closed during all tuning operations.

"Simple enough," admitted Tommy.  
"Now, what do I do when I want to op-  
erate the transmitter on 10 meters—*as-  
suming I pass my General Class license  
one of these days?*"

"Don't worry about the General exam!  
You'll do okay when the time comes. Then  
you'll be ready for 28-mc. DX'ing! Here  
are the tuning steps for ten and eleven  
meters . . ."

Both the oscillator and amplifier tuned  
circuits cover the range of 20 mc. to 32 mc.,  
inclusive. It is possible, therefore, to tune to  
any frequency in that portion of the spec-  
trum. For 10-meter operation, resonate C3  
to 28 mc., which is near minimum capacity.  
At this point, grid current may be observed  
on the meter when S2 is in the grid position.

Adjust C3 for about 0.5-ma. current read-  
ing. Set C17 near minimum capacity and

Always say you saw it in—POPULAR ELECTRONICS



C18 at maximum capacity. Attach the 10-meter antenna, and place S2 in the plate position. Close S3 and resonate C17 for minimum plate current. Adjust antenna loading by means of C18 until the plate meter reads 0.6 ma., corresponding to a plate current of 120 ma.

"Gee, that's swell," said Tommy, "but what if I want to get on 11 meters?"

"No problem there if you use a crystal between 6750 and 6800 kilocycles. Your plate tuning capacitors may need a little touching up since this is a lower frequency."

"Well, I'm off to the junkbox," announced Tommy, heading for the door.

"Slow down a minute," I yelled after him. "You may have to check that big jobber downtown for the power transformer and LMB cabinet. But don't worry; they're in stock. Good luck!"

## FM Commercial Silencer

(Continued from page 69)

shielded cable to the end of the 68,000-ohm resistor that is nearest the side of the cabinet. This is the output for the beeper tone. Conversion to another type of tuner or FM radio is just as simple.\*

**Testing and Adjusting.** Once the unit is connected to your tuner or radio, the adjustment is extremely simple, though it will take some time to catch enough announcements to tune it properly. Connect a voltmeter across the relay coil and adjust the squelch control R5 so that the relay drops out and the audio comes through. During an announcement that has a beeper tone, adjust the filter coil, L1, for maximum voltage across the relay coil. When the beeper tone is absent, the voltage across the coil should be about 8 volts. When the beeper tone is present, the voltage should rise to about 20 volts.

These voltages are approximate and will vary with the type of relay used. Any sensitive relay will work satisfactorily. The resistance of the relay coil acts as bias for the output tube V1b; and if a relay of more than 8000 ohms is used, the relay will probably not trip. In general, any coil resistance between 4000 and 8000 ohms will be satisfactory. Make sure the squelch control is not set up too high, or the relay

\* If you are connecting the silencer to a radio, it will be necessary to install two more connectors. Select the wire that is connected to the end of the volume control opposite the ground connection and remove it. Then connect the shielded wire to one of the connectors. This is the audio input. The wire that was removed from the volume control should be connected to the other connector. This is the audio output. Both of these connections are wired to the silencer through fairly short pieces of shielded wire.

March, 1957

# knight-kit 'SCOPES

## ARE THE BEST YOU CAN BUILD

**EASIEST TO ASSEMBLE—AND YOU SAVE!**



Feature for Feature, the World's Best Scope Kit Values



Dozens of other knight-kits available

KNIGHT-KIT 'Scopes will equal or better the performance of commercially wired instruments costing several times the price. You'll marvel at the ease of KNIGHT-KIT assembly—you'll be proud of your finished instrument—and you'll save more!

### 5" Wide-Band All-Purpose Scope Kit

Truly wide-band performance for lab use and color TV servicing. 5-mc bandwidth. Two printed circuit boards and laced wiring harness for easy, accurate assembly. Wide sweep range—from 15 to 600,000 cps. Response, 5 cps to 5 mc, down only 1 db at 3.58 mc color burst frequency, down only 3 db at 5 mc. High sensitivity of 25 mv/inch. Features: Cathode-follower inputs; high intensity trace; push-pull amplifiers; positive and negative locking; one volt p-p calibrating voltage; Z-axis input; astigmatism control; blanking circuit; DC positioning control; many other deluxe features. Complete with CRT and all parts. Shpg. wt., 31 lbs.

Y-144, 5" Wide-Band Scope. Only \$69.00

### Low-Cost General-Purpose 5" Scope Kit

Defies comparison with any scope kit at anywhere near its price! Meets 90% of all scope requirements; ideal for radio-TV servicing and audio work. Standout features include: *Phantastar Sweep Circuit*—provides high linearity of sweep from 15-150,000 cps; *Regulated Calibration Voltage*—injected into circuit by spring return switch; *25 Millivolts/Inch Sensitivity*—three times the sensitivity of other kits in its price class; *Reverse Blanking*—found only in high-priced scopes; *Vertical Amplifier*—response  $\pm 3$  db from 3 cps to 1.5 mc ( $\pm 6$  db to 2.5 mc). Frequency-compensated input controls. Impedance, 3.3 meg and 45 mmfd. Has positive and negative internal sync. Complete with CRT and all parts; printed circuit, laced wiring harness. Shpg. wt., 28 lbs.

Y-146, 5" General-Purpose Scope. Only \$49.50

GET THE BIG PAGE 1957

**FREE**

## ALLIED CATALOG

See our complete selection of KNIGHT-KITS—plus the world's largest stocks of Hi-Fi systems and equipment, recorders, Amateur equipment, test instruments, TV components, parts, tubes and tools. FREE—send for it today!



our 36th year

## ALLIED RADIO

ALLIED RADIO CORP., Dept. 79-C-7  
100 N. Western Ave., Chicago 80, Ill.

Send the following KNIGHT-KITS:

- Y-144.  Y-146.  
\$ \_\_\_\_\_ enclosed. (Prices Net F.O.B. Chicago)  
 Send FREE 356-Page ALLIED CATALOG.

Name \_\_\_\_\_

Address \_\_\_\_\_

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

# F.C.C. LICENSE QUICKLY!

## Grantham Training Is Best

Grantham School of Electronics specializes in preparing students to pass FCC examinations. We train you quickly and well. All courses begin with basic fundamentals—NO previous training required. Beginners get 1st class commercial (not amateur) license in 12 weeks!

**Here's Proof!** Recent graduates, the license they got, and how long it took them:

	License Weeks
D. Seigler, 216 Dowling, Walterboro, S. C.	1st 10
Tim Marek, P. O. Box 9167, Suitland, Md.	1st 13
W. Reynolds, 328½ Wash. Bl., Venice, Calif.	1st 12
Richard Jones, Station KGHF, Pueblo, Colo.	1st 13
Joe C. Davis, Waynesboro, Miss.	1st 11
W. D. Mains, 6332 S. Paramount, Rivera, Cal.	1st 12
B. A. Willms, 1401 E. Muriel, Orlando, Fla.	1st 12
J. E. Murphy, Wesley Hotel, Washington, D. C.	1st 12

(Mail coupon to school nearest you.)

### Grantham Schools, Desk 73-C

821 19th Street, NW Washington 6, D. C. **OR** 1505 N. Western Ave. Hollywood 27, Calif.

Please send me your free booklet, telling how I can get my commercial FCC license quickly. I understand there is no obligation and no salesman will call.

NAME .....

ADDRESS .....

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

I am interested in:  
 Correspondence course  Resident classes

## PORT ARTHUR COLLEGE ELECTRONICS COMMUNICATIONS

AM FM Television Broadcast Engineering  
Marine Radio Radar

CHECK THESE FEATURES: tuition \$84 per mo., room & board \$50 per mo. in dorm on campus. College operates 5 KW broadcast station. Students get on-the-job training at studios on campus. FCC license training with all courses. Well equipped classrooms & lab., am fm transmitters, radar & marine eqmt., television camera chain, experiment lab test eqmt., & other training aids. Our graduates in demand at good salaries. Free placement service. Have trained men from all 48 states. Approved for GI. Write for details.

**PORT ARTHUR COLLEGE** Port Arthur Texas  
Established in 1909

### STYLUS PRESSURE GAUGE


Precision stylus pressure gauges available in 2 models calibrated from 2 to 15 grams or 3 to 30 grams each way from center position.

**\$9.85**

The extra indicator "hand" will remain at the maximum reading of the device until reset by a knob on the dial face.

Send for Folder Code GIOJU

**GEORGE SCHERR CO., INC.**



**CORRECT STYLUS PRESSURE NOT ONLY GUARANTEES MINIMUM STYLUS AND RECORD WEAR, BUT ASSURES SOUND PICK-UP AT MINIMUM DISTORTION.**

200-CS Lafayette St.  
New York 12, N. Y.

might trip on high-frequency sounds, such as violins.

**Caution:** The 24-hour music stations are protected by the FCC. You cannot install an FM receiver using this circuit in a *commercial* establishment. This includes your friend who owns a hamburger stand around the corner and wants you to buy him an FM receiver to reduce the indigestion of his customers.

-30-

## Infrared Photocell System

(Continued from page 49)

approximately 3 5/8" from the center of the lens. The distance of the filament from the lens is easily changed by sliding the socket backward or forward between the jaws of the battery clip.

Putting the infrared lens assembly together is a simple matter. Using a pair of diagonal pliers, cut through the plastic frame of the lens in two or three places so that it may be peeled off. Set the lens in the wide portion of the infrared filter holder and lay a piece of thick spaghetti tubing around its edge. Carefully bend the flanges downward to exert pressure all around the circumference. This holds the lens firmly in place without a metal-to-glass contact.

Cut a hole in the front panel of the light-source case the same distance up from the bottom as in the photo-relay. The hole size should be carefully chosen so that the smaller flange of the infrared filter holder fits into it snugly without light leaks. Finally, bend the inside serrations against the sides of the hole to prevent the assembly from falling out.

If there are objectionable light leaks due to improper fit anywhere on the case, these may be sealed with black vinyl insulating tape.

### INSTALLATION

Line up the light source and photocell relay with the infrared beam sharply focused. Although the beam itself is invisible, a dull red glow may be seen in a slightly darkened room by looking into the lens of the light source. Slide the 32-candlepower lamp back and forth between the jaws of the battery clip until a projected



**Connections** of test lamp setup that may be connected to the relay binding posts during adjustment of photo-relay. These help determine the position of the Sigma 4F relay contacts while the setup is being adjusted.



# Be informed

Now, the latest international news, events, directly by short wave radio ...  
**LONDON, PARIS, ROME, CAIRO, MOSCOW, BERLIN, CHINA, JAPAN, AUSTRALIA**

**IN YOUR CAR with Gonset's innovation, the Push Button,**

## Shortwave Converter



Usable only on cars having 12 volt battery systems.

Operates in conjunction with your present auto radio and antenna to provide excellent short wave reception.

No need to open or alter auto radio. Merely connect leads provided to auto radio and to dash auxiliary battery lead

Covers 13, 19, 31 and 49 meter international SW broadcast

2995

Available at radio stores handling amateur equipment and also from many automobile parts stores.

**GONSET** BURBANK CALIF.

DIVISION OF L.A. YOUNG SPRING & WIRE CORPORATION.

# MATHEMATICS

ADVANCED

INDUSTRY TODAY DEMANDS, MORE THAN EVER, THE MAN WITH A GOOD MATHEMATICAL FOUNDATION.



In any branch of engineering, too, mathematics (up to and including calculus) is essential if you want to get ahead in this modern age of technical development. Our reasonably priced home study courses can train you by easy stages to advanced standards—even from an elementary beginning. Examination successes have been won by our students throughout the world. Write today for our handbook listing mathematics and over ninety other courses in all branches of engineering.

Civil	Radio	A.M.I.Mech.E.
Structural	Electronics	A.M.Brit.I.R.E.
Mechanical	Aeronautical	A.F.R.Ae.S.
Electrical	A.M.I.C.E.	B.Sc. (Pure Science)

**105 PAGE HANDBOOK FREE**

Canadian Institute of Science and Technology Limited  
 650 Century Bldg., 412, 5th St. N.W. Washington, D.C.

Please forward free of cost or obligation your handbook, "ENGINEERING OPPORTUNITIES".

Name .....

Address .....

Interested in ..... Course

Age

Canadian Enquiries: Canadian Institute of Science & Technology, 263 Adelaide St. W., Toronto, Ont.

# 40¢ FOR ANY TUBE

WE WILL NOT BE UNDERSOLD

**We Have OVER 1000 USED TV SETS**

At All Times in Our Huge Warehouse. Buy one or more of these WORKING TV's to sell or just as your own second set! All sets in GOOD WORKING condition! Your Choice—Console or Table Model.

- |                 |                 |
|-----------------|-----------------|
| 10".....\$23.00 | 19".....\$58.00 |
| 12".....\$28.00 | 20".....\$64.00 |
| 14".....\$33.00 | 21".....\$72.00 |
| 16".....\$40.00 | 24".....\$99.00 |
| 17".....\$46.00 |                 |

When ordering TV's, state whether table model or console is desired. Also preference on make of set. All TV's sent railway express F.O.B. Newark. On any quantity WIRE or CALL today!

PROMPT SHIPMENT OF ALL ORDERS!

FREE BONUS ANTENNA GIVEN WITH ANY TV SET ORDER!

SEND for our FREE complete TUBE & PARTS LIST and order blank.

FREE POSTAGE in U.S.A. and Territories on orders over \$5.00. 25¢ handling charge on orders under \$5.00. 25% deposit required on C.O.D.'s. Please send approximate postage or freight on Canadian and Foreign orders. Subject to prior sale.

DON'T PAY MORE FOR SET TESTED LONG LIFE DEPENDABLE HI-FI RADIO & TV TUBES • BUY VIDEO • INDIVIDUALLY BOXED—ALL GUARANTEED FOR ONE YEAR OR YOUR MONEY BACK WITHIN 5 DAYS—37.00 Per Hundred

Some Standard Brand—Others With Famous VIDEO Brand

0A2	2X2	GAC7	6BK5	6S67	7F8	12V6GT
0A3	3A4	GAG5	6BK7	6SH7	7N7	12X4
0A4	3A5	GAF4	6BN6	6S17GT	7Q7	14A7
0B2	3AL5	GAH4GT	6BL7GT	6SK7GT	7Y4	14B6
0C3	3AU6	6AK5	6BQ6GT	6SL7GT	7Z4	14Q7
0Z4	3BC5	GAL5	6BQ7	6SN7GT	7A6	19B6GC
1A7GT	3CB6	GAMB8	6BY5G	6SQ7	12AH7GT	19T8
1B3GT	3Q4	GAN4	6BZ7	6S57	12AT6	24A
1C7G	3S4	GQ5	6C4	6S77	12AT7	25AV5GT
1F4	3V4	GQ7GT	6CD6G	6T8	12AU6	25BQ6GT
1H4	4B27	6AS5	6CF6	6U4GT	12AU7	25C06G
1H5GT	4B97	6A57G	6CS6	6U7G	12AV6	25C06
1I6GT	5A8	GAT6	6CU6GT	6U8	12AV7	25L6GT
1L4	5AN8	6AU4GT	6E5	6V3	12AX4GT	25W4GT
1L6	5AQ5	6AU5GT	6E6GT	6V6GT	12AX7	25Z6GT
1LA6	5AT8	6A6	6J4	6W4GT	12Z7	35L6GT
1LC5	5A78	6BV5GT	6JS5GT	6X4	12BA6	35W4
1LH4	5AW4	6AV6	6J6	6X5GT	12B6	50B5
1LN5	5AZ4	6AX4GT	6KG6T	6X8	12B7	35Z6GT
1M5GT	5I6	6A6	6L6	6Y6G	12BY7	50A5
154	5T8	6AX5GT	6N7GT	7A5	12C6	50B5
155	5U4G	6B5	6S4	7A7	12C6	50C5
174	5U8	6B7	6S7G	7B5	12C7	50L6GT
1U5	5V4G	6B6	6SA7	7B7	12S7	80
1V2	5V6GT	6B5	6S87Y	7C5	12S7GT	117N7GT
1K2	5Y3	6B6G	6SC7	7C6	12SK7	117P7GT
2A7	5Y4G	6B8G	6SF5	7C7	12SN7GT	117Z3
2D21	6AB4	6B16	6SF7	7F7	12SQ7	

FREE RCA "CHEATER" CORD GIVEN WITH ANY TUBE ORDER OF \$7.00 OR MORE! PROMPT SHIPMENT OF ALL ORDERS

# VIDEO ELECTRIC COMPANY

79 CLINTON PL. NEWARK, N. J. Phone HUmboldt 4-9848



**QUAL-KITS  
ARE  
EASIEST!**

Hi-Fi Amplifier Kit \$28.50  
Hi-Fi AM-FM Tuner Kit \$28.95\*  
And they have the finest features and specs. Fully illustrated step-by-step 28-page manual makes assembly a snap! WRITE FOR FREE CATALOG!

319 Church Street Dept. P-3 New York 13, N. Y.

## YOUR F. C. C. LICENSE

**GUARANTEED PREPARATION**

Get Your License by the Easy Emig Method—Paced at Your Speed—Study Time at Your Convenience.

Write Now For Free Information

**EMIG SCHOOL OF ELECTRONICS**

4902 SUNSET BLVD. HOLLYWOOD 27, CALIF.

## INVENTORS

Send for  
**PATENT INFORMATION**  
Book and  
**INVENTOR'S RECORD**  
without obligation

**GUSTAVE MILLER**  
37-PE WARNER BUILDING  
WASHINGTON 4, D. C.

**REGISTERED PATENT  
ATTORNEY**

ASSOCIATE EXAMINER  
U. S. PAT. OFF. 1922-1929

Patent Attorney & Advisor  
U. S. NAVY DEPT. 1930-1947  
**PATENT LAWYER**

## MULTIPLE FM-TV COUPLER...

Designed to permit simultaneous operation of an unlimited number of FM and TV sets from one common antenna. Coupler can be used on any open line or twin lead regardless of spacing or impedance. Simple to install it will deliver the signal to the set without causing loss or distortion in other sets on the same antenna. Coupler is Dependable. Service free. Permanent. Satisfaction guaranteed or money refunded. \$3.00 Postpaid. Check or Money Order. No. C.O.D.'s.

**NANTAIS ANTENNA SYSTEMS**  
15718 Paramount Boulevard, Paramount, California

## BIG MONEY FOR YOU THROUGH V.S.I. ELECTRONICS & TV SCHOOL

AGE—NO BARRIER—FUTURE UNLIMITED—EQUIPMENT—ALL THE LATEST—TECHNIQUES—THE BEST APPROVED FOR VETS—CORRESPONDENCE OR RESIDENCE

WRITE FOR YOUR CATALOG—NOW

**V.S.I. TELEVISION SCHOOL**

4570 Firestone Blvd. Dept. P.E. South Gate, Calif.

## THERE IS AN AC BATTERY HOLDER FOR EVERY BATTERY POWERED ELECTRONIC APPLICATION



Spring-clip style made of non-corrosive aircraft aluminum, all connections fibre insulated. For all types of Dry or Mercury cells. More than 50 stock models making a complete range of voltages available.

Write for FREE illustrated Folder and Circuit Chart!  
**AUSTIN-CRAFT CO., Dept. PE**  
431 S. Victory Blvd., Burbank, Calif.

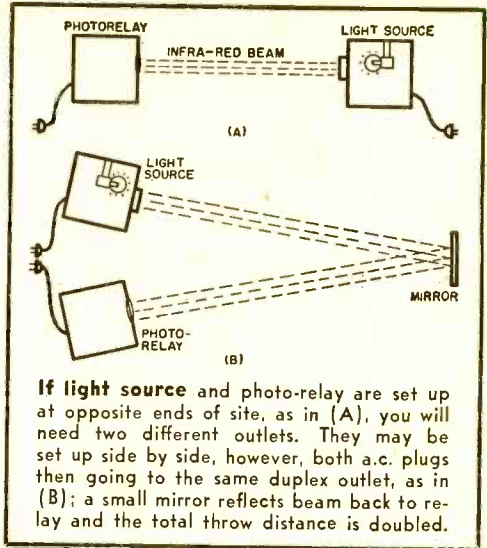


## HOW TO BE THE HAPPIEST CREATIVE ENGINEER IN CALIFORNIA

Engineers (E.E., M.E., Mfg., Sales) can have the kinds of jobs that creative men dream about. Top salaries and benefits. Suburban locations in Fullerton, Newport Beach, Richmond, or Palo Alto.

Write Beckman Instruments, Inc., 2999 W. 6th Street Los Angeles 5, California. Ask for Career File #92-C

122



If light source and photo-relay are set up at opposite ends of site, as in (A), you will need two different outlets. They may be set up side by side, however, both a.c. plugs then going to the same duplex outlet, as in (B); a small mirror reflects beam back to relay and the total throw distance is doubled.

spot is focused on the lens of the photocell.

It is absolutely essential that the infra-red beam be focused sharply on the solar cell. It may be necessary to shift the box slightly laterally or up or down to get proper alignment. Experiment with the setup until you become familiar with the best orientation of the two cases. After that, you can increase the distance between the units up to 30 feet and still obtain positive relay action.

—50—

## Subminiature Power Supplies

(Continued from page 62)

All parts can be mounted in the little plastic box in which the AR-100 transformer is purchased. Make the holes for the screws to hold the Fahnestock clips to the top of the box. Then mount the transformer in the hinge end of the lower half of the box.

Scrape the two mounting ears of the transformer, and scrub these areas thoroughly with fingernail lacquer remover. Then run a generous bead of household plastic cement along the underside of the transformer and immediately clamp it in place. Red and blue leads should be toward the hinges of the box. With the transformer clamped securely, run a generous blob of cement over each mounting ear. When it has hardened, apply a second blob of cement to each ear in exactly the same manner. Allow all of this to harden for at least 12 hours, and then remove the clamp.

In the meantime, make a little panel to hold the crystal rectifier and filter capacitor. Any 1/16"-thick insulating material will do. The panel should be a

Always say you saw it in—POPULAR ELECTRONICS



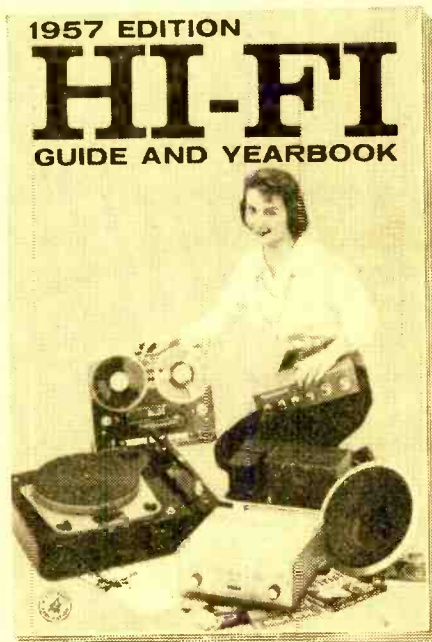
# BUY THE WORLD'S MOST COMPLETE HI-FI GUIDE

*Compiled by the Editors  
of Popular Electronics*

## 164 PAGES!

Nine Big Chapters on:

- WHY AND HOW HI-FI
- TUNERS
- TAPE AND TAPE RECORDERS
- RECORD PLAYERS AND CHANGERS
- TONE ARMS, CARTRIDGES AND NEEDLES
- PREAMPLIFIERS AND AMPLIFIERS
- LOUDSPEAKERS
- SPEAKER ENCLOSURES
- SAVING MONEY IN HI-FI



Price: 75c



Also included in this new Hi-Fi Guide is a helpful YEARBOOK SECTION covering all the latest trends in high fidelity. This "book within a book" lists the nation's outstanding Hi-Fi records and artists, all FM stations, and contains a complete calendar of 1957 Hi-Fi Shows, plus a directory of Hi-Fi literature available free!

## BE SURE TO BUY YOUR COPY!


NOW ON SALE AT ALL NEWSSTANDS AND RADIO PARTS DEALERS!

March, 1957

123

**LEARN**  
**RADAR MICROWAVES**  
**TRANSMITTERS**  
**CODE TV RADIO**  
**Phila. Wireless Technical Institute**  
**1533 Pine St. Philadelphia 2, Penna.**  
**A Non-Profit Corp. Founded in 1908**  
*Write for free catalog "P"*

**NEW BODIES FOR OLD!**



Thomas Manfre

**G**IVE me a skinny, peplless, second-rate body—and I'll cram it so full of handsome new muscles that your friends will grow bug-eyed with amazement. See what I did for Thomas Manfre (above). Let me show you what I've done for thousands of others and let me prove what I can do for you, in just 15 minutes a day.

**FREE BOOK** Send your name, address for 32-pg. illustrated book filled with valuable advice, actual photos of men who got handsome new bodies my way. Yours **ABSOLUTELY FREE**. Address me personally: **CHARLES ATLAS, Dept. 429-C, 115 E. 23rd St., N. Y.**

**NEW MAGIC RADIO WALKIE TALKIE!**

**YOUR OWN POCKET SIZE RADIO STATION!**  
**BROADCASTS TO ANY HOME OR CAR RADIO WITHOUT WIRES OR HOOKUPS!** Wt. only 5 oz. Size (1 1/2 x 2 1/4 x 4 1/2"). Built-in telescoping antenna. Powerful Transistor—sensitive microphone. Frequency setter, break-in switch! Runs for weeks on self-contained flashlight batteries. Durable plastic case. With this Radio Talkie you **CAN TALK TO YOUR FRIENDS UP TO A BLOCK OR MORE AWAY!** Talk up to 1 mile or more between two automobiles. **INSTANT OPERATION!** Just push button to talk! No license needed. Uses inductive field magnetic radiation. Useful and real fun in a million ways! **GUARANTEED TO WORK, 1 YEAR SERVICE GUARANTEE.**

**SEND ONLY \$2.00.** (cash, ck, mo) and pay postman \$9.99 COD postage and send \$1.98 for prepaid delivery. **COMPLETE, READY TO OPERATE** with instructions and hundreds of ways and tricks for broadcasts thru any radio you desire. Price may go up soon so get your **NEW POWERFUL RADIO WALKIE TALKIE NOW.** Available only from **WESTERN RADIO, Dept. REL-3, KEARNEY, NEBR.**

**RADIO COURSES**

- FCC LICENSE PREPARATION
- COMMERCIAL
- AMATEUR
- CODE BRUSH-UP
- THEORY

**TELEVISION AND RADIO SERVICING**  
 Residence Courses Only

Personal Counseling Approved for Veterans

**YMCA TRADE & TECHNICAL SCHOOL of N. Y.**  
**15 West 63 St. New York 23, N. Y.**  
**EN 2-8117 Catalog P. E.**

**SENDING RECEIVING SPEED**

**CODE**



Be a "key" man. Learn how to send and receive messages in International Morse code. Communicate with operators around the globe. Learn at home quickly through famous Candler System. Used by best operators. Qualify for Amateur or Commercial License. Write for **FREE BOOK.**  
**CANDLER SYSTEM CO.**  
 Dept. 5-C, Box 928, Denver 1, Colo., U.S.A.

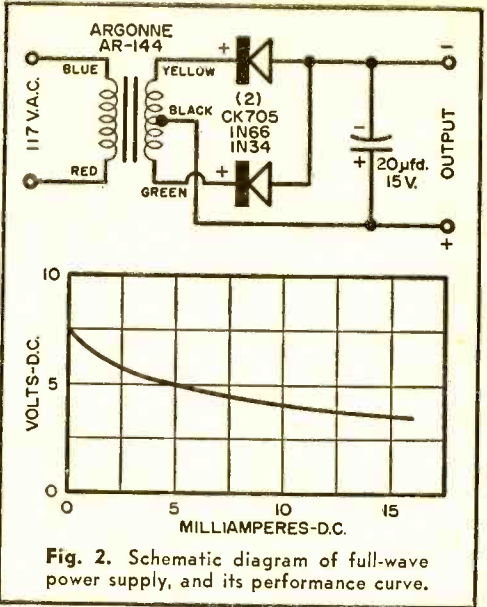


Fig. 2. Schematic diagram of full-wave power supply, and its performance curve.

snug fit in the space between the transformer and the front of the box. Drill three 1/4-40 x 1/4" holes for the screws which act as terminals. Make the connections between the transformer, panel and Fahnestock clips; then cement the panel in place. Connect a light power cord to the two Fahnestock clips associated with the transformer primary (red and blue leads).\*

D.c. output is available across the two remaining clips. Marking the positive (+) clip with a dab of red fingernail lacquer will help you to observe correct polarity when you're connecting the supply to a transistor circuit.

**Full-Wave Supply.** Figure 2 is the schematic of a full-wave supply. Its size and weight are identical to those of the half-wave unit, but the regulation of this supply is considerably improved. The open-circuit voltage of the full-wave unit is about 7 volts. This tapers down to 3.5 volts when 16 ma. are drawn. Close to 25 ma. may be drawn at 2.5 volts.

Construction of the full-wave supply is identical to that of the half-wave supply, except that an additional crystal rectifier is used and four terminal screws are needed instead of three. —Frank H. Tooker

\*A word of caution. Neither of the transistor transformers discussed on these pages were originally constructed to be operated from a 117-volt power line. The author's transformers checked out in a 300-volt insulation test, so they would seem to be quite safe. To insure still greater safety, some constructors may prefer to wire a small fuse in series with the 117-volt side of the transformer. Also, it is advisable to cover the Fahnestock clips (117-volt side) with tape to prevent accidentally touching them or shorting out the house wiring line. Possibly a better method would be to drill through the plastic case and run the line cord directly to the transformer.



# STANLEY ELECTRONICS

joins the tube crushing program

Broken Tubes — Smashed Tubes — Tubes in any condition are worth

**5¢** ea.

Put them out of your attic. Dig them out of your garden. Crush them before shipping if you want to. Resard. less of the shape its in any tube its worth money. Any quantity — 1 to a million.

HERE'S HOW IT WORKS . . .

Suppose you send in 51 old, broken or smashed tubes. You will receive 5¢ credit for each tube to be applied toward the purchase of 51 new tubes of any type you want. If your order is for less than the number you have shipped to the crusher, you will receive a credit for the balance to be used against any future purchases. Pack and ship your tubes as scrap material post or freight prepaid to Metallic Enterprises, Inc., 113 Mill St., Paterson, N. J. with a packing slip listing the quantity of tubes shipped for credit. Send Stanley a duplicate of that slip with your order so that proper credit can be given. — **DO NOT SEND ANY TUBES TO STANLEY.** **FREE! 4-Piece Interchangeable SCREWDRIVER SET** with every order regardless of size!

UNCONDITIONALLY GUARANTEED FOR ONE YEAR  
Individually boxed—RETMA SPECS.  
WRITE FOR NEW FREE TUBE and PARTS LIST!

024	.43	6AF4	.79	6J8G	.80	7L7	.58
1A7GT	.43	6AG5	.80	6K3GT	.47	7N7	.50
1AX2	.79	6AG7	.68	6S6GT	.39	7Q7	.59
1B3GT	.58	6AH4	.80	6K7	.39	7Y4	.35
1B4P	.35	6AH6	.70	6K7GT	.39	7Z4	.40
1C5GT	.41	6AK5	.54	6K8G	.65	12A7B	.41
1D5GP	.43	6AK5	.42	6K8GT	.39	12A7C	.46
1E7GT	.41	6AL7GT	.70	6L6G	.68	12A7D	.66
1G6GT	.41	6AQ5	.46	654	.40	12A7E	.59
1H5GT	.47	6AQ6	.47	647	.48	12A7F	.42
1L44	.57	6AQ7GT	.70	65C7	.48	12A7G	.57
1L46	.47	6AMB	.80	6D7GT	.37	12AX7	.63
1L84	.59	6AN8	.80	6S6GT	.41	12AY7	.90
1LC5	.49	6AS5	.48	65H7GT	.43	12B7B	.46
1LN5	.47	6AT6	.39	65J7	.43	12B7A7	.60
1N5GT	.50	6AU4	.68	65K7	.50	12B8	.68
1R4	.66	6AUSGT	.60	65L7GT	.57	12B8E	.46
1R5	.51	6AU6	.43	65N7GT	.57	12B8H	.60
1S4	.59	6AV6	.39	65Q7	.41	12B7Y	.64
1S5	.51	6AX4	.67	65R7	.42	12K8	.49
1U5	.50	6B5S	.40	6W6GT	.53	12J7GT	.45
1T5GT	.58	6BA6	.47	6T7G	.63	12S7	.48
1U4	.47	6BA7	.49	678	.75	12S7GT	.50
2A3	.50	6BF5	.50	6U8	.80	12SA7GT	.48
1U6	.53	6BD5GT	.53	6V6GT	.48	12S7H	.47
1X2A	.68	6BE6	.46	6WA7	.48	12S7JGT	.45
1T4	.51	6BK4	.67	6847	.42	12S7K7	.48
3A4	.51	6BG6G	1.18	6X4	.39	12S7L7	.60
3AL5	.57	6BH6	.51	6XS7	.39	12S7M7GT	.57
3AU6	.57	6BJ6	.47	688	.75	12S7N7GT	.40
3AV6	.60	6BS5	.68	6V6G	.60	12S7O7GT	.40
3BA6	.60	6BK7A	.76	7A4-XXL	.47	14A7	.45
3PER	.75	6BL7GT	.75	7A5	.53	18C6GG	1.18
3Q5GT	.40	6CF6	.58	7A6	.45	19T8	.70
3S4	.47	6R6GT	.80	7A7	.45	18B6GT	.85
3V4	.58	6R7A	.80	7A8	.45	25L6GT	.47
5AQ5	.60	6BY5G	.58	7B4	.44	25Z6GT	.37
5AT8	.80	6BZ7	.88	7B5	.41	25Z6GT	.37
5J6	.69	6C4	.37	7B6	.42	35A8	.45
5T4	.80	6CS6GT	.35	7B7	.43	35B5	.48
5U8	.49	6CF6	.80	7B8	.47	35C5	.48
5U4G	.88	6CC	.47	7C4	.39	35S6GT	.47
5V4G	.58	6CB6	.51	7E5	.42	35Y4	.40
5X4G	.44	6CE6	.44	7G5	.42	35Z4	.41
5Y3G	.39	6CD6G	1.18	7C7	.45	35Z5GT	.39
5Y3GT	.39	6C5E	.51	7E5	.42	4875GT	.40
4V4G	.43	6D6	.43	7E6	.43	50B5	.48
3Z3	.45	ES5	.44	7E7	.49	50A5	.48
5Z4	.54	6F3GT	.37	7E7	.59	50C5	.48
6A7	.67	6H6GT	.38	7F8	.75	50LGT	.45
6AB4	.45	6J5	.39	7C7	.75	70LGT	.45
6A87	.80	6J6	.49	7H7	.50	117Z3	.37
6AC5GT	.59	6J7	.43	7J7	.75	117Z6GT	.62
6AC7	.67	6J7GT	.45	7K7	.75	117Z6GT	.62

Brand New DUMONT AND RCA Inc. TV PICTURE TUBES

One year Guarantee—in factory sealed carton—No dud required

10 inch	\$10.95	17 inch	\$17.95
12 inch	\$12.95	19 inch	\$20.95
14 inch	\$14.95	20 inch	\$22.95
16 inch	\$16.95	21 inch	\$22.95

Add \$4.00 to above prices for aluminized tubes



- Motorola
- Westinghouse
- Sylvania
- National Union
- SE

**STANLEY**

935 MAIN AVE.  
PASSAIC, N. J.  
Gregory 1-2498

ELECTRONICS CORP

**FREE! 4-Piece Interchangeable SCREWDRIVER SET** with every order regardless of size!

TERMS: FREE POSTAGE on all prepaid continental U.S.A. orders on receiving tubes only. 50¢ handling charge on all orders under \$5. 25% deposit on all C.O.D.'s. Picture tubes F.O.B. Passaic, N. J. via Railway Express.

## GIGANTIC MAIL SALE

WAR SURPLUS EXCESS INVENTORY BANKRUPT STOCK

### ARMY POWER PLANTS

Amazing buys surplus Army and factory-to-you plants and generators. Save to 60%.  
 • 1000-w. 115-v. 60-c \$179.50 Ppd.  
 • 2000-w. 115-v. 60-c \$269.95 Ppd.  
 • 3000-w. 115-v. 60-c \$299.50 FOB  
 • 5000-w. 115-v. 60-c \$497.50 FOB  
 Many other plants, generators. Get catalog.

### HYDRAULICS—PUMPS—AIR COMPRESSORS

Bargains in surplus finest quality hydraulic pumps, cylinders, valves. Also irrigation pumps, plastic pipe-fittings and air compressors, air tanks, regulators, gauges, paint spray, etc.  
 • Farm hyd. cylinder \$14.95. 1500-lb. gauge, \$3.49. Blackhawk hyd. system \$24.95. Control valve \$12.95. Air Compressor \$19.95. Air Tank \$8.29. Gauge 160-lb. \$1.89. Air Regulator \$3.29. Air Filter \$2.99. Many other air items.  
 • Irrigation Pump 2 1/2" \$44.37. Plastic Pipe 1/2" 8c. 3/4" 12c. 1" 20c. Rotary Gas Pump \$22.96. All of the above prepaid.

### GEAR REDUCTION MOTOR BARGAINS

(a) INDUSTRIAL MOTOR.  
 54 to 1 ratio. Output 10 to 200 rpm. Hi-torque. Run on 6 or 12 volts DC or 110-AC thru rheostat. Many uses. Cost \$35. \$4.97 Ppd.

(b) GOLF AND SMALL CAR MOTOR. Powerful, runs on 6, 12 or 24 volt battery. Speed 100 to 300 rpm. Wt. 34 lbs. Cost \$250. \$19.46 F.O.E.

INDIVIDUAL CHAIR BOYS AUTO MOTOR  
 Marvelous electric gear-reduction motor on 6 or 12 v. battery. Wonderful drive for small cars. Many industrial uses. Gear ratio 40:1. Reversible. Cost \$150. \$14.99 FOB SALE

## SPECIAL OF THE MONTH!

### 50mf-330v AC CONDENSER

Gen. Surplus—800 units available  
 • Marvelous new high capacity PYRANOL type capacitor (600V DC—330V AC). Tremendous value. Use for motor starting circuit to replace faulty electro-lytic type phase-splitting circuit. Filtered. Laboratory applications. Wonderful experimental industrial unit. Size 4 1/2" x 5 1/2". Wt. 6 lbs. Brand new. Govt. cost \$17.55. SALE Ppd. \$4.61

PREVIOUS SPECIAL BUYS  
 • Edwards AC-DC Bell (\$3.75) . . . \$ .79  
 • G.E. 0-300 DC Meter . . . 6.89  
 • Stainless Steel Mach. Calipers . . . 2.94  
 • Ultra-High Frequency Revv. (\$125) . . . 4.98  
 • Navy Signal Alarm (AC-DC) . . . 2.15  
 • Surveyors Level, tripod, rods . . . 42.95

ORDER FROM AD or write for big new WINTER CATALOG 1000s items at tremendous savings. We pay frt. except where FOB.

**STANLEY CENTER**  
 842 "O" St. LINCOLN, NEBRASKA

LET RCA TRAIN YOU FOR A  
LIFETIME CAREER IN



TELEVISION  
ADVANCED ELECTRONICS

Resident classes, day and evening, start February 26th, May 20th, September 3rd and November 26th. Free graduate placement service. Approved for Veterans. Send for free catalog now.

**RCA INSTITUTES, INC.**

A Service of Radio Corporation of America  
350 West 4th St., New York 14, N. Y.



## EASY TO LEARN CODE

Learn or increase speed with an Instructograph—the Radio-Telegraph Code Teacher that takes the place of an operator-instructor and enables anyone to master code without further assistance. Available tapes from beginners alphabetically to typical messages on all subjects. Speed range 5 to 40 WPM. Always ready—no QTM. Thousands have "acquired the code" with the Instructograph System. Write today for convenient rental and purchase plans.

INSTRUCTOGRAPH COMPANY  
4713-F Sheridan Road, Chicago 40, Illinois



## GET INTO ELECTRONICS

Train for best technical positions in a Top-flight school. Specialize in missiles, computers, radar, communications, industrial electronics, color TV, automation. Excellent program in theory, laboratory, mathematics. Major firms select our graduates as tech. reps., field engineers, specialists. Associate degree granted. 21 months program. High school or equivalent required. Catalog.

**VALPARAISO TECHNICAL INSTITUTE**  
DEPT. PE VALPARAISO, INDIANA

## GARAGE DOOR OPENER

Actuator Mechanism \$24.50

EASY TO INSTALL, SAFE, RELIABLE

WRITE for interesting free information... TODAY

P. E. HAWKINS CO.

631 Prospect Dept. PE Kansas City 24, Mo.

## CABINET MAKING



**LOW COST HOME TRAINING COURSE FOR BEGINNERS & ADVANCED CRAFTSMEN**

Make money. Learn skills and secrets of fine woodworking and tool use. Professionally prepared shop method training tells and shows how. Covers everything. Easy to master.

**INTERSTATE TRAINING SERVICE**

Write for Free Booklet  
Dept. F-95 PORTLAND 13, OREGON

## 2 WAY PORTABLE RADIO SET

SENDS — RECEIVES UP TO 10 MILES AS SHOWN

with built-in antenna or hundreds of miles with outside antenna! Works on 80 and 40 meter amateur radio bands—also Aircraft and overseas broadcast bands (3 to 8mc). PORTABLE SELF-CONTAINED POWERED WITH STANDARD LONG LIFE. LOW COST PORTABLE RADIO BATTERIES. NO AC PLUG-INS NEEDED! Take it with you everywhere you go—on trips, vacations, camping—keep in contact with home, friends. Has 5 watt crystal controlled transmitter—

Sensitive Regenerative Receiver. Talk-listen switch. Wt. only 3 lbs. Size, only 6"x4"x4".

TESTED—PROVEN—SIMPLIFIED—PRACTICAL—

Full information given on quick easy to get license.

SEND ONLY \$3.00 (bill, ck, mo) and pay post-

man \$11.95 C.O.D. postage on arrival or send \$14.95 for postpaid delivery.

Complete kit includes all parts, tube, coils, plastic cabinet, easy instructions. (Set of batteries

val \$1.25; crystal \$1.25). COMPLETELY WIRED

AND TESTED POSTPAID \$19.95. A regular \$49.95 value—Order now before Price goes up.

GUARANTEED AVAILABLE ONLY FROM:



WESTERN RADIO Dept. BNE-3 KEARNEY, NEBR.

## A "WAVE" in Naval Electronics

(Continued from page 40)

Electronic Technicians, where physics, mathematics, and basic electronic theory are ladled out in heavy doses. On the practical side, she learned the circuitry of various types of electronic gear, from simple radio receivers to complete radar systems. The biggest thrill of her electronics training was operating navigation equipment and airborne radar in actual flight, directing a plane from target to target.

Later, on the job, the thorough schooling ripened into a sure knack for troubleshooting equipment. With the great variety of electronic devices passing under her hands, Dee has had hardly a dull moment at her workbench.

**Sailors Ashore.** Service life in this technical age is a far cry from our traditional ideas about soldiering. Looking back at her Navy career, Dee tallies up pluses and minuses and feels that she comes out well ahead in the balance. Nowhere else could she have got such a good technical education—not just for free, but actually being paid for it. Nowhere else would she have been able to learn so much so fast. No civilian job open to beginners fresh out of school would have given her the variety of electronic experience she obtained from her Navy assignment.

There are off-duty gains also: meeting and making friends with people from all parts of the country and many different backgrounds has enhanced Dee's personality, giving her a wider range of human experience and understanding. "I have formed many rewarding friendships and I've learned tolerance and self-control," she says. "Many people feel that when you go into the service you lose your individuality and have to conform to a group. This is certainly true to a point. My individual desires became secondary when they conflicted with those of 40 other people. You do very little without thinking how it will reflect on the uniform you wear."

Yet the dulling of the individual's outer edge is compensated for by strengthening of the core. "I feel that I am more of a person now than I was the day I joined," says Dee, "more capable of making my own decisions and standing up for what I believe in."

Dee has formed a very realistic attitude about the military atmosphere pervading her work: "If you talk back to your boss in civilian life, you get fired. In the Navy, your punishment is different. That's all."

**Steady Ahead.** After discharge, Navy electronic technicians, male or female, find the doors of the fast-growing electronics



industry wide open to them. Or, using the educational provisions of the G.I. Bill, they may continue their schooling toward a formal engineering degree.

Dee is steering a steady course toward her own goal: a combination of electronics and marriage. The shipmate whom she plans to sign on permanently also works in Naval electronics. When they are both back in civilian life, she wants to work in industry while he completes his engineering studies.

Perhaps it seems paradoxical that the net result of Dee's Navy training is a firm foundation for civilian life. But we must remember that, after all, the purpose of the military in a democracy is not a war-like quest for "glory," but to assure the safety of the private citizen and help this troubled world gain enough peace to sustain the good of ordinary living. —30—



### Civil Air Patrol

(Continued from page 44)

ble without the formality of using a state "control" station; but once such a mission is definitely established, a "redcap" is declared and all transmissions are handled through the control station. During the duration of a "redcap," all stations located in nearby states which might cause interference with the communications either secure or go to different channels.

**Many CAP units**, either Cadet or Senior squadrons, conduct courses in radio communications under supervision of competent licensed personnel. Membership is open to all persons 14 years of age or over. There is nothing compulsory about the organization. While it is an auxiliary of the Air Force, there is no obligation or arrangement for any Civil Air Patrol member or unit ever to be taken into the armed forces as a result of his or her participation in the CAP program.

Although Civil Air Patrol radio communications is not connected with amateur radio, many hams become CAP members and many CAP members develop an interest in radio and become hams. . . . Neither activity conflicts with the other.

Many varied adventures reward the CAP volunteer. All too often, search and rescue missions become necessary—several hundred a year. There are also practice missions, Cadet encampments at Air Force bases, state and national meetings. Any man or woman interested in radio Civil Air Patrol has a definite place to go to learn theory and actual operating practice on the world's largest network of two-way radio stations. —30—

March, 1957

## AN INDISPENSABLE HANDBOOK

# All the Latest Developments in RADIO, TELEVISION, ELECTRONICS, HI-FI

A much-needed basic illustrated manual for readers of this magazine. Covers all the latest developments in electronics, radio, television, hi-fi. An invaluable guide for the beginner; an authoritative "refresher course" for the technician, serviceman, "ham" and Hi-Fi enthusiast anxious to keep abreast of the numerous changes and improvements going on in this fascinating field. Written so anyone can understand it. 288 photos, charts, diagrams.

**FOR BEGINNERS AS WELL AS PROFESSIONALS**

**CONTENTS INCLUDE:** Recent Developments in Electronics, Electrical Measuring Instruments, Oscillatory Circuits, Electron Tubes, Power Supplies, Amplifiers and Amplification, Tape Recorders, Acoustics, Microphones, Transmitting and Receiving Antennas, A-M and F-M Receivers, High Fidelity Systems, Transistors, Television.



**FREE 5-DAY EXAMINATION**

Fill out and mail coupon. Pay nothing now. Pay nothing to postman on delivery. Simply pay bill after 5 days, or return book.

**ONLY \$4.95**

**COMPLETE**

**AMERICAN TECHNICAL SOCIETY**  
Dept. PC-3, 848 E. 58th St., Chicago 37, Ill.

AMERICAN TECHNICAL SOCIETY, Dept. PC-3  
848 E. 58th St., Chicago 37, Ill.

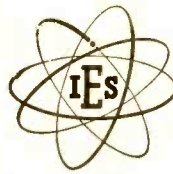
Please send me "Radio-Television and Basic Electronics" for 5 days FREE EXAMINATION. If I keep the book after 5 days, you may bill me for \$4.95, plus shipping costs.

PRINT NAME.....

ADDRESS.....

CITY..... ZONE..... STATE.....

Check here if enclosing \$4.95 with coupon; we pay shipping charges. Money back guarantee.



## ELECTRONIC TECHNICIANS ARE IN DEMAND

**TRAINED MEN ARE NEEDED NOW!**

In just 18 months you can complete Electronic Technicians training to enter this ever-growing industry. Day or evening classes.

Opportunity for employment in local industry. Approved for Korean Veterans.

Terms beginning April, July, September, January  
Write for Catalog 224 TODAY

### INDIANAPOLIS ELECTRONIC SCHOOL

312 E. Washington St. Indianapolis 4, Indiana

## AMAZING NEW "LIFETIME" RADIO



**REALLY WORKS—FOR LIFE!**

**GUARANTEED TO WORK FOR YOUR LIFETIME!** USES NO TUBES, BATTERIES OR ELECTRICAL PLUGS. Never runs down! SMALLER THAN A PACK OF CIGARETTES! RECEIVES LOCAL RADIO STATIONS MOST ANY TIME ANYWHERE WITHOUT EXTRA ANTENNA. Uses perma-crystal diode Hi-Q Tuner—Built-in Speaker-Phone. Beautiful Black gold plastic case.

**SEND ONLY \$2.00** (bill, ck, mo.) and pay postman \$4.99 COD on arrival or send \$6.99 for postpaid delivery. SENT COMPLETE READY TO LISTEN—NOTHING EXTRA TO BUY EVER!

Extra long distance aerial kit included. Free to receive stations up to 1000 miles away! Available only from: MIDWAY COMPANY DEPT. WPL-3 KEARNEY, NEBR.

# Classified

RATE: 50¢ per word. Minimum 10 words prepaid. May issue closes March 4th. Send order and remittance to: POPULAR ELECTRONICS, 366 Madison Avenue, N. Y. C. 17.

## FOR SALE

**ELECTRIC Pencil:** Engraves all Metals, \$2.00. Beyer Mfg., 10511-P Springfield, Chicago 43.

**HAMS!** Work-the-world Alcoa all-band vertical antenna for 80, 40, 20, 15, 10, 6 meters, \$16.95 shipped collect. Guaranteed, needs little space, no guy wires. Literature. Gotham, 1805A Purdy Ave., Miami Beach, Fla.

**WALKIE-Talkie chassis** \$6.98. Illustrated in this issue. See display ad this issue. Springfield Enterprises.

**CITIZENS band radio plans** for building your own receiver and information on transmitter design, FCC requirements, etc. plus special discount on type approved transceivers. All for \$1.00. Springfield Enterprises, Box 54-E2, Springfield Gardens 13, N. Y.

**DIAGRAMS** for repairing radios \$1.00, Television \$2.00. Give make, model. Diagram Service, Box 672-PE, Hartford 1, Conn.

**WALKIE-TALKIE.** Build wireless portable radiophone for less than \$10.00. Plans for variable frequency and crystal control types, only 50¢ for both, including assembly photographs. Springfield Enterprises, Box 54-E2, Springfield Gardens 13, N. Y.

**TRANSISTOR devices,** walkie-talkies, VHF AM-FM portable radios, wireless mikes, etc. at wholesale prices direct from our factory. Free literature. Springfield Enterprises, Box 54, Springfield Gardens 13, N. Y.

**TUBES-TV, Radio, Transmitting And Industrial Types At Sensibly Low Prices.** New, Guaranteed 1st Quality Top Name Brands Only. Write For Free Catalog or Call Walker 5-7000, Barry Electronics Corp., 512 Broadway, New York 12N, N. Y.

**DIAGRAMS! Repair Information! Radios—Amplifiers—Recorders \$1.00. Televisions \$1.50.** Give Make, Model, Chassis. TV Miltie, Box 101-PE, Hicksville, New York.

**TELEPHONE Transmitter.** Hand set type. Suitable for inter-house phones, speakers or any communication purpose. Delivered two for \$1.00. No C.O.D.'s. Telephones, Dept. C-829, 1760 Lunt, Chicago 26.

**COMPLETE Television sets** \$11.95. Jones TV, 1115 Rambler Avenue, Pottstown, Pa.

**TELEPHONE Extension in your car.** Answer your home telephone by radio from your car. Complete diagrams and instructions. \$1.25. C. Carrier Co., 734 15th St., N.W., Washington 5, D. C.

**FAVESDROP** with a pack of cigarettes. Miniature transistorized radio transmitter. Complete diagrams and instructions. \$1.25. C. Carrier Co., 734 15th St., N.W., Washington 5, D. C.

**2 WAY Wrist Radio** with auxiliary long distance booster. Complete diagrams and instructions. \$1.25. C. Carrier Co., 734 15th St., N.W., Washington 5, D. C.

**DO It Yourself tube tester route.** Testers, with tube stock, placed in drugstores and supermarkets, in your city. A few weekend calls assure excellent income. For immediate information on routes in your city call Mr. Poier, JORDAN 3-2706, Ft. Atkinson, Wisconsin.

**TRANSISTOR Workshop.** Write for details! Transit, Box 15-C3, Alden Manor, New York.

**FABULOUS Utility 6 KV-RF Power Supply Kits,** \$11.75 Delivered. Complete Instructions and Schematics. Assembled Units \$16.50, Order 3 Save 10%—Supply Limited. Worldwide Impex Co. Electronics, Corona 68, N. Y.

**FIRE-Alarm!** Merlite Fire-Alarm Howls 1/5-mile warning before fire makes headway! Don't let fire destroy your home, your family . . . or you! No installation! Just hang on wall! 20 year guarantee! \$4.95 Postpaid or send \$1.00 balance C.O.D. TV Miltie, Box 101, Dept. 357, Hicksville, New York.

**4-TRANSISTOR "Speaker" Radio Plans \$1.00!** Reconsider "January" Advertisement Beginning: "Remaining!"

**RUBBER instrument feet—75** for \$1.00. Free lists. Bigelow Electronics, 105 North Main, Bluffton, Ohio.

**"COIL Winding Methods" Handbook 30¢.** Laboratories, 328-L Fuller, Redwood City, California.

**MINIATURE Rechargeable Battery.** 2 volt size 7/16" x 11/16" x 3/4" \$1.00. Miniature Battery Charger \$2.00. C. E. Steelman, 1040 S. Worth St., Indianapolis 21, Indiana.

**DISGUSTED** with "HI" Hi-Fi Prices? Unusual Discounts on all your High Fidelity requirements. Write now. Key Electronics Co., 120 Liberty St., N. Y. 6, N. Y.

## WANTED

**SELL Your Way To Wealth!** Wanted: Surplus military and commercial aircraft electronics: ARN-7, ARC-3, 51R-3, APN-9, BC-348, RTA-1B, BC-788, I-152, L-5, MN-53, 18S-4, BC-610, CW-3, test equipment and All Vacuum Tubes. Top prices paid! For fattest checks—sell to Rex! P. E. Sanett, W6Rex, 1524 S. Edris Drive, Los Angeles 35, California. Phone: REPUBLIC 5-0215.

**CYLINDER** and old disc phonographs. Edison, Conqueror, Idelia, and Oratorio models. Berliner Gramophones and Zono-o-phones, Columbia cylinder Graphophones, and Coin-operated cylinder Phonos. Want old catalogues and literature on early phonos prior to 1919. Will pay cash or trade late hi-fi components. POPULAR ELECTRONICS, Box 50.

**TUBES** and equipment bought, sold and exchanged. For action and a fair deal write B. F. Gensler, W2LNI, 56 Crosby St., N. Y., 12N, N. Y.

**CASH Paid!** Sell your surplus electronic tubes. Want unused, clean transmitting, special purpose, receiving, TV types, magnetrons, klystrons, broadcast, etc. Also want military & commercial lab test and communications gear. We swap too, for tubes or choice equipment. Send specific details in first letter. For a fair deal write, wire or telephone: Barry, 512 Broadway, New York 12, N. Y. WALKER 5-7000.

## INVENTIONS WANTED

**INVENTIONS** wanted. Patented; unpatented. Global Marketing Service, 2420 77th, Oakland 5, Calif.

## HELP WANTED

**HIGH Paying Jobs:** Foreign, U.S.A. All trades. Travel paid. Information. Application forms. Write Dept. 21M National, 1020 Broad, Newark, N. J.

## BUSINESS OPPORTUNITIES

**TO \$100.00 Weekly.** Sparetime, Home Operated Mail-order business. Successful "Beginner's" Plan. Everything Supplied. Lynn, 10420-E National, Los Angeles 34.

**FREE Booklet "Money-Making Facts"** tells mechanically-inclined men how to start sparetime business at home. Lee Foley Company, Columbia Heights, Minnesota.

**\$60 WEEKLY,** spare time—easy! Home Venetian Blind Laundry. Free book. Burt, 2434 BY, Wichita 13, Kansas.

**VENDING Machines—No Selling.** Operate a route of coin machines and earn amazing profits. 32-page catalog free. Parkway Machine Corporation, Dept. 12, 715 Ensor St., Baltimore 2, Md.

**PLATE Baby Shoes,** jewelry, gifts, bronze and colored pearl. Free booklet. Thompson, 11029 South Vermont, Los Angeles 44, Calif.

**ASSOCIATE** wanted by manufacturer of "Do-It-Yourself" tube testers. You call on drugstores and supermarkets, weekends. Replace tubes sold. Collect money. Split the tube markup of 100% to 125%. For immediate information on routes in your city call Mr. Poier, JORDAN 3-2706, Ft. Atkinson, Wisconsin.

Always say you saw it in—POPULAR ELECTRONICS



\$200. MONTHLY Possible. Sewing Babywear! No house selling! Send stamped, addressed envelope. Babygay, Warsaw 80, Indiana.

## HIGH FIDELITY

**RECORDS** from your tapes. Complete high fidelity recording service. Sample record \$1.00. Free information. Baron's Sound Recording. Lynden, Wash.

## INSTRUCTIONS

**LEARN** While Asleep! Complete instructions \$2.00. Guaranteed. Research Association, Box 610-PE, Omaha, Nebraska.

**PIANO** Tuning course. Complete self-instruction lessons. Also teaches you piano regulating, repairing and other servicing operations. Wonderful illustrations. Full price only \$4.95 postpaid, or C.O.D. plus postage. Satisfaction guaranteed or refund. Nelson Company, 210 South Clinton, Dept. AT-43, Chicago 6.

**ENGINEERING** Degrees earned by home study. (Residential Courses also available.) Pacific International University, Box 27724-D, Hollywood 27, California.

**BECOME** Tax Consultant. Graduates earn \$3,000 every tax season preparing returns evenings. State approved. Union Institute, 68 Hudson, Hoboken 3T, N. J.

**MORSE** Code—Easy to learn with Uncle Sam Recording Slow and Fast Signals. Actual Messages to Decode. 12 inch 78 RPM 1.95 postpaid. Uncle Sam Recording, 6123 N. Damen, Chicago 26, Ill.—Dept. P.

**NOVICE** code course, to 8 WPM, \$5.95. Advanced course—9 to 18 WPM, \$4.95. Both above \$9.95. 7" magnetic recording tape, dual track, 3 3/4 IPS. Unbeatable. Rush your order today to Tapedcode, Box 31-B, Langhorne, Pa.

**TEST** Your Knowledge—Earn Degree: Science, Engineering, etc. Free information. Aureon, Central Valley, New York.

## TAPE RECORDERS

**RECORDERS**, Tape. H1-F1. Wholesale Prices. Catalogue. Kerstin, 215 E. 88 St., N. Y. C. 28.

**TAPE** Recorders, Tape. Unusual Values. Free Catalog. Dressner, 69-02F, 174 St., Flushing 65, N. Y.

**PRE-RECORDED** Tapes, Recorders, Accessories, Unusual Values. Catalog. Efsco Sales, 270-A Concord Avenue, West Hempstead, N. Y.

## REPAIRS & SERVICINGS

**ALL** Type kits expertly wired and tested including all Ham Gear. Satisfaction assured. McSwan, Box 1101, Culver City, Calif.

## STAMPS & COINS

**300 DIFFERENT** Given Free With Approvals. Particulars. Windsor Stamps, 8834B Cornell Ave., Chicago 17.

**FREE!** 50 British Colonies. 5¢ handling. Approvals included. Kensington Stamps, Buffalo 15, N. Y.

## MISCELLANEOUS

**SONGPOEMS** and Lyrics Wanted! Mail to: Tin Pan Alley, Inc., 1650 Broadway, New York 19, N. Y.

*Your choice of school is highly important to your career in*



**INDUSTRIAL  
ELECTRONICS**



**RADIO-  
TELEVISION**



**ELECTRONICS  
COMMUNICATIONS**

*Become an*  
**ELECTRICAL ENGINEER**  
*or an*  
**ENGINEERING TECHNICIAN**  
*at*

**MSOE** in Milwaukee

*Choose from courses in:*  
ELECTRICAL ENGINEERING  
*Bachelor of Science degree in 36 months.*  
Communications option (radio-tv)  
Power option.

ENGINEERING TECHNICIAN  
*Assoc. in Applied Science degree — 18 months.*  
Electronics Communications  
Electrical Power.

MSOE — located in Milwaukee, one of America's largest industrial centers — is a national leader in electronics instruction — with complete facilities, including the latest laboratory equipment, visual aid theater, amateur radio transmitter — offers 93 subjects in electrical engineering, electronics, radio, television, electrical power, and electricity.

Advisory committee of leading industrialists. Courses approved for veterans. Over 50,000 former students. Excellent placement record.



QUARTERS BEGINNING OCTOBER, JANUARY, APRIL, JULY

*Choose wisely — your future depends on it. Write for more information today!*

**MILWAUKEE**  
SCHOOL OF ENGINEERING

Dept. PE 357, 1025 N. Milwaukee St.  
Milwaukee 1, Wisconsin

Send FREE career booklets. (Please print)

I am interested in..... (Name of course)

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

Address.....

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

If veteran, give discharge date..... MS-57A

 help your  
**HEART FUND**  
help your HEART

## Kit Builder's Korner

(Continued from page 52)

Wonder of wonders, the FM-3A kit contains enough spaghetti to cover all bare leads, which is not a practice followed by most radio equipment kit manufacturers. In fact, all you will need (and this applies to most kits) is the usual assortment of tools and some rosin-core solder.

Heath seems to have pre-alignment down to fine tolerance. When we turned our kit

on, it immediately pulled in a local station that was three miles away. Touching up the ratio detector and some other minor adjustments will give you an FM tuner to be proud of.

**Comment.** Obviously the FM-3A is built in a case that matches the Heathkit pre-amp. However, it still makes a fine-looking unit on its own behalf. Although there are a lot of stories around about how difficult it is to assemble an FM tuner, we didn't think this was tough at all. -50-

## POPULAR ELECTRONICS

# BARGAIN BASEMENT

SAVE ON THESE SPECIAL BUYS OF THE MONTH

### JUNEERO Mjiniature MACHINE SHOP



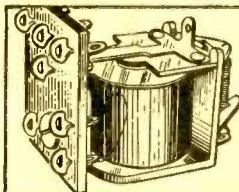
Stock No. TL-125

**\$3.93**

Deluxe Model  
Stock No. TL-128  
\$5.11

Made in England. Bends, shears & punches strip metal. Makes all kinds of complex brackets. Holes & slots too. Includes supply of steel strip. Deluxe Model also has rod material & threading die.

**OLSON RADIO WAREHOUSE,**  
275-B E. MARKET ST. AKRON 8, OHIO



### LITTLE "JEWEL" R/C RELAY

The Mighty Mite of the R/C field. Weighs less than 1/2 oz. Only 3/4" H x 17/32" W x 1-1/16" L. Highly sensitive—extremely rugged. Pulls at 1.4 Ma—drops out 1.2 Ma D.C. S.P.D.T. 5000 ohm coil.

F-260.....Net 2.75

**Lafayette Radio** 100 SIXTH AVE. BOSTON 10, MASS. 110 Federal St.  
NEWARK 2, N. J. 74 Central Ave.  
PLAINFIELD, N. J. 139 W. Second St.  
BRONX 58, N. Y. 542 E. Fordham Rd.  
DEPT PE2 Include postage with order

### HARMONICA CONTACT MICROPHONE

Makes a one man band out of every harmonica player.

A fine quality, sensitive, crystal microphone with a high output especially designed to fit harmonicas. May be connected to any P. A. system, or the audio section of a phonograph or radio. Installation is simple. Sturdily built and measure only 1 1/2" L x 3/4" W x 3/4" D. Complete with 7 ft. shielded cable. Dept. PE-L.....Net 2.95



**Lafayette Radio** 165-08 LIBERTY AVE. JAMAICA 33, N. Y.

## TELEPHONES



Desk Stand Style  
Slightly used but in excellent condition  
Many Valuable Uses

Inter-House Phones House to Barn, etc.  
Loud Speakers Microphones  
Educational Purposes Toys, etc.

Come complete, ready to use with wiring diagrams included. **\$2.75** Postpaid in U.S.A.

Two complete for only \$5.00.  
**TELEPHONE LAMP KIT**—with illustrated instructions for making Desk Telephone Lamp including all parts (harp, nipples, push switch, cord, plug, etc.)... \$6.50 Ppd. (Shade is not included.)

**MICROPHONE, Dept. C-707, 1760 W. Lunt Ave., Chicago 26, Ill.**

### RADIO CONTROL Headquarters

For model airplanes, boats, cars, etc. FREE CATALOG "P"  
No operator's license required. FREE—SEND FOR FCC FORM 505  
Garage Door Radio Control Transmitter & Receiver Kits Available.  
R/C TRANSMITTER & RECEIVER KIT—27 1/2 Mc, 5 Watt 2-Tube Simple Transmitter & Supersons, 2-Tube Simple Receiver—Parts incl. Drilled Bases Wound Coil, Res., Cond., SIGMA Rev. \$9.95 lay, Instruct.

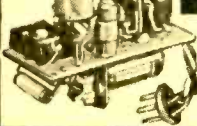
SIGMA 4F RELAY: 8,000 ohm, \$3.85; 6 Reed Relay ..... 14.95  
2-6V Battery Charger Kit \$4.95; wired ..... 6.95  
R/C BOOKS: Model Control S1; Radio Control S1; Handbook ..... 2.25  
CRYSTALS: 27,255 Mc, Petersen 29A ..... \$3.95; HOLDER ..... .15  
2" METERS: 150 MicroA, \$3.95; 500 MicroA, \$3.95; 3 Ma incl. Sensitive 10,000 ohm Sig-  
MA Relay (1 1/2 Ma) Thermal Bi-metal Strip, Heating Element, Hi Z Audio Choke, Mini Alnico V Magnet, Neon Lamp, Resistors, Capacitors ..... .99  
TUBES: XFG1, RK61, 3A6, 2A5, 1A64, 6K4—Transistors ..... .99  
Storage Batteries: Mini, 6V NTP \$2.45; 2V 27A/Hour ..... 2.75  
RELAYS: 10K ohm 2 Ma DC or 110V AC SPDT 95c; SPST .85  
Flash STROBOSCOPE 110 V AC, Range 900-14000 per min. 29.95

**GYRO ELECTRONICS** 325-P CANAL ST. NEW YORK 13, N. Y.

7.95

### LAFAYETTE SPECIAL

R/C RECEIVER



Completely wired and assembled, with tube, ready to operate on exam free 27.255 MC remote control band. Size: 1 3/8" x 1-15/16" x 3". Weight 3.3 oz. Uses one 1.5 volt and one 45 volt battery. Less batteries. Shpg. wt., 6 oz.

F-208 .....Net 7.95

**Lafayette Radio** 100 SIXTH AVE. BOSTON 10, MASS. 110 Federal St.  
NEWARK 2, N. J. 74 Central Ave.  
PLAINFIELD, N. J. 139 W. Second St.  
BRONX 58, N. Y. 542 E. Fordham Rd.  
DEPT PE2 Include postage with order

### 19.95 LAFAYETTE SPECIAL RADIO CONTROL TRANSMITTER



Completely assembled — tested — and guaranteed R/C transmitter. Includes tube and 27.255 MC crystal, 6 sect. telescoping antenna. Size: 4" x 4" x 12". Approx. 1 mile range. Shpg. wt., 3 lbs. Less batteries.

F-249 .....Net 19.95

**Lafayette Radio** 165-08 LIBERTY AVE., JAMAICA 33, N. Y.  
DEPT PE-L Include postage with order

## When you order by mail . . .

please print your name and address clearly, be specific in your order, enclose proper amount, allow ample time for delivery.



## ADVERTISERS INDEX

ADVERTISER	PAGE
Allied Radio Corp.	8, 9, 119
Altec Lansing Corporation	10
American Radio Relay League, Inc.	95
American Technical Society	127
Arnhold Ceramics, Inc.	26
Argonne Electronic Manufacturing Company	33
Atlas, Charles	124
Audak Company	97
Audel Publishers	104
Austin Craft	122
B & K Manufacturing Co.	22
Bailey Technical Schools	34
Barjay Co., The	26
Beckman Instruments, Inc.	122
British Industries Corp.	87
Brooks Radio & TV Corp.	107
Eurstein-Applebee Co.	107
Galbart	109
Canadian Institute of Science and Technology Limited	121
Candler System Co.	124
Capitol Radio Engineering Institute	15
Centralab	18
Central Technical Institute	31
Cisin, H. G.	97, 109
Civin, L.	26
Cleveland Institute of Radio Electronics	17
Coyne Electrical School	5, 23, 105, 109
DeVry Technical Institute	11
Duotone Company, Inc.	95
Electro-Voice, Inc.	19
Electronic Instrument Co., Inc. (EICO)	38
Electronic Measurements Corp.	12
Embry-Riddle School of Aviation	28
Emig School of Electronics	122
Fair Radio Sales	101
Garfield Co., Oliver	35, 108, 116
General Electric	16
Gonset	121
Grantham Schools	120
Greenlee Tool Co.	114
Gyro Electronics	130
Hallcrafters	37
Hawkins Co., P. E.	126
Heath Company	89, 90, 91, 92, 93
Herschel Radio Co.	32
Hi-Fi Guide and Yearbook	123
Indiana Technical College	26
Indianapolis Electronic School	127
Instructograph Company	126
International Correspondence Schools	13
Interstate Training Service	126
Kester Solder Company	130
Lafayette Radio	7, 102, 103, 130
LaPointe Industries, Inc.	107
Levtron Specialties	117
Merit International	104
Midway Company	127
Miller, Gustave	122
Milwaukee School of Engineering	129
Modernophone, Inc.	108
Moss Electronics Distributing Co., Inc. 132, 3rd & 4th Cover	122
MusCraft	27
Nazais Antenna Systems	122
National Radio Institute	3
National Schools	21, 26
North American Phillips Co., Inc.	14
Nortronics, Inc.	116
Olson Radio Warehouse	130
Oradio Industries, Inc.	30
Pacific States University	96
Philadelphia Wireless Technical Institute	124
Popular Photography	98
Port Arthur College	120
Precise Development Corp.	Second Cover
Precision Electronics, Inc.	20
Prentice-Hall, Inc.	113
Progressive "Edu-Kits," Inc.	29, 114
Quality Electronics	122
RCA Institutes, Inc.	25, 126
Radio & Television News	96
Radio-Television Training Association	99, 100
Raytheon Manufacturing Co.	6
Rek-O-Kut Company, Inc.	112
Rider, Publisher, John F.	111
Rinehart & Co., Inc.	106
Sams, Howard W.	94
Scherr Company, George	120
Scott-Mitchell House, Inc.	97
Shure Brothers, Inc.	24
Springfield Enterprises	113
Standard Line Electric Mfg.	115
Stanley Electronics	125
Surplus Center	125
"TAB"	131
Telephone Repair & Supply Co.	130
Tri-State College	118
Tube Mart	110
Uncle Sam's Recording Corp.	116
University Loudspeakers, Inc.	113
V.S.I. Television School	122
Valparaiso Technical Institute	126
Van Nostrand Company, Inc., D.	118
Video Electronics Company	121
Western Radio	124, 126
Whitcomb Pharmaceutical Co.	18
World Radio Labs	36
YMCA Trade Schools	124

## BARGAINS ★ BARGAINS ★ BARGAINS

Meter Miniature 0-1ma/2% accy.	\$4.00	2 for \$7
Milten 1007 Chrome Knob	.39c	@ 3/\$1
Snooper Scope Tube Selected Gtd.	\$4.75	@ 2/\$9
Meter 800ma DC/31% lrd/2% accy.	.53	@ 2/\$5
Relay 4PDT 12 to 28VDC Min Size	.52	@ 3/\$5
Battery Charger Kit 6 & 12 volt @ 4 amp hrs	.52	@ 4/\$10
ADJUSTAVOLT PA-170-132v/1.25 Amps	.52	@ 4/\$10

### ELECTRONIC FLASH! LUCKY PURCHASE \$59 SHAWLITE 4001 SPECIAL \$20

Assembled & ready to work! Not a Kit. Latest features SUPER CIRCUIT—Low cost flash less than 3/4c. inhibit AC & Batteries\* all in one case, powerful, compact. Guide & Color 60+. B&V 200+. Recycles 2 seeds. Limited Qty. Special  
\*Batteries not included. Two (2)/240V. . . \$10



### NEW "TABTRON" SELENIUM RECTIFIERS

#### FULL WAVE BRIDGE—One Year Guarantee

18VAC 14DC-1 Amp \$1.60; 2A \$2.40; 3A \$3.45;	4A \$4.25; 6A \$5.10; 10A \$7.50; 12A \$9.20.
36VAC 28VDC-1 Amp \$2.70; 2A \$3.40; 3A \$4.75;	4A \$6.45; 6A \$10.05; 10A \$14.35; 12A \$16.10.



### NEW VARIABLE 0 to 6 & 12 VOLT/12 AMP

#### D.C. Power Supply

Battery Eliminator, Charger, Model RR. Plates Aircraft, Marine or any CQ requirement. Extra Hvy. duty Selenium Rectifier, 2 meters volt & ammeter (insert for V & A). Designed for cont. service & up to 20 amps intermittent overload.  
MODEL T612 . . . . . \$29.95

## TUBES "TAB" Guaranteed

OUR 12th YEAR IN BUSINESS			
TESTED			
0A2 .70	6AQ5 .45	65A .45	12AX7 .55
024 .42	6AS7 .75	6SA7 .45	12BH7 .65
1B3 .60	6AT6 .35	6SH7 .40	12BY7 .70
<b>808 .89</b>	6AU4 .75	6SJ7 .45	
	6B6 .40	6SK7 .45	
	6AX4 .60	6SL7 .55	<b>7193 10/\$1</b>
	6BA6 .45	6SN7 .55	12SA7 .65
	6BC5 .45	6SQ7 .45	12SK7 .43
		6T4 1.00	12SN7 .55
		6T8 .75	12XQ7 .45
	<b>954 6/\$1</b>		14A7 .55
			19BG6
	6BE6 .45	<b>2V3 3/\$1</b>	25BQ8 .90
	6BF5 .50		25Z6 .45
	6BG6 1.12	6U8 .75	35C5 .50
	6BK5 .75	6V6 .55	35L6 .50
	6BL7 .80	6X4 .30	35WA .45
	6BN6 .85		35Z5 .45
	6BQ6 .90	<b>2C22 10/\$1</b>	50A5 .45
	6C06 1.12		50B5 .55
	6CQ7 .85	7A8 .50	50C5 .45
		7C5 .55	50L6 .40
	<b>2D21 .75</b>	7F7 .55	
		7N7 .55	
	6C4 .35	12AT6 .40	<b>1626 7/\$1</b>
	6C6 .48	12AT7 .35	
	6C8 .48	12AU7 .50	
<b>5BP1 1.49</b>	6C9 .38	12AV6 .35	75 .45
	6E .45	12AX4 .70	77 .40
6AH6 .85	6K6 .39		
6AK5 .52	6K7 .35		
6AL5 .38			

### FREE! WRITE TODAY FOR OUR NEW CATALOGS

**"TAB" FINEST HI-FI RECORDING TAPE**  
**7" Reel—1200 Ft. Per Reel . . . \$1.45 Lots**  
**Sold on Money Back Guarantee . . . \$1.45** Lots of 12  
 FERRO-SHEEN processed, quality controlled, constant output. Noise FREE, Splice FREE Plastic Tape. Freq. 7 1/2 IPS, 40-15KC Oxide Wnd In. . . . . "TAB" @ \$1.50 ea; 3/\$1.50 ea.

## KITS! KITS!

Each "TAB" Kit Contains the Finest Selection of Top Quality Components in the Most Popular Values & Sizes

### EXTRA: Free Kit with Each \$10 Kit order

25 Precision Resistors	25 Power Resistors
10 Switches	65 Mica Condensers
25 Knobs	5 Crystal Diodes
75 Carbon Resistors*	250 ft. Hook Up Wire, Ass't'd
36 Panel Lamps	100 Fuses
10 Electrolytic Cond's	35 Ceramic Condensers
15 Volume Controls	10 Rotary Switches
25 Tube Sockets	6 Crystals
50 Tubular Condensers	60 Inductors & Coils
500 Lugs & Eyelets*	5 Microswitches
10 Bathtub Oil Cond's	10 Wheat Lamps
5 lbs. Surprise Package	*In Plastic Box
10 Transmit Mica Cond's	
40 Insulators	

**1,000's OF SATISFIED CUSTOMERS**  
**EACH KIT ONLY . . . . . 99c**

**"TAB"** TERMS: Money Back Gtd. (cost of mds. only). \$5 min. order F.O.B. N.Y.C. Add shipp. charges or for C.O.D. 25% Dep. Tubes Gtd. via R-Exp. only. Prices shown are subject to change.

111P Liberty St., N. Y. 6M, N. Y., Rector 2-6245

Superior's New Model 670-A

# SUPER-METER

**A Combination VOLT-OHM MILLIAMMETER PLUS Capacity, Reactance, Inductance and Decibel Measurements.**



**SPECIFICATIONS:**

**D.C. VOLTS:** 0 to 7.5/15/75/150/750/1,500/7,500 Volts  
**A.C. VOLTS:** 0 to 15/30/150/300/1,500/3,000 Volts  
**OUTPUT VOLTS:** 0 to 15/30/150/300/1,500/3,000 Volts  
**D.C. CURRENT:** 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes  
**RESISTANCE:** 0 to 1,000/100,000 Ohms 0 to 10 Megohms  
**CAPACITY:** .001 to 1 Mfd. 1 to 50 Mfd. (Good-Bad scale for checking quality of electrolytic condensers)

**ADDED FEATURE:**

**Built-in ISOLATION TRANSFORMER** reduces possibility of burning out meter through misuse.

The Model 670-A comes housed in a rugged crackle-finished steel cabinet complete with test leads and operating instructions.

**REACTANCE:** 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms  
**INDUCTANCE:** 15 to 7 Henries 7 to 7,000 Henries  
**DECIBELS:** -6 to +18, +14 to +38, +34 to +58

**28<sup>40</sup>**

Superior's New Model TV-60

**20,000 OHMS PER VOLT**

# ALLMETER



Includes services never before provided by an instrument of this type. Read and compare features and specifications below!

**8 D.C. VOLTAGE RANGES:** (At a sensitivity of 20,000 Ohms per Volt) 0 to 15/75/150/300/750/1500/7500/30,000 Volts.  
**7 A.C. VOLTAGE RANGES:** (At a sensitivity of 5,000 Ohms per Volt) 0 to 15/75/150/300/750/1500/7500 Volts.  
**3 RESISTANCE RANGES:** 0 to 2,000/200,000 Ohms, 0-20 Megohms.  
**2 CAPACITY RANGES:** .00025 Mfd. to 30 Mfd.  
**5 D.C. CURRENT RANGES:** 0-75 Microamperes, 0 to 7.5/75/750/Milliamperes, 0 to 15 Amperes.  
**3 DECIBEL RANGES:** -6 db to +58 db.

- FEATURES**
- Giant recessed 6 1/2 inch 40 Microampere meter with mirrored scale.
  - Built-in Isolation Transformer.
  - Use of the latest type printed circuit and 1% multipliers assure unchanging accurate readings.

**R.F. SIGNAL TRACER SERVICE:** Enables following the R.F. signal from the antenna to speaker of any radio or TV receiver and using that signal as a basis of measurement to first isolate the faulty stage and finally the component or circuit condition causing the trouble.

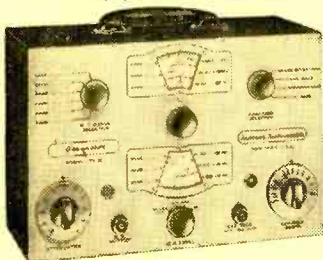
**AUDIO SIGNAL TRACER SERVICE:** Functions in the same manner as the R.F. Signal Tracing service specified above except that it is used for the location of cause of trouble in all audio and amplifier systems.

Model TV-60 comes complete with book of instructions; pair of standard test leads; high-voltage probe; detachable line cord; R.F. Signal Tracer Probe and Audio Signal Tracer Probe. Pflolm bag for all above accessories is also included. Price complete. Nothing else to buy. **ONLY**

**52<sup>50</sup>**

Superior's New Model TV-50

# GENOMETER



MODEL TV-50 comes absolutely complete with shielded leads and operating instructions. **Only**

**47<sup>50</sup>**

**7 SIGNAL GENERATORS IN ONE!** R. F. Signal Generator for A.M. • R. F. Signal Generator for F.M. • Audio Frequency Generator • Bar Generator • Cross Hatch Generator • Color Dot Pattern Generator • Marker Generator

**R. F. SIGNAL GENERATOR:** Provides complete coverage for A.M. and F.M. alignment. Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics. • **VARIABLE AUDIO FREQUENCY GENERATOR:** In addition to a fixed 400 cycle sine-wave audio, the Genometer provides a variable 300 cycle to 20,000 cycle peaked wave audio signal. • **BAR GENERATOR:** Projects an actual Bar Pattern on any TV Receiver Screen. Pattern will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars. • **CROSS HATCH GENERATOR:** Genometer will project a cross-hatch pattern on any TV picture tube. The pattern will consist of non-shifting horizontal and vertical lines interlaced to provide a stable cross-hatch effect. • **DOT PATTERN GENERATOR (FOR COLOR TV):** The Dot Pattern projected on any color TV Receiver tube by the Model TV-50 will enable you to adjust for proper color convergence. • **MARKER GENERATOR:** The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency.)

**SHIPPED ON APPROVAL  
 NO MONEY WITH ORDER — NO C. O. D.**

**SEE FOLLOWING PAGE FOR COMPLETE DETAILS**

PRINTED IN U.S.A.



Superior's New Streamlined Model TD-55

# TUBE TESTER

**FOR**

The Experimenter or Part-time Serviceman, who has delayed purchasing a higher priced Tube Tester. The Professional Serviceman, who needs an extra Tube Tester for outside calls. The Busy TV Service Organization, which needs extra Tube Testers for its field men.

Speedy, yet efficient operation is accomplished by: 1. Simplification of all switching and controls. 2. Elimination of old style sockets used for testing obsolete tubes (26, 27, 57, 59, etc.) and providing sockets and circuits for efficiently testing the new Noval and Sub-Minar types.

**CHECKS FOR SHORTS AND LEAKAGES BETWEEN ALL ELEMENTS**—Model TD-55 provides a super sensitive method of checking for shorts and leakages up to 5 Megohms between any and all of the terminals. Continuity between various sections is individually indicated. **"FREE-POINT"** **ELEMENT SWITCHING SYSTEM**—Model TD-55 incorporates a newly designed element selector switch system which reduces the possibility of absenteeism to an absolute minimum. Any pin may be used as a filament pin and the voltage applied between that pin and any other pin, or even the "top-cap." **ELEMENTAL SWITCHES ARE NUMBERED IN STRICT ACCORDANCE WITH R.M.A. SPECIFICATION**—The 4 position fast-action snap switches are all numbered in exact accordance with the standard R.M.A. numbering system. Thus, if the element terminating in pin No. 7 of a tube is under test, button No. 7 is used for that test.

Model TD-55 comes complete with operating instructions and charts. Housed in rugged steel cabinet. Use it on the bench—use it for field calls. A streamlined carrying case, included at no extra charge, accommodates the tester and book of instructions.

**\$26<sup>95</sup>**

Superior's New Model TV-12

# TRANS-CONDUCTANCE TUBE TESTER



**TESTING TUBES**  
 • Employs improved TRANS-CONDUCTANCE circuit. An in-phase signal is impressed on the input section of a tube and the resultant plate current change is measured. This provides the most suitable method of simulating the manner in which tubes actually operate in Radio & TV receivers, amplifiers and other circuits. Amplification factor, plate resistance and cathode emission are all correlated in one meter reading. • **NEW LINE VOLTAGE ADJUSTING SYSTEM.** A tapped transformer makes it possible to compensate for line voltage variations to a tolerance of better than 2%. • **SAFETY BUTTON**—protects both the tube under test and the instrument meter against damage due to overload or other form of improper switching. • **NEWLY DESIGNED FIVE POSITION LEVER SWITCH ASSEMBLY.** Permits application of separate voltages as required for both plate and grid of tube under test, resulting in improved Trans-Conductance circuit.

## ALSO TESTS TRANSISTORS!

**TESTING TRANSISTORS**  
 A transistor can be safely and adequately tested only under dynamic conditions. The Model TV-12 will test all transistors in that approved manner, and quality is read directly on a special "transistor only" meter scale. The Model TV-12 will accommodate all transistors including NPN's, PNP's, Photo and Tetrodes, whether made of Germanium or Silicon, either point contact or junction contact types.

Model TV-12 housed in handsome rugged portable cabinet sells for only

**\$72<sup>50</sup>**

Superior's New Model TW-11  
**STANDARD PROFESSIONAL**

- Tests all tubes, including 4, 5, 6, 7, Octal, Lockin., Hearing Aid, Thyatron, Miniatures, Sub-miniatures, Novals, Sub-minars, Proximity fuse types, etc.
- Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TW-11 as any of the pins may be placed in the neutral position when necessary.
- The Model TW-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.
- Free-moving built-in roll chart provides complete data for all tubes. All tube listings printed in large easy-to-read type.
- **NOISE TEST:** Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.



**EXTRAORDINARY FEATURE**  
**SEPARATE SCALE FOR LOW-CURRENT TUBES**—Previously, on standard emission type tube testers, it has been standard practice to use one scale for all tubes. As a result, the calibration for low-current types has been restricted to a small portion of the standard scale. The extra scale used here greatly simplifies testing of low-current types.

The Model TW-11 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover.

**\$47<sup>50</sup>**

# SHIPPED ON APPROVAL NO MONEY WITH ORDER — NO C. O. D.

We invite you to try before you buy any of the models described on this page, the preceding page and the following pages. If after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate.

**NO INTEREST OR FINANCE CHARGES ADDED!**

If not completely satisfied, you are privileged to return the Tester to us, cancelling any further obligation.

MOSS ELECTRONIC DISTRIBUTING CO., INC.

Dept. D-327 3849 Tenth Avenue, New York 34, N. Y.

Please send me the units checked. I agree to pay down payment within 10 days and to pay the monthly balance as shown. It is understood there will be no finance or interest charges added. It is further understood that should I fail to make payments when due, the full unpaid balance shall become immediately due and payable.

- Model TW-11... Total Price \$47.50  
\$11.50 within 10 days. Balance \$6.00 monthly for 6 months.
- Model TV-12... Total Price \$72.50  
\$22.50 within 10 days. Balance \$10.00 monthly for 5 months.
- Model 670-A... Total Price \$28.40  
\$7.40 within 10 days. Balance \$3.50 monthly for 6 months.
- Model TV-50... Total Price \$47.50  
\$11.50 within 10 days. Balance \$6.00 monthly for 6 months
- Model 76... Total Price \$26.95  
\$6.95 within 10 days. Balance \$5.00 monthly for 4 months.
- Model TD-55... Total Price \$26.95  
\$6.95 within 10 days. Balance \$5.00 monthly for 4 months.
- Model TV-60... Total Price \$52.50  
\$12.50 within 10 days. Balance \$8.00 monthly for 5 months.

Name \_\_\_\_\_  
 Address \_\_\_\_\_  
 City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

All prices net, F.O.B., N.Y.C.

**SEE OTHER SIDE**

CUT OUT AND MAIL TODAY! ▶

# For the first time ever: **ONE TESTER** **PROVIDES ALL THE SERVICES LISTED BELOW!**

Superior's

New Model

**76**



### Specifications

#### ✓CAPACITY BRIDGE SECTION

4 Ranges: .00001 Microfarad to .005 Microfarad; .001 Microfarad to .5 Microfarad; 1 Microfarad to 50 Microfarads; 20 Microfarads to 1000 Microfarads. This section will also locate shorts, and leakages up to 20 megohms. And finally, this section will measure the power factor of all condensers from 1 to 1000 Microfarads. (Power factor is the ability of a condenser to retain a charge and thereby filter efficiently.)

#### ✓RESISTANCE BRIDGE SECTION

2 Ranges: 100 ohms to 50,000 ohms; 10,000 ohms to 5 megohms. Resistance can be measured without disconnecting capacitor connected across it. (Except, of course, when the R C combination is part of an R C bank.)

As Design Engineers, we the undersigned would like to say that the Model 76 is in our opinion the best combination unit of its kind we have been privileged to design. Although it is comparatively a low-priced tester, it will, after you become acquainted with its multiple services, be your most frequently used instrument.

S. LITT  
 L. MELENKEVITZ

IT'S A

## CONDENSER BRIDGE

with a range of .00001 Microfarad to 1000 Microfarads (Measures power factor and leakage too.)

IT'S A

## RESISTANCE BRIDGE

with a range of 100 ohms to 5 megohms.

IT'S A

## SIGNAL TRACER

which will enable you to trace the signal from antenna to speaker of all receivers and to finally pinpoint the exact cause of trouble whether it be a part or circuit defect.

IT'S A

## TV ANTENNA TESTER

The TV Antenna Tester section is used first to determine if a "break" exists in the TV antenna and if a break does exist the specific point (in feet from set) where it is.

#### ✓SIGNAL TRACER SECTION

A built-in high gain pentode voltage amplifier, plus a diode rectifier, plus a direct coupled triode amplifier are combined to provide this highly sensitive signal tracing service. With the use of the R.F. and A.F. Probes included with the Model 76, you can make stage gain measurements, locate signal loss in R.F. and Audio stages, localize faulty stages, locate distortion and hum, etc. Provision has been made for use of phones and meter if desired.

#### ✓TV ANTENNA TESTER SECTION

Loss of sync., snow and instability are only a few of the faults which may be due to a break in the antenna, so why not check the TV antenna first? The Model 76 will enable you to locate a break in any TV antenna and if a break does exist, the Model 76 will measure the location of the break in feet from the set terminals. 2 Ranges: 2' to 200' for 72 ohm coax and 2' to 250' for 300 ohm ribbon

Model 76 comes complete with all accessories including R.F. and A.F. Probes; Test Leads and operating instructions. Nothing else to buy . . . . . Only

**\$26<sup>95</sup>**

# SHIPPED ON APPROVAL NO MONEY WITH ORDER — NO C.O.D.

**BUSINESS REPLY CARD**

No Postage Stamp Necessary if Mailed in the U. S.

**FIRST CLASS**

Permit No. 61430

New York, N. Y.

**VIA AIR MAIL**

POSTAGE WILL BE PAID BY —

**MOSS ELECTRONIC DIST. CO., INC.**

**3849 TENTH AVENUE**

**NEW YORK 34, N. Y.**

We invite you to try before you buy any of the models described on this and the preceding pages. If after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate. (See other side for time-payment schedule details.)

**NO INTEREST**  
**OR FINANCE**  
**CHARGES ADDED!**

If not completely satisfied, you are privileged to return the Tester to us, cancelling any further obligation.

**SEE OTHER**  
**SIDE**

◀ **CUT OUT AND MAIL TODAY!**