POPULAR ELECTRONICS

FEBRUARY 1957

35 CENTS

Foreign Short-Wave

Programs in English
Stations & Times

- Add "Presence" to Hi-Fi
- Build a Police Radio
- Electronic Anemometer
- TV Tube Rejuvenator
- Code Practice Oscillator
- PLUS 5 other Projects

AN $11.94 VALUE SENT TO YOU AT ONCE

FREE ANY 3

OF THESE SUPERB HIGH-FIDELITY

12" COLUMBIA (LP) RECORDS

If you join the Columbia (LP) Record Club now — and agree to accept as few as 4 selections during the coming 12 months

YES! You may have, FREE, ANY 3 of these best-selling 12" Columbia (LP) records. We make this unique offer to introduce you to the money-saving program of the Columbia (LP) Record Club . . . a program that selects for you each month the greatest works in every field of music — performed by the world's finest artists and brilliantly reproduced on Columbia (LP) records.

HOW THE CLUB OPERATES

To enjoy the benefits of this program — mail coupon, indicating which of the four Club divisions best suits your musical taste: Classical; Jazz; Listening and Dancing; Broadway, Movies, Television and Musical Comedies.

Each month you will receive free the Club Magazine, describing current selections in all four divisions. You may accept or reject the monthly selection for your division . . . or take records from the other divisions. This unique advantage assures you the widest possible choice of recorded entertainment. Or you may tell us to send you NO record in any month. Your only obligation is to accept as few as 4 selections from the almost 100 that will be offered during the next 12 months, and you may cancel membership at any time thereafter. The records you want are mailed and billed to you at only $3.98 plus a small mailing charge.

FREE BONUS RECORDS GIVEN REGULARLY

The 3 records sent to you now represent an "advance" of the Club's bonus system—given to you at once. After you have fulfilled your membership obligation by purchasing four records, you will receive an additional free Bonus record of your choice for every two additional Club selections you accept. Bonus records are superb 12" Columbia (LP) records — the very best of the world-famous Columbia (LP) catalog. Because you are given a Columbia (LP) record free for each two records you purchase, membership provides the best buy in records — anywhere.

Indicate on the coupon which 3 records you want free, and the division you prefer. Then mail the coupon at once. You must be delighted with membership or cancel it by returning free records within 10 days.

COLUMBIA (LP) RECORD CLUB

165 West 46th St., New York 36, N. Y.

MAIL ENTIRE COUPON NOW!

COLUMBIA (LP) RECORD CLUB,
Dept. 676, 165 West 46th St.,
New York 36, N. Y.

Please send me as my FREE gift the 3 records indicated here: (Select the records you want by checking the 3 boxes in the list at the right) . . . and enroll me in the following Division of the Club:

(check one box only)

☐ **Classical** ☐ **Listening and Dancing** ☐ **Jazz**

☐ **Broadway, Movies, Television and Musical Comedies**

Each month you will send me the Columbia (LP) Record Club Magazine which describes the records offered in all four Club divisions. I have the privilege of accepting the monthly selection in the division checked above, or any other selection described, or none at all. My only obligation is to accept a minimum of four records in the next 12 months at the regular list price plus a small mailing charge. After accepting 4 records, I will receive a free Bonus record for every two additional records I purchase. If not delighted with membership, I may cancel within 10 days by returning all records.

Name .....
(Please Print)

Address .....

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

CANADA: Prices slightly higher. Address 11-13 Soho St., Toronto 2B

If you wish to have this membership credited to an established Columbia Records dealer, authorized to accept subscriptions, please fill in the dealer's name and address also.

Dealer's Name .....

Dealer's Address **48-3**

CHECK THE 3 RECORDS YOU WANT:

☐ **Tchaikovsky: Nutcracker Suite; The Sleeping Beauty Ballet** Philadelphia Orchestra, Ormandy, cond.

☐ **Concert by the Sea** Erroll Garner — recorded in an actual performance at Carmel, Calif.—playing 11 numbers — *Red Top, Where or When*, etc.

☐ **Day Dreams** Doris Day sings 12 popular songs—including *Sometimes I'm Happy, You Go To My Head*, etc.

☐ **Levant Plays Gershwin** 3 works—Rhapsody In Blue; Concerto in F; An American in Paris.

☐ **King of Swing; Vol. I** Benny Goodman and Original Orch., Trio Quartet. *Ridin' High, Moonglow*—9 more.

☐ **The Voice** Frank Sinatra in 12 songs that first made him famous — *Lover, Fools Rush In*, etc.

☐ **My Fair Lady** Percy Faith and his Orchestra play music from this hit show.

☐ **Rimsky-Korsakov: Scheherazade** Philadelphia Orch., Ormandy, conductor. A superb performance of this exotic score.

☐ **Brahms: Double Concerto; Variations on a Theme by Haydn; Tragic Overture** Stern, violin; Rose, 'cello; N. Y. Philharmonic, Walter, cond.

☐ **Music of Jerome Kern** Andre Kostelanetz and his Orchestra play 20 Kern favorites.

☐ **Songs from Walt Disney's Magic Kingdom** 12 happy songs from famous Disney films.

☐ **Jazz: Red Hot & Cool** Dave Brubeck Quartet in *Love Walked In, The Duke*—5 more.

POPULAR ELECTRONICS is published monthly by Ziff-Davis Publishing Company, William B. Ziff, Chairman of the Board (1946-1953), at 64 E. Lake St., Chicago 1, Ill. Entered as second class matter August 27, 1954 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

(Also see page 6 for DEPARTMENTS)

Cover photo by Maynard Frank Wolfe

Average Net Paid Circulation 240,151

FEBRUARY 1957

VOL. 6—NUMBER 2

Publisher
OLIVER READ, W1ETI

Managing Editor
OLIVER P. FERRELL

Technical Editor
CHARLES S. TEPFER

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. VAHLSING **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

Member Institute of High Fidelity Manufacturers, Inc

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.

LEARN ELECTRICITY AND Industrial Electronics ON REAL EQUIPMENT IN THE GREAT SHOPS OF COYNE

LARGEST, OLDEST AND BEST EQUIPPED SCHOOL OF ITS KIND IN U.S.

This five story Chicago building is occupied entirely by Coyne. Five big floors of Classrooms and Massive Equipment. Thousands of successful men have trained at Coyne during past 58 years. There is no substitute for Coyne's wealth of experience.

Young men and Older men prepare for OPPORTUNITIES IN ELECTRICITY-ELECTRONICS

Whether 17 or up to 45 years of age, don't be satisfied with a "no future job." Train the Coyne way for a better job in *Electricity-Electronics—a field that offers a world of opportunities now and in the years ahead.* In industry—in the home—Electricity and Electronics are playing a vastly greater role than ever before. New developments and fabulous growth are creating increasing job opportunities.

AUTOMATION ELECTRONICS—one of the more recent applications of Industrial Electronics to manufacturing processes—promises to create additional demands for trained Electrical-Electronics men such as we have never seen.

YOU TRAIN IN CHICAGO—Learn the easier practical way in shops of Coyne in Chicago. Shop work plus technical training. No advanced education or previous experience needed. Lifetime Employment Service to Coyne Graduates.

START NOW—PAY LATER

New liberalized credit terms and Finance Plans. Part-time employment service to students. Help in making housing arrangements.

VETERANS OR NON-VETERANS

Coyne training is offered to Veterans and Non-Veterans alike. We'll send Bulletin giving full information. *Send coupon for details.*

Training in Refrigeration and Electric Appliances can be included.

1. You are told the how and why of each job.

2. You're shown how to do it by trained instructors.

3. You do the jobs yourself on finest equipment.

TELEVISION—RADIO—COLOR TV

Great opportunity for a good job or your own business in one of America's fastest growing industries! New stations by the hundreds . . . new sets by the millions . . . and now Color TV . . . all means greater opportunities in Sales and Service. Separate courses in Radio-Television or in combination with Electricity-Electronics available. Coupon brings details.

Mail coupon for big free book!

48 Page Illustrated Book, *"Guide to Careers"* gives you all the facts, answers your questions. Whether you prefer Electricity-Electronics or Television-Radio this book describes all training offered.

All information will come by return mail. No obligation and no salesman will call, so send coupon now!

Coyne Electrical School, Dept. 27-71H
500 S. Paulina St., Chicago 12, Ill.

Send BIG FREE BOOK and details of all training you offer. However, I am especially interested in

☐ Electricity-Electronics ☐ Television-Radio

*Name*_____

*Address*_____

*City*_____ *State*_____

(I understand no Salesman will call.)

H. W. COOKE JR., President **COYNE ELECTRICAL SCHOOL** FOUNDED 1899

A Technical Trade Institute Operated Not For Profit
500 S. Paulina Street, Chicago, Dept. 27-71 H
ELECTRICITY • RADIO • TELEVISION • REFRIGERATION • ELECTRONICS

DEPARTMENTS

COMING NEXT MONTH (MARCH)

(ON SALE FEBRUARY 21)

The cute WAVE that will be looking at you from our March cover gives an indication of our lead feature story—it discusses women in Naval electronics. If you have any sisters or daughters that are likely to enter military service, they will certainly find this actual case history very interesting.

Held over from our February issue is the transistor checker and FM commercial silencer. Then we are adding construction projects on an infra-red photocell system that defies detection, a voice alarm gadget, an "intelligence" tester and, finally, W6SAI's 21-mc transmitter for the new novice ham. Hi-fi fans will be pleased to see a three-way crossover network construction article, plus other important articles.

IN THIS MONTH'S

RADIO & TELEVISION NEWS

(FEBRUARY)

Transistorized Amateur Transmitter — 45,000 Miles-per-Watt

Balcony or Orchestra—Which Loudspeaker?

A Simplified Automatic Tone Compensator

Subminiature Construction Techniques for the Home Builder

Lafayette CAMERA DIVISION

Direct Imports
YOU SAVE
Importer's profits

SAVE 33⅓-50%

~~49.50~~ Value!

PORTABLE 35MM TABLE VIEWER & PROJECTOR

Special only 23.50

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 ⅝" x ⅝" 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 3½" 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, 2¼ x 2¼ 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"

F2.8 LENS

Reg. Value ~~69.50~~

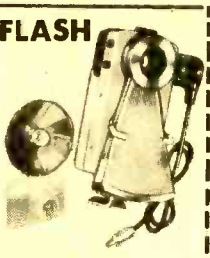
Only 34.95

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 36 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**

FOLDING BC POCKET FLASH



Unique, pocket size flash gun that folds like a fan to 4" x 2". Efficient 4½" 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.

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

Please ship following:

☐ 35mm Viewer 23.50 ☐ Stereo Outfit 9.95
☐ REFLEX 19.49 ☐ CASE 3.95 ☐ Outfit w/Gun 26.39
☐ 35mm Camera 34.95 ☐ Outfit w/Gun & Case..... 41.85
☐ FLASH GUN 3.99 ☐ COMPLETE CATALOG (FREE)

I am enclosing $.....
Send C.O.D. I enclose 20% deposit

NAME .....

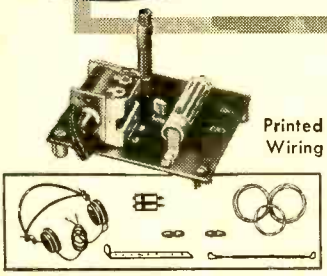
ADDRESS .....

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 premium quality parts
★ You get advanced design and top performance ★ You get exclusive new features
★ You get easiest-to-follow instructions for assured success in the finished equipment

BUY WITH CONFIDENCE FROM THE PIONEERS IN ELECTRONIC KITS



Fascinating knight-kit TRANSISTOR RADIO KIT

Model S-765 only $4.35 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 only $15.95 All-new 2-band receiver, easy to build—a great value. Bandswitch 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 10½ x 6"; for 110-120 v. 50-60 cycle AC or DC. Shpg. wt., 4½ lbs.

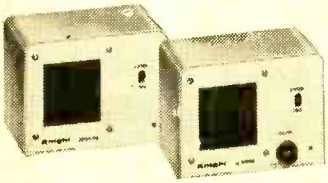
Model S-243. Net only **$15.95**

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

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

Model S-735 only $17.25 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.

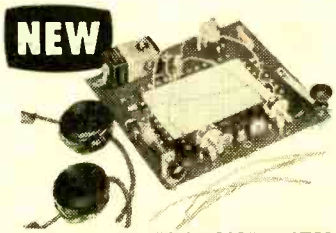
Model S-735. Net only **$17.25**



knight-kit TWO-WAY INTERCOM SYSTEM KIT

Model S-295 only $14.75 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 4¾ x 6½ x 4⅜"; 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 only $15.45 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). 8¼ x 11¼ x 8¾". 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
only **$24.95**

Easy to build. Reads peak-to-peak. 1% resistors. Balanced-bridge push-pull circuit; 4½" 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. 7¾ x 5¼ x 4⅛". 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
only **$29.50**

Low cost 32-range VOM. Features 4½" 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, 6¾ x 5¼ x 3¾". 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.

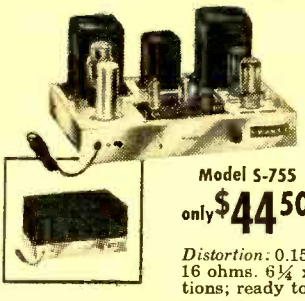
Model F-119. Net only..... **$12.50**

FREE CATALOG

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

ORDER NOW →

BUILD YOUR OWN QUALITY HI-FI AND SAVE!



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

Model S-755
only **$44.50**

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. 6¼ x 14 x 9". With all parts, tubes, instructions; ready to build. Shpg. wt., 27 lbs.

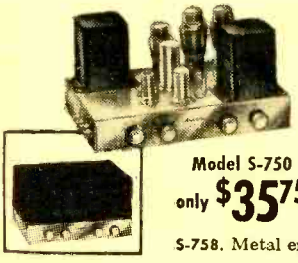
Model S-755. Net only..... **$44.50**
S-759. Metal enclosure for above; black finish.... **$4.25**

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

Model S-753
only **$23.50**

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. Net 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

Model S-750
only **$35.75**

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, 7½ x 13 x 8¾". With all parts, tubes and easy instructions. 23 lbs.

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-B7
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 (expresr is shipped collect).

☐ Send me your FREE Supplement covering all Knight-Kits.

Name_____

Address_____

City_____ Zone____ State_____

LETTERS FROM OUR READERS

The SRF "Affair"

■ For those who haven't learned the value of continued POP'tronics reading, as I have, I would suggest looking at page 52 of the October, 1956, issue. They will find there the frequency and location of SRF (as requested by readers Cooke and Lingbloom in December, 1956, page 26).

A. A. Rollins, KN6UHB
Happy Camp, Calif.

■ What's all this fuss about? Gosh, for only 25 cents, your readers can obtain from the Superintendent of Documents, Washington 25, D. C., a copy of "Airman's Guide," which lists all these so-called mysterious stations.

Charles Locke
Oakland, Calif.

■ The Superintendent of Documents can supply a "Flight Information Manual" (55 cents) listing aircraft beacons. It also contains other information that the readers might want.

John R. Dildine, W8NPP
Columbus, Ohio

■ I can offer your readers an answering service on these calls. I have complete information on lightships, navigational aids, beacons, etc. I also have a list of U.S. ships and yachts. All I ask is that the reader writing me enclose a self-addressed, stamped postal reply card.

Wade H. Williams
2327 Wheeling Street
El Paso, Texas

The identification of SRF produced an avalanche that was unprecedented in the history of POP'tronics. It is impossible for us to acknowledge the vast number of letters and cards. They were all appreciated and we hope the information above will stave off further inquiries.

War Surplus Conversions

■ Please publish material on how to convert an Army surplus receiver called the BC-459.

(Name Withheld)

■ I have a BC-187A Army surplus transmitter. How can I modify it to cover the Novice bands?

J. Butler
New York, N. Y.

If this were the year 1947, we would probably give thorough consideration to publishing articles on war surplus radio gear conversions. A survey we have made of the available pieces which can be purchased by the radio novice clearly indicates that there is not enough "good stuff" to go around, so we prefer to publish construction articles using all new radio parts.

We might indicate, however, that there are two possible sources of information on war surplus gear. Editors and Engineers (a publishing com-

Letters

(*Continued from page 10*)

pany) has two books available on this topic. They contain circuit diagrams and suggested modifications for many pieces of equipment. We are also under the impression that R. E. Goodheart, Beverly Hills, Calif., will supply schematics and conversion ideas at a modest price.

Kind Words for POP'tronics

■ I really enjoy and look forward to receiving POP'tronics each month. I like the articles on home projects. Let's have some more of these important "discoveries" by Carl Kohler. His wacky stories are terrific.

DAVID MILLER
Evanston, Ill.

Glad to oblige, Dave. See page 75 of this issue for Carl's latest antics.

■ Just finished Bill Orr's 15-meter preselector, as described in your October, 1956, issue. It really works FM with my S-38D.

J. NIDECKER, KN2SLF
Erlton, N. J.

■ The 21-mc. preselector works like a charm!

S. HARNEY
Brooklyn, N. Y.

■ I like your refreshing language and the approach of your writers. It's not the dull monotonous stuff published by some of your contemporaries.

MAJOR M. D. GRUSH
FPO, San Francisco, Calif.

■ How come the November issue didn't have a Carl Kohler story? What happened to him?

DAVID BROCKMAN
Riverside, Calif.

Great jumping jack rabbits, another Kohler fan! What's the man doing—paying you people off?

"Help Wanted" Helps

■ A few months ago you ran my name in Herb Brier's "Help Wanted" column. I received many letters and I'm going to send away for my license examination thanks to this assistance received. The letter that really made me happy was one from Chong Man Lee in Seoul, Korea.

AVRUM GITTLER
Brooklyn, N. Y.

Many readers have wondered whether or not the "Help Wanted" column really works. The above letter is a small sample of its success. We are proud to have been able to help over 750 potential novices during 1956 by listing their names and addresses in this column. —30—

Out of Tune

The "Economy" Signal Chaser (*November, 1956, page 63*): In the wiring diagram and parts list, the value of line cord resistor *R1* should be 390 ohms and not 960 ohms as shown.

HOW WOULD YOU LIKE TO BREAK INTO ENGINEERING STARTING NEXT MONTH?

Your start in Engineering could mean higher pay, more interesting work, a real chance for advancement. Here's how to do it—fast!

A career in Engineering may be closer than you think, whatever your age or education or present job.

You know about the tremendous demand for engineers and technicians. But do you know how easy it is to get the training that will qualify you for this vital work, and how quickly you can advance?

First Step Wins Job Consideration

The moment you enroll for a course in Engineering you're in a position to change your job. I.C.S. Engineering Courses, for example, start you off with Basic Mathematics and Drafting. Most employers are quick to accept men who start technical training.

Your Advancement Is Rapid

Your interest, your determination, your willingness to spend free hours improving yourself all work in your favor. But your mastery of engineering subjects is what wins you the biggest boosts.

The I. C. S. method makes it possible for you to learn while you earn, to qualify yourself for upgrading step by step—from Draftsman to Detail Designer to Engineering Technician to full-fledged Engineer. It's a plan fitted to your needs, with personalized instruction and guidance, and, if you like, regular progress reports to your employer.

Mail Coupon for Free Books

If you are seriously interested in a fresh start in an opportunity-packed field, then mark and mail the coupon today. We'll send you *three* free books—(1) the 36-page career guide "How to Succeed," (2) Opportunity outlooks in your field of interest, (3) sample lesson (Math) demonstrating I. C. S. method.

For Real Job Security—Get an I. C. S. Diploma! **I. C. S., Scranton 9, Penna.** Member, National Home Study Council

INTERNATIONAL CORRESPONDENCE SCHOOLS — 65TH YEAR

BOX 14949A, SCRANTON 9, PENNA.

(Partial list of 256 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):

ARCHITECTURE and BUILDING CONSTRUCTION
- ☐ Air Conditioning—Refrig.
- ☐ Architecture
- ☐ Architectural Interiors
- ☐ Building Contractor
- ☐ Building Estimator
- ☐ Building Maintenance
- ☐ Carpentry and Mill Work
- ☐ Heating
- ☐ Painting Contractor
- ☐ Plumbing
- ☐ Reading Arch. Blueprints

ART
- ☐ Cartooning
- ☐ Commercial Art
- ☐ Fashion Illustrating
- ☐ Magazine Illustrating
- ☐ Show Card and Sign Lettering
- ☐ Sketching and Painting

AUTOMOTIVE
- ☐ Auto Body Rebuilding
- ☐ Auto Elec. Technician
- ☐ Auto-Engine Tune Up
- ☐ Automobile Mechanic

AVIATION
- ☐ Aeronautical Engineering Jr.
- ☐ Aircraft & Engine Mechanic

BUSINESS
- ☐ Advertising
- ☐ Bookkeeping and Accounting
- ☐ Business Administration
- ☐ Business Correspondence
- ☐ Public Accounting
- ☐ Creative Salesmanship
- ☐ Federal Tax
- ☐ Letter-writing Improvement
- ☐ Office Management
- ☐ Professional Secretary
- ☐ Retail Business Management
- ☐ Sales Management
- ☐ Stenographic-Secretarial
- ☐ Traffic Management

CHEMISTRY
- ☐ Analytical Chemistry
- ☐ Chemical Engineering
- ☐ Chem. Lab. Technician
- ☐ General Chemistry
- ☐ Natural Gas Prod. & Trans.
- ☐ Petroleum Engineering
- ☐ Plastics
- ☐ Pulp and Paper Making

CIVIL, STRUCTURAL ENGINEERING
- ☐ Civil Engineering
- ☐ Construction Engineering
- ☐ Highway Engineering
- ☐ Reading Struct. Blueprints
- ☐ Sanitary Engineering
- ☐ Structural Engineering
- ☐ Surveying and Mapping

DRAFTING
- ☐ Aircraft Drafting
- ☐ Architectural Drafting
- ☐ Electrical Drafting
- ☐ Mechanical Drafting
- ☐ Mine Surveying and Mapping
- ☐ Plumbing Drawing and Estimating
- ☐ Structural Drafting

ELECTRICAL
- ☐ Electrical Engineering
- ☐ Electrical Maintenance
- ☐ Electrician ☐ Contracting
- ☐ Lineman

HIGH SCHOOL
- ☐ Commercial ☐ Good English
- ☐ High School Subjects
- ☐ Mathematics

LEADERSHIP
- ☐ Foremanship
- ☐ Industrial Supervision
- ☐ Leadership and Organization
- ☐ Personnel-Labor Relations

MECHANICAL AND SHOP
- ☐ Gas—Electric Welding
- ☐ Heat Treatment ☐ Metallurgy
- ☐ Industrial Engineering
- ☐ Industrial Instrumentation
- ☐ Industrial Supervision
- ☐ Internal Combustion Engines
- ☐ Machine Design-Drafting
- ☐ Machine Shop Inspection
- ☐ Machine Shop Practice
- ☐ Mechanical Engineering
- ☐ Quality Control
- ☐ Reading Shop Blueprints
- ☐ Refrigeration
- ☐ Sheet Metal Worker
- ☐ Tool Design ☐ Toolmaking

RADIO, TELEVISION
- ☐ Industrial Electronics
- ☐ Practical Radio TV Eng'r'ng
- ☐ Radio and TV Servicing
- ☐ Radio Operating
- ☐ Television Technician

RAILROAD
- ☐ Air Brake Equipment
- ☐ Car Inspector
- ☐ Diesel Engineer & Fireman
- ☐ Section Foreman

STEAM AND DIESEL POWER
- ☐ Combustion Engineering
- ☐ Diesel—Elec. ☐ Diesel Eng's
- ☐ Electric Light and Power
- ☐ Stationary Fireman
- ☐ Stationary Steam Engineering

TEXTILE
- ☐ Carding and Spinning
- ☐ Cotton, Rayon, Woolen Mfg.
- ☐ Finishing and Dyeing
- ☐ Loom Fixi'g ☐ Textile Des'ing
- ☐ Textile Eng'r'g ☐ Throwing
- ☐ Warping and Weaving

MISCELLANEOUS
- ☐ Domestic Refrigeration
- ☐ Marine Engineering
- ☐ Ocean Navigation
- ☐ Professional Engineering
- ☐ Short Story Writing
- ☐ Telephony

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.

POP'tronics BOOKSHELF

"MAN OF HIGH FIDELITY" by Lawrence Lessing. Published by J. B. Lippincott Co., E. Washington Square, Philadelphia, Pa. 320 pages. Hard cover. $5.00.

Messages in sight, sound, or symbol—spanning distance without time—are the hallmark of the electronic age. Radio transmission of words has changed the pattern of business and public life, while broadcasting of images and music is a major influence in the home.

The man who contributed more than any other to this development is largely unknown outside of engineering circles. He is Edwin Howard Armstrong, Mr. Lessing's "Man of High Fidelity." Armstrong invented the regenerative circuit and the superheterodyne circuit, which gave radio range enough to circle the earth. Then he single-handedly developed FM to give radio's voice the full sonority of music. His inventive genius was matched by strength of character, which makes his life story a truly grand adventure of struggle, achievement, and fight for principle.

This book describes the man's personal daring and courage, his bitter patent litigations against corporate giants, his defiance of public indifference, the spending of his hard-earned fortune on further experiments, and the final tragedy of his suicide. The story is told simply and intelligently, providing a moving experience for any reader.

Recommended: to all who care about the present state of man, science, and society.

"LET ERMA DO IT" by David O. Woodbury. Published by Harcourt, Brace, and Co., 383 Madison Ave., New York N. Y. 305 pages. Hard cover. $5.00.

ERMA cost two million dollars and proved to be worth every cent of it. Her history goes back to the first ingenious attempts to free men from drudgery. Her goal is to free us for even greater opportunities to do more of the things we want to do. ERMA ("Electronic Recording Machine—Accounting") is a computer, one of the family that includes such "brains" as ENIAC, UNIVAC, AUDREY, WHIRLWIND, and others. These fabulous machines are explained in simple, down-to-

earth language which makes the book read like an adventure story. And, essentially, it is just that: a non-technical account of the technical frontiers of our time. The author manages to impart a warm, personal touch to the glass and steel monsters whose services promise a richer life.

Recommended: to all interested in computers and automation.

"RADIO-TELEVISION AND BASIC ELECTRONICS" by R. L. Oldfield. Published by The American Technical Society, 848 E. 58th St., Chicago 37, Ill. 342 pages. Hard cover. $4.95.

Fundamentals of electronics in general, and radio in particular, are explained in this book. Basic theory is presented in concise fashion with a minimum reference to mathematics. Next, electronic applications are treated, with emphasis on vacuum tubes. Functioning of equipment, such as microphones, transmitters, antennas, receivers, etc., is explained. The contents are rounded out with brief introductory texts on television, high fidelity, and transistors, thus making this one of the most up-to-date of the books on fundamentals. Its use as a school text is suggested by the review questions at the end of each chapter. Numerous illustrations, a lengthy glossary, tables of data and symbols, and a subject index add to its usefulness.

Recommended: as a basic text for serious beginners.

Free Literature Roundup

Laminated magnetic tracks for motion picture film is the subject of "Sound Talk" Bulletin No. 33, available on request from Minnesota Mining and Manufacturing Co., 900 Fauquier St., St. Paul 6, Minn.

Reference chart shows interchangeability of Mullard tubes with American and European types. For a copy, write to International Electronic Corp., (Mullard Products), 81 Spring St., New York 12, N. Y.

Provocative and stimulating is Altec-Lansing's "A Frank Statement of High Fidelity Facts." This illustrated pamphlet is available from that company at 9356 Santa Monica Blvd., Beverley Hills, Calif., or at 161 Sixth Ave., New York 13, N. Y.

Portable electric tools and kits are fully described in a 32-page "Catalog No. 104." For a copy, write to Porter-Cable Machine Co., 93 Exchange St., Syracuse 8, N. Y. Canadian readers should write to Porter-Cable Power Tools, Ltd., Box 5019, London, Ontario. —30—

INTERESTED IN Electronics-TV-Radio

CARL E. SMITH, E.E., President

then you will want to know

WHAT IS THE FCC?

It's amazing what the future holds for you in this modern world of electronics. Let me send you the entire story—FREE!

- How to pass the FCC Exam
- A Sample FCC lesson
- Money-making FCC License Information

I can train you to pass the Valuable FCC exam in a minimum of time if you have any practical experience and a fair knowledge of mathematics.

CARL E. SMITH, E.E., President

How Can I Get a Valuable FCC COMMERCIAL LICENSE?

MY PASSPORT TO FUTURE SECURITY

GET THESE FREE

These Three Booklets Tell You

1 Where to apply to take FCC Examinations.
2 Scope of knowledge required.
3 Necessary FCC exam preparation.
4 Positive knowledge check.

And additional data of great value.

JOIN the LIST of SUCCESSFUL ELECTRONIC TECHNICIANS

	License	Time
Walter Eggers, Pacific Grove	1st Class	12 Weeks
Paul Reichert, West Salem, Ohio	2nd Class	10 Weeks
Harold Phipps, LaPorte, Indiana	1st Class	28 Weeks
John J. Johnson, Boise City, Okla.	2nd Class	12 Weeks
James Faint, Johnstown, Pa.	1st Class	26 Weeks

AND THOUSANDS MORE!

YOUR GUARANTEE—

If you fail to pass your Commercial License exam after completing our course, we guarantee to continue your training without additional cost of any kind until you successfully obtain your Commercial License.

START BUILDING FOR A LIFETIME PROFESSION

- **Employers make job offers every month!**
- **Your FCC ticket is recognized by most employers in the Electronics field as proof of your technical ability.**
- **Pave the way for Your Share of the better things in life.**

Cleveland Institute of Radio Electronics

Member National Home Study Council

Desk PE-21, 4900 Euclid Ave., Cleveland 3, Ohio

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

☐ Military ☐ Amateur Radio ☐ Telephone Company
☐ Radio-TV Servicing ☐ Broadcasting ☐ Other . . . . . .
☐ Manufacturing ☐ Home Experimenting

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

By JOHN T. FRYE

Electronic Cops and Robbers

CARL AND JERRY had a very distinguished visitor in their basement laboratory. It was none other than Chief of Police Morton. Carl and Jerry sat stiffly on the leather couch, frantically reviewing their acts of the immediate past in an effort to guess which particular misdeed might interest the chief officially. Chief Morton, on the other hand, seemed to be having difficulty in stating the reason for his visit.

"All right; relax, you two," he finally said gruffly. "You've done nothing wrong—or at least we've not caught you at it. I'm here on the off chance you may be able to help us with a problem. Here is the dope: for the past few weeks we've been having a series of car thefts in this town that point to the operation of an organized gang. Only new, flashy, sports-type cars are taken. So far, not a single stolen car has been recovered. We're pretty certain the cars are being repainted and worked over somewhere near here and then transported a long way off for sale."

"Why don't you 'plant' a car and follow it when it is stolen?" Carl asked.

Chief Morton gave him a searing look. "You know, Son, that is a very clever idea! After watching TV whodunits, I can't imagine how we on the force ever managed to think of it too, but we did. There's only one joker: it is practically impossible to 'tail' a good driver who is thoroughly familiar with the streets and alleys under the crowded traffic conditions that exist in this town. All we did when we tried that was to lose a fine new sports car, and that is a little too much like using caviar to bait rat traps to suit the Police Commissioner.

"Some of the boys down at the station suggested you two might be able to dream up a way we could trace the car without actually having to keep it in sight. Maybe I'm wasting my time, but—"

WAIT A MINUTE," Jerry interrupted. "This shouldn't be too hard. It will be just like the 'hidden transmitter hunt' our radio club puts on. All we have to do is

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 Ocillator, TV Circuits, Audio Oscillator, TRF Receiver, Signal Generator
- A Valuable Professional Multitester

YOUR NATIONAL SCHOOLS TELERAMA COURSE COVERS ALL 8 PHASES

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

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

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 job while you learn. Check box in coupon for full information.

MEMBER
NATIONAL HOME STUDY COUNCIL

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!

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. R2G-27
4000 S. FIGUEROA ST. LOS ANGELES 37, CALIF. OR 187 N. LA SALLE ST. 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 _____

Carl & Jerry (*Continued from page* 18)

conceal a continuously operating transmitter in the 'bait' car. We'll get 'fixes' by installing direction-finding equipment in a couple of other cars that have two-way communication with each other. By plotting the 'fixes' furnished by these two stations on a map, we should know exactly where the stolen car is all the time."

"Maybe you've got something there," the chief said slowly. "We could use a regular squad car to determine what direction the stolen car was taking and relay this information to a fast panel truck job we have. There is enough room in the back of the truck to set up a receiving station and have a large map of the area spread out on a plotting table. While it looks like an ordinary truck, this baby will hit up to about a hundred miles an hour. Now, where can we hide the transmitter?"

"Almost anywhere," Jerry said casually. "It won't be larger than a grapefruit, including batteries. With transistors and printed circuits, you can put a lot of transmitter in a mighty small space. If you like, we can put it inside the spare tire."

"That will be fine," the chief agreed. "This sports job we'll be using for bait has an ornamental antenna mounted on the side of the rear deck, but this time it will be more than ornamental. We'll connect it to the transmitter inside the spare tire. How soon do you boys think you can have all this equipment ready?"

"By tomorrow night," Jerry said promptly. "Tomorrow is Saturday; so we don't have to go to school. We have receivers, and Carl and I will build the transmitter tonight. Tomorrow we can install it in the bait car and also get our receivers set up in the squad car and panel truck. We can run some checks in the afternoon, and then tomorrow night we'll see if the fish bite."

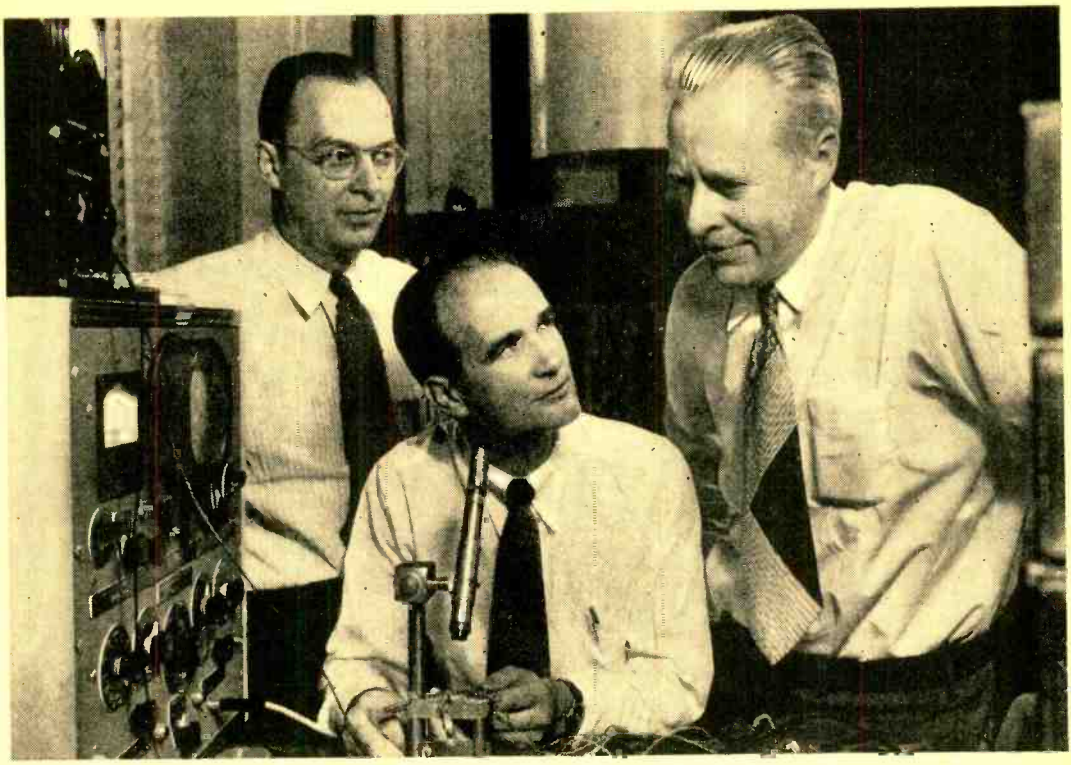
"Hey! You two really work fast!" the chief said admiringly. "I didn't imagine you could be ready for a couple of weeks."

"We do so much experimenting that we've almost always got equipment lying around that can be converted to special uses in a short time," Carl explained.

"Okay then; I'll get out of here and let you boys get started," the chief said as he picked up his cap. "Give me a call when you're ready tomorrow morning, and I'll have a truck come over and take you and your equipment to the garage so the mechanics can install it for you."

THE LATE-LATE show on TV was nearly over by the time Carl and Jerry got to bed that night; but they were up bright

(*Continued on page* 24)



(Left to right) Dr. John Bardeen*, Dr. William Shockley* and Dr. Walter H. Brattain, shown at Bell Telephone Laboratories in 1948 with apparatus used in the early investigations which led to the invention of the transistor.

Bell Telephone Laboratories Salutes Three New Nobel Prize Winners

Drs. John Bardeen, Walter H. Brattain and William Shockley are honored for accomplishments at the Laboratories

The 1956 Nobel Prize in Physics has been awarded to the three inventors of the transistor, for "investigations on semiconductors and the discovery of the transistor effect."

They made their revolutionary contribution to electronics while working at Bell Telephone Laboratories in Murray Hill, N. J. Discovery of the transistor was announced in 1948. Bell Laboratories is proud to have been able to provide the environment for this great achievement.

This is the second Nobel Prize awarded to Laboratories scientists. In 1937 Dr. C. J. Davisson shared a Nobel Prize for his discovery of electron diffraction.

Such achievements reflect honor on all the scientists and engineers who work at Bell Telephone Laboratories. These men, doing research and development in a wide variety of fields, are contributing every day to the improvement of communications in America.

**Dr. Bardeen is now with the University of Illinois, and Dr. Shockley is with the Shockley Semiconductor Laboratory of Beckman Instruments, Inc., Calif.*

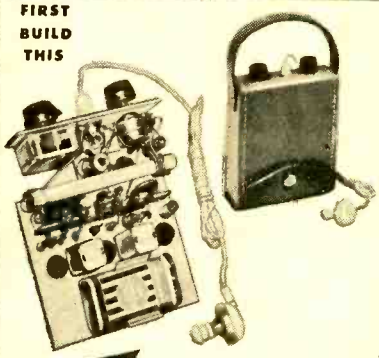
BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

Lafayette's

4 AND 6 TRANSISTOR SUPERHET KITS POCKET AND HOME RADIOS FOR SPEAKER AND EARPHONE OPERATION

FIRST BUILD THIS



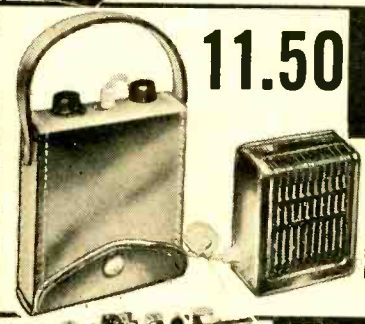
THEN BUILD THIS **19.95**

POCKET SIZE: 4"L x 3-5/16"W x 1"D BUILT-IN ANTENNA! REQUIRES NO EXTERNAL ANTENNA OR GROUND!

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-96 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.

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**



11.50

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 2⅜" W x 1⅜" 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, 2½" PM speaker, pre-punched chassis, speaker case to hold entire stage, battery, hardware, instructions and diagrams. Shpg. wt., 1 lb.

KT-96 ..... Net **11.50**

FM-AM TUNER KIT

34.95

Basic FM-AM Tuner having outstanding specifications and delivering astonishing performance — all at a budget price in easily assembled kit form.

- **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 Armstronf 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 80 UV/meter. **SELECTIVITY:** FM, 200 KC bandwidth, 6 db down; 375 KC FM discriminator peak to peak separation, AM, 8 KC bandwith, 6 db down. **IMAGE REJECTION:** 30 db minimum. **HUM LEVEL:** 60 db below 100% modulation: **TUBE COMPLEMENT:** 2-12AT7, 1-6BE6, 1-BA6, 2-6AU6, 1-6AL5 plus selenium rectifier. **SIZE:** 5¼" high x 9⅝" wide x 9½" deep (excluding knobs). **CONSUMPTION:** 30 watts. For 110-120V 60 cycles AC. Attractive etched copper-plated and lacquered finish. Less metal case. Shpg. wt., 9 lbs.

KT-100 ..... NET **34.95**
ML-100....Metal cage for above, Shpg. wt., 3 lbs. **5.00**

LAFAYETTE SIGNAL GENERATOR

COMPLETELY WIRED AND TESTED! ACCURACY AND QUALITY GUARANTEED!

22.50

- **FREQUENCY 120KC to 260MC!**
- **120KC to 120MC ON FUNDAMENTALS!**
- **30 DAY TRIAL PERIOD! FULL REFUND IF YOU ARE NOT SATISFIED FOR ANY REASON**

Completely wired and tested instrument. Do not confuse with kits sold in the same price range. Has the quality and accuracy of instruments selling for 3 to 4 times as much. Six overlapping ranges — 120KC to 320KC, 320KC to 1000KC, 1MC to 3.2MC, 3.2MC to 11MC, 11MC to 38MC, 37MC to 130MC — all on fundamentals — calibrated harmonics from 120MC to 260MC. Switch between internal modulation at 400 cps or any external source at other frequencies. 400 cps signal can be used separately. Outputs are unmodulated RF, modulated RF and 400 cps audio. RF output is in excess of 100,000 micro volts. Jacks are provided for high or low RF output.

Highly stable special circuit design. Fine adjust RF control. AF output 2-3 volts, input 4 volts, across 1 megohm. 5 inch etched dial plate — protected by clear plastic bezel. Common AF terminals for EXT-MOD input and INT-AF output eliminates need for special connectors. Gray metal case — carrying handle — complete with leads, line cord and plug. For 105-125V. 50-60 cycle A.C. Shpg. wt., 8 lbs.

LSG-10 — Signal Generator **22.50**

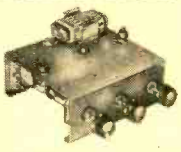
Lafayette Radio **165-08 Liberty Ave. JAMAICA 33, N. Y.**

100 SIXTH AVE. NEW YORK, N.Y.
PLAINFIELD, N. J., 139 W. Second St. BOSTON 10, MASS., 110 Federal St.
BRONX 58, N. Y., 542 E. Fordham Rd. NEWARK 2, N. J., 24 Central Ave.
Include postage with order.

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 BUYS! SEND FOR YOUR FREE COPY TO-DAY.

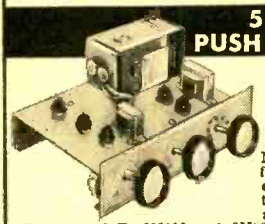


3 TRANSISTOR HI-FI PREAMPLIFIER KIT

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-noice, stable preamplification without hum and microphonics. Complete with all parts transistors, pre-punched chassis, battery and detailed step-by-step instructions. Size 4⅛" x 3¾" x 1½". Shpg. wt., 2 lbs.

KT-117—Complete Kit.....Net **18.45**

5 TRANSISTOR PUSH PULL AMPLIFIER KIT



- ¼ WATT, CLASS B, PUSH-PULL OUTPUT
- CRYSTAL AND MAGNETIC INPUT
- SEPARATE BASS AND TREBLE CONTROLS

New 5 transistor audio amplifier for phonos—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 feed back for reduction of distortion. Transformer coupled driver and output stages. Complete with punched chassis, knobs, transistors, all parts and detailed instructions and diagrams.

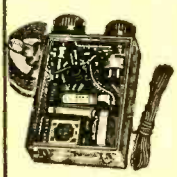
KT-104—3.2 ohm output.....Net **22.95**
KT-105—8 ohm output.....Net **22.95**

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 2½"x3½"x1¼" 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, Argonne transistor audio transformer, resistors, condensers, plastic case, etc. Including schematic and instructions.

KT-68A Complete Kit less earphones. Net **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: 250 mmf to .2 mfd and .005 to 1 mfd. Heavy plastic panel, metal bottom. 4¼" x 3½" x 1⅝". With batteries and test leads. Shpg. wt. 4 lbs.

RW-27A **8.95**

NEW! Mail Order Center ------►

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. 4⅛"x2⅝"x1-1/16". 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 kit. 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. 3⅝" x 2⅝" 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 3⅜" x 4⅜" x 1⅝". Shpg. wt., 3 lbs.

KT-20—Kit .....Net **11.95**

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

SEND FREE CATALOG

NAME _____
ADDRESS _____
CITY _____
ZONE ____ STATE ____

CUT OUT AND MAIL TODAY!

Carl & Jerry

(*Continued from page* 20)

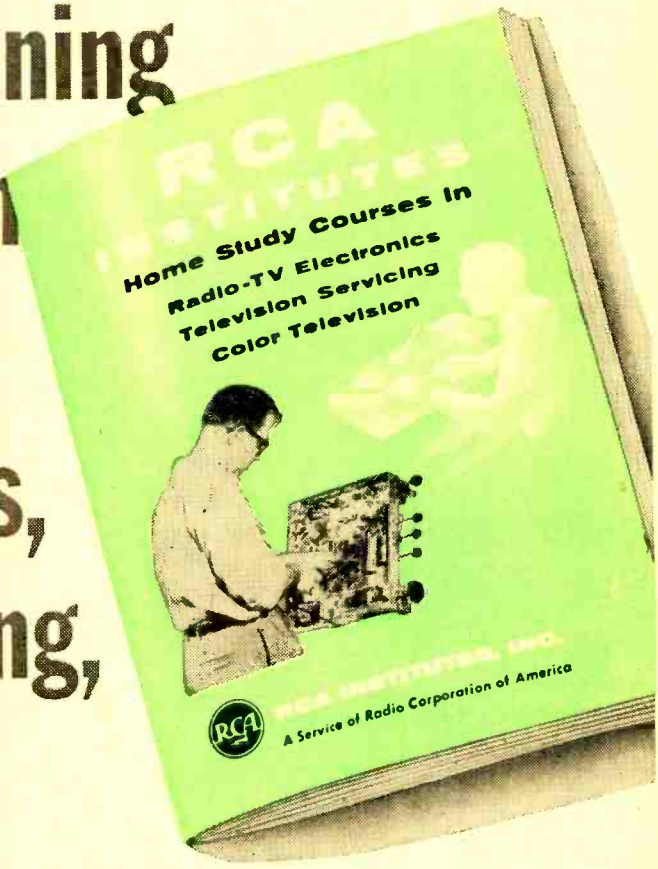
and early the next morning, eager to get on with this new game of *Electronic Cops and Robbers*. The chief was as good as his word. The truck took the boys and their equipment to the police garage, where two mechanics were put at their disposal, and in a couple of hours everything was installed in the sleek sports car, the squad car, and the panel truck.

Right after dinner they gave the equipment a test. A plainclothes detective took the sports car out and tried to lose it. Carl rode in the back seat of the squad car and operated his receiver and the loop antenna that was mounted on a slender rod running right through the roof of the car. One policeman drove the squad car while another relayed the information Carl gave him over the two-way radio. Two other policemen in "plain clothes" performed similar functions in the panel truck. Back in the body of the truck, a third policeman plotted bearings furnished him on a large map. Jerry's direction-finding equipment was on a table bolted to the floor, and his loop antenna on the roof was concealed inside an inverted cardboard carton, with other empty cartons piled about it in a luggage-carrier. This was done so that the truck could pass in sight of the bait car, if necessary, without arousing the thief's suspicion.

The equipment worked to perfection. No

. . . Back in the body of the panel truck, Jerry was busy with his direction-finding equipment, which was on a table bolted to the floor . . .

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



SEND FOR THIS FREE BOOK NOW!

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

RCA Institutes, Inc., Home Study PE-27
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 solesmon will call.

Name .....
Please Print

Address .....

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

VETERANS
KOREAN G.I.
P.L. 550
CHECK HERE
☐

Carl & Jerry

(*Continued from page* 24)

matter how fast the detective drove or how he doubled back and forth, the two direction-finding cars knew where he was all the time.

It was soon discovered that the most accurate spotting could be done if the two direction-finding cars maneuvered so that the bait car was kept roughly at the apex of an isosceles right triangle. When all three cars returned to the garage and compared notes, it was found that the route traced on the map agreed in every detail with that described by the detective.

CARL AND JERRY returned home, bolted their suppers in record time and then returned to the police garage. As soon as they arrived, Chief Morton ordered the bait car parked on a dark side street where it could be watched by a concealed policeman equipped with a hand transmitter. If and when it was stolen, this man was to flash the word to the squad car parked on a side street and the panel truck at the garage.

Contrary to all considerations for the niceties of suspense, the car had hardly been parked when the policeman with the hand transmitter reported someone fooling around it. A few seconds later he reported the guy wasn't fooling: the car was being driven away. The chief got into the back of the panel truck with Jerry and the fix-plotter, and the truck roared out of the garage. No attempt was made to close in on the car as it drove aimlessly about the town. Both direction-finding cars tried to keep at least three or four blocks away from it at all times. Finally the 'fixes' relayed back and forth showed the car was standing still at a deserted spot down in the factory district. Apparently the thief was satisfied that he had shaken off any possible pursuit and was ready to be picked up by the gang. The two police cars now parked in positions well removed from the car.

Once again, though, they did not have long to wait. The directional antennas indicated the car was moving again. This time it headed for the country. The squad car drove along a road roughly parallel to the highway on which the stolen car was moving, while the panel truck stayed a half-mile or so behind it.

It was confusing trying to keep the exact position of all three cars plotted at the same time, and suddenly it was found that both the squad car and the panel truck were giving each other nearly the same bearings for the stolen car. Apparently the stolen car had pulled off the highway and the panel truck had gone beyond it. By the

Another BOGEN 'FIRST'

IT'S A DUAL PREAMPLIFIER! IT'S AN EXTRA 10-WATT AMPLIFIER!

MODEL ST10G

BOGEN ST10 Stereo Tape Amplifier with 2-Channel Preamp

STEREOPHONIC TAPE PLAYBACK is now within the reach of every budget – thanks to the Bogen ST10. Until now, using a stereo tapedeck meant buying a separate preamp for your second channel – and an additional amplifier as well – and a lot of work balancing two sets of controls.

But not any more... because Bogen has developed the ST10. It saves you trouble–and a lot of money. Here's why:

First, the ST10 preamplifies both of your stereo signals for you (the gain control acts on both channels simultaneously, automatically assuring balanced stereophonic playback). Then one preamplifier feeds your present hi-fi system, while the second preamplifier feeds the ST10's built-in 10-watt amplifier for your second speaker. This one amazing wonder-unit does it all – and all for the incredibly low price of $52.50 in chassis form, or $59.50 for the ST10G with cage and legs, as illustrated.

JUST OUT!

New, illustrated Bogen catalog. Everything you want to know about 25 great tuners, receivers, amplifiers, preamplifiers, power amplifiers, loudspeakers, record players, and automatic changers. It's FREE!

HI-FI SECRETS REVEALED!

Whether your interest is records, tape, radio, or television, don't shop for another piece of sound-reproduction equipment until you read UNDERSTANDING HIGH FIDELITY by Louis Biancolli and Lester H. Bogen. 56 pages, profusely illustrated. Up-to-date 3rd edition. Only 25c.

Bogen
HIGH FIDELITY
A UNITRONICS CORPORATION AFFILIATE

David Bogen Co., Dept. CM, P.O. Box 500, Paramus, N. J.

Please send me literature checked

- ☐ *My copy of UNDERSTANDING HIGH FIDELITY. I enclose 25c.*
- ☐ *Free Bogen hi-fi catalog.*
- ☐ *Details on the ST10 Stereo Tape Playback Unit.*

Name.....

Address.....

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

MAIL THIS COUPON TODAY

Carl & Jerry (*Continued from page* 26)

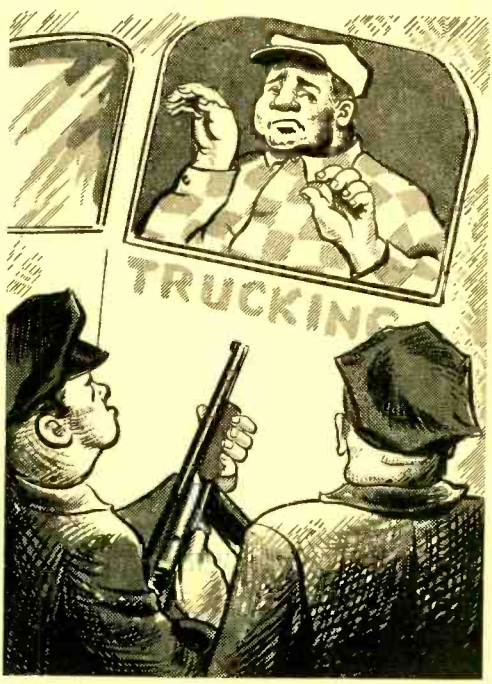
time this was clear, the panel truck was a half-mile from the point where it was first noticed. Suddenly word came from the squad car that the stolen car was apparently moving again. The direction indicated by the loop on top of the panel truck still pointed straight back along the highway, but Jerry noticed the signal strength was increasing rapidly. He reported this to Chief Morton.

"Drive along slowly and let that guy overtake us," the chief ordered as he cautiously peeped out the small rear glass. "I'd like to get a look at him anyway."

Almost as he finished speaking the signal built up to a very high level and then fell off. The loop had to be turned around, showing that the signal source had passed them; yet the only vehicle in sight was a huge tractor-trailer.

"That thing must have flipped," Chief Morton grunted. "No one could make a sports car look like that truck—at least not in two or three minutes—unless—tell the boys in the squad car to join us!" he snapped. "We're going to stop that truck!"

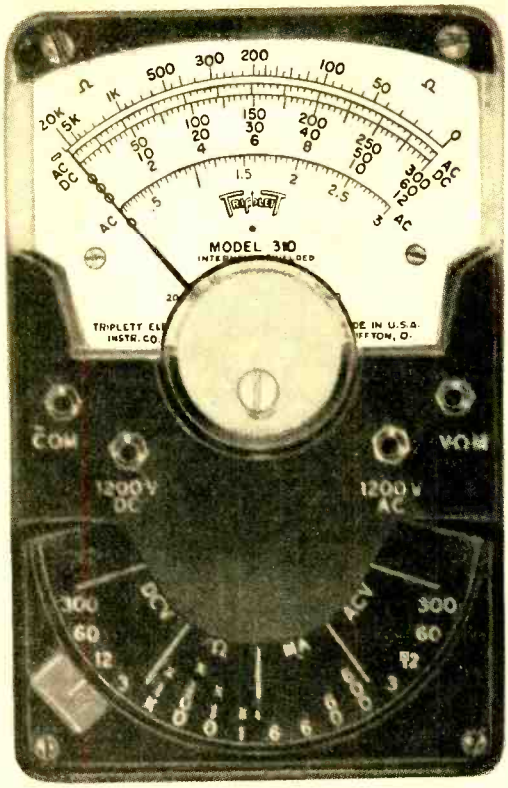
In a few minutes the squad car caught up with them, swung around in front of the truck and waved to the driver to pull off the road. Since the waving was done with the barrel of a submachine gun, the



. . . The police waved to the driver to stop, and since the waving was done with the barrel of a submachine gun, the order was promptly obeyed . . .

JUST BEGINNING *or an old hand It's* ESSENTIAL

for everyone who builds or repairs radios, hi-fi, television, inter-com, house-wiring systems, appliances, etc.



ACTUAL SIZE

MIGHTY MITE

Model 310 MIGHTY MITE the only complete miniature V-O-M (AC-DC) only $29.50 net

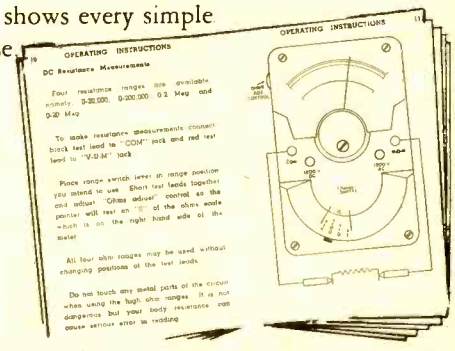
The same valuable tool professionals use for:

- current measurements . . . voltage measurements . . . resistance measurements
- checking circuit continuity
- checking for defective components (shorted condensers, open resistors, etc.) both before and after installation
- checking for shorts or opens in wiring

Tells all about everything electrical and electronic—all essential ranges.

- 20,000 ohms per volt. D.C.
- 5,000 ohms per volt. A.C.

A complete professional tester you won't be afraid to use. This book shows every simple easy step you need to use.



TRIPLETT

TRIPLETT ELECTRICAL INSTRUMENT CO.

Bluffton, Ohio

Burton browne advertising

Carl & Jerry (*Continued from page 28*)

order was promptly obeyed. As soon as the huge truck was stopped, Chief Morton began tugging at the fastening of the rear doors; and when he threw them open an astonishing sight met the bulging eyes of the policemen and the two boys.

SITTING INSIDE the truck was the sports car; but while the rest of the body was still the original cream color, the hood was streaked with brilliant red. Standing in front of the car was a man with a paint gun still in his hand. Two other men stood along a bench mounted to one side of the truck. The inside of the huge trailer was fitted out as a complete body shop, with paint sprayers, grinders, and row after row of cans of paint, enamel, and lacquer. There was a huge exhaust fan to take out the fumes, and a power-operated ramp folded into the floor.

This ramp had undoubtedly been down waiting for the sports car in a secluded spot just off the highway. In a matter of seconds the small car had driven into the trailer, the ramp had been lifted, and the doors closed. The truck pulled back on the highway and went on its way while the men in the trailer started their job of completely changing the appearance of the stolen car. When the camouflage job was done, the car could be returned to the highway without fear that even its owner would recognize it. And there was no fixed garage to arouse suspicion. The whole operation could be quickly changed from one town to another.

In response to a radio call, the "paddy wagon" came to collect the members of the gang. Carl and Jerry rode back to town in the panel truck with Chief Morton.

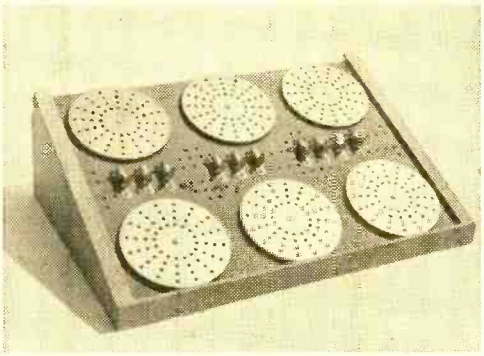
"I certainly want to thank you boys for the fine job you did," the chief said. "Without your help, there is no telling how long it might have taken us to catch up with those crooks. I just wish there was a reward or something for catching them, but there isn't."

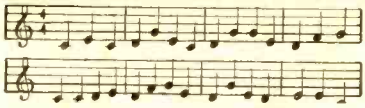
GOLLY NED, we don't want any reward," Carl said. "It benefits all of us to put jokers like those behind bars. I can still see the look on the face of the fellow holding the paint gun when you threw open the doors. You might say we caught him red-handed!"

Jerry, who hated puns, groaned aloud.

"Yes," Chief Morton said with a twinkle in his eye, "considering the fact that we ran them down by taking bearings on them, you might say that we really had them in a 'fix.'" —30—

New! A MACHINE THAT COMPOSES MUSIC





Actual tune composed on GENIAC

COMPUTES, "REASONS" PLAYS GAMES

GENIAC ELECTRIC BRAIN

BUILD IT YOURELF 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 1956 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—P1A
☐ Part 2—P1B
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
☐ Quantitive
☐ 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-27, 31 Broadway, New Haven, Conn.

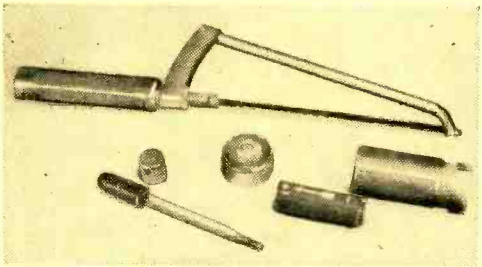
Name..... Age..... Occupation.....

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

TIPS and TECHNIQUES

SOURCE OF MERCURY

Need an inexpensive source of metallic mercury for assembling home-made mercury switches, or for other experiments? Just save the exhausted mercury oxide



batteries from subminiature electronic equipment, transistorized gear, or hearing aids. Cut the cells open, using a small hacksaw (they are cased in steel). Using a flat piece of wood, or a bone or fiber spatula, squeeze the chemical paste out of the cell and against a flat, hard surface. You'll get several drops of mercury from each cell. These may be picked up with a small eye-dropper and stored in a glass or plastic vial. —*E. G. L.*

AID FOR CAR RADIOS

When a car radio comes into a repair shop, or is removed by the owner for his own self-service, spraying the base of the vibrator and rectifier sockets with anti-corona dope may obviate future removal to correct "arc-over." The added insulation protects against low resistance from accumulations of dirt, grease, etc., which will flash over under low humidity conditions. Leave the vibrator or tube in the socket to act as a mask while spraying. Remove any grease or dirt before spraying. —*J. A. McR.*

CUTTING COAXIAL CABLE

The same tool used for cutting copper, brass, and aluminum tubing without distorting it can be used just as well for cutting coaxial cable without squeezing it out of shape. It is equally handy for cutting through just the outer insulating jacket, or for cutting through the jacket plus the outer braided conductor, where desired,

America's Fast Growing AIRLINES NEED YOUNG MEN as Communications Specialists

and as RADIO-RADAR-ELECTRONICS TECHNICIANS

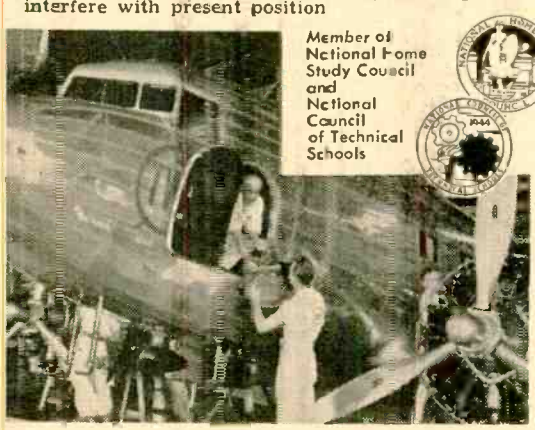
CENTRAL TECHNICAL INSTITUTE PREPARES YOU QUICKLY FOR AN AIRLINE CAREER!

In today's jet age, electronic communications and navigational aids are the vital nerve system of the world's fast-growing airlines. Demand for skilled young specialists who can operate and maintain complex radio-radar-electronic equipment greatly exceeds the supply! Positions include air/ground radio operators, installation and maintenance, airborne radar installation and maintenance, electronic technicians, etc.

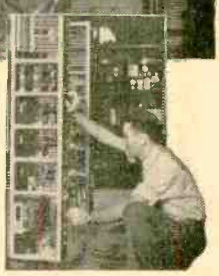
The Airline Training Division of Central Technical Institute, world's leading and largest airline personnel school, can train you quickly to take advantage of this unusual career opportunity. Many fine non-technical airline jobs are also open to Central graduates. Free nation-wide placement service

PREPARE THROUGH HOME STUDY OR RESIDENT TRAINING

Whether you choose Central's home study course (with 9 kits of equipment) or resident training at our Kansas City School, you'll receive thorough, up-to-date, nationally-recognized training to qualify you for a rewarding career. Over 14,000 graduates placed with all major U. S. airlines since 1937—your assurance that Central training is effective, practical and profitable. **Central's airline instruction is formulated under the guidance of an Airlines Advisory Board composed of representatives from 19 major airlines.** Preliminary training need not interfere with present position



Member of National Home Study Council and National Council of Technical Schools



CENTRAL ALSO OFFERS COMPLETE TRAINING IN TELEVISION AND ELECTRONICS ENGINEERING TECHNOLOGY

Get full information on Central's home study and resident courses which have qualified thousands for well-paying careers in Radio & Television Stations—Radio-TV repair—Electronics Manufacturers — Guided Missiles — Automation—etc

VETERANS

Central offers courses approved under G. I. Bill

MAIL COUPON TODAY FOR FREE INFORMATION

CENTRAL TECHNICAL INSTITUTE

Dept. A-27, 1644 Wyandotte St., Kansas City 8, Missouri

Tell me more about your training program(s) which I have checked below:

- ☐ Airline Communications & Electronics
- ☐ Airline Station Agent (non-technical)
- ☐ Television and Electronics Engineering Technology

Name_____ Age_____

Address_____ Phone_____

City, State_____ County_____

If Korean vet., give approx. discharge date_____

Tips

(*Continued from page* 32)

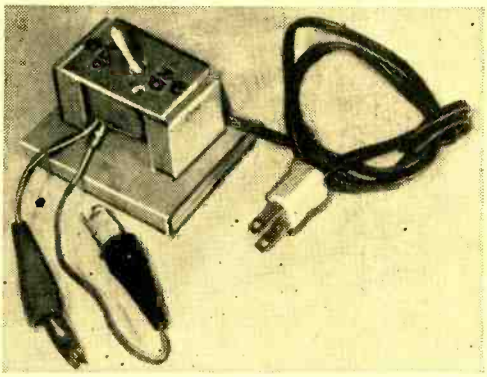
leaving the inner conductor and insulation unharmed. It will also cut rod up to 1-inch diameter. —*F. H. T.*

BATTERY HOLDERS

Vertical-mounting holders for type C or D dry cells can be made from easy-to-get capacitor mounting rings. Use 1" diameter rings for type C cells and 1⅜" diameter rings for type D cells. A narrow strip of thin cardboard, about ¼" shorter than the circumference of the cell, is used as a shim between the ring and the cell. The complete assembly of battery and holder is shown in the photograph above. —*J.E.P.*

PORTABLE POWER OUTLET

A very useful portable 110-volt a.c. power outlet can be made, as shown in the photo (p. 110). Mount the switch in a suitable wood or utility box enclosure. Then wire the incoming line cord to one side of the switch and the extension wires with clips to the other side. Large "ON" and "OFF" markings are essential so that you know the clips are "dead" before hooking up a



circuit. A d.p.s.t. switch is best because it isolates both sides of the circuit, but a single pole switch may be substituted if proper precautions are taken with the "hot" wire. The fully insulated alligator clips, such as Mueller No. 63, are recommended. A piece of large spaghetti may be slipped over the ends of standard clips as an alternate. A de luxe outlet could be made by adding a fuse to the block. —*C.R.E.*

This book is a Gold Mine
Send for it immediately!

FREE

REVEALS HOW YOU CAN GAIN QUICKER SUCCESS OR TURN YOUR HOBBY INTO A WELL-PAID CAREER IN RADIO . . . TELEVISION . . . ELECTRONICS

Whether you're an amateur . . . a hobbyist . . . or already in electronics . . . Let us show you how to have a bright career in

RADIO! TELEVISION! ELECTRONICS!

TURN YOUR HOBBY INTO A HIGH-PAY CAREER!

Today thousands of electronics hobbyists have an opportunity to turn their hobbies into profits. It's the "Age of Electronics"! Trained men are in crucial demand! You may be "outside" the electronics industries now, working on a job you enjoy far less than experimenting, building, transmitting, receiving; working for less money than is being paid to electronics engineering technicians. But your "true love" is electronics. Why not awaken to your opportunities—now?

ELECTRONICS HAS GOOD PAYING JOBS FOR TRAINED MEN LIKE YOU!

And only trained men can fill them. You can get your share, if you take time now to gain that indispensable knowledge.

Here are just two of the typical high-level opportunities available to CREI-trained men:

"Just about four months have passed since I made my first recruiting trip to CREI. As a result of that visit Messrs. Kohs, Plante and Wenger are now members of the Laboratories and Mr. Kresge soon will be . . . we have some openings now and will have others . . ."—Bell Telephone Laboratories, Murray Hill, N. J.

"Two openings in our Field Service . . . aircraft electronics . . . starting salary is $380 and up . . ." —North American Aviation, Inc., Columbus, Ohio.

YOU NEED ADVANCED TRAINING

Sure you have some experience. But the fellows with only partial technical knowledge move slowly, or stand still while you—the man with advanced technical training—plunge ahead in the golden world of electronics opportunities.

ACQUIRE NECESSARY TRAINING AT HOME

Use spare-time hobby hours for CREI Home Study as thousands of successful technicians have done since 1927. Get concentrated training in minimum time, then step into a good job and enjoy good pay in the mushrooming electronics industry.

SEND FOR FREE BOOKLET. IT TELLS YOU HOW

How to gain career success in the tremendous electronics industries. It pinpoints opportunities which exist. By 1960, the electronics industries will do no less than $15 billion worth of business per year, not counting military orders. Take TV for example: there are about 36,000,000 TV sets and over 425 TV stations on the air. Color TV is pushing ahead furiously. Electronics is the ONE field of maximum opportunity in this electronic age.

CREI TRAINS YOU IN MINIMUM TIME AT HOME

Thousands of men before you have benefited quickly from CREI Home Study training. Thousands of CREI graduates are now employed in industry here and abroad. Here is what they say:

"In this time of less than two years, I have almost doubled my salary and have gone from wireman, to engineering assistant and now to junior engineer. I have CREI to thank."—Frank A. Eckert, 22 Clover Lane, Levittown, Pa.

FAMOUS FOR 30 YEARS

CREI is known and respected throughout the Electronic world. Since 1927 we have trained thousands in the military, industry and government. "ASK ANY ENGINEER."

VETERAN?

If you are eligible for training under the new G.I. Bill of Rights, check coupon for full information.

LIKE TO STUDY IN WASHINGTON?

CREI also offers resident instruction at same high level day or night. Classes start often. Check coupon for Residence School catalog. Qualified residence graduates earn degree: "Associate in Applied Science."

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? .....

.....

.....

MAIL THIS COUPON . . . TODAY!

CAPITOL RADIO ENGINEERING INSTITUTE

Accredited Technical Institute Curricula—Founded in 1927
3224 16th St., N. W., Dept. 122-D, Washington 10, D. C.

Send booklet "Your Future in the New World of Electronics" and course outline.

CHECK FIELD OF GREATEST INTEREST

- ☐ Practical Radio Electronic Engineering
- ☐ Broadcast Radio Engineering (AM, FM, TV)
- ☐ Practical Television Engineering
- ☐ Practical Aeronautical Electronic Engineering

Z

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

Street .....

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

Check: ☐ Home Study ☐ Residence School ☐ Korean Veteran

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

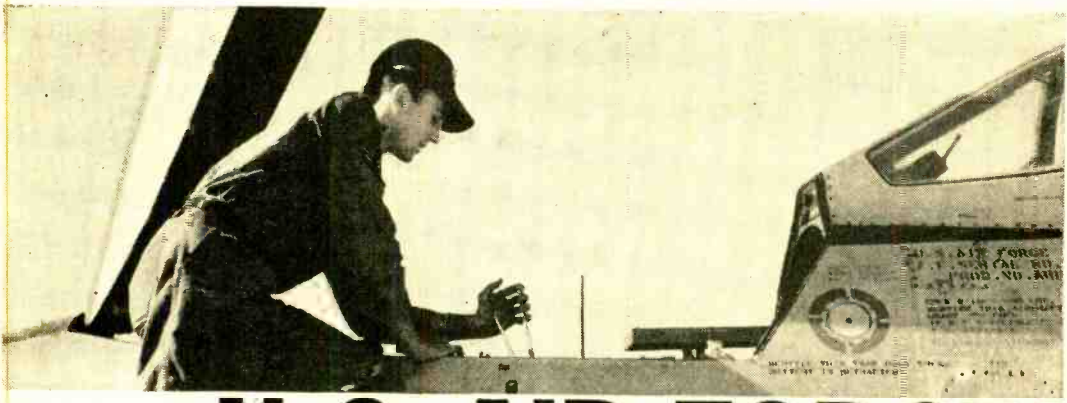
name _____

address _____

city _____ zone ____ state _____

IF YOU *"like to get under the hood . . ."*

you can get a great training . . . and start a great future . . .



in the **U.S. AIR FORCE!**

Your talent with engines—or any mechanical ability—can pay big dividends, when it is backed up with solid training. And that's what you get when you serve in the U. S. Air Force. The Air Force offers you opportunities to learn one of over 40 career fields—training that will stand you in good stead, wherever your future may lie.

Start developing your valuable talents today—and go places *faster*—in the U. S. Air Force. See your local Air Force Recruiter—or mail the attached coupon.

M-79-PE

Paste Coupon on Postcard and mail to:

Airman Recruiting Information Branch
Box 2202, Wright-Patterson AFB, Ohio

Please send more information on my opportunities for enlisting in the U. S. Air Force. I am between the ages of 17-34 and reside in U.S.A. or possessions.

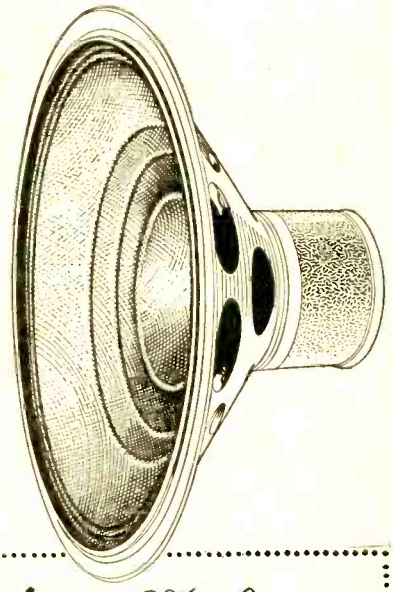
NAME_____

ADDRESS_____ AGE____

CITY_____ ZONE___ STATE_____

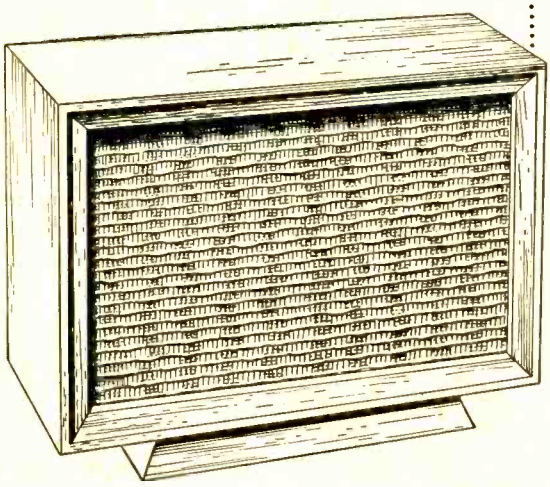
You can have the finest sound reproduction throughout all frequency ranges without distortion

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.



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

Norelco *F.R.S.

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

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. N2 for brochures and prices of these unique speakers.

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

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, headphone 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

CHICAGO 24, ILLINOIS

where the best ideas in communications are born!

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

FREE 1957 EICO® CATALOG

SAVES YOU 50% on your TEST INSTRUMENT & HI-FI COSTS

50 KITS & WIRED MODELS to choose from!

EICO® 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-2

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 $12.50
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

Sine & Square Wave AUDIO GENERATOR #377
KIT $31.95 WIRED $49.95

RF-AF SIGNAL GENERATOR #320
KIT $19.95 WIRED $29.95

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 (4½" 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

EXCLUSIVE

Listen to the Voices of the World

By STEWART WEST

Voice of America

Comprehensive up-to-the-minute English language s.w. broadcasts

Sovfoto

Women play important part on international short-wave broadcasting scene. At upper left, Shirley Walsh operates controls in a VOA studio. The women above are part of team at Radio Moscow.

HAVE YOU EVER had the opportunity of listening to voices speaking directly from Melbourne, Australia, Copenhagen, Denmark, or other far-off and fascinating lands? Every day our local radio networks broadcast news reported from all over the world by means of short-wave radio. You can have a first-hand glimpse of many foreign countries right in your own home.

There are broadcasts in English on the short-wave bands which present plays, various kinds of entertainment, quiz programs, and music for every taste. They give you a chance to know more about people abroad, to understand their problems and views on current events better. We will endeavor to open wide for you the door to this fascinating and entertaining means of relaxing and learning—short-wave radio.

Lists of the "Best Heard" stations and some of the news broadcasts you can hear are each divided into two sections—one for those listening in Eastern North America and another for those in Western North America. You'll find the "Best Heard" stations on pages 42, 43, 45 and 46; the news broadcasts on pages 44 and 46.

THE BATTLE OF THE "JAMMERS"

Tuning through any one of the short-wave broadcast bands may cause the newcomer to wonder if his receiver is in working order. Spotted throughout these bands are signals that sound like shrieking metal lathes. These loud, obnoxious sounds are generated by super-high-power short-wave transmitters. It is their professed intent and purpose to make it impossible to listen to any radio signal on a particular channel. Almost invariably the station being "jammed" has a political doctrine opposed to the country doing the "jamming."

At this writing, the "jammers" are actively trying to cover up the *Voice of America, Radio Liberation, Radio Free Europe,* Greece, and Egypt. Directional measurements tell us that they are being "jammed" by transmitters in the Soviet Union, Czechoslovakia, East Germany, Po-

ENGLISH LANGUAGE SHORT-WAVE BROADCAST STATIONS BEST HEARD IN EASTERN NORTH AMERICA

Readers in the eastern part of the United States and Canada will find the following list of "Best Heard" stations helpful in tuning the short-wave broadcast bands. The left-hand column lists the hour in Eastern Standard Time for broadcasts in English only; in the middle column, the city and country from which the broadcasts originate are listed with the name the station uses for identification in parentheses; and on the right are the frequencies and call letters for stations using them during their broadcasts.

TIME (EST)	CITY, COUNTRY (NAME)	FREQUENCIES (kc.)
6:00- 6:30 a.m.	Warsaw, Poland *(Radio Warsaw)*	17000, 15120
7:00- 7:15 a.m.	Helsinki, Finland *(Finland Calling)*—no English on Sundays and holidays	17798, 15190
7:15- 8:15 a.m.	Warsaw, Poland *(Radio Warsaw)*	17800, 15120
7:15- 8:45 a.m.	Melbourne, Australia *(Radio Australia)*	11770, (VLA11)
8:00- 9:30 a.m.	Cape Haitien, Haiti *(The Evangelistic Voice)*—no broadcast on Thursdays	15390, 9638
8:15- 8:45 a.m.	Stockholm, Sweden *(Radio Sweden)*	17840
10:00-12:15 p.m.	London, England *(North American Service)*	17700
1:00- 4:00 p.m.	London, England *(North American Service)*	17700
4:00- 5:15 p.m.	London, England *(General Overseas Service)*	17700, 15310, 9008
4:15- 4:45 p.m.	Hilversum, Holland *(Radio Netherlands)*—no English on Sundays	15365, 11950
4:30- 5:20 p.m.	Jerusalem, Israel *(The Voice of Zion)*	9008
5:00- 5:30 p.m.	Port-au-Prince, Haiti *(Radio Commerce)*—on Sundays only	9482 (4VC)
5:15- 6:15 p.m.	London, England *(General Overseas Service)*	15310, 11930
6:00- 6:30 p.m.	Tokyo, Japan *(Radio Japan)*	17825 (JOA22), 15235 (JOB9)
6:00-10:00 p.m.	London, England *(General Overseas Service)*	11930, 9825
9:30-11:00 p.m.	Hilversum, Holland *(The Happy Station)*—special program on Sundays only	11950, 9590
9:30-11:00 p.m.	Port-au-Prince, Haiti *(Radio Haiti)*—on Thursdays only	6192 (4VHW)
9:45-10:00 p.m.	Brazzaville, French Equatorial Africa *(Radio Brazzaville)*	11970, 9625
9:55-10:35 p.m.	Montreal, Canada *(Radio Canada)*	11945 (CKNK), 9585 (CKLP)
10:00-10:30 p.m.	Bucharest, Romania *(Bucharest Calling)*	11937, 9570
10:00-11:00 p.m.	Prague, Czechoslovakia *(Radio Prague)*	9585, 6170, 6105, 6055
10:00-11:45 p.m.	Guatemala City, Guatemala (TGNA)	9668, 5952
10:15-11:00 p.m.	Madrid, Spain *(The Voice of Spain)*	9360, 6130
10:30-11:00 p.m.	Copenhagen, Denmark *(The Voice of Denmark)*—no English on Sundays	9520 (OZF)
11:00-11:30 p.m.	Budapest, Hungary *(Radio Budapest)*	11910, 9833
11:00-11:30 p.m.	Sofia, Bulgaria *(Sofia Calling)*	9700
11:00-12:00 p.m.	San Jose, Costa Rica (TIFC—*The Lighthouse of the Caribbean)*	9647, 6037
11:15-12:00 p.m.	Berne, Switzerland *(Switzerland Calling)*	11865 (HER5), 9535 (HER4)
11:15-12:00 p.m.	Madrid, Spain *(The Voice of Spain)*	9360, 6130
11:30-12:00 p.m.	Bucharest, Romania *(Bucharest Calling)*	11937, 9570
12:00-12:30 a.m.	Stockholm, Sweden *(Radio Sweden)*	9620
12:15-12:30 a.m.	Brazzaville, French Equatorial Africa *(Radio Brazzaville)*	11970
12:15- 1:00 a.m.	Madrid, Spain *(The Voice of Spain)*	9360, 6130
12:30- 1:00 a.m.	Warsaw, Poland *(Radio Warsaw)*	9525, 6025

TIME (EST)	CITY, COUNTRY (NAME)	FREQUENCIES (kc.)
6:00- 1:00 a.m.	Moscow, USSR *(Radio Moscow)*	11937, 11890, 11845, 11825, 11805, 11740, 11700, 9700, 9665
6:15- 7:00 p.m.	Ankara, Turkey *(Radio Ankara)*	9515
7:15- 7:35 p.m.	Rome, Italy *(Italian Broadcasting and Television System)*	9575, 6010
7:30- 7:50 p.m.	Tokyo, Japan *(Radio Japan)*	15235 (JOB9), 11705 (JOA4)
7:30- 8:00 p.m.	Budapest, Hungary *(Radio Budapest)*	11910, 9833
7:30- 8:00 p.m.	Prague, Czechoslovakia *(Radio Prague)*	9585, 6170, 6105, 6055
7:30- 8:30 p.m.	Warsaw, Poland *(Radio Warsaw)*	9525, 6025
7:55- 8:45 p.m.	Montreal, Canada *(Radio Canada)*	15190 (CKCX), 11720 (CHOL)
8:00- 8:30 p.m.	Sofia, Bulgaria *(Sofia Calling)*	9700
8:00- 9:30 p.m.	Stockholm, Sweden *(Radio Sweden)*	9620
8:00-10:30 p.m.	Cape Haitien, Haiti *(The Evangelistic Voice)* — no broadcasts on Wednesdays and Thursdays	15400, 9656, 6105
8:15- 9:00 p.m.	Brazzaville, French Equatorial Africa *(Radio Brazzaville)*	11970, 9625
8:30-10:15 p.m.	Berne, Switzerland *(Switzerland Calling)*	11865 (HER5), 9535 (HER4), 6165 (HER3)
9:00- 9:20 p.m.	Oslo, Norway *(Radio Norway)*— on Sundays only	15175, 11735, 9540
9:00- 9:30 p.m.	Copenhagen, Denmark *(The Voice of Denmark)*—no English on Sundays	9520 (OZF)
9:00-12:00 p.m.	Quito, Ecuador (HCJB—*The Voice of the Andes)*—no broadcasts on Mondays	15115, 11915, 9745
9:25- 9:45 p.m.	Rome, Italy *(Italian Broadcasting and Television System)*	9575, 6010
9:30- 9:40 p.m.	Cologne, Germany *(The Voice of Germany)*	11795, 9640
9:30-10:00 p.m.	Warsaw, Poland *(Radio Warsaw)*	9525, 6025
9:30-10:10 p.m.	Hilversum, Holland *(Radio Netherlands)*	11950, 9590

land, Bulgaria, Romania, and Great Britain. Conservative estimates indicate that the Soviet Union and countries in the Soviet bloc actually have more "jamming" transmitters in operation than they do in the short-wave broadcasting service!

POPULAR PROGRAMS YOU CAN HEAR

To help you know a little about what can be heard on the short waves, some popular programs are listed below. Most stations broadcast news and music of their own people. Several stations present DX programs which inform listeners of the latest news and schedule changes of stations around the world. Also, many stations have "Mailbag" programs during which letters and questions from listeners are answered over the air.

Australia—*The North American Service* is very popular with listeners because of its excellent programs. "My Song Goes Round The World" deserves special mention for it is a unique "live-artists" program of music requested by listeners. It is heard every Saturday. On Sundays, the mailbag is opened by Keith Glover at 8:00 a.m. EST and 7:45 a.m. PST, followed by the weekly DX program with Graham Hutchins at 8:30 a.m. EST and 8:00 a.m. PST.

Canada—There are two services for North America from Montreal. The first is broadcast each evening for listeners in the United States and consists mostly of news and news features about Canada. On Sundays at 8:15 p.m. EST, 5:15 p.m. PST, letters from listeners are answered. Later in the evening, *The Northwest Service* has programs for listeners in Northern Canada. On Sundays during the winter this service is extended to include "The Northern Messenger," which sends greetings to listeners in the north at 9:55-11:20 p.m. EST, 6:55-8:20 p.m. PST.

Denmark—Every evening except Sundays there are English programs covering the features and music of Denmark. On Saturdays, Marianne presents the "Saturday Night Club Night," which consists of popular Danish music and answering the mail. A DX program is heard on Tuesday evenings.

England—The British Broadcasting Corp. has more than 11 hours of English programs for North America every day. These programs are of all kinds and can best be followed by those who listen often with a subscription to "London Calling" ($5.00 a year).

Holland—Every Sunday Ed Startz presents *The Happy Station* with 90 minutes of music, chit-chat, features and almost anything.

(*Continued on page* 115)

ENGLISH LANGUAGE NEWS BROADCASTS FOR EASTERN NORTH AMERICA

The following listing of news broadcasts has been prepared for those readers living in the Eastern United States and Canada. Times are given in Eastern Standard Time and the frequencies in kilocycles.

TIME (EST)	CITY AND COUNTRY	FREQUENCIES (kc.)
5:30 a.m.	Wellington, New Zealand	9540, 6080
6:00 a.m.	Warsaw, Poland	17800, 15120
6:15 a.m.	Djakarta, Indonesia	9710
7:00 a.m.	Helsinki, Finland	17798, 15190
7:15 a.m.	Warsaw, Poland	17800, 15120
7:15 a.m.	Melbourne, Australia	11770
7:45 a.m.	Warsaw, Poland	17800, 15120
8:15 a.m.	Stockholm, Sweden	17840
8:15 a.m.	Melbourne, Australia	11770
8:45 a.m.	Lisbon, Portugal	21495, 17895
12:00 Noon	London, England	17700
12:15 p.m.	Lisbon, Portugal	21700, 17895
12:30 p.m.	Athens, Greece	17775, 15345
3:00 p.m.	London, England	17700
3:15 p.m.	Teheran, Iran	15100
3:30 p.m.	Damascus, Syria	17865
4:15 p.m.	Hilversum, Holland	15365, 11950
4:30 p.m.	Jerusalem, Israel	9008
5:15 p.m.	Belgrade, Yugoslavia	6100
6:00 p.m.	London, England	15310, 11930, 9825
6:00 p.m.	Tokyo, Japan	17825, 15235
6:00 p.m.	Moscow, USSR	11937, 11890, 11845, 11825, 11805, 11740, 11700, 9700, 9665
6:15 p.m.	Ankara, Turkey	9515
6:30 p.m.	Caracas, Venezuela (Monday-Friday)	4970
7:00 p.m.	Moscow, USSR	11937, 11890, 11845, 11825, 11805, 11740, 11700, 9700, 9665
7:15 p.m.	Rome, Italy	9575, 6010
7:30 p.m.	Tokyo, Japan	15235, 11705
7:30 p.m.	Prague, Czechoslovakia	9585, 6170, 6105, 6055
7:30 p.m.	Warsaw, Poland	9525, 6025
8:00 p.m.	Moscow, USSR	11890, 11845, 11825, 11805, 11740, 11700, 9665
8:00 p.m.	Montreal, Canada	15190, 11720
8:00 p.m.	Warsaw, Poland	9525, 6025
8:00 p.m.	Sofia, Bulgaria	9700
8:15 p.m.	Stockholm, Sweden	9620
8:15 p.m.	Brazzaville, French Equatorial Africa	11970, 9625
8:30 p.m.	Montreal, Canada	15190, 11720
8:30 p.m.	Paramaribo, Surinam (Mondays only)	15407, 4752
8:35 p.m.	Berne, Switzerland	11865, 9535, 6165
9:00 p.m.	Stockholm, Sweden	9620
9:00 p.m.	Oslo, Norway (Sundays only)	15175, 11735, 9540
9:00 p.m.	Copenhagen, Denmark (Mondays only)	9520
9:00 p.m.	Moscow, USSR	11890, 11845, 11825, 11805, 11740, 11700, 9700, 9665
9:25 p.m.	Rome, Italy	9575, 6010
9:30 p.m.	Cologne, Germany	11795, 9640
9:30 p.m.	Warsaw, Poland	9525, 6025
9:30 p.m.	Hilversum, Holland (not on Sundays)	11950, 9590
9:45 p.m.	Brazzaville, French Equatorial Africa	11970, 9625
10:00 p.m.	Montreal, Canada	11945, 9585
10:00 p.m.	Moscow, USSR	11890, 11845, 11825, 11805, 11740, 11700, 9665
10:00 p.m.	Bucharest, Romania	11937, 9570
10:15 p.m.	Madrid, Spain	9360, 6130
10:30 p.m.	Copenhagen, Denmark (Monday only)	9520
11:00 p.m.	Sofia, Bulgaria	9700
11:00 p.m.	Moscow, USSR	11890, 11845, 11825, 11805, 11740, 11700
11:15 p.m.	Madrid, Spain	9360, 6130
11:20 p.m.	Berne, Switzerland	11865, 9535
11:30 p.m.	Bucharest, Romania	11937, 9570
12:00 Midnight	Stockholm, Sweden	9620
12:00 Midnight	Moscow USSR	11860, 11845, 11805, 11740, 11700, 9685, 9665, 9610
12:15 a.m.	Madrid, Spain	9360, 6130
12:15 a.m.	Brazzaville, French Equatorial Africa	11970
12:30 a.m.	Warsaw, Poland	9525, 6025

ENGLISH LANGUAGE SHORT-WAVE BROADCAST STATIONS BEST HEARD IN WESTERN NORTH AMERICA

Readers in the western part of the United States and Canada will find the following list of "Best Heard" stations helpful in tuning the short-wave broadcast bands. The left-hand column lists the hour in Pacific Standard Time for broadcasts in English only; in the middle column, the city and country from which the broadcasts originate are listed with the name the station uses for identification in parentheses; and on the right are the frequencies and call letters for stations using them during their broadcasts.

TIME (PST)	CITY, COUNTRY (NAME)	FREQUENCIES (kc.)
6:00- 8:00 a.m.	Manila, Philippines *(The Call of the Orient)*	11855, 9730
6:30- 7:30 a.m.	Djakarta, Indonesia *(The Voice of Indonesia)*	9710, 4910
7:15- 8:15 a.m.	Melbourne, Australia *(Radio Australia)*	11770 (VLC11)
8:00- 8:15 a.m.	Stockholm, Sweden *(Radio Sweden)*	15155
10:00- 1:00 p.m.	London, England *(North American Service)*	17700
1:00- 2:15 p.m.	London, England *(General Overseas Service)*	17700, 15310
2:15- 3:15 p.m.	London, England *(General Overseas Service)*	15310, 11930
3:00- 3:30 p.m.	Tokyo, Japan *(Radio Japan)*	17825 (JOA22), 15235 (JOB9)
3:00- 7:00 p.m.	London, England *(General Overseas Service)*	11930, 9825
3:00-10:00 p.m.	Moscow, USSR *(Radio Moscow)*	17865, 15140
4:30- 4:50 p.m.	Tokyo, Japan *(Radio Japan)*	15235 (JOB9), 11705 (JOA4)
4:55- 5:45 p.m.	Montreal, Canada *(Radio Canada)*	15190 (CKCX), 11720 (CHOL)
5:00- 7:30 p.m.	Cape Haitien, Haiti *(The Evangelistic Voice)* — no broadcasts on Wednesday and Thursday	15400, 9656
5:30- 7:15 p.m.	Berne, Switzerland *(Switzerland Calling)*	11865 (HER5), 9535 (HER4), 6165 (HER3)
6:00- 9:00 p.m.	Quito, Ecuador (HCJB—*The Voice of the Andes)*—no broadcast on Monday	15115, 11915, 9745
6:25- 6:45 p.m.	Rome, Italy *(Italian Broadcasting & TV System)*	9575, 6010
6:30- 6:40 p.m.	Cologne, Germany *(The Voice of Germany)*	11795, 9640
6:30- 7:00 p.m.	Warsaw, Poland *(Radio Warsaw)*	9525, 6025
6:30- 7:10 p.m.	Hilversum, Holland *(Radio Netherlands)*	11950, 9590
6:30- 8:00 p.m.	Hilversum, Holland *(The Happy Station)* — special program on Sundays only	11950, 9590
6:45- 7:00 p.m.	Brazzaville, FEA *(Radio Brazzaville, French Equatorial Africa)*	11970, 9625
6:55- 7:35 p.m.	Montreal, Canada *(Radio Canada)*	11945 (CKNK), 9585 (CKLP)
7:00- 7:30 p.m.	Bucharest, Romania *(Bucharest Calling)*	11937, 9570
7:00- 7:30 p.m.	Peking, China *(Radio Peking)*	17745, 17720, 15350, 15118
7:00- 8:30 p.m.	Prague, Czechoslovakia *(Radio Prague)*	9585, 6170, 6105, 6055
7:00- 8:45 p.m.	Guatemala City, Guatemala (TGNA)	9668, 5952
7:15- 8:00 p.m.	Madrid, Spain *(The Voice of Spain)*	9360, 6130
7:30- 8:00 p.m.	Copenhagen, Denmark *(The Voice of Denmark)*—no English on Sundays	9520 (OZF)
7:30- 8:00 p.m.	Tokyo, Japan *(Radio Japan)*	15235 (JOB9), 11705 (JOA4)
8:00- 8:20 p.m.	Oslo, Norway *(Radio Norway)*—on Sundays only	15175, 11735, 9540
8:00- 8:30 p.m.	Budapest, Hungary *(Radio Budapest)*	11910, 9833
8:00- 8:30 p.m.	Sofia, Bulgaria *(Sofia Calling)*	9700
8:00- 9:00 p.m.	San Jose, Costa Rica (TIFC—*The Lighthouse of the Caribbean)*	9647, 6037
8:15- 9:00 p.m.	Berne, Switzerland *(Switzerland Calling)*	11865 (HER5), 9535 (HER4)
8:15- 9:00 p.m.	Madrid, Spain *(The Voice of Spain)*	9360, 6130
8:30- 9:00 p.m.	Bucharest, Romania *(Bucharest Calling)*	11937, 9570

(*Continued on page* 46)

STATIONS BEST HEARD IN WESTERN NORTH AMERICA

(*Continued from page 45*)

TIME (PST)	CITY, COUNTRY (NAME)	FREQUENCIES (kc.)
9:00- 9:30 p.m.	Taipei, Taiwan *(The Voice of Free China)*	15225, 11815
9:00- 9:30 p.m.	Stockholm, Sweden *(Radio Sweden)*	9620
9:15- 9:30 p.m.	Brazzaville, FEA *(Radio Brazzaville, French Equatorial Africa)*	11970
9:15-10:00 p.m.	Madrid, Spain *(The Voice of Spain)*	9360, 6130
9:30-10:00 p.m.	Warsaw, Poland *(Radio Warsaw)*	9525, 6025
10:30-11:00 p.m.	Taipei, Taiwan *(The Voice of Free China)*	15225, 11815
10:30- 2:45 a.m.	Wellington, New Zealand *(Radio New Zealand)*	9540 (ZL2), 6080 (ZL7)
11:30-11:45 p.m.	Papeete, Tahiti *(The Voice of France in the Pacific)*	6135
12:00- 1:15 a.m.	Manila, Philippines *(Call of the Orient)*	17805, 15300, 11855, 9730

NEWS BROADCASTS FOR WESTERN NORTH AMERICA

The following listing of news broadcasts has been prepared for those readers living in the Western United States and Canada. Times are given in Pacific Standard Time and the frequencies in kilocycles.

TIME (PST)	CITY AND COUNTRY	FREQUENCIES (kc.)
6:45 a.m.	Djakarta, Indonesia	9710, 4910
7:00 a.m.	Manila, Philippines	11855, 9730
7:30 a.m.	Melbourne, Australia	11770
8:00 a.m.	Stockholm, Sweden	15155
9:00 a.m.	London, England	17700
12:00 Noon	London, England	17700
3:00 p.m.	London, England	15310, 11930, 9825
3:00 p.m.	Tokyo, Japan	17825, 15235
3:00 p.m.	Moscow, USSR	17865, 15140
4:00 p.m.	Moscow, USSR	17865, 15140
4:30 p.m.	Delhi, India	17720, 15160
4:30 p.m.	Tokyo, Japan	15235, 11705
5:00 p.m.	Montreal, Canada	15190, 11720
5:00 p.m.	Moscow, USSR	17865, 15140
5:00 p.m.	Karachi, Pakistan	17750, 15335
5:30 p.m.	Montreal, Canada	15190, 11720
5:35 p.m.	Berne, Switzerland	11865, 9535, 6165
6:00 p.m.	London, England	11930, 9825
6:00 p.m.	Moscow, USSR	17865, 15140
6:25 p.m.	Rome, Italy	9575, 6010
6:30 p.m.	Cologne, Germany	11795, 9640
6:30 p.m.	Warsaw, Poland	9525, 6025
6:30 p.m.	Hilversum, Holland (not on Sunday)	11950, 9590
6:30 p.m.	Delhi, India	17830, 15160, 11710
6:45 p.m.	Brazzaville, French Equatorial Africa	11970, 9625
7:00 p.m.	Moscow, USSR	17865, 15140
7:00 p.m.	Montreal, Canada	11945, 9585
7:00 p.m.	Bucharest, Romania	11937, 9570
7:00 p.m.	Peking, China	17745, 17720, 15350, 15118
7:00 p.m.	Prague, Czechoslovakia	9585, 6170, 6105, 6055
7:15 p.m.	Madrid, Spain	9360, 6130
7:30 p.m.	Copenhagen, Denmark (only Mondays)	9520
7:30 p.m.	Tokyo, Japan	15235, 11705
8:00 p.m.	Moscow, USSR	17865, 15140
8:00 p.m.	Oslo, Norway (only Sundays)	15175, 11735, 9540
8:00 p.m.	Sofia, Bulgaria	9700
8:15 p.m.	Madrid, Spain	9360, 6130
8:20 p.m.	Berne, Switzerland	11865, 9535
8:30 p.m.	Bucharest, Romania	11937, 9570
9:00 p.m.	Taipei, Taiwan	15225, 11815
9:00 p.m.	Moscow, USSR	17865, 15140
9:00 p.m.	Stockholm, Sweden	9620
9:15 p.m.	Brazzaville, French Equatorial Africa	11970
9:15 p.m.	Madrid, Spain	9360, 6130
9:30 p.m.	Warsaw, Poland	9525, 6025
10:30 p.m.	Taipei, Taiwan	15225, 11815
11:30 p.m.	Wellington, New Zealand	9540, 6080
11:30 p.m.	Papeete, Tahiti	6135
12:30 a.m.	Wellington, New Zealand (not on Sunday)	9540, 6080
1:00 a.m.	Manila, Philippines	11855, 9730
2:30 a.m.	Wellington, New Zealand	9540, 6080

Two Hearts Beat in Computer Time

TV stuntmaster Art Linkletter assists with Cupid's bow as Univac tries to pick a mate for hopeful Nancy Martin (above). John Caran and Barbara Smith (left) are acclaimed by Linkletter as world's first "electronic couple.

GIRLS LOOKING for boys and vice versa can now get electronic computers to fix them up with a not-so-blind date. In fact, the computer can figure the elements of mutual attraction so well that customers should be prepared to fall head-over-heels in love. To prove it, the world's first electronically arranged marriage will soon take place in California.

Electronic "matching" is a quite serious approach to the problem of loneliness. When TV's Art Linkletter heard that more than 14 million Americans belong to lonely-hearts clubs, he hit on the idea of polling a large sample of singletons with a long questionnaire about themselves—their looks, likes, dislikes, foibles, etc. Then he encoded this information for the Univac computer, instructing it to pair up couples opposed in sex but matched in nearly everything else. Result: Most of the "electronic" couples hit it off fine. Among them, John Caran and Barbara Smith of Los Angeles feel that Univac's judgement is not just a passing fancy; they plan to get married.

When one of Barbara's former boyfriends complained that "the girl that might have become my wife was taken by Univac and given to another," Univac had a ready consolation for him. "We'll run his data through the machine," said Linkletter. "He'll have the equivalent of 3000 dates in a couple of minutes."

Some of the "electronically created" couples ask themselves, "But is this the natural thing?" In terms of social custom and human need, the answer is surely yes. Pre-arranging marriage through family councils, often before the bride and groom ever see each other, is the usual procedure in many lands. Yet in North America, Australia, and Western Europe, young people like to do their own picking. This is undoubtedly more romantic, but our divorce rate throws some doubt on the wisdom of romance. The American Institute of Family Relations points out that by relying mainly on romance, most people get married in a very haphazard way and many a love match doesn't last.

Electronic matching lets us eat our cake and have it, too, because it helps in turning the perishable food of love into the durable staple of marriage. It figures out the compatibility of people even *before* they meet. That's what puts the odds on happiness.

—Shane Smith

Smallest Radar Set

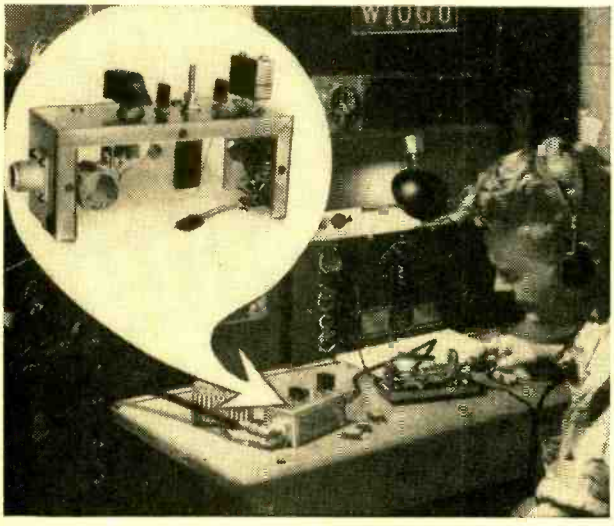
The world's smallest known radar set, with a maximum range of 6000 yards, was announced recently by the U. S. Army. Lightweight and portable, it provides troops with local battle area surveillance of enemy movements despite smoke, darkness or fog. Measuring only 14" high by 14" wide, it weighs 85 pounds. It was developed by Sperry Gyroscope Co., Great Neck, N. Y., working with the Signal Corps Engineering Laboratories, Ft. Monmouth, N. J., and the Army Electronic Proving Ground in Arizona.

Pocket-Sized Receiver for Private Paging

Doctors at St. Thomas' Hospital, London, are paged through tiny receivers in their pockets. Powered by miniature mercury cells, a receiver responds, by means of magnetic induction, to audio signals that are carried by a wire loop surrounding the hospital. Messages for individual doctors are sent from a switchboard control panel whose 56 push buttons control 56 separate channels. A buzz in a receiver alerts its wearer to the message; the doctor then presses a button to listen, as shown at right. The idea for this system came to the hospital's chief technician, Peter Stiles, who developed it in conjunction with the Multitone Electric Co., 12 Underwood St., London N. 1, England.

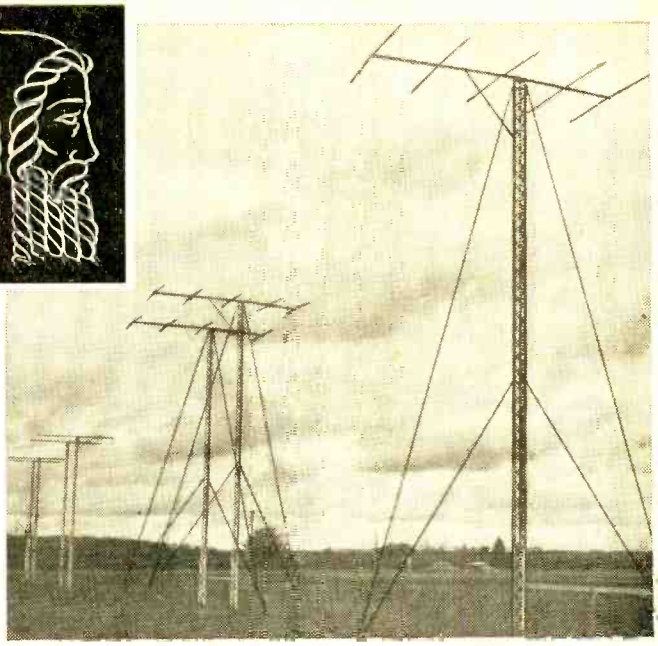
3800 Miles on Transistors

Ham radio history was made when W1OGU contacted Denmark, spanning a transatlantic distance of 3800 miles for the first time with a transistorized transmitter. The set was devised by Raytheon ham-technicians at the company's Missile Systems Labs in Bedford, Mass. Shown below, it uses two Raytheon 2N113/CK761 fusion-alloy transistors.



Servicing Data

A new technical data service which supplies diagrams and maintenance information for individual radio and TV sets of all popular makes has been announced by Supreme Publications, publishers of electronics books. The radio material covers receivers dating back to 1926 and up to present models. TV data goes back to 1948 sets and up to current models. The radio data is priced at 40 cents, TV material at 75 cents—for any one model. For details and a free 48-page list of available material, write to Supreme Publications, 1760 Balsam Rd., Highland Park, Ill.



Janus, the two-faced Roman god lent the female version of his name to "Janet," Canada's revolutionary two-way radio system, whose antennas (at right) tack messages to shooting stars.

Radio Rides Stardust Trail

By H. H. FANTEL

Errant meteors, too close to Earth, have to carry messages

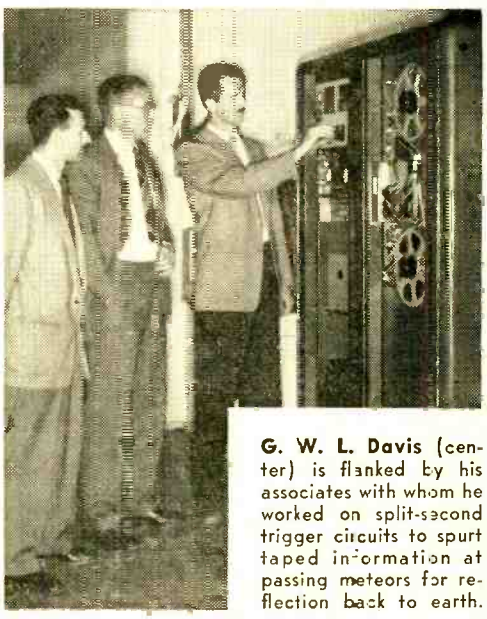
IN ITS soaring progress, the science of electronics has evidently hitched its wagon to a star. But the expression ceased to be just a metaphor when a Canadian scientist recently made radio signals literally ride piggyback on meteor trails.

It is no mere accident that this development took place in Canada. For along Canada's bleak tundra, giant radars of the DEW Line look toward the North Pole to guard America's safety. Yet the aurora borealis often plays havoc with radio messages to and from these outposts. Long-distance communication fades into crackling silence, and even telephone lines grow mute under the northern lights.

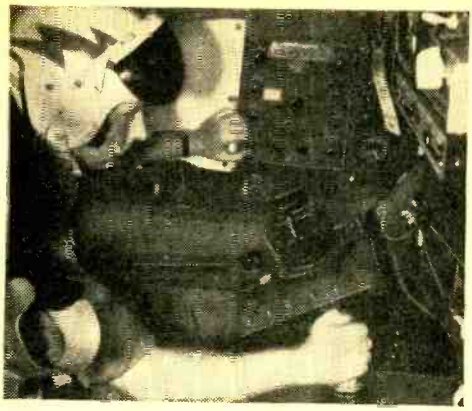
Faced with this problem, Dr. P. A. Forsyth of the Canadian Defense Research Board remembered that meteors flashing through the upper atmosphere leave behind them momentary ion trails capable of reflecting radio waves. Forsyth worked out a system of radio communication which bounces high-frequency signals off individual meteor trails, using the meteors like tiny temporary mirrors in the sky. With such "sky" waves, he is able to sidestep the radio transmission troubles of the Arctic. The passing bits of stardust bounce his messages nearly a thousand miles.

Hundreds of pin-head size meteors fall

(*Continued on page* 126)



G. W. L. Davis (center) is flanked by his associates with whom he worked on split-second trigger circuits to spurt taped information at passing meteors for reflection back to earth.

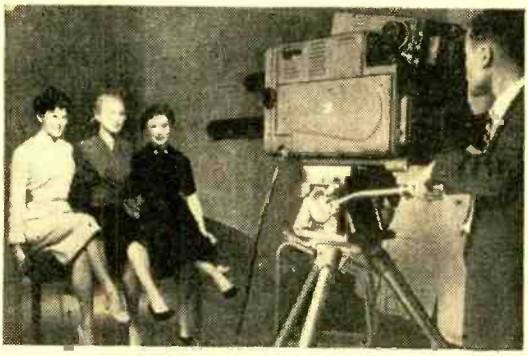


Electronics Drops a Bomb

As the ways of warfare ripen to perfection, the optical bombsights that loosened the rains of dynamite in the last war are now succeeded by combined bombing-navigation controls that can draw a deadly nuclear bead on any spot on earth in any weather. These electronic "K-Systems," made by the Sperry Gyroscope Co., automatically measure distance and time for target, compute the bomb trajectory for existing altitude, temperature and crosswind, trigger the "bomb away" at the proper instant—then help guide the plane home. The recently "cleared" picture at left shows the bombardier holding the trigger of this "Atomic Marksman."

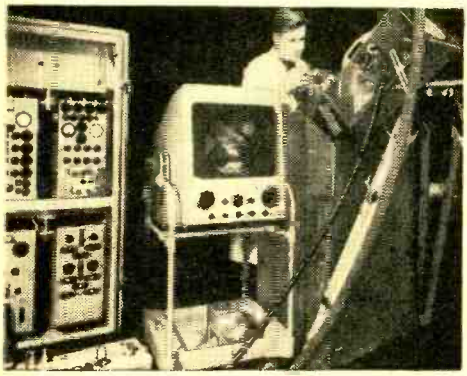
Lasses Launch Aussie TV

By lucky coincidence, Australian TV and the Olympics opened about the same time, giving the people "down under" a chance to see something really exciting during the weeks of initial fascination with their new sets. But the Olympics would be hard put to match either the excitement or the fascination engendered by the trio telecast at right as the resourceful Aussies train the new Marconi cameras on what appear to be some of their best natural resources.



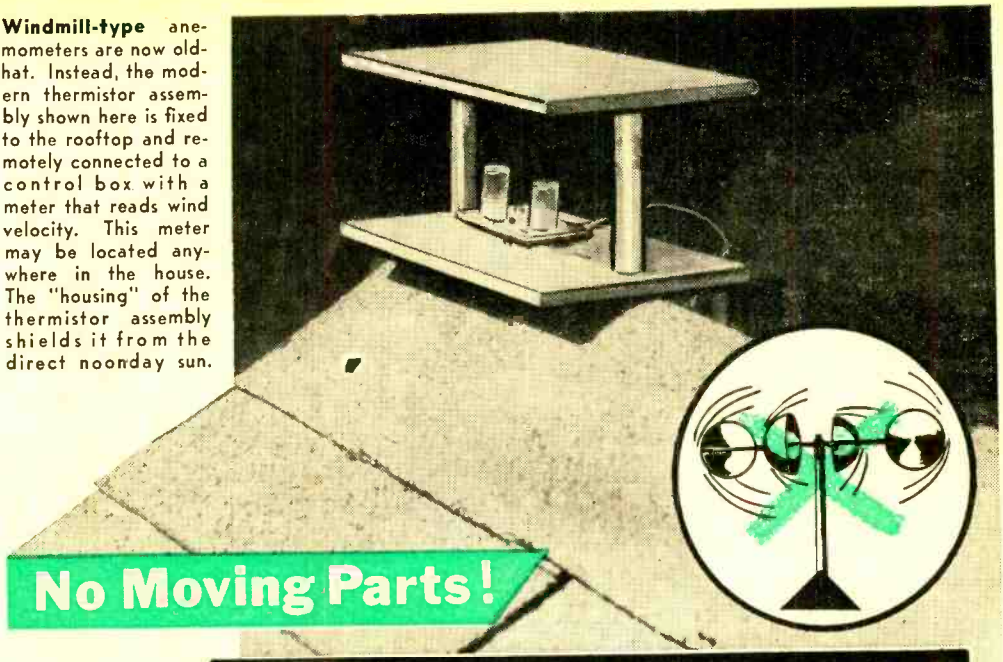
Drill a Square Hole

Those concerned with the ramifications of square pegs in round holes will be pleased to know that electronics now enables them to solve their problems by drilling square holes. The trick is done with an ultrasonic generator and a high-powered amplifier linked to a square drill bit that doesn't rotate but dances like a piston to the rhythm of the high-speed vibrations. Its tiny but persistent impacts break down the material to be worked, and the resultant hole precisely matches the shape of the tool bit. The "square drill" is demonstrated by its inventors at left.



TV Tackles Atom

An experimental closed-circuit television microscope is in use at Britain's Atomic Energy Research Establishment at Harwell. It presents enlarged images of highly radioactive metal specimens without endangering the eyes of the researchers. A camera is trained on the "hot" metal in a safe remote location while the enlarged image is shown on the 15" screen of a special cathode-ray tube. Direct examination through optical systems would be impossible since the radiation from the metal specimen would contaminate the optical pathway and affect the human eye.



Windmill-type anemometers are now old-hat. Instead, the modern thermistor assembly shown here is fixed to the rooftop and remotely connected to a control box with a meter that reads wind velocity. This meter may be located anywhere in the house. The "housing" of the thermistor assembly shields it from the direct noonday sun.

No Moving Parts!

An Electronic Anemometer

By HARVEY POLLACK

Want to know how strong the wind is? Build this wind speed meter

THE WORD "anemometer"—meaning a device which measures velocity of the wind—calls to mind a crossed-rod affair with end-mounted cups whirling around in the fashion of a horizontal windmill. Although such anemometers are far from obsolete, the thermistorized anemometer discussed in this article, together with the electronic thermometer* and the all-electronic hygrometer**, makes up a very modern home weather station.

The thermistorized anemometer is an electronic bridge containing two thermistors of identical characteristics. One of these is completely enclosed in a polystyrene capsule while the other is exposed to air movement through small holes in a second capsule. Wind velocity is read from a meter by referring to a calibration chart.

Construction. Use an aluminum box with hammertone finish as the case, and mount the main controls on the front panel. No chassis is necessary; the battery holder, most of the small fixed resistors, and two of the three potentiometers (*R2* and *R4*) are mounted on a 1/16"-thick sheet of polystyrene about 3/4" smaller than the inside dimensions of the case. Secure the polystyrene sheet to the box with the meter terminal screws.

Potentiometers *R2* and *R4*, which do not require frequent adjustments, have slotted shafts and are available through grommetted holes in the sides of the case. Bend a strip of scrap aluminum about 3/4" wide

HOW IT WORKS

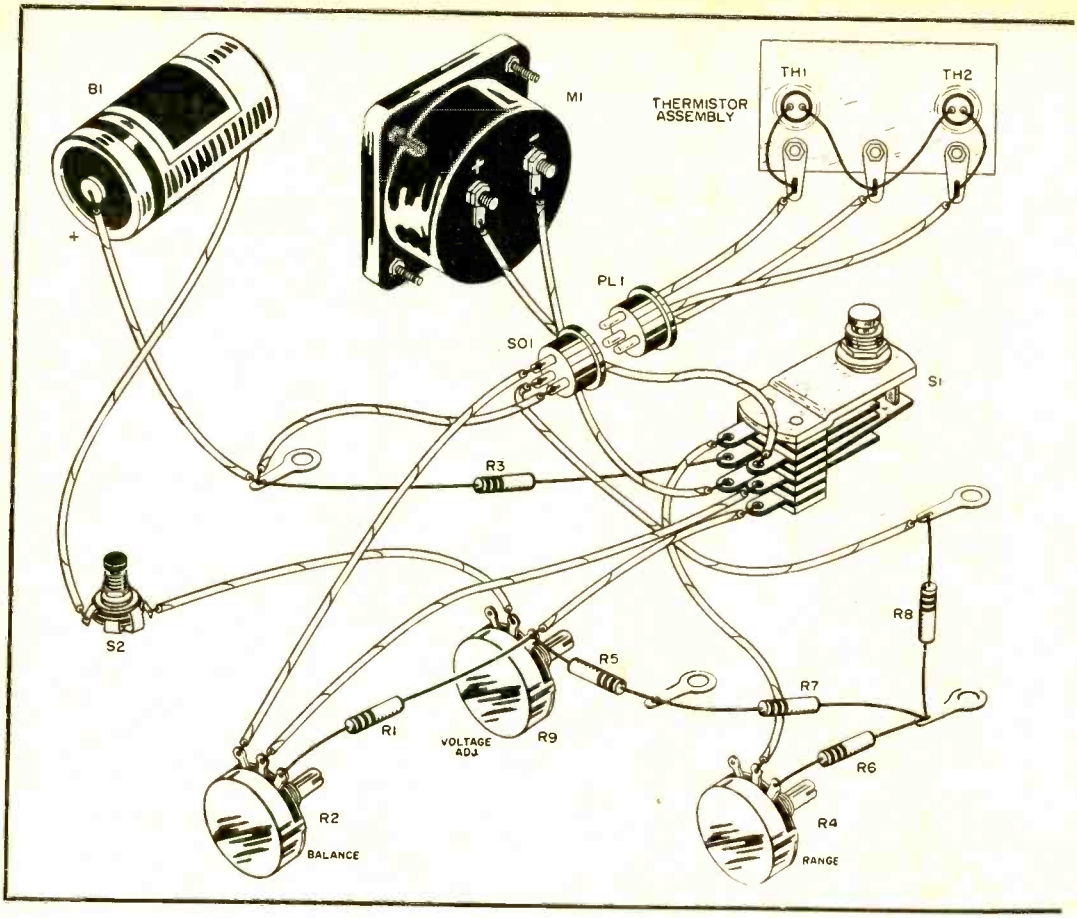
When the *Read Wind Speed* button (*S2*) is pressed, the battery is connected to the bridge circuit. If the *Battery Test* button (*S1*) is operated at the same time, the current from the battery follows the path through *R3*, the meter, and back to the battery through *R9*. *R3* and *R9* act as voltmeter multipliers and, if *R9* is set at about half range, the voltage applied to the main circuit is:

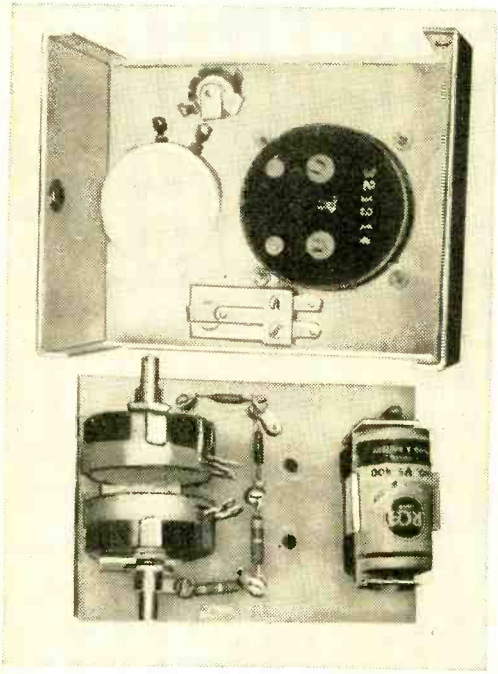
$$E = IR = .001 \times 3100 = 3.1 \text{ volts}$$

The anemometer circuit is a modified Wheatstone bridge. Two thermistors form a part of the bridge and are closely matched in nominal resistance so that the bridge may be balanced. When current flows through the thermistors, it causes them to heat. As the wind blows through the holes in the shield of one thermistor, this unit is cooled and its resistance rises sharply, upsetting the bridge balance, and causing the meter to show a reading. The size of the meter deflection is determined by the magnitude of the resistance change, which, in turn, is a function of the wind velocity.

* "Make Your Own Electronic Thermometer," POPULAR ELECTRONICS, April, 1956, p. 62.

** "Build an All-Electronic Hygrometer," POPULAR ELECTRONICS, October, 1956, p. 65.





Chassis and subchassis of the control box are at left. The polystyrene subchassis is mounted to rear of meter by terminals.

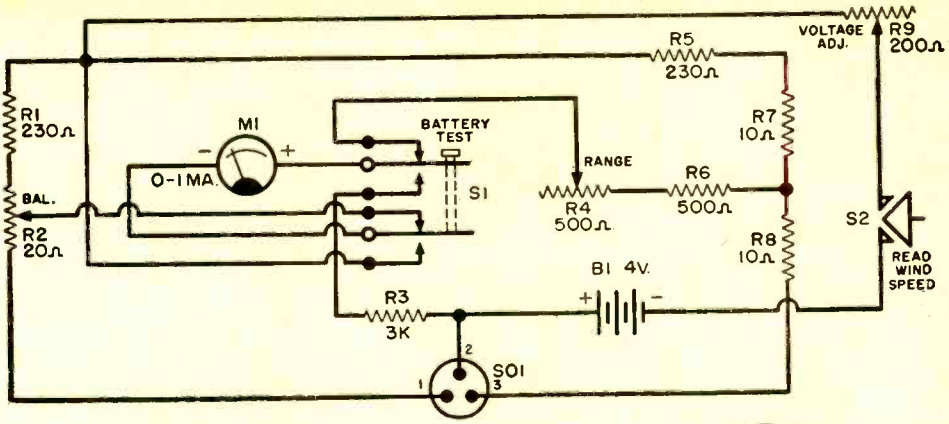
into a U-bracket and slot it to take the shaft bushings of these potentiometers. Mount *R2* and *R4* back-to-back so that their shafts protrude outward toward the sides of the case; the shafts are cut and slotted with a hacksaw.

A 3-wire cable emerges from the bottom of the case. This is the transmission line from the remotely located thermistors on the rooftop.

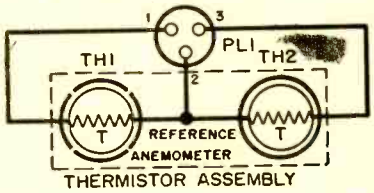
The matched pair of thermistors are packaged in two small polystyrene vials which make perfect casings for the thermistors in the final assembly. Punch four very tiny holes symmetrically around the top of one of the vials by means of a fine sewing needle heated to dull red.* A 3½" x 1⅜" polystyrene base plate is used to hold the assembly; drill very small holes in it to pass the thermistor leads.

Cement the vials to the base plate with

* These holes should be as tiny as possible.

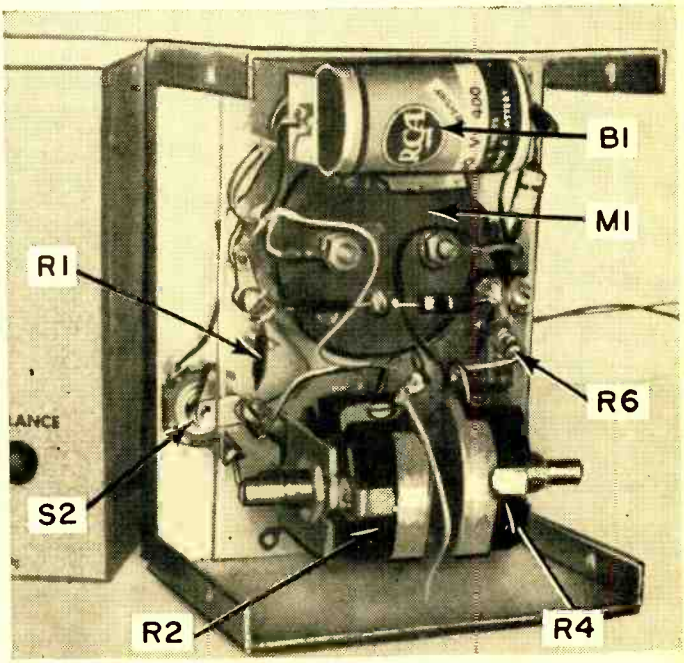


Diagrams and parts list for the electronic anenometer. The circuit above is contained in the control box; the thermistors diagrammed on the right are placed on a separate base and located out in the open. A three-wire cable connects the thermistor assembly to the control box containing the meter. Pictorial diagram showing method of connecting parts is at the left.



B1—4-volt mercury cell battery (RCA VS-400)
M1—0-1 milliammeter in 2" square case (Triplett Model 227-T)
PL1—Three-prong plug (optional)
R1, R5—230-ohm, ½-watt resistor
R2—20-ohm potentiometer
R3—3000-ohm, ½-watt resistor, 5% tolerance
R4—500-ohm potentiometer
R6—500-ohm, ½-watt resistor
R7, R8—10-ohm, ½-watt resistor
R9—200-ohm potentiometer
S1—Spring-operated, d.p.d.t. push-button switch
S2—Spring-operated, s.p.s.t. push-button switch (Switchcraft Type 201)
SO1—Three-prong socket (optional)
TH1, TH2—Thermistor assembly; a matched pair of 2000-ohm nominal (25°C) thermistors (Victory Engineering Corp. Type A-33)
1—5" x 4" x 3" aluminum case, hammertone finish (Premier PMC-1005)
1—Battery holder for 4-volt cylindrical mercury cell
Misc. polystyrene sheeting, hardware, three-wire cable, solder, wire, etc.

Inside view at right shows location of major parts on chassis and subchassis.



polystyrene cement. The wires are soldered to lugs screwed to the base plate. One common connection between the two thermistors and the two remaining leads comprise the terminals for the three-wire transmission cable that goes to the control box.

Testing. Set both the *Voltage Adj* control (*R9*) and the *Range* control (*R4*) to maximum resistance. Set the *Balance* control (*R2*) at the center of its range.

Depress *both* push buttons (*S1* and *S2*) simultaneously and hold them down for about 5 seconds. The meter should read

Front view of anemometer control box with meter which may either be calibrated directly to read wind velocity or may be used with a graph.

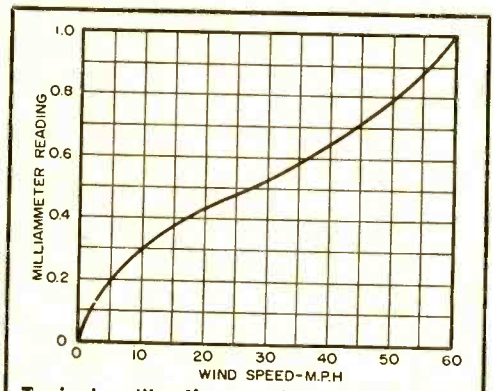
somewhat above half scale. Now advance the *Voltage Adj* control slowly until the meter reads exactly full scale. This adjusts the voltage to approximately 3.1 volts —a value which represents the standard operation of the instrument.

Release the *Battery Test* button (*S1*), maintaining pressure on the *Read Wind Speed* button (*S2*). Make sure that the thermistor assembly is in still air. Now adjust the *Balance* control for a zero reading on the meter.

Release the *Read Wind Speed* button and advance the *Range* control. Again press the *Read Wind Speed* button and, if necessary, readjust the *Balance* control to its maximum resistance position. The anemometer is now ready for calibration.

Calibration. Enlist the services of a competent automobile driver for this task because you are going to "generate" a readable wind speed by holding the thermistor assembly out of a car window while in motion at various speeds. Choose a highway which permits maximum state speed limits.

Have your driver accelerate to and maintain a speed of 60 m.p.h. Hold the thermistor assembly as far out of the window as possible and depress the *Read Wind Speed* button. The meter reading should be substantially less than full scale. Advance the *Range* control until you arrive at

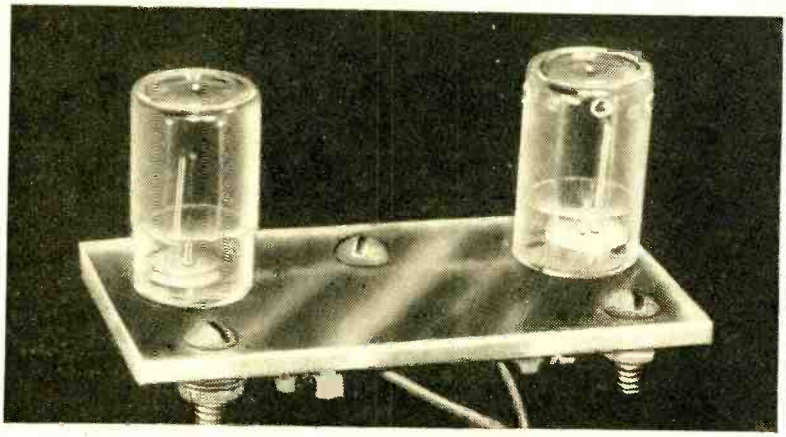


Typical calibration graph used with meter.

a full-scale reading on the meter. At this point, a reading of 1.0 ma. is equivalent to a wind speed of 60 m.p.h.*

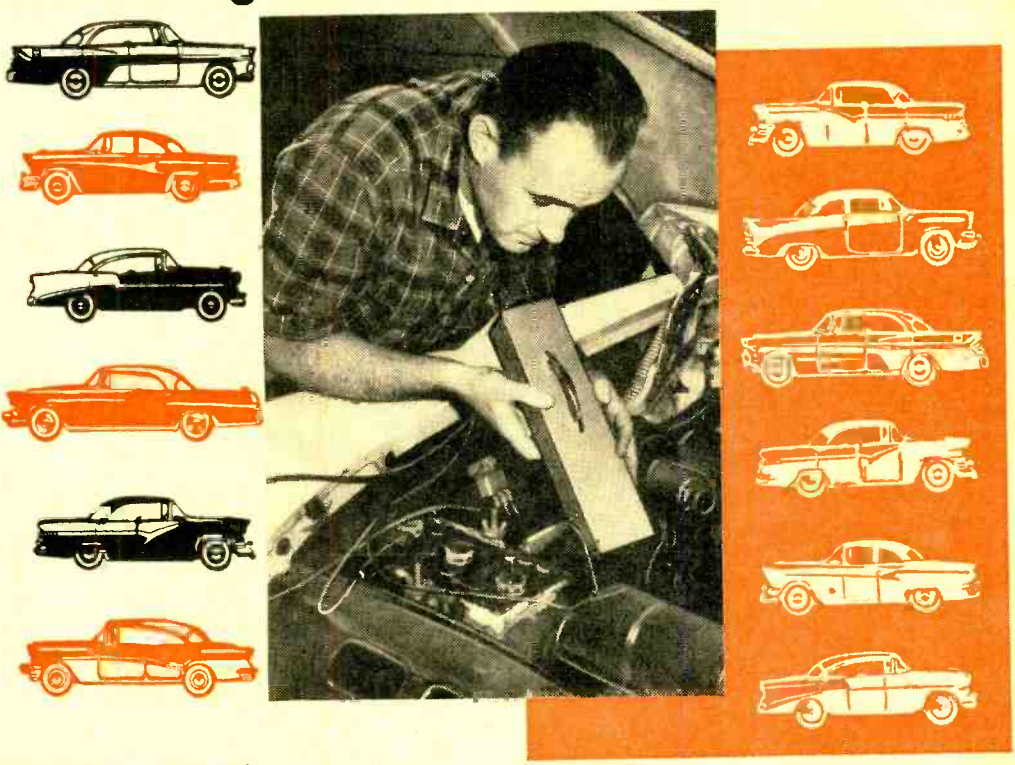
Repeat this procedure for speeds of 55, 50, 45, 40, etc., m.p.h., but do not alter the setting of the *Range* control. Keep records of the meter readings for each of these speeds for your calibration curve. —30—

* If full scale is not reached at 60 m.p.h. with any setting of the *Range* control, the needle-baffle holes should be *slightly* enlarged.



Thermistor assembly is shown at right. One of the units is exposed to the wind via some holes in its enclosure; the other is kept airtight in its case. This assembly should be located where it will be exposed to winds to be measured. You will be able to obtain the matched pair of thermistors from Victory Engineering Corp., Springfield Road, Union, N. J.

Something New in an Auto Timing Light



By PAUL HARVEY

Brilliant strobe flashes from this simple device permit daylight adjustment

INCREASED gasoline consumption and lackadaisical engine performance are often signs of improper ignition timing. If you would like your car to purr along at all speeds with the kind of power of which it is capable, you need not invest $25.00 or more for a commercial timing light. The instrument described in this article can be constructed for ten dollars or less, depending upon how you shop around for parts.

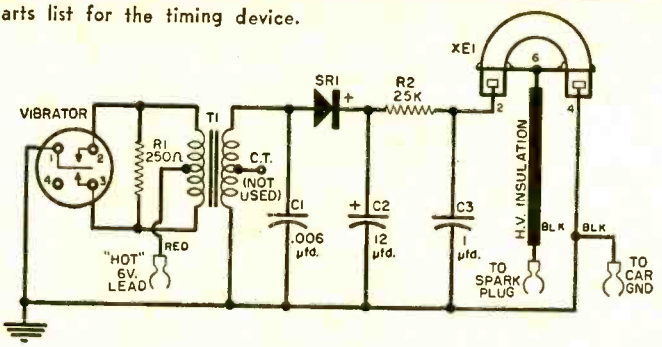
Construction. The foundation of this unit is a slip cover aluminum box measuring 3⅛" x 13" x 2⅝". Its shape is such as to provide an easy one-hand hold during the time of motor adjustment. Two small aluminum shelves are cut from scrap metal and fitted inside the case. One of these supports the vibrator transformer *T1* and the other holds the vibrator socket. The shelves are spaced about 1½ inches apart to make room for the transformer leads and the connections to the socket. Above the second shelf is the vibrator, buffer capacitor (*C1*), high-voltage selenium rectifier (*SR1*), filter capacitor (*C2*), charging resistor (*R2*), discharge capacitor (*C3*), and associated wiring.

The Amglo U-35 strobe tube is designed to fit a standard 6-prong radio socket. To insure against arcing between the high voltage triggering prong, which connects to the spark plug of the car, and any other grounded points in the case, an Isolantite socket was mounted on a ⅛" thick sheet of polystyrene cut to fit the box.

If this constructional layout is used, the inter-shelf wiring should be completed before the shelves are secured to the case. Two ⅜" holes are drilled in the rear of the case, fitted with grommets, and used to provide entry for the triggering wire and the two battery leads. Note that the wire from the spark plug must have high-voltage heavy insulation. Both battery leads enter the box through the same hole; one is red, for the "hot" side connection to the battery, while the other is black and signifies the ground connection.

Care should be taken in soldering the spark-plug triggering lead to the #6 lug

Schematic diagram and parts list for the timing device.



C1—0.006-µfd., 1500-volt paper tubular buffer capacitor (Cornell-Dubilier Cub 16D6)
C2—10-µfd., 600-volt (minimum) filter capacitor
C3—1-µfd., 600-volt capacitor
R1—250-ohm, 1-watt resistor
R2—25,000-ohm, 1-watt resistor
SR1—Selenium rectifier, high voltage type, rated at 1000 volts or more (Sarkes Tarzian H.V. Type 1, 1000-volt stack)
T1—Transformer, 250 volts peak each side of center-tap, for use with 6-volt vibrator (Thordarson 22R26)
XE1—Xenon gas stroboscope tube (Amglo U-35)
Vibrator—6-volt non-synchronous type (Mallory 509P)
1⅛" x 13" x 2⅝" slip-cover aluminum case (ICA 29100, spray-painted to taste)
1—6-prong medium socket, Isolantite or Steatite preferred. If Bakelite is used, isolate prong #6 from prongs #2 and #4 by a ¼" hacksaw cut across middle of socket.
1—4-prong radio socket (Amphenol 78-S4)
3—Large battery clips with rubber insulating covers
3—5' lengths of wire, one having high voltage ignition insulation.

HOW IT WORKS

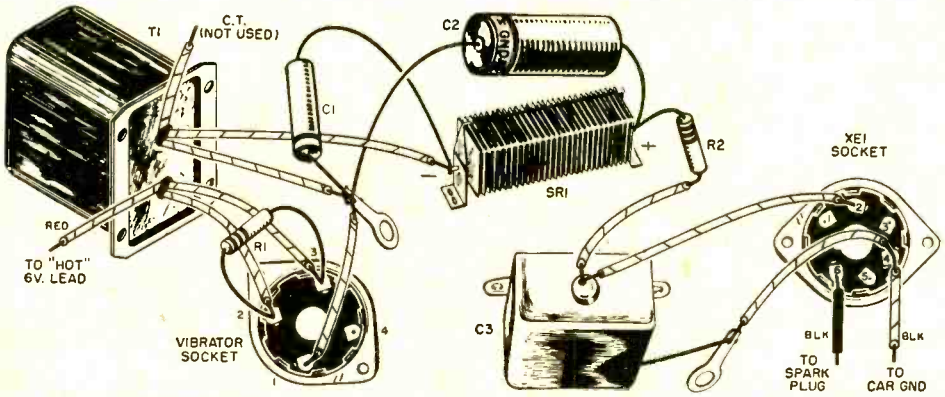
The 6 volts of the car battery are converted into approximately 500 volts peak a.c. by means of the vibrator and power transformer. The entire secondary is connected in a half-wave circuit to obtain the 500 volts. *R1* absorbs the inductive surges and prevents premature pitting of the vibrator contacts. *C1* is a buffer capacitor which comes into semi-resonance with the secondary winding. The a.c. voltage is rectified by *SR1* and filtered by *C2*. The voltage that appears across *C2* is transferred through *R2* to *C3* at the start of the operating cycle. Thus, about 500 volts of d.c. appear at the terminals of the U-35 discharge tube. The U-35 idles until a high voltage surge from the spark plug is applied to the triggering electrode. This starts the discharge by ionizing the xenon gas in the tube. Once ionization has begun, the tube becomes a dead short-circuit across *C3* and a large charge of energy passes through it, causing the xenon to glow.

The discharge ends when the potential of *C3* falls below the de-ionization voltage of the U-35. In the meantime, *C3* recharges through *R2*, building up its voltage so that it, too, is prepared for the next trigger impulse.

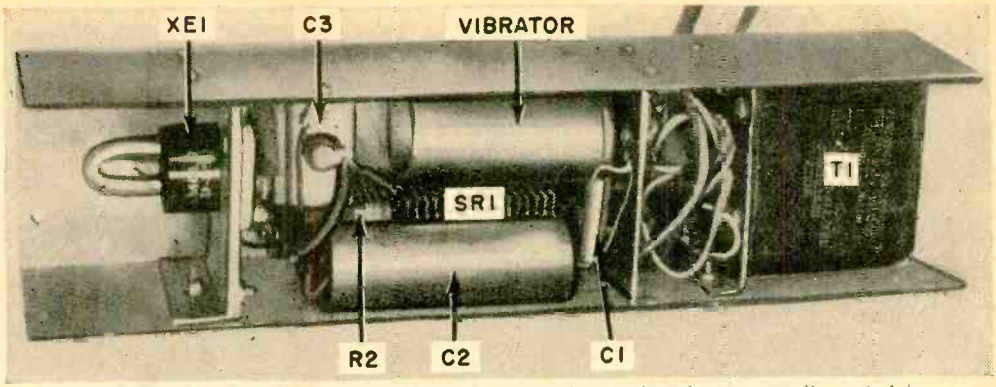
of the 6-prong socket. Keep the bare end of this wire away from ground points or there will be internal arcing.

The light emitted by the strobe tube is of very high intensity. A lens at the end of the case is not altogether necessary if engine timing is to be done in an enclosed garage. The lens will intensify the light so that the instrument may be used in full daylight under the shadow of the hood. Any short-focus, convex lens will do the trick; the one used in this model was taken from a 50-cent flashlight.

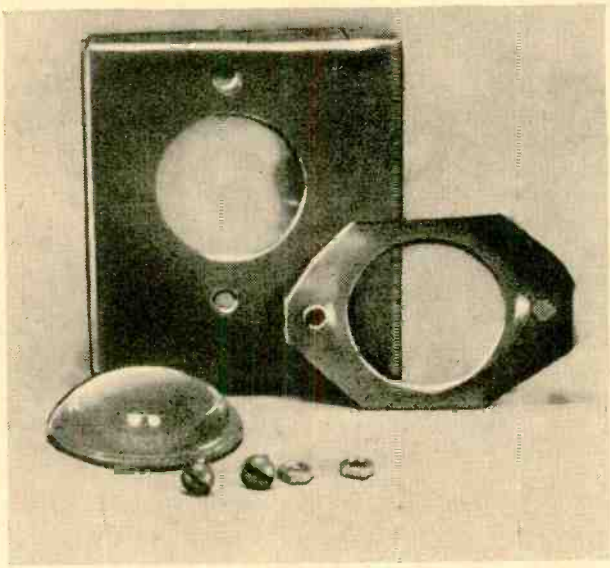
Testing. When the wiring is complete, the timing light should be checked with the cover removed. Shut off the car engine, connect the black wire to ground on the frame of the automobile, the red wire to the ungrounded terminal of the battery, and the heavily insulated triggering lead to the #1 spark plug. If the car uses a

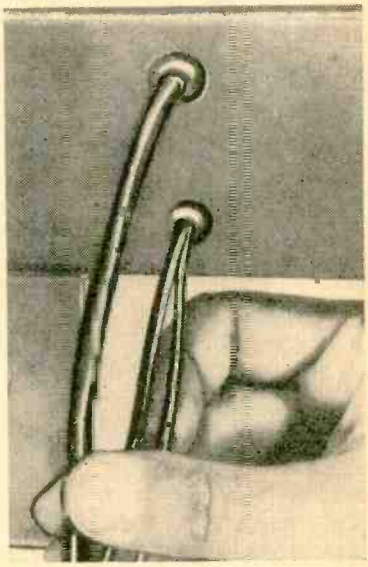


Parts are interconnected according to the pictorial wiring view above.



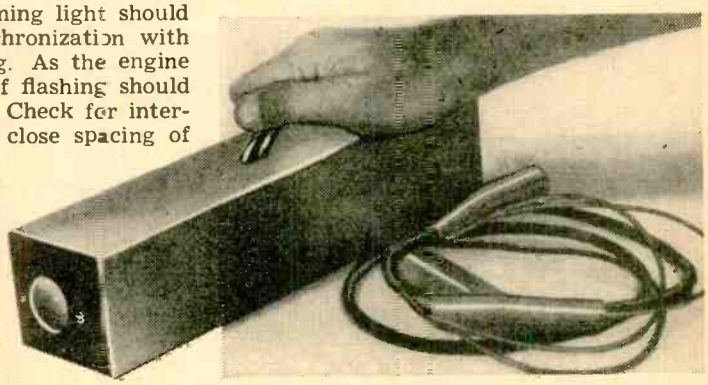
Aluminum case for the electronic timing strobe can be purchased at most radio parts jobbers. The transformer used by the author was one he obtained at a second-hand store. Note placement of major parts inside the case (above). The lens, which can be taken from a broken flashlight, is held in place by a simple bracket (below, left). All three leads enter the case through grommets (below, right); the heavy lead is the cable connection to the spark plug.





12-volt battery, the red wire should be clipped to the bar connecting cell #3 to cell #4—a point which provides 6 volts for operating the vibrator.

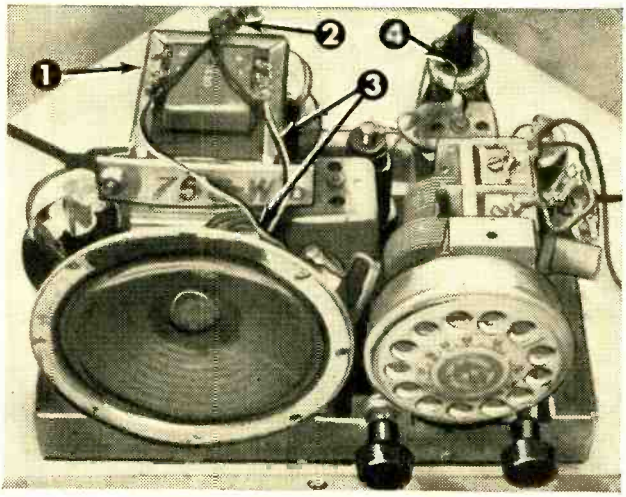
Set the timing light on the fender and start the engine. The timing light should flash on and off in synchronization with the firing of the #1 plug. As the engine is speeded up, the rate of flashing should increase proportionately. Check for internal arcs. Arcing due to close spacing of parts may be stopped by slipping a small thin sheet of polystyrene between the offending points. A little benzine or gasoline will cure arcing across the surface of the socket. —30—



A drawer pull was used by the author to hold the strobe timer (at right); it is positioned at a center of balance so that the unit can be easily handled. This external view shows the neat appearance of the timer.

Get NEW Sound from OLD Radios

SMOOTHING it out or "souping it up"—call it what you like, there is something you can do to your small, old radio to get it to sound pretty much like a more expensive console, and even approach the quality of hi-fi. A few changes and connections, with little strain on your pocketbook and the least bit of technical effort on your part, can do the trick. Aside from the pleasure derived through making the improvements, the finished job has a number of uses. You can use it for the a.m. half of binaural broadcasts, or as an auxiliary amplifier for a regular sound system, or as a standby amplifier when your main rig is in repair. Or, tote it along on your next vacation trip and amaze the neighbors. It still looks like an ordinary five-tube set, but man — what sound! Total cost of the project, including the new transformer, shouldn't exceed $5.00. These pages tell you how to do it.



Changes which will improve sound in small, 5-tube a.m. receiver; ① new output transformer; ② leads connecting to external loudspeaker; ③ negative feedback connections; ④ added filter capacitor with unused terminals taped. Latter is clamped to i.f. can.

Step No. 1

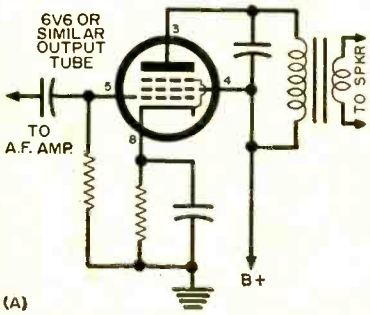
Connect New Output Transformer

The power amplifier of a typical small radio looks something like circuit (A) below. Usual frequency response is from 100 to 3000 cps. Simply replacing the existing output transformer with a better one will produce marked improvement in sound quality. The one used here was a Stancor Type A-3830. Connect one blue lead to output tube's plate, the other blue lead to B plus. Red lead (center tap) is used in Step 2, below. Green and black leads connect to speaker voice coil.

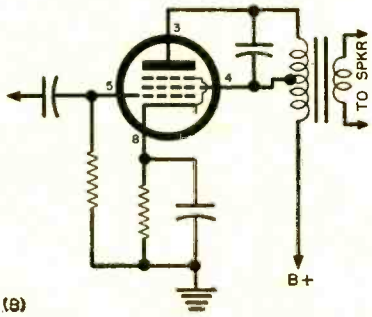
Step No. 2

Re-Wire Screen Grid Connection

Installation of better transformer permits further improvements for more linear frequency response from small set. New transformer has center-tapped primary. By connecting output tube's screen grid to this center-tap, you can simulate the "ultra-linear" principle of operation. New hookup is shown in (B) at left. Such a connection makes for wider frequency response, and generally "crisper" sound. You'll find you have to turn up the volume control a little more to get same sound level as before.



(A)

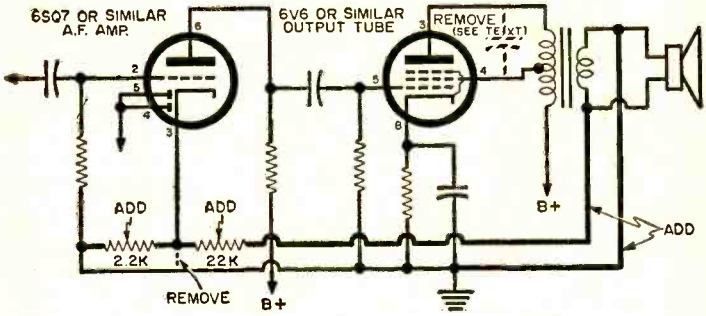


(B)

Step No. 3

Negative Feedback Loop

Your small radio is now ready for its next improvement—adding negative feedback. The diagram below shows a simple but effective way of wiring a negative feedback loop into the set. Feedback voltage is taken from secondary of output transformer and fed back to input of first audio amplifier stage. With correct polarity of connection, the sound will be noticeably improved with just a small reduction in volume. When the polarity is wrong, positive feedback will result and audible oscillations will occur. Simply reverse connections to secondary of output transformer to correct this situation. Some sets will operate best with a lower value resistor than 2200 ohms. Use lowest one that gives good results.



Step No. 4

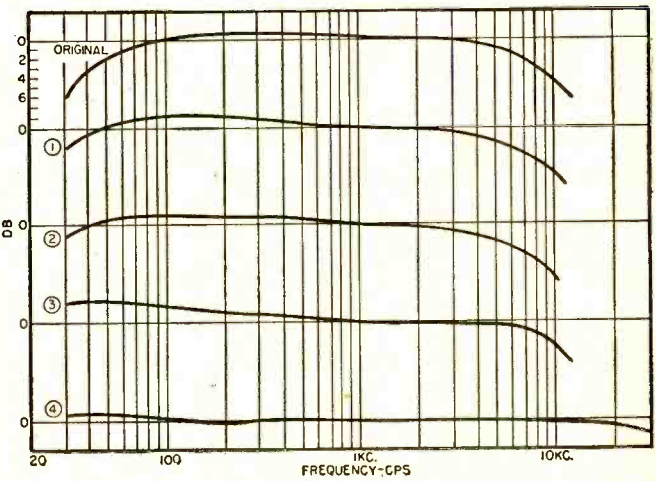
Juggling Capacitors

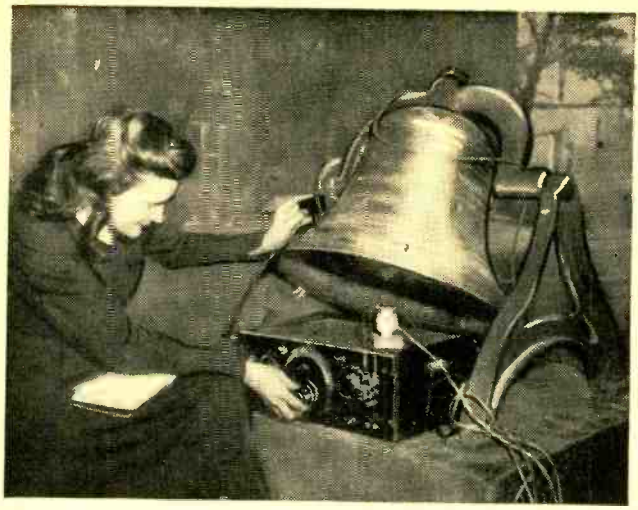
The above steps will result in generally improved sound, with reduced distortion. The most obvious improvement will be in the set's output of bass frequencies. For further improvement, in treble region, try removing capacitor between output tube's plate and screen, or plate and B-plus, or plate and ground (see diagram above). This should extend response of set beyond the limits of hearing. In some sets, however, its removal may result in more noise than anything else. If this is true in your case, better put the capacitor right back into the circuit. Another trick, involving capacitors, is to step up the current reserves of the set's power supply. Such upgrading will prepare the radio for smooth handling of big orchestral sounds. Simply increase the size of your filter capacitors to upwards of 40 μfd. per section. Add enough so that the set "continues to play" for a brief instant after it is turned off.

And Finally

Step-by-step improvements in frequency response, resulting from the "souping-up" process detailed above, are shown in the graph (below, right). The response of your small set's modest little amplifier has now been stretched and straightened as much as possible. This has been done at the expense of over-all gain, but there's usually enough gain built into such sets to compensate for the loss. You may hear switch clicks more sharply now, but you'll also hear music more clearly. One obvious step remains: to take full advantage of your improved receiver, you'll want a better speaker system. This means at least an 8" unit, or better—a 10" or 12" unit—mounted in a suitable enclosure. There are several good ones available at reasonable prices. Leave the original one connected, or use it together with the new one. A level control, such as an L-pad, will help match the two. This improvement puts the final touch to your job of getting better sound from an old set.

—Elbert Robberson





Beat Checks Bell

"A properly tuned bell is one of the most complicated mechanisms in the world," according to William Parker, owner of the McShane Bell Foundry, Baltimore, Md. At left, Edith Myers tackles one of the complications by using an electronic beat frequency oscillator to check the bell's pitch for a perfect "middle C" tone. (Wide World Photo.)

Attack Triggers Automatic Protector

Even if humans fail to sound a warning in the event of a nuclear attack, the control board shown below will instantly "button up" a threatened installation. Detectors, responding to nuclear detonation, trigger the board. Once activated, the board can sound alarms, close doors, start air filters, turn off gas, and take other defensive measures. It also responds to poison gas attacks. System was developed by the U. S. Signal Corps Engineering Laboratories, Ft. Monmouth, N. J.

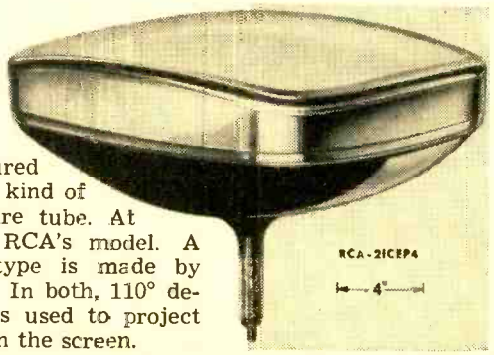
Music at Bus Stop

Free music is being provided at bus-stop benches in Albuquerque, New Mexico, for riders waiting for buses. The music comes from a small radio receiver, tucked away behind the bench. Each set starts 10 min-

utes of broadcasting with the push of a lever. If, after 10 minutes, the bus hasn't arrived, the lever may be activated again for more listening. Receivers are pre-tuned to KDEF, popular local station. The sets used are transistorized portables obtained by the Albuquerque Bus Co. from University Courtesy Co., 1826 Solano Dr. N. E., Albuquerque.

Wider and Shorter TV Tubes

Wider screens with decreased length of tube are featured in a new kind of TV picture tube. At right is RCA's model. A similar type is made by Sylvania. In both, 110° deflection is used to project images on the screen.



Rejuvenate Your TV Picture Tube

MOST television picture tube failures are caused by a condition that can be remedied temporarily, usually providing additional months of satisfactory operation. The symptoms of this type of failure are a slow warm-up and a dim, washed-out picture. If your picture tube exhibits these symptoms, chances are that the trouble is due to nothing more than the premature formation of an oxide coat covering that results in a degree of leakage between the grid and cathode of the tube. This simple rejuvenator will burn away the undesirable coating.

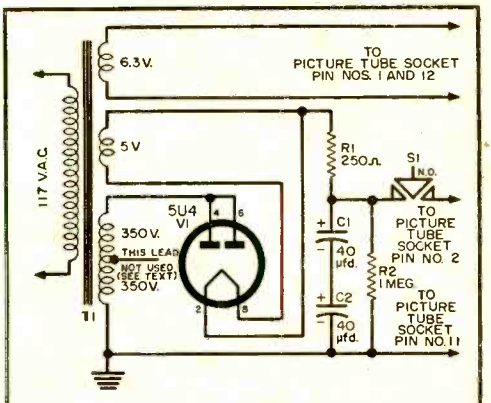
The heart of the rejuvenator is a standard power transformer. The author chose a transformer from an old table-model radio because of its small size. Transformer, rectifier tube socket and switch *S1* are mounted on a small chassis measuring about 7" x 5" x 3". Component placement is not critical in this simple circuit.

Only three windings of the transformer are employed—the 6.3-volt winding to provide filament voltage to the TV picture tube, the 5-volt winding for the 5U4 rectifier filament, and the secondary winding to provide high voltage. If your transformer has additional windings, the leads should be clipped short and carefully insulated from the chassis. The center tap of the secondary winding is not used. Instead, the whole winding is applied across a half-wave rectifier circuit with one end of the circuit completed through chassis ground.

Switch *S1* is an s.p.s.t., push-button switch of the "normally open" type. A heavy-duty switch would be a good idea in view of the heavy current flow through the circuit. Add resistors *R1* and *R2*, and filter capacitors *C1* and *C2*, as shown in the wiring diagram. The author used two 450-volt capacitors in series to provide a high voltage rating.

The final step consists of wiring in the standard picture tube socket. This can be obtained with the leads already attached, thus making it necessary only to pass them through a pre-drilled hole in the rear of the chassis. Four of the five wires coming from

(*Continued on page* 101)

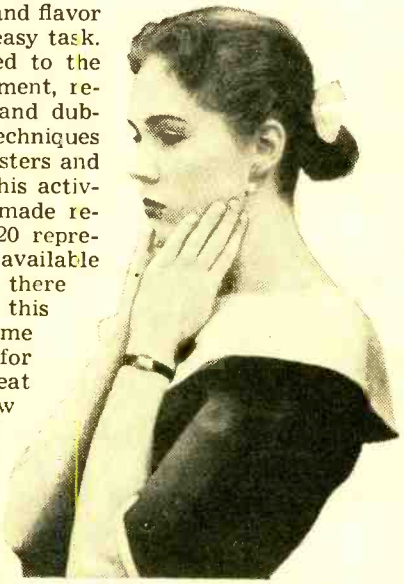


Schematic and parts list for the rejuvenator.

C1, C2—40-μfd., 450-volt electrolytic capacitor
R1—250-ohm, 10-watt resistor
R2—1 megohm, 2-watt resistor
S1—S.p.s.t. push-button switch, normally open
T1—Power transformer (see text)
V1—5U4 tube
1—Octal tube socket
1—Picture tube socket with leads
1—7" x 5" x 3" aluminum chassis
Misc. wire, hardware, rubber grommets, etc.

Sound Impressions

TO RECREATE, in a recording studio, the feeling and flavor of a show originally intended for the stage is no easy task. Skills of both performers and technicians are taxed to the limit. On the other hand, careful microphone placement, relentless critical appraisal of "takes," re-recording and dubbing to smooth over rough spots are some of the techniques used during a recording session to assure perfect masters and thus top-quality pressings for the public. Some of this activity is suggested in these behind-the-scenes photos made recently at a leading recording studio. A listing of 20 representative shows, with comments on their best available recordings, appears on the next page. To be sure, there are many more shows worthy of attention, but this "scoreboard" can serve as a guide and checklist to some of the greatest. Enthusiasm for musical comedy discs is so great that even records made a few years ago—admittedly not the latest in sonic perfection—are being grabbed by collectors. –30–



Lady fair who portrays Eliza Doolittle in both stage and recorded versions of "My Fair Lady." Julie Andrews, above, is caught during a tense moment at first playback of her recording. Other performers, musicians, technicians, and production director are also listening for over-all quality and flaws. "Flubs," "goofs," and "boners" that can occur at a hectic recording session are corrected before master tape is approved for cutting disc. Public never really finds out about them, gets professionally perfect release.

Singer and recordist combine laughs as well as talents during playback of "Pajama Game" above. Obviously pleased with the results are vocalist Janis Paige and Columbia's Goddard Lieberson. Latter sparked development of LP records and his project of recording musical comedy shows is making hi-fi history. At right, recording of orchestra and chorus presents special problem to technicians who must achieve feeling of spaciousness together with "presence" effect of voices. Correct microphoning, calculated reverberation, and close coordination with musical director can do the trick.

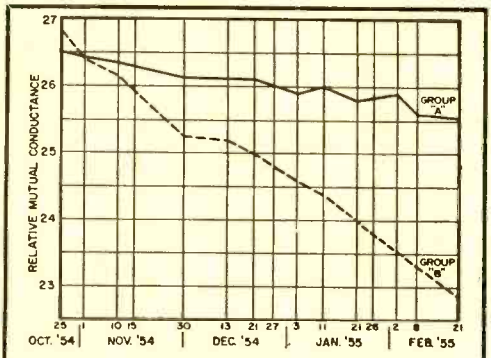
SHOW (Composer)	WHAT IT'S ABOUT	THE RECORDS
Annie Get Your Gun (Berlin)	Exploits and romance of fabulous Annie Oakley in Old West.	Film soundtrack version on MGM E-509 has big, rich sound, but original cast recording on Decca 9018 features the one-and-only Ethel Merman in title role.
Brigadoon (Loewe and Lerner)	American tourists discover Scottish village that has sunk beneath the moors.	Both versions—Victor LOC-1001, original cast, and MGM 3135, film soundtrack—excel in performance and sound.
Call Me Madam (Berlin)	Satire on diplomats who mix love with politics.	Ethel Merman's clarion-call vocalizing surmounts any sonic limitations on Decca's original cast version (9022).
Carousel (Rodgers and Hammerstein)	Carnival barker tries to settle down to married life in fishing village.	Authentic flavor of Broadway stage on original cast recording (Decca 9020); better sound on film soundtrack version (Capitol W-694); voices of opera soloists on Victor LPM-1048.
Finian's Rainbow (Lane and Harburg)	Leprechaun falls for girl sharecropper in mythical state of "Missitucky."	Original cast version on Columbia ML-4062 features top vocal talents and fine sound. Singers have plenty of "presence."
Girl Crazy (Gershwin)	Eastern playboy brings chorus girls to dude ranch in Arizona.	Special production by Goddard Lieberson boasts Mary Martin and others in modern, hi-fi sounding version on Columbia CL-822.
Guys and Dolls (Loesser, Swerling, and Burrows)	Damon Runyon characters romp through hilarious adventures in big city.	Full justice to zany characters and songs is done on original cast version (Decca 9023); Columbia's pressing (CL-2567) has outstanding cast and sound.
King and I (Rodgers and Hammerstein)	Schoolmarm Anna tries to "housebreak" the headstrong King of Siam.	Original Broadway cast version on Decca 9008 has Gertrude Lawrence and much sentimental value; film soundtrack release on Capitol W-740 has excellent performers and hi-fi sound.
Kiss Me Kate (Porter)	Troupe of Shakespearian actors gets mixed up with romance and gangsters.	Columbia's original cast release (OL-4140) has plenty of zip and better-than-average sonics.
Lady In The Dark (Weill)	Stern career woman has trouble managing her own emotions.	If you can find one, try Victor's LRT-7001 with Gertrude Lawrence as the bemused Lady; a newer version, Victor LM-1882, features Ann Sothern, fine supporting cast and excellent hi-fi sound.
My Fair Lady (Loewe and Lerner)	Shaw's "Pygmalion" story of professor who makes a "lady" of a slum girl.	One of the greatest musical shows of all time superbly recorded by original cast on Columbia OL 5090. Cut and pressed recently, this is truly a modern hi-fi disc.
Of Thee I Sing (Gershwin)	Pulitzer Prize winner; savage satire on national politics.	You may still find copies of this out-of-print rarity on dealers' shelves (Capitol S-350). There should be a re-issue on some label of this terrific show!
Oklahoma (Rodgers and Hammerstein)	Intimate glimpses into lives and loves of early western settlers.	Decca 9017 has the original Broadway cast; Capitol SAO 595 has the fabulous soundtrack from the Todd-A-O film version.
Pajama Game (Adler, Ross, Abbott, and Bissell)	Labor vs. management in pajama factory, complicated by love affairs.	Columbia OL 4840 ranks high with the authenticity of the original cast plus the benefits of hi-fi recording.
Pal Joey (Rodgers and Hart)	Chicago nightclub owner in and out of trouble, mostly with women.	Tops in performance and sound is Columbia OL 4364. This one really gives you a "front-row center" feeling.
Peter Pan (Barrie, Leigh, and Charlap)	A visit to "Never-neverland" where children fly and "never grow up."	Victor's recent original cast version with Mary Martin and Cyril Richards (LOC-1019) rates high in performance and sound.
Porgy and Bess (Gershwin)	Love, adventure, crime, humor, and pathos down in "Catfish Row."	Complete work on 3 Columbia records available as album (OSL-162). Excerpts, in hi-fi production by Goddard Lieberson, on Col. OL-4766. Victor LM-1124 features Robert Merrill with Shaw Chorale. Decca 9024 is original cast version.
Show Boat (Kern and Hammerstein)	Laughter and tears with entertainers sailing up and down "Ole Man River."	Victor's new recording (LM-2008) of this perennial favorite is outstanding for singing and sonics. MGM 3230 contains the movie soundtrack, big on sound but somewhat short on interpretation.
South Pacific (Rodgers and Hammerstein)	Plantation owner falls for U. S. Navy nurse "some enchanted evening."	Nobody but nobody can sing this one like Pinza and Mary Martin on Columbia OL 4180. Not the latest in hi-fi sound, but very clean and very listenable.
Street Scene (Weill, Rice, and Hughes)	Strange mixture of sympathy and bitterness over lives of city dwellers.	A very sensitive yet forceful production is available on Columbia OL 4139. While not obtrusive, sound is clean and full.

Tube Saver Triples Tube Life

Every time you switch on your radio, TV, hi-fi set, or other electronic equipment, your tubes suffer serious strain. During these first few seconds of operation, a surge of starting current rushes through cold tube filaments and cathodes, gradually wearing them down. For the same reason, light bulbs in your home invariably burn out when they are first switched on—the delicate filaments are blasted out by the initial current surge.

Radio engineers know this, and therefore turn their transmitters on at a very low voltage for a short period each morning before starting the broadcast day. They realize that it is important to let their expensive tubes warm up slowly. Only after the tubes reach operating temperature is the filament current raised to the rated value.

An electronics device, the Wuerth Tube-Saver, has recently been developed to reduce initial current surges in TV and hi-fi receivers, thus increasing the life of radio and TV tubes, including the picture tube. Through a patented principle known as "Thermal Cushion Action," the Tube-Saver absorbs destructive current surges until heating elements in tubes have slowly warmed up to the point where they can safely handle the full charge of current. The device accomplishes this by reducing starter heating voltage to about 50% of normal for 10 seconds. Graph below shows the lengthened life of tubes operated with the Tube-Saver as compared to those in ordinary operation.



Decay of tube efficiency measured in terms of mutual conductance of two groups of tubes. Group A was used with Tube-Saver, Group B without. Group B deteriorated three times faster. Measurements were made by U.S. Testing Co.

The Wuerth Tube-Saver is easily installed. The TV or hi-fi cord simply plugs into the Tube-Saver receptacle, and in turn, the Tube-Saver plugs into the wall outlet. It operates on 117 volts, a.c.-d.c., for equipment drawing from 100 to 300 watts, carries the Underwriters' Laboratories approval, and is manufactured by the Wuerth Tube-Saver Corporation, 9125 Livernois Avenue, Detroit 4, Michigan.

Top Honors to Transistor Team

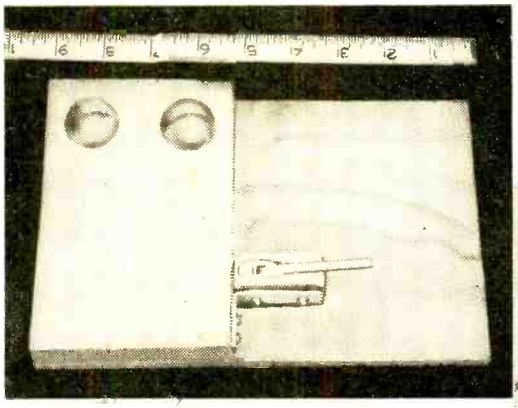
Three research scientists of Bell Telephone Laboratories were singled out this year for the highest honors in science. The Swedish Academy of Sciences awarded the 1956 Nobel Prize for Physics to Doctors John Bardeen, William Shockley and Walter Brattain for "investigations on semiconductors and the discovery of the transistor effect." They are shown at left with the equipment used in their work that led to the invention of the transistor in 1948. It is noteworthy that electronics, a branch of engineering, has thus earned a distinction usually reserved for work in pure science. Perhaps this signifies the vanishing of the traditional gap between pure and applied research.

Heat-Controlled Soldering Stand

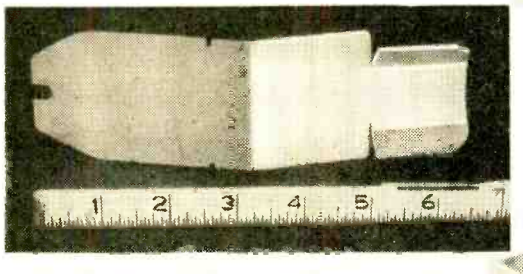
VERSATILE and easy to build, this soldering iron stand will not only hold your iron when not in use but will automatically control its heat. The unit features a rocker-arm rest which triggers a simple circuit that regulates the voltage fed to the iron's heating element.

For light soldering, there's enough heat in the tip of the iron to do a good job at all times. But if you need high heat, the iron is ready 15 seconds after lifting it from its rest.

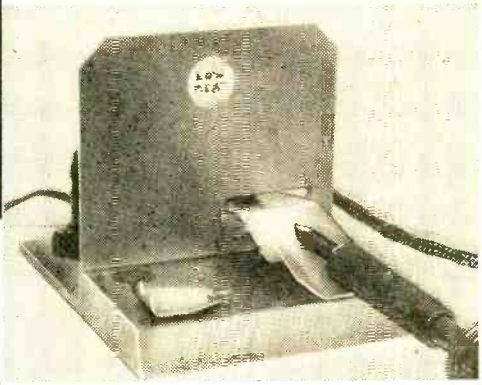
The stand boasts other useful features: a readily accessible steel-wool cup permits occasional brightening of the faces. All



1 Base block is shown above after being glued to main base. The two holes are 1¼" in diameter and must line up with holes in aluminum plate. Lever switch and bracket nestle in cutout made in main base and are secured in place with wood screws.



2 Rocker arm (above) is fashioned from aluminum. Notches must fit snugly into narrower part of rocker cutout in aluminum mounting frame. The leaf spring is stainless steel strap and the switch bracket is aluminum. All dimensions are given in table on following page.



3 Vertical section is aluminum, bent where it joins base block so that remaining portion covers block (below). Slit in lower right corner accommodates rocker-arm rest. Two circular holes must be punched in aluminum to match holes for cleaner and resin cups in base block.

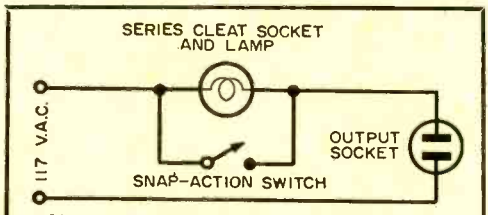
4 Close-up of completed stand from side opposite to that in photo at top of page. Note the two sockets; the one in foreground is for plugging in the iron, the other—near rocker—holds 100-watt bulb.

Bill of materials for constructing the soldering stand is given at right. The two sockets used are called "cleat-sockets." The words "Low Heat" may be lettered on a 2" square of frosted glass, held in place with vinyl tape.

PART	MATERIAL	LENGTH	WIDTH	THICKNESS
Plywood base	3-ply pine	9½"	6¼"	¼"
Base block	pine	4¼"	6¼"	¾"
Mounting frame	aluminum	9"	6¼"	18 gauge
Rocker arm	aluminum	7"	2"	14 gauge
Leaf spring	stainless steel TV antenna chimney strap	4½"	¾"	.....
Lever switch mounting bracket	aluminum	3"	½"	14 gauge
Flux cover and high heat rest	aluminum	2⅜"	1½"	14 gauge
Lever switch	Lever-arm spring switch, s.p.d.t., normally open type.			

you need do is insert the tip into the pad and rotate it once or twice. A similar cup, further forward on the stand's base, contains rosin flux; the cover of this cup not only protects the flux when not in use but serves as a high-heat rest for the iron.

To construct this useful stand, follow the directions given with the photos on page 65. Refer also to the parts list and the wiring diagram at right. -30-



Simple circuit used in soldering iron stand.

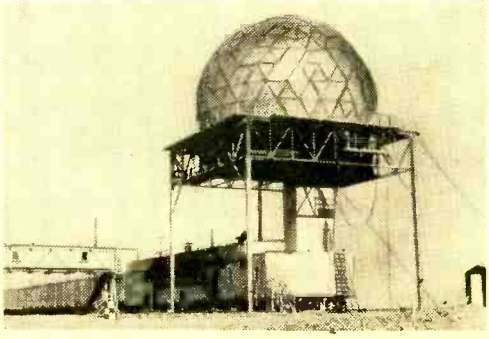
Electronic "Private Tutor" Is Always on Hand!

You can learn while relaxing if you have a "Memory Trainer" developed by Modernophone, Inc., 30 Rockefeller Plaza, New York 20, N. Y. A cartridge, containing a message, is inserted in the unit. It will play its contents, as controlled by a timer, through a built-in amplifier and speaker. Private earphones can be used, if preferred. Messages may also be recorded with the same device.

In addition to serving as a training aid for learning specific material, such as foreign languages, the "Memory Trainer" can also repeat sales messages in public places. The so-called "talking gas pump" at auto service stations utilizes just such a device. As an instrument for correcting speech defects, it may be employed at schools and hospitals.

First DEW Line Radars

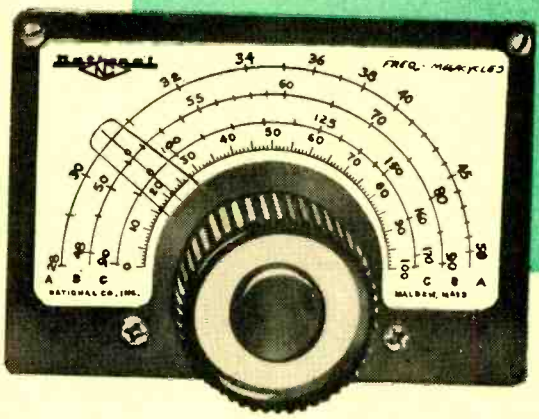
Radar domes, such as the one at right, have become a familiar sight far above the Arctic Circle. Housed in the building is the electronic equipment needed for operating the U. S. Air Force's Distant Early Warning (DEW) Line. This is a radar fence that stretches 3000 miles from Alaska to Baffin Island above Canada. One section of the line was completed recently and turned over to the government by the Western Electric Company, prime contractor for the DEW Line.



V.H.F. Explorer's Receiver

Because this receiver has a single audio amplifier, a set of headphones are used as demonstrated here. The full frequency range of this set is covered in three bands as shown below.

By RICHARD GRAHAM



Tune in on emergency broadcasts, FM and TV sound—and aircraft frequencies too

EXPLORING the many services using the v.h.f. band* can provide real excitement in listening. Not only are the familiar FM and TV broadcasting services found in this region, but a host of others, such as: Police, Fire, Public Utilities, Taxi, Aircraft, Amateur, etc.

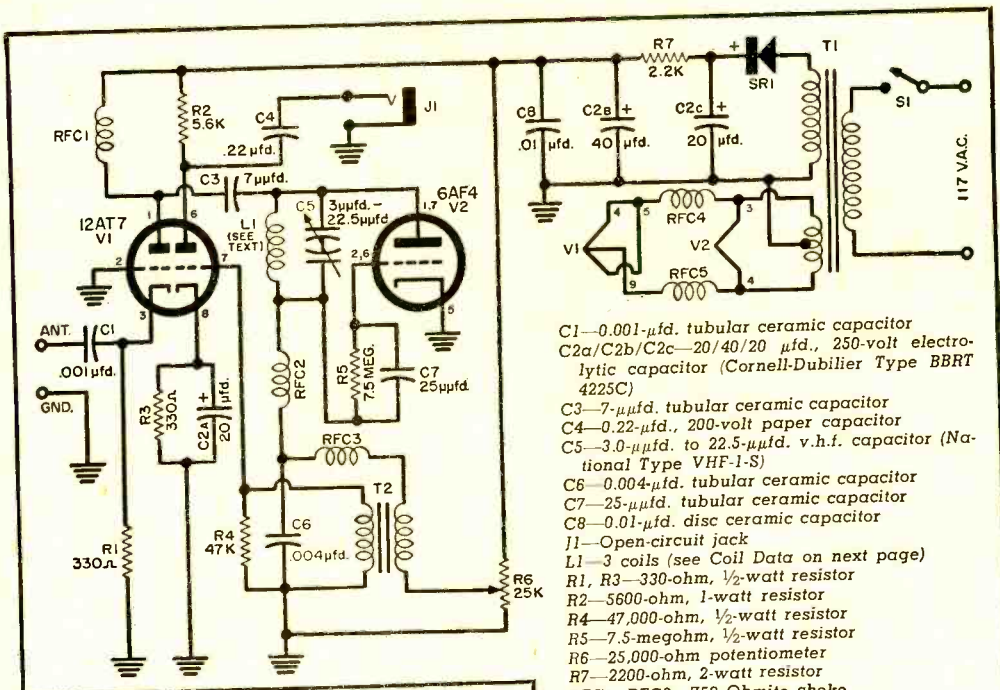
The *Explorer's Receiver* has three plug-in coils and will pick up all these services in the range of 28 to 175 megacycles. The receiver has excellent sensitivity although it uses only two tubes. This is accomplished by using a superregenerative detector. This detector circuit has long been famous for its sensitivity, as well as for some of its less desirable traits. Among the more important is its ability to cause interference. A superregenerative detector is basically an oscillator. So it's only natural for it to cause interference. The problem is overcome in this receiver by preceding the detector with an r.f. isolation stage.

Construction. This receiver requires some care in building. The lengths of leads play an important part in successful operation. For this reason it is recommended that the photographs of the receiver be carefully studied. If possible, copy my layout of parts exactly.

The receiver itself is constructed in a 6" x 6" x 6" LMB box in which the chassis is mounted vertically. There is a good reason for this unorthodox approach. It permits very short leads between the antenna input and the detector. Note that the r.f. stage is mounted horizontally from one side of the chassis so the bottom of the socket will face the 6AF4 socket.

The detector tube socket is mounted on

* See "High Adventure in V.H.F. Reception," POPULAR ELECTRONICS, December, 1956, p. 58.



C1—0.001-μfd. tubular ceramic capacitor
C2a/C2b/C2c—20/40/20 μfd., 250-volt electrolytic capacitor (Cornell-Dubilier Type BBRT 4225C)
C3—7-μμfd. tubular ceramic capacitor
C4—0.22-μfd., 200-volt paper capacitor
C5—3.0-μμfd. to 22.5-μμfd. v.h.f. capacitor (National Type VHF-1-S)
C6—0.004-μfd. tubular ceramic capacitor
C7—25-μμfd. tubular ceramic capacitor
C8—0.01-μfd. disc ceramic capacitor
J1—Open-circuit jack
L1—3 coils (see Coil Data on next page)
R1, R3—330-ohm, ½-watt resistor
R2—5600-ohm, 1-watt resistor
R4—47,000-ohm, ½-watt resistor
R5—7.5-megohm, ½-watt resistor
R6—25,000-ohm potentiometer
R7—2200-ohm, 2-watt resistor
RFC1, RFC2—Z50 Ohmite choke
RFC3—25-mh. choke
RFC4, RFC5—Z144 Ohmite choke
S1—S.p.s.t. toggle switch
SR1—65-ma., 160-volt selenium rectifier
T1—Power transformer, sec. 150 volt, 25 ma.; 6.3 volt @ 0.5 amp. (Stancor P8181)
T2—Audio transformer, interstage 1:3 ratio (Stancor A-53)
V1—12AT7 tube
V2—6AF4 tube
1—Crystal socket (Miller No. 33102)
1—6" x 6" x 6" cabinet (LMB)

Schematic and parts list for receiver.

HOW IT WORKS

A 12AT7 double triode serves as a grounded grid r.f. stage preceding the detector. The second half of this tube serves as an audio amplifier. The detector is of the superregenerative variety and uses a 6AF4 triode.

A grounded grid r.f. amplifier serves to isolate the oscillating detector from the antenna. Since the grid is grounded and the signal is fed into the cathode, it is necessary to feed the filament through r.f. chokes. The output is very loosely coupled to the detector.

The detector is an ultraudion type of oscillator that is brought in and out of oscillation at a low frequency rate. This low frequency is called the "squelch" or "quench" frequency. Feedback for the oscillator is accomplished through the circuit wiring and the internal capacities of the tube. These capacities are not shown as such on the schematic diagram, although they are adequate at the frequencies used in the receiver to enable oscillation.

The detector output is fed to a conventional audio stage which feeds the headphone jack. D.c. power is obtained from a transformer-fed half-wave selenium rectifier supply. To enable the use of resistance filtering in the supply, the transformer selected has a higher output voltage than the usual transformer of this type. This eliminates the use of a filter choke.

the variable capacitor *C5*, which is made specifically for this application and has brackets for mounting a tube socket. The coil socket is a ceramic (or other high quality material) crystal socket. All sockets, couplings and capacitors used in the r.f. and detector stages should be of similar high-quality material.

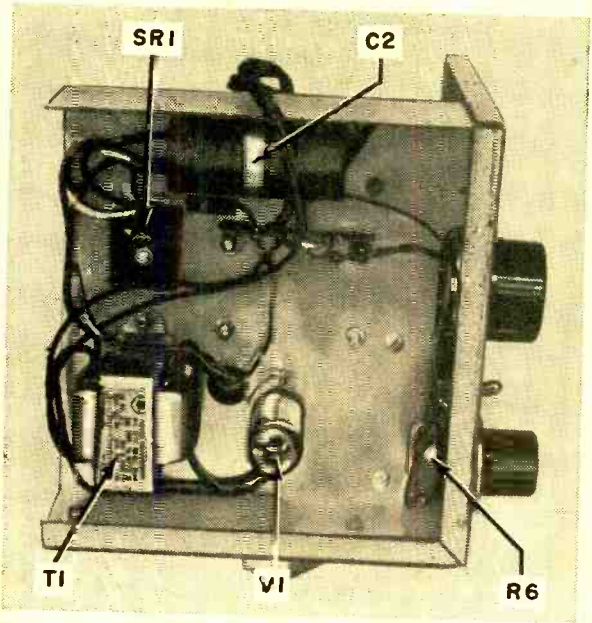
The National VHF-1-S tuning capacitor *C5* is different from the type of variable capacitor commonly used at lower frequencies. There are two stators and two rotors, but the capacitor wiring terminals are connected to the two stators while the rotors are fastened to a common shaft. Thus, two variable capacitors are effectively placed in series.

The power supply section is located on the chassis opposite the r.f. wiring.

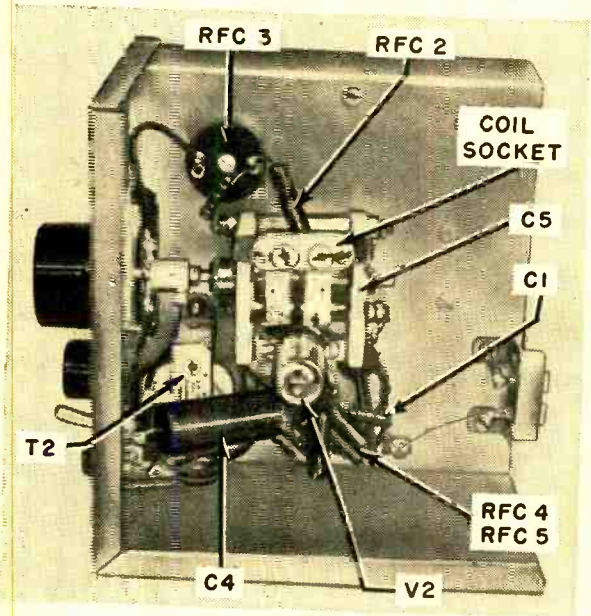
Before the unit is assembled, the cabinet will need a large hole cut through the side to comfortably allow the plugging in of the three coils. The hole in the model shown is 1¼" by 2⅜".

Trying It Out. After the receiver is completed, including the coils, turn on the a.c. switch and advance the regeneration control *R6* until a loud hissing sound is heard in the headphones. Now tune the receiver for a signal—always remembering to adjust the regenerative control for the proper level.

The last step is to calibrate the three bands. If you have access to a signal generator, this is no problem. It becomes more difficult, but not insurmountable, if no sig-

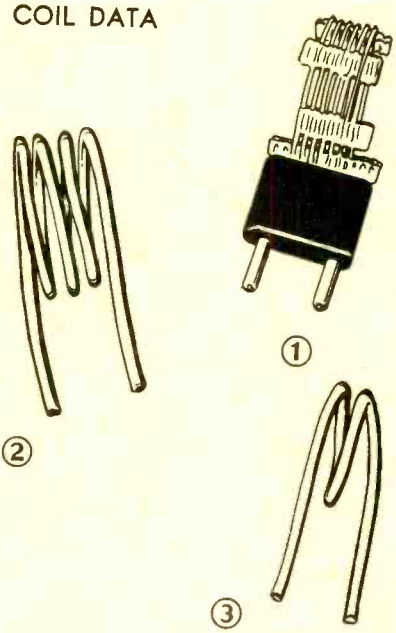


Interior view of left side of the receiver showing location of power supply components and the combination r.f. and audio amplifier tube, mounted horizontally.



Exterior view of the receiver (at right) shows cutout in the right side through which the various coils are inserted into the coil socket to obtain the desired frequency band. In this photo, the coil for the 28-50 mc. band has been inserted; coils for the other two bands are also shown.

COIL DATA

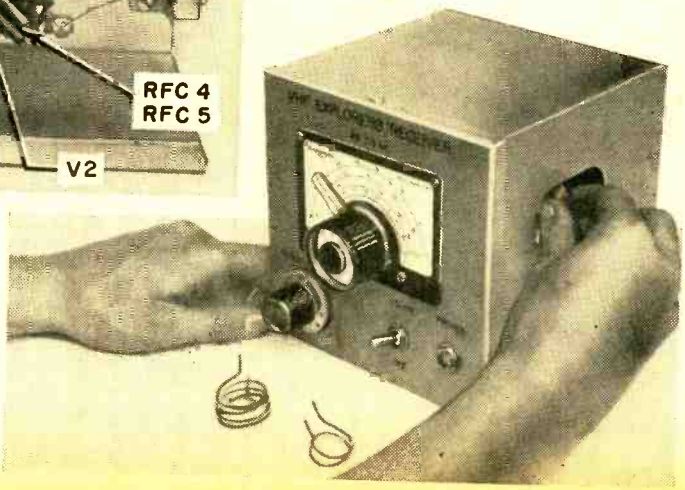


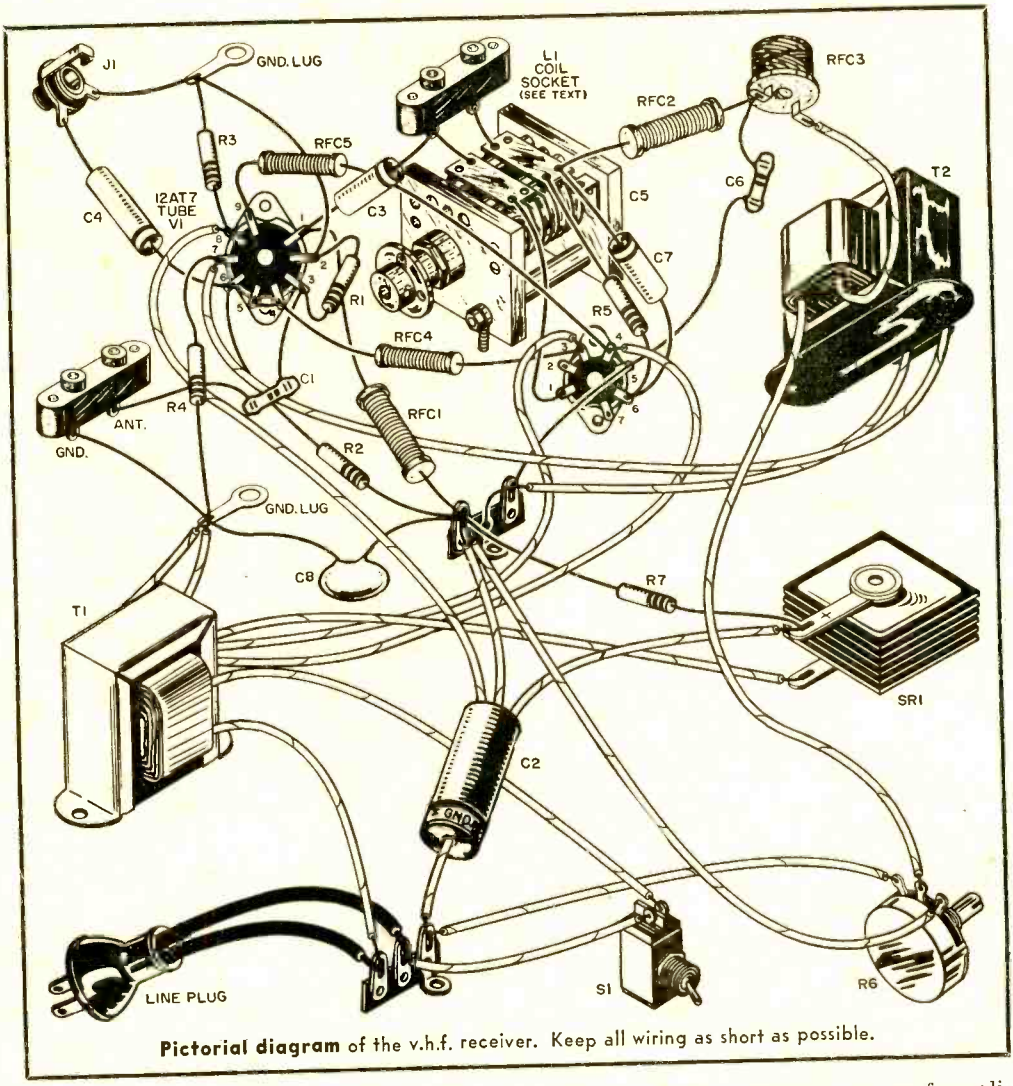
① For the 28-50 mc. band: six turns of Barker & Williamson Miniductor No. 3015 coil stock (16 turns/inch), soldered into Millen No. 37412 plug.

② For the 48 to 90 mc. band: four turns of No. 12 wire, tinned, ½" long, 1" in diameter.

③ For the 90 to 175 mc. band: two turns of No. 12 wire, tinned, ½" long, ¾" in diameter.

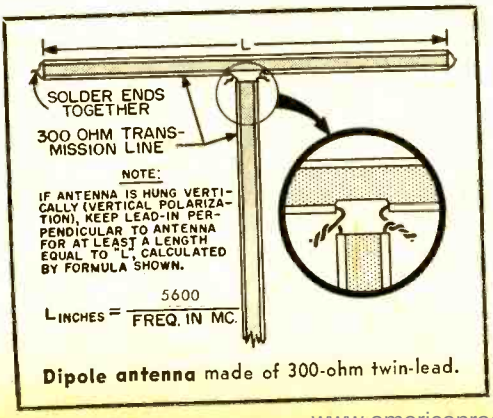
Right side of receiver (at left) contains oscillator tube and coil socket into which band coils are plugged. Point-to-point wiring and short leads are used.





Pictorial diagram of the v.h.f. receiver. Keep all wiring as short as possible.

nal generator is available. Generally there are enough signals of known frequency, such as TV and FM stations, to enable a rough calibration.



Dipole antenna made of 300-ohm twin-lead.

Another instrument you can use for calibrating is the grid-dip meter.*

There is no single antenna that will produce top performance over the complete range covered by the receiver. An outdoor TV antenna will perform fairly well. However, this type of antenna is directional and horizontally polarized. Most mobile services use vertically polarized antennas. The writer has found that for general listening a plain random length piece of wire does as well as anything.

For top performance, a dipole cut to the desired frequency will produce superior results. The antenna can then be hung vertically or horizontally. Details of a dipole antenna for use on any specific band are shown in the drawing at left. —30—

* See "How to Use a Grid Dipper," POPULAR ELECTRONICS, September 1956, p. 49.

By LEONARD FELDMAN

SPOTLIGHT ON THE VOCALIST

—with Presence Control

Singing voice can be made to "stand out" during recording as well as playback by the use of the "presence" control. Above, Rex Harrison takes a solo during recording of "My Fair Lady" for Columbia Records.

EVER NOTICE how the vocalist seems to "stand right up front" in some pop records? The singer isn't *louder* than the orchestra, yet the three-dimensional feeling prevails—the soloist almost seems to be "present" in your living room. Part of this effect is achieved by microphone placement during the recording session. But there's another—even more important—engineering gimmick sometimes used to achieve the feeling of "presence."

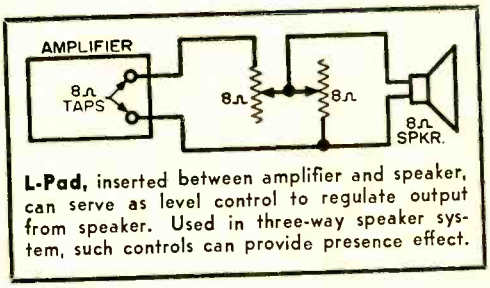
The sound we hear spans a musical range of about nine octaves or, to put it in hi-fi terms, a frequency range from about 20 cps to 15,000 cps. That includes everything from the big bass drum to the shrill notes of the piccolo. The human vocal range, however, comprises just the *central portion* of that over-all range. What's more, the tones which help us "place" the sound lie mostly between 2000 and 5000 cps. They're the tones that add crispness to human speech and to solo instruments such as the violin. A radio playing in the next room or apartment sounds dull because these very same frequencies aren't "getting through" the intervening walls.

Presence In Recordings. Recording engineers get that elusive quality of presence by boosting mid-range frequencies above the level of high and low frequencies. In other words, a deliberate "bump" is inserted electronically so that all tones contained in the region from about 1000 to 5000 cps are accentuated to a small degree. The effect has to be used in moderation. To overdo it would create a noticeable unbalance in the over-all recording.

In recording studios, special consoles costing hundreds of dollars are required to do this job, and not every studio does this type of frequency "bumping."

You can achieve very much the same results in your hi-fi setup. The presence effect can be achieved by loudspeaker manipulation, or by electronic control. Let's take the speaker method first.

Three-Way Speaker Systems. In a three-way speaker system, the woofer usually handles frequencies below 600-800 cps. The mid-range speaker takes over from about 600 to 4000 cps, and the tweeter carries on from there. Normally, the three elements are arranged so that they produce *equal* sound in their respective frequency regions. Furthermore, the cross-



L-Pad, inserted between amplifier and speaker, can serve as level control to regulate output from speaker. Used in three-way speaker system, such controls can provide presence effect.

over networks associated with the speakers are arranged so that as one element starts to "give up," the next one starts to "give out."

The result is flat or uniform response over the whole audible range of tones. Now, if you could readily increase the output of the mid-range speaker without affecting the output of the other two elements, or if you could decrease the sound output from the other two and leave the mid-range output unchanged, you'd be emphasizing just those frequencies which create the presence effect that helps make a soloist "stand out."

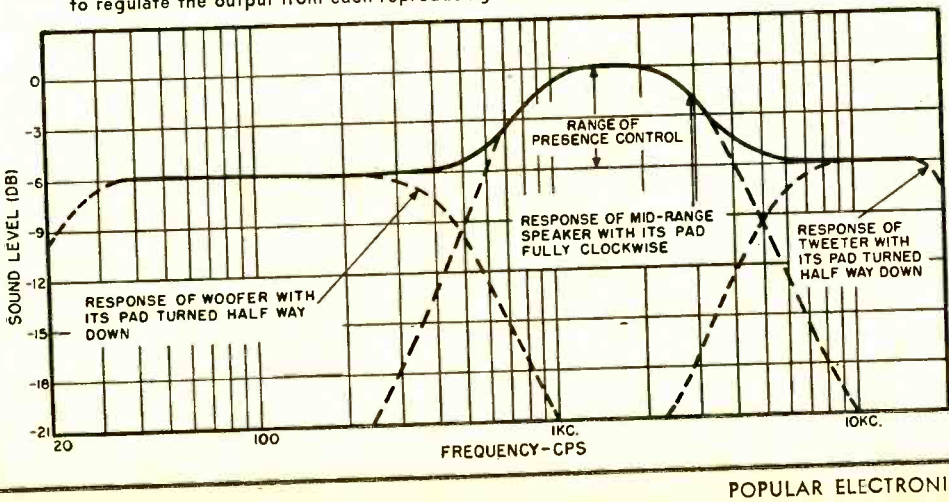
Speaker Level Controls. All you need to add this flexibility to your system are three speaker level controls, known as L-Pads. The L-Pad controls volume at the speaker (see diagram given above). Individual L-Pads may be connected at each speaker in the three-way system. As a first trial, set the woofer pad and tweeter pads about halfway counterclockwise from the maximum volume setting. Listen to some program material containing either a vocalist or an instrument solo and rotate the mid-range speaker pad from halfway to fully clockwise. Notice how the soloist seems to take on a prominent position in the over-all sound picture. If you end up with the mid-range control fully clockwise, the total response of your system will be a very close approximation of the "presence bump" used by some recording companies.

Of course, you can vary the effect to suit your taste by experimenting with the pads until you find the over-all balance which pleases you most. Remember that woofer and tweeter pads should be *equal* in their settings. Then, the mid-range pad is played against the other two for the most natural, lifelike effect.

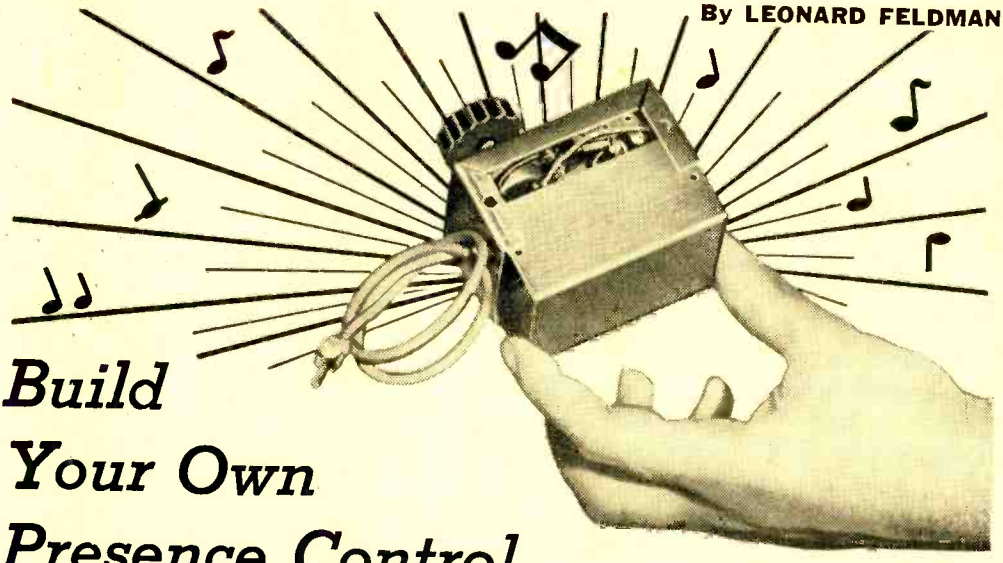
Electronic Presence Control. Nearly two years ago, the Electro-Voice Company of Buchanan, Mich., designed a circuit into its Model PC-1 "Music Control Center," which accomplishes the same presence effect electronically. This control is part of the preamp circuitry. The E-V engineers, after considerable experimentation, decided that the optimum frequency of the "bump" should be centered at about 4500 cps and that the control should vary from totally flat response to a maximum of 10 decibels of boost at the presence frequency. The amount of presence effect is continuously variable depending upon the setting of a variable resistor.

"Outboard" Presence Control. If you already have a preamplifier not equipped with a presence control, you can incorporate a similar control into your system by building the "outboard" presence control described in the article starting on the next page. This control requires *no* power supply and can be "patched in" directly between your preamplifier and power amplifier without even removing a screw from either of your present units. —30—

Graph shows response curve of three-way speaker system in which L-Pads are used to regulate the output from each reproducing unit. Mid-range unit provides presence.



By LEONARD FELDMAN



Build Your Own Presence Control

MOST "presence controls" in hi-fi components are built right into the circuits of preamplifiers or amplifiers. Yet it is quite simple to add this type of control externally to almost any hi-fi system.

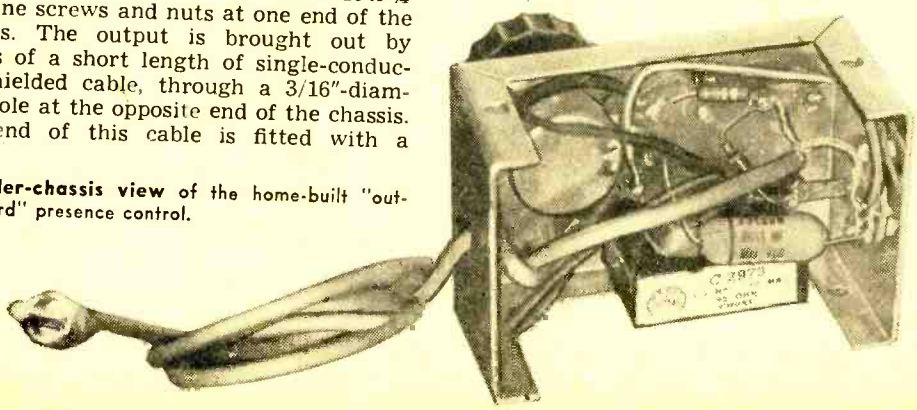
The only electrical requirement is that your total system have a "reserve" of gain of about 12 to 14 db. Since most preamp and amp combinations are never operated near to "full volume," it is safe to say that the extra gain is generally available. After installation of this control, you will want to turn your volume control up a bit to restore the same listening levels you had before.

The entire control and associated circuitry can be built on a tiny chassis which, fully enclosed, measures only 3¼" x 2⅛" x 1⅝". Since the completed unit is to be inserted between the preamplifier and power amplifier of your system, the input jack you should use is a standard phono jack which is mounted by means of 4-40 x ¼ machine screws and nuts at one end of the chassis. The output is brought out by means of a short length of single-conductor shielded cable, through a 3/16"-diameter hole at the opposite end of the chassis. The end of this cable is fitted with a standard phono-tip plug. No additional interconnecting cables will be required when adding the presence control to your existing system.

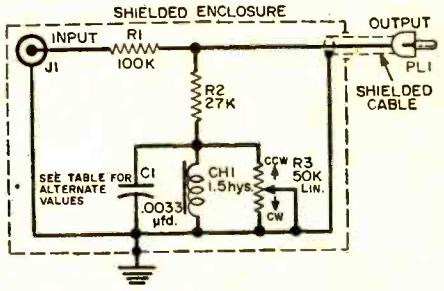
Mount the control itself, as well as the 1.5-henry choke, against the largest surface of the chassis by means of suitable hardware. A one-point insulated terminal strip is also mounted on this surface, to accommodate the junction of *R1* and *R2*.

In wiring the connections of potentiometer *R3*, observe the "sense" of rotation. The presence effect should become greater as the control is rotated clockwise. Therefore, the arm, or center terminal of the control, should be wired to the right-hand terminal (as viewed from the rear of the control with the terminals facing upward); and this point, in turn, is wired to "ground."

Speaking of "ground" connections, all



Under-chassis view of the home-built "outboard" presence control.



Schematic diagram and parts list are shown directly at left. Table below lists different "presence" frequencies that may be emphasized with different C1 values. Bottom diagram shows how to connect "outboard" presence control into circuit of complete amplifier.

C1—0.0033-µfd. tubular capacitor (see table below)

CH1—1.5-henry, 10-ma. audio choke (Merit #C-2973 or equal)

R1—100,000-ohm, ½-watt composition resistor

R2—27,000-ohm, ½-watt composition resistor

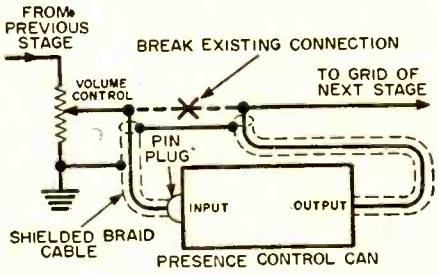
R3—50,000-ohm, ¼-watt linear taper potentiometer (IRC #Q-11-123 or equal)

1—Terminal strip with mounting foot and one insulated tie point

1—3¼" x 2⅛" x 1⅝" aluminum box

Misc. shielded cable, 4-40 x ¼ machine screws, 4-40 hex. nuts, standard phono plug and jack

C1 (µfd.)	Freq. (cps)
.01	1250
.0068	1800
.0047	2000
.0033	2500
.0022	3000
.0015	3500
.001	4000



HOW IT WORKS

In this version of the "presence control," a maximum accentuation of 6 db was found to be ideal, and the frequency of the "presence bump" was designed to be at 2500 cycles. To obtain these results, *R3* was selected as 50,000 ohms and *C1* was chosen to have a value of 0.0033 µfd. Since opinion and tastes vary as to the amount and frequency of "presence" which is ideal, other values of *C1* may be used for different "presence" center frequencies (see table above). Increasing the value of *R3* will produce somewhat greater maximum accentuation values. For example, if *R3* is a 200,000-ohm potentiometer, the maximum presence effect will be about 8.5 decibels. Increasing the value of *R3* much beyond this value will not materially increase the presence effect at maximum because the reactance of the inductance *CH1* itself begins to limit the action.

the ground-returns in the circuit should be returned to one point, preferably the ground side of the input jack. This procedure will minimize the possibility of annoying "hum loops."

Installing the Control. If your system includes a separate preamplifier-control-chassis and a basic power amplifier, or if you have an FM-AM tuner which includes tone controls and preamplifier, no additional wiring or soldering is required. Simply disconnect the cable now running between the output jack on your preamplifier and the input jack on your power amplifier at the power amplifier end. Connect the pin plug of this cable to the input jack of the presence control. Connect the pin plug of the presence control output cable to the input jack of the power amplifier.

The control shaft may be cut down to suitable length and an appropriate knob fitted to it. The knob selected should preferably have some sort of pointer or marking dot so that the control can be set to optimum values after you have had a chance to experiment with its action.

How to Use It. With the control turned fully counterclockwise, your hi-fi system will have its normal "flat" response. You may prefer this setting for listening to symphonic music where emphasis of a particular portion of the audible spectrum may not contribute noticeably to the overall results. Rotating the control clockwise causes a gradual insertion of mid-frequency emphasis. In the case of solo instrumentalists or vocalists, a setting of the control adds the feeling of "presence" without seeming the least bit unnatural.

If your equipment includes an all-in-one preamplifier-amplifier combination, it is a simple matter to "tap into" the circuit at a convenient point and take advantage of the presence effect. A suggested method of doing this is illustrated at left. Disconnect the lead now wired to the arm of your existing volume control. Run a length of shielded conductor cable from the arm of the volume control to the input of the presence control by installing a pin plug on the end of the shielded cable. The output cable of the presence control, less pin plug, should be spliced to the lead which was previously connected to the volume control. Solder both shielded braids (input and output) to the ground side of the volume control and the job is complete. —30—

WE'RE COMPLETELY BAFFLED

By Carl Kohler

I HAD BEEN SHAMBLING through the house and was on my third trip around when the wife intercepted me.

"Lose something?"

"Shhhh!" I hissed, pointing to the amplifier from which emanated the spirited harmonics of Ravel's *Bolero*. "Listen! Do *you* hear it?"

Cocking her head, she listened intently, then turned and eyed me suspiciously. "Sounds great to me. Always did like that piece. It's something-or-other from *South Pacific*, ain't it? What're you trying to prove, anyway?"

Taking her hand, I led her through all five rooms containing the small amplifiers. Pausing in each, I indicated (by sign language) that she was to listen closely. Finally, I led her back into the study where *Bolero* was beating forth in full hi-fi tones. I snapped the recording off.

"See what I mean!" I said emphatically.

"Frankly—no."

"Why it's so obvious that even *you* should be able to spot it—tin ear or no tin ear!" I declared with an amused chuckle.

"Who's got a tin ear?" she demanded irritably.

"Well, I'll draw you a word-picture. Our entire inter-room music system is nothing more than a series of five wide-range speakers. Here, in the study, is a regular hi-fi amplifier—complete with separate woofer, squawker and tweeter. Consequently, the moment the music leaves this room it loses that fine tonal quality achieved only by hearing it through separate speakers.

"Sounds great to me the way it is," she insisted. "Besides, I can smell another of your mad, expensive ideas. I suppose you're thinking of tearing out the whole system and replacing it with a lot of costly gismos —just so you can hear each violin, each horn and the conductor breathing behind his baton."

"That's it!" I cried joyously. "That's exactly why—"

"And I suppose that means not only splurging gobs of money, but tearing up the whole house, making a terrible mess with wires and tools and—"

"I'll be neater than a New England spinster," I promised—crossing my heart and making the scout sign. "You'll never know a thing has been changed until you hear the gloriously clear and faithful surges of—

"I've got a tin ear —remember?" she said acidly.

"Even so," I stated uncomfortably (wishing I'd kept my truthful observations to my big-mouthed self), "you'll notice a tremendous difference in the music around here, once I get the entire system hi-fi'ed."

"Wanna bet on it?" she chortled.

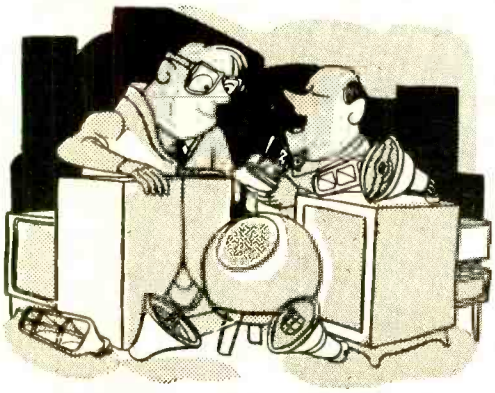
"Anything you say—anything!" I babbled confidently.

"Will you get me that color-TV set I want if I don't like the new music system?" she inquired, tiny lights of cunning leaping back and forth in her narrowed eyes.

"It's a deal," I agreed.

"It's all yours, sucker!" She departed, giggling snidely. I experienced a momentary flash of uneasiness, but squelched it with the surety that, given the latest components, I would build a music system guaranteed to thrill a tone-deaf aborigine.

(*Continued on page* 119)



. . . "Certainly, I'll send them today," Mr. Golenpaul assured me, adding up a rather horrendous column of figures and cackling happily to himself . . .

How to Fix Up Old Radios

By EUGENE F. CORIELL
Lt. Col., USAF

Don't throw out that broken-down set... minor repairs or tube replacements can give it new life

THERE'S a lot of fun to be had in fixing old radios—perhaps because there's a challenge to be met in substituting whatever parts are available for original components which can no longer be obtained. Also, since these old models can be bought in second-hand shops for fifty cents to a couple of dollars—or dug out of your basement or attic, this is an inexpensive way of acquiring an additional set for the rumpus room, workshop, garage, etc.

You will be able to save considerable time and trouble if you can secure a schematic and parts list of the "oldie." Some schematics are still available in a manual published by Supreme Publications, 1760 Balsam Rd., Highland Park, Ill., selling for $2.50. John F. Rider Publisher, Inc., 480 Canal St., New York, N. Y., also has provisions for supplying schematics at nominal fees. Contact these publishers if your "oldie" is a pre-war model.

Locate the Trouble. When you have lugged the set down from the attic, blow out the dust and, before firing it up, put an ohmmeter across the a.c. cord plug with the power switch in the set turned on. This is to make sure that there's no direct short circuit inside. If there is one, run it down point-to-point with your ohmmeter. Then put in any tubes needed, or substitutes for them, and plug in the set.

Perhaps it will work but the hum level will be high, in which case the electrolytic filter capacitors in the power supply are probably weak, open, or leaking electrically. In this latter instance, the rectifier tube and the power transformer will be very hot, due to excessive current flow.

Weak or distorted output is usually due to bad tubes, wrong plate, screen and bias voltages, defective resistors and capacitors, and badly oxidized soldered joints. And there is always the possibility that someone has been tinkering with the receiver and made some wrong connections. Hence the value of the schematic.

If the set produces no signal but the tubes light up, there is a complete failure of some component. Look for a bad tube, or open plate and screen resistors, open coupling capacitors, open speaker or power supply. These difficulties can be located by the first usual trouble-shooting techniques such as visual checks for loose, burned or broken components, then substitution of known good tubes, and finally signal tracing, voltage measurements and continuity checks.

The problem in servicing old receivers is

not so much in finding the cause of the trouble but in replacing defective and non-available parts with present-day items. Since parts costs may well run to several times the second-hand price of the set, a well-filled junkbox under the workbench can help hold these costs down. Let's start with the tubes.

Replace Obsolete Tubes. Many of the older tube types are no longer manufactured or are hard to find, but there are quite a few that can be replaced with modern types in the same sockets without wiring changes. Buy a tube substitution guide such as *TV And Radio Tube Substitution Guide*, available for fifty cents from H. G. Cisin, Amagansett, N. Y. An old guide of some value is *Successful Radio Repairing With Available Substitute Parts*, which was published during World War II by Supreme Publications.

Tube substitution guides show tubes that can be used in the same sockets for the same general purpose, as well as those that require socket or circuit changes. Some guides also indicate the need for certain precautions. For example, in a.c./d.c. sets, the tube filaments are in series and the same current flows through all the filaments. A substitute tube must therefore have the same filament current drain if circuit changes are to be avoided. This is also important in a.c. sets where the tube heaters are in parallel, since a substitute tube requiring additional current may overload the power transformer. Tube substitution guides should be used with discretion, and their data should always be checked against a standard tube data book such as the *RCA Receiving Tube Manual* for pin numbers and voltages.

When substitute tubes are used, they may result in broad or inaccurate tuning due to differences in internal tube capac-

(*Continued on page* 101)

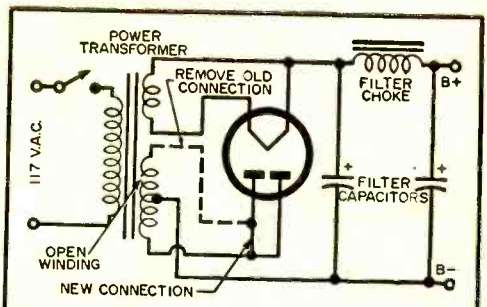


Fig. 1. Salvaging power transformer with half of high voltage winding open, by conversion from full-wave rectification to half-wave circuit.

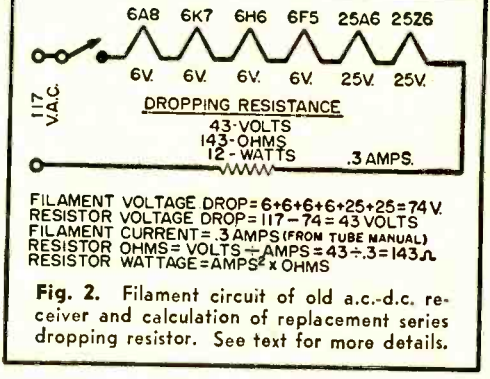


Fig. 2. Filament circuit of old a.c.-d.c. receiver and calculation of replacement series dropping resistor. See text for more details.

ORIGINAL	SUBSTITUTES	ORIGINAL	SUBSTITUTES
3B5	3C5, 3Q5	6X5	6AX5, 6W5
3C5	3B5, 3Q5	6W5	6AX5, 6X5
3Q5	3B5, 3C5	6W7	6J7, 6K7, 6S7, 6U7
5Z3	80, 83	25A6	25B6, 25C6, 25L6
6AB6	6N6	25B6	25A6, 25C6, 25L6
6AX5	6W5, 6X5	25C6	25A6, 25B6, 25L6
6B6	6Q7, 6R7, 6T7, 6V7	25L6	25A6, 25B6, 25C6
6D6	75, 77, 78	25Y5	25Z5
6J5	6L5, 6P5	25Z5	25Y5
6J7	6K7, 6S7, 6U7, 6W7	27	56
6K6	6V6	37	76
6K7	6J7, 6S7, 6U7, 6W7	41	42
6L5	6J5, 6P5	42	41
6N6	6AB6	50C6	50L6
6P5	6J5, 6L5	50L6	50C6
6Q7	6B6, 6R7, 6T7, 6V7	56	27
6R7	6B6, 6Q7, 6T7, 6V7	75	6D6, 77, 78
6S7	6J7, 6K7, 6U7, 6W7	76	37
6T7	6B6, 6Q7, 6R7, 6V7	77	6D6, 75, 78
6U7	6J7, 6K7, 6S7, 6W7	78	6D6, 75, 77
6V7	6B6, 6Q7, 6R7, 6T7	80	5Z3, 83

Table 1. Each substitute tube type listed fits the same socket as the original tube and requires the same heater voltage, but there may be differences in gain, internal capacitances, heater current and other characteristics. Glass and metal tubes of the same type are usually interchangeable, except that shielding cans may be needed when going from metal to glass tubes.

Tuning the Short-Wave Bands

=with Hank Bennett

I AM CUTTING back on the column this month in view of the very excellent feature article by Stew West on page 41. If there is some overlap between the information in his feature and in this column, it may be best to assume that Stew's material is a little more up-to-date. Next month I'll be back with more information and latest schedules.

Station Reports

The following is a resume of the current reports. All times shown are EST, based on the 24-hour clock. When sending your reports in, you may use any time zone that you wish, but please specify the one that you are using.

Brazil — PRL5, *R. Ministerio da Educacao*, Rio de Janeiro, 11,950 kc., can be heard on the West Coast with an excellent signal at 1640-1905. They feature a lot of classical music but little English. *(39)*

Cameroons — Last month we reported a French-speaking station on 4975 kc. that was believed to be *Radio Djibouti*, French Somaliland. This has proven to be incorrect; the station is Yaounde, Cameroons. S/off is around 1600. Afrikaans-type music is noted from 1540 and s/off is in French with no anthem. The 9270-kc. outlet may be inactive as it is not being heard now. *(GC)*

China—Shanghai, 9980 kc., is noted around 0600 with an all-Chinese program of music and talk and at 0830 with other Chinese programs. This one usually is quite weak, with c.w. QRM. *(AS, GC)*

Bill Berger is shown at his listening post in Fairfax, Oklahoma. The receiver which he uses is a Philco 38-3 and his antenna is 200 feet long.

Cyprus—ZJM4, Limassol, is noted on 6120 kc. at 1555, dual to 6790 kc., with an Arabic program. Both outlets close at 1600 after final ID. This is the first time that this one has been reported. *(GC)*

Egypt—For those who need this country, try for the Cairo Home Service on 9944 kc. around 1430 with Arabic news, or at 2310 with a march; music to 2315, chanting and music to around 2350. *(GC, 59)*

Ethiopia—*Radio Addis-Ababa* is scheduled as follows: Home Service, 0000-0030, 0430-0500, 0600-0700, and 1130-1330 on 6419, 9620, and 15,010 kc.; foreign service in English at 0500-0600, 1100-1130, and 1330-1430 on 9620 and 15,010 kc. Call letters and power are: 6419 kc., ETA94, 500 watts; 9620 kc., ETHA, 2500 w.; 15,010 kc., ETAA, 7500 w. *(34)*

Formosa—*The Voice of Free China*, Taipeh, can be heard on 15,225 and 11,815 kc. at 2355-0200 with various English programs. *(11)*

French Guinea—*Radio Conakry* is noted almost daily around 1600-1630 s/off with French music and language. Signal is usually poor to weak. This one signs off with a musical number, *not* "La Marseillaise." *(GC)*

Deutscher Demokratischer Rundfunk (DDR) operates daily (except Sunday) in English at 1500-1630-1730 (half-hour periods) on 9730, 7150, and 6115 kc. They continue at 1800 in French. ID is *This is Berlin, Democratic Germany, speaking to you.* They are asking for reports. *(44)*

Deutsche Welle, Cologne, can be noted on 11,795 kc. Sundays at 2130, with news to N.A. Has anyone ever heard their 1400-1405 news broadcast? *(6, 8)*

Guatemala—TGJA, *R. Nuevo Mundo*, 5990 kc., Guatemala City, is good most evenings at 2200-0100 with Latin American music and Spanish language commercials. This is not to be confused with TGTA, *Radio Sonora*, 6000 kc., Guatemala City, which is also easily noted at 0000-0055 s/off with light and classical music. *(WF, 61)*

Hong Kong—*Radio Hong Kong* on 3940 kc. has an English lesson on Tuesday, Thursday, and Saturday at 2300-2315. The address is: *Radio Hong Kong*, Electra House, 3 Connaught Road, Hong Kong. *(HK)*

Indonesia — One of the easier stations to hear from the Far East is YDF6, Djakarta, on 9710 kc. at 0615-0700 s/off with news and music. *(25)*

Iran — *Radio Teheran*, operating on 15,100 and 9680 kc., has an all-English session at

(*Continued on page* 122)

By LOUIS E. GARNER, Jr.

Transistor Amp Perks Up Your Ears

THE HIGH COST of commercial hearing aids has, to some extent, restricted their use by people who are very hard of hearing. A person whose hearing is only slightly impaired has only a limited need for a "high-gain" hearing aid and may, therefore, hesitate to invest the money needed to get one.

But here is a *transistorized* hearing aid circuit that should take top honors as a low-cost design. While it doesn't have quite the gain of expensive models, its sensitivity is adequate for many applications. What's more, the unit is smaller than a package of cigarettes. Cost has been kept low by using a special circuit requiring a few inexpensive parts.

Construction. Parts used in this hearing aid are standard and readily available. Neither parts layout nor wiring arrangement is critical. You can follow the layout shown here or make up a new one of your own.

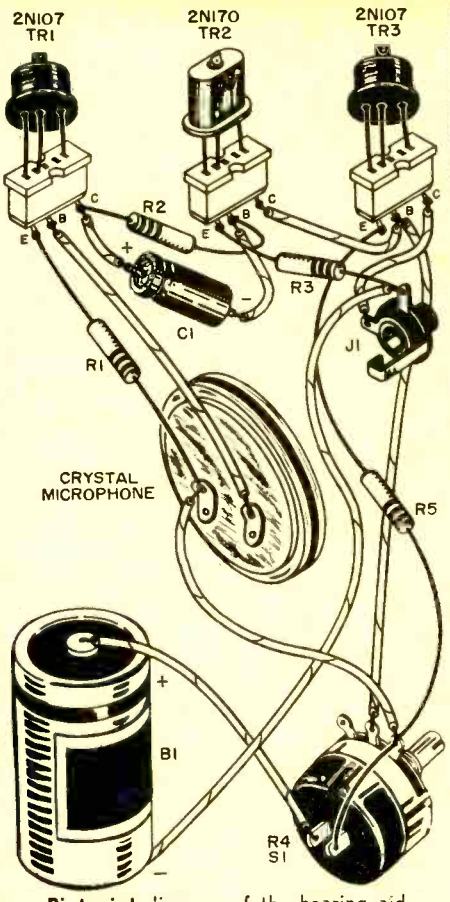
Three standard transistor sockets are cemented to the Bakelite chassis. Use of sockets makes it easy to change transistors, but for maximum economy, the sockets may be eliminated and the transistors soldered permanently into the circuit.

A 5.6-volt battery serves as the power supply. This is obtained by cutting a four-cell section from an RCA Type VSO 87 "separable cell" transistor battery. Then the battery "clip" is made from two long soldering lugs, mounted on the Bakelite chassis with small machine screws and nuts and formed to shape, after mounting, with a pair of long-nosed pliers. The *positive* terminal, as well as the *positive* end of the battery, may be identified with a dab of red fingernail polish.

Follow the diagrams when wiring the unit. Pay particular attention to the electrolytic capacitor *C1* and battery *B1* polarities. Do not install the battery or transistors until *after* all wiring has been double-checked.

A small plastic box serves as a case for

The circuit described here is presented not as a substitute for medically prescribed and fitted hearing aids, but as a likely experiment for transistor enthusiasts. We make no claims for its therapeutic value; there is no doubt, however, that it could be quite serviceable in a number of cases in which the hearing impairment is not so acute as to warrant a custom-fitted device. Because of its simplicity this circuit can be assembled for about $10.
The Editors



Pictorial diagram of the hearing aid.

HOW IT WORKS

This hearing aid uses a three-stage direct-coupled amplifier. Direct coupling eliminates the need for subminiature interstage transformers. One *n-p-n* and two *p-n-p* junction transistors are employed, with all three connected in the common-emitter circuit configuration. The direct-coupled arrangement utilizes the complementary characteristics of the two different types of transistors. Thus, the collector of one is connected directly to the base of the other type.

Sound picked up by the microphone is applied to the base-emitter circuit of *p-n-p* transistor *TR1*. After amplification, the audio signal is transferred to a type 2N170 *n-p-n* transistor, through *R2* and *C1*. Base bias is established by *R1*, the emitter-collector resistance of *TR1* and *R2*. The resulting audio signal is coupled directly to the base electrode of the third stage *TR3*. Control *R4* acts as a gain control.

Because of *R4's* "three-way" action, it is not adjusted like a simple gain control. Maximum gain is obtained with a setting midway between maximum and minimum resistance. Adjustment to either side of this value results in a loss of gain.

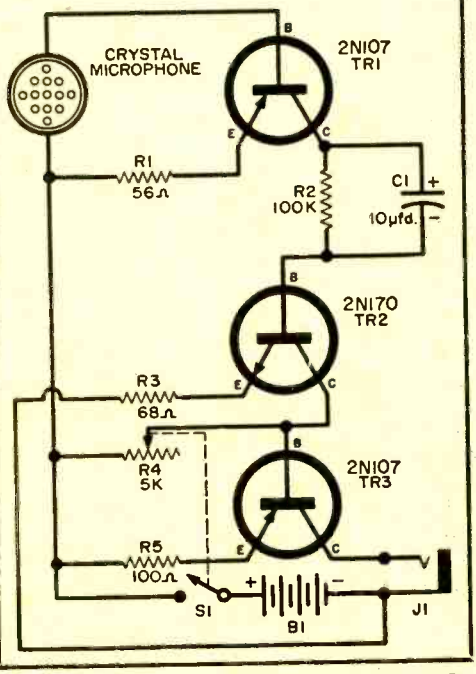
The third stage is given an improved input impedance characteristic and better stabilization by the use of an un-bypassed emitter resistor *R5*. The audio signal, after final amplification by the third stage, drives a high-impedance magnetic earphone which serves as the collector load for the final 2N107. Power for all three stages is supplied by a single battery *B1*.

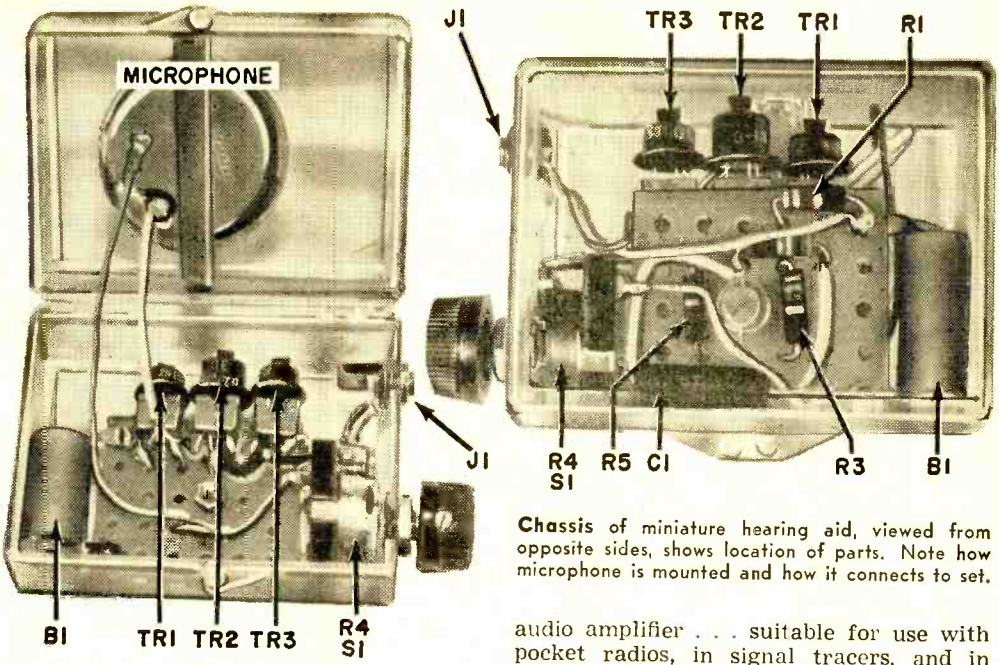
the unit. Mount the wired "chassis" in place with a single machine screw. The crystal microphone cartridge is held against a round cutout in the front of the case by a thin strap, cut from scrap aluminum. The aluminum strap, in turn, is mounted by two machine screws and nuts. Mount the output jack *J1* and gain control *R4* directly to the case.

Operation and Use. Construction completed, plug a high-impedance *magnetic*

Parts list and schematic diagram for the transistorized hearing aid are given below. For complete picture of how unit is put together, check photos on next page.

B1—5.6-volt battery (cut down from RCA VSO 87; see text)
C1—10-μfd., 6-volt electrolytic capacitor (Lafayette No. CF-103)
J1—Miniature phone jack (Lafayette No. MS-282)
R1—56-ohm, ½-watt carbon resistor
R2—100,000-ohm ½-watt carbon resistor
R3—68-ohm, ½-watt carbon resistor
R4—5000-ohm miniature potentiometer, with switch (Lafayette No. VC-27)
R5—100-ohm, ½-watt carbon resistor
S1—S.p.s.t. switch on R4
TR1, TR3—2N107 p-n-p transistor
TR2—2N170 n-p-n transistor
1—Crystal microphone cartridge (Argonne No. AR-52)
1—High-impedance magnetic earphone (Lafayette No. MS-260)
1—Subminiature phone plug
1—Small plastic box
3—Transistor sockets
Misc.—Bakelite mounting board; miniature control knob; soldering lugs; machine screws; etc.





Chassis of miniature hearing aid, viewed from opposite sides, shows location of parts. Note how microphone is mounted and how it connects to set.

earphone into jack *J1*. *A crystal earphone cannot be used.* With the 'phone to your ear, turn the gain control knob until *S1* clicks "on." Then, speaking in a normal voice, *gradually* adjust the gain control until maximum volume is heard in the earphone. This is the best setting of *R4* and *will not* be at full rotation. Adjustment of *R4* to either side of this setting will result in loss of gain.

In addition to its use as a hearing aid, this circuit makes a good general-purpose audio amplifier . . . suitable for use with pocket radios, in signal tracers, and in similar applications. Simply replace the crystal microphone cartridge with a high value (2 to 5 megohm) ½-watt carbon resistor and provide a fair size input coupling capacitor (0.5 to 2 μfd.).

In some cases, other *p-n-p* transistors, such as the CK722 or 2N34, may be used in place of the 2N107's specified, with other *n-p-n* units, such as the 2N35, used in place of the 2N170. Where different transistors are employed, however, some experimental changes in component values may be required.

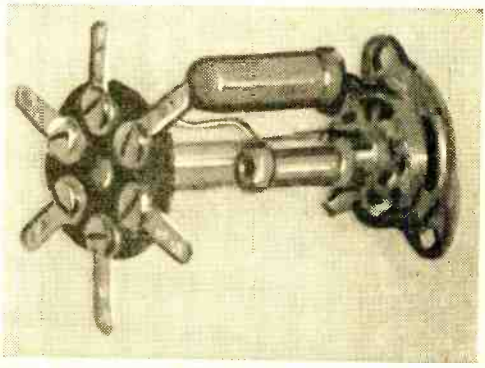
—30—

"Custom-Design" Your Own Vector-Type Sockets

Vector- or turret-type sockets, which are very useful where compact wiring is desired, have the disadvantage of being rather expensive for many experimenters. For considerably less money, you can build vector-type sockets such as those shown in the photo at right.

The turret can be built to accommodate the exact number of parts required. Also, the distance between the turret and the tube socket may be increased as desired to accommodate the largest component. Or an intermediary turret or ring can be added to provide additional tie points. By adding turrets in this fashion, it is possible to simulate the modules of the "Tinker Toy" type of electronic construction.

Actual construction is largely a matter of individual preference and also depends in part upon the type of tube socket used. The author used discs cut from Bakelite for the turrets and ¼" polystyrene rod for



the connecting pillars. The method of attaching the pillar to the 9-pin socket is male to female, while for the 7-pin type it is female to male. Acrylic cement is useful in glueing these parts. Solder lugs are held to the turret with machine screws in tapped holes. —*Wm. B. Rasmussen*

THE TRANSMITTING TOWER

Herb S. Brier, W9EGQ

THE REASON radio amateurs obtain licenses to operate transmitters is to talk to other amateurs. No matter how long we are hams, I doubt that any of us will ever forget the thrill of that first contact over our own station . . . the incredulous awe of hearing your own call letters coming back to you through your phones . . . how hard it was to control your transmitting key or to write down what the other fellow was saying, because your hands were shaking so much.

The thrill of just working other amateurs seldom leaves us entirely, but after a while the DX bug usually bites. One evidence of its bite is the desire to work the 48 states and to collect the 48 confirmations (QSL's) to earn a WAS ("Worked All States") certificate. This is a real accomplishment for any amateur, especially for a Novice, who must make all contacts in the crowded Novice bands.

Working All States. One way to work all states is simply to work different amateurs as they come along. If you work enough of them, you should eventually work the 48 states automatically. This method is satisfactory at first, because there are so many states to be worked. However, after about half of them are worked, new ones appear in the station log more slowly. But it can be done. George, W9BKJ, completed his WAS by this method a few months ago, only 35 years after making his first amateur contact.

A faster way to work all states is to become a good listener. Prepare a chart of the 48 states, arranged by amateur call areas. Make three columns headed "Date Worked," "Date QSL Sent," and "Date QSL Received" after the list of states. Keep the chart in your station log book.

Fill in the three columns as you work the states, and send and receive the QSL cards. As soon as all three are filled after the name of any state, you can forget that state as far as WAS is concerned. Pretty soon, you will have entire call areas eliminated in this manner.

Tom Sanford, W7CFG, who became a Novice and a Technician at 12, is assembling a 75-watt transmitter to use with his new General Class license.

Clayton Dunnihoo, KN5ESV, Shattuck, Okla., has a DX-35 transmitter and an S-85 receiver. He made 45 contacts in nine states in one month on the air.

For example, all WN6 and KN6 stations are located in California (unless they are operating "portable"). All WN9's and KN9's are in Illinois, Indiana, or Wisconsin, all WN2's and KN2's are in New York or New Jersey, and so forth.

You may also wish to write the call letters of the stations you work on the chart for reference, in the event that a promised card does not come through. It is no secret that collecting the 48 QSL cards is often harder than making the contacts themselves.

Searching for New Ones. You'll find that a copy of the latest *Call Book* is helpful in this respect. However, you will hear

(*Continued on page* 111)

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

Thomas G. M. Kubicko, 37 Matthew Drive, Stratford, Conn.

Robert L. Flesch, 13 Middle St., Caribou, Maine. (Code)

Paul Roy, Jr., 23 Lamothe Ave., Biddeford, Maine.

John Maikisch, 166 Washington St., Freeport, N. Y. (Code)

K2/W2 CALL AREA

Richard McMorrow, 347 Robin Rd., Englewood, N. J. (Code)

Angelo M. Juliano, 20 Hamas St., Clifton, N. J.

J. D. Wilson, 90 Doat St., Buffalo 11, N. Y. (Needs code practice and will give help on theory)

Richard Inzerillo (15), 1615 Putnam Ave., Brooklyn 27, N. Y. Phone: HE 3-9682. (Code and theory)

Gerald A. Grant, 154 Washington St., Lakewood 5, R. I.

Frank Gaff, Jr. (15), 38 E. 33rd St., Paterson 4, N. J. (Code and theory)

Louis A. Willis, IC3, USS Vogelgesang DD 862, C/O FPO, New York, N. Y.

Lewis Winkler, 100 Catherine St., Valley Stream, N. Y. (Theory and code)

Philip Schrag, 25 Shore Rd., Pelham, N. Y.

Robert A. E. King, 27-27 Ericsson St., East Elmhurst 69, N. Y.

K3/W3 CALL AREA

John S. Swain, 363 Fox Chapel Rd., Pittsburgh 38, Pa. (Code)

Richard Keech (13), 12702 Atlantic Ave., Rockville, Md. (Code and theory)

Skip Rockwell (13), 413 Meadow Rd., Glenshaw, Pa. (Code)

Redmond Stevens, 100 Jefferson St. N. W., Washington 11, D. C. (Code and theory)

Allen Weiss, 1537 Pennsylvania St., Allentown, Pa. (Code)

William R. Kight, 7707 Atwood St., S. E., Washington 28, D. C. (Code)

Paul R. Kight, 7707 Atwood St. S. E., Washington 28, D. C. (Theory)

L. Richard Woodyatt, 1901 E. Mountain Rd., Scranton, Pa.

James Hansen, 8844 Peebles Rd., Allison Park, Pa. (Code and theory)

Bob McElhose, WN3HFX, 419 Tenth St., Oakmont, Pa. (Theory)

K4/W4 CALL AREA

Frances Overhart (15), Apt. E-7, Heathwood Ct., Columbia, S. C. (Code and theory)

James Raws (16), Rt. 13, Fountain City, Tenn. (Code and theory)

Ben Carmichael (13), 4392 E. Brookhaven Dr. N. E., Atlanta, Ga. Phone: CE 7-8797. (Code and theory)

Robert L. S. Shenka, 5601 N. W. 4th Ave., Miami 37, Fla. (Code)

Fred C. Bale, 907 W. Oakridge Rd., Orlando, Fla.

K5/W5 CALL AREA

R. G. Stelter III (16), 2528 Mervosh Ave. S. W., Albuquerque, N. M. (Code and theory)

Silas Dunn (12), 712 South Cedar St., Little Rock, Ark. (Code and theory)

Kirby Griffin, Box 572, Bunkie, La. (Code and theory)

Hank Downey, R. F. D. 4, Hattiesburg, Miss.

Jimmy M. Shinn, 1418 8th St., P. O. Box 706, Las Vegas, N. M.

James E. Camp, 717 Anthony St., Bossicer City, La. (Code)

K6/W6 CALL AREA

Dennis Bender (13), 1323 11th Ave., Delano, Calif.

Carl Lee Wesson, 1131 23rd St., Manhattan Beach, Calif.

Robert Larson, 2204 Chestnut, Manhattan Beach, Calif.

Alfred Matsuno, 2942 9th Ave., Los Angeles 18, Calif.

Stephen Fouke, 1315½ No. Stanley Ave., Hollywood, Calif. Phone: HO 4-3972. (Needs help in theory and selection of equipment)

Ronney S. Brown, 3850 Dublin Ave., Los Angeles 8, Calif. (Code)

Roger Miller, 8021 Natick Ave., Van Nuys, Calif.

SP/3 Robert G. Gordon, RA27705601, C Btry, 441st AA MSL BN, Benicia Arsenal, Benicia, Calif. (Code and theory)

John Schwab, 4320 Vallejo Court, San Diego 17, Calif. (Code and theory; pen pals)

Donald Newell, 4743 Iroquois Ave., San Diego 17, Calif. (Code and theory; pen pals)

Jim Duggan, 577 Ramona Ave., Laguna Beach, Calif.

K7/W7 CALL AREA

Gayle Eastman (16), Rt. 1, Box 286, Clackamas, Ore. (Code and theory)

Samuel J. Reed, 2020 E. Turney Ave., Phoenix, Ariz. (Code)

Eugene Martin (14), Cornish, Utah.

Dave Wicke, P. O. Box 114, Cherry Grove, Ore. (Code)

Bruce Store, 1619 S. E. Clayborne, Portland, Ore. (Code and theory)

Roger Palmer, 153 Piermont St., Apt. 4, Salt Lake City, Utah. (Code)

K8/W8 CALL AREA

Ronald Kregoski, 9915 Fox, Allen Park, Mich. (Wants help in obtaining General Class license)

B. C. Parker, P. O. Box 423, Detroit, Mich. Phone: TY 4-9462.

Tim Sakach, Eddy Rd., R. D. #1, Willoughby, Ohio.

Richard Pytlak, 20101 Charest, Detroit 34, Mich. (Code and theory)

Clarence Dempsey, Lookout, W. Va.

Tom Koerber, 1304 Girard Ave., Middletown, Ohio. (Code)

K9/W9 CALL AREA

Ronald Moore (15), 8205 South May St., Chicago 20, Ill. Phone: RA 3-1569. (Code)

Dodge Bruch, 1324 W. Harris St., Appleton, Wis.

Richard Grelck, 4048 N. Campbell, Chicago 18, Ill. (Code)

Clement Riedner, Rt. 2, Frederic, Wis. (Code)

KØ/WØ CALL AREA

Terry Jackson, P. O. Box G, Kenesaw, Nebr. (Needs help in General Class theory)

Bob Barth (13), 3300 Magnolia, Denver 7, Colo. (Code and theory)

Raymond K. Blair, Jr., La Belle, Mo.

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 33⅓ 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

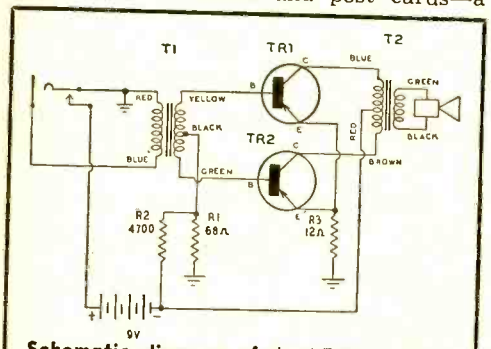
By LOU GARNER

IF YOU HAVE FOLLOWED this column since it first started, chances are you've noticed a number of changes. Often, these have been brought about as a direct result of your suggestions and comments, for it is through your cards and letters that we learn exactly what you'd like to see and read here.

This month we're making another change. In the past, we've featured a *Reader's Circuit* in every issue. But last December we included an experimental circuit from another source . . . a code practice oscillator from CBS-Hytron's new booklet of power transistor circuits. We didn't discuss the circuit in much detail because of limited space. However, your response was most gratifying.

As a result, in the future we'll feature experimental circuits from *many* sources . . . from you, the readers . . . from books . . . from manufacturer's literature . . . from outstanding transistor kits . . . in fact, from wherever interesting circuits can be obtained. And we'll make a special effort to include the type of circuits you request . . . if you'll send us a post card and let us know what you'd like to see.

Loudspeaker Amplifier. There is one circuit that you have requested time and again in your letters and post cards—a simple "power amplifier" stage . . . that is, a transistor amplifier which produces good loudspeaker volume, which uses easy-to-obtain low-cost components, and which can be added to any transistor receiver or other piece of gear designed for earphone operation. Lafayette Radio (165-08 Liberty Ave., Jamaica 33, N. Y.) features such a circuit in its Model KT-96 push-pull audio output speaker kit. With Lafayette's permission, we are reproducing the full circuit diagram here, complete with *all parts values*.



Schematic diagram of the KT-96 push-pull audio output speaker kit. Note in this wiring arrangement that the sleeve of the phone plug must be the signal lead and that the tip is the ground connection. The positions are reversed to permit the battery to be saved when the unit is not in operation. Simply plugging in the phone jack turns on the amplifier.

In operation, inserting a plug in the input jack turns the circuit "on." The input audio signal is applied to the primary of transformer *T1*, which serves the dual function of providing two signals to the push-pull stage and of matching the low input impedance of the transistor amplifier. The amplified output signal is coupled to the loudspeaker through the output transformer *T2*.

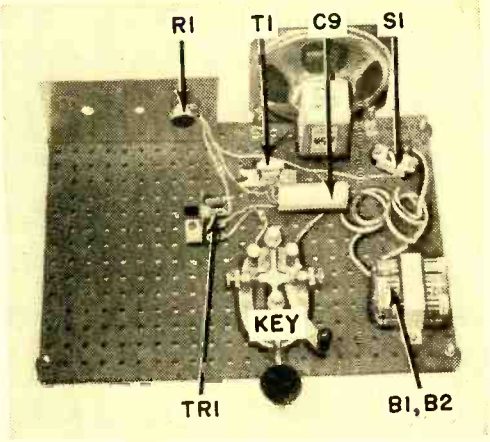
The Lafayette KT-96 kit (above, right) was designed to be used with Lafayette Radio's transistor superhet kit called the KT-94 (above, left).

Transistors *TR1* and *TR2* may be either Raytheon Type CK722 or G.E. Type 2N107. The input jack is a switch-type jack made by Telex. Input transformer *T1* is an Argonne Type AR-109. Output transformer *T2* is Argonne Type AR-119. Any loudspeaker with a 3.2-ohm voice coil may be employed. A Burgess Type P6 or RCA Type VS300 battery may be used for the

(*Continued on page* 124)

Transistor Experiment No. 15

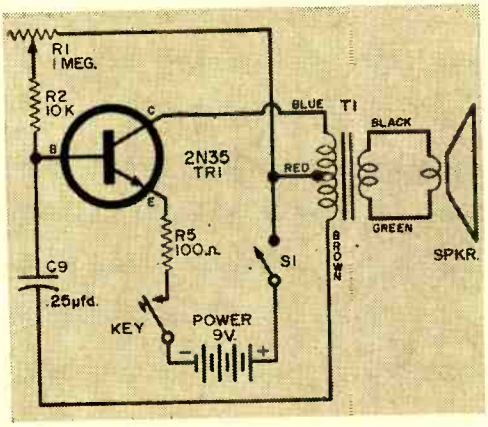
Code Practice Oscillator



THIS is another experiment in the series that started in the March, 1956, issue. The last experiment, No. 14, appeared on page 85 of the January, 1957, issue.

If you assemble the circuit shown in the wiring diagram, you won't have to wear a headphone to practice your "dits" and "dahs." You and your friends may even want to work in a group when learning code, since the output volume of this code practice oscillator is ample for a small class.

Except for the usual care regarding battery polarity, there are no special precautions which you must observe when wiring the oscillator. Be sure to connect the proper transformer leads, however—these are color-coded to facilitate identification.



With the wiring completed, install the transistor and close switch *S1*. Close the "KEY" and adjust *R1* for the tone you prefer. Once these simple steps are completed, you're ready to practice! You can "dit" and "dah" to your heart's content, for battery life is quite long, and penlite cells are inexpensive.

The transistor is connected in the common-emitter circuit configuration, with audio transformer *T1* serving a dual purpose. Its center-tapped primary winding provides the feedback necessary to sustain oscillation while the transformer itself serves to match the impedance of the transistor to the impedance of the loudspeaker's voice coil, insuring a good transfer of audio energy.

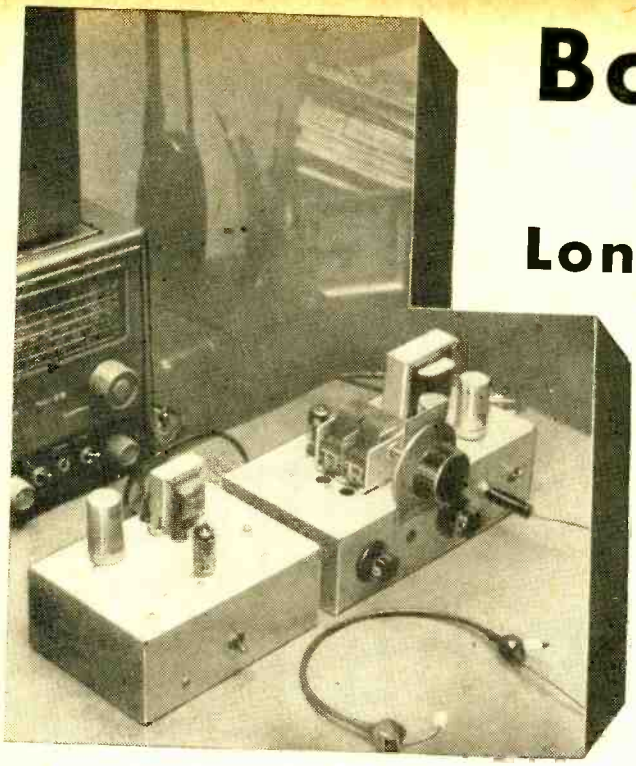
Feedback provided by the transformer between *TR1's* collector and base circuits is more than is needed for oscillation. As a result, "blocking oscillator" action takes place, with the rate of blocking depending on the *RC* time constant in the base-emitter circuit, and hence on the value of capacitor *C9* and resistors *R1* and *R2*. With *C9* and *R2* having fixed values, the setting of *R1* determines the blocking rate and hence the frequency ("tone") of the output signal.

Emitter resistor *R5* serves to protect the transistor against damaging current surges as the oscillator is keyed. Except as a protective measure, it is not essential to the operation of the circuit.

Power is supplied by the 6-cell 9-volt supply used in earlier projects, controlled by s.p.s.t. switch *S1* and the "KEY." —*Louis E. Garner, Jr.*

Boosting Your Long-Wave DX

By FRANK H. TOOKER



Easily built device improves reception, rejects interference

IF YOU ARE TUNING the long-wave band (100-500 kc.) and would like to fish for DX, or if you have been troubled by interference from broadcast stations leaking through your receiving setup, then this booster is for you. It requires no manual tuning. You merely connect it between your antenna and your receiver or converter, make one simple adjustment, and then tune your setup.

This booster has filters in both its input and output circuits to prevent interference from broadcast stations.

Construction. The various parts of the booster can be quite easily seen in the photos. Of particular importance is the placement of *RFC1, RFC2,* and *RFC3*. It is imperative that these three coils be arranged for minimum magnetic coupling. Note that *RFC1* and *RFC2* are mounted on 2-lug tie points and are arranged with their axes at a right angle to each other. These coils should be separated as widely as the space between the centrally mounted tube socket and the end of the chassis will allow. Too close spacing harms bandpass action.

Locate output coil *RFC3* on the opposite side of the chassis with its axis at a right angle to those of *RFC1* and *RFC2*. In other words, *RFC1* should be mounted with its axis *parallel to the length* of the chassis deck. Mount *RFC2* with its axis *parallel to the width* of the chassis deck, and *RFC3* with its axis *perpendicular* to the chassis deck.

Modifying Output Choke. To get resonance in the output circuit at the desired frequency, the Meissner 19-1995 r.f. choke used as *RFC3* must be modified before you mount it on the chassis. Clip the *outside lead* of the winding, remove 300 turns, then

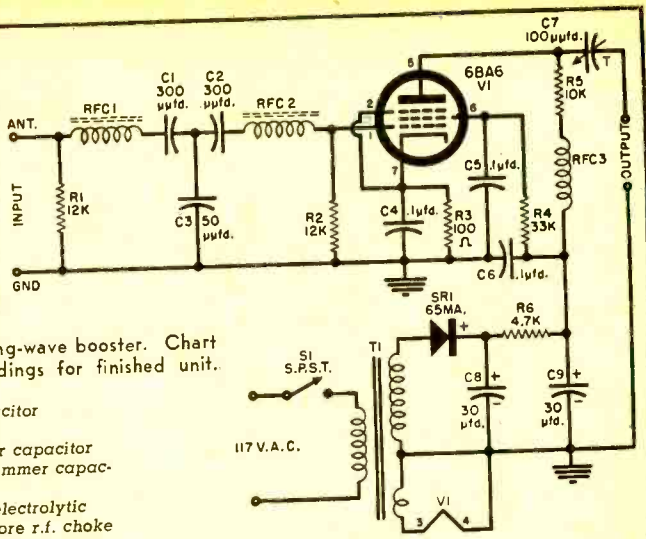
HOW IT WORKS

A type 6BA6 remote-cutoff pentode tube is used in this r.f. stage to prevent cross-modulation in the presence of strong signals. Input circuit components *R1, R2, RFC1, RFC2, C1, C2,* and *C3* form a low-frequency bandpass filter, which permits the passage of signals between approximately 100 and 450 kc. It rejects those at lower and higher frequencies. In the booster's output circuit, the inductance of *RFC3,* combined with its distributed capacitance, stray circuit capacitance, and the output capacitance of the tube, tunes to about 350 kc.

Below 350 kc., the output load circuit is inductive, and the inductive reactance of *RFC3* combines with the resistance of *R5* to permit adequate gain down to 100 kc. Above 350 kc., the output circuit tends to become capacitive; and the capacitive reactance, decreasing as the frequency increases, causes the gain of the booster to begin dropping at higher frequencies. Thus, the characteristics of the output circuit are such that they aid those of the input circuit in the rejection of broadcast station interference. *R5* is actually a part of the output tuned circuit, even though it appears to be merely in series with an r.f. choke. As a part of this circuit, *R5* prevents the gain from rising too high at resonance. The result is a fairly uniform frequency response curve.

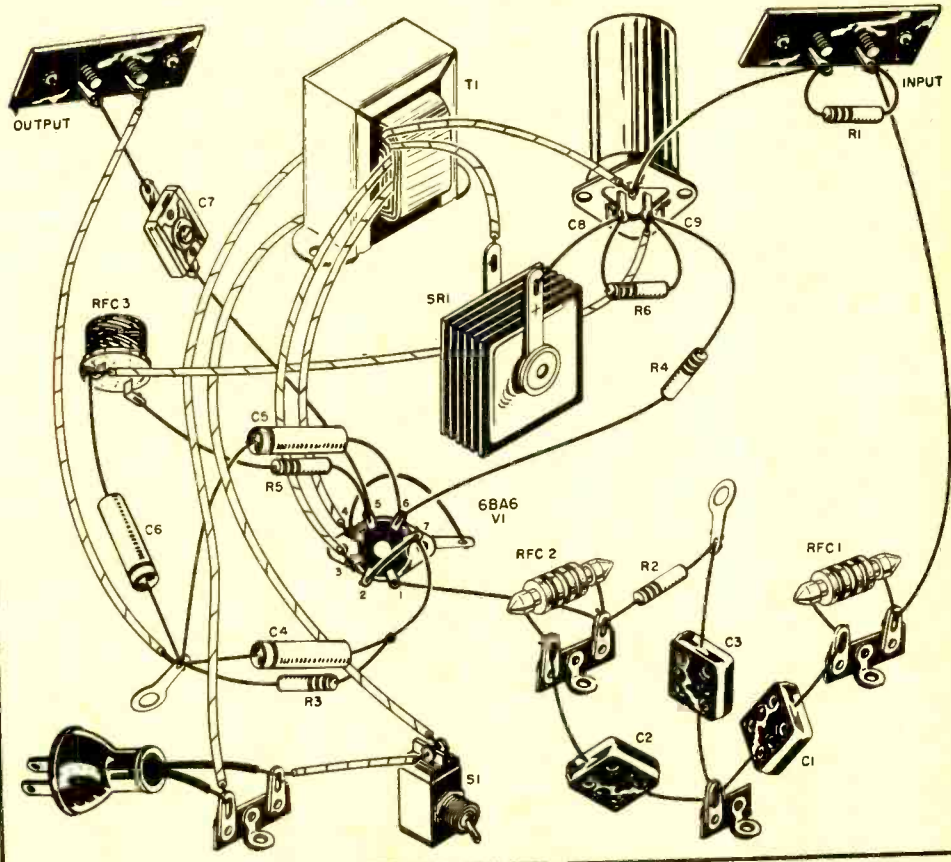
If desired, two of these boosters may be connected in cascade, i.e., one following the other, to realize even greater amplification of long-wave DX signals.

TUBE VOLTAGE CHART	
Pin	**Volts to Ground**
1	0
2	0.65 d.c.
3	6.3 a.c.
4	0
5	70 d.c.
6	55 d.c.
7	0.65 d.c.



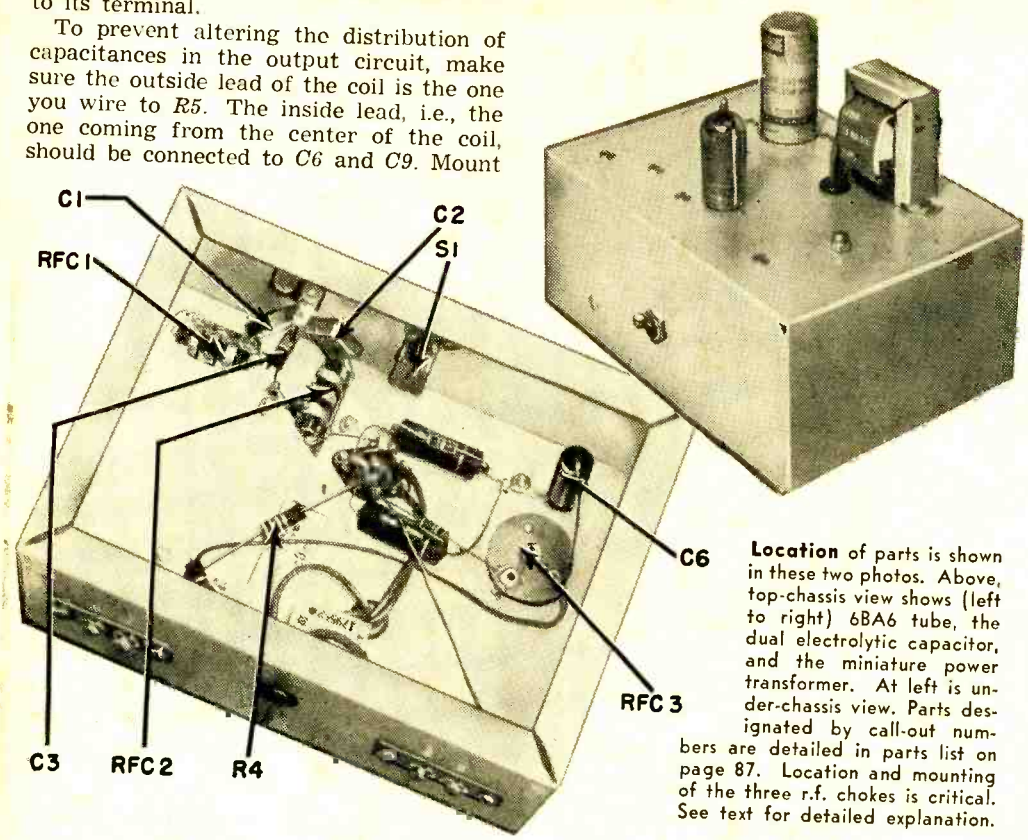
Diagrams and parts list for the long-wave booster. Chart above shows normal voltage readings for finished unit.

C1, C2—300-μμfd. silver mica capacitor
C3—50-μμfd. silver mica capacitor
C4, C5, C6—0.1-μfd., 400-volt paper capacitor
C7—100-μμfd. mica-compression trimmer capacitor
C8, C9—30/30-μfd., 150-volt dual electrolytic
RFC1, RFC2—5-millihenry ferrite-core r.f. choke (Grayburne F-50 or equal)
RFC3—Output coil (Meissner 19-1995 r.f. choke with 300 turns removed—see text)
R1, R2—12,000-ohm, ½-watt composition resistor
R3—100-ohm, ½-watt composition resistor
R4—33,000-ohm, 1-watt composition resistor
R5—10,000-ohm, ½-watt composition resistor
R6—4700-ohm, 2-watt composition resistor
S1—S.p.s.t. toggle switch
SR1—65-ma., 130-volt selenium rectifier
T1—Miniature power transformer, 125 volts at 15 ma. d.c., 6.3 volts at 0.6 amp. (Stancor PS-8415 or equal)
V1—6BA6 tube
1—5" x 7" x 3" aluminum chassis
2—2-terminal strips
1—Miniature 7-pin tube socket
1—Power cord and plug
Misc. tie points, rubber grommets, wire, solder



clean, tin, and resolder the end of the wire to its terminal.

To prevent altering the distribution of capacitances in the output circuit, make sure the outside lead of the coil is the one you wire to *R5*. The inside lead, i.e., the one coming from the center of the coil, should be connected to *C6* and *C9*. Mount



Location of parts is shown in these two photos. Above, top-chassis view shows (left to right) 6BA6 tube, the dual electrolytic capacitor, and the miniature power transformer. At left is under-chassis view. Parts designated by call-out numbers are detailed in parts list on page 87. Location and mounting of the three r.f. chokes is critical. See text for detailed explanation.

the coil with a ⅝" brass or aluminum spacer between it and the chassis, and secure it with a brass (not steel) screw through its center.

Hookup Hints. Orient the tube socket to place pins 1 and 2 toward the front of the chassis. This will position the grid (pin 1) close to the end of *RFC2* for a short lead between these two points, and will permit direct wiring of the remainder of the circuit without any crossing of input and output leads. Most of the components can be wired in point-to-point by means of their own leads and terminals. Make sure the outside foil of each bypass capacitor (*C4*, *C5*, and *C6*) is connected to chassis ground. The lead for the outside foil is usually identified either by the words "outside foil" or a line printed around this end of the capacitor.

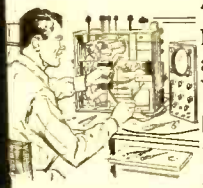
Mount the small, adjustable, compression-type output capacitor *C7* vertically between one of the lugs on the output terminal strip and a single-lug tie point. A ⅜"-diameter hole drilled just above the output terminal strip permits easy access to the capacitor for adjustment. The solder lug for the capacitor plate that is in contact with the adjusting screw should be the one soldered to the lug on the output terminal strip. Make sure of this when you're assembling the booster, since reversing *C7* would make the adjusting screw "hot" with plate voltage.

A chart of the operating voltages measured directly at the tube socket is given on page 87. Use this chart for comparison with your own measurements if you run into difficulties. Any readings which are considerably different from those given in the chart indicates that something is wrong in the wiring or with one or more of the components in your booster. Minor variations are usually of no consequence.

Using the Booster. Disconnect the antenna and ground from your long-wave receiver (or converter) and connect the output terminals of the booster in their place. Connect the antenna and ground to the input terminals of the booster. Then turn on your receiver and the booster, and adjust the output trimmer *C7* for optimum reception of all stations.

To keep broadcast station interference at a minimum, make the leads between the output of the booster and the antenna and ground terminals of the receiver (or converter) as short as possible. —30—

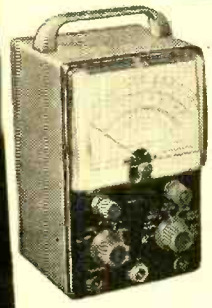
HEATHKITS . . . are fun to build, and you save by dealing directly with the manufacturer!



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

MODEL V-7A

$24.50

Shpg. Wt. 7 lbs.

$2.45 DWN., $2.06 MO.

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.

Compact, portable . . . a favorite in the home and in the service shop

HEATHKIT HANDITESTER KIT

MODEL M-1

$14.50

Shpg. Wt. 3 lbs.

$1.45 DWN., $1.22 MO.

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.

New improved . . . full 5" size . . . etched circuit for only

$42.50

Shpg. Wt. 21 lbs.

$4.25 DWN., $3.97 MO.

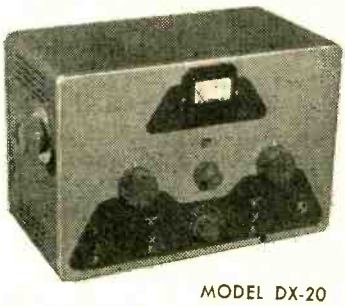
MODEL OM-2

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."

HEATH COMPANY • BENTON HARBOR 10, MICH.

A Subsidiary of Daystrom, Incorporated



MODEL DX-20

$3.60 DWN., $3.02 MO.

$35.95

Shpg. Wt. 18 lbs.

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 SG-8

$19.50

$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

$30.75

incl. Fed. Excise Tax (less cabinet)

Shpg. Wt. 12 lbs.

HAM BANDS CLEARLY MARKED

$3.08 DWN., $2.58 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 — headphone 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.

MODEL GD-1B

$19.95

$2.00 DWN., $1.68 MO.

Shpg. Wt. 4 lbs.

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 parasitics, 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.

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.

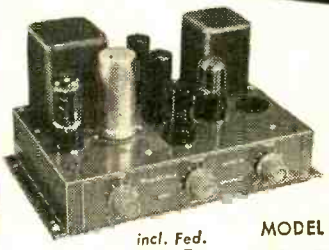
MODEL BR-2

$19.25

incl. Fed. Excise Tax (less cabinet)

$1.92 DWN., $1.62 MO.

Shpg. Wt. 10 lbs.



incl. Fed. Excise Tax

$1.87 DWN., $1.57 MO.

MODEL A-7D

$18.65

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.

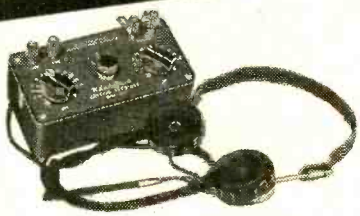
MODEL CR-1

$8.75

incl. Fed. Excise Tax

Shpg. Wt. 3 lbs.

$.88 DWN., $.73 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

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.

MODEL ET-1

$11.50

Shpg. Wt. 3 lbs.

$1.15 DWN., $.97 MO.

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.

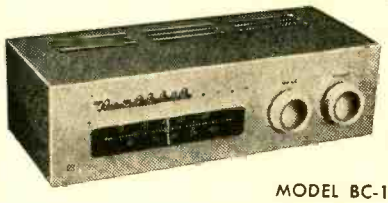
MODEL FM-3A

$26.95

incl. Fed. Excise Tax (with cabinet)

Shpg. Wt. 7 lbs.

$2.70 DWN., $2.26 MO.



MODEL BC-1

$26.95

incl. Fed. Excise Tax (with cabinet)

Shpg. Wt. 8 lbs.

$2.70 DWN., $2.26 MO.

NEW EDGE-LIGHTED TUNING DIAL. MATCHES MODEL FM-3A

HEATHKIT BROADBAND

AM TUNER KIT

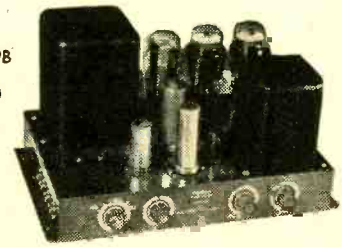
The BC-1 was designed especially for high fidelity applications. It features a low-distortion detector, broad band IF's, and other characteristics essential to usefulness in hi-fi. Sensitivity and selectivity are excellent, and audio response is within ± 1 DB from 20 CPS to 2 KC, with 5 DB of pre-emphasis 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

$35.50

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 ± 1 DB from 20 CPS to 20,000 CPS. Total harmonic distortion only 1% (at 3 DB below rated output).

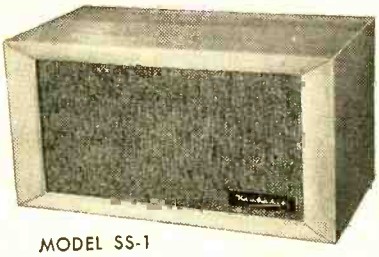
HEATH COMPANY • BENTON HARBOR 10, MICH.

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 ± 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
$39.95
Shpg. Wt. 30 lbs.

$4.00 DWN.,
$3.36 MO.

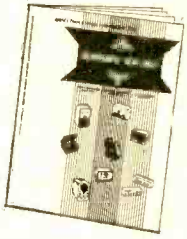
MODEL SS-1B
$99.95
$10.00 DWN.,
$8.40 MO.
Shpg. Wt. 80 lbs.

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 ± 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
		POSTAGE	
		TOTAL	

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.

AFTER CLASS

Special Information on Radio, TV, Radar and Nucleonics

THE BINARY TRIGGER

FIRST described in 1919 by Eccles and Jordan, the circuit arrangement which we now call a "binary trigger" gave little indication of the importance it was to assume later in the century. Modified but slightly to conform with changes in vacuum-tube parameters over the years, the Eccles-Jordan trigger circuit may be found in computers, as frequency dividers in counters, medical equipment, and in communications systems of all kinds.

The chief characteristic of the basic hookup (see page 96) is its ability to divide the number of input pulses it receives by two; for example, if 300 pulses are fed to the system in a given time, there will be only 150 output pulses in the same interval. By making the output voltages serve as input for a second trigger circuit, the resultant count would be 75 for the same time. This process may be continued indefinitely, making it possible to bring the frequency of even high speed pulses down to the point where they may be counted by slow electromagnetic solenoids.

Here's the way the circuit works: Assume that both triodes are conducting equally for the moment. Any random circuit change will cause one of the tubes, say *V1*, to experience a slight increase in plate current which causes the voltage drop across *R1* to rise. This makes the plate of *V1* negative-going (increased drop across *R1* leaves *less* positive plate voltage than before), an effect that is transmitted to the grid of *V2* through *R3*. As this grid becomes slightly less positive, or more negative, its plate current decreases, causing a smaller voltage drop across *R2*. The plate of *V2* thus becomes somewhat more positive; this change is transferred to the grid of *V1* through *R4*, raising the plate current of this tube a bit more. The drop

BUILD 16 RADIO CIRCUITS AT HOME

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

only **$19.95**

Reg. U.S. Pat. Off.

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. Out Kit is 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" will provide you with a basic education in Electronics and Radio, worth many times the complete product of many years of teaching and engineering experience. The "Edu-Kit" will 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 any voltage from 105 to 125 volts, AC and DC. For use in countries employing higher line voltages, a 210-250 Volt AC/DC model is available.

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 educational 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 Printed Circuit 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 High 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 that 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." Our Consultation Service will help you with any technical problems you may have.

J. Stataitis, 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 them. I have been in Radio for the last seven years, but like to work with Radio Kits, and like to build Radio Testing Equipment. I enjoyed every minute I worked with the different kits; the Signal Tracer works fine. Also like to let you know that I feel proud of becoming a member of your Radio-TV Club."

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 of it 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.

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

UNCONDITIONAL MONEY-BACK GUARANTEE

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

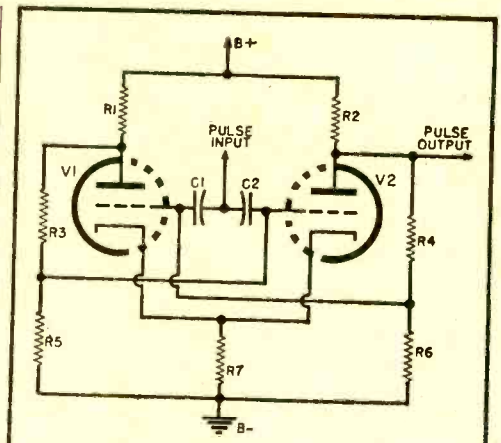
☐ Send "Edu-Kit" Postpaid. I enclose full payment of $19.95.
☐ Send "Edu-Kit" C.O.D. I will pay $19.95 plus postage.
☐ Send me FREE additional information describing "Edu-Kit." Include FREE value Hi-Fi, Radio and TV Servicing Literature.
(Outside U.S.A.—No C.O.D.'s. Send check on U.S. bank or Intern't'l M.O. "Edu-Kit" for 105-125 V. AC/DC $20.95; 210-250 V. AC/DC $23.45.)

Name .....

Address .....

.....

PROGRESSIVE "EDU-KITS" INC.
497 Union Ave., Room 529D, Brooklyn 11, N. Y.



Basic hookup of binary trigger circuit.

across *R1* again increases, making the plate of *V1* even more negative-going. Clearly, the effect is cumulative, with the grid of *V2* finally going negative enough to cut off the plate current. All this takes a tiny fraction of a second. At the time when *V2* is cut off, the grid of *V1* reaches approximately zero voltage and the system becomes stable, the plate current of *V1* being just about as large as it can become.

Now assume that a short positive pulse is applied to the input terminal. It is passed along to *both* grids through *C1* and *C2*, but it can have no effect upon *V1*, as this tube is already conducting to capacity. It does, however, drive the grid of *V2* somewhat positive, instantaneously taking it out of the cutoff condition, allowing a bit of plate current to flow, and causing a negative pulse to appear at the grid of *V1*. This starts the plate current of *V1* on its way down assisted by the same kind of feedback from one tube to the other as just described. As a result of this positive pulse, the circuit has "flipped" to the condition in which *V2* is conducting and *V1* is cut off. A second positive pulse prods the circuit back to its original condition, producing an output pulse at the output terminal connected to the plate of *V2*.

Hence, for every *two* input pulses, one output pulse appears.

RESONANCE QUIZ

TUNE across your radio receiver dial and note the number of stations received. Now try to imagine the confusion which would result if all of these stations were received simultaneously. The jumble of sounds from the loudspeaker would be both meaningless and annoying. Since this does not normally happen, it is obvious that the receiver is capable of *sorting out* the desired station from the many signals picked

FEBRUARY "BEST-SELLER" FESTIVAL!

63 of our Biggest-Selling Values!
AVAILABLE ONLY FROM LEKTRON!

ANY $1 ITEM FREE WITH $10 ORDER
FREE GIFT WITH EVERY ORDER

FREE! 8-PAGE 1957 FLYER OF BARGAINS Write Today!

BUY-OF-THE-MONTH!
GIANT SOLAR BATTERY

NEW! Giant hi-output Sun Battery powers 1 or 2-transistor radios from SUN, DAYLIGHT or even 60 watt lamp! 2½ x 1⅞ x ½" sealed case w/plastic window. Ideal for all sun-power experiments! Buy several at this fabulous price! Reg. $10 **$2.98** K-321

74-page SUN BATTERY HANDBOOK K-322 only $1.50

LEKTRON'S FAMOUS KIT KING® DOLLARBUYS! EXCLUSIVE!

HOBBY TRANSFORMER. 115VAC, 60 cycle to 24V @ 3 Amps. Fil. transformer for shop, surplus gear, hobbyists. Wt. 3 lbs. Reg. $6. K-317 **$1**

2 TRANSISTOR LOOPSTICKS, tapped. Match trans. input impedance for better selectivity. K-315 **$1**

APPLIANCE MOTOR. 3,000 rpm, 115VAC, 60 cycles. For fans, blowers, hobby uses. Fan blade, 35¢ extra. Wt. 2 lbs. Reg. $4.50. K-167 **$1**

FOUR G-E IN69 DIODES. Germanium, superior to commercial. Reg. $3. K-300 **$1**

2 TRANSISTOR COUPLERS. Eliminate transf. & r/c coupled amp. stages. 100K imp., 5000 DC ohms; center tapped. ⅞" x ⅞". Reg. $3. B-739 **$1**

HOBBY TRANSISTOR. Scoop! Plug-in type printed circuit transistor. Reg. $3.75. K-156 **$1**

WORLD'S SMALLEST RADIO KIT. 2½ x 1¼ x ¾". Permability tuner, diode, pre-drilled case. All parts, instructions. Reg. $3.50. B-677 **$1**

SUN BATTERY & photocell. 1⅛" dia. Better than famed B2M! Reg. $5. B-670 **$1**

125 RESISTORS. Carbon, ½ to 2W, 40 values: 5 ohms to 10 megs. 5%, too! Reg. $15. K-164 **$1**

3 OUTPUT XFMRS. (Choose any 3) 50B5, 35L6, 50L6, 6V6; to 3-4 ohms. Reg. $1.50 each. K-301 **$1**

7 PILOT LITE ASSEMBLIES. Std. mtg Amber jewel, enclosed. Miniature bayonet. Reg. 75¢ each. K-302 **$1**

3 LBS. HARDWARE. 2000 pcs. asstd. screws, springs, washers, etc. Reg. $8. K-104 **$1**

G-E PREAMP KIT for magnetic cartridges. Chassis, parts, diagram. Less 6SC7 (88¢ extra). Wt. 1 lb. Reg. $4.50. K-103 **$1**

175-ft. HOOKUP WIRE in 25-ft. rolls. Asstd. colors, stranding, insulation. #18 to 24. Wt. 2 lbs. Reg. $3.75. K-129 **$1**

100 CERAMIC CONDENSERS. Asstd. types, top makers. 30 values, color-coded. Discs, too. Reg. $15. K-152 **$1**

4 CRYSTAL DIODES. Most commonly used—1N34, 1N56, 1N58, 1N69 in poly bag. Reg. $5. K-303 **$1**

150 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, 1 to 20 screw and solder points. Wt. 1 lb. Reg. $5. K-153 **$1**

70 RESISTORS. Insulated IRC, A-B, etc. 5 ohms to 10 megs; ½, 1 & 2 W. 1% & 5%. Wt. ½ 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**

70 STANDARD KNOBS. Asstd. colors, bakelite & plastic. Wt. 2 lbs. Reg. $9. K-143 **$1**

1000 RADIO PARTS! Wide variety resistors, condensers, pots, plugs, strips, slugs, forms & more! Reg. $10. K-306 **$1**

30 POPULAR BULBS. 1.1 to 6V, screw and bayonet types, miniature. Wt. ½ lb. Reg. $2.40. K-113 **$1**

25 PORCELAIN CONDENSERS, tubular. 10 values: .001 to .03 mf to 1000WV. Wt. ½ lb. Reg. 25¢ each. K-308 **$1**

40 MINIATURE CONDENSERS. Asstd. 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 & carbofilm. 30 values, 56 ohms to 1 meg; ½, 1 & 2W. 1% tol. Wt. ½ lb. Reg. $21. K-150 **$1**

30 TUBE SOCKETS, 4 to 11-prong miniatures, subminiatures, octals, zip-ins. Tube shields, too. Wt. 2 lbs. Reg. $6.50. K-154 **$1**

15 SUBMINIATURE CENTRALAB TRIMMERS. Asstd. values, for printed circuits, etc. Reg. 79¢ each. K-310 **$1**

15 CERAMIC VARIABLE condensers. Erie, Elmenco, up to 300mmf. Reg. 85¢ each. Duals, too! K-105 **$1**

12 VOLUME CONTROLS. Singles, concentric, TV, some w/ switch. Standard shaft. Up to 1 meg. Some $2.50 each. K-311 **$1**

12 ROTARY SWITCHES, ceramic & bakelite, 1, 2, 3 gangs. Standard shafts. Shop must! Wt. 3 lbs. Reg. $10. K-139 **$1**

20 AC/DC LINE CORDS, for clocks, motors, etc. 2-cond. w/ molded plugs. Wt. 1 lb. Reg. $5. K-149 **$1**

10 "POLY" BOXES. Asstd. sizes, clear plastic hinged boxes w/ snap locks. Reg. $2.50. K-170 **$1**

10 ELECTROLYTICS, FP & twist, tubular, rect. Asstd. sizes, 8 to 500 mmf to 450V. Wt. 3 lbs. Reg. $15. K-142 **$1**

8-PC. NUTDRIVER SET. Plastic handle. 3/16, 7/32, ¼, 5/16, 11/32, ⅜, 7/16" steel socket wrenches in plastic case. Wt. 1 lb. $3 value. K-102 **$1**

15-PC. TWIST DRILL SET. 1/16 thru ¼" by 64ths; in graduated plastic holders. Reg. $4. K-144 **$1**

8-PC. MAGNETIC SCREWDRIVER SET. Magnetic, tempered steel blades, shockproof handles. UL approved. Phillips included. $3.50 value. B-609 **$1**

8 TRANSISTOR SOCKETS, for sub-miniature tubes, Mica filled. Reg. $3. B-596 **$1**

5 SILICON DIODES. 1N21, two 1N22, 1N23, 1N105. Reg. $15. K-148 **$1**

40 SUBMINIATURE RESISTORS, in poly box. ¼" long! 20 values, 15 ohms to 10 megs. 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**

60 TRANSFORMERS & COILS. IF, RF, ant., slug-tuned coils, chokes, 25 types! Wt. 3 lbs. Reg. $15. K-313 **$1**

MINI-METER BUY! 1¾", round. 0 to 6 amps, AC. Chromed. For model railroads, power supplies, mobile. Reg. $3. K-312 **$1**

5 ROLLS TAPE, electrical, plastic, friction, rubber. For home, shop or lab. Reg. $2.50. K-305 **$1**

TRANSISTOR SCOOP! Hermetically sealed PNP transistor (cannot advertise mfrs. name). Guaranteed satisfaction. Reg. $5. K-304 **$1**

ABOVE KITS AND ASSORTMENTS ONLY ONE DOLLAR EACH!

SUPER-POWERED HEADSET. 5,000 ohms, w/cord & tips. HI-FI quality. Strengthens weak signals. Reg. $5. K-314 ONLY **$2.50**

TRANSISTOR ADD-A-STAGE. Transistorize your crystal sets easily, simply by adding an amplifier stage. All parts, instructions. K-316 ONLY **$2.50**

WIRED CODE PRACTICE OSCILLATOR. Pocket size, transistorized, self-powered for signal tracing. Built-in hand key. B-754 **$2.88**

WORLD'S SMALLEST TRANSISTOR I.F. 455 kcs. For superhets, ½" sq. w/5 lugs; ferrite tuned. Reg. $2. B-902 **69c** 2 for $1.25

TRANSISTOR RADIO SPEAKER. 1½" sq., 1" deep. Amazing fidelity. 3.2 v.c., powerful magnet. Used in high-priced sets. Reg. $4.50. B-723 **$1.99**

SUBMINIATURE CRYSTAL MIKE. Postage-stamp size—¾" sq. Styrene cased. Clear, crisp response. High impedance. Reg. $6. B-682 **$1.19**

HIGH IMPEDANCE MAGNETIC PICKUP by Pacific Audio. Used in "name" playbacks. Includes cartridge, arm, etc. Reg. $8. B-688 **$1.49**

4 x 6" SPEAKER WITH BAFFLE. For portables, phonos, rear-deck car speaker. Top make, hvy slug. 3-4 ohm v.c. Reg. $4.50. B-658 **$1.69**

ELECTRIC APPLIANCE CLOCK-TIMER. Turns radios, TV, appliances "ON" "OFF" at pre-set time within 12 hrs. Less hardware. Reg. $10. K-318 **$2.50**

MULTI-PURPOSE POWER SUPPLY KIT. 115VAC. Out: 250VDC@70 ma. Xfmr., condensers, resistors, wire, cord, sockets, switch, tube. Wt. 3 lbs. Reg. $8. K-319 **$3.33**

FOUR TIMING MECHANISMS, 3-SEC. Hand-wound, multi-geared precision units. Reg. $3. K-320 **$1.00**

3-TUBE AC/DC AMPLIFIER, WIRED! Lowest price ever: For phonos, P.A., etc. Sep. vol. & tone controls. Reg. $5. B-570 Tubes, $1.91 extra (B-571). **$2.99**

30-PC. ELECTRIC DRILL SET. NEW! Top make! Drill & 29 different accessories. Wt. 5 lbs. Reg. $24. B-988 **$11.99**

2½" SQ. PERSONAL PM SPEAKER. Used in famous American-made superhet & transistor radios. 8-ohm v.c. Reg. $5. K-322 **$1.98**

3-TUBE POCKET PERSONAL SUPERHET RADIO

5½ x 3½ x 1¼" ebony & ivory case. Big set performance. w/built-in hearing aid phone and directional antenna. Volume & tuning controls. NO EXTERNAL CONNECTIONS. plays anywhere! Sold elsewhere from $20 to $28. A sensitive, selective. factory-built set. B-689 ONLY **$12.99** Batteries $2 Extra

HI-FI TYPE 5-WATT AMPLIFIER COMPLETELY WIRED!

Beam power output. 4 tubes, w/built-in G-E preamp, mike, phono inputs. Sep. gain & volume controls. Incl. 115VAC power supply, tubes. Shp. wt. 6 lbs. Reg. $29. B-977 Reg. $28 ONLY **$19.90**

HOW TO ORDER

ORDER BY STOCK NUMBERS, I.E.
"ONE K-321 $2.98"

New ordering procedure helps avoid errors, speeds delivery. Send check or MO including sufficient postage; excess returned. C.O.D. orders, 25% down. Rated, net 30 days.

MONEY BACK GUARANTEE OF SATISFACTION

LEKTRON SPECIALTIES

131-133 Everett Ave. Chelsea 50, Mass.

up by its antenna. This ability of the receiver is known as *selectivity*, and is determined by the number and quality of its resonant circuits.

The following quiz will test your knowledge of resonance. Each correct answer is worth ten points. A score of 60 or less is poor, 70 is fair, 80 is good, 90 is very good, and 100 is excellent. Answers are given on page 124.

1. **If the value of capacity in a tuned circuit is increased:**
   (a) the frequency of resonance will increase; (b) the frequency of resonance will decrease; (c) the frequency of resonance will remain the same
2. **The circuit shown in Fig. 1(A) is:**
   (a) a band-pass filter; (b) a band-rejection filter
3. **A resonant circuit is one in which:**
   (a) the inductance is equal to the capacity; (b) the inductive reactance is equal to the capacitive reactance; (c) voltage and current

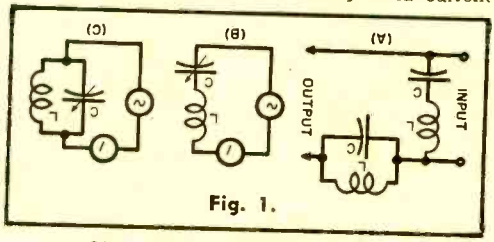


Fig. 1.

   are 180 degrees out of phase; (d) all of the above statements are correct
4. **The Q of a coil will be large if:**
   (a) its resistance is large compared to its reactance; (b) its resistance is equal to its reactance; (c) its reactance is large compared to its resistance; (d) its reactance is small compared to its resistance
5. **What is the resonant frequency of a circuit containing 20 μhy. of inductance and 20 $\mu\mu$fd. of capacitance?**
   (a) 400 kilocycles; (b) 159.2 megacycles; (c) 25,330 kilocycles; (d) 7.96 megacycles
6. **Removing the iron slug (core) from the coil of a tuned circuit:**
   (a) will increase the resonant frequency; (b) will decrease the resonant frequency; (c) will not change the resonant frequency
7. **When capacitor of Fig. 1(B) is adjusted to a value which makes the circuit resonant to the frequency of the applied voltage, the reading of the meter will:**
   (a) increase; (b) decrease; (c) remain the same
8. **When capacitor of Fig. 1(C) is adjusted to a value which makes the circuit resonant to the frequency of the applied voltage, the reading of the meter will:**
   (a) increase; (b) decrease; (c) remain the same
9. **The wavelength corresponding to a frequency of 3 megacycles is:**
   (a) 300 meters; (b) 100,000 meters; (c) 159 meters; (d) 100 meters
10. **If the capacity of a resonant circuit is reduced to one-fourth its initial value, the frequency of resonance will be:**
    (a) twice as great; (b) half as great; (c) four times as great; (d) one-fourth as great

—30—

Rejuvenate Your Picture Tube

(*Continued from page* 61)

the picture tube socket are used—the filament leads coming from pins 1 and 12, the cathode lead from pin 11, and the grid lead from pin 2. The lead from pin 10 is not used and should be clipped off.

When you use the rejuvenator, all power to the television receiver must be turned off. It is not necessary to remove the picture tube from the set. Remove the picture tube socket from the receiver and replace it with the socket from the rejuvenator. Plug the rejuvenator into an a.c. socket, allow a few seconds for the rectifier to warm up, and you're ready for action.

Depress switch *S1* and release it as quickly as possible. Rapid opening and closing of the circuit is necessary to avoid damage to the tube elements. Repeat this operation from three to six times, depending on the condition of the tube. Each time you press the switch, you will notice a bluish arcing in the neck of the tube; this is caused by the disintegration of the undesirable oxide coating and is not harmful to the tube.

The author's experience has indicated that most tubes will readily respond to this rejuvenation method. However, some tubes fail because of long, hard use rather than oxide formation; rejuvenation of any type will not remedy complete exhaustion of the cathode element. —*William J. Lynott*

How to Fix Up Old Radios

(*Continued from page* 77)

itances, necessitating some circuit realignment. There also may be changes in gain, and whether circuit changes are worthwhile to correct these is a matter of personal choice. Oscillation may develop as a result of excessive gain, causing squeals and howls which can often be corrected by installing shielding cans on glass tubes and/or dropping plate and screen voltages. In push-pull audio stages, the two tubes should be identical to avoid oscillation, hum or weak output due to unbalance. Therefore, substitution for one push-pull tube requires identical substitution for the other.

Table 1 (page 77) shows substitutions for some older tube types—and for some of the newer ones—requiring no socket or wiring changes. However, the table should be used with the above-mentioned precautions in mind.

A typical tube line-up in old sets is found in the Stewart-Warner Model R1302A, calling for one of each of the following: 6A7, 6D6, 75, 42, and 80 (rectifier). The table shows no directly interchange-

able tube for the 6A7, but the *RCA Receiving Tube Manual* indicates that the 6A8 is electrically identical and requires only the replacement of the seven-prong socket by an eight-prong one. The table shows that the 6D6 can be replaced by a 75, 77 or 78. The 75 can be replaced by a 77 or 78, and the 42 by a 41. The 80 is still a standard tube.

Tubes having the same numerical designation with different suffix letters like G and GT are, in general, directly interchangeable (6K7, 6K7G, 6K7GT). However, when going from a metal to a glass tube, shielding cans may be needed to avoid oscillation resulting from coupling to other stages.

Make Circuit Changes. Power supply circuits of old radios often need attention. Sometimes a defective transformer can be repaired or salvaged. For example, broken leads can be soldered if the break is outside the winding. A transformer with half the high-voltage winding open in a full-wave rectifier circuit can be continued in service by converting to half-wave rectification, as shown in Fig. 1 (page 77).

If the transformer must be replaced, an exact duplicate is probably not necessary. The important points are that it have the *minimum* electrical characteristics needed and fit into the space available. If the plate winding delivers too much voltage, this can be reduced by a dropping resistor. The new transformer probably won't fit the original mounting but a new bracket can easily be improvised. Some older sets have roomy cabinets and can tolerate projection of an oversize transformer an inch or so beyond the chassis.

If the set is an a.c./d.c. model, there is no power transformer. The high voltage consists of the d.c. furnished by the rectifier from the house current. The tube filaments are energized by applying the 117 volts a.c. or d.c. across a series group consisting of the filaments and a dropping resistance. The latter absorbs that portion of the applied voltage not accounted for by the filaments. It may be a resistor as such, a length of resistance wire woven into the power cable and known as a line cord resistor, or a ballast tube.

Ballast tubes are readily available and it is simpler to replace them with new ones rather than with an equivalent resistor, especially if pilot lights are energized by the voltage drop across a portion of the ballast tube resistance element. Also, any voltage-regulating action provided by the ballast tube is sacrificed if it is replaced by a resistor. However, if the dropping resistance is a line cord resistor or a conventional resistor, it can be replaced by any resistor having the necessary

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.**

FIRST AID FOR TV SETS!

TV DOCTOR

(TM)

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.

$1

ONLY $1—You'll say it's worth hundreds.

FREE: STROBOSCOPE DISC with each TV DOCTOR.

Rush Coupon with your name & address. Enclose $1; 5-days to read without risk or return for refund.

H. G. CISIN, Consulting Eng.
(Dept. P), Amagansett, N. Y.

☐ Enclosed find $1. Rush TV DOCTOR and include FREE Stroboscope Disc.

Name .....

Address .....

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

ORDER NOW! POSTPAID

★ CALLING ALL BOYS FROM 7 TO 70! ★

EDUCATIONAL! ECONOMICAL! EASY!

35 EXPERIMENTS

Including

- Radios
- Test Sets
- Stroboscope
- Code Set
- Amplifier
- Oscillators
- Power Supplies
- Electronic Organ
- Alarm Devices
- Many Others

Here is the perfect kit for beginners and experimenters of all ages. Simple enough that even a youngster can use it, yet fascinating enough to hold the interest of the older student or experimenter. This kit contains all the necessary materials required for any of the experiments listed above plus many others. Best of all, no batteries are required in any of the experiments, saving you the cost of replacing expensive batteries. Complete instruction book contains basic theory for experiments, plus an explanation of radio symbols, thus establishing a foundation for further study of electronics.

MODEL EK-35 ELECTRO-KIT

$10.59 NET

PLEASE ADD $.50 FOR POSTAGE AND HANDLING

NOTE!
For a copy of our 1957 catalog FREE, just write us and mention this ad in Popular Electronics.

WALTER ASHE RADIO CO.

1125 PINE STREET, ST. LOUIS 1, MO. • CHESTNUT 1-1125

resistance and wattage ratings. These are easily calculated (see Fig. 2, page 77).

Repair the Loudspeaker. Old sets generally used a heavy electromagnetic speaker with a field coil winding in series with the plate voltage. Since the field coil was inductive, it also served as the filter choke for the power supply system. If the speaker is giving trouble, it may be desirable to repair it, if practical.

Common difficulties here are rattles and distortion which may be due to loose speaker mounting bolts or to torn or punctured cones. The tears can sometimes be repaired with a small piece of masking tape; but be careful not to cause other punctures in the cone which may be brittle with age. Another cause of rattles and distortion is contact between the voice coil and the magnet pole piece. The remedy here is to re-center the voice coil, which is not difficult.

If you have a suitable speaker available from your spare parts collection, by all means use it. However, if the replacement is of the permanent-magnet type, a choke coil must be connected in place of the field coil to provide the latter's filtering and voltage-dropping functions.

Other Adjustments. The peculiarities of old radios include some odd intermediate frequencies (i.f.), such as 130, 175, 260 and 470 kilocycles, instead of the more usual 455 kc. of later-day sets. This value is on the manufacturer's schematic as found in the trade service manuals. There is also a list of i.f. values in older sets contained in Ghirardi's *Radio Troubleshooter's Handbook*. While the i.f. values are important if you are going to replace the coils and do a real alignment job, you can peak them without this information. Tune in a station and adjust the trimmer screws on top of the i.f. cans (sometimes they are on the chassis rear apron) for maximum output judged by ear or measured on an a.c. voltmeter connected across the speaker terminals.

The tuning capacitor of an old set is often full of dust, causing crackling noises which can be cleared up by cleaning out the spaces between the plates with a pipe cleaner. A hard-to-duplicate volume control having worn spots can sometimes be repaired by rubbing the worn area of the resistance element with a soft pencil. If the switch on the volume control is bad, disconnect it and wire in an ordinary toggle switch which can be mounted on the panel. If you want more bass, increase the value of the coupling capacitor between the first and second audio stages.

There's probably a lot of mileage left in that sturdy old relic in the attic (or basement). Why not go after it? —30—

STANLEY ELECTRONICS joins the tube crushing program

In line with its policy of providing service and quality to its customers, Stanley Electronics of Passaic, N. J. has entered into an agreement with a crusher to crush and destroy any and all old or obsolete tubes to take them off the market.
For the first time: You can send all your old tubes to one location, Metallic Enterprises, Inc., 113 Mill St., Paterson, N. J. and receive credit dollars for them.
Our crusher will take them all and allow you a 5¢ credit toward each tube you buy.

Broken Tubes — Smashed Tubes — Tubes of any condition are worth 5¢ ea.

Pull them out of your attic. Dig them out of your garden. Crush them before shipping if you want to. Regardless of the shape its in, any tube is worth money. Any quantity —1 to a million.

HERE'S HOW IT WORKS . . .

Suppose you send in 100 old, broken or smashed tubes. You will receive 5¢ credit for each tube to be applied toward the purchase of 100 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.**

• Zenith • Motorola • Westinghouse • Admiral • SE • Sylvania • National Union • Tung-Sol

Your order will include one or more of these famous brands

UNCONDITIONALLY GUARANTEED FOR ONE YEAR

Individually boxed—RETMA SPECS.

WRITE FOR NEW FREE—TUBE and PARTS LIST!					
0Z4	.43	6AV6	.39	7B4	.44
1A7GT	.43	6AX4	.67	7B5	.41
1AX2	.79	6AX5GT	.57	7B6	.42
1B3GT	.68	6BA6	.47	7B7	.43
1B4P	.35	6BA7	.49	7B8	.47
1C5GT	.41	6BC5	.50	7C4	.39
1D5GP	.43	6BD5GT	.53	7C5	.42
1E7GT	.41	6BE6	.46	7C6	.43
1G6GT	.41	6BF5	.40	7C7	.45
1H5GT	.47	6BG6G	1.18	7E5	.25
1LA4	.57	6BH6	.51	7E6	.30
1LA6	.47	6BJ6	.47	7E7	.49
1LB4	.59	6BK5	.68	7F7	.59
1LC5	.49	6BK7A	.76	7F8	.70
1LN5	.47	6BL7GT	.75	7G7	.75
1N5GT	.50	6BN6	.58	7H7	.50
1R4	.66	6BQ6GT	.80	7J7	.75
1R5	.51	6BQ7A	.80	7K7	.75
1S4	.59	6BY5G	.58	7L7	.58
1S5	.51	6BZ7	.38	7N7	.50
1T4	.51	6C4	.37	7Q7	.59
1T5GT	.58	6C5GT	.35	7Y4	.35
1U4	.47	6CF6	.80	7Z4	.40
1U5	.50	6CG	.47	12AT6	.41
1U6	.53	6CB6	.51	12AT7	.66
1X2A	.68	6CL6	.71	12AU6	.43
2A3	.50	6CD6G	1.18	12AU7	.59
3A4	.51	6CS6	.51	12AV6	.42
3AL5	.57	6D6	.48	12AV7	.67
3AU6	.57	6E5	.44	12AX7	.63
3AV6	.57	6F5GT	.37	12AY7	.90
3BA6	.60	6H6GT	.38	12BA6	.46
3BE6	.60	6J5	.39	12BA7	.60
3Q5GT	.57	6J6	.49	12B4	.68
3S4	.47	6J7	.43	12BE6	.46
3V4	.58	6J7GT	.45	12BH7	.60
5AQ5	.60	6J8G	.80	12BY7	.64
5AT8	.80	6K5GT	.47	12J5GT	.40
5J6	.60	6G6GT	.39	12K8	.49
5T4	.69	6K7	.39	12SA7	.48
5U8	.80	6K7GT	.39	12SA7GT	.48
5U4G	.49	6K8G	.65	12SG7	.55
5V4G	.58	6K8GT	.65	12SH7	.47
5X4G	.44	6L6G	.68	12SJ7GT	.45
5Y3G	.39	6S4	.40	12SK7	.48
5Y3GT	.39	6SA7	.48	12SK7GT	.50
5Y4G	.43	6SC7	.48	12SL7GT	.60
5Z3	.45	6SD7GT	.57	12SN7GT	.57
5Z4	.54	6SG7	.41	12SQ7GT	.40
6A7	.57	6SH7GT	.43	14A7	.45
6AB4	.45	6SJ7	.43	15SG6G	1.18
6AB7	.80	6SK7	.50	19T8	.70
6AC5GT	.59	6SL7GT	.57	25AQ6GT	.85
6AC7	.67	6SN7GT	.57	25L6GT	.47
6AF4	.79	6SQ7	.41	25Z6GT	.37
6AQ5	.50	6SR7	.42	35A5	.46
6AG7	.69	6SS7	.41	35B5	.48
6AH4	.80	6T7G	.63	35C5	.48
6AH6	.70	6T8	.68	35L6GT	.47
6AK5	.54	6U8	.80	35W4	.39
6AL5	.42	6V6GT	.48	35Y4	.40
6AL7GT	.70	6W4GT	.40	35Z3	.41
6AQ5	.46	6W6GT	.53	35Z5GT	.39
6AQ6	.42	6X4	.39	45Z5GT	.40
6AQ7GT	.70	6X5GT	.39	50A5	.48
6AW8	.80	6X8	.75	50B5	.48
6AN8	.80	6Y6G	.60	50C5	.48
6AS5	.48	7A4-XXL	.47	50L6GT	.45
6AT6	.39	7A5	.53	70L6GT	.45
6AU4	.65	7A6	.45	70L7GT	.60
6AU5GT	.60	7A7	.45	117Z3	.37
6AU6	.43	7A8	.45	117Z6GT	.62

Brand New DUMONT AND RCA IIc. 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	$20.95
16 inch	$16.95	21 inch	$22.95

Add $4.00 to above prices for aluminized tubes

TERMS: FREE POSTAGE on all Prepaid continental U.S.A. orders on receiving tubes only. 50c handling charge on all orders under $5. 25% deposit on all COD's. Picture tubes F.O.B. Passaic, N. J. via Railway Express.

STANLEY ELECTRONICS CORP
935 MAIN AVE.
PASSAIC, N. J.
Gregory 1-2498

KITS! KITS!

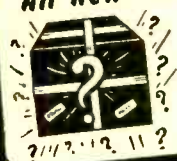
HERSHEL'S KITS ACCLAIMED BEST!

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

YOUR CHOICE ANY KIT LISTED IN THIS AD 97c

- 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
- 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

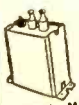


Worth $40.00

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 hams, etc.

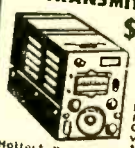
OIL CONDENSER



$1.65

2 MFD. 3000 VDC. Pyranol Oil W/Mounting Brackets. Mfd. 3000 VDC. removed from new equip. 4¾"x4¼"x 2½" 1—1

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

HERSHEL RADIO CO. TYler 8-9400

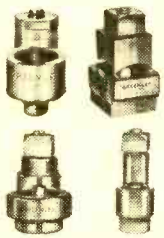
5249 GRAND RIVER Detroit 8, Michigan

CUT CHASSIS HOLES FAST!

ROUND SQUARE KEY "D"

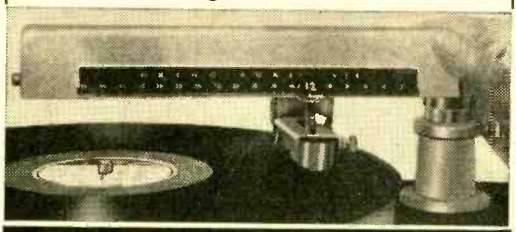
Smooth, accurate openings made in 1½ minutes or less with Greenlee Radio Chassis Punch

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., 2382 Columbia Ave., Rockford, Ill.



GREENLEE

Something BIG in Hi-Fi



Ortho-sonic V/4

TRACKS COURSE OF ORIGINAL RECORDING STYLUS

Now, old and new records give perfect reproduction—all distortion is eliminated.

ORTHO-SONIC V/4 Tone Arm follows course of original recording stylus: Eliminates tracking error; rides center of groove, always!

Model #100 (plays all records up to 12") $35.95

REDDI-SWEEP RECORD BRUSH

Sensational! Soft camel's hair; adjustable height; faces record revolution thus removes dust, etc.; flip of finger disengages action; pressure-sensitized base adheres to any surface. Complete, $4.95.

At Better Hi-Fi Dealers. Write for Brochure.

ORTHO-SONIC INSTRUMENTS, Inc.

66a Mechanic Street, New Rochelle, N. Y.

40¢ FOR ANY TUBE

we will not

BE UNDERSOLD!

$37.00 PER HUNDRED

DON'T PAY MORE FOR SET TESTED LONG LIFE DEPENDABLE 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	3BC5	6AQ7GT	6H6GT	6Y6G	12SJ7GT
0A3	3CB6	6AS5	6J4	7A5	12SK7
0A4	3Q4	6AS7G	6J5GT	7A7	12SN7GT
0B2	3Q5GT	6AT6	6J6	7B5	12SQ7
0C3	3S4	6AU4GT	6K6GT	7B7	12V6GT
0Z4	3V4	6AU5GT	6L6	7C5	12X4
1A7GT	4B27	6AU6	6N7GT	7C6	14A7
1B3GT	4B97	6BV5GT	6S4	7C7	14B6
1C7G	5AM8	6AV6	6S7G	7F7	14Q7
1F4	5AN8	6AX4GT	6SA7	7F8	19BG6G
1H4	5AQ5	6BA6	6SB7Y	7N7	19T8
1H5GT	5AT8	6AX5GT	6SC7	7Q7	24A
1J6GT	5AW4	6BC5	6SF5	7Y4	25AV5GT
1L4	5AZ4	6BC7	6SF7	7Z4	25BQ6GT
1L6	5J6	6BE6	6SG7	12A6	25CD6G
1LA6	5T4	6BF5	6SH7	12AH7GT	25CU6
1LC5	5T8	6BG6G	6SJ7GT	12AT6	25L6GT
1LH4	5U4G	6BH6	6SK7GT	12AT7	25W4GT
1LN5	5U8	6BJ6	6SL7GT	12AU6	25Z6GT
1N5GT	5V4G	6BK5	6SN7GT	12AU7	35L6GT
1S4	5V6GT	6BK7	6SQ7	12AV6	35W4
1S5	5Y3	6BN6	6SS7	12AV7	35Y4
1T4	5Y4G	6BL7GT	6SV7	12AX4GT	35Z3
1U4	6AB4	6BQ6GT	6T8	12AX7	35Z5GT
1U5	6AC7	6BQ7	6U4GT	12AZ7	50A5
1V2	6AG5	6BY5G	6U7G	12B4	50B5
1X2	6AF4	6BZ7	6U8	12BA6	50C5
2A7	6AH4GT	6C4	6V3	12BE6	50L6GT
2D21	6AK5	6CB6	6V6GT	12BH7	80
2X2	6AL5	6CD6G	6W4GT	12BY7	117N7GT
3A4	6AM8	6CF6	6W6GT	12CU6	117P7GT
3A5	6AN4	6CS6	6X4	12SA7	117Z3
3AL5	6N8	6CU6GT	6X5GT	12SG7	
3AU6	6AQ5	6E5	6X8	12SH7	

SAME DAY SHIPMENT OF ALL ORDERS!

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 use 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!

FREE BONUS ANTENNA GIVEN WITH ANY TV SET ORDER!

FREE RCA "CHEATER" CORD GIVEN WITH ANY TUBE ORDER OF $7.00 OR MORE!

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.

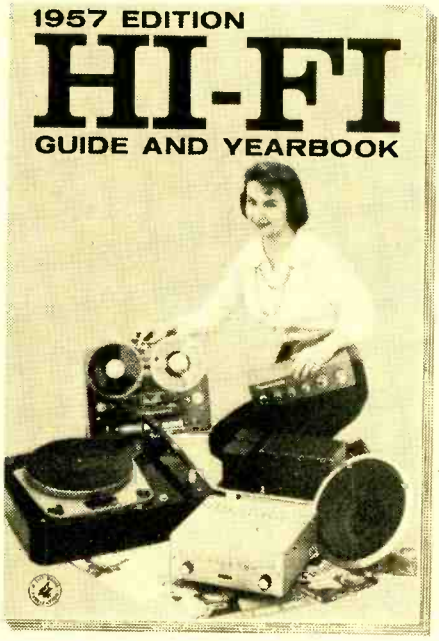
VIDEO ELECTRIC COMPANY

79 CLINTON PL. NEWARK, N. J.

Phone HUmboldt 4-9848

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
- TAPES
- RECORD PLAYERS AND CHANGERS
- TONE ARMS, CARTRIDGES AND NEEDLES
- PREAMPLIFIERS AND AMPLIFIERS
- LOUDSPEAKERS
- SPEAKER ENCLOSURES
- SAVING MONEY IN HI-FI

Also included in this new Hi-Fi volume is a giant YEARBOOK SECTION covering all the latest trends in high fidelity. This "book within a book" lists the nation's best-selling records and artists, pre-recorded tapes, all FM stations, and contains a new Hi-Fi glossary and much, much more!

BE SURE TO BUY YOUR COPY!

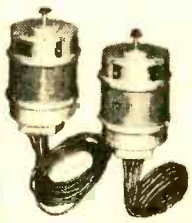
ON SALE FEBRUARY 5 AT ALL NEWSSTANDS AND RADIO PARTS DEALERS!

Kerosene or Gasoline Heater Reduced to $4.95

Brand new. Evans blue flame heater. Output approx. 50,000 BTU. Ideal for—camping, garages or ham shack. Size: 10" dia. x 12" high. Cost Govnmt. many times our low price. Shipped in orig. packing; wt. 47 lbs. **$4.95**

SYNCHRO Motor and Generator

Only $4.95 Per Pair



Simply connect like stator wires of each unit (marked with S on unit) and rotor wires (marked with R on unit) in series with 110 V. 60 cycle current, you have an electrical equivalent of a flex. shaft without usual limit to length, backlash error, and friction. Ideal for your beam direction indicators, wind direction indicators, antenna rotation, etc. Popular size 5 (6½" long 3½" dia.). Units orig. made for 400 cycle but operate intermittently on 60 cycle when connected in series as above. Ship. wt. 12 lbs. per pair. Price per pair, used units..... **$4.95**
Regular 60 cycle units, per pair.....$9.95

Brand New Telephones—$9.95 Pair

Regular industrial type wall telephone at fraction of original cost. Mfgd. for Signal Corp. but never used. Use as extension or connect between any two points with a two conductor wire and you have your own telephone system. Self-contained induction coils and bells. 6 V. dry cell batteries required for operation not included. Size of units 8½" x 9" x 8" overall. Ship. wt. 11 lbs. each.

Price $5.35 ea. or $9.95 pair

GOLF CAR MOTOR $4.50

New 1¾ HP. battery operated motor for building up your golf car or other use. Operates from 12 to 24 V. with speed to 6000 RPM. Measures 4⅛" dia. x 9" long, ⅝" shaft. Wt. 11½ lbs. Ship. wt. 13 lbs.

Freq. Crystals—Less Than 5c Ea.

Imagine crystals costing Govnmt. $3.50 to $12.00 ea. in this assortment. 100 brand new; various freqs.; plenty in ham bands. Practically all types of holders; all mounted; guaranteed to oscillate. Assortment of 100. Ship. wt. 4 lbs.....$4.95

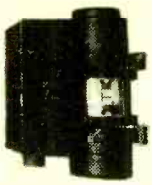
T-26 Carbon Mike—$1.95

A first class carbon microphone with chest plate. Replace your present mobile mike with this and have both hands free for driving. Has on-off switch and strap as pictured. Uses F-1 W.E. microphone cartridge. Ship. wt. 3 lbs.

M-1 ODOGRAPH.....$179.50

An instrument used for vehicular mapping of terrain over which it is driven. Compass information is passed on thru a photo electric circuit to the plotting unit which combines this information with the speedometer drive for control of the pencil across the map paper, giving a map with possible errors of less than 1%. Will do survey work in hours that normally requires weeks. These instruments are new and the current mfgd. price is over $5,000. They are versatile in that parts can be adapted to other uses such as the compass unit to auto pilot boat control, etc. Ship. wt. 200 lbs.
U.S. Corps of Engineers rebuilt units.
$179.50 complete
Brand new units.....$279.50 complete

115 V. 400 Cycle Inverter—New—$4.95



Just what is needed for operation of the numerous aircraft, radar, and electronic items on the surplus market requiring a 400 cycle 115V source at 100 watts or less. Input is 24 volts at 11 amps. Size 9"x6"x 4½". Wt. 10½ lbs. Ship. wt. 12 lbs.

Storage Battery BB-29

New—$4.30 ea.

Exide 80 Amp. Hr. 4 volt lead acid type with hinged cover. Ideal for series connection for DC source around shop, etc. Shipped dry—add 1.270 sp.g. sulphuric acid.

$4.30 ea. or 3 for $12.50

Edison Nickel-Iron Alkaline Storage Batteries

6 V. 37½ AH lifetime storage battery consisting of five type B2H cells in rack. These batteries not harmed by overcharge, discharge, or short circuit. Used by railroads and industry. Here is a chance to acquire these batteries at a fraction of original cost. Size of battery 10½" x 12" x 6". Ship. wt. 50 lbs. Price each..... **$27.50**

SPECIAL Garage Door Lift $44.50

An electrical operated garage door lift for raising overhead doors up to 8 x 16 ft. These lifts were locally mfgd. and two have been in use by us here at Esse for over 3 yrs. and no trouble. We purchased the complete units except for the electrical hookup of relays, switches, etc. and pass them on to you at about 1/5 orig. price for your wiring as per included instructions. All parts and mounting hdwe. incl. Wt. approx. 100 lbs. Shipped by motor truck only..... **$44.50**

TEST SET EE-1 NEW—$19.50

A test set for aircraft containing AC & DC volt, ohms, meter, tachometer, pressure gauge & test gauge cords & tools. In aluminum suitcase type case that opens forming sloping 2 sec. panel. Ideal for your test bench applications. Cost hundreds of dollars but yours in original evacuated shipping container for only. Ship. wt. 270 lbs. **$19.50**

R-1/ARR-1 Receiver—$1.95

Described in Radio TV News, Jan. 1949, for use in 220 Mc. converter. Essentially a two stage RF acorn tube superhet converter as it now stands. Also can be used for a preselector. Small enough for mobile only 3½" w. x 3" h. x 10" d. Rugged aluminum construction. Has four 954 acorn tubes. Filaments now operate on 12 or 24 volts by merely throwing switch in unit or can be easily modified for 6 V. operation. Dial is calibrated in range of 234-258 MC. Operation can be changed for use from 50 to possibly 300 Mc. Cover not shown but included. Complete with conversion as written in above mag. Brand new units, not demilitarized, $2.95 ea. Ship. wt. 4 lbs..... **$1.95**

ARR-1, mobile antennas for above receiver and frequencies. Ship. wt. 1 lb. **New** **$1.25**

Co-Axial antenna relay for use with above or other transmitter-receiver combinations. Ship. wt. 2 lbs. **New**.....**$1.25**

1 KW PLATE TRANSFORMER $8.95 ea.

Arma IIV. Plate transformer for the construction of that 1 KW. Rig. Two CT 400 V. windings may be series connected for 800 V. 1.25 amps. Size 9½" x 9" x 8". Ship. wt. 100 lbs. New Navy Surplus. Price.....**$8.95 ea.**

14 Amp. Battery Charger While Supply Lasts

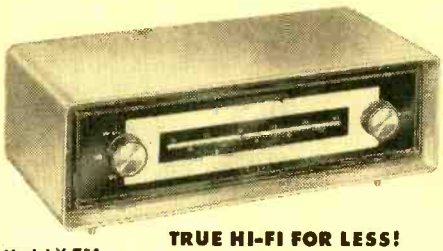
Cost Govmt. $300 ea. Our purchase of large quantity allows this bargain. Charges 6, 12, or 24 V. batteries at 14 amp. rate max. Operates from 110 V. DC. Mfg. by Ward-Leonard. Size 12" w. x 20" h. x 10" d. Brand new in orig. packing; wt. approx. 80 lbs. They'll go fast at this low price, so order now **$7.50**

ESSE RADIO CO. • 42 WEST SOUTH ST. • INDIANAPOLIS 25, IND.

REMIT SHIPPING CHARGE AND INSTRUCTIONS WITH ALL ORDERS. OTHERWISE ORDER WILL BE SHIPPED EXPRESS COLLECT. ALL ITEMS GUARANTEED TO YOUR SATISFACTION OR MONEY REFUNDED IF RETURNED PREPAID WITHIN 10 DAYS OF RECEIPT.

Sensational new **knight-kit**

BASIC HI-FI TUNER KIT



Model Y-751

$37.75

TRUE HI-FI FOR LESS!

OUTSTANDING FEATURES:

★ Deluxe custom high-fidelity styling
★ AFC and Flywheel Tuning Control
★ Printed circuit—no critical wiring

The best-looking, best-performing tuner kit your money can buy. Covers 88 to 108 mc; features AFC (with special disabling feature); pre-adjusted RF coils; pre-aligned IF's; cascode broadband RF amplifier; drift-compensated oscillator; illuminated lucite pointer. Sensitivity is 10 microvolts for 20 db of quieting across entire band. Ideal for use with 20-Watt Knight-Kit amplifier (see our 2-page ad in this issue) or any amplifier with phono-tuner switch. Easy to build—a custom Hi-Fi Tuner you'll be proud of! Shpg. wt., 12 lbs.

Model Y-751. Basic FM Tuner Kit. Net..... **$37.75**

ORDER FROM **ALLIED RADIO**

100 N. Western Ave., Dept. 79-BB7, Chicago 80, Ill.

New

MORROW FALCON

AMATEUR RECEIVER
MOBILE or FIXED STATION

SELECTIVE BANDPASS: Narrow 2.8 KC, Broad 9.2 KC at 6DB down.

SENSITIVITY: 1 microvolt with 14DB signal to noise ratio on 10 meters.

DUAL CONVERSION superhetrodyne receiver eliminates images.

Tunes amateur bands 75, 40, 20, 15, 10 meters.

Provision for Broadcast accessory tuner.

YOU CAN HEAR THEM ON A FALCON!

Amateur net $169.00

(Less power supply and speaker)

QUALITY AND PERFORMANCE

MORROW

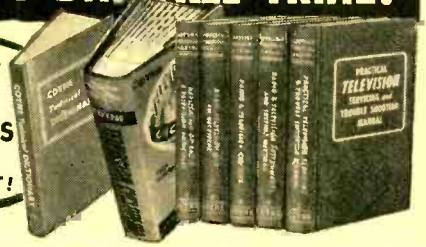
radio manufacturing co.

2794 Market St. Salem, Ore.

SEE YOUR JOBBER

Get This Valuable Book FREE

Just For Examining COYNE'S New Set "Applied Practical Radio-Television" on 7 DAY FREE TRIAL!



NOW! 7 BIG BOOKS IN ONE GREAT SET!

Yes, you get this big, brand new book, "150 Radio-Television Picture Patterns and Diagrams Explained," absolutely FREE! Just off the press. Gives complete 11 x 22" Schematic Diagrams on leading models Radio and TV Sets. Easy-to-read, large 8½ x 11" pages, with full instructions on how to use the diagrams. A "must" in every repair kit. You get this book as a FREE Gift for asking to see Coyne's new 7-book set, "Applied Practical Radio-Television!"

AT LAST! MONEY-MAKING "KNOW-HOW" ON TRANSISTORS, COLOR TV AND SERVICING

Coyne's great 7-volume 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 on over 5000 practical facts and data. Every step from fundamentals to installing, servicing and trouble-shooting all types of radio and TV sets. So up-to-date it covers COLOR TV, UHF and the latest on TRANSISTORS. All this plus Volume 6—NEW Coyne TECHNICAL DICTIONARY with over 4000 definitions of the latest terms, symbols and abbreviations in radio-TV, electronics and electricity.

EXTRA! 900-PAGE TELEVISION CYCLOPEDIA INCLUDED

And then, for speedy on-the-job use, you get volume 7—the famous Coyne TELEVISION CYCLOPEDIA. It answers **today's** television problems on servicing, alignment, installation, etc. In easy-to-find ABC order, cross-indexed. Use this 7-volume TV-RADIO LIBRARY FREE for 7 days; get the valuable Servicing Book ABSOLUTELY FREE!

Educational Book Publishing Division

COYNE ELECTRICAL SCHOOL

500 S. Paulina St., Dept. C6-PE Chicago 12, Ill.

SEND NO MONEY! Just mail coupon for 7-volume set on 7 days free trial. We'll include book of 150 TV-Radio Patterns and Diagrams. If you keep the set, pay $2 in 7 days and $2 per month until $24.50 plus postage is paid. (Cash price, only $22.95.) Or you can return the library at our expense in 7 days and owe nothing. YOU BE THE JUDGE. **Either way, the book of TV-Radio Patterns is yours FREE to keep!** Offer is limited. Act NOW!

FREE BOOK—FREE TRIAL COUPON!

Educational Book Publishing Division
COYNE ELECTRICAL SCHOOL, Dept. C6-PE
500 S. Paulina St., Chicago 12, Ill.

YES! Send 7-Volume "Applied Practical Radio-Television" for 7 days FREE TRIAL per your offer. Include TV-Radio Patterns & Diagram Book FREE.

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

Address .....

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

Where Employed .....

☐ Check here if you want library sent C.O.D. You pay postman $22.95 plus C.O.D. postage on delivery. 7-day money-back guarantee.

The Transmitting Tower

(*Continued from page 82*)

many stations in the Novice bands with licenses too new to be listed in the latest *Call Book*. These give you a chance to gamble a bit. If they are in call areas in which you have not "Worked All States," call them. If you pick up another state, that's fine. If not, that's fine, too. You can suspend your hunt long enough to have a chat.

You can spot new states without a *Call Book*, too. Listen to stations exchanging locations. When you locate a new state, plug into your transmitter the crystal nearest to the frequency being used and monitor the contact to its conclusion. Then, call the station you are stalking. It will often be easier to raise new states in this manner than by answering their CQ's.

No matter how you locate stations in new states, you will not raise them all on your first call, nor on the second. But keep plugging away, and eventually, you will raise them. If you do not raise stations the first day you hear them, carefully note their frequencies and times and keep a watch for them on succeeding days, until you work that state.

In the Novice bands, a "3 x 3" call* is normally sufficient to raise stations within a few kilocycles of your own frequency, because practically all amateurs tune around their own frequencies first when looking for stations to work. When calling stations farther away from your frequency, you may expand the call to a "5 x 3," to give the receiving operator time to tune to your frequency. If one short call does not do the trick, you can always try again—until the called station answers someone else, calls CQ again, or you decide that you are not going to raise it.

If you have a couple of different crystals fairly close to the called station's frequency, you might try calling on each frequency. One frequency may be covered by local interference, while the other one may be reasonably interference-free.

Directional CQ's. So far, I have stressed the necessity for listening and more listening to add new states to your "worked" list. What about directional CQ's? Wouldn't it be easier to use them? Yes, they are easy to use, but the percentage of answers to them from the desired localities is usually very low. However, it is worthwhile to try one once in a while.

Be specific with your directional CQ's. In the 80- and 40-meter Novice bands, "CQ DX" is nearly meaningless, because no two

* The call sign of the called station three times, DE, and your own call sign three times.

Novices agree on what is "DX" on these bands. "CQ KN6," "CQ Florida," or something equally specific is much better.

By following the above suggestions, it should not take too long to push your states-worked total above 40. But after that you will probably have to change your operating habits to work the rest in a reasonably short period of time. For example, if you have been doing most of your operating on 80 or 40 meters in the evening hours, try going to bed early and getting up to operate after midnight a couple of times. Or get up early in the morning.

Try a different band. For example, 15 meters is an excellent daytime and early evening band for picking up some of the more distant states.

Oh, yes, when you get the cards proving that you have worked 48 states, send them by first class mail to the American Radio Relay League, Inc., 38 LaSalle Road, West Hartford, Conn., and request your certificate. Include first-class postage for the return of your cards.

News and Views

In eight months as a Novice, **Mark, W3FTL,** has worked 24 states and 14 countries on the 80-, 40-, and 15-meter Novice bands. Among the countries worked are: Australia (VK), Union of South Africa (ZS), Norway (LA), and Italy (I). All work was done with home-built transmitters running 50 watts or less power to a variety of antennas, with most of the DX being worked on 15 meters with a home-built beam. Mark offers to help prospective amateurs get their licenses and to answer any questions about his equipment . . . **Matt Blender** in Rhode Island forgot to include his call letters with his report, but his Johnson Ranger transmitter and National NC-300 receiver have accounted for 36 states (35 confirmed) and six countries in his eight months on the air. His antenna is a 40-meter doublet.

From Germany, **Jose, KP4AFS/DL4CD,** reports that since he got his DX-35 transmitter, the big BC-610 sits idle most of the time. His first station called and worked was a G3 (England), and he works into the States on 10-meter phone with S8 and S9 reports. No, he doesn't use a beam, just a half-wave doublet . . . **Ed, K2QIG,** worked 15 states in nine months as a Novice on 80 meters with his Heathkit AT1 transmitter and AR-2 receiver. Then, dropping to 20 meters, he picked up another 15 states and three countries in two months. But he couldn't transmit a signal two blocks on 40 meters, that is, until he corrected the wiring "goof" he had made in the AT1 and worked a VE7, a KH6, and a bunch of 5's, 6's, and 7's on 40 meters the other night. You can't get him off of the band now.

Paul, K4HLA, recently licensed as a "General" after several months as a Novice, feeds the output of his AT1 to a half-length, (34') 40-meter doublet. His receiver is a 2-tube re-

generative job, which he will stack up against any of the less expensive commercial amateur receivers. Paul is interested in playing chess by radio, and he offers help to any prospective amateurs . . . **Jerril, KN1AEP,** is trying to help several of his friends obtain their licenses and would appreciate suggestions on how to teach them the code and how to start a radio club . . . **Bruce, KN6QDS,** uses an SX99 receiver and a Johnson Adventurer transmitter, running 50 watts to a 75'-long wire antenna for 80 and 40 meters and a 7' vertical antenna ("surplus" AN-75) for 15 meters. Fifteen meters is his favorite band, on which he has worked 39 states and 29 countries—a marvelous record for such an antenna—and he hopes to complete his WAS on that band as a Novice. Bruce offers to help prospective Novices get their licenses.

Arnold, KN4ISJ, has been on the air for about six months. Running 25 watts to a home-built 6AG7—6L6 transmitter feeding a folded dipole antenna, and using a converted "surplus" ARC-5 receiver, he has worked 26 states. He has also worked a couple of Canadian call areas but is still looking for his first KN7/WN7 contact. Who will oblige? KN4ISJ

Notice: WSBA Radio, 910 kc., Susquehanna Broadcasting Co., York, Pa., has started a program for Hams, aired each Sunday at 12:35 a.m. EST. The program consists of code practice at different speeds, want ads, club news, etc. Items for the program must be in Thursday's mail at WSBA for inclusion in the next Sunday's program. Suggestions and comments are invited. Address all items to Chief Engineer, WSBA.

---

operates in the 3.7-mc. band, usually on 3725 kc. . . . **Marvin, KOADI,** started out as a Novice with an SW-54 receiver and an AT1 transmitter. He then graduated to an NC-101X receiver and Globe Scout transmitter and now has a Viking I. His Novice record was 40 states and four Canadian call areas. Marv offers to schedule anyone needing North Dakota on phone or c.w. and to help prospective amateurs get their licenses.

Addresses of Contributors: **W3FTL, Mark Lawyer,** Hanover, Pa.; **KN1???, Matt Blender,** 72 Bartlett Ave., Cranston, R. I.; **KP4ACS/DL4CD, Jose I. Alvarado,** HQ Btry., 34th AAA Brigade, APO 28, New York, N. Y.; **K2QIG, Edward DeBewitz** (15), 146 Kay St., Buffalo, N. Y.; **W7CFC, Tom Sanford,** 6219 40th N.E., Seattle 15, Wash.; **K4HLA, Paul Brown,** 6006 S.W. 14 St., Miami 44, Fla.; **KN1AEP, Jerril Smith,** Box 236, Bethel, Me.; **KN6QDS, Bruce Berry,** 10226 Elizabeth Ave., South Gate, Calif.; **KN4ISJ, Arnold Smith,** Rt. 1, Box 305, Covington, Va.; **KOADI, Marvin Kosmatka,** 1609 9th Ave., No., Grand Forks, North Dakota.

Remember that this is your column. Send in your picture, comments, details of unusual work done, and the like. However, much as I might like to, I cannot print your name or call letters unless you furnish some news to go with them. Until next month, 73.

Herb, W9EGQ

Voices of the World

(*Continued from page* 43)

This program has been very popular with a great many short-wave listeners for nearly 30 years.

Spain—For those who like Spanish music, Madrid is the station to tune in. *The North American Service* announces in English, so you will learn quite a bit about Spain; and your letters and questions will be answered Thursday evenings on "Post Exchange."

Germany—*The Voice of Germany* broadcasts to North America daily at 8:30-11:30 p.m. EST, 5:30-8:30 p.m. PST. Programs are mostly music, and announcements are made in German. The 10-minute English news (at 9:30 p.m. EST, 6:30 p.m. PST, daily) and the DX program in English and German on the second Monday of each month (at 9:00 p.m. EST and 6:00 p.m. PST) are the only regular programs in English.

Sweden—*Radio Sweden* has a regular feature, the "Stockholmer's Diary," which tells about day-to-day life in Sweden. The "Letterbox" is heard on the next to the last Thursday of each month at 9:15 p.m. EST, 9:15 p.m. PST. "Sweden Calling DX'ers" is presented on the fourth Monday of each month at 8:30 p.m. EST and 9:15 p.m. PST.

Switzerland—For Swiss dance music, listen to "Dance with Lance" on Mondays at 8:45 p.m. EST and 8:30 p.m. PST. The DX program is on the air on the first Thursday of each month at 8:50 p.m. EST and 8:35 p.m. PST. There are many other popular programs such as the "A Penny—A Song" musical request program on Saturdays and "Swiss Yodels" on Tuesdays.

Missionary Stations — The following stations all broadcast religious programs and music: HCJB—*The Voice of the Andes* in Quito, Ecuador; *The Call of the Orient* in Manila, Philippines; *The Evangelistic Voice of the West Indies* in Cape Haitien, Haiti; TGNA in Guatemala City, Central America; and TIFC—*The Lighthouse of the Caribbean,* San Jose, Costa Rica. *The Call of the Orient* has a "Short-wave Mailbag" Wednesdays at 7:15 a.m. PST and *The Evangelistic Voice* has a "Listeners' Post" Saturdays at 9:30 a.m. EST and Mondays at 9:30 p.m. EST, 6:30 p.m. PST.

Communist Countries — Most of the programs from Bulgaria, Communist China, Czechoslovakia, Poland, Romania, and the Soviet Union are patterned after the same line of propaganda. There are some good musical programs such as the

one from Czechoslovakia at 10:00 p.m. EST, 7:00 p.m. PST. Hungary may not be on the air due to the trouble they have been having there lately.

If you want to know more about the programs presented by a particular short-wave station, write to the station for a program schedule; many stations send these out free of charge. If you would like to know more about short-wave listening on the whole, read the regular column, *Tuning the Short-wave Bands,* which appears monthly in POP'tronics. Another valuable aid to enjoying short-wave listening is the *World Radio Handbook,* which may be purchased from Gilfer Associates, P. O. Box 239, Grand Central Station, New York 17, N. Y., for $2 postpaid.

May you all have a wonderful time when you start tuning in the "Voices of the World."

—30—

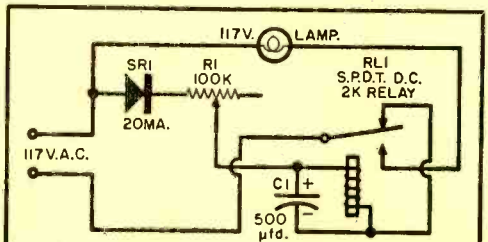
Improved Lamp Flasher

The March, 1955, issue of POPULAR ELECTRONICS (page 74) contained a circuit for a lamp flasher constructed with a surplus relay. A quick check of the junk box revealed that all the necessary parts were on hand except the high-resistance d.c. relay shown in the diagram. The only available sensitive relay was of the s.p.d.t. variety, instead of the d.p.s.t. type specified in the parts list.

A slight rearrangement of the original circuit made possible the use of the s.p.d.t. relay. Since this kind of relay is more readily available than the d.p.s.t. variety, a revised circuit is shown below. These parts values result in an on-off cycling rate of approximately 1 cps. By using a relay with more resistance or a capacitor with greater capacity, the flashing rate may be slowed down. Reducing either the relay resistance or the capacity will result in faster cycling.

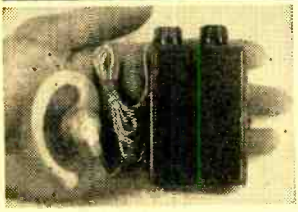
When building a flasher, make certain that the relay contacts are large enough to carry the current drawn by the lamp bulb. Too small contacts will soon pit from the arcing caused by carrying an excessive load.

—Hartland B. Smith



Revised circuit utilizes an s.p.d.t. relay.

NEW! 4-Transistor Pocket Radio!



Size of cigarette package. No external antenna needed. Brings in stations 800 miles away at night. Loud volume. Uses 12½-cent flashlight battery that lasts 600 hours. Printed circuit. Free literature.

Complete kit, $23.50. Fully wired, $29.50.

2-transistor kit, $15.50. 1-transistor kit, $9.50.

Order now from

GARDINER ELECTRONICS CO., Dept. 13

2545 East Indian School Road • Phoenix, Arizona

PEE WEE BATTERYLESS TUBELESS "LIFETIME" RADIO

REALLY WORKS—FOR LIFE! Works WITHOUT TUBES, BATTERIES OR ELECTRICAL PLUG-INS. Will never run down or burn out! World's smallest. SMALLER THAN A PACK OF CIGARETTES! GUARANTEED TO RECEIVE LOCAL RADIO STATIONS ANYTIME—ANYWHERE YOU GO! Sensational new Ferrite Selective Tuner—Permanent Crystal diode, Super SPEAKERPHONE, durable black and gold plastic case.

SEND ONLY $2.00 (bill, ck, mo) and pay postman $4.99 COD postage on arrival or send $6.99 for postpaid delivery. SENT COMPLETE READY TO LISTEN WITH LIFETIME GUARANTEE. Nothing extra to buy—ever. Available only from:

MIDWAY COMPANY Dept. WPL-1 KEARNEY, NEBRASKA

MINIATURE EAR PHONE $2 ppd

MADE FOR AIR FORCE REGULAR $7.00 VALUE *Only*

Highest quality, magnetic personal phone. Listen to TV, Radio, Phono, Auto Radio, not disturb others. Ready for easy connection. Ear loop, cord, Instructions. Satisfaction Guaranteed. MAIL Check, Cash or M. O. today. (No C.O.D.'s.)

TURNER RADIO 1217-B NICOLLET AVE., MINNEAPOLIS, MINN.

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.

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.

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 (1⅝x2½x 4½"). 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 or send $11.98 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. PEL-1, KEARNEY, NEBR.**

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

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

Usable only on cars having 12 volt battery systems.

29.95

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
639 Century Bldg., 412, 5th St. N.W. Washington, D.C.

Please forward free of cost or obligation your handbook, "ENGINEERING OPPORTUNITIES".

Name.....

Address.....

.....Course

.....Age

Interested in.....

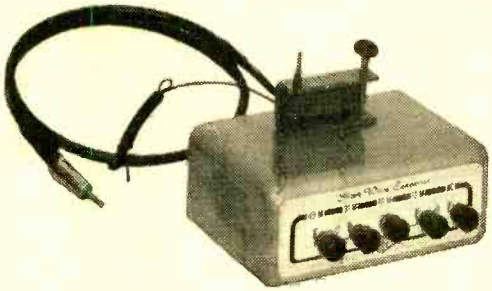
Canadian Address: Canadian Institute of Science Garden Building, 263 Adelaide St. W., Toronto, Ont.

New SWL Equipment

Hammarlund Manufacturing Co., 460 West 34th St., New York 1, N. Y., has introduced the new HQ-100 (shown on our cover with Barbara Gewant from the Jackie Gleason show in the background). This receiver has a number of features that immediately recommend it to the SWL. We cannot possibly cover all of them in this article and suggest that interested readers write to Frank Lester, W2AMJ, at the above address for further information.

There are three things we want to mention particularly. First, the receiver is designed so that controls are placed where they are the easiest to reach. Secondly, the circuit includes a "Q-multiplier" which means more station separation ability (very important in the short-wave broadcast bands) than provided by most receivers at this price. And, lastly, it includes a timer (about $10 extra) which will turn on the receiver for a "warm-up" just before your favorite programs go on the air. All these features make this receiver worth looking at the next time you visit your local radio parts jobber.

The Gonset Company, 801 S. Main St., Burbank, Calif., is announcing in this issue a new departure in short-wave converters. It is a four-band push-button converter that can be attached to a 12-volt automobile radio in a matter of minutes. Gonset is particularly emphasizing how easy it is to get this converter going. Using a regular car antenna, it will pick up short-wave broadcasts in the 49-, 31-, 19-, and 13-meter bands. If you're just getting started in SWL'ing, this is roughly equal to those stations listed on pages 42-46 as operating around 6000, 9600, 15100 and 21600 kc.



Pushing one of the converter buttons immediately puts your regular 12-volt car radio on the short-wave band indicated. You tune your auto radio in the normal fashion between approximately 1000 and 1500 kc. to hear short-wave broadcasting stations. Because of the high power of many of the foreign broadcasters, these stations usually come through with a terrific punch.

We're Completely Baffled

(*Continued from page 75*)

Armed with this dubious victory and sustained by absolute confidence in future developments, I thought it best to let the matter rest for a few days.

A WEEK LATER, I made inroads upon the family budget that might have turned lesser enthusiasts pale. Friend Wife met this spending program (spending program: finances for "Where did it all go?") with tight-lipped silence. But as I always say: what's *wrong* with spaghetti three times a week?

With these minor matters (wife and money) out of the way, I gave all my concentration to carrying out the master plan.

Surrounded with enough speakers to construct several four-way (woofer, squawker, tweeter and super-tweeter) systems, I set about removing the old, wide-range amplifiers.

Next, I returned to my electronics supply dealer to choose the five baffles necessary to give the system that final touch of grandeur, tonal perfection and all-over economy of sound usage. Having previously purchased twenty-five speakers, I was greeted with a mixture of delight and confusion by Mr. Golenpaul—whose firm conviction is that all hi-fi enthusiasts are but a step removed from a padded cell.

"You want *five* baffles? *Five*?" The Golenpaul face sagged with disbelief. Apparently, this was an unusual order—even for me. And Mr. Golenpaul is accustomed to getting some mighty tasty orders from me.

"Yep. Five," I chuckled. "Like to get five different types, differing styles if you have them."

Golenpaul, having survived the initial shock, was beginning to assume his usual "avid dealer" manner.

"We have them, we have them!" he spouted, now anxious lest this crazy customer suddenly lose all his mind—thereby spoiling a magnificent sale.

Thereupon, with intense energy and application (and much frantic scrabbling in the stockroom), dealer Golenpaul produced a Karlson Coupler; a Varkon enclosure; a Bonn Sonosphere; a National Catenoid; and, lastly, an Acousti-Magic Labyrinth. I was temporarily torn between getting the Acousti-Magic and a Hegeman System—choosing the former because it's complicated interior appealed to my inborn sense of the intriguingly complex.

"Send them out today, please," I requested.

"*Certainly!*" Mr. Golenpaul assured me, busily adding up a rather horrendous column of figures and cackling happily to

himself. "Ah—is the wife—ah—enjoying her trip?"

"Trip?" I echoed blankly. "What trip?"

"Oh, then she's *not* going to Reno!" said Mr. Golenpaul. A sheepish smile gave his usually dour features a jolly twist. "Ah—when you—ah—ordered all these . . . that is, I thought, naturally, you—"

That Golenpaul chap is a real cynic sometimes.

THE FOLLOWING MONTH was a busy one. Between experimenting with what baffle best suited which room, changing and re-installing the various speakers, and constantly checking the crossover networks to make sure of getting the total frequency ranges completely free of IM distortion—I was kept plenty busy, plying my enthusiastic skill like a toothless beaver gumming a giant Sequoia to a fall. By month's end, the entire project was finished and ready for enjoying.

"That it?" asked the wife.

I scooped up the last of my tools, diligently swept the floor of all litter, and made one, final check of the wiring system. *"En garde!"* I replied with boyish high spirits. "Prepare yourself for acoustical delights beyond all belief! From now on, we've got music that's *music*!"

"That a fact?"

Bounding into the study, I put Eugene Ormandy's version of *Carmen* on the turntable and snapped the *all-rooms* switch on. As the magnificent opening bars began swelling throughout the house, I grabbed the wife by the hand and raced from room to room—drinking in the spine-tingling clarity and fidelity of the surging melody.

. . . I quivered with sensitive reaction to every crystal clear note, while Friend Wife stood there with the indifferent complacency of a stone idol . . .

. . . Experimenting with baffles, changing speakers, etc., I was plenty busy plying my skill like a toothless beaver gumming a giant Sequoia to a fall . . .

"How's that, eh!" I exclaimed in the dining room.

"Well . . ." she stalled, nervously eyeing the National Catenoid.

"Isn't this the greatest!" I vowed in the living room.

"Uh . . . well . . ." Her restless eyes roamed between the Varkon and me. "I really don't—"

"Just *listen* to that *quality*!" I babbled. "Listen to those overtones . . . those basses . . . those trebles . . . those wonderfully blended mid-ranges!"

She stood next to me, in the bedroom, and said nothing.

IT WAS THE SAME in the guest bedroom and the kitchen. I was quivering with sensitive reaction to every crystal clear note. Friend Wife stood there with the indifferent complacency of a stone idol, her face a mask of patient endurance. Finally, I led her back to the study.

"Well?" I said.

"That number—" she mused. "It's from *South Pacific*, ain't it?"

"Didn't notice the difference in the system, eh?" I said dully.

"Oklahoma?"

"You heard nothing in the way of acoustical improvement?"

"Guys and Dolls?"

"Okay," I sighed. "I lose!"

"I never could stand *Carmen* anyway," she said, "and being the kid with the original tin ear—I'm surprised you expect me to appreciate music. Now about that color-TV set—"

"Don't worry," I said bitterly. "I'll get it tomorrow."

THAT Golenpaul is going to flip when I walk into his store and order a color-TV. He's already as bewildered as a starfish in the Gobi desert.

I'm color blind, and he knows it. —30—

Tuning the Short-Wave Bands

(*Continued from page* 78)

1500-1530. This xmsn is omni-directional. They would like listener reports and will verify with a QSL card. (*11, 124*)

Israel—Reports to *Kol Zion Lagola* go to P. O. Box 754, Jerusalem. Reports to the *Voice of Israel* go to Israel Broadcasting Service, P. O. Box 1082, Jerusalem. (*MR, 44, 61, 90, and 118*)

Italy—Rome continues to operate on this current schedule: on 6010 kc. at 1730-2210 to N.A. (replacing 11,905 kc.); on 6060 kc. at 2000-2210 to L.A. (replacing 11,810 kc.); on 9575 kc. at 1730-2210 to N.A. (replacing 15,325 kc.); on 9630 kc. at 1730-2210 to L.A. (replacing 15,400 kc.); on 9710 kc. at 1730-2210 and on 11,810 kc. at 1730-1950, both xmsns to L.A. (*JR, 82, 100*)

Ivory Coast—*Radio Abidjan* has now moved to 4940 kc. from 4945 kc. and is good daily to 1730 close-down. (*GC*)

Malaya—Singapore, 9690 kc., is being heard at 0600-0615 s/off with BBC news. (*25*)

VS2K6, Radio Malaya, Kuala Lumpur, 6025 kc., carries English news at 0900-0915 daily. The output of this station is 5 kw. It verifies by letter. (*HK*)

Mozambique—*Radio Clube de Mozambique* is scheduled at 1030-1600 with an all-English session over CR7BJ, 9762 kc., and CR7BF, 11,745 kc. CR7BG, 15,085 kc., is being heard at 1425-1515 s/off with a good musical program but no English. IS is four notes on a gong. This one is poorly heard at first but signal rapidly builds up and is in the clear at s/off. (*11, 39*)

North Vietnam — *The Voice of Vietnam,* Hanoi, has an English program from 0430 s/on to 0500 and 0945-1010 s/off on 6095, 7405, 7465, 12,000, and 15,020 kc. (*21*)

Norway—LKJ2, Oslo, 9540 kc., is heard at 1800-1900 to L.A. and at 2000-2100 and 2300-0000 to N.A., replacing 9550 kc., which previously replaced 9610 kc. (*AS, 100*)

Pakistan — *Radio Pakistan,* Karachi, 15,245 kc., is excellent at 1314 with IS and English ID. A program summary follows, then classical music. News at 1330; continued with concert music to 1400 s/off. Dual to 9740 kc. (*GC, 76*)

Philippines — Far East Broadcasting Co., Manila, can be heard on 9730 kc. at 0900-1015 with religious programs in English and news at 1000. ID noted at 0900, 0930, and 1000. Religious program continues from 1015. Dual with 11,855 kc., the latter channel is usually stronger and can be tuned from 1130 with

SHORT-WAVE ABBREVIATIONS

BBC—British Broadcasting Corporation
c.w.—Code
ID—Identify, identification
IS—Interval signal
L.A.—Latin America(n)
N.A.—North America(n)
QRM—Interference
s/on—Sign on
s/off—Sign off
w.—Watts power
xmsn—Transmission from station
xmtr—Transmitter used by station

classical music. Stations close at 1205. (*11, 61*)

South Korea—HLKA, Seoul, has been testing on 11,925 kc. at 0100-0145 in a special beam to Hawaii in English and Korean. They are asking for reports. (*JM, JR, 25*)

Spain—*Radio Nacional de Espana,* Madrid, continues its N.A. xmsn at 2315-0000, 0015-0100, and 0115-0200 on 9360 and 6130 kc. in English. (*RS*)

Sweden—*Radio Sweden,* Stockholm, can be noted in English sessions to N.A. at 0815-0845 on 17,840 kc. and 2045-2100 on 9620 kc. Good level at both times. (*11*)

SHORT-WAVE CONTRIBUTORS

Christophen Bennion (*CB*) Riverside, Conn.
Camilo Castillo (*CC*) Panama, R. P.
George Cox (*GC*) New Castle, Del.
Ned Conklin (*NC*) Farmington, Conn.
Walt Connelly (*WC*) Denhigh, Va.
William Ficht, (*WF*) St. Louis, Mo.
Ha Chung Kwan (*HK*)Kowloon, Hong Kong
Tommy Kneitel (*TK*) New York, N. Y.
Joseph Montoya (*JM*) San Dimas, Calif.
Robert Migliorino (*RM*) Paterson, N. J.
Jimmy Monahan (*MO*) East Haven, Conn.
J. Art Russell (*JR*) San Diego, Calif.
Mario Rotondo (*MR*) Astoria, N. Y.
Albert K. Saylor (*AS*) Quantico, Va.
Rick Stearns (*RS*) Osage, Iowa
Michael Dorgan (*6*) Jordan, N. Y.
Bill Flynn (*7*) Berkeley, Calif.
Bill Berger (*8*) Fairfax, Okla.
Chuck Maxant (*11*) Baldwin, N. Y.
George Quay (*21*) Allentown, Pa.
Francis Welch (*25*) Jr., Worcester, Mass.
Ross Brownell (*39*) Vancouver, B. C.
Anson Boice (*44*) New Britain, Conn.
Grady Ferguson (*59*) Charlotte, N. C.
John Beaver (*61*) Pueblo, Colo.
Bill Hutchinson (*76*) Baltimore, Md.
John Mann (*82*) Montreal, P. Q.
Thomas Ivas (*90*) Chicago, Ill.
Dorothy Sanderson (*94*) Malvern, Australia
Roger Legge (*100*) McLean, Va.
Joel Richmond (*118*) Mattapan, Mass.
Tom Thompson (*124*) Saginaw, Mich.

Tangier—*IBRA Radio,* Tangier, is noted on 6975 and 11,515 kc. at 1405 with language religious program; in English from 1600 to 1645 s/off. The 9490-kc. outlet is heard until 1630 in English. They offer a copy of the New Testament to any requesting it. (*CB, GC, AS, 94*).

Trinidad—VP4RD, Port-of-Spain, operates on 6085 kc. (500 watts) at 0500-1700; on 3275 kc. (500 watts) and 790 kc. (5 kilowatts) at 0500-2200. (*WC*)

United States—In answer to queries, the General Electric Co. ended operations from KGEI last December. The station, established in 1939, was noted for its cultural and educational broadcasts beamed at Central and South America. (*7*)

The Maritime Trades Department operates a program to ships at sea on Sunday at 1120 over WFK39, 19,850 kc., WFL65, 15,850 kc., and WFK95, 15,700 kc. (*TK*)

Venezuela—YVLK, *Radio Rumbos,* Caracas, 4970 kc., has "The Supper Club" daily at 1800-1900 in English (Spanish ID). (*RM, MO*)

YVKB, *Radiodifusora Venezuela,* Caracas, is noted on 4892 kc. at 1815-1830 with Italian news. YVKR, *Radio Caracas,* is heard on 4915 kc. at 1830 with world and local news in Spanish. (*CC*)

Windward Islands—WIBS, *Grenada,* is heard on 17,800 kc. at 1900-1930. They are asking for reports. Address is St. Georges, Grenada, British West Indies. (*NC*) —30—

Transistor Topics

(*Continued from page 84*)

power supply. Be sure to remove the amplifier plug when the instrument is not in use, to avoid excessive battery drain.

Circuit Handbook. Ever since we announced our new *Transistor Circuit Handbook* a few months back, we have been literally deluged with inquiries—including several from other countries—as to where the book could be purchased. So, in *final* answer to your many letters and cards, here's the information you've requested:

The *Transistor Circuit Handbook*, by your columnist, is a 430-page cloth-bound volume covering approximately two hundred practical transistor circuits. Parts values are included. The volume sells for $4.95 and is available . . .

1. From your local radio parts distributor. If he doesn't have it, he can order it for you.

2. From *any* of the large mail order parts suppliers who advertise in POP'tronics, including Allied Radio, Lafayette Radio, Radio Shack, and others.

3. Direct from the publisher . . . Coyne Electrical School, 500 S. Paulina St., Chicago, Ill.

4. Direct from the distributor . . . Howard W. Sams & Co., Inc., 2201 E. 46th St., Indianapolis 5, Ind.

5. If you are overseas . . . from the Export Department of Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y.

Experimenters' Transistors. Of the literally hundreds of types that have been manufactured since the transistor was first invented, relatively few have been designed specifically for use by experimenters, home-builders, students and hams. Experimenters' transistors are known for their broad characteristics—permitting their use in a variety of circuits, comparatively low cost, and wide availability. Here is a quick "run-down" of currently available units.

Audio types: Raytheon, CK722, CK721; G.E. 2N107; General Transistor 2N222; Philco AO-2; Marvelco CQ-1. (All are *p-n-p* units.)

R.f. types: Raytheon CK768 (*p-n-p*); G.E. 2N170 (*n-p-n*); Philco AO-1 (*surface barrier*); Marvelco RF-1 (*p-n-p*).

High-power types: CBS-Hytron 2N255, 2N256 (both are *p-n-p* units).

Not all of these transistors are available

RESONANCE QUIZ

(Answers to quiz on page 98)

1. b	2. b	3. b	4. c	5. d
6. a	7. a	8. b	9. d	10. a

from every local parts distributor, but most can be obtained from the larger mail order firms. Characteristics and general specifications, as well as maximum ratings, are available from the manufacturers.

Transistor Prices. When transistors were first introduced, they were hand-assembled in very small quantities. As a result, they sold at fantastically high prices. Typical prices ranged from $18.00 to $100.00 *each!* During the last few years, prices have dropped ever lower. But many experimenters still feel that transistors are "expensive" when compared to vacuum tubes, and—because of this feeling—hesitate to use them.

Your columnist recently checked the *net* prices on standard-brand vacuum tubes. Out of over 470 vacuum tubes, 29 were priced at less than one dollar, and, of these, only 12 were *amplifier* types. The 17 remaining types were rectifiers. Percentagewise, just 2.55% of the listed tubes sold for under $1.00, taking amplifier types only.

In another catalog, we found some 120 different types of transistors listed. Of these, three sold for less than one dollar . . . or, percentagewise, 2.5% of the listed types. And *all* transistors are amplifiers!

New Publication. For the first time in any electronics magazine, we can announce that Raytheon has a new booklet for transistor experimenters. It contains a lot of down-to-earth information on using transistors, modifying transistor circuits, wiring techniques, etc. Also included are a number of interesting construction projects. The title of the booklet is "Transistor Guide." For full information concerning availability, price, etc., of this new publication, write directly to Raytheon Manufacturing Co., Dept. TT-2, Newton 58, Mass.

Product News. Delco Radio is making industry's highest power transistors. Types 2N173 and 2N174 both have power dissipation ratings of *55 watts*! The 2N173 has a maximum collector voltage rating of 60 volts, maximum current of *12 amperes*. The 2N174 is similar, but has a maximum collector voltage rating of 80 volts.

A new type of transistor socket is available from Elco Corporation (Philadelphia 24, Pa.). Called a "Combination Transistor Socket," it has four holes, so arranged that it can be used with transistors having *either* a three-pin "in-line" arrangement or a triangular pin configuration. What's more, the new socket has a *round* body, and can be fitted into a drilled hole!

That's it for now, fellows.

Lou

Radio Rides Stardust Trail

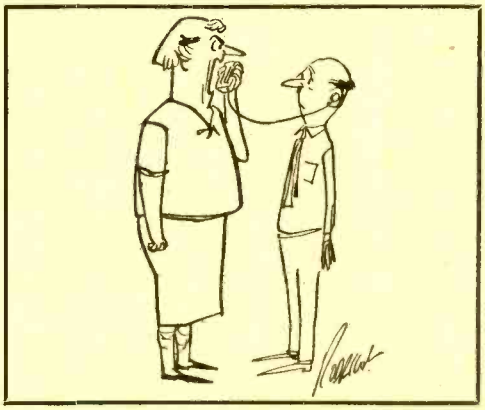
(*Continued from page 49*)

toward the Earth every hour, burning themselves up in the rarefied air at a height of about 60 miles. Yet in the brief flash which is its funeral pyre, each meteor carries a moment of Dr. Forsyth's message. In a sense, the meteor is a "bus" on which the message, like a group of passengers, rides to its destination.

Brief Bus Ride. The trouble is that the meteor flash lasts only about a second and only a small part of the message can be transmitted. The rest of the message has to wait for the next "bus," i.e., the next meteor. Every effort is made to cram the greatest possible number of "passengers" (message units) onto each meteor "bus."

In ordinary voice transmission, hardly more than a single syllable could be transmitted via each meteor trail. Forsyth's message is recorded ahead of time on magnetic tape or some other memory device. Meteors appearing in the sky automatically trigger transmission of the prerecorded message at tremendous speed. This speed-up allows a lot more information to be crammed onto each meteor trail. The message shoots out in fast bursts to make the most of each short transmission period. On the receiving end, the high-speed message is recorded and played back at a slower rate. Thus, the rapid transmission bursts packed onto individual meteor trails are averaged into smooth, continuous reception.

Elastic Time. This method of hacking up a continuous message into separate "parcels," transmitting each "parcel" at high speed at a suitable moment and then recombining the chunks into continuous information is called "quantizing," because each "parcel" represents a "quantum" of information. In effect, it stretches and compresses time. The trick was originally developed by computer engineers to shuttle data between various parts of a computer



Showing her long reach, "Janet" flashed signals via meteor from Port Arthur to Ottawa, Canada.

at just the right moment for effective use.

The system was first nicknamed "Janus" after a Roman god who kept track of things both coming and going by having two faces. This aptly symbolized a two-way radio channel that also kept a lookout for meteors all around. But some of the engineers felt they would rather have a girl, so the Roman "Janus" became "Janet," which proves that nearly everything is possible with electronics.

Quick on the Draw. To make her mark on the meteors, Janet had to develop a trigger finger faster even than Annie Oakley's. Once a meteor appears, the message must be tacked on to its tail quickly before the shooting star dives burning to the bottom of the sky.

Janet's receivers always keep their ears cocked for a "trial tone" constantly sent out by the transmitter. As soon as a meteor appears, the reflected trial tone "checks in" at the formerly silent receiver. The receiver station, in turn, flashes an "okay" back to the transmitter, which triggers a burst of information into the air. When the meteor vanishes, the trial tone fades, thus halting transmission until the next meteor flashes in the sky to act unwittingly as a come-and-go mirror for Janet.

Using very high frequencies—which normally would not go much farther than the visible horizon—for this long-distance bounce brings a two-fold advantage: (1) it makes the radio "stardust trail" almost immune to interception; (2) transmitters can operate economically at low power. Because of these two factors, Dr. Forsyth foresees extensive use of his system.

Janet's transition from her experimental childhood to the maturity of everyday use is now guided by Ferranti Electric, Ltd., of Toronto, Canada. Mr. G. W. L. Davis, the chief electronic engineer, feels that Janet has now mastered the most difficult phase of "growing up": the jack-rabbit stop-and-go action that lets her make the most of each meteor. From here on out, the sky's the limit. —30—

Classified

RATE: 50¢ per word. Minimum 10 words prepaid. April issue closes February 1st. 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.

ADJUSTABLE Regulated Power Supply, Dual Range. Zero to 50 volts, 105 to 150 volts, each at twenty milliamperes DC. 6.3 VAC at one ampere. $24.90 postpaid. Dieme, Box 7, Chaska, Minnesota.

1000 RAISED Letter Business Cards $2.95 ppd. Samples. Astral, Box 141, Hempstead, N. Y.

WESTINGHOUSE, used meters for registering watthours on appliances, trailers, etc. $3.95 Prepaid or $2.00 plus balance and C.O.D. Glasco, Anderson, S. C.

24 PAGE Handbook "Record One Tube DX'er" with Experimenter's catalog — 30¢. Laboratories, 328-L Fuller, Redwood City, California.

WALKIE-Talkie chassis $6.98. Illustrated in this issue. See index on last page. 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 Garden 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.

EAVESDROP with a pack of cigarettes. Miniature transistorized radio transmitter. Complete diagrams & instructions. $1.25. C. Carrier Co., 734 15th St., N.W., Washington 5, D. C.

NEW for all Hams and SWL'ers. UR Call Letters in Plastic. Attaches to smooth surfaces, windshield, xmitter, receiver, etc. Only $1.00 Postpaid. Frad Co., Dept. B2, Box 234, Coshocton, Ohio.

TRANSISTOR, batteryless, pocket radio. No outside antenna needed. Included free powerful inexpensive shocker. Both plans 50¢. Houser, Box 108, Piqua, Ohio.

ELECTRIC Guitars, amplifiers, parts, wholesale. Free catalog. Carvin, PE, Covina, California.

POWER Supplies—Made to order for: Receivers, Transmitters, Hi-Fi's, Transistor circuits, etc. Send specifications to: "Custom Design" P. O. Box 43, Waverly, Iowa.

NOTHING Similar! Listen "Yards" Away! Reconsider "January" Advertisement Beginning: "Remaining".

HALLICRAFTERS SX62, excellent, $145, Paul Damai, Calumet City, Ill.

WANTED

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.

BEFORE You Sell—Check With Rex! Wanted: Surplus military and commercial aircraft electronics. BC-788, I-152, ARN-7, ARC-1, ARC-3, BC-221, RTA1B, ART-13, DY-21, APN-9, transmitters, receivers, test equipment, etc. Also Want Electronic Tubes: broadcast, transmitting, receiving, Magnetrons, Klystrons, miniatures, sub-miniatures, ruggedized, etc. For Top Prices Contact: P. E. Sanett, W6Rex, 1524 S. Edris Dr., Los Angeles 35, Calif. Phone: REpublic 5-0215.

INVENTIONS WANTED

INVENTIONS wanted. Patented; unpatented. Global Marketing Service, 2420 77th, Oakland 5, Calif.

HELP WANTED

EARN Extra Money Selling Advertising Book Matches. Free Sample Kit furnished. Matchcorp, Dept. EZ-7, Chicago 32, Illinois.

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

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. Burtt, 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.

$200. MONTHLY Possible, Sewing Babywear! No house selling! Send stamped, addressed envelope. Babygay, Warsaw 80, Indiana.

$100-$200 MONTHLY Possible, addressing envelopes, postcards, from mailing lists at home. Longhand, typewriter. Detailed Instructions only 25¢! L. Economy, Box 1686, Clearwater, Florida.

TAPE RECORDERS

RECORDERS, Tape, Hi-Fi. 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.

HIGH FIDELITY

FREE Monthly Hi-Fi Bulletin. Write for quotation on any components. Sound Reproduction Inc., 34 New St., Newark, N. J. Mitchell 2-6816.

RECORDS from your tapes. Complete high fidelity recording service. Sample record $1.00. Free information. Baron's Sound Recording. Lynden, Wash.

DISGUSTED Of "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.

INSTRUCTION

ENGINEERING Degrees earned by home study. (Residential Courses also available.) Pacific Internation 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.

LEARN While Asleep! Details free. Research Association, Box 610, Omaha.

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.

NOVICE code course, to 8 WPM, $5.95. Advanced course—9 to 18 WPM, $4.95. Both together $9.95. 7" magnetic recording tape, slow speed (3¾ IPS). Unbeatable. Rush your order today to Tapedcode, Box 31-B, Langhorne, Pa.

REPAIRS & SERVICING

ELECTRONIC Kits conscientiously assembled. Lyle Estabrook, Route 2, Nampa, Idaho.

TELEPHONE Transmitter, hand set type and Ear Cap receiver inter-house phones, speakers or any communication purpose. Both only $1.00. No C.O.D.'s. Telephones, Dept. D-5, 1760 Lunt, Chicago 26.

MISCELLANEOUS

SONGPOEMS and Lyrics Wanted! Mail to: Tin Pan Alley, Inc., 1650 Broadway, New York 19, N. Y.

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.

Complete Training

FOR BETTER RADIO-TV SERVICE JOBS

Let these two great Ghirardi training books teach you to handle all types of AM, FM and TV service jobs by approved **professional methods—and watch your efficiency and earnings soar!**

Each book is a complete service training guide. Each contains the up-to-date data on the methods and equipment—NOT a re-hash of old, out-of-date material. Each is co-authored by A. A. Ghirardi whose famous RADIO PHYSICS COURSE and MODERN RADIO SERVICING were, for 20 years, more widely used for military, school and home study training than any other books of their type!

THE NEW Ghirardi
RADIO-TV SERVICE LIBRARY

Almost 1500 pages and over 800 clear illustrations show step-by-step how to handle every phase of troubleshooting and servicing.

1—Radio and Television Receiver
TROUBLESHOOTING AND REPAIR

A complete guide to profitable professional methods. For the beginner, it is a comprehensive training course. For the experienced serviceman, it is a quick way to "brush up" on specific jobs, to develop improved techniques or to find fast answers to puzzling service problems. Includes invaluable "step-by-step" service charts, 820 pages, 417 illus., price $7.50 separately.

2—Radio and Television Receiver
CIRCUITRY AND OPERATION

This 669-page volume is the ideal guide for servicemen who realize it pays to know what really makes modern radio-TV receivers "tick" and why. Gives a complete understanding of basic circuits and circuit variations; how to recognize them at a glance; how to eliminate guesswork and useless testing in servicing them. 417 illus. Price separately $6.75.

Special low price . . . you save $1.25

If broken into lesson form and sent to you as a "course," you'd regard these two great books as a bargain at $50 or more!

Under this new offer, you save $1.25 on the price of the two books—and have the privilege of paying in easy installments while you use them! No lessons to wait for. You learn fast—and right!

STUDY 10 DAYS FREE!

Dept. PE-27, RINEHART & CO., Inc.
232 Madison Ave., New York 16, N. Y.

Send books below for 10-day FREE EXAMINATION. In 10 days, I will either remit price indicated (plus postage) or return books postpaid and owe you nothing.

☐ Radio & TV Receiver **TROUBLESHOOTING & REPAIR** (Price $7.50 separately)

☐ Radio & TV **CIRCUITRY & OPERATION** (Price $6.75)

☐ **Check here for MONEY-SAVING COMBINATION OFFER . . . Save $1.25.** Send both of above big books at special price of only $13.00 for the two. (Regular price $14.25 . . . you save $1.25.) Payable at rate of $4 plus postage after 10 days if you decide to keep books and $3 a month for 3 months until the total of $13.00 has been paid.

Name .....

Address .....

City, Zone, State .....

Outside U.S.A.—$8.00 for TROUBLESHOOTING & REPAIR; $7.25 for CIRCUITRY & OPERATION; $14.00 for both. Cash only, but money refunded if you return books in 10 days.

POPULAR ELECTRONICS BARGAIN BASEMENT

SAVE ON THESE SPECIAL BUYS OF THE MONTH

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 DEPT PE-L

165-08 LIBERTY AVE., JAMAICA 33,

Include postage with order.

ELECTRONIC KITS

COMPLETE KITS FOR ARTICLES DESCRIBED IN THIS AND OTHER MAGAZINES EACH MONTH— WRITE FOR PRICES

ALGERADIO ELECTRONICS CO.

236 N. Franklin St. Phone IV 9-0808 Hempstead, N. Y.

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 Transmitters & Receivers Kit Available.

R/C TRANSMITTER & RECEIVER KIT

27¼ Mc. 5 Watt 2-Tube Simple Transmitter & Super-sens. 2 Tube Simple Receiver—Parts incl. Drilled Bases Wound Coil, Res., Cond., SIGMA Relay, Instruc. ..... Only $9.95

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 $1; Radio Control $1; Handbook 2.25
CRYSTALS: 27.255 Mc. Petersen Z9A . . $3.98; HOLDER . . .15
2" METERS, 150 MicroA, $3.95 ..... 0-1 Ma. 3.65
RELAY CONTROL UNIT incl. Sensitive 10,000 ohm Sigma Relay (1½ Ma) Thermal Bi-metal Strip, Heating Element, Hi Z Audio Choke, Mini Alnico V Magnet, Neon Lamp, Resistors, Capacitors ..... only .99
TUBES: XFG1, RK61, 3A4, 3A5, 1AG4, 6K4—Transistors .99
Storage Batteries: Mini. 6V. NT6, $2.45; 2V 27A/Hour . . 2.75
Flash STROBOSCOPE 110 V AC, Range 20-200 RP/Sec 29.85

GYRO ELECTRONICS 325-P CANAL ST. N. Y. 13, N. Y.

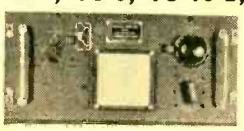
HARMONICA CONTACT MICROPHONE

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 measures only 1⅝" L x ⅝" W x ¾" D. Complete with 7 ft. shielded cable. Dept. PE-L . . . Net 2.95

Lafayette Radio 165-08 LIBERTY AVE. JAMAICA 33, N. Y.

TU-7, TU-9, TU-10-B, TU-26 Tuning Units



$1.95 ea.

Used in the BC-375 transmitter, but the most favorable and acceptable piece of surplus gear for obtaining good cheap useable parts. The TU-10-B contains three double spaced transmitting type variable condensers of 16, 27, and 7 plate varieties. 3 mica transmitting type micas, 2 isplantite shaft couplings, antenna coupling switch, two precision vernier dials, chokes, inductances and other useful parts. Better order plenty before supply is exhausted again. Ship. wt. 13 lbs. Size 7⅝" x 16½" x 7½". PRICE, Used, ea. ..... $1.95. New, ea. $2.50

ESSE RADIO CO. 42 WEST SOUTH ST., INDIANAPOLIS 25, IND.

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.

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: 1⅜" 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. NEW YORK, N.Y. DEPT PE2
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.
Include postage with order

EXPERIMENTERS - AMATEURS - HOBBYISTS

We are reducing a large inventory of brand new vacuum tubes and this get-acquainted offer is limited to the stock on hand. 15 different electron tubes, including 5" CRT—a $50 value for only $2.95 postpaid in the U.S.A.; two assortments for $4.95. Order early and we will include "giant acorn" (orbital beam pentode) and famous "lighthouse" tubes. Sample deal of half a dozen tubes including 3" CRT $1.85 postpaid.

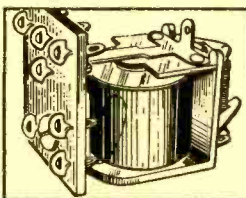
A fortunate purchase enables us to offer you a brand new Navy RAK-8 receiver; this is the ultimate in TRF covering the 15-600 KC frequency spectrum. This is a CW man's dream, and it cost Uncle Sam about $1600; operates from 115 volt, 60 cycle AC. Ready to go, and complete with power supply. . . . . $89.50 FOB Sacramento. Shipping weight 160 pounds. Write for details.

Write for free government surplus bargain bulletin

JOE PALMER

1440 LAS SALINAS WAY SACRAMENTO, CALIFORNIA

DON'T MISS THE HI-FI BARGAINS ON PAGE 108



LITTLE "JEWEL" R/C RELAY

The Mighty Mite of the R/C field. Weighs less than ½ oz.! Only ¾" H x 17/32" W x 1-1/16" L. Highy sensitive—extremely rugged. Pulls at 1.4 Ma—drops out 1.2 Ma D.C. S.P.D.T. 5000 ohm coil.

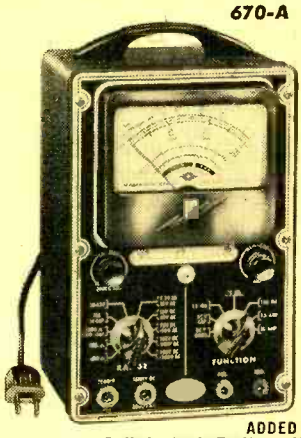
F-260 ..... Net 2.75

Lafayette Radio 100 SIXTH AVE. NEW YORK, N.Y. DEPT PE2
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.
Include postage with order

ADVERTISER'S INDEX

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 electrolytics)
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

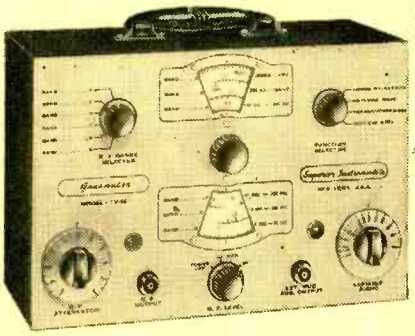
ADDED FEATURE:
Built-in ISOLATION TRANSFORMER reduces possibility of burning out meter through misuse.

The Model 670-A comes housed in a rugged crackle-finished steel cabinet complete with test leads and operating instructions.

$28.40

The new Model TV-50

GENOMETER



A versatile all-inclusive GENERATOR which provides ALL the outputs for servicing:

A.M. Radio • F.M. Radio • Amplifiers
Black and White TV • Color TV

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: The Model TV-50 Genometer 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 sinewave audio, the Model TV-50 Genometer provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.

CROSS HATCH GENERATOR: The Model TV-50 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): Although you will be able to use most of your regular standard equipment for servicing Color TV, the one addition which is a "must" is a Dot Pattern Generator. 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 Model TV-50 includes all the most frequently needed marker points. 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).

BAR GENERATOR: The Model TV-50 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.

THE MODEL TV-50 comes absolutely complete with shielded leads and operating instructions.

$47.50

SHIPPED ON APPROVAL

NO MONEY WITH ORDER — NO C.O.D.

SEE FOLLOWING PAGE FOR COMPLETE DETAILS

PRINTED IN U.S.A.

For the first time ever: ONE TESTER PROVIDES ALL THE SERVICES LISTED BELOW!

Superior's New Model **76**

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.

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

✓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

$26.95

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.

SEE OTHER SIDE

CUT OUT AND MAIL TODAY!

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-321 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 670-A . . . Total Price $28.40 $7.40 within 10 days. Balance $3.50 monthly for 6 months.

☐ Model TV-12 . . . Total Price $72.50 $22.50 within 10 days. Balance $10.00 monthly for 5 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.

Name _____

Address _____

City _____ Zone _____ State _____

All prices net, F.O.B., N.Y.C.

Superior's New Model TV-12

TRANS-CONDUCTANCE TUBE TESTER

ALSO TESTS TRANSISTORS!

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.

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 **$72.50**

Superior's new Model TW-11 **STANDARD PROFESSIONAL**

TUBE TESTER

- Tests all tubes, including 4, 5, 6, 7, Octal, Lock-in, Hearing Aid, Thyratron, 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.

$47.50

SHIPPED ON APPROVAL

NO MONEY WITH ORDER — NO C.O.D.

FIRST CLASS
Permit No. 61430
New York, N. Y.

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the U. S.

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!