Build the SSS Transistor Transmitter

POPULAR ELECTRONICS

AUGUST 1958

35 CENTS

MAC 8

Missiles and Electronics

At Cape Canaveral

Check Your I.Q. • DX'ing the Airlanes • Allergic Hi-Fi

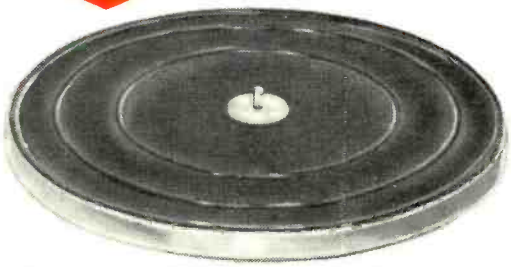
It's Here!

The Turntable Kit

. . . Another

Weathers

Original



Now you can get the incomparable Weathers Synchronous Turntable in *kit form.* Ready to mount in existing cabinet and sound system. *Can be assembled in a few minutes with only pliers and screwdriver . . . no soldering necessary.*

Designed on a New Principle

Light: Light construction eliminates the mechanical noises inherent in weight and moss — to a noise level which is 25 db less than the noise recorded on the best phonograph records available today.

Compact: Motor and turntable (with your tonearm) can be assembled on a 14⅛" x 15⅛" motor-board with a total overall height of only 2½".

Smooth: The Weathers Turntable comes up to synchronous speed in ¾ of one revolution of the platter. Its very small 12 pole synchronous motor drives the aluminum turntable at exactly synchronous speed regardless of variations in line voltage or lood.

Silent: The unique Weathers Turntable Bearing Assembly is the lowest friction and quietest bearing ever produced. The new principle drive system eliminates the mechanical noise caused by heavier equipment. Acoustic feed back, rumble, wow and flutter are practically eliminated from the Weathers Turntable. This kit includes the Weathers conical spring shock mountings which isolate the turntable from floor and table vibrations.

Plus the Weathers Discushion: A turntable pad of such design that records are suspended by their outer dimensions only, with no part of the playing surfaces touching any supporting areas, eliminating the greatest source of record contamination and noise.

Weathers Industries

DIVISION OF ADVANCE INDUSTRIES, INC.

66 E. Gloucester Pike, Barrington, N. J.

Export: Joseph Plasencia, Inc., 401 Broadway, New York, N. Y.

WEATHERS TECHNICAL MAGIC IS SOUND

Just 2 settings on the NEW Model FC-2 FAST-CHECK TUBE TESTER

SIZE:
H: 11¼"
W: 14⅜"
D: 4¾"

tests over 600 tube types completely, accurately ...AND IN SECONDS!

- **NO MULTIPLE SWITCHING**
- **NO ROLL CHART CHECKING**
- **CANNOT BECOME OBSOLETE**

Engineered to accommodate all future tube types . . . new tube listings furnished periodically.

The FAST-CHECK enables you to save valuable time and eliminate unprofitable call backs. You earn extra money and win confidence by showing your customer the actual condition and life expectancy of the tube on the large meter scale of the FC-2. The extra tubes you will sell each day will pay for the FAST-CHECK in a very short time.

NEW Special compartment to accommodate line cord and CRT Test Adapter cable

WIDE RANGE OF OPERATION

- Checks quality of over 600 tube types . . . more than 99% of all TV and radio tubes, including the newest series-string TV tubes, auto 12 plate-volt tubes, OZ4s, magic eye tubes and gas regulators.
- Checks inter-element shorts and leakage.
- Checks for gas content.
- Checks for life expectancy.

IMPORTANT FEATURES

√ Checks each section of multi-section tubes and even if only one section is defective the tube will read "Bad" √ 41 long lasting phosphor-bronze tube sockets accommodate all present and future tube types—cannot become obsolete √ Less than 10 seconds required to test any tube √ Large D'Arsonval type meter is extremely sensitive yet rugged—is fully protected against accidental burn-out √ Line isolated √ 7-pin and 9-pin straighteners conveniently mounted on panel √ Quick reference tube chart lists over 600 tube types √ Line voltage compensation

NEW A specially designed PICTURE TUBE ADAPTER cable is now part of the FC-2 . . . making it a highly efficient CRT Tester-Rejuvenator. This feature eliminates the need of carrying extra instruments and makes the FC-2 truly an all-around tube tester. The adapter enables you to check all picture tubes (including the new short-neck 110 degree picture tubes) for cathode emission, shorts and life expectancy . . . . also to rejuvenate and restore cathode emission of weak picture tubes.

TRY THE FC-2 BEFORE YOU BUY IT!

Shipped on approval for FREE 10 day trial . . . No obligation to buy

EASY TO BUY IF YOU'RE SATISFIED!

Pay in small monthly payments at net cash prices . . . no financing charges

MODEL FC-2—housed in rugged oak carrying case complete with CRT adapter, tube listings.....only **$69.50** Net **GUARANTEED FOR ONE FULL YEAR**

This extremely low price is made possible only because YOU ARE BUYING DIRECT FROM THE MANUFACTURER

WHAT SERVICEMEN* are SAYING ABOUT THE FC-2

"You've really made tube testing a snap" . . . "I've almost got the cost of the Fast-Check paid off with the extra money I've made, and it's only 2 weeks" . . . "It's easier to use than you said" . . . "I wouldn't ever want to be without it" . . . "I use it in the shop and take it along on every call."

*Names on request

MAIL COUPON NOW—NO MONEY REQUIRED WITH ORDER . . .

ABSOLUTELY NO RISK ON YOUR PART . . .

CENTURY ELECTRONICS CO., INC.

111 Roosevelt Avenue
Dept. 308, Mineola, N. Y.

Please rush the new Model FC-2 FAST-CHECK TUBE TESTER for a 10 day trial period. If I am not completely satisfied I will return the instrument within 10 days without further obligation. If fully satisfied I agree to pay the down payment within 10 days and the monthly installments as shown. No financing charges are to be added. Should I fail to make payment when due, the unpaid balance shall become due and payable at once.

☐ **BUDGET TERMS:** Pay $14.50 within 10 days after receipt of instrument. Balance $11.00 monthly for 5 months, plus shipping charges.

☐ **PREPAID TERMS:** Enclose $69.50 with coupon as payment in full and Century will pay all shipping costs. 10 day money-back guarantee.

Name.....

Address.....

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

POPULAR ELECTRONICS is published monthly by Ziff-Davis Publishing Company, William B. Ziff, Chairman of the Board (1946-1953), at 434 S. Wabash Ave., Chicago 5, Ill. Entered as second class matter August 27, 1954 at the Post Office, Chicago, Illinois. Authorized by Post Office Department, Ottawa, Canada, as second class matter. **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

AUGUST 1958

VOLUME 9 NUMBER 2

Feature Articles and Electronic Developments

Electronic Build-It-Yourself Projects

Audio and Hi-Fi Features

Experimenter's Workshop

Departments

POPULAR ELECTRONICS

Average Net Paid Circulation 267,256

Cover photo courtesy of Radio Corporation of America

ZIFF-DAVIS PUBLISHING CO., One Park Ave., New York 16, N. Y. William Ziff, President; H. J. Morganroth, Vice President; W. Bradford Briggs, Vice President; Michael Michaelson, Vice President and Circulation Director; Victor C. Stabile, Treasurer; Albert Gruen, Art Director.

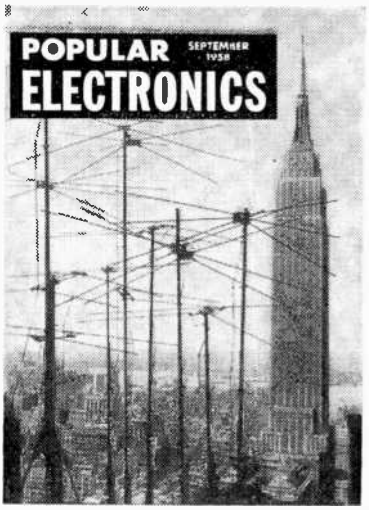
Member Audit Bureau of Circulations

MEMBER INSTITUTE OF HIGH FIDELITY MANUFACTURERS, INC

BRANCH OFFICES: Midwestern Office, 434 S. Wabash Ave., Chicago 5, Ill., Jim Weakley, advertising manager; Western Office, Room 412, 215 W. 7th St., Los Angeles 17, Calif., John E. Payne, manager.

Foreign Advertising Representatives: D. A. Goodall Ltd., London; Albert Milhado & Co., Antwerp and Dusseldorf.

COMING NEXT MONTH

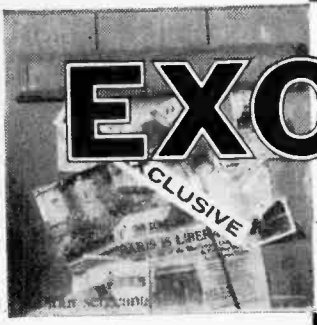


(ON SALE AUGUST 21)

Emphasizing the importance of the television antenna to good reception, our cover photograph next month will show outlines of typical antennas in use silhouetted against the sky. In the background is the Empire State Building, on whose top is the mast that supports the broadcasting antennas of the seven stations serving TV signals to viewers in New York City and its suburbs. An accompanying article will explain how you can improve your reception by bringing your antenna installation up to date to take best advantage of the new stations or channel assignments in your area.

Construction articles will describe a tiny "Transiprobe" for signal tracing your circuits, a simple timer for short intervals that uses a minimum of parts and needs no external power supply, an electronic warning or guide light that flashes and uses less battery current than old-fashioned interrupters, and how to start your hi-fi stereo system from scratch or adapt your present rig.

SAMPLE THE EXCITEMENT OF ELECTRO-VOICE STEREO



get this brilliant

new E-V stereo record $1.50

What a great way to show off your new Stereo system: Here, for the first time, you get thrilling stereo selections from six new ABC-Paramount albums . . . produced especially for Electro-Voice in superlative stereophonic sound.

Hear this sparkling Electro-Voice Stereo Record at your high fidelity showroom* . . . and ask to hear it played with Stereo's Standard, the Electro-Voice totally compatible Stereo Cartridge. For stereo, it's superb; for monaural, superior to even your present cartridge. Tens of thousands already in use attest to its acceptance as the industry's standard. (Model 21D . . . $19.50 net).

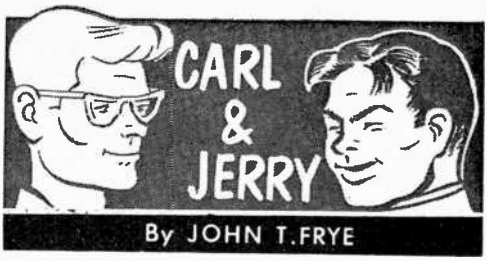
For complete information, write Electro-Voice for free brochure on choosing stereo equipment.

Electro-Voice®

ELECTRO-VOICE, INC., Buchanan, Michigan

Foremost in Electro-Acoustics—High Fidelity Loudspeakers and Enclosures for STEREO. Microphones, Phono-Cartridges and Public Address Speakers, Marine Instruments, EVI Professional Electronic Instruments or Military Material.

***OR SEND $1.50 PREPAID TO STEREO DEMONSTRATION RECORD, ELECTRO-VOICE, INC., BUCHANAN, MICH.**



By JOHN T. FRYE

Cow-Cow Boogie

IT WAS LATE AFTERNOON and Carl and Jerry were riding along a country road in a long black car with huge golden stars painted on the sides. Neat white letters spelled out "Sheriff" across the red spotlight lens. The boys, though, did not look the least bit frightened or guilty as they listened with deep interest to what the thin little blue-eyed man at the wheel was saying:

"Police Chief Morton suggested I talk to you two boys. He says you have—er—unconventional minds."

"Didn't he really say that we get a lot of wacky ideas?" Jerry asked with a grin.

"Well, he did say that; but he also said that some of those wacky ideas turn out surprisingly well. Now here's the situation. We've known for some time that a big still is operating somewhere in this vicinity; but the guys running it are real cute, and we've had no luck at all locating it. Two weeks ago we got our first break. A farmer named Elkins—we're heading for his place now—came into my office and reported something very unusual. He has a cow that comes in from the pasture about three nights a week staggering drunk. We know from the particles still sticking to her muzzle that the cow has been eating fermented mash, and it's almost a sure bet she's getting the mash at the still we're hunting."

"Then it ought to be easy to find," Carl suggested.

"Ought to be, but it's not. The pasture takes in eighty acres of very rough ground. Wildcat Creek runs along one end, and that part is almost all gullies and washes. To make matters worse, a goodly portion of the eighty acres is uncultivated and overgrown with trees and scrub brush. A couple of my deputies, pretending to be surveyors, have gone over every inch of it without spotting a thing. What's more, when they were in the pasture, Petunia—that's the cow's name—came home at night sober as

Exciting Adventures out of Thin Air!

with hallicrafters *Short Wave Radios*

MODEL S-38E $54.95

Latest model! Standard broadcast plus *three* short wave bands (1650 kc to 32 mc.). Electrical bandspread. Rich-toned 5" speaker, phone tip jack. Handsome grey steel cabinet, silver trim. Also blonde or mahogany, gold trim.....$59.95

MODEL S-53A $89.95

Has easy-to-read overseas dial with international stations indicated. Electrical bandspread and logging scale. Complete with 5" speaker, headphone jack plus phono jack. Two stages of i.f. Coverage: standard broadcast, 540-1650 kc., plus four SW bands 2.5-31 mc. 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 SW 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, simplified controls for easy operation. Coverage: (S-94) – 30-50 mc.; (S95) – 152-173 mc.

MODEL SX-99 $149.95

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

MODEL SX-62A $349.95

The ultimate in reception for the short-wave listener or amateur. Wide vision, slide-rule dial features band-in-use lighting; 500 kc. crystal calibration oscillator built in to check dial accuracy. Covers standard broadcast plus short wave bands from 1.62 to 32 mc. In addition you enjoy FM and AM coverage from 27 to 109 mc.

For complete specifications and convenient terms, see your Radio Parts Distributor

Export Sales: International Operations
Raytheon Manufacturing Co., Waltham, Mass.

The new ideas in communications are born at . . . **hallicrafters**

In our 25th year of service — Chicago 24, Illinois

Carl & Jerry (*Continued from page* 8)

a judge. The 'shiners must have been watching every single movement my men made.

"The situation is doubly ticklish because we don't just want to scare the bootleggers off. We want to find that still and destroy it. It must be a whopper from the amount of rotgut it's turning out."

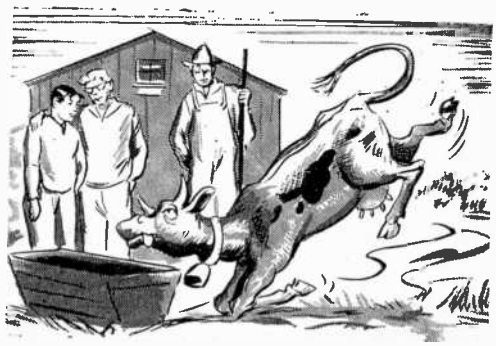
As he finished speaking, the sheriff wheeled into a barnlot and drove over to where a long, lanky, sad-faced man was standing by a watering tank. The boys had barely been introduced to Mr. Elkins when he shaded his eyes with a bony hand, stared down a lane leading into a pasture, and exclaimed dourly: "Here comes Petunia loaded to the gills again!"

Sure enough, there was a long line of cows in single file plodding sedately down the lane, but one fawn-colored cow was cavorting wildly up and down the line, throwing her tail high into the air and making the bell about her neck clang loudly as she wheeled in dizzy circles. As she reached the barnlot, she broke into a stumbling run and ran full-tilt into a corner of the barn, knocking herself to her knees. She got to her feet, shook her head from side to side, then staggered over to the water tank and began to drink deeply and noisily.

"Now ain't that a shameful sight!" Mr. Elkins said sadly. "If this keeps up, I'm going to have to destroy the critter."

Petunia raised her dripping woozy head from the water and stared foggily at the four people for a few seconds with her large, limpid, slightly blurred eyes; and then she jerked in what was unmistakably a gargantuan bovine hiccup!

"Boy, what a hangover she's going to



. . . She shook her head from side to side, then staggered over to the water tank and began to drink . . .

LET DEVRY TECH PREPARE YOU IN SPARE TIME AT HOME AS AN

ELECTRONICS TECHNICIAN

NO PREVIOUS TECHNICAL EXPERIENCE OR ADVANCED EDUCATION NEEDED!

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

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

Live-Wire Employment Service

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

Draft Age?

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

SAMPLE BOOKLET FREE!

We'll give you a free copy of an interesting booklet, "Electronics and YOU." See for yourself how you may take advantage of the opportunities in this fast-growing field.

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

Accredited Member of National Home Study Council

DEVRY TECHNICAL INSTITUTE
CHICAGO 41, ILLINOIS
FORMERLY
DEFOREST'S TRAINING, INC.

AN INDEX to a BETTER JOB, A BRIGHTER FUTURE

- Electronics
- Radar
- Guided Missiles
- Television
- Micro-Waves
- Communications
- Radio
- Industrial Electronics
- Computers
- Automation Electronics
- Remote Control Systems
- Broadcasting
- Your Own Service Shop

MAIL TODAY FOR FREE FACTS

DeVry Technical Institute
4141 Belmont Ave., Chicago 41, Ill., Dept. PE-8-C,

Please give me your FREE booklet, "Electronics and YOU," and tell me how I may prepare to enter one or more branches of Electronics as listed above.

NAME _____ AGE _____
Please Print
STREET _____ APT. _____
CITY _____ ZONE _____ STATE _____

☐ Check here if subject to military training.

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

Carl & Jerry (*Continued from page* 10)

have in the morning!" the sheriff said with a tinge of awe in his voice. "Well, boys, any ideas?"

"I'm getting sort of one," Jerry said hesitantly. "How about fastening a tiny transmitter with a very sensitive mike to Petunia and listening to the sounds it picks up as she wanders about the pasture? The moonshiners are used to her, and she can walk right up to their still. Then all we have to do is find Petunia and we've found the still."

"Where would you hide a transmitter on a cow?" the sheriff asked.

"Inside the cowbell," Carl broke in. "A transistorized transmitter could fit in there easily, and we can fasten a fine wire to that leather strap on her neck for an antenna."

"You got another bell just like that one?" Jerry asked Mr. Elkins.

"Yep."

"Well, take the clapper out of the bell Petunia's wearing and let us have the other bell."

"What's that for?" the sheriff asked.

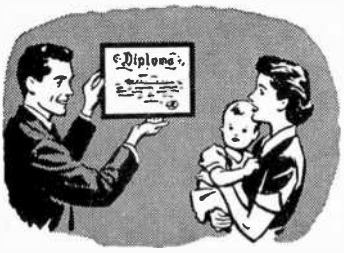
"We can't have the bell with the transmitter ringing because that would cover up the sounds we want to hear, but neither do we want the moonshiners looking inside our 'doctored' bell to see why it's not ringing. If Petunia is around them for a day or so with a dead bell, they'll investigate, decide the missing clapper has been lost, and won't check after we switch bells."

"Okay!" Sheriff Greer exclaimed with an appreciative twinkle in his blue eyes. "That's using your noggin. Let's give it a try. I'll take you boys back to town, and you get busy rigging up the transmitter. It will probably take you a couple of days or so, and in the meantime I'll do a little arranging of my own. I've got a hunch that Petunia here will soon be joining Al-*cow*-holics Anonymous!"

Mr. Elkins turned his morose gaze from Petunia to the grinning little sheriff. "It's not enough that I'm plagued with a drunken cow; now I've got to put up with a punning sheriff," he said, heaving a deep sigh and heading for the barn to get another cowbell.

BUILDING and testing the little transmitter so that it would have sufficient

FOR REAL **JOB SECURITY** —GET AN **I.C.S.** DIPLOMA



"You can stop worrying, Jane. My job's secure now! And here's the insurance policy to prove it—my I.C.S. diploma!"

This feeling of security is probably typical of every I.C.S. graduate. Because—as the job situation gets tighter, the man with I.C.S. training has the advantage.

Why? Your I.C.S. diploma tells your present employer three important things: (1) You want to make the most of your present job. (2) You have the training you need for advancement. (3) You look for better ways of doing things *on your own.*

What you do about your future is up to *you.* Do nothing and stay at your present job at the same old pay. Or earn an I.C.S. diploma in your spare time for *security, promotions, more pay!* Your first step is to mark the course that interests you in the coupon below, and mail it to us.

Three *Free* Books

We'll send you three interesting books. The first, "How to Succeed," is a gold mine of helpful tips. Points out many small things in your personality and behavior that can make the difference between success and failure. The second tells about the opportunities in the field of your choice. The third is a sample lesson (Math).

Costs *pennies* a day

Many an I.C.S. student has made up the cost of his course in one month with the salary increase his I.C.S. training earned for him. By studying at home in your spare time, you pay yourself many times an hour more than you're now making. (One student reports—"My I.C.S. course was worth $95 an hour to me.")

The security of your present job—or success in finding the new job you've always wanted—is in *your* hands. Move ahead with I. C. S. training while others stay behind on the routine, small-pay jobs.

Remember, your first step to security is to mail this coupon. Take a few minutes and do it *now.* If you put it off, it can cost you your future.

For Real Job Security—Get an I. C. S. Diploma! I. C. S., Scranton 15, Penna. Accredited Member, National Home Study Council

INTERNATIONAL CORRESPONDENCE SCHOOLS

BOX 81295G, SCRANTON 15, PENNA.

(Partial list of 257 courses)

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

ARCHITECTURE and BUILDING CONSTRUCTION
- ☐ Air Conditioning
- ☐ Architecture
- ☐ Arch. Drawing and Designing
- ☐ Building Contractor
- ☐ Building Estimator
- ☐ Carpentry and Millwork
- ☐ Carpenter Foreman
- ☐ Heating
- ☐ Interior Decoration
- ☐ Painting Contractor
- ☐ Plumbing
- ☐ Reading Arch. Blueprints

ART
- ☐ Commercial Art
- ☐ Magazine & Book Illus.
- ☐ Show Card and Sign Lettering
- ☐ Sketching and Painting

AUTOMOTIVE
- ☐ Automobiles
- ☐ Auto Body Rebuilding and Refinishing
- ☐ Auto Engine Tuneup
- ☐ Auto Technician

AVIATION
- ☐ Aero-Engineering Technology
- ☐ Aircraft & Engine Mechanic

BUSINESS
- ☐ Accounting
- ☐ Advertising
- ☐ Business Administration
- ☐ Business Management
- ☐ Cost Accounting
- ☐ Creative Salesmanship
- ☐ Managing a Small Business
- ☐ Professional Secretary
- ☐ Public Accounting
- ☐ Purchasing Agent
- ☐ Salesmanship
- ☐ Salesmanship and Management
- ☐ Traffic Management

CHEMICAL
- ☐ Analytical Chemistry
- ☐ Chemical Engineering
- ☐ Chem. Lab. Technician
- ☐ Elements of Nuclear Energy
- ☐ General Chemistry
- ☐ Natural Gas Prod. and Trans.
- ☐ Petroleum Prod. and Engr.
- ☐ Professional Engineer (Chem)
- ☐ Pulp and Paper Making

CIVIL ENGINEERING
- ☐ Civil Engineering
- ☐ Construction Engineering
- ☐ Highway Engineering
- ☐ Professional Engineer (Civil)
- ☐ Reading Struc. Blueprints
- ☐ Structural Engineering
- ☐ Surveying and Mapping

DRAFTING
- ☐ Aircraft Drafting
- ☐ Architectural Drafting
- ☐ Drafting Machine Design
- ☐ Electrical Drafting
- ☐ Mechanical Drafting
- ☐ Sheet Metal Drafting
- ☐ Structural Drafting

ELECTRICAL
- ☐ Electrical Engineering
- ☐ Elec. Engr. Technician
- ☐ Elec. Light and Power
- ☐ Practical Electrician
- ☐ Practical Lineman
- ☐ Professional Engineer (Elec)

HIGH SCHOOL
- ☐ High School Diploma

- ☐ Good English
- ☐ High School Mathematics
- ☐ Short Story Writing

LEADERSHIP
- ☐ Industrial Foremanship
- ☐ Industrial Supervision
- ☐ Personnel-Labor Relations
- ☐ Supervision

MECHANICAL and SHOP
- ☐ Diesel Engines
- ☐ Gas-Elec. Welding
- ☐ Industrial Engineering
- ☐ Industrial Instrumentation
- ☐ Industrial Metallurgy
- ☐ Industrial Safety
- ☐ Machine Design
- ☐ Machine Shop Practice
- ☐ Mechanical Engineering
- ☐ Professional Engineer (Mech)
- ☐ Quality Control
- ☐ Reading Shop Blueprints
- ☐ Refrigeration and Air Conditioning
- ☐ Tool Design ☐ Tool Making

RADIO, TELEVISION
- ☐ General Electronics Tech.
- ☐ Industrial Electronics
- ☐ Practical Radio-TV Eng'r'g
- ☐ Practical Telephony
- ☐ Radio-TV Servicing

RAILROAD
- ☐ Car Inspector and Air Brake
- ☐ Diesel Electrician
- ☐ Diesel Engr. and Fireman
- ☐ Diesel Locomotive

STEAM and DIESEL POWER
- ☐ Combustion Engineering
- ☐ Power Plant Engineer
- ☐ Stationary Diesel Engr.
- ☐ Stationary Fireman

TEXTILE
- ☐ Carding and Spinning
- ☐ Cotton Manufacture
- ☐ Cotton Warping and Weaving
- ☐ Loom Fixing Technician
- ☐ Textile Designing
- ☐ Textile Finishing & Dyeing
- ☐ Throwing
- ☐ Warping and Weaving
- ☐ Worsted Manufacturing

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.

Carl & Jerry (*Continued from page* 12)

range and sensitivity for their purpose was no easy job, and it was almost a week later before the boys were satisfied with it. Bright and early on a Wednesday morning they went with the sheriff out to the Elkins farm. Mr. Greer had driven his official car out the night before and parked it inside the corn crib; so he used his own unmarked car this morning. The special bell was fastened about Petunia's neck, and she was turned out with the other cattle. Then began what promised to be a long vigil as the boys and the sheriff listened to the receiver that had been set up in the corn crib.

"A state police helicopter is standing by at the airport," Sheriff Greer explained. "The instant I call him on my car transmitter, he'll take off and try to spot Petunia from the air. We can keep in touch with him all the time by radio."

Looking through the cracks of the crib, the boys watched Petunia separate from the other cattle and disappear into a clump of brush. Then all three lapsed into silence as they listened to the sounds coming from the radio speaker. Every step of the cow produced a clumping sound, and the calls of birds and the buzzing of insects came through with startling clarity. Suddenly the clumping stopped and there was a sound like the tearing of a glued flap off a cardboard carton.

"What's that?" the sheriff gasped.

"Just Petunia grazing," Jerry said with a grin. "Kind of a noisy eater, ain't she?"

But the cow only stopped briefly; then the resumed regular clumping sound indicated that she was moving steadily along. Suddenly all three of the listeners sat bolt upright as they heard the faint sound of human voices coming from the speaker;

. . . Minutes later they saw the helicopter hovering over the end of the pasture down by the creek . . .

Carl & Jerry (*Continued from page* 14)

rapidly the voices grew louder until it was easy to hear what was being said.

"Hey, Jed, looky!" a deep bass voice said. "Here's our regular customer, and we ain't even got the saloon open yet."

"Quit fooling with that mash-happy cow and shake a leg," a shrill querulous voice commanded. "I want to dump this mash into the creek and get back inside the cave. I'm still worried about those surveyor fellows who were fooling around here a couple of weeks ago."

"Okay, okay, Jed; keep your shirt on. I'll just give Bossy her regular slug and then we'll dump the rest of the mash. Somehow I get a large charge out of seeing the way she guzzles the stuff. That cow is a natural-born lush."

The sheriff was already talking earnestly into the hand-mike of his car unit. He had hardly stopped speaking when the unmistakable throbbing sound of a chopper was heard, and a few minutes later they saw the ungainly aircraft hovering over the end of the pasture down by the creek.

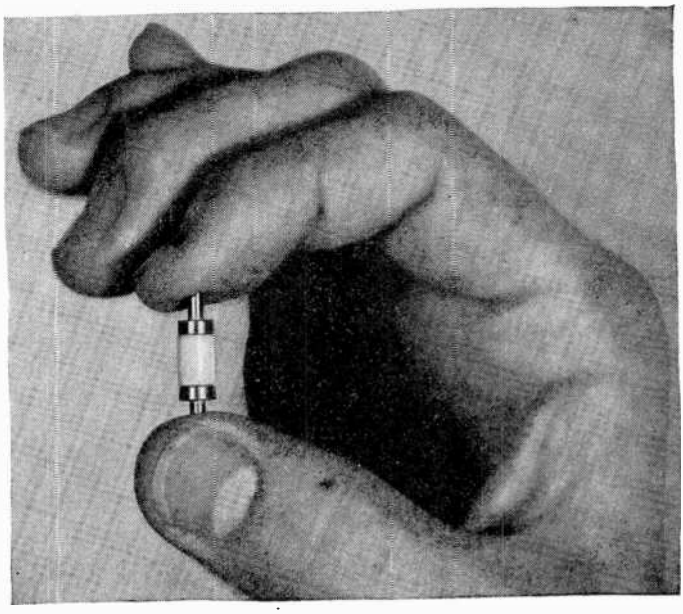
"I've spotted them!" a voice said from the car radio. "Two men are running back into a little gully leading away from the creek. Hey! They disappeared! You come on out and I'll hover right here to keep them pinned down."

THE SHERIFF grabbed a hand-held transmitter-receiver from the car, and all three started at a dead run down the lane. Mr. Elkins saw them through the open barn door, and he snatched up a pitchfork and took out after them.

When they arrived out of breath at the creek, the pilot directed them through the portable radio unit right to the spot where he had last seen the two men. But search as they would, they could not find a single trace of the two. Under the sheriff's direction, they climbed to the top and searched the flat ground on either side of the ravine. It was Mr. Elkins who pushed aside a clump of leaves with his pitchfork and revealed a metal grating set flush in the ground. Silently he beckoned the sheriff and pointed to it.

Very quietly Sheriff Greer took a metal cylinder from his pocket, lifted the grating, tripped a little trigger on the cylinder, and dropped it through the opening. A couple of seconds later there were muttered curses

NEW DIODE SPEEDS VOICES—



AT 6,000,000,000 C.P.S.

How the radio art can be improved through solid state science is illustrated by a recent development at Bell Telephone Laboratories. To make voice signals travel by microwaves they must first be "converted"—caused to vibrate at billions of cycles per second. To date, it has been possible to accomplish this conversion only at the cost of appreciable loss of signal energy. Could a more efficient converter be provided?

In the field of solid state science it was known—as a laboratory curiosity—that semiconductor diodes can be made not only to convert the frequency of signals, but also to amplify them. At Bell Laboratories Dr. Arthur Uhlir, Jr., and his associates calculated that this amplifying action could be put to practical use. They proved the point by developing a junction diode converter which can deliver up to 40 times as much signal energy as previous converters.

This efficient new converter will be applied in a new Bell System microwave highway able to transmit thousands of telephone conversations and a dozen television programs simultaneously at six billion cycles per second. In other forms it is being developed, under Signal Corps contract, for radar and military communications where more efficient frequency conversion can also be used to advantage.

This development is an example of the many different ways in which Bell Laboratories works to improve your telephone service and communications at large.

BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

Carl & Jerry (*Continued from page* 16)

and a scuffling sound from below. The four rushed to the side of the gully just in time to see a section of the wall erupt and two men come tumbling out rubbing their streaming eyes. Clouds of tear gas billowed out of the opening behind them.

In a matter of seconds, the sheriff and Mr. Elkins had the two men's arms handcuffed around sturdy trees and had directed the helicopter to return to the airport and send out some deputies. Then he, Mr. Elkins, and the two boys entered the mouth of the cave which had been so cleverly camouflaged that they had walked past it a dozen times without seeing it. Inside the cave they found the largest still Sheriff Greer said he had ever seen. Supplies had been brought in and the liquor taken out at night by boat on the creek so as to leave no trail, and a light metal boat was in the cave.

"Well, boys, I certainly want to give you credit for a very bright idea," Sheriff Greer said, as they walked out into the sunlight. "Without your help, this poison factory would probably have been going a long time before we found it."

Mr. Elkins walked with a determined stride down to the bank of the creek where Petunia was still licking at the bucket of mash the moonshiners had given her. A vigorous kick sent the bucket sailing far out into the stream.

"Come on, Petunia," he said, wrapping a wiry arm around her neck, and leading her up the bank of the stream. "The party's over. From here on in you're on the water wagon. Come on home and I'll make you up a tub of black coffee." —30—

. . . Sheriff Greer took a metal cylinder from his pocket, lifted the grating, tripped a trigger on the cylinder, and dropped it through the opening . . .

RCA INSTITUTES offers you the finest of home study training. The equipment illustrated and text material you get with each course is yours to keep. Practical work with very first lesson. Courses for the beginner and the advanced student. Pay-as-you-learn. You need pay for only one study group at a time.

Send for this FREE Book Now

FOR RESIDENT SCHOOL COURSES SEE AD ON OPPOSITE PAGE

RCA INSTITUTES, Inc. Home Study Dept. PE-88
A Service of Radio Corporation of America
350 West Fourth Street, New York 14, N. Y.

Without obligation, send me FREE 52 page CATALOG on Home Study Courses in Radio, Television and Color TV. No salesman will call.

Name.....
please print

Address.....

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

Korean Vets! Entes discharge date.....

CANADIANS — Take advantage of these same RCA courses at no additional cost. No postage, no customs, no delay. Send coupon to:
RCA Victor Company, Ltd., 5001 Cote de Liesse Rd., Montreal 9, Quebec
To save time, paste coupon on postcard.

LETTERS FROM OUR READERS

Train Whistle Becomes Howler

■ Here is a variation in the use of your Electronic Train Whistle (December 1954 issue). We installed a dial telephone system here and needed a howler to get receivers back on the cradles. The whistle was modified by adding a toggle switch to the power line, leaving out rheostat *R1*, raising *C1* to about 0.5 μμfd., and getting a nerve-shattering screech. *T1* was a tube-to-line transformer isolated from d.c. by a 1-μfd. capacitor in series with the output so the dial machine could return to normal when the receiver was replaced. It has proved very valuable in finding defective phones and pairs in cables. Of course, test leads replace the speaker.

My thanks for a fine magazine.

GEORGE D. LANTIS
Lincoln, Mont.

Electronic Echo Chambers

■ I have recently built an amplifier for use with a guitar and have used the vibrato circuit in your December 1957 issue. However, the person for whom the amplifier was built would like to have an echo chamber added, if possible. Have you ever published such a circuit?

EDWARD JENSEN
Stamford, Conn.

■ I play in a small band and would like to install an "echo" effect in our p.a. system, i.e., one which electronically repeats the attack on the notes. I would like to build this myself.

STEPHEN M. EHMELA
Chicago 51, Ill.

An electronic echo chamber is difficult to design. The effect can be achieved acoustically, however, with a long hollow pipe or other mechanical delay device.

Vibrato or Tremolo?

■ I would like to take exception to the article entitled "Build Your own Vibrato," December 1957. My contention is that the circuit described does not add "vibrato" but "tremolo" to the input signal.

To the prospective builder I would point out that there is a world of difference between the two effects. The article states that it is "the vibrato which produces the soul-stirring throbbing, especially in the bass notes, of a pipe organ." If we consult Webster, he states correctly that vibrato is a "slightly tremulous or pulsating effect (but no tremolo) for adding warmth and beauty . . . it consists of slight and rapid variations in the pitch of the tone being produced." Note that the effect is that of a pitch (frequency) change, not amplitude.

Let us examine the circuit described. The author states that there are three important functions; a phase shift oscillator, an amplifier-modulator, and a mixer. Actually, the net result is a stage

WE'RE MAKING IT EASIER THAN EVER TO BECOME A WELL PAID

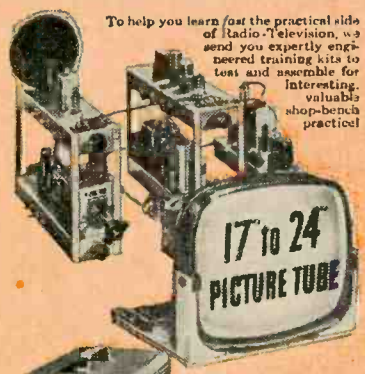
RADIO-TELEVISION SERVICE TECHNICIAN

NOW – Just $6 Starts You Training in

RADIO-TELEVISION

the SPRAYBERRY "Learn-by-Doing" Way . . .

25 BIG, COMPLETE KITS of PARTS & EQUIPMENT



To help you learn fast the practical side of Radio-Television, we send you expertly engineered training kits to test and assemble for interesting, valuable shop-bench practice!

- The new Sprayberry Training Television Receiver, built and tested in 5 sections.
- Now offered . . . this fine modern oscilloscope.
- You build this powerful two-band superheterodyne radio receiver.

You build the new Sprayberry tester — a complete 18-range Volt-Ohm-Milli ammeter test meter.

Big New CATALOG and Sample Lesson FREE!

★ ★ ★ ★ This great industry is begging for trained men . . . to step into good paying jobs or a profitable business of their own! Our new plan opens the doors of Radio-Television wide to every ambitious man who is ready to act at once!

Men by the thousands . . . trained Radio-Television Service Technicians . . . are needed at once! Perhaps you've thought about entering this interesting, top paying field, but lack of ready money held you back. Now — *just $6 enrolls you* for America's finest, most up to date home study training in Radio-Television! Unbelievable? No, the explanation is simple! We believe Radio-Television *must* have the additional men it needs as quickly as possible. We are willing to do our part by making Sprayberry Training available for less money down and on easier terms than ever before. This is your big opportunity to get the training you need . . . to step into a fine job or your own Radio-Television Service Business.

Complete Facts Free — Act Now; Offer Limited

Only a limited number of students may be accepted on this liberal and unusual basis. We urge you to act at once . . . mail the coupon below and get complete details plus our big new catalog and an actual sample lesson—*all free*. No obligation . . . no salesman will bother you.

HOME STUDY TRAINING IN SPARE TIME

Under world-famous 27-year old Sprayberry Plan, you learn entirely at home in spare time. You keep on with your present job and income. You train as fast or as slowly as you wish. You get valuable kits of parts and equipment for priceless shop-bench practice. And everything you receive, lessons and equipment alike, is all yours to keep.

LET US PROVE HOW EASILY YOU CAN LEARN!

Radio-Television needs YOU! And Sprayberry is ready to train you on better, easier terms, that any ambitious man can afford. *Just $6 starts you!* Mail coupon today . . . let the facts speak for themselves. You have everything to gain. Let us prove the kind of opportunity in store for you!

SPRAYBERRY Academy of Radio-Television

1512 Jarvis Avenue, Dept. 105-K, Chicago 26, Illinois

Mail This Coupon Now — No Salesman Will Call

Sprayberry Academy of Radio-Television
Dept. 105-K, 1512 W. Jarvis Ave., Chicago 26, Ill.

Please rush all information on your ALL-NEW Radio-Television Training Plan. I understand this does not obligate me and that no salesman will call upon me. Include New Catalog and Sample Lesson FREE.

NAME ..... Age .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

Letters

(*Continued from page 20*)

of signal amplification where the gain of the amplifier is varied at a preset rate and in a preset amount to produce tremolo, a change in volume level.

As for examples of vibrato, the electronic organ generally uses a low-frequency oscillator (6-8 cps) to modulate the supply voltage for the various tone oscillators. This causes the pitch (frequency) to vary at the same rate and in excursion (FM, if you will) by the depth of modulation.

The Hammond organ, with a mechanical tone generator, uses a complicated mechanical phase delay line which essentially splits the signal tone into two paths, straight through and delayed, and recombines the signals with a random phase delay. In stringed instruments it is produced by a rapid rocking of the player's finger on the string.

As for the soul-stirring pipe organ, this total effect is due to reverberation, phase cancellation of some frequencies, and downright poor acoustics. It is pretty difficult to alter the length of a pipe (pitch change) at a 7-cps rate; in fact, it just isn't done . . . !

This is not to deny the existence of electronic vibrato circuits—the Wurlitzer organ uses one—but a circuit which will affect the pitch of a tone after it is generated unfortunately just doesn't turn out to be a simple two-tube device.

JOSEPH F. CURRAN
Neptune, N. J.

Not being music connoisseurs, we sought advice from two experts (?) in the field when we edited the article. We must have been misled.

■ I was fortunate to acquire the December 1957 issue of P.E. and built the "Throbbing" Vibrato. I am very pleased with the results. It is wonderful.

ARNOLDO VARELA
Chitre, Prov. Herrera
Republic of Panana

More Hints for FM in Car

■ In answer to William Welch's question on interference with an FM tuner in an automobile in your May issue *(After Class)*, I suggest that he eliminate the interference at its source. Ignition noise is caused by static charges set up on and between various parts of the vehicle, also from emissions radiated from the sparking of each spark plug.

Putting a suppressing resistor on the high-tension lead to the distributor, a capacitor on the generator and possibly on the gas gauge, are possibilities. To check for improvement, apply an unmodulated signal to the set for quieting and accelerate the engine.

For further information, Mr. Welch might consult the service manuals supplied by the makers of FM two-way radio equipment (Motorola, G.E., etc.). I hope he has success with his tuner.

R. W. ANGER
Bell Telephone Mobile Repair
Toronto, Ont., Canada

Pen Pal for Transistor Fans

■ I am delighted with your crystal set and three transistors, published in October 1957, page 55 (Something Old—Something New). I should like

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 Generato·
- 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
NATIONAL CORRESPONDENCE SCHOOLS 1914

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.

NATIONAL SCHOOLS
TECHNICAL TRADE TRAINING SINCE 1905
LOS ANGELES 37, CALIFORNIA

GET FAST SERVICE – MAIL NOW TO
NATIONAL SCHOOLS, DEPT. R2G-88
4000 S. FIGUEROA ST.
LOS ANGELES 37, CALIF.

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 _____

Letters (*Continued from page 22*)

to exchange opinions with transistor experimenters in other countries.

JOSE MARIA RUIBAL
1041 Laprida Str.
Lomas de Zamora
Buenos Aires, Argentina

Better Bulb for Worm Turner

■ The NE-16 neon bulb specified for Worm Turner No. 1 in the article "Don't Dig Those Crazy Worms," May 1957 issue of POPULAR ELECTRONICS, is an error. The NE-16 should not be used, since it is suitable only for d.c. An NE-45 bulb will be satisfactory.

Thanks to Joseph Telatko, Jr., of Cleveland, Ohio, for bringing this to my attention.

R. WAYNE CRAWFORD
Columbus, Ohio

Ideas Wanted

■ WHO but POPULAR ELECTRONICS can give an amateur electronics gadgeteer an assist when he needs one?

WHAT I need is a contraption to cut off a battery charger automatically when a storage battery has reached full charge.

WHY I need such a gadget is because, like many others with too many hobbies, I possess an electric outboard motor which runs on storage batteries. Naturally, the batteries need recharging after use but I cannot always return to the lake at the proper time to turn off the charger. Since storage batteries are being more widely used in electronic flash photography, portable tape recorders, etc., such a device would have plenty of applications.

The gadget should work on one 6-volt battery or on two 6-volt batteries being charged in parallel. I'm now using a homemade timing device that shuts off after any preset interval up to 72 hours, but it is not entirely satisfactory since the required time interval to charge the battery fully must be guessed at.

WHERE can I get ideas for building such an item?

JULIAN H. HOFFMAN
Box 397
Danville, Va.

Such an automatic control for the charger would interest your Editors, too. Like everyone faced with this problem, we depend on the common trickle and taper charge methods. None of these shut themselves off automatically, however. We are sure that some of our readers will contribute ideas on this subject.

Putting Echo on Tape

■ I wonder if any readers could supply me with information on how to make an echo attachment for my tape recorder (Revere T-1100).

DAVE VAIL
478 Main Street
Yarmouth, N. S., Canada

Does anyone have any data? —30—

matching Electro-Voice and all other high quality systems

Now, for the first time, you don't need two full-range speakers to enjoy the added third dimension of stereophonic sound... thanks to a new application by Electro-Voice engineers of a basic principle of acoustics. As early as 1934 it was verified that bass tones below 300 cps do not indicate the location of the sound source... therefore, these tones contribute no stereo effect. This is because the ear lacks the ability to qualify direction when sound wave-lengths reach 2½ feet or more between their pressure crests. The *entire* stereo effect relies upon the directional placement of sounds *above* this point. The second sound source in stereo, therefore, need only be a system designed specifically to reproduce that directional part of the audio spectrum above 300 cps. Based upon this fact, Electro-Voice engineers developed the STEREON, an uncompromised second channel loudspeaker to match even the largest bass producer... a compact, functional furniture piece allowing greatest placement flexibility for optimum stereo. The STEREON is designed to complement any full-range speaker by reproducing only those frequencies required for stereo, thus eliminating your need for a *second* expensive bulky enclosure.

HERE'S WHAT HAPPENS:

Low bass frequencies from *both* stereo channels are properly phased through the XX3 STEREON Control Filter and channeled into your present full-range speaker to utilize its full-bass reproduction capabilities; the mid-bass, treble and very high tones are fed, one channel to your full-range speaker, the other channel to the STEREON ...to give you full dimensional stereo... inexpensively, compactly.

Stereo—the Electro-Voice STEREON way—gives the impact and true-to-life spaciousness of the original performance... puts you in the best seat in the house.

(In larger rooms, by the way, when you'll want stereo with the scope and magnitude of the latest movie processes ... you add-on two addicional STEREONS, placing them inconspicuously around the room. The two central STEREONS simply parallel each of the channels and are adjusted to a slightly lower level to make a smooth sound picture... providing directionality and full depth... the ultimate in stereo.)

Hear the remarkably versatile Electro-Voice STEREONS demonstrated at your Electro-Voice show room. After one listening you'll agree that STEREONS are THE answer to stereo in *your* home.

GO-ON TO STEREON... FOR SUPERLATIVE STEREO NOW...

For more complete information on the Stereon and other Electro-Voice ways to go Stereo, write for free booklet on choosing stereo equipment.

STEREO'S STANDARD

Electro-Voice®

ELECTRO-VOICE, Inc.
Buchanan, Michigan

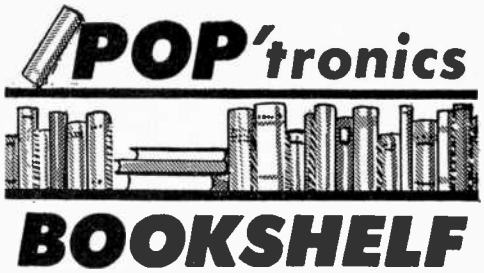
Foremost in Electro-Acoustics — *High Fidelity Loudspeakers and Enclosures for STEREO. Microphones, Phono-Cartridges and Public Address Speakers, Marine Instruments, EVI Professional Electronic Instruments and Military Material.*

STEREON III—3-way system for use with high efficiency systems. Employs MT30 mid-bass coaxial assembly and T35 VHF driver, built into integral 200 cps taper rate horn. Integral crossover network limits overall input to signals above 300 cps crosses over electrically at 3500 cps to Model T35 VHF driver. Flat response ± 2 db 300 cps to 19,000 cps. Two AT37 level controls at rear provide overall level match to full range speaker system. Quality match assured by individual control of "Presence" and "Brilliance" control. Available in mahogany, walnut, and limed ook. Size: 25" high, 17½" deep, 7½" wide. Shipping weight: 37 lbs. Net.....$129.50

STEREON 1A—Identical to Stereon III, for use with normal efficiency systems. Uses MT30B and T35B driver components. Shipping weight: 33 lbs. Net.....$99.50

XX3 STEREON CONTROL FILTER—For use with Electro-Voice Stereons. Uses matching transformer and crossover network components. All signal of 1st channel above 300 cps feeds Stereon; all signal below 300 cps from this channel is combined with full range output from second channel to utilize full bass reproduction capabilities of a single full range system. Input impedance from both amplifiers 8 ohms, output impedance 16 ohms nominal. Size: 5½" high, 4¾" wide, 5¼" deep. Ship. wt.: 8 lbs. Net $30.00

STEREO begins with the E-V totally compatible STEREO Cartridge—already the accepted standard.



"YOUNG PEOPLE'S BOOK OF POPULAR SCIENCE" edited by Glenn O. Blough. Published by Whittlesey House, McGraw-Hill Book Co., 330 West 42d St., New York, N. Y. 446 pages. Hard cover. $4.50.

To meet the ever-increasing appetite of young people for science, publishers are turning out more and more books designed to satisfy that hunger. This is one of the better ones, in that it is written so a teenager can understand it, yet is complete and factual. It covers the field in eight broad-ranging chapters, from biology to electronics. It is written by a staff of 16 well-known science writers.

Recommended: to all young people who show an interest in science.

"MOST-OFTEN-NEEDED 1958 RADIO DIAGRAMS AND SERVICING INFORMATION" compiled by M. N. Beitman. Published by Supreme Publications, 1760 Balsam Road, Highland Park, Ill. 192 pages. Soft cover. $2.50.

Diagrams and data needed for servicing over 20 different makes of a.c. and a.c./d.c. receivers are provided in this manual—including portables, auto radios, record players, and FM sets. No theory or explanations are given; this is strictly a manual for the service technician, although the general student of electronics might be interested in comparing circuits and design features of the new popular priced receivers.

Recommended: as an inexpensive means of building up a reference library of the most common of the year's circuits.

"INDUSTRIAL CONTROL CIRCUITS" by Sidney Platt. Published by John F. Rider, Inc., 116 West 14th St., New York 11, N. Y. 200 pages. Soft cover. $3.90.

If you have a fundamental knowledge of

AT LAST!

RADIO-TV and ELECTRONICS TRAINING

.... AT A PRICE YOU CAN AFFORD!

Yes, this great course costs *far less* than any training of its kind given by other major schools! Radio-Television Training School will train you for a good job in Television or Industrial Electronics — **AT HOME IN YOUR SPARE TIME.**

Think of it—a complete training program including over 120 lessons, Fourteen Big Radio-Television Kits, Complete Color-TV Instruction, Unlimited Consultation Service . . . *ALL at a really big saving to you.* How can we do this? Write to us today . . . and find out!

And what's more — you can (if you wish)
OPEN YOUR OWN RTS-APPROVED AND FINANCED RADIO-TV SERVICE SHOP

We Want 100 More Shops This Year

This 35 year old training organization — called RTS, that's Radio-Television Training School — wants to establish a string of Radio-TV Repair Shops in principal cities throughout the U. S. So far, 36 such shops are NOW IN BUSINESS AND PROSPERING. We are signing contracts with ambitious men to become future owners and operators of these shops in all areas.

FOR UNSKILLED INEXPERIENCED MEN ONLY — WE TRAIN YOU OUR WAY!

We must insist that the men we sign up be trained in Radio-TV Repair, Merchandising and Sales by our training methods—because WE KNOW the requirements of the industry. Therefore, we will TRAIN YOU . . . we will show you how to earn EXTRA CASH, during the first month or two of your training period. YOU KEEP YOUR PRESENT JOB. TRAINING TAKES PLACE IN YOUR OWN HOME, IN YOUR SPARE TIME!

RTS APPROVED SERVICE SHOP

Get your free book on the
FAMOUS RTS BUSINESS PLAN
find out how you can open
A REPAIR SHOP OF YOUR OWN

We supply and finance your equipment

When you are ready and qualified to operate one of our RTS-Approved TV Repair Shops ***WE WILL SUPPLY AND FINANCE EVERY BIT OF EQUIPMENT YOU NEED TO GET STARTED*** plus an inventory of parts and supplies. In other words *we will stake you* . . . **AN OFFER NEVER MADE BEFORE BY ANY TRAINING ORGANIZATION.** Under the RTS Business Plan you receive:

1. An electric sign for the shop front.
2. Radio and TV test Equipment.
3. Letterheads, calling cards, repair tickets, etc.
4. Basic inventory of tubes, parts, supplies.
5. Advertising and promotional material.
6. Plans for shop arrangement.
7. Instructions on how to go into business.
8. Continuous consultation and help.
9. The right to use RTS Seal of Approval, and the RTS Credo.
10. The right to use the Famous Trade Mark.

RADIO-TELEVISION TRAINING SCHOOL
5100 S. VERMONT AVENUE
LOS ANGELES 37, CALIFORNIA

ACT NOW!

ASSOCIATION OF HOME STUDY SCHOOLS

RTS' Membership in The Association of Home Study Schools is your assurance of Reliability, Integrity, and Quality of Training.

ALL THESE FREE!

CUT OUT AND MAIL — *TODAY!*

RADIO-TELEVISION TRAINING SCHOOL
5100 S. Vermont Avenue, Dept. PE 88,
Los Angeles 37, California

SEND ME FREE — all of these big opportunity books — "Good Jobs in TV-Electronics," "A Repair Shop of Your Own" and "Sample Lesson." I am interested in:

☐ Radio-Television ☐ Industrial Electronics (Automation)

Name _____ Age _____

Address _____

City & State _____

300

Bookshelf

(*Continued from page* 26)

electronics, this book is all you need to expand your background to include the common industrial control circuits. The author has written directly to those who are unfamiliar with basic control equipment, and he explains the concepts and applications involved in a straightforward, easy-to-understand way. Every phase of control circuit application is discussed, including electronic relay control and timing circuits, photoelectric control, power controls and industrial control instrumentation.

Recommended: to those who know basic theory and application and who wish to delve deeper into the mechanisms of automation and industrial control.

Free Literature Roundup

Deciding that some information on how *not* to use a transistor would be a welcome relief to transistor users, the General Transistor Corporation (91-27 138th Place, Jamaica, N. Y.) has published a booklet of cartoons which should prove entertaining reading for beginners and old-timers alike.

Bulletin S-61 gives comprehensive performance data on Radio Receptor's entire silicon diode line. A two-color catalog, it can be obtained from Robert L. Ashley, Germanium and Silicon Products Sales Manager, Radio Receptor Co., Inc., 240 Wythe Ave., Brooklyn 11, N. Y.

A helpful new guide for selecting the right magnetic tape for your recording needs is available from Minnesota Mining and Manufacturing Co., Dept. A8-89, St. Paul, Minn. Called "Which Tape Type Are You?", it illustrates the outstanding features of each of the eight popular "Scotch" brand magnetic tapes. Accessory items are described, and a convenient playing time chart and tips on dry lubrication are included.

Clarostat's Catalog No. 58 is just off the press. It covers replacement parts for radio, TV, and electronic servicing, etc., and presents the Series 44 and 44S miniaturized 0.2-watt carbon controls. A copy may be had from any Clarostat distributor or direct from Clarostat Mfg. Co., Inc., Dover, N. H. —30—

BUILD 16 RADIO CIRCUITS AT HOME

with the New Deluxe 1958 PROGRESSIVE RADIO "EDU-KIT"

A Practical Home Radio Course

ONLY $22.95

Reg. U. S. Pat. Off.

Now Includes

- ★ TRANSMITTER
- ★ SIGNAL TRACER
- ★ SIGNAL INJECTOR
- ★ CODE OSCILLATOR

- ★ No Knowledge of Radio Necessary
- ★ No Additional Parts or Tools Needed
- ★ EXCELLENT BACKGROUND FOR TV
- ★ School Inquiries Invited
- ★ Sold in 79 Countries

YOU DON'T HAVE TO SPEND HUNDREDS OF DOLLARS FOR A RADIO COURSE

The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our 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. THIS IS A COMPLETE RADIO COURSE IN EVERY DETAIL.

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 and 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, Hi-Fi and Electronics.

Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the complete price of $22.95. 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.

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.

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 time tested 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.

Included in the "Edu-Kit" course are sixteen Receiver, Transmitter, Code Oscillator, Signal Tracer, and Signal Injector circuits. These are not unprofessional "breadboard" experiments, but genuine radio circuits, constructed by means of professional wiring and soldering on metal chassis, plus the new method of radio construction known as "Printed Circuitry." These circuits operate on your regular AC or DC house current.

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, mica, ceramic and paper dielectric condensers, resistors, tie strips, coils, hardware, tubing, punched metal chassis, Instruction Manuals, hook-up wire, solder, 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 and 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 Membership in Radio-TV Club, Free Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.

FREE EXTRAS

- **SET OF TOOLS**
- SOLDERING IRON
- ELECTRONICS TESTER
- PLIERS-CUTTERS
- ALIGNMENT TOOL
- WRENCH SET
- VALUABLE DISCOUNT CARD
- CERTIFICATE OF MERIT
- 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

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 on 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."

Unconditional Money-Back Guarantee

The Progressive Radio "Edu-Kit" has been sold to many thousands of individuals, schools and organizations, public and private, throughout the world. It is recognized internationally as the ideal radio course.

By popular demand, the Progressive Radio "Edu-Kit" is now available in Spanish as well as English.

It is understood and agreed that should the Progressive Radio "Edu-Kit" be returned to Progressive "Edu-Kits" Inc. for any reason whatever, the purchase price will be refunded in full, without quibble or question, and without delay.

The high recognition which Progressive "Edu-Kits" Inc. has earned through its many years of service to the public is due to its unconditional insistence upon the maintenance of perfect engineering, the highest industrial standards, and 100% adherence to its Unconditional Money-Back Guarantee. As a result, we do not have a single dissatisfied customer throughout the entire world.

ORDER DIRECT FROM AD—RECEIVE FREE BONUS RESISTOR AND CONDENSER KITS WORTH $7

- ☐ Send "Edu-Kit" postpaid. I enclose full payment of $22.95.
- ☐ Send "Edu-Kit" C.O.D. I will pay $22.95 plus postage.
- ☐ Send me FREE additional information describing "Edu-Kit."

Name .....

Address .....

.....

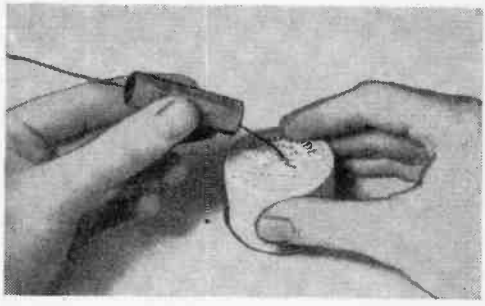
PROGRESSIVE "EDU-KITS" INC.

1186 Broadway, Dept. 547D, Hewlett, N. Y.

TIPS and TECHNIQUES

HOLE IN LID DISPENSES FLUX

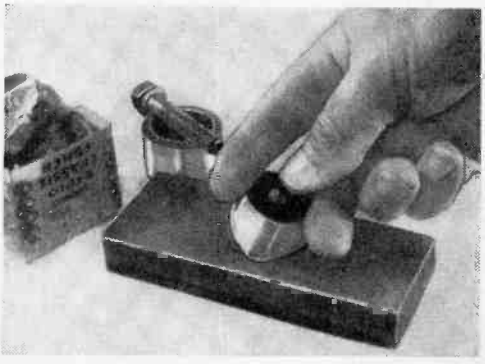
A small hole made in the lid of a can of soldering paste dispenses the flux conveniently, sparingly, and cleanly in just the



right quantity for radio-electronics work. The tip of the wire or a length of wire solder can be inserted into the hole and withdrawn with just the right amount of flux adhering. Heating the can in a shallow pan of hot water occasionally redistributes the paste. —*J. A. C.*

SHARPEN PUNCH ON OILSTONE

Lacking a grinding wheel, a round chassis punch can be sharpened equally well—and perhaps with greater safety—on an oilstone. Use the first and second fingers to



grasp the "flats" on the back of the punch, applying pressure with the thumb on the forward stroke. It is best to count the

STUDY AT HOME
for a career in radio-tv-electronics

CREI prepares you quickly for success . . . in Electronic Engineering Technology, including Servomechanisms; Computers; Radar; Automation; Aeronautical Electronics; Broadcasting; Communications and Manufacturing, and the Electronic principles associated with guided missiles, telemetering, astronautics and instrumentation.

Benefits Felt Right Away

Almost immediately, you feel the benefits of CREI training. Your employer, when informed of your step toward advancement (only at your request), is certain to take new interest in you and in your future. What you learn in CREI Home Study can start helping you do a better job immediately.

CREI Home Study . . . Quick Way To Get There

Since 1927, CREI has given thousands of ambitious young men the technical knowledge that leads to more money and security. CREI can help you, too — if you really want to be helped. CREI lessons are prepared by experts in easy-to-understand form. There is a course of instruction geared to the field in which you want to specialize. Study at your convenience, at your rate of speed.

Industry Recognizes CREI Training

CREI courses are prepared with an eye to the needs and demands of industry, so your CREI diploma can open many doors for you. Countless CREI graduates now enjoy important, good-paying positions with America's most important companies. Many famous organizations have arranged CREI group training for their personnel. To name a few: All American Cables and Radio, Inc.; Canadian Broadcasting Corporation; Columbia Broadcasting System; Gates Radio Company; Federal Electric Corp.; The Martin Company; Douglas Aircraft Co.; U. S. Information Agency (Voice of America); Canadair Limited; Trans-Canada Air Lines; United Air Lines. Their choice is a good cue for your choice.

Get This New Fact-Packed Booklet—It's Free!

Pays For Itself Quickly

Your very first raise could repay your investment in CREI Training, and leave you a profit the very first year. Increases in pay thereafter are pure profit, and you'll be prepared for many more promotions and pay raises in the future.

CREI also offers residence training in Washington, D. C. at the same high technical level. Day and evening classes start at regular intervals. Qualified residence school graduates earn degree as "Associate in Applied Science." Check coupon if you prefer residence or home study information, or write, Capitol Radio Engineering Institute, Dept. 128-E, 3224 16th St. N.W., Wash., 10, D. C.

MAIL COUPON FOR FREE BOOKLET

CAPITOL RADIO ENGINEERING INSTITUTE
ECPD Accredited Technical Institute Curricula—Founded 1927
Dept. 128-E, 3224 - 16th St., N.W., Washington 10, D. C.

Please send me your course outline and FREE illustrated Booklet, "Your Future in the New World of Electronics" . . . describing opportunities and CREI Home Study courses in Practical Electronic Engineering Technology.

CHECK FIELD OF GREATEST INTEREST
- ☐ Radar, Servo and Computer Engineering Technology
- ☐ Electronic Engineering Technology
- ☐ Broadcast (AM, FM, TV) Engineering Technology
- ☐ Television Engineering Technology
- ☐ Aeronautical Electronic Engineering Technology

L1

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

Street .....

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

Check: ☐ Home Study ☐ Residence School ☐ Korean Veteran

If you have had a high school education, and experience in electronics—and realize the need of a high-level technical knowledge to make good in the better electronic jobs — you can qualify for CREI home study training. (Electronics experience is not required for admission to CREI Residence School.) **Please fill in the following information.**

Employed By _____

Type of Present Work _____

_____

Education:
Yrs. High School _____

Yrs. College _____

Electronics Experience _____

_____

New! YEARS AHEAD! *Lafayette* STEREO TUNER KIT

THE MOST FLEXIBLE TUNER EVER DESIGNED

Use it as a Binaural-Stereophonic FM-AM tuner

Use it as a Dual-Monaural FM-AM tuner

Use it as a straight Monaural FM or AM tuner

- Multiflex Output for New Stereo FM
- 11 Tubes (including 4 dual-purpose) + Tuning Eye + Selenium rectifier Provide 17 Tube Performance
- 10KC Whistle Filter
- Pre-aligned IF's
- Tuned Cascode FM
- Separately Tuned FM and AM Sections
- Armstrong Circuit with FM/AFC and AFC Defeat
- 12 Tuned Circuits
- Dual Cathode Follower Output
- Dual Double-Tuned Transformer Coupled Limiters.

KT-500 74.50 IN KIT FORM
ONLY 7.45 DOWN
7.00 MONTHLY

More than a year of research, planning and engineering went into the making of the Lafayette Stereo Tuner. Its unique flexibility permits the reception of binaural broadcasting (simultaneous transmission on both FM and AM), the independent operation of both the FM and AM sections at the same time, and the ordinary reception of either FM or AM. The AM and FM sections are separately tuned, each with a separate 3-gang tuning condenser, separate flywheel tuning and separate volume control for proper balancing when used for binaural programs. Simplified accurate knife-edge tuning is provided by magic eye which operates independently on FM and AM. Automatic frequency control "locks in" FM signal permanently. Aside from its unique flexibility, this is, above all else, a quality high-fidelity tuner incorporating features found exclusively in the highest priced tuners.

The 5 controls of the KT-500 are FM Volume, AM Volume, FM Tuning, AM Tuning and 5-position Function Selector Switch. Tastefully styled with gold-brass escutcheon having dark maroon background plus matching maroon knobs with gold inserts. The Lafayette Stereo Tuner was designed with the builder in mind. Two separate printed circuit boards make construction and wiring simple, even for such a complex unit. Complete kit includes all parts and metal cover, a step-by-step instruction manual, schematic and pictorial diagrams. Size is 13¾" W x 10⅜" D x 4½" H. Shpg. wt., 18 lbs.

The new Lafayette Model KT-500 Stereo FM-AM Tuner is a companion piece to the Models KT-300 Audio Control Center Kit and KT-400 70-watt Basic Amplifier Kit and the "Triumvirate" of these 3 units form the heart of a top quality stereo hi-fi system.

KT-500.....Net **74.50**

LAFAYETTE MASTER AUDIO CONTROL CENTER with BINAURAL CHANNEL AND DUAL VOLUME CONTROL.

- Self-Powered • DC On All Filaments
- 24 Positions of Equalization
- Tape Head Input, High Impedance
- Dual Cathode Follower Output Stages

This is not only the finest hi-fi preamp characterized by unmatched features, but it has been functionally designed to keep pace with the conversion of your present hi-fi system to binaural (Stereophonic) sound. Incorporates an extra channel and dual volume control for binaural reproduction. Features include DC on all tube filaments, negative feedback in every stage, dual cathode follower output stages and latest printed circuit construction. Less than 0.09% IM distortion and less than 0.07 harmonic distortion at 1V. Hum and noise level better than 80 db below 3V. Uniformly flat frequency response over entire audible spectrum. 7 inputs for every type of phono, tuner or tape. Tasteful styling, brilliantly executed. Size 12¾" x 9⅛" x 3¾". Shpg. wt., 10½ lbs.

KT-300—Lafayette Master Audio Control Kit Complete with cage and detailed assembly instructions. .....Net **39.50**

LT-30—Same as above completely wired and tested with cage and instruction manual. .....Net **59.50**

DELUXE 70 WATT BASIC AMPLIFIER

- Conservatively Rated At 70 Watts
- Metered Balance And Bias Adjust Controls
- Inverse Feedback • Variable Damping
- Available In Kit And Wired Form

Here's ultra-stability in a 70 watt basic power amplifier employing highest quality components conservatively rated to insure performance and long life. Features matched pair KT 88's and wide range linear Chicago output transformer, variable damping control, meter for bias and balance and gold finish chassis. Frequency response 10-100,000 cps ± 1db. Hum and noise 90db below full output. IM distortion less than 1½% at 70 watts, less than 0.3% below 30 watts. Harmonic distortion less than 2% at 70 watts from 20 to 20,000 cps ± 1db. Output impedance 4, 8 and 16 ohms. Handsome decorative cage perforated for proper ventilation. Size 14½ x 10 x 7⅜" including cage and knobs. Shpg. wt., 40 lbs.

KT-400—Lafayette 70 watt Deluxe Basic Amplifier Kit complete with cage and detailed assembly instructions. .....Net **69.50**

LA-70—Same as above completely wired and tested with cage and instruction manual. .....Net **94.50**

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

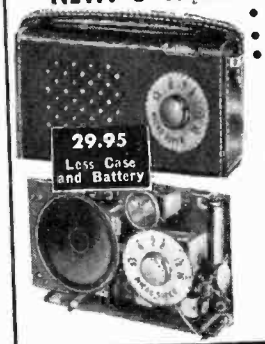
NEW YORK 13, N.Y. 100 6th Ave.
BRONX 58, N.Y. 542 E. Fordham Rd. BOSTON 10, Mass. 110 Federal St.
PLAINFIELD, N.J. 139 W. 2nd St. NEWARK 2, N.J. 24 Central Ave.
PLEASE INCLUDE POSTAGE WITH ORDER

FREE LAFAYETTE CATALOG

FEATURING THE BEST BUYS IN THE BUSINESS

The newest and largest assortment of Electronic, Radio and TV parts, Hi-Fi and Public Address Components and systems, Test Equipment, tubes, Transistor Kits and miniaturized components for transistor circuitry, Ham Equipment, Builders Kits, Tools, Books, Microscopes, Binoculars, Telescopes, Cameras, and Drafting Equipment.—*ALL AT LOWEST PRICES*—Catering to the economy minded dealer, serviceman, engineer, technician, experimenter and hobbyist. *CRAMMED FULL OF MONEY SAVING BUYS. SEND FOR YOUR FREE COPY TODAY.*

NEW! 6 TRANSISTOR SUPERHET RECEIVER with LATEST NPN-PNP TRANSISTORS



- GE 2N188A AUDIO OUTPUT TRANSISTORS • 100% SUBMINIATURE PARTS – NO COMPROMISES!
- CLASS B PUSH-PULL AMPLIFICATION-PLENTY OF POWER. • FOR GROUP AND PRIVATE LISTENING
- LABORATORY DESIGNED — SENSITIVE, SELECTIVE, STABLE!

Superb Performance! Incomparable Value!

Transistor-wise Lafayette proudly presents its newly revised 6 Transistor Superhet Receiver Kit KT-119A. This improved model uses the latest GE NPN-PNP Transistors in an ingeniously engineered, laboratory tested circuit providing superb performance and an amazing superior commercial quality. The circuit features a specially matched set of 3 IF transformers, Oscillator Coil, High-Q Loop, Class B Push-Pull Audio Amplification and optimum Transformer Coupling in audio and output stages. Has efficient 2¾" speaker for exemplary reproduction and earphone jack for private listening. Complete with all parts, transistors, pre-punched chassis, but less battery and leather case. New 28 page easy-to-follow step-by-step instruction book. Size 6 x 3½ x 1½. Shpg. wt., 3 lbs.

KT-119A — Complete Kit-Less Case and Battery.....Net **29.95**

BATTERY 9V BURGESS 2N6.....Net **1.30**

MS-339A — Sturdy attractive brown leather case with carrying strap for KT-119A. 6 x 3½ x 1½". Shpg. wt., 1 lb.....Net **2.95**

MS-366 — Sensitive matching earphone.....Net **1.29**

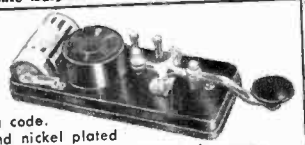
3 TRANSISTOR SUPERHET POCKET RADIO KIT

• 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 marown 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**

NEW! CODE PRACTICE SET



Economical and practicol code practice key and buzzer unit for learning code. Telegraph key chrome and nickel plated with both adjustable spring tension and contact clearance. The high frequency buzzer has frequency adjustment with locknut to keep tone constant. Screw type pin jack terminals for headphone connection. Works with inexpensive 1½ volt battery. Heavy black molded phenolic base and buzzer housing. Base 6¾" x 2¾" x 1⅜", overall length 8½". Shpg. wt., 2 lbs. **MS-438** Code Practice Set (less battery) . **1.95**

BATTERY Burgess 2.....**.13**

MS-369 Stethoscope Headset.....**1.69**

NEW MINIATURE, HIGH SENSITIVITY MULTITESTER

20,000 OHMS PER VOLT DC — 10,000 OHMS PER VOLT AC

CLEAR PLASTIC FACE COVER

A terrific buy in a hand-held, compact, light, accurate, completely wired instrument. Has a 36 μA movement, 1% precision resistors and simple selector switch with calibration markings protected against wear. Scales: Volts DC and AC; 0-5-25, 100, 500, 1000; Ohms: 0-6K-600K-6 Meg; DC Current; 0-50 μA- 5-50-500 MA; Decibels- —20 to +64 in 5 ranges. Size 4⅝" x 2⅞" x1¼". Shpg. wt., 1 lb. Complete with batteries and test leads. Imported to save you money.

AR-660 Miniature Meter.....Net **22.50**

Lafayette's Radio-Control Specialties

LAFAYETTE SPECIAL R/C TRANSMITTER

New crystal controlled 27.255 MC R/C transmitter, completely assembled, tested and guaranteed. Includes tube, crystal and 6 section telescoping antenna. Approx. 1 mile range. Size 8½ x 2½ x 1¾" Shpg. wt., 2½ lbs. Less batteries.

F-249 R/C TRANSMITTER (Less Batteries) Net 14.95

LAFAYETTE SPECIAL R/C RECEIVER

New factory wired and tested RC receiver. Completely enclosed — for use around water — case may be removed. Ready to operate on esan-free lead, and connector plug. Requires one 1.5V and one 45V battery. Complete with 3S4 tube, less batteries. Size 3 x 2¼ x 1½" Ideal companion for F-249 Transmitter. Shpg. wt., 8 oz.

F-208 R/C RECEIVER (Less Batteries) Net 8.95

SPECIAL COMBINATION OFFER

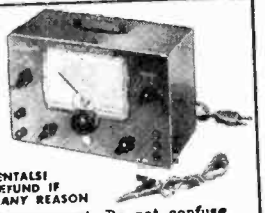
Consists of R/C Transmitter (F-249) and R/C Receiver (F-208)

F-259 Combination Net **22.90**

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 DEPT I-H

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.

Tips

(*Continued from page 30*)

strokes so as to sharpen each side of the punch equally. Unlike an abrasive wheel, as recommended by the punch manufacturer, the oilstone cannot overheat and draw the temper of the metal. —*K. M.*

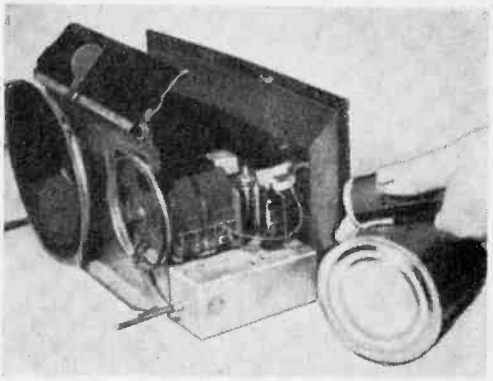
DATA CARD HOLDER

A handy holder for data cards, radio diagrams, etc., may be made from two large paper clips and a piece of wood about 5" x

3" x ½". Bend the paper clips at right angles one-third of the distance from one end, and mount them on the board with small wood screws as shown. —*K. P.*

SPRAY GUN DUSTS CHASSIS

The next time the chassis of your radio, TV, or hi-fi needs a good dusting, use an



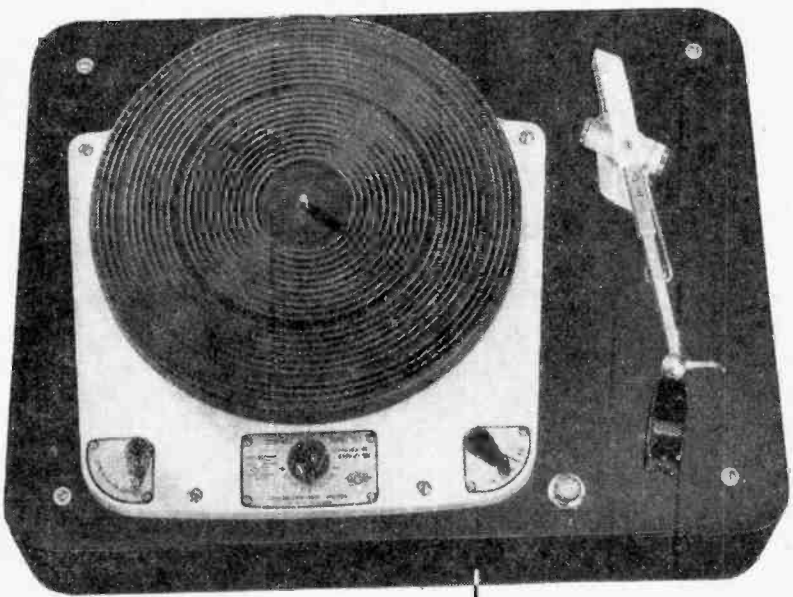
old plunger-type insecticide gun for the job. It saves plugging in and setting up the vacuum cleaner, yet does the job just as thoroughly. Make certain the gun is empty, however, or you may spray "bugs" into your equipment rather than prevent the possibility of them forming due to dust and dirt! —*J. A. C.*

He who is fortunate enough to own the Garrard 301 Transcription Turntable and the Garrard TPA/10 Tone Arm can enjoy the unique pleasure of knowing that *his* is the finest . . . the handsomest . . . record-playing combination in the entire high fidelity galaxy.

A pair of great products . . . great because they reflect 35 years of skill and the standards of leadership. No gadgets . . . no compromises . . . only the time-proven features which guarantee continuing, undeviating excellence.

Garrard

WORLD'S FINEST RECORD PLAYING EQUIPMENT



Model 301
PROFESSIONAL
TRANSCRIPTION TURNTABLE

- Features continuously variable control of each speed . . . the record can be "tuned" to match a musical instrument
- Heavy-duty 4-pole shaded motor is entirely Garrard-built
- Cast aluminum turntable is a full 6½ lb. . . . dynamically-balanced
- Motor and connected levers are completely isolated from unit by an exclusive damping system of tension-compression springs
- Exclusive built-in pressure lubrication system
- Performance of each 301 is certified with a written individual test card

$89.00

Model TPA/10
TRANSCRIPTION
TONE ARM

- Built to insure professional quality performance, with traversing and vertical friction reduced to absolute minimum by special cone-type ball-bearing pivots, as in the finest chronometers
- Takes any cartridge
- Fits into more installations than any other professional tone arm, since it is adjustable in length and tracking angle . . . plays up to a full 16" record
- Simple to install, with specially designed templates

$24.50

There's a Garrard for every high fidelity system

B. I. C. ENDORSED QUALITY

Model RC88
4-Speed Super
Auto-Manual
Changer
$67.50

Model RC88
4-Speed Deluxe
Auto-Manual
Changer
$54.50

Model RC121/II
4-Speed Mixer
Auto-Manual
Changer
$42.50

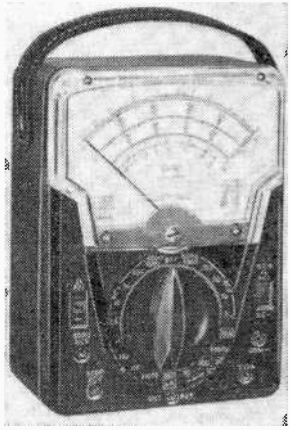
Model T Mk II
4-Speed
Manual Player
$32.50

For Information Write Dept. GK-358 **GARRARD SALES CORP., Port Washington, N. Y.**

TOOLS and GADGETS

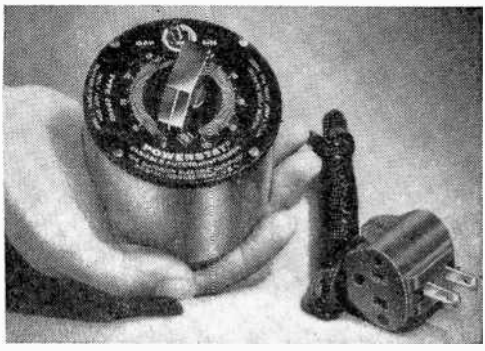
VOLT-OHM-MILLIAMMETER

Triplett's Model 630 volt-ohm-milliammeter is easy to read; it has a clear, unbreakable front for accurate vision of the longer, wider-spread scales. Other features include: 5 to 500,000 cps response on a.c.; continuous resistance scales from 0.1 ohm to 100 megohms; a polarity reversing switch; a single king-sized switch to select both circuit and range—minimizing wrong settings and burn-outs; and a.c. and d.c. voltage scales of 2.5, 10, 50, 250, 1000, 5000. (*Triplett Electrical Instrument Co.*, Bluffton, Ohio.)



VOLTAGE CONTROL

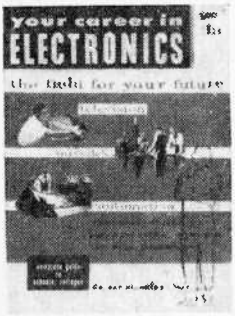
A compact, portable low-wattage assembly, the Powerstat Type 2PF10 is suited for laboratory, inspection, classroom and many other applications where current requirements do not exceed 1.0 ampere. It can serve as the voltage control of small motors, heaters, centrifuges, mixers and test



Coming Soon!

4 NEW ANNUALS FROM THE ZIFF-DAVIS ELECTRONICS DIVISION

This fall, Ziff-Davis, publisher of POPULAR ELECTRONICS will bring out 4 exciting publications you're sure to enjoy. Last year, these Annuals were immediate sell-outs at many newsstands. Watch for the 1959 Editions!



YOUR CAREER IN ELECTRONICS

(on sale September)

All-new material from men in all phases of electronics on how to get started, learn in service, earn spare-time money, and how to use electronics to pay your way through school . . . plus helpful personal experiences of a field engineer, radio-TV serviceman, tech writer, missileman, others. 128 pages, 200 pix, $1.00.

HI-FI ANNUAL & AUDIO HANDBOOK

(on sale September)

Complete A-to-Z technical course in hi-fi and audio with latest, authoritative facts on room resonance, transient response, speaker efficiency, upgrading your amplifier, RC filter tone controls, tape recorders and mikes, stereo and FM, 9-part series by Wharfedale's Briggs, etc., 43 articles, 128 pages, 325 pix, $1.00.

ELECTRONIC KITS—BUILDERS' GUIDE & DIRECTORY

(on sale October)

First how-to manual for kit builders. Shows tools you need, contents of typical kit, instructions on assembling various units plus directory section, facts on test instrument kits, hi-fi kits, ham kits, kits for home and for children. 30 construction articles, 160 pages, 640 pix, $1.00.

HI-FI DIRECTORY & BUYER'S GUIDE

(on sale October)

World's most complete hi-fi guide lists all equipment, prices, specs, mfrs. Features buying tips on tuners, amplifiers, preamps, record players, turntables, tape, speakers, etc. Full stereo coverage. Glossary of hi-fi terms. 180 pages, 10 chapters, 973 pix, $1.00.

RESERVE YOUR COPIES AT YOUR NEWSSTAND OR RADIO PARTS STORE TODAY!

ZIFF-DAVIS PUBLISHING CO., 434 S. Wabash Ave., Chicago 5, Ill.

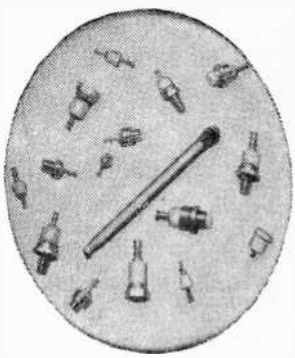
Tools

(*Continued from page* 36)

apparatus, or as the control of the light source in optical equipment. It will replace the less efficient, bulky, heat-producing rheostat and other resistance types of control for the relatively low wattage requirements of 50, 100 and 130 watts. With an input of 120 volts, 60 cycles, single phase, output is 0-132 volts, 1.0 ampere, 132 volt-amperes. Price $16.50. (*The Superior Electric Company,* Dept. 2PF10, Bristol, Conn.)

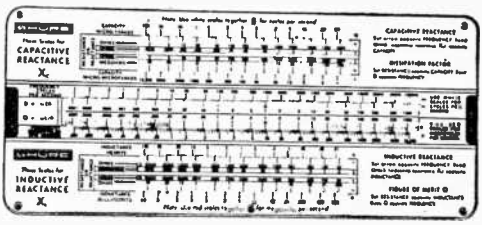
COLOR-CODED TEFLON UNITS

Teflon-insulated terminals and test jacks in ten colors are now available in standard, miniature and subminiature sizes—including test jacks, feedthroughs and standoff terminals for board thicknesses from 1/32" to 1/8". The terminals have high resistance to humidity and salt spray, will operate in temperatures from −90°C to +260°C, and recover fully from exposure to an arc without "tracking." (*Hiram Jones Electronics,* 2313 W. Olive St., Burbank, Calif.)



REACTANCE SLIDE RULE

Redesigned in red and black, an improved, easy-to-read version of the Shure reactance slide rule is now available. A single setting can solve such problems as resonant frequency, capacitive reactance,

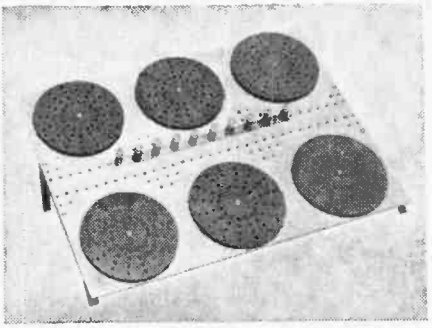


inductive reactance and coil *"Q"* and dissipation factor. It is useful for filter, transformer and amplifier design, oscillator tank circuits, coupling circuits, etc. Price, 75 cents. (*Shure Brothers, Inc.,* 222 Hartrey Ave., Evanston, Ill.) —30—

BUILD 125 COMPUTERS AT HOME WITH GENIAC®

ONLY $19.95

With the 1958 model GENIAC®, the original electric brain construction kit including seven books and pamphlets, over 400 parts and component rack, and parts tray, and all materials for experimental computer lab plus DESIGN-O-Mat®.



A COMPLETE COURSE IN COMPUTER FUNDAMENTALS

The GENIAC Kit by itself is the equivalent of a complete course in computer fundamentals, in use by thousands of colleges, schools and industrial training labs and private individuals. Includes everything necessary for building an astonishing variety of computers that reason, calculate, solve codes and puzzles, forecast the weather, compose music, etc. Included in every set are seven books described below, which introduce you step-by-step to the wonder and variety of computer fundamentals and the special problems involved in designing and building your own experimental computers—the way so many of our customers have.

ANYONE CAN BUILD IT!

You can build any one of these 125 exciting electric brain machines in just a few hours by following the clear cut step by step directions given in these thrilling books. No soldering required . . . no wiring beyond your skill. But GENIAC is a genuine electric brain machine—not a toy. The only logic and reasoning machine kit in the world that not only adds and subtracts but presents the basic ideas of cybernetics, boolean algebra, symbolic logic, automation, etc. So simple to construct that a twelve year old can build what will fascinate a PhD. In use by thousands of schools, colleges, etc. and with the special low circuitry you can build machines that compose music, forecast the weather, which have just recently been added.

TEXT PREPARED BY MIT SPECIALIST

Dr. Claude Shannon, known to the readers of Popular Electronics for his invention of the electronic mouse, that runs a maze, learning as it goes, formerly a research mathematician for Bell Telephone Laboratories is now a research associate at MIT. His books include publications on Communication theory and the recent volume "Automat Studies" on the theory of robot construction. He has prepared a paper entitled "A Symbolic Analysis of Relay and Switching Circuits" which is available to purchasers of the GENIAC. Covering the basic theory necessary for advanced circuit design it vastly extends the range of our kit.

The complete design of the kit and the manual as well as the special book DESIGN-O-Mat® was created by Oliver Garfield, author of "Minds and Machines," editor of the "Gifted Child Magazine" and the "Review of Technical Publications."

KIT IS COMPLETE

The 1958 GENIAC comes complete with the following books and manuals and over 400 components.

1) A sixty-four page book "Simple Electric Brains and How to Make Them."

2) Beginners Manual—which outlines for people with no previous experience how to create electric circuits.

3) "A Symbolic Analysis of Relay and Switching Circuits" By Dr. Claude Shannon provides the basis for new and exciting experimental work by the kit owner who has finished book No. 1.

4) DESIGN-O-Mat® introduces the user to over 50 new circuits that he can build with GENIAC and outlines the practical principle of circuit design.

5) GENIAC STUDY GUIDE equivalent to a complete course in computer fundamentals, this guides the user to more advanced literature.

6) A Machine to Compose Music shows in an actual circuit what other GENIAC owners have been able to do on their own in designing new devices.

7) A Machine to Forecast the Weather—again a new adventure in scientific thinking created by one of our users who was trained on his GENIAC Kit.

Plus all the components necessary for the building of over 125 machines and as many others as you can design yourself.

OVER 20,000 SOLD

We are proud to announce that over 20,000 GENIACS are in use by satisfied customers—schools, colleges, industrial firms and private individuals—a tribute to the skill and design work which makes it America's leading scientific kit. People like yourself with a desire to inform themselves about the computer field know that GENIAC is the only method for learning that includes both materials and texts and is devoted exclusive to the problems faced in computer study.

You are safe in joining this group because you are fully protected by our guarantee, and have a complete question and answer service available at no cost beyond that of the kit itself. You share in the experience of 20,000 kit users which contributes to the success of the 1958 GENIAC—with DESIGN-O-Mat® the exclusive product of Oliver Garfield Co., Inc., a Geniac is truly the most complete and unique kit of its kind in the world.

COMMENTS BY CUSTOMERS

We know the best recommendation for GENIAC is what it has done for the people who bought it. The comments from our customers we like best are the ones that come in daily attached to new circuits that have been created by the owners of GENIACS. Recently one man wrote: "GENIAC has opened a new world of thinking to me." Another who designed the "Machine that Forecasts the Weather" commented:

"Several months ago I purchased your GENIAC *Kit and found it an excellent piece of equipment. I learned a lot about computers from the enclosed books and pamphlets and I am now designing a small relay computer which will include arithmetical and logical units . . . another of my pet projects in cybernetics is a weather forecaster. I find that your* GENIAC *Kit may be used in their construction. I enclose the circuits and their explanation."* Eugene Dowling, Malden.

Oliver Garfield Co., Inc. Dept. PE-88
108 East 16th St., N. Y. 3, N. Y.

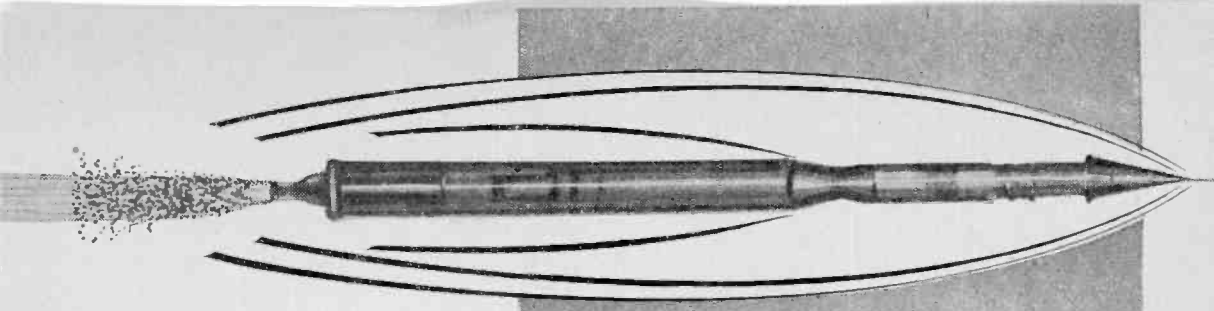
Please send me at once the GENIAC Electric Brain Construction Kit, 1958 model. I understand that it is guaranteed by you and may be returned in seven days for a full refund if I am not satisfied.

☐ I have enclosed $19.95 (plus 80c shipping in U. S., $1.50 west of Miss., $2.00 foreign), 3% New York City Sales Tax for N. Y. City Residents.

☐ Send GENIAC C.O.D. I will pay postman $19.95 + postage and C.O.D. charges.

Name.....

Address.....

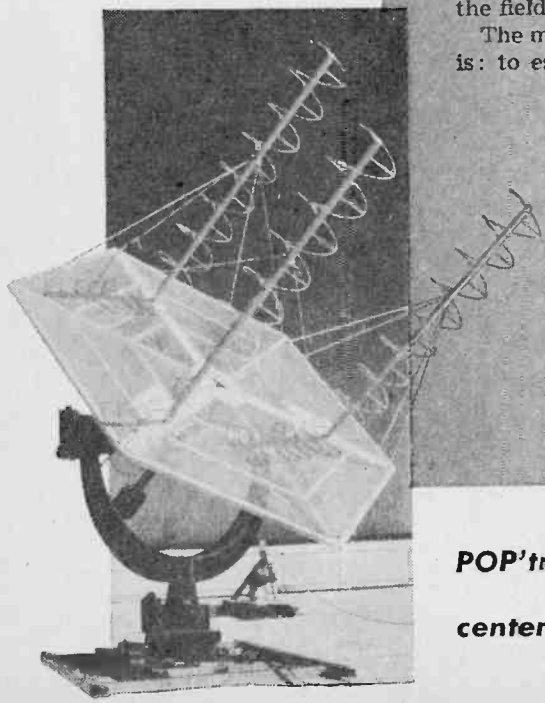


Electronics—Vital to Missile Control

By **OLIVER READ**
Publisher and Editor

MISSILES AND ELECTRONICS are essential to our national defense. At no time in history has any science played a more vital role than in the development of electronic devices capable of determining the behavior of guided missiles. We paid a visit to the Test Center at Cape Canaveral and the Air Force Missile Test Center at Patrick Air Force Base in order to bring a first-hand report to POP'tronics readers as to the function of electronic devices in the fields of control and instrumentation.

The mission of the Air Force Test Center is: to establish, maintain and operate the Florida Missile Test Range and its supporting facilities for the purpose of conducting tests and collecting test data on guided missiles, controlled targets, drones and allied equipment for the U. S. Air Force, and for the Army and Navy when directed; to support Air Force contractors and other governmental testing agencies; to evaluate tests performed by the Air Force or Air Force contractors, and to



POP'tronics pays a visit to the test center at Cape Canaveral, Florida

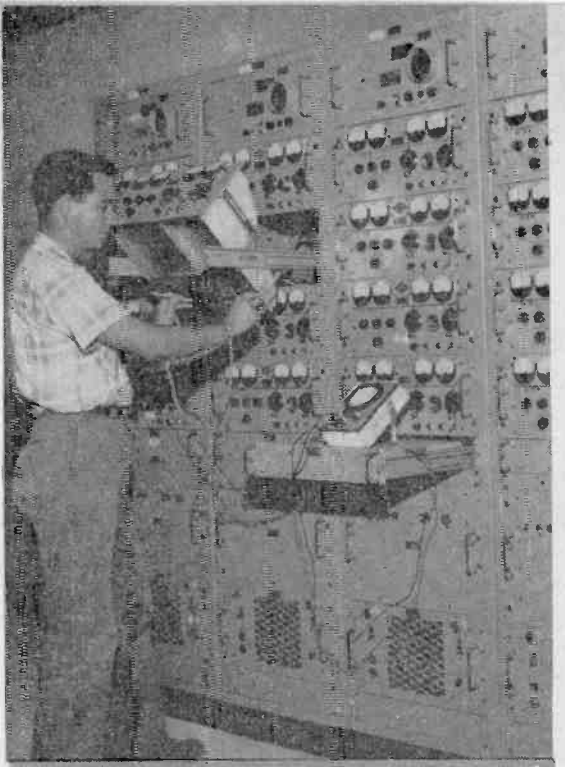
conduct and support missile testing and operational training.

Measurements. Electronic instrumentation is the responsibility of six divisions—these include radar, optics and telemetry. In other areas are communications, timing and firing, and a group referred to as "data translation." Instrumentation is described as follows: making measurements of phenomena and translating these measurements into language that humans can understand either by on-board telemetry transmitted back to the ground or by radar optical devices on the ground looking at a distance.

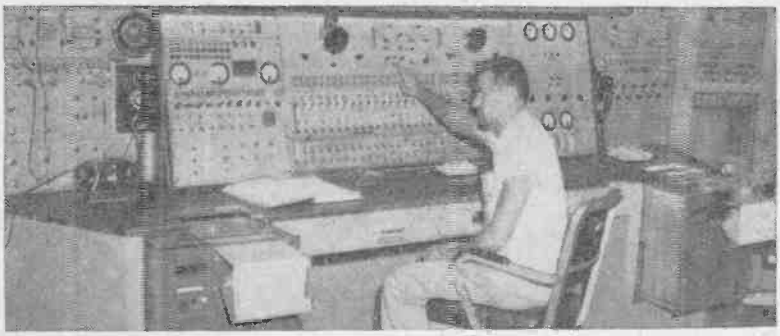
Speed, direction, height and trajectory of test missiles are determined both by external and internal measurements.

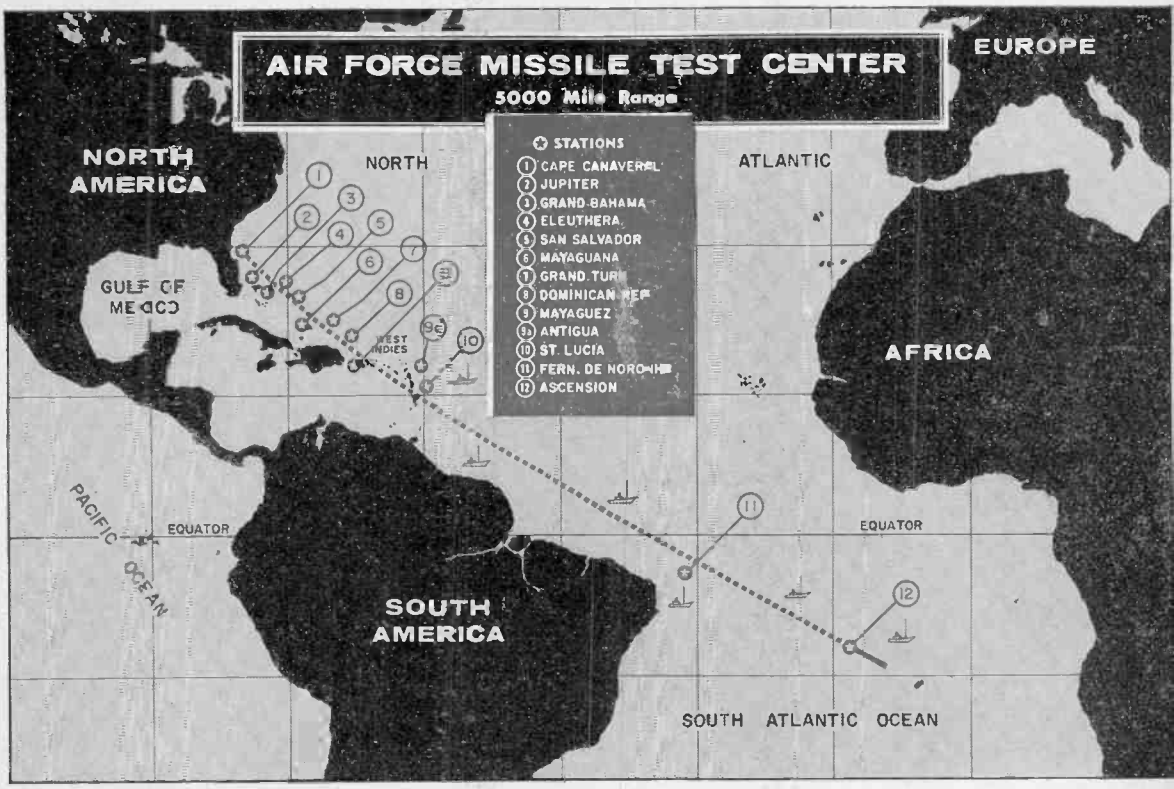
RCA engineers at the Air Force Missile Test Center are concerned primarily with external measurements. From a fixed position they derive measurements of velocity and acceleration using pulse radar techniques, c.w. techniques, tracking metric cameras and long focal-length cameras. Fixed cameras are used along the launch area for accurate determination of position during the launch phase. The c.w. tracking systems, which employ the later, more sophisticated techniques of phase comparisons, determine the position from the velocity and acceleration of the missile.

In the telemetry area, measurements are made primarily to receive and record information which has been transmitted in accordance with inter-range standards. Find-



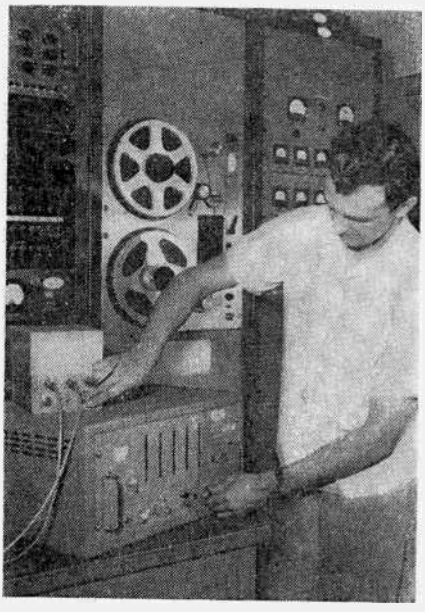
Maintenance and operation of the telemetry equipment at Cape Canaveral is a full-time job for RCA engineers and technicians. Above, a technician runs the daily maintenance check on a telemetering discriminator. At left, a crew calibrates telemetry receivers and recording equipment. Above right, "Timing Central" at the Cape picks up time signals from Station WWV and retransmits them throughout the vast missile test range to provide accurate and standardized timing for all missile operations. Below, right, is the Varipotter display board, which is a part of the Impact Prediction System. At right center is a chart of the complete 5000-mile range Air Force Missile Test Center, which has as its origin the launching area at Cape Canaveral, Florida.




AIR FORCE MISSILE TEST CENTER
5000 Mile Range
STATIONS
1 CAPE CANAVERAL
2 JUPITER
3 GRAND BAHAMA
4 ELEUTHERA
5 SAN SALVADOR
6 MAYAGUANA
7 GRAND TURK
8 DOMINICAN REP.
9 MAYAGUEZ
9a ANTIGUA
10 ST. LUCIA
11 FERN. DE NORONHA
12 ASCENSION
NORTH AMERICA
NORTH ATLANTIC
EUROPE
AFRICA
GULF OF MEXICO
WEST INDIES
PACIFIC OCEAN
EQUATOR
EQUATOR
SOUTH AMERICA
SOUTH ATLANTIC OCEAN

ings are defined to the customers (the missile manufacturers) as well as the frequencies that they shall use, the deviations they shall use on those frequencies both for the r.f. transmission and for the subcarrier composite transmission. These are recommended as a result of research done by the Instrumentation Engineering Branch of RCA Service Co. and by others which are combined with the old Research and Development Board standards and the Inter-Range Instrumentation Group (called IRIG).

The telemetering process, as it applies to the tracking or the gathering of data about the performance of a missile, is indeed a



Tape speed indicator at RCA center is adjusted by technician before missile launching.

fascinating subject. The standards recommended by IRIG specify the r.f. frequencies between 215 and 245 mc. and that the subcarriers will go from some 300 to 400 cycles up to 70 kc. The deviations are required to be within plus or minus 7½% of the center frequency.

A system of tape recording has been developed through the years permitting the recording of all information transmitted via telemetry on half-inch 7-track tape. All intelligence received from an airborne missile is recorded in addition to range timing to a very accurate degree. A reference frequency, which is crystal-controlled, is also mixed with the information and is used later to eliminate wow and flutter areas. These three—timing, reference and airborne composite—are all recorded for each radar frequency link.

Range timing is the key to all of the instrumentation because all phenomena occur as a function of time. If a Snark, for example, lost a wing in flight, instrumentation would reveal its position, probably its velocity and its acceleration, as well as provide other pertinent data.

Critical Period. Preparations for a test begin many hours before an actual firing. In order to provide information for the missile manufacturers, literally hundreds of electronic instruments are needed in the field. Tests are run on all equipment to determine what it will and will not do.

The period during "count down" is primarily in the hands of the customer—the missile contractor. He's the one calling the shots according to a prescribed procedure. The electronic engineers, in turn, indicate to him that they can or cannot make the measurements requested. If a radar, for example, scheduled to operate during the tests, blows up or burns out a tube during the count, the operators inform the contractor immediately and give an estimate of when the equipment will be back in service. The contractor makes the decision right on down through the launch as to whether or not he will "go," depending upon the availability of range instrumentation or his own missile instrumentation.

It was emphasized to us during our visit that the primary concern is "range safety." Not only does electronics serve to protect the mainland of Florida, but its function extends to protect the down-range islands from possible damage. We were told that several missiles have been deliberately destroyed to prevent them from causing any potential damage to human life throughout the range.

The 5000-mile range is divided into grids on the charts, and if a missile deviates into a danger zone, an electronic system called ELSSE takes over. This is an electronic sky screen which, by using r.f. radiation from telemetry or other signal sources on the missile, predicts what the flight path will be both in azimuth and programing (the tilt from the vertical). This information is given to an Air Force officer, and if

(*Continued on page* 115)

Build the Quizzomat

By HARVEY POLLACK

Set up your own quiz program with simple switching circuits and neon scoring lamps

THE POPULARITY of radio and television quiz programs proves that people like to answer questions, especially if there is a reward for the right answer. The "QUIZZOMAT" is designed for your home quiz program—with built-in "cheat-catcher" and "suspense" circuits to hold interest and make it valuable as a testing machine as well as a game.

How to Play. A typed or handwritten sheet of true-false questions is placed on the QUIZZOMAT panel. Each of the questions has a corresponding toggle switch and a neon lamp. The player moves each switch to the right or left to indicate his answer—

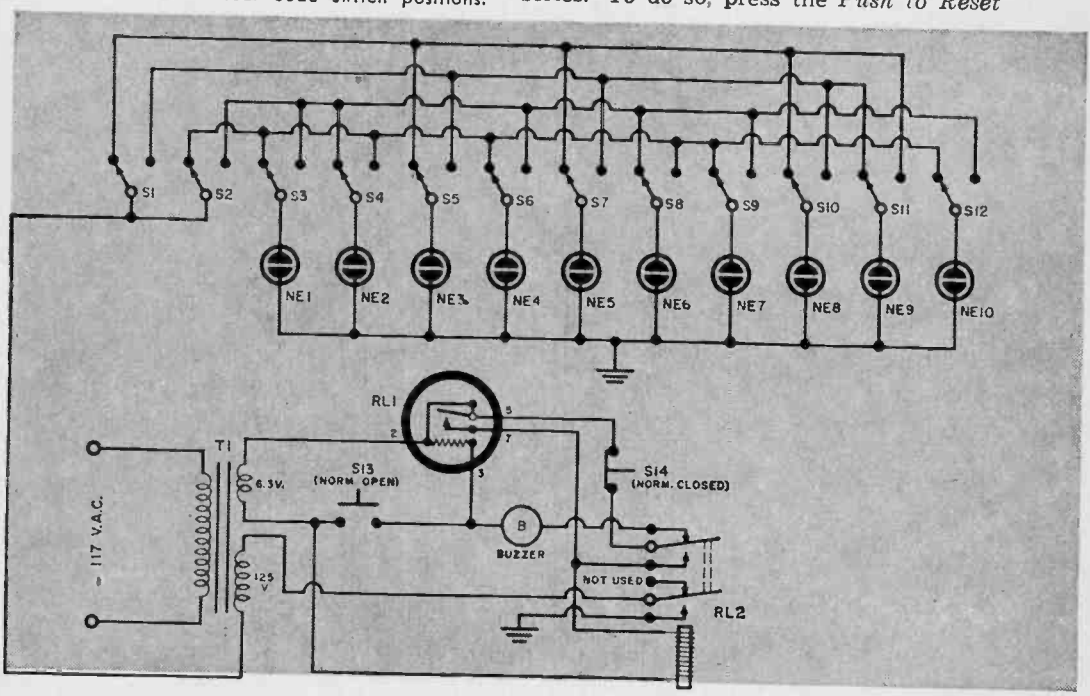
Code Switch Position		↑↑	↓↑	↓↓	↑↓
Answers that will light the scoring lamps	1	false	false	true	true
	2	true	false	false	true
	3	false	true	true	false
	4	false	false	true	true
	5	true	true	false	false
	6	false	true	true	false
	7	false	false	true	true
	8	false	true	true	false
	9	true	true	false	false
	10	false	false	true	true

With the wiring as shown below, answers in table above are for each of the four code switch positions.

"True" or "False"—for each question. During the test no indication is given of the correctness of the answers.

When all questions have been answered, the push button labeled *Hold Down To Score* (*S13*) is depressed. A buzzer sounds, but *none of the scoring lights glow.* After *S13* is held down about five seconds, the buzzer cuts out and the scoring panel springs to life. Correct answers are indicated by the lit lamps, incorrect answers are shown by the dead ones.

The scoring lamps will remain latched-in until you are ready to start a new question series. To do so, press the *Push to Reset* button (*S14*) and the QUIZZOMAT is restored to its original condition.



PARTS LIST

NE1 through NE10—Neon light assembly (Drake Type 110 Flushlite or NE-2—see text)
RL1—Thermal-time delay relay, 6.3-volt heater, 5-second delay (Amperite 6N05)
RL2—6.3-volt a.c., d.p.d.t. relay (Guardian Coil Assembly 200-6A, Contact Assembly 200-2)
S1 through S12—S.p.d.t. toggle switch
S13—Push-button switch, normally open (Hart & Hegeman 3391E or Olson Radio Warehouse SW-109 wired as above)
S14—Push-button switch, normally closed (Hart and Hegeman 3391 or Olson Radio Warehouse SW-109 wired as above)
T1—Power transformer, 6.3-volt @ 0.6-amp. and 125-volt @ 15-ma. secondary (Stancor PS8415 or equivalent)
1—10" x 12" x 3" aluminum chassis (Bud AC-413)
2—Brass spacers, 1" long, to pass 6-32 screw
1—Octal socket
1—6-volt a.c. buzzer (E. F. Johnson Co., No. 114-400 or equivalent)
Misc. hardware, solder lugs, wire, etc.

The buzzer and time delay arrangement does two things. It prevents the player from pressing the scoring button and sneaking a look to see how he's doing. And the waiting interval between pressing the scoring button and the appearance of the final score adds a bit of suspense that multiplies the fun.

Can the right sequence of true and false answers be memorized? Not a chance. Each series of questions carries a code in the form of two arrows which instructs the player how to set the two toggle switches (*S1* and *S2*) at the upper left corner of the

panel before he begins. These switches "program" the QUIZZOMAT to accept a particular set of true-false answers for each test.

Construction Details. A 10" x 12" x 3" aluminum chassis is used for the foundation of the game. Along its right side, drill a series of ten holes for the s.p.d.t. answer switches. The neon signal lights are mounted to the left of each switch.

If Flushlite lamps are used, you will need two 5/16" terminal openings in addition to the mounting screws. NE-2 neon lamps may be substituted, held in place by grommets in ½" holes, and connected into the appropriate circuits by soldering directly to their leads. (Each NE-2 must have a 47,000-ohm, ½-watt resistor in series with it. Flushlites have these resistors built in.)

The sequence-code switches, reset button, and scoring button are most convenient to use when they are mounted along the edges of the chassis as shown in the photographs. This arrangement leaves plenty of room for a 6"x9½" sheet of paper to fit nicely alongside the answer switches.

To avoid screw heads on the top surface of the chassis where they would interfere with the use of the questions sheet, all the other parts—the thermal time-delay relay,

(*Continued on page* 107)

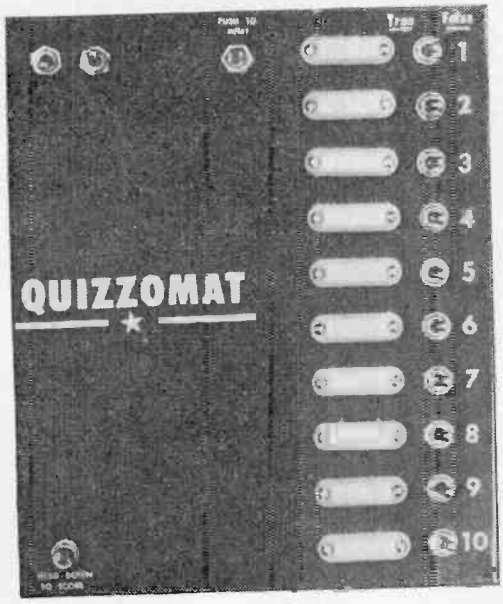
HOW IT WORKS

As each answer switch is operated, it either connects or disconnects one terminal of the associated neon lamp to one terminal of the 125-volt secondary of transformer *T1*. The other terminal of the neon tube is connected to chassis at all times, but the opposite end of the 125-volt secondary is open since relay *RL2* is not activated until the scoring button is held down for the proper interval.

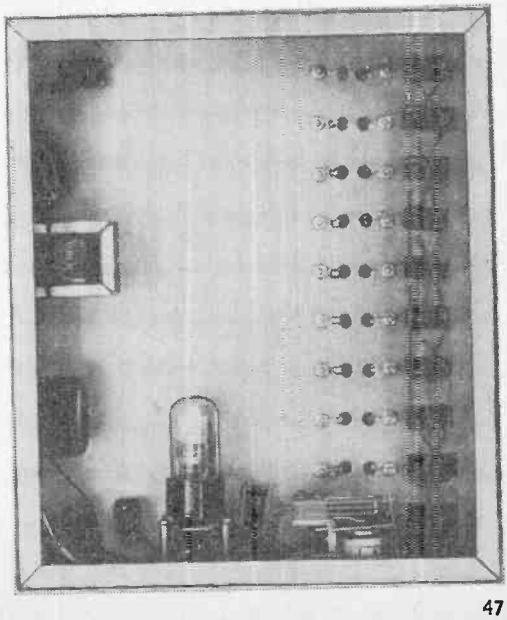
When the scoring push button (*S13*) is pressed and held down, current flows into the heater of the thermal delay relay (*RL1*), causing the bi-metallic armature to bend toward the contact slowly. After about five seconds, contact is made between the armature (terminal 5 on the octal socket) and the contact point (terminal 7 on the octal socket). During this delay, 6.3 volts are fed to the buzzer, causing it to sound continuously. (This feature may be eliminated at the constructor's option.)

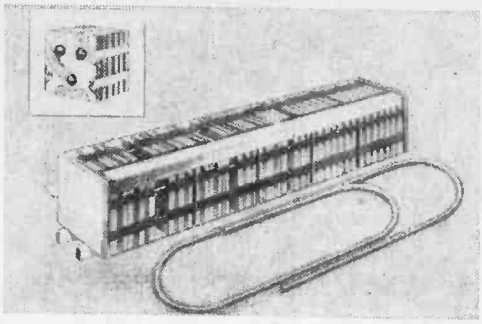
As soon as contact is established in *RL1*, the 6.3-volt winding of *T1* is connected to the coil of *RL2*. When *RL2* closes, the buzzer circuit is broken and the neon lights corresponding to the correct answers are turned on. *RL2* stays closed since its upper contacts bridge the thermal relay and the coil of *RL2* remains energized. The scoring lights will therefore stay lit when *S13* is released. The scoring tally can then be made and noted for later reference.

To reset the system, *S14* is depressed. This releases *RL2*. The lights go out, and a new answer sequence can be selected by using a new topic sheet and resetting *S1* and *S2* as per the code arrows.

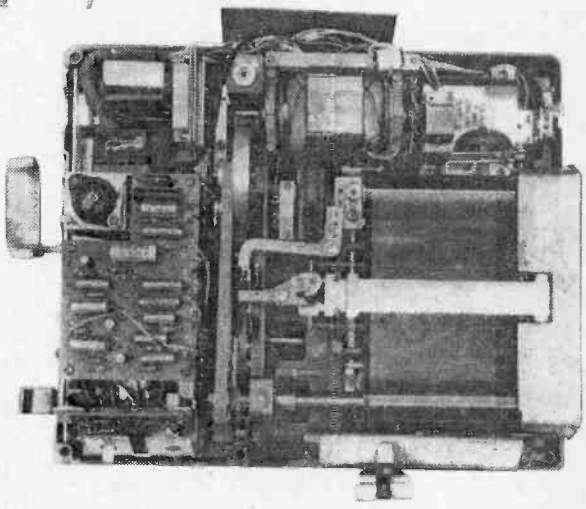


Quizzomat front panel above shows the parts layout to be followed. The two switches on the upper left side of the panel set the "programing" which determines the "right" and "wrong" sequence for each topic sheet. Note that the timing and scoring circuit components are mounted on the inside aprons of the chassis box (below).





They get Smaller... and Smaller



TRANSISTORS are playing a larger and larger role in smaller and smaller devices, as witness the two items on this page.

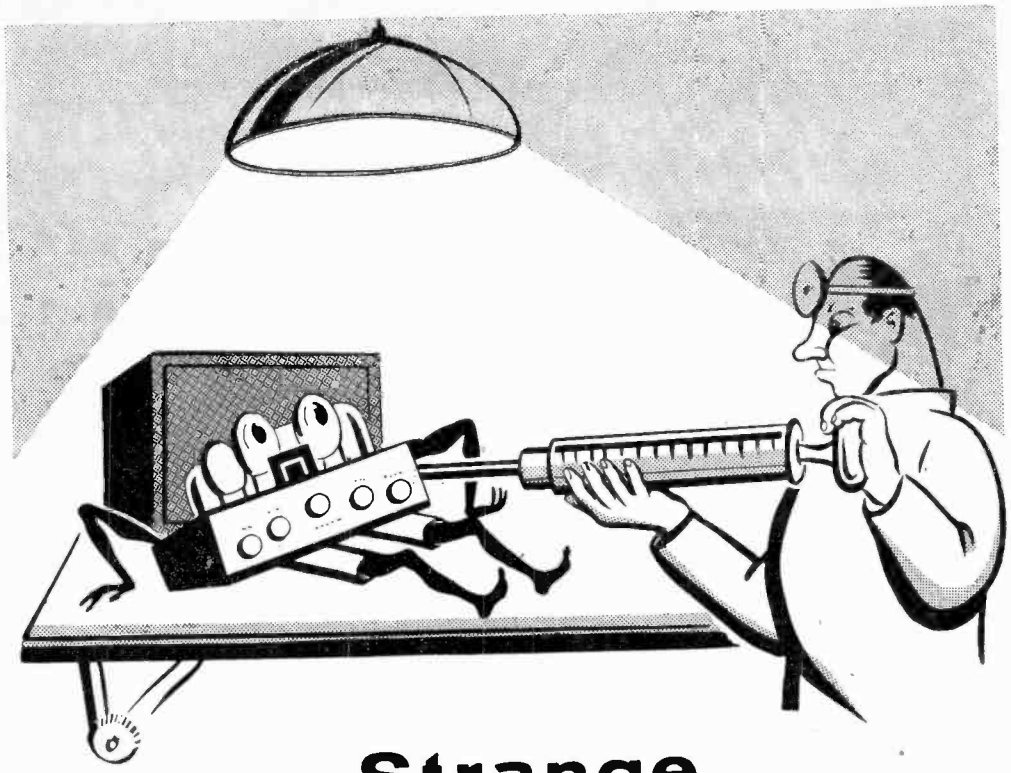
Up above, RCA has achieved a breakthrough in miniaturization in its development of the micro-module concept. The young lady is holding a "fountain pen" radio which, it is claimed, will duplicate the functions of a standard RCA five-transistor portable radio.

Although several years away from production, the micro-module used in this radio, shown in the drawing at the girl's right compared in size with a paper clip, is expected to play an important part in military use. The module in the inset of the drawing is said to be the smallest unit to which a complete electronic stage has been reduced.

At right, above, is a transistorized automatic dictating machine. Dictaphone's "Time-Master" is ready for action as soon as the microphone is picked up, and shuts itself off when the mike is returned to rest.

Maintenance is eased and longer life and greater reliability are claimed through the use of transistors in the amplifier stage of the unit, at the left of the machine. By simply touching a button, the user can record, hear playback, make corrections or indicate letter length in a fraction of the time it took with earlier models of dictating machines.

-30-



Strange ALLERGIES of Hi-Fi

By NORMAN H. CROWHURST

Some unusual ailments and how they were remedied

WHEN A HI-FI SYSTEM gets sick, it may distort all program material in a similar way—in which case the trouble-shooting and cure are fairly simple.

Sometimes the first sign that all is not well is the development of an "allergy." The rig just objects to reproducing one particular kind of sound. This may be due to some part beginning to go bad, or to an unsuspected change in "diet." So it may be profitable to check into recent changes in a setup.

Here's what happened in a few specific "allergy" cases.

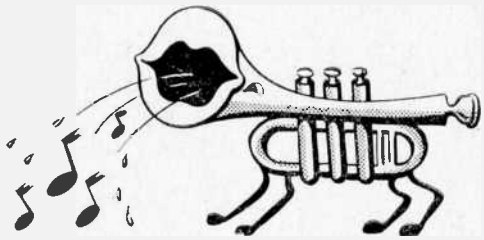
Trumpets. This particular installation belonged to a trumpet-fan friend of mine. Good cool jazz, Dixieland, or what-have-you . . . John likes trumpets. To his dismay, his set gradually developed a *dislike* for them. It sounded as if the trumpeter were deliberately spitting into the instrument, or waving a mute in and out at an impossible rate.

At first it only happened when John played loud music, but then it happened whenever the rig "heard" trumpets at any volume. It was a bit off-color with woodwinds, too, but he didn't like woodwinds anyway. Anything else, violins, organ, etc., sounded fine . . . but the set was allergic to trumpets.

It checked out on all the usual voltage checks. Frequency response seemed okay, and it met its power output specifications,

so I put a voltmeter across the high-volt-supply that feeds all the tubes and had John play a record with trumpets. When the sound started cutting up, the voltmeter kept time with it, fluctuating up and down —just a little way, but definitely in time—about once or twice a second.

Most amplifiers will show a little B-plus fluctuation when music plays, but



. . . as if the trumpeter were spitting . . .

usually only when a loud passage starts or there's a sudden volume change. The reading shouldn't fluctuate for average program material. It looked as if the electrolytic capacitor that smooths and stores the B-plus voltage must be going bad.

Normally a bad electrolytic in this position drops the voltage below normal or causes a background hum (it didn't here). These things happen because its leakage current is abnormally large, or because its capacitance has decreased. In this case the capacitor had only partly "dried out"—not enough to produce the usual hum symptoms.

A quick check, paralleling another electrolytic across the suspected one, removed the annoying distortion on the trumpets, and putting in a replacement capacitor made the improvement permanent.

As well as storing the voltage to tide the amplifier over sudden bursts (crescendos) in the music, and smoothing out the supply ripple that causes hum, these capacitors also help keep the amplifier stable—prevent it from "motorboating." When there is a slight loss of capacity, certain musical "waveforms" may start the amplifier partially motorboating—trying to motorboat, as it were.

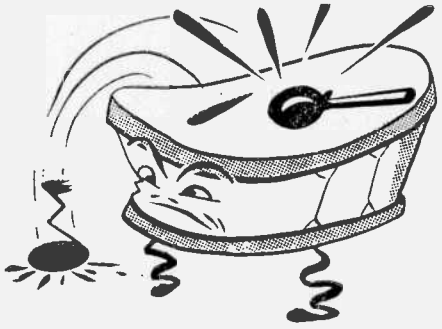
The trumpet is particularly prone to do this, because, being a wind instrument, its waveform has more "up" than "down." This disturbs the usual balance of current delivered to successive tubes in the amplifier and starts the trouble. The large amount of feedback provided in most modern amplifiers does the rest.

Bass Drum. Another case of allergy "just developed gradually." When Leonard's system was called on to render the big bass drum, it went "unga plop" and the music came back on again a fraction of a second later—an annoying interruption of the music instead of a pleasant thump from the drum. His wife was particularly fond of drums, so the case was urgent.

A quick check proved that all the voltages were in order. Putting the voltmeter across the high-voltage supply showed a sharp little kick every time the drum produced this effect. It could have been another case of a drying electrolytic, but a quick paralleling test made no difference this time. A test of the tubes found them "good," but the reading for steady plate current on the two output tubes differed quite a bit, although they both came within the "good" range.

A pair of "matched" output tubes cured the allergy. Most output tubes can be obtained in "matched pairs," selected by the manufacturer so that both plate currents will be equal and the two tubes will equally share the output power requirements.

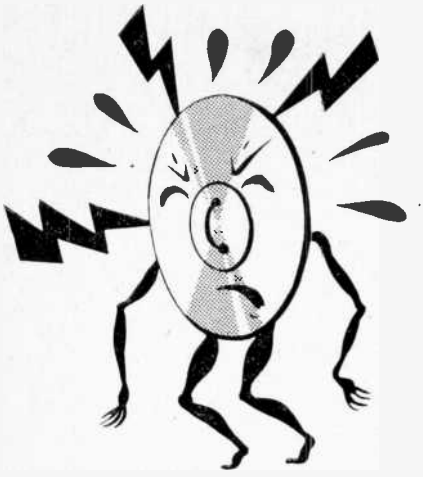
Leonard's output tubes, although still "good" according to the tube checker, had aged differently. This unbalanced the



. . . it went "unga plop" off the big bass drum . . .

plate current in the output transformer, reduced its primary inductance below its normal operating value and narrowed the stability margin designed into the amplifier. The thump of the big drum set off a "one blocking shot" oscillation.

Cymbals and Triangles. George is a fellow who likes his "highs." So he was particularly upset when his system devel-



. . . his system would crackle on cymbals . . .

oped a dislike for cymbals and triangles. Every time they were played, the system would crackle as if there were a bad connection—or "static." Having checked all the connections, including tube pins, I asked George if he had made any change in his system lately.

He told me he had a new pickup, but was sure that couldn't cause it. "It just extends the frequency range up to about 20 kc., and it's very smooth," he assured me. It certainly sounded very smooth—with anything but a cymbal or triangle.

I checked his pickup on another system. It reproduced cymbals and triangles perfectly. So did his amplifier with his old pickup—not so much "zing," but quite clean. But the combination just would not handle them.

I brought an audio oscillator around to George's place to check his amplifier. We connected it to the input of the amplifier and an audio voltmeter to the output to measure the response as we varied the frequency . . . beautifully flat response, up to 20,000 cycles.

We went higher. At about 45 kc., I found a peak in the response that went right off the map. Only by turning the input down could I get a reading on the output.

This is not an uncommon occurrence with some modern amplifiers. Technically it shows trouble in the feedback design. George's trouble was that the pickup was *too good* for his amplifier—at least on cymbals and triangles. A technical report on the pickup noted that it had a rising response at 20 kc., too.

Different values of small capacitors were connected across the input terminals of the amplifier. Eventually I found that a 220 $\mu\mu$fd. stopped the trouble, without noticeably spoiling the treasured "highs."

While the best remedy would have been a better amplifier, George was much happier this way.

Bass Pipes (Organ). Unlike the one that objected to "sudden bass," Neil's amplifier objected to the *sustained* bass tones of an organ. For the duration of the tones the music got badly 'broken up."

When did it start doing this? Neil told me he had never noticed it before he bought a new speaker.

When the rig started "breaking-up" on

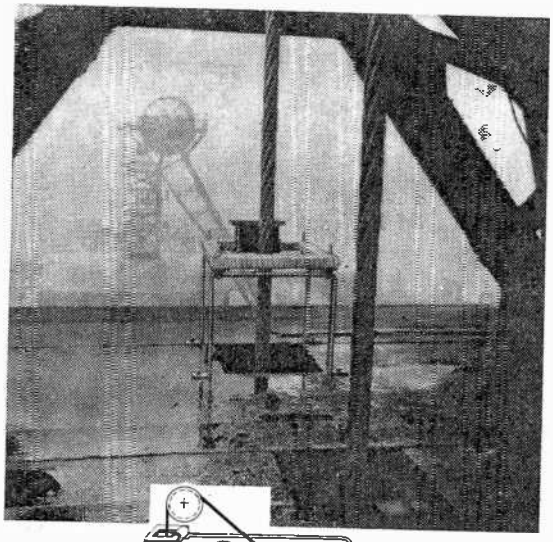
. . . the music got badly broken up . . .

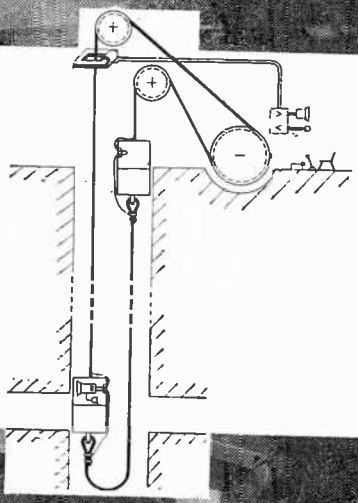
an organ record, we tried turning the volume down, and the distortion stopped. I turned the volume back up and stepped over to the speaker to feel it. On the bass tones, the vibration could be felt better than it could be heard.

I stepped over to his turntable; the same vibration, but not so strong, could be felt in its baseboard.

In this case it was not the improved bass Neil could hear, but the improved bass *he couldn't hear,* that was causing the trouble. A very low frequency from the speaker, barely audible, was being transmitted back to the pickup, which was almost bouncing out of the groove.

The remedy proved to be the use of foam plastic shock-mounting for the record player to isolate the vibration. —30—



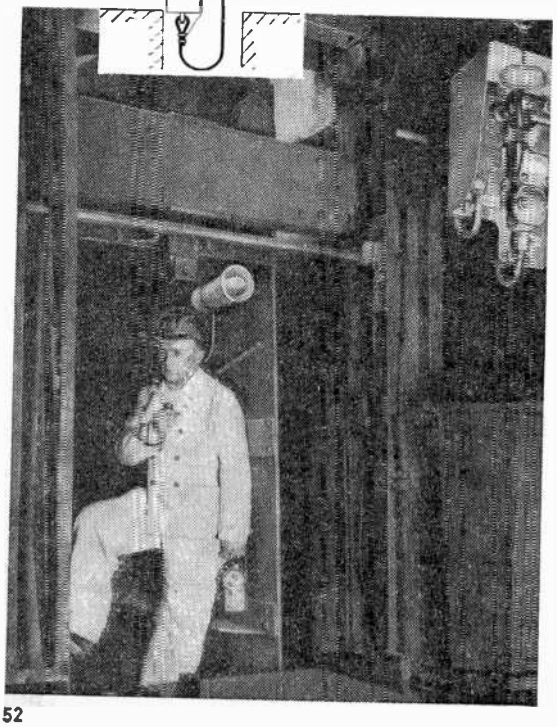


Telephone in the Mine

TO ELIMINATE the expense and possible failure of an ordinary telephone communications system between a mine head and shaft, a German engineering firm, Standard Elektrik of Stuttgart, has switched to a new method using the elevator hoisting cable as the secondary "winding" of a transformer.

The output of the microphone at the shaft head is amplified and fed to the primary of the transformer, which is electromagnetically coupled to the elevator cable. See top photo. A corresponding voltage is induced in the cable (secondary) which feeds a transistorized loudspeaker system in the car in the shaft, as shown in the bottom photo.

As the output is only about 0.4 watt, the current and voltage are so low that they won't cause an explosion under fire-damp conditions. Note the cable circuit in the diagram. The loudspeakers can be heard about 75 feet from the car. -30-



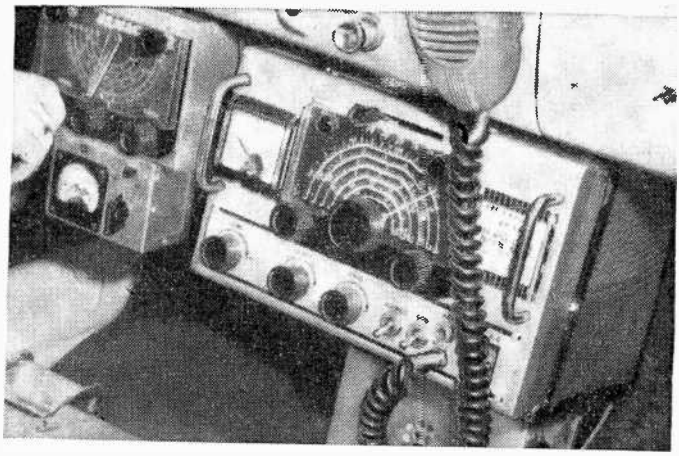
Hamming on the Highways

By CAROLE HOOVER, K9AMD

It's easy to win friends if you have two-way radio equipment in your car

"AN AMERICAN," a European observer recently remarked, "is never completely happy doing anything until he is able to do it in his automobile."

This comment was probably sparked by the sight of our drive-in movies, churches and restaurants, or possibly by the automobile accessories that enable us to eat, sleep, stay warm, stay cool, play records, shave, and warm the baby's bot-



Typical mobile installation located under the instrument panel in the front seat of a car.

tle without setting foot outside the car.

But he also could have been talking about those amateurs who keep right on enjoying their communication hobby while rolling along the highway at a mile-a-minute clip . . . in short, the amateurs who have "gone mobile."

There is something perverse in the average ham. No sooner does he have his fixed station arranged just to his liking than he starts thinking about building another in his car.

Limited Power. Basically, a mobile installation uses the same units as a home station: receiver, transmitter, power supply and antenna. The receiver can be a special all-band job that replaces the car radio, or it can be a small converter that works in conjunction with the car receiver to tune the amateur bands. The transmitter is ordinarily smaller, more compact, more rugged, and lower powered than the average home station.

It is lower powered because its power must be drawn from the long-suffering automobile battery. Motor generators, vibrator power supplies, and, quite recently, transistorized power supplies, change the low battery voltage to the higher potentials needed for the transmitter. There is considerable loss in this conversion, and there is a limit to the amount of current that can be diverted from the car battery for this extra chore; so the average mobile transmitter input is less than 50 watts plate power.

As to where this equipment goes, that depends on whether or not the ham is married. The bachelor consults a book on good mobile installation practice. The married man —the wise married man—consults his wife! After all, she is the one who will snag hose and catch hems on jutting edges. And she will have to answer her girl friends when they ask: "Mary, why do you put up with all that junk in your car?"

Choice of Location. The bachelor will probably install the receiver, transmitter, and even the power supply under the instrument panel where they will be easy to observe and adjust. But the married man will quite likely have only the little receiver-converter up there. The other bulkier components will be put out of sight in the trunk and remotely controlled.

You might think the latter is the ideal arrangement, and so did I; but I forgot that ordinarily a mobile transmitter or power supply requires some little adjustment before a long trip is over.

I remembered this vividly as we stopped along the road in the hot sun and unloaded suitcases, hat boxes, tennis rackets, fishing rods, and the gladiola bulbs we were taking to Aunt Edna so that we could reset an overload relay that had kicked out and redip the final tank circuit. While semi-trailer trucks roared by, blasting us with shock waves of wind, curious motorists slowed down to get a better look at Dad curled up in the trunk like a pretzel. I just hope they couldn't hear what he was muttering about where that blankety-blank transmitter *should* be installed!

Antenna "Emblem." The proud emblem of the "mobileer" is his transmitting antenna, and mobile antennas come in almost as many shapes as women's hats. It may be a stiff broomstick affair, a tall flexible steel whip with a plastic-enclosed loading

Repairing equipment in trunk while on the road requires the ability to bend like a pretzel.

coil at the center or base, a fat "halo" on a stubby rod, a sophisticated, nodding "top hat," or a tiny, hairlike wire sprouting from the center of the car's roof.

The choice is dictated more by the amateur bands being worked than by esthetic considerations, but you seldom see two antenna installations exactly alike.

Regardless of the newness of the car or the mechanical coddling it otherwise receives, a true mobileer gives no more thought to drilling into the smooth shiny body of the car to install a whip than I do to taking an opener to a can of pork and beans.

That whip antenna commands a lot of attention. People in other cars will slow down when meeting you, build up a line of traffic behind you, wave deferentially as they finally go around, and show in other ways they suspect you of being an incognito cop trying to booby-trap them.

Other amateurs, of course, instantly recognize your emblem for what it is and salute you with greetings tooted out in Morse code with their horns. It is not at all unusual to come back to the car from lunch or a shopping trip and find a friendly scribbled note under the windshield wiper from a ham who has spotted the whip and wants to say, "Hello," or possibly set up a schedule to talk to you.

One-Hand Operation. A mobile station is arranged for easy, safe, one-hand operation. When a button on the hand-mike is pressed with the thumb, this turns the receiver off, transfers the antenna from the receiver to the transmitter, and turns on the transmitter power supply.

After a "CQ" or other transmission is completed, releasing the button cuts power off the transmitter and connects the antenna to the reactivated receiver. The left hand never has to leave the wheel.

When I change the transmitter from one amateur band to another, it is necessary to get out and move a slider on my whip antenna coil. While doing this I stumbled innocently onto a man-trapping aid that is far more successful than dropping a perfumed handkerchief.

Performing this simple chore alongside a busy highway is almost certain to halt one or two gallant fellows who offer to help me do whatever I am doing. In fact, this attention-getter is so good that unless I feel in the mood for making new acquaintances, I hunt a side road to change the slider.

Making Contacts. Perhaps you think that with low power a mobile station can only talk over short distances. This is not the case. Even on seventy-five meters, where power means most, I have often talked with friends 200 and 300 miles away. I'll admit this was done when conditions were good and the band was not crowded; but most fixed stations like to work mobiles, will try hard to hear them, and will avoid interfering with them if at all possible. That helps.

On 10 meters, power is not so important, and I have sat at my receiver here in the Middle West during my lunch hour and listened to mobile stations rolling along the streets of Miami Beach, crossing the blistering Mohave Desert, following the snow plows through Donner Pass, and preparing to cross the Golden Gate Bridge.

Just last week I heard a student at the

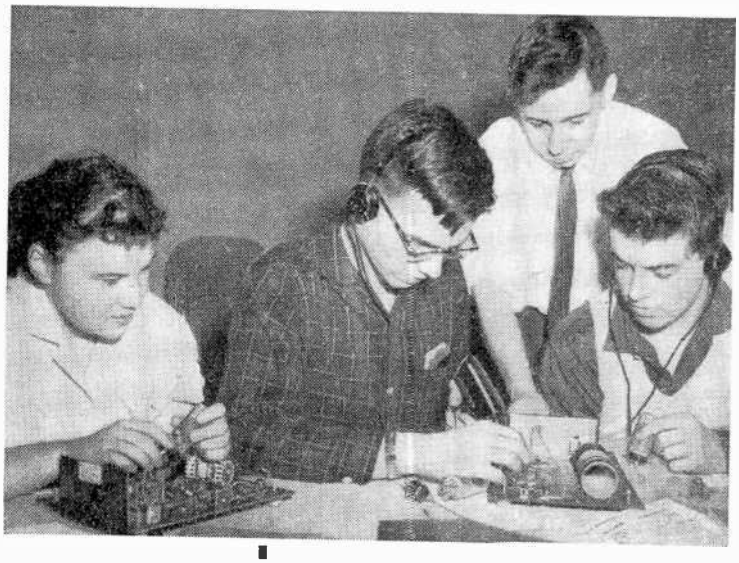
(*Continued on page* 107)

Exploring Electronics

...with simple projects

HERE is a way of presenting the subject of electronics to junior-high students in a manner that captures their imagination and provides a stimulus for future work in high school. Marvin Grossman had the idea, and brought it to Bradford Washburn, Director of Boston's Museum of Science. The result is "Exploring Electronics"—a popular Saturday afternoon course held at the Museum with Grossman as instructor.

Grossman holds an electrical engineering degree from M.I.T. and is now a sales manager with H. H. Scott. He has been amazed to find almost 100% attendance at every one of his classes. His eager young students (26 of them) wouldn't think of missing a session, even when the fish are biting or the fans are filling the bleachers.

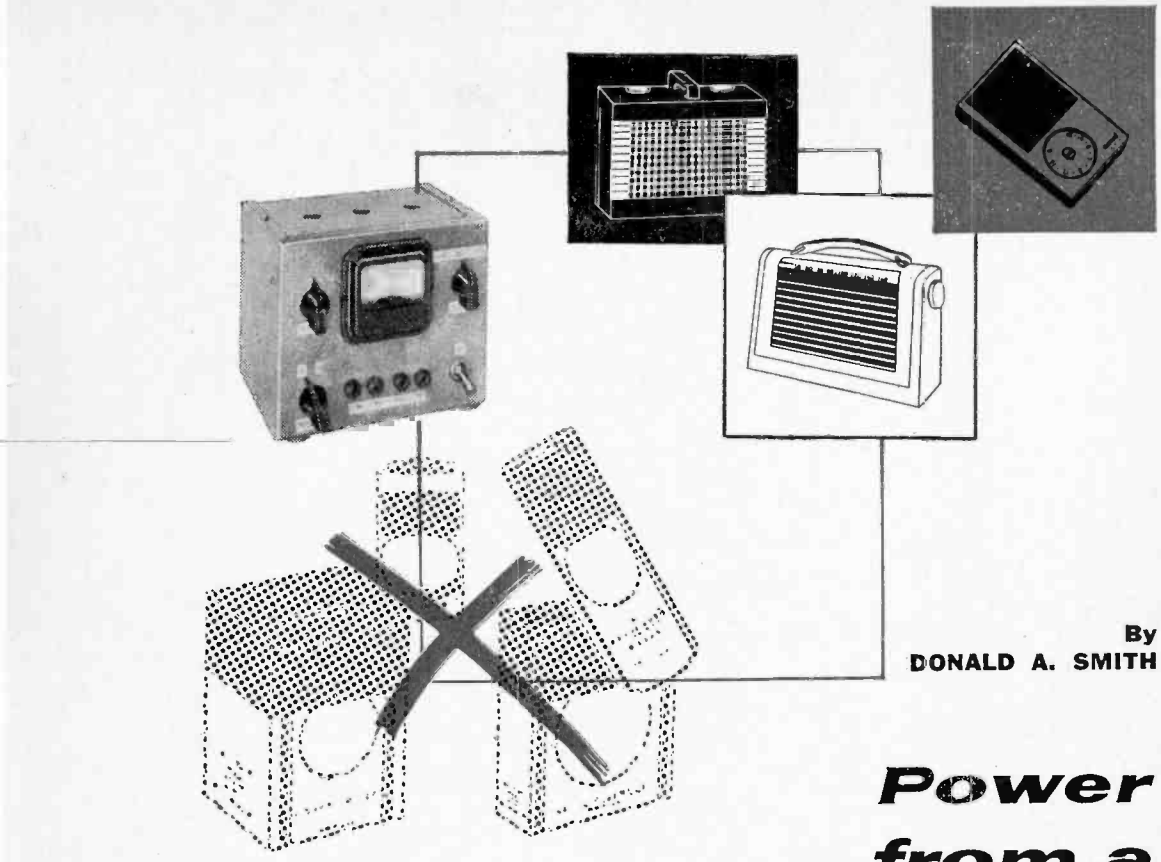


"You can't talk theory very long to boys and girls in this age group," says Grossman, "so immediately after we discuss a principle, we try it out by building something.

"Our first project was a simple four-part crystal set. Each youngster wound his own coil so he would get the feel of the hardware. At the end of the second session, the youngsters took their sets home and tried different ways of hooking them up to hear better. . . . The next step was a vacuum-tube amplifier."

Radio parts were provided by companies in the electronics industry, printed materials by various publishing houses. POPULAR ELECTRONICS participated by providing ideas and details for several electronic projects. On completion of the course, the students know how to work with basic electronic components, read circuit diagrams and construct their own equipment.

The avid response of the youngsters and the eagerness of so many others to join "Exploring Electronics" would seem to indicate that there is no lack of interest in science among early teenagers. —30—



By
DONALD A. SMITH

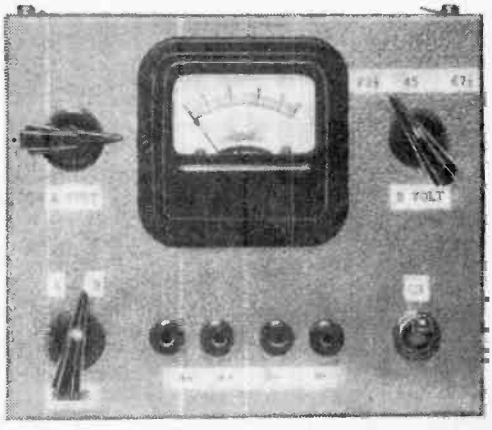
Power from a Batt-inator

SUMMER brings out your portable radio, and problems of getting it ready for use. Some sets will need nothing more than a new set of batteries and others will require tubes or more extensive work.

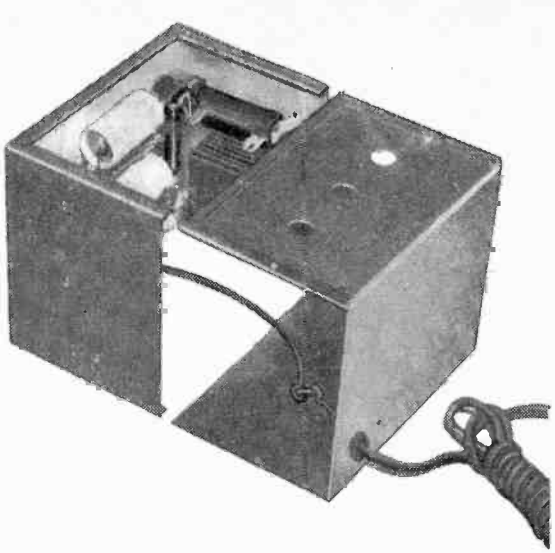
Some readers have sets that operate only on battery, and others will be three-way (a.c./d.c./battery) types. To stock batteries for all different types on your workbench is impractical since the shelf life of batteries is short and the cost is high.

Here is a power supply which will substitute for a battery supply in almost all battery-operated portable receivers. New uses for the instrument on the experimenter's workbench will be found daily.

Construction Details. The Batt-inator supplies 0-10 volts "A" voltage and 22½,



Simple power supply replaces a wide variety of batteries in portable sets



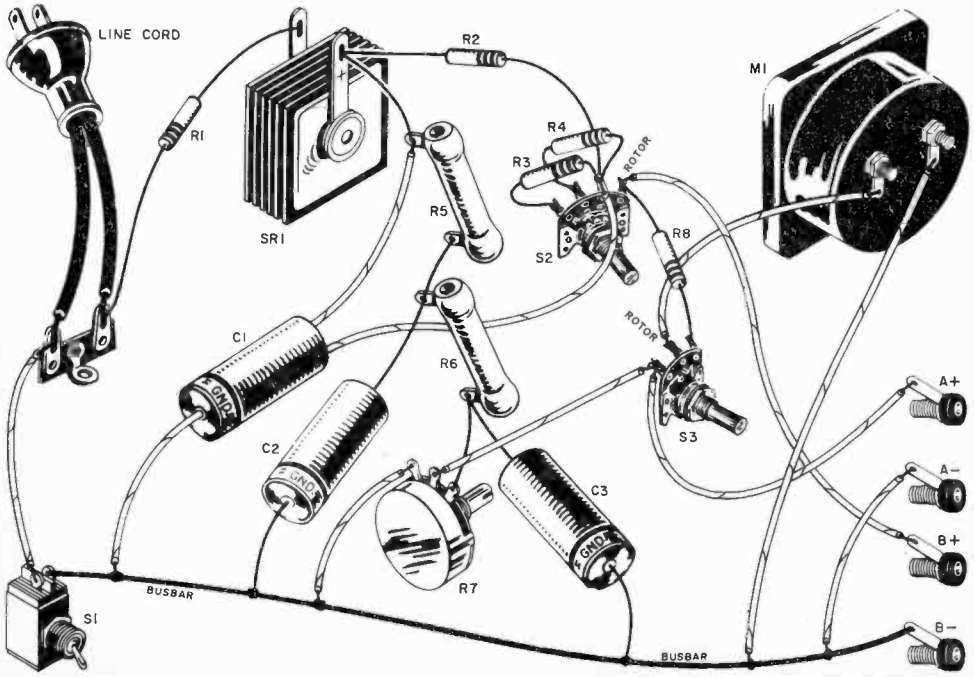
Method of assembly of Minibox is shown above, right. Note ventilation holes in top of cabinet. Other holes can be drilled or punched in rear panel.

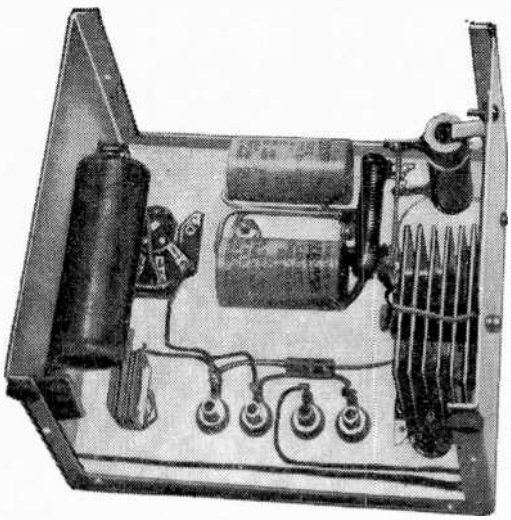
HOW IT WORKS

Resistors *R3* and *R4* are used as dropping resistors for 22½ and 45 volts respectively. Switch *S2* selects the desired "B" voltage output. *R7* is a wire-wound potentiometer which permits adjustment of the "A" voltage output from 0 to 10 volts.

Switch *S3* is the meter switch and connects the meter to read either the "A" voltage or the "B" voltage. The value of resistor *R8* was chosen so that the meter reading when switched to the "B" battery position is multiplied by 10. For example, if the meter reads 5 when the meter switch is at the "B" position, the actual voltage would be 50 volts.

Pictorial diagram of the Batt-inator. The busbar is connected to the B— jack. Both the A— and B— jacks should be well insulated from the chassis to prevent the possibility of shock or short circuit. Other jacks, tie points and switches should also be insulated.

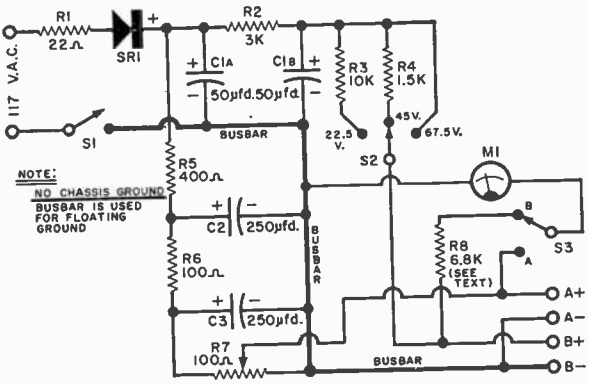




PARTS LIST

C1a/C1b—50-50 μfd., 150-volt dual tubular electrolytic capacitor
C2, C3—250-μfd., 50-volt electrolytic capacitor
M1—0-10 volt d.c. meter (Shurite #9107)
R1—10-22 ohms, 1 watt
R2—3000 ohms, 2 watts
R3—10,000 ohms, 2 watts
R4—1500 ohms, 2 watts
R5—400 ohms, 25 watts
R6—100 ohms, 5 watts
R7—100-ohm, 2-watt wire-wound potentiometer
R8—6800 ohms, 1 watt (meter multiplier resistor—see "HOW IT WORKS")
S1—S.p.s.t. toggle switch
S2—S.p., 3-pos. rotary switch (Centralab #1461)
S3—S.p.d.t. rotary switch (Centralab #1460)
SR1—117-volt, 350-ma. selenium rectifier

Completely wired unit is shown above. As can be seen from schematic at right, the Batt-inator B— and A— outputs are connected directly to one side of the a.c. line. Make sure to polarize a.c. line cord to prevent a "hot" chassis at the receiver being operated or tested.



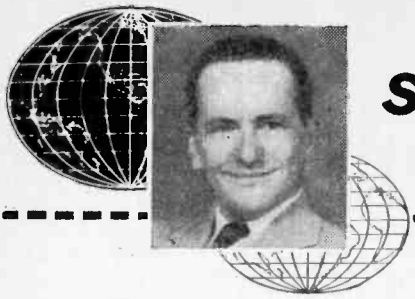
45, or 67½ volts for the "B" voltage. It has a built-in meter for reading either output *while in use.* A compact unit which can be built in a Bud Minibox cabinet, its total cost including the meter should be below $15.00.

The Minibox used to house the model shown is available in both natural aluminum or grey hammertone finish. Drill all holes for mounting parts first and make sure to drill some ¾" ventilation holes in the cabinet for heat dissipation. The 400-ohm, 25-watt resistor (*R5*) used as the filament-dropping resistor gets quite hot and should be located away from the filter capacitors and near the ventilation holes.

No other special precautions are necessary as the circuit is not at all critical and there is plenty of room in the Minibox for all parts. Substitutions may be made to utilize the parts in your "junk box." *Do not use the cabinet as the Common, B— or Ground!*

Using the Batt-inator. Check the receiver to determine what "A" and "B" voltage is required. Be sure that the filament or "A" voltage control (*R7*) is completely counterclockwise (minimum voltage) before turning on the supply. Connect the leads from the eliminator to the receiver, set the meter switch (*S3*) to the "A" position, and adjust *R7* until the proper voltage is applied as read by the meter.

Switch the "B" voltage selector switch (*S2*) to the desired "B" voltage, 22½, 45, or 67½ volts. "B" voltage can be checked by switching *S2* to the "B" position. —30—



Short-Wave Report

By HANK BENNETT

MANY OF YOU have written in to inquire about the amateur radio program that is broadcast by the *Voice of America*. Here is a resume of the program, with transmission times and frequencies.

Each week the *Voice of America* broadcasts the *VOA* Ham Show—15 minutes devoted to the latest gossip on the ham bands, interviews with licensed radio operators around the world, the latest propagation forecasts, and discussions of technical news of interest to radio amateurs and short-wave listeners.

The broadcasts, which are presented in English, are written and voiced by Bill Leonard, W2SKE, one of America's well-known news commentators and an active ham operator. Gene Kern, W2BAK, produces the program; and propagation forecasts are made by George Jacobs, W3ASK. All amateurs and SWL's are invited to participate.

Beamed to Europe, but receivable in most areas of the world, the *VOA* Ham Show can be heard as part of the "Report from America" broadcasts each Tuesday during the summer months. For time and frequencies, see the accompanying table. There is an additional transmission at 1730-1800 on 173 kc. (long-wave) from the 1000-kw. station near Munich. Since short-wave schedules are subject to change, you can obtain the latest schedules directly from: Amateur Radio, Box 922, Washington 4, D. C.

VOA HAM SHOW BROADCASTS

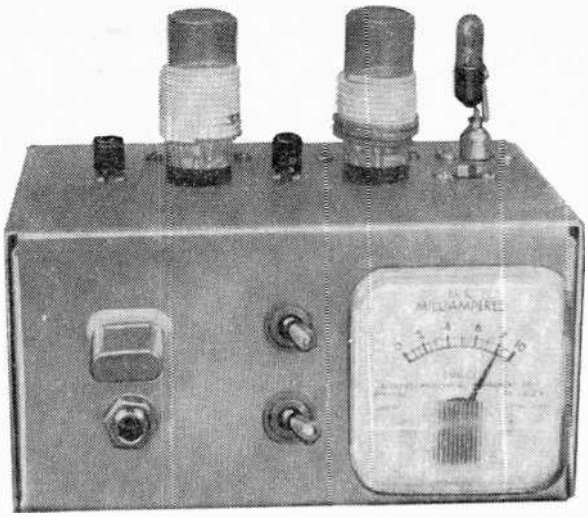
Time (EST)	Station	Frequencies (kc.)
1600-1630	Tangier	21,580; 9635
1600-1630	WDSI	21,500; 17,785
1600-1630	WLWO	21,485; 15,250
1600-1630	Munich	15,340; 6170
1700-1730	Munich	15,340; 6170
2300-2330	Tangier	17,710; 11,875

The *Voice of America* has prepared a distinctive verification card for listeners of the Ham Show; and W2SKE and his staff are looking forward to receiving QSL and SWL cards from you.

(*Continued on page* 123)

Patricio McGrath, of Kingston, Jamaica, is the holder of P.E. monitor card #379.

Equipment at Bill Hutchinson's listening post (left), Baltimore, Md., includes a Hallicrafters SX-71 receiver, home-built preselector.



The Semiconductor Space Spanner

A challenge to your operating skill, this 96-milliwatt transistor transmitter operates on 15 and 10 meters

By DON STONER, W6TNS

MANY AMATEURS, both Novices and old-timers, feel that it requires a lot of power to make contacts with foreign lands. The Novice longs for the time when he can discard the chains that bind him to the 75-watt power limit. And the old-timer dreams of a kilowatt rig to end all rigs.

Amateurs wise in the ways of propagation, and good operating techniques, know that this is not necessarily so. By taking advantage of good radio conditions and a snappy "fist," you can work wonders with low power, while the kilowatt may be bogged down by poor propagation.

You can prove this to your own satisfaction by constructing the "Semiconductor Space Spanner." It seems fantastic but this little giant is 750 times weaker than a typical Novice transmitter. The legal maximum for any transmitter is 10,000 times greater than the power input (96 milliwatts) for this rig! And yet the SSS transistor transmitter has logged an impressive list of contacts all over this continent and the Territory of Hawaii. Some of the contacts were pre-arranged, but many of them were the result of a 3 x 3 "CQ."

The Crystal. One might think that a transistor transmitter would be extremely expensive to construct. All the components except the quartz crystal were purchased for slightly over $19.00. In buying the crystal, specify a third overtone type, and the frequency that you wish to operate on.

For Novice or General Class operation on the 15-meter band, you can use a 7-mc. crystal in this transmitter. The crystal is made to oscillate on its third overtone (harmonic mode). Its frequency will be "pulled" slightly because of the overtone operation.

As an example, a 7140-kc. crystal would produce a 21.420-mc. signal in an oscillator

tripler circuit. In an overtone circuit such as is used in the SSS transmitter, this same crystal produces an output on 21.412 mc. or a difference of 8 kc.

If the third overtone of the crystal that you select comes out near the edge of the band, be extremely cautious and check the actual frequency with an accurate receiver or frequency standard.

Drilling and Mounting. The first step is to lay out the holes to be drilled on the chassis. You can either mark the paper wrapper and save it for a template, or if you are careful, mark the chassis directly. Drill as shown in the chassis layout diagram. Remove all burrs from the holes, rub the chassis lightly with steel wool, and then spray on a thin coat of clear plastic.

Start mounting the components by installing the meter switch (*S2*) and the crystal socket. Mount the key jack (*J1*) with the lugs away from the open end of the chassis. Install the power switch (*S1*) with the lugs toward the large meter hole.

The transistor sockets must be modified. Paint a dot on one end with red fingernail polish, then count away from the red end and remove the second lug. Do this for both sockets. The pin "by itself" (near the red dot) is the collector, then a space, the shield, the base and finally the emitter. Mount the sockets by forcing the rings down until they lock on the socket ridges. The red dot (collector end) should point towards capacitor *C7*.

Mount coil sockets (*L1* and *L2*) by sliding the rings down until they grip the socket and the chassis tightly. Pin 3 on both of these sockets also points towards *C7*.

Install the ground lug between capacitors *C2* and *C6*, using *4-40* hardware. Mount the three variable capacitors (*C2*, *C6*, and *C7*) with *4-40* hardware, and position the stators toward the rear of the chassis. Mount *J2* (antenna jack) in the remaining hole, with the smaller lug (ground lug) towards *L2*.

Mount the battery holders on the outside of the rear of the chassis with *4-40* hardware. Finally, install the ¼" grommet in the hole on the rear apron. To avoid scratching the meter, do not mount it until the wiring is complete.

Coil Construction. If you hold a Novice license, you must operate on the 15-meter

HOW IT WORKS

"Drift" transistor *TR1* is employed as an overtone oscillator. Bias and d.c. stabilization for *TR1* are provided by resistors *R1* and *R2*. Additional bias and stabilization are obtained in the emitter circuit by *R3*, which is connected in series with the key.

To stabilize the oscillator frequency, a quartz crystal is connected in series with the feedback path, between the collector and emitter. Oscillations appearing in the collector circuit are fed back to the emitter through the crystal and re-amplified. In this manner, the stage continues to oscillate.

The oscillator tank circuit, composed of *L1*, *C2* and *C3*, resonates the crystal and also provides an impedance match to the power amplifier circuit. R.f. energy for driving the power amplifier is removed from the oscillator circuit at the low-impedance tap on coil *L1*.

Another drift transistor *(TR2)* is employed as the power amplifier. No d.c. bias is applied to this stage, however. The r.f. energy driving the base causes it to draw current on the negative peaks, thereby operating *TR2* in true Class C.

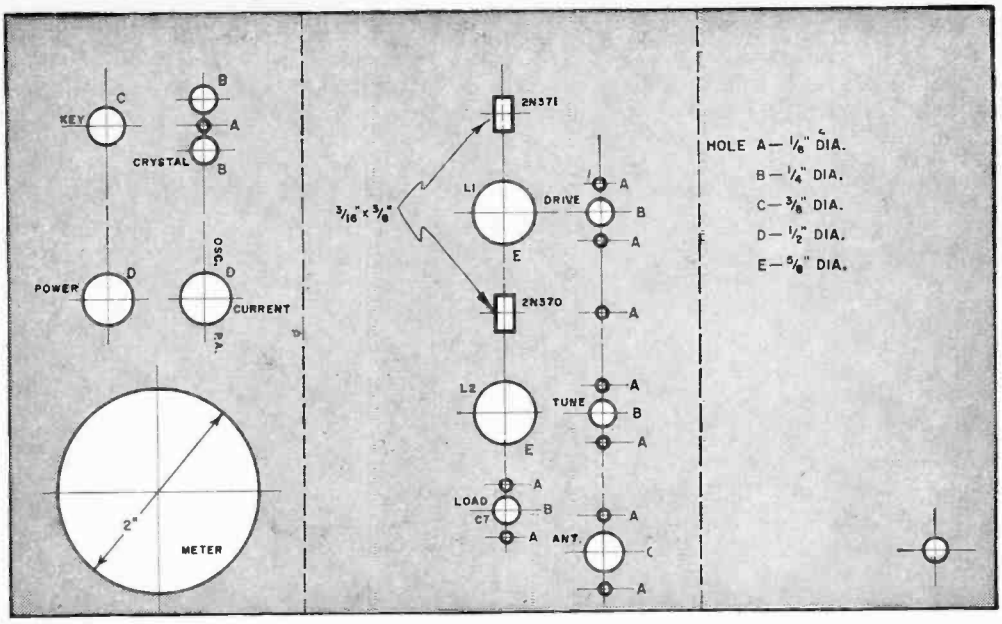
Because the only bias for *TR2* is obtained from the r.f., when the key is pressed, it draws no current until *TR1* is oscillating. The output tank is resonated by *C6* and is tuned to the operating frequency. The link and capacitor *C7* match the amplifier tank to the antenna.

Both *TR1* and *TR2* are rated at 50 milliwatts dissipation. They can be operated at a much higher input because of the short duty cycle of Class C. It is possible to run 160-mw. input on an ICAS (intermittent commercial and amateur service) basis as long as the maximum rating of 20 volts between collector and emitter is not exceeded.

The power input to the final amplifier (in mw.) can be calculated by multiplying the voltage and the current (in ma.). This transmitter runs 8 ma. at 12 volts, which equals 96 milliwatts.

PARTS LIST

B1—12-volt battery (8 RCA VS034 penlight [or larger] cells connected in series)
C1, C4, C5, C8—1000-μμfd. disc capacitor
C2, C6—15-μμfd. variable capacitor (Hammarlund MAPC-15)
C3—10-μμfd. disc capacitor (Centralab DD-100)
C7—50-μμfd. variable capacitor (Hammarlund MAPC-50)
J1—Closed-circuit key jack
J2—RCA type phono jack
L1, L2—See coil data at right
M1—0-10 milliammeter (Shurite 8303)
R1—10,000 ohms
R2—47,000 ohms — *All resistors ½ watt*
R3—180 ohms
R4—3300 ohms
S1—S.p.s.t. toggle switch (Cutler Hammer 8280K16)
S2—D.p.d.t. toggle switch (Cutler Hammer 836377)
TR1—Oscillator transistor (RCA 2N371)
TR2—Amplifier transistor (RCA 2N370)
Xtal—Third overtone crystal for the desired frequency (International Crystal FA-9)
1—Crystal socket
1—3" x 4" x 6" chassis (Bud AC-430)
2—Five-pin transistor sockets (see text)
2—Coil forms (Amphenol 24-5H) and sockets (Amphenol 78S5S)
1—RCA type phono plug to fit J2 (for installation on antenna lead-in)
1—#49 pilot lamp (for testing)
2—Penlight battery holders



TESTED By POPULAR ELECTRONICS

L1 DETAIL

10-11 METERS

11 TURNS #20 PLASTIC COVERED HOOK-UP WIRE TAPPED AT 2 3/4 TURNS FROM BOTTOM

15 METERS

15 TURNS #20 PLASTIC COVERED HOOK-UP WIRE TAPPED AT 3 3/4 TURNS FROM BOTTOM

L2 DETAIL

10-11 METERS

10 TURNS #20 PLASTIC COVERED HOOK-UP WIRE. LINK 3 3/4 TURNS SAME WIRE WOUND IN THE SAME DIRECTION AND OVER BOTTOM OF L2

15 METERS

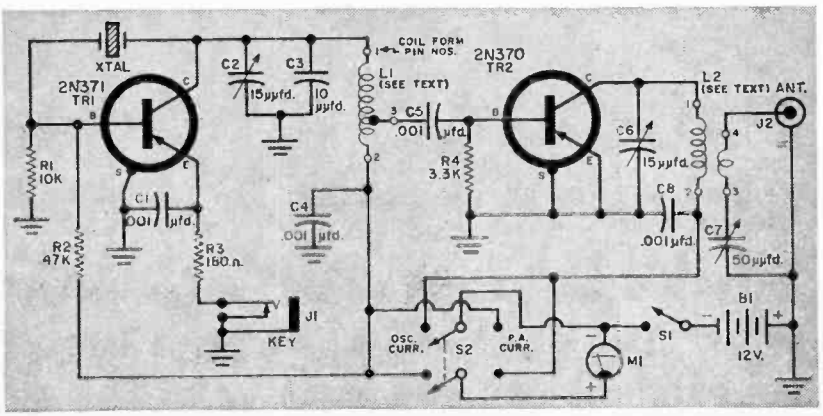
15 TURNS #20 PLASTIC COVERED HOOK-UP WIRE. LINK 4 3/4 TURNS

DUMMY LOAD DETAIL

TRANSISTOR DETAIL

C—COLLECTOR
S—SHIELD
B—BASE
E—EMITTER

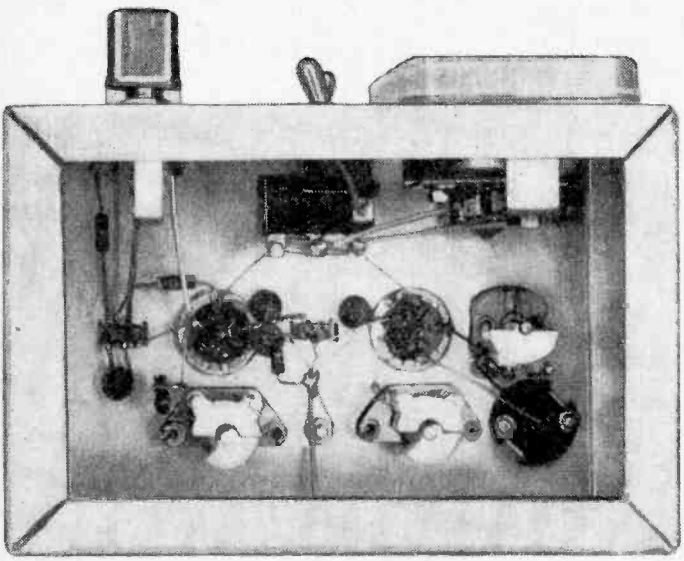
Layout of mounting holes above provides neat appearance and short leads required at these frequencies. Over-all size of chassis is optional with builder.



band and need only one set of coils. However, if you have General Class privileges, you can operate on either 10 or 15 meters. The coil data covers both bands.

The coils are wound starting at the bottom, in a clockwise direction, while viewing the top. Holes should be drilled in the coil form directly above the pin to which the wire is connected.

When soldering the wires to the coil form pins, observe the same precautions as you would when soldering transistor leads. The pins should be gripped tightly with long-nose pliers to conduct the heat away, as polystyrene coil forms will melt with a very small amount of heat. This is also a good time to construct the test lamp, to be used later.



Under-chassis view of Space Spanner shows location of components. Antenna jack is a phono connector placed in lower right-hand corner.

Wiring. The transmitter should be wired up as shown in the schematic diagram. Keep the wires as short and straight as possible. Install the cells (*B1*) with the first one up, the second one down, the third one up, and so on. Connect them all in series by soldering wires between the positive terminal (brass tip) of one cell to the negative terminal (zinc base) of the adjacent cell.

Install the meter (*M1*) in the large hole on the front apron of the chassis, and connect it up (observe meter polarity). From this point on, you must be very careful not to scratch the meter face.

Before inserting the transistors (*TR1*, *TR2*), make some safety checks. Locate the wire between *B1*'s cells and *S1* (negative lead). Place the negative lead of a voltmeter (on the 15-volt scale) on this wire and connect the positive lead to the chassis. The meter should read slightly over 12 volts with fresh cells.

Make sure that *S1* is off and insert the coils. Connect an ohmmeter between the chassis and the stator of *C2* and *C6* alternately. It should read infinity. If it does not, you have a short circuit. Assuming that the rig checks okay, let's fire it up.

Testing. With *S1* still off, insert *TR1* and *TR2* in their correct sockets, insert the key in the jack, and install the crystal. Place *S2* in the oscillator position, press the key intermittently, and turn *S1* on. When the key is pressed, the meter should read between 5 and 8 ma. (depending on the setting of *C2*).

Switch to the "PA" position and check for current. It may read anything between zero and 10 ma. Adjust *C2* to make the meter read maximum. Insert the test bulb load and set *C7* for *minimum* capacitance. Adjust capacitor *C6* for a dip in the collector current. It should read approximately 4.5 ma. at the "bottom" of the dip.

Slowly increase the capacitance of *C7*, while readjusting *C6* for a dip, until the collector current reads 8 ma. You should now be able to observe that the pilot lamp filament is glowing at about half brilliancy. Once you have reached this point, you are ready to put the Semiconductor Space Spanner on the air.

Tuning and Operation. Oscillator capacitor *C2* is adjusted for *maximum collector current of the power amplifier,* rather than maximum grid drive as in a vacuum-tube transmitter. Power amplifier capacitor *C6* is always tuned for *a dip in the*

(*Continued on page* 109)

Transistor Topics

By LOU GARNER

HAMS, R/C enthusiasts, experimenters and transmitter design engineers will welcome the news that a major semiconductor manufacturer has succeeded in developing an r.f. *power* transistor.

The Lansdale Tube Company (a division of Philco) has announced an MADT unit capable of producing *1 watt of output power at 70 megacycles,* with a collector efficiency of over 80% and less than 250 milliwatts of driving power! Although still in the experimental stage, this high-frequency, high-power transistor should be in pilot production in the near future and may be available soon.

Other manufacturers are busy designing high-frequency power transistors, of course, and we can expect other types to be announced before the end of the year. Medium- and high-power r.f. transistors can be used in mobile transmitters, high-efficiency R/C controls, walkie-talkies, and similar types of equipment. Until now, transistorized radio transmitters have been limited to outputs in the milliwatt range.

Reader's Circuits. Transistorized control circuits have many potential applications in the home. They can be used as rain alarms, fire alarms, burglar alarms, humidity and temperature controls, power failure alarms, and so on. But regardless of their final application, such circuits are basically similar.

In general, transistorized controls consist of a *sensing device,* such as a photocell, a transistorized *amplifier,* and an electromagnetic *relay* which switches some external electrical or electromechanical device, such as a fan, light, alarm, or solenoid.

Reader Gene Richardson, of Alexandria, Va., has submitted the two basic control circuits shown in Fig. 1. Either can be assembled using a variety of transistors and different *sensing* devices.

The circuit in Fig. 1(A) uses a single *p-n-p* transistor as a direct-coupled common-emitter amplifier. Resistor *R1,* in series with the base electrode, serves as a current-limiting resistor, preventing accidental transistor overload by the externally applied signal which acts as the control.

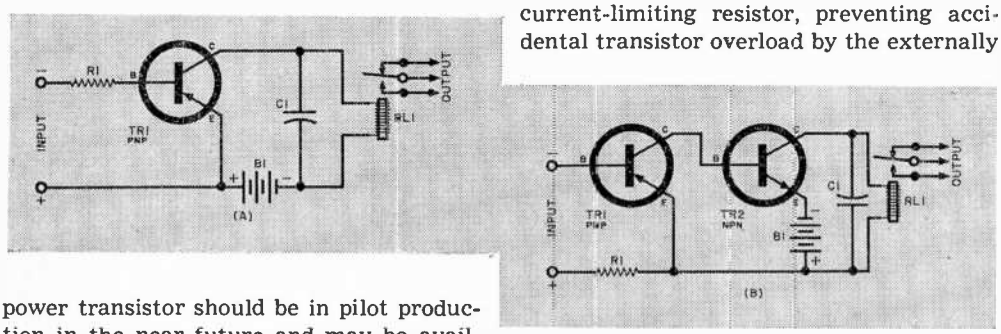


Fig. 1. Reader Gene Richardson's single-stage (A) and two-stage (B) basic transistor control circuits.

In operation, a d.c. control signal obtained from the sensing device is applied to the *Input* terminals with the polarity shown. This signal, amplified by the transistor, operates the relay. *C1,* across the relay's coil, serves to bypass inductive voltage peaks developed by current surges and thus to prevent transistor "punch-thru" by these transients. (An *n-p-n* transistor may be used if battery and input signal polarities are reversed.)

Sensitivity depends on the transistor's *beta* (gain) and on the relay's basic sensitivity. If the relay, for example, requires a current of 1 ma. to close, and the transistor supplies a gain of 10, then a control signal of only 100 microamperes is needed. But

much greater sensitivity can be obtained with the circuit in Fig. 1(B). Here, the complementary characteristics of *p-n-p* and *n-p-n* transistors are used in a two-stage direct-coupled amplifier. The common-emitter arrangement is employed in both stages. Operating power is supplied by a single battery (*B1*). Resistor *R1* serves as an input current-limiting resistor, relay *RL1* is the amplifier's output load, and *C1*, across the relay, protects the output transistor against voltage transients.

Used with a TV receiver, the Regency FM TeleVerter permits reception of FM broadcast stations.

The young lady above is holding a new all-transistor auto-portable receiver which may be used either in or out of an automobile. Compare this in size with the 1929 Cadillac auto radio shown with its B batteries.

Circuit sensitivity is a function of the gain of *both* transistors as well as relay sensitivity. Using our previous example, suppose that each transistor supplies a current gain of 10, and that the relay requires a current of 1 ma. for operation. In this case, a control signal of only *10 microamperes* is needed.

In practical equipment using these basic circuits, *R1* may have values of from 20,000 ohms to 1 megohm; ½-watt resistors can be employed. *C1* may have values of from 0.1 μfd. to as high as 10.0 μfd., and should have a d.c. working voltage which is at least twice that of the battery voltage.

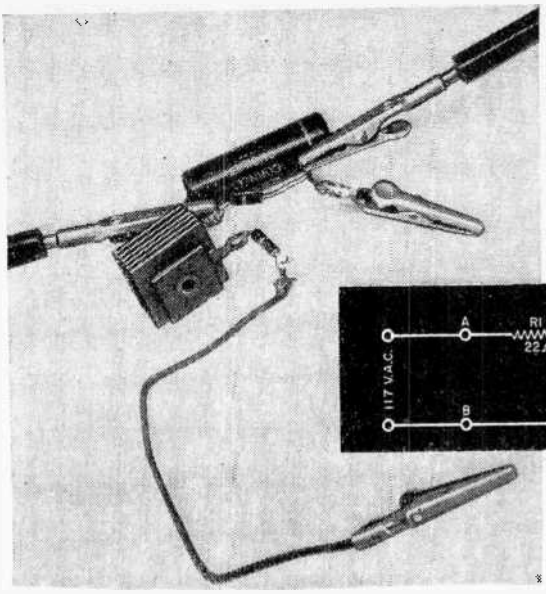
Standard transistors can be used in either circuit. Typical *p-n-p* units are Raytheon Types CK721 and CK-722, G.E. Type 2N107, GT Type GT-222, and RCA Type 2N109. Suitable *n-p-n* units are the 2N229 and 2N170.

The battery needed will depend on the maximum voltage rating of the transistor and on relay characteristics. Fairly sensitive relays should be employed; typical units are the Sigma 4F series, Advance SO series, and Potter and Brumfield Type SS5D.

The *sensor* connected to the circuit's *Input* terminals may be a selenium or silicon photocell, such as International Rectifier Types B2M (selenium) and SA-5 (silicon), or a switch.

FM TeleVerter. One of the most interesting commercial transistor applications we've seen is found in Regency's FM TeleVerter (manufactured by Regency Division, I.D.E.A., Inc., 7900 Pendleton Pike, Indianapolis, Ind.). This compact unit permits reception of the FM broadcast band through Channels 3 and 4 on standard TV receivers. It contains ganged, continuously tuned r.f. and oscillator circuits and a single high-

(*Continued on page* 117)



This simple circuit requires no chassis mounting. Lettered points in schematic of voltage source are explained in text.

Check Your A.C. Calibration

Achieve laboratory accuracy with a four-component voltage source

By JAMES A. McROBERTS

WHEN YOU FINISH putting together that VTVM kit, are you stuck for a stable a.c. voltage source with which to adjust the calibration of the a.c. scales? Or when you are going to make some critical a.c. measurements, would you like to be able to recheck the accuracy of your VTVM or multimeter?

Calibration of the d.c. ranges of a meter is relatively simple since dry cells and batteries are universally available. Flashlight cells have an output voltage of 1.54 volts when new. "B" batteries are available in standard 45-, 67.5- and 90-volt sizes for calibration of the higher voltage ranges in the B+ testing area.

Two 67.5-volt batteries, for example, can be connected in series to give over 135 volts for checking of the meter scale in the 150-volt section where many important measurements are made. (Actual voltage of each battery when fresh, measured with a VTVM, will be 69.3. The output voltage of a fresh battery is a physical constant and is dependent on the electrochemical makeup of the battery.)

Calibrating the a.c. ranges of the meter is a problem. The power line voltage which is your source of a.c. varies from instant to instant and from hour to hour. Another a.c. meter of *known* accuracy which is needed to check the power line and the a.c. scale is usually not readily available.

Here is a simple means of calibrating the a.c. ranges by means of the *previously calibrated* d.c. voltage ranges. All that's required is a simple half-wave rectifier sys-

tem. Use a 130-volt selenium rectifier (*SR1*) of 30-ma. or higher current rating, a 22-ohm surge resistor (*R1*), and a 22,000- to 47,000-ohm load resistor (*R2*). A 0.25- or 0.5-μfd. capacitor plus some wire and solder completes the parts list.

Measure the d.c. voltage across points *C, D* in the diagram on page 67. It almost equals the peak value of the a.c. voltage. Allow for about 1% drop through *R1* and *SR1*. Now switch your meter to its a.c. function and measure the a.c. voltage between *A* and *B*. Set the a.c. calibration control of your meter to read 0.7 (actually 0.707) of the previously measured d.c. voltage.

For example, if the d.c. voltage across *C, D* is measured as 160 volts (this would correspond to the *peak* a.c. voltage), then the a.c. r.m.s. voltage is 112 volts (160× 0.7). Since the line voltage may vary from one moment to the next, switch back to the d.c. scale immediately after setting the a.c. calibration control. Recheck the d.c. reading, then switch back again to the a.c. scale to recheck the line voltage which may have shifted.

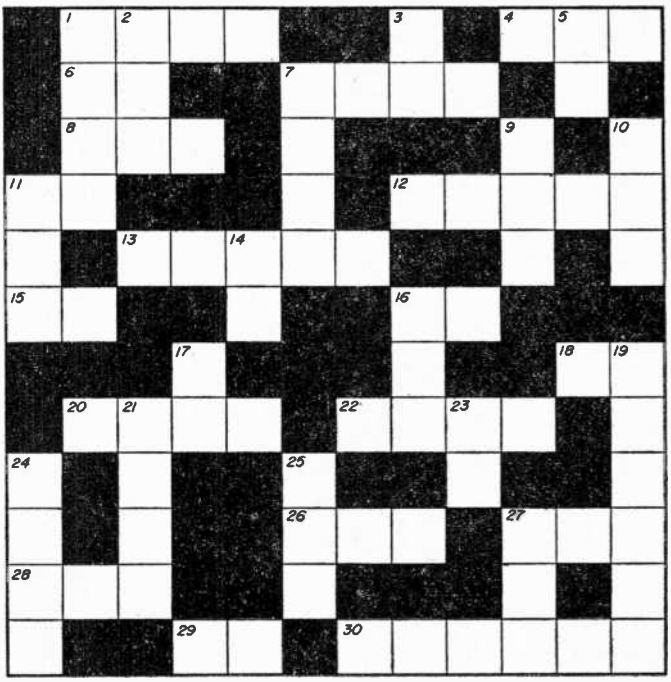
Certain precautions should be observed since this little gadget is operated directly from the a.c. line. Never touch the metal cabinet of your meter or uninsulated sections of the test probes and an external ground simultaneously. Make all connections and disconnections of your test clips or probes only when the calibration circuit is *not* plugged in.

Don't touch any water pipes and avoid damp floors when working on any device which has its common or B− return connected directly to the a.c. line. —30—

CROSS*NUMBER* PUZZLE

By John A. Comstock

Like to work crossword puzzles? Then you have a treat awaiting you. Here is something new—a cross*number* puzzle. Instead of filling in words, you fill in numbers . . . "electronic" numbers. Read the clues and see how well you can do.



ACROSS

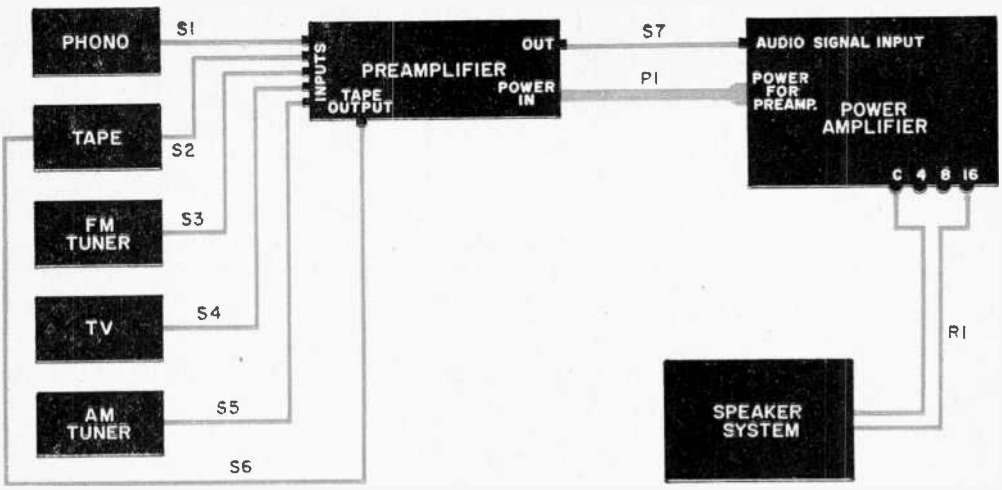
1 Upper frequency limit of broadcast band: kc.
4 Amount of wattage that equals 1 hp.
6 Number of degrees phase shift through capacitor.
7 One kilowatt: watts.
8 Impedance of common ribbon-type TV twin-lead.
11 Common record player speed: rpm.
12 Value of resistor color-coded brown, grey, violet, red.
13 TV line scanning frequency used in U. S.
15 TV field frequency.
16 Total resistance of two 5-ohm resistors in series.
18 Last TV channel in u.h.f. group.
20 Foot-second velocity of sound waves in free space.
22 The year Edison demonstrated transverse of electrons between hot filament and cold plate in vacuum.
26 Amount of power that can be dissipated by two 15-ohm, 50-watt resistors in series.
27 Ripple frequency output of single-phase full-wave rectifier: cps.
28 Hot resistance of 110-volt, 50-watt light bulb.
29 First TV channel in u.h.f. group.
30 Velocity of electromagnetic radiation in free space: mph.

DOWN

1 The year in which E. H. Armstrong first demonstrated his system of FM broadcasting.
2 Wavelength of 500-kc. signal: meters.
3 Common commercial power line frequency in U. S.
5 Total capacitance of two 20-μfd. capacitors in parallel.
7 The year Marconi sent wireless messages.
9 Intermediate frequency of some superhets.
10 International distress frequency: kc.
11 Intermediate frequency of many superheterodyne AM receivers.
14 In FM, frequency deviation that corresponds to 100% modulation: number of kc.
16 Upper limit of commercial FM broadcast band: mc.
17 Number of volts from 12-volt battery.
19 Velocity of radio wave traveling in free space: meters.
21 The year E. H. Armstrong first demonstrated superheterodyne circuit.
23 Lower frequency limit of commercial FM band: mc.
24 Seventh harmonic of 360 kc.
25 Upper limit of TV v.h.f. Channel 13: mc.
27 Number of degrees phase shift through transformer.

(See page 116 for solution)

What Goes In Between?



A primer on interconnecting your hi-fi components

By E. EUGENE GARNES

MANY PEOPLE in the market for a high-fidelity system tend to shy away from buying separate components because they're "afraid to make electrical connections." They are under the impression that it takes a skilled electronics serviceman to install the rig properly. This is not so. Anyone, with a bit of instruction, can do a bang-up job of hooking up the units of a system.

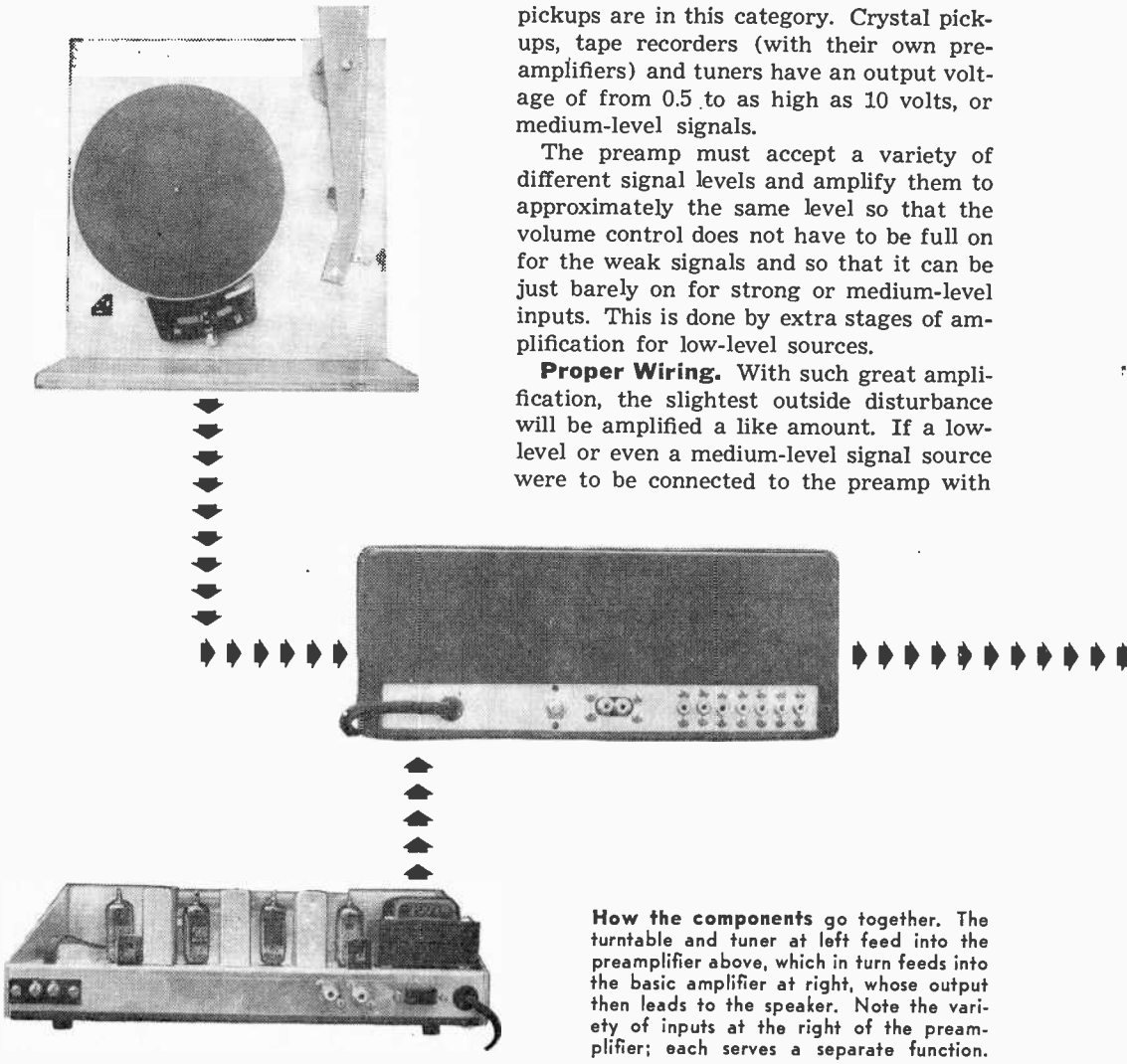
Let's consider the components that are essential for every setup. There should be, of course, a loudspeaker, an amplifier, and at least one "program" source such as an AM or FM tuner or phonograph. More elaborate outfits may include a tape recorder or playback mechanism, and possibly a TV receiver. Such auxiliary units enhance the enjoyment of any system and must be properly installed for top performance.

The Amplifier. In every rig, all wiring centers around the amplifier—either an integrated amplifier or a preamplifier and a separate power amplifier. Each has certain advantages. Generally, the integrated system is somewhat less expensive than the equivalent preamplifier/power amplifier arrangement. In terms of performance the latter is usually considered superior.

It is much easier to design a hum-free amplifier where the a.c. power circuits can be remote from the high-gain section of the unit, which is extremely sensitive to magnetic fields such as are created by power transformers. In addition, the preamplifier stages can be miniaturized to occupy small, attractive cabinets with the larger, heavy-power section hidden in some remote location, allowing a more flexible installation.

If the amplifier controls are to be mounted in full view of, say, your living room, a small preamplifier control cabinet is much to be preferred than a chassis of, say, one cubic foot or more, required for a high-power integrated unit. Most preamps have a cathode follower output of

Typical hi-fi components and the proper method for interconnection are shown above. Note that tape output jack on preamp feeds tape recorder "radio" input to allow you to record without interfering with listening.



How the components go together. The turntable and tuner at left feed into the preamplifier above, which in turn feeds into the basic amplifier at right, whose output then leads to the speaker. Note the variety of inputs at the right of the preamplifier; each serves a separate function.

pickups are in this category. Crystal pickups, tape recorders (with their own preamplifiers) and tuners have an output voltage of from 0.5 to as high as 10 volts, or medium-level signals.

The preamp must accept a variety of different signal levels and amplify them to approximately the same level so that the volume control does not have to be full on for the weak signals and so that it can be just barely on for strong or medium-level inputs. This is done by extra stages of amplification for low-level sources.

Proper Wiring. With such great amplification, the slightest outside disturbance will be amplified a like amount. If a low-level or even a medium-level signal source were to be connected to the preamp with low impedance so that there is little high-frequency cable loss even with distances up to 200 feet away from the power amplifier.

"Program" Sources. All sound sources (mike, phono pickup, tuner, etc.) feed audio signals to the preamplifier. The preamplifier then processes them according to the control settings. It amplifies these signals to a level acceptable by the power amplifier, which develops the power to drive the loudspeaker system.

Signal levels of the sources differ greatly and, for our purposes, can be broken down in two general classes—low and medium level. Low-level signals are extremely weak, in the vicinity of 0.01 volt. Magnetic lamp cord, for example, the induced hum pickup from the house wiring would be intolerable. It is, therefore, absolutely necessary to use shielded cable properly grounded to prevent random noise and hum pickup.

Conventional wiring paths are shown on page 69. Wiring from *S1* through *S7* must be single-conductor shielded cable, known as phono cable, or single-conductor microphone cable. If the distance between any source and the preamp exceeds five feet, and if the source does not have a cathode follower output, mike cable will be well worth the slightly higher cost, since it has lower internal capacitance and thus less effect on the signal.

In phono cable, an insulated wire is completely surrounded by a copper wire braid which is always grounded and acts as a shield against the hum fields present. This braid should also be insulated to avoid ground loops and noise from accidental contact with the various chassis.

The diagram below, right, shows plug connector and wire preparation to accommodate the plug. When using cable whose center conductor is insulated by a plastic material, it is important that soldering be done quickly to prevent melting the insulation and causing a short.

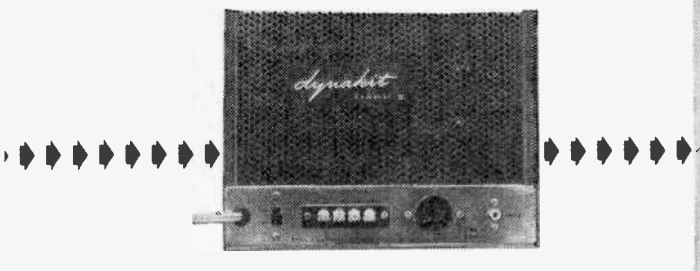
Plugging In the Units. The cables connecting the different units to the preamplifier or integrated amplifier should be plugged into the jacks designated on the equipment or in the instruction manual. For example, the lead from the phono pickup should be plugged into the phono jack marked *Mag* or *Xtal*, depending on whether you are using a magnetic or crystal pickup. Connect the FM tuner to the *FM Jack*, tape machine to the *Tape Jack*, and so on.

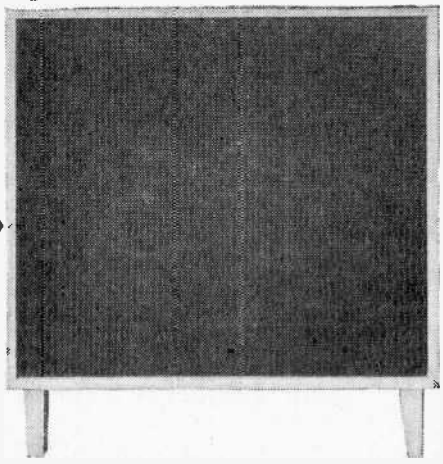
The output of a tape recorder having its own preamplifier should be connected to the jack designated in your amplifier instruction manual. Since there is usually no way to tell externally if the tape input on your amplifier is high- or low-level, the manufacturer must be your guide.

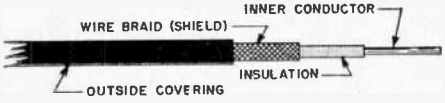
If your machine does not have its own playback amplifier, or if you wish to bypass this amplifier, the signal may be taken directly from the playback head and fed to the amplifier jack marked *Tape Head*.

Many hi-fi amplifiers also provide a jack marked *Tape Output*. Although the term is slightly misleading, this feature is designed to allow tape recordings to be made at the same time that you are listening to a program. All that is necessary is a lead (*S6*) from this jack to the *Radio* or *High Level* input on the tape recorder. This lead can be left connected at all times without interfering with playback operation.

If you are using a separate preamplifier, the leads labeled *S7* and *P1* must be supplied. *S7* is a shielded lead which carries the audio signal from the preamp to the power amplifier. If you have a self-powered preamp, one that plugs directly into the 117-volt a.c. line, *S7* is all that is needed.

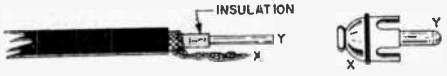






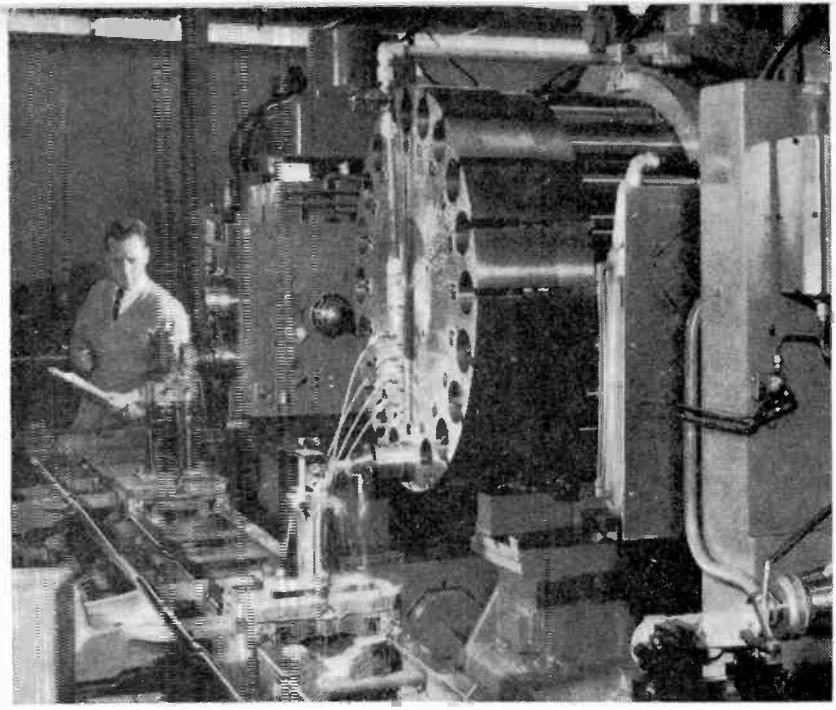
Construction of single-conductor shielded cable (above) for interconnecting components.

In preparing the cable for phono plugs, unbraid shield as shown below, cut off excess to allow ½" at X. Twist together, telescope plug over wire, and solder at X and Y on plug.



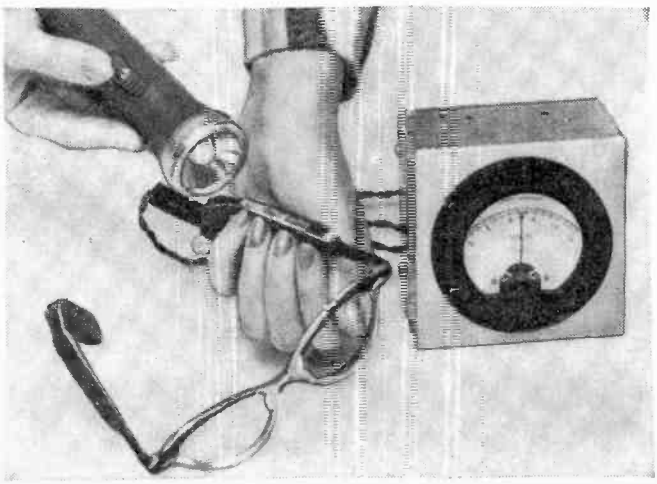
Preamps are frequently *not* self-powered and do require *P1* to receive B+ and filament voltage from the main amplifier. The cable here will be of the unshielded multiconductor variety—usually having five to eight separate insulated conductors. The

(*Continued on page* 110)

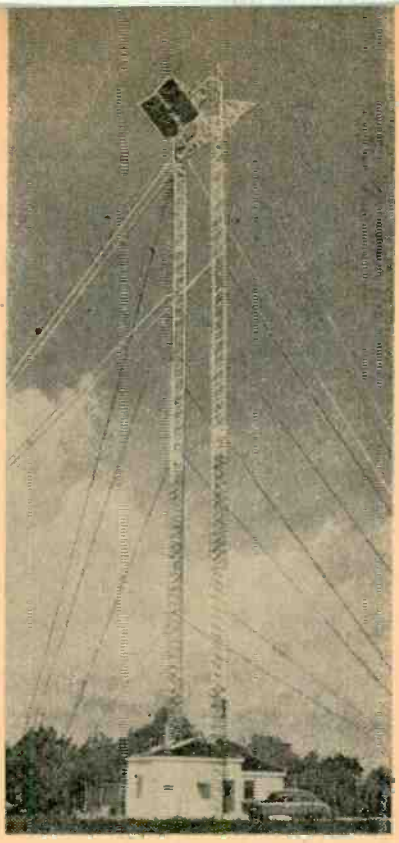


The nation's first all-electronically controlled line of machine tools is installed at Hughes Aircraft in Los Angeles. Working as a team, milling, drilling and boring machines pass parts along automatically after each machine operation. The line is operated by new Digitape electronic controls and was developed in cooperation with the Kearny & Trecker Corp., of Milwaukee.

Electronics Today

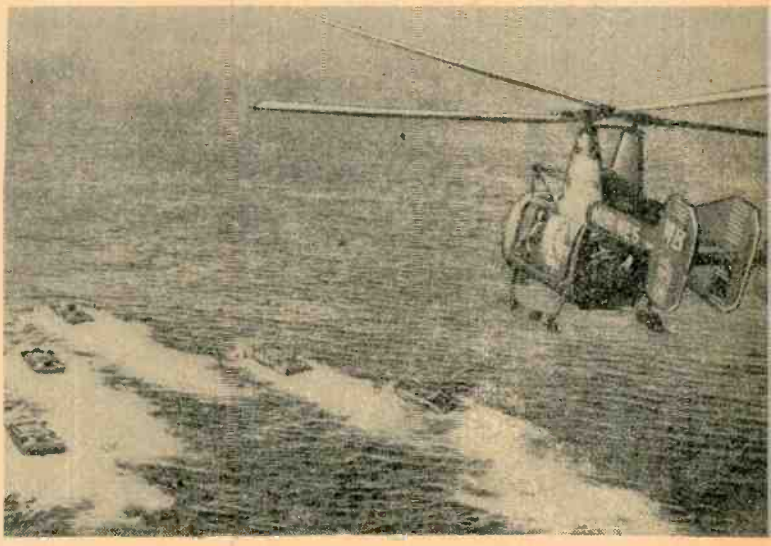


Hearing aids take on a new dimension with the debut of the new Zenith Solaris unit, which employs silicon solar cells (same type as used in the Vanguard satellite) to power its amplifier. The cells are so efficient that they can even use the weak light of a flashlight to register a voltage. Overcast sunlight will run the device properly. In darkness, it automatically switches to batteries. It uses four transistors.



Self-supporting microwave tower with "fly-swatter" reflectors (at right) is used in Western Union's new radio beam system between Pittsburgh, Cincinnati and Chicago. A reflector catches the beam and directs it to receiving equipment at the bottom of the tower, where the signal is retransmitted and angled upward to another reflector which beams it on to the next tower.

An engineer at Bendix Aviation holds the stick of the automatic "power-thinking" control system (above) developed for the B-58 "Hustler." Without it, the plane would be harder to control than a thousand bucking broncos. The system translates the stick motion electronically and hydraulically to control surfaces.



A wave of Marine Corps amphibious assault vehicles churns toward the California coastline under the electronic control of the operator in the helicopter. The radio control system was developed to put the vehicles through rugged surf tests without endangering human lives.

By
VICTOR BROCINER

OUTDOOR Hi-Fi

WITH THE ACCENT on outdoor living, the music lover need not give up listening to hi-fi. There are now available hi-fi speakers especially designed for outdoor use which can be permanently installed as music system extensions for patios, swimming pools, terraces, or wherever you want to relax.

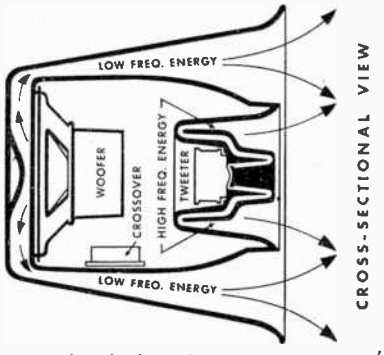
Volume control at or near the speaker can be provided by using a suitable L-pad, mounted in a small metal can. You will find this handy, especially on warm, lazy days, when you may not have the ambition to rush back and forth between your amplifier's volume control and your favorite spot.

The most practical method of adjustment is to turn the L-pad on "high" (full clockwise), adjust the amplifier's volume control to the highest level that you would ever want, and then decrease the volume with the L-pad.

One side of the speaker line to the amplifier chassis must be grounded to a water pipe or a metal rod driven several feet into the ground. While the audio voltage applied to a loudspeaker is small, remember that, in most hi-fi amplifiers, the output transformer secondary connects to chassis at the "common" output terminal.

Most chassis are bypassed to the power line by a capacitor of sufficient size to have disagreeable shock possibilities to someone, for example, who happens to establish a circuit between a floating chassis and ground by standing barefoot just after emerging from the swimming pool. (If the rig is an a.c./d.c. or transformerless type, just forget the L-pad; take no chances.)

One compact, easily installed outdoor extension speaker is shown in the photograph at left—the new University Model MLC hi-fi projector. It has a woofer and a tweeter, both horn-loaded. The dual-horn and its two drivers are compressed into a space of less than a cubic foot.



The paths that high and low frequencies follow from woofer and tweeter of the University MLC. Crossover is built in.

The tweeter response goes to 15,000 cycles, while the woofer, rated conservatively down to 150 cycles, has usable response to 80 cycles. Since horn loading results in high efficiency, the 15-watt power capacity is more than adequate outdoors. —30—

Squawk with the Transihorn

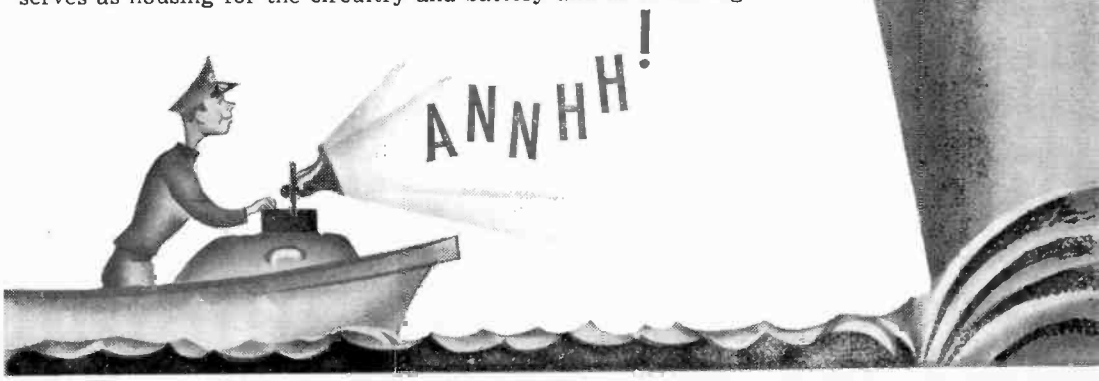
Transistorized all-purpose horn is handy on boats, for Civil Defense, or any other need

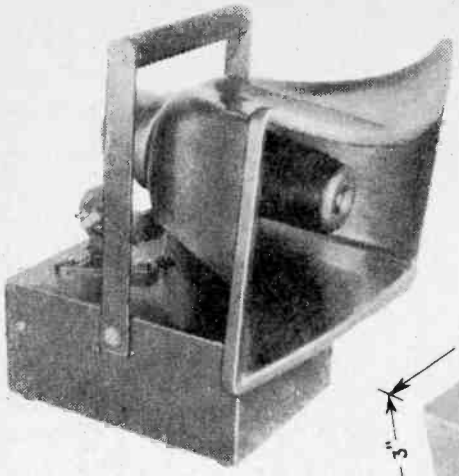
By LOUIS E. GARNER, JR.

CHANCES ARE that you could use a self-contained, reasonably powerful electric horn for club, civic, school, Civil Defense, sporting or other activities. If you're a boating enthusiast, maybe you've been looking for an inexpensive foghorn that won't place an excessive drain on your boat's electric system.

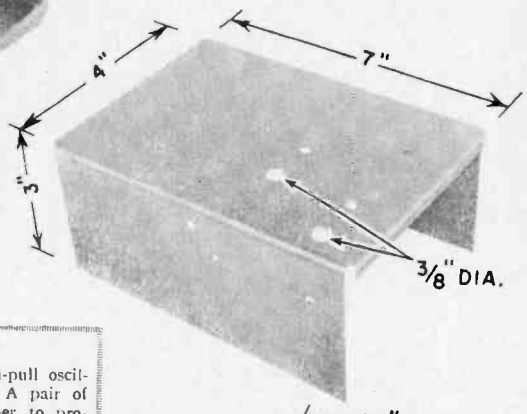
With inexpensive power transistors, it is possible to design a fully transistorized electric horn that has plenty of volume but needs relatively little power. The "Transihorn" requires so little current that it can be operated from a small, self-contained battery. The horn and its power supply become one lightweight, rugged, easy-to-carry-and-use unit.

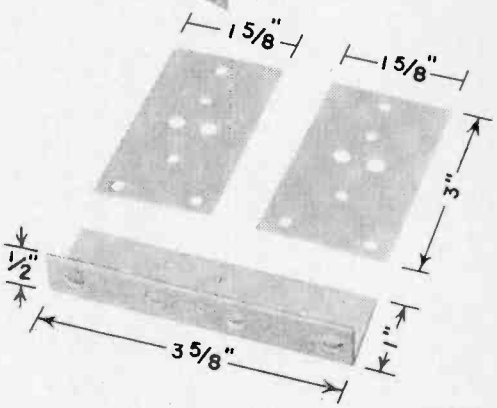
Construction and Wiring. A 7" x 5" x 3" aluminum box serves as housing for the circuitry and battery and as mounting





The holes to be drilled in the chassis and transistor heat sinks are shown below. Note that the two heat sinks must be insulated from the chassis and each other by means of fiber or mica washers.





HOW IT WORKS

This circuit is basically a transistor push-pull oscillator direct-coupled to a paging trumpet. A pair of power transistors is used with a transformer to provide part of the oscillator load and also the feedback necessary for oscillation. The two transistors are cross-coupled, with the "output" signal of one serving as the "input" signal for the other.

Due to inherent minor differences in the characteristics of the transistors, one will conduct more heavily when *S1* is first pressed. As the collector current of *TR1* (for example) starts to increase, a positive-going signal is developed between its collector and emitter electrodes. At the lower end of the primary winding, this shows up as a negative-going signal.

The positive-going signal developed on the collector of the upper transistor is coupled through *C2* to the base of the lower transistor, reducing its collector current and further aiding in the development of a negative-going signal between its collector and emitter electrodes. This negative-going signal is coupled through *C1* back to the base of *TR1*, tending to increase collector current. And the cycle continues.

The signal developed by this type of oscillator is not a sine wave. It approaches a square wave in general form, and is very rich in harmonics, giving the output sound obtained from the trumpet a penetrating raucous quality comparable to that obtained with a conventional electromechanical horn.

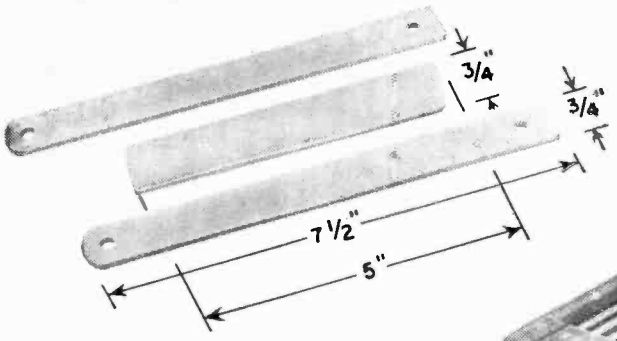
base for the horn, a small University "Cobra" paging trumpet.

The box separates into halves: the upper half is used for housing the electronic circuitry and for mounting the trumpet and carrying handle; the lower half holds the 6-volt battery (Burgess F4P1) which is secured with an aluminum bracket. Mount four rubber feet on the outside of the lower half of the case.

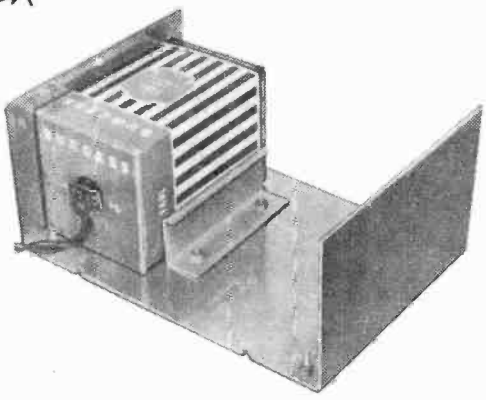
Two CBS-Hytron 2N255 power transistors are mounted on aluminum heat sinks measuring about 3" x 1⅝". The heat sinks are mounted on an aluminum angle bracket secured to one side of the upper half of the case. Fiber washers insulate them from each other and from their common mounting bracket. Mount a three-terminal tie-point strip on each of the heat sinks for connecting the transformer leads and other components.

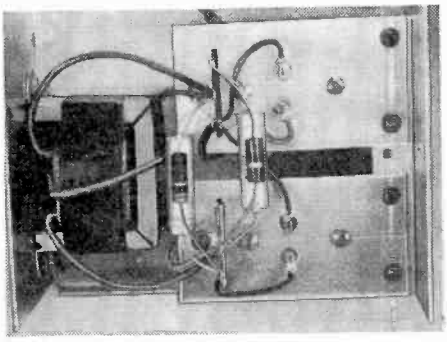
Secure the trumpet, output transformer and heat sink mounting brackets with standard machine screws, hex nuts, and lock washers. The "on-off" switch (*S1*) is a s.p.s.t. momentary push-button type mounted on the top half of the aluminum case. The carrying handle is made from two straps of aluminum, ⅛" thick by ¾" wide by 7½" long, and a ¾" by 5" wooden dowel rod.

Neither circuit layout nor lead dress is especially critical, but make sure to allow



Dimensions for the parts of the handle are given at left. Battery mounting clamp is made of a length of angle iron as shown below.

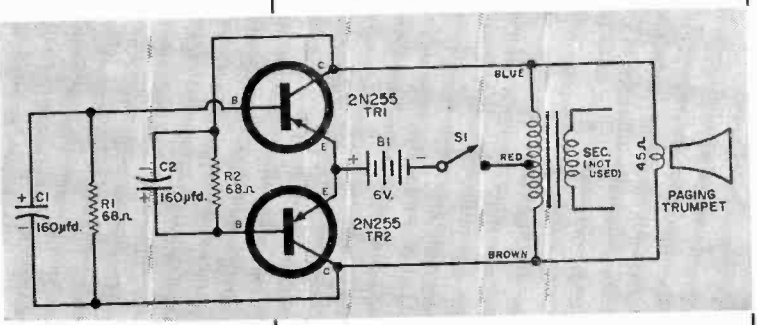




Placement of the heat sinks and transformer is shown in photo above. Note that the collectors of both transistors used in the Transihorn are connected internally to shell.

PARTS LIST

B1—6-volt battery (Burgess F4P1)
C1, C2—160-μfd., 15-volt electrolytic capacitor (Lafayette CF-127)
R1, R2—68-ohm, 2-watt resistor
S1—S.p.s.t. push-button switch, normally open



TR1, TR2—2N255 transistor (CBS-Hytron)
1—Transistor output transformer, 48 to 3.2 ohms, secondary winding not used (Argonne AR-503)
1—5" x 7" x 3" aluminum case
1—Cobra-type trumpet, 45-ohm voice coil (University CMIL-45)
Misc. rubber feet (4), 3-terminal tie points (2), sheet aluminum, wooden dowel, shoulder and flat fiber washers, battery plug, etc.

space for the battery when the box halves are fitted together.

When wiring, remember that the transistor's collector is internally connected to its metal shell. Thus, the collector connections are made to the heat sinks. Base and emitter connections are either soldered to the pins (if soldering is done quickly) or made with clips salvaged from a 7-pin tube socket. Note that the normal "secondary" leads of the transformer are *not* used. These can be taped to one side, but take care that the free ends do not short.

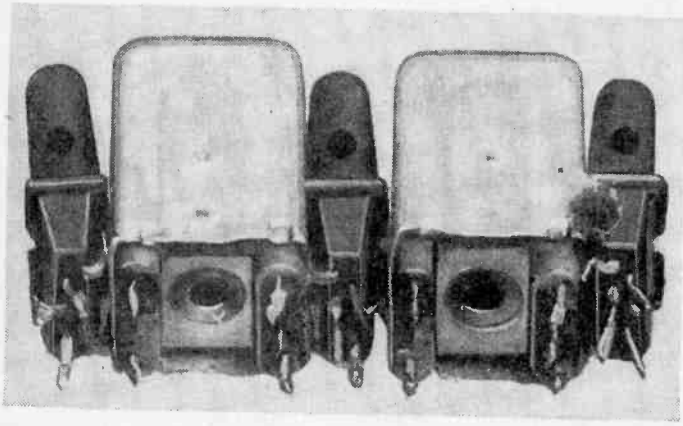
Once you've completed the wiring, carefully recheck all connections for possible errors and accidental shorts before you connect the battery. Pay particular attention to the polarity of capacitors *C1* and *C2*.

Modifications. There are several changes that can be made in construction.

(*Continued on page* 112)

MOUNTING TRANSISTOR RADIO COMPONENTS

Availability of miniature components to complement the transistor has made possible the construction of "real" pocket-size radios. With midget i.f. transformers, variable capacitors, etc., at hand, the major problem is to mount the components so as to utilize the space available for a particular circuit most efficiently.



The usual method of mounting i.f. transformers and transistor sockets (cutting matching holes in a chassis strip of thin material such as Bakelite or Micarta) leaves the components separated more than they need be. Space can be saved by eliminating the chassis strip entirely and letting the transistor sockets support themselves and the i.f. transformers.

The trick is to use 7-pin subminiature *tube* sockets for the transistors instead of the standard transistor type sockets. Since only three socket pins are required for the transistor leads, at least three other pins are available for interconnecting the sockets and the i.f. cans.

How this is done is shown in the photo. Pins 1 and 7 are bent to one side of the socket, pin 4 to the other. An aluminum flux such as Sal-Met makes it easy to solder the socket pins to the aluminum i.f. cans. Before soldering, however, it's best to remove the i.f. coil windings.

If more rigidity is desired, a reinforcing rod can be soldered to the cans. The width of the transistor determines the spacing to leave for each socket.

When the assembly is finished, working space will be limited but tweezers can be used to position the transistors and insert them in the sockets without difficulty.

—Wm. B. Rasmussen

SATIN-FINISHING ALUMINUM PARTS

You may have wondered how manufacturers achieve the satinized finishes on their aluminum chassis and panels. It's no real secret and they are rather easy to duplicate with chemicals obtainable from commercial chemical stores.

Clean the aluminum with paint thinner to allow proper etching. Dip it into a solution of warm sodium hydroxide or Oakite #160. The aluminum will start to bubble. After a few minutes, wash it in water, then dip it into a sodium dichromate solution. This last dipping will remove any black stain that might have appeared.

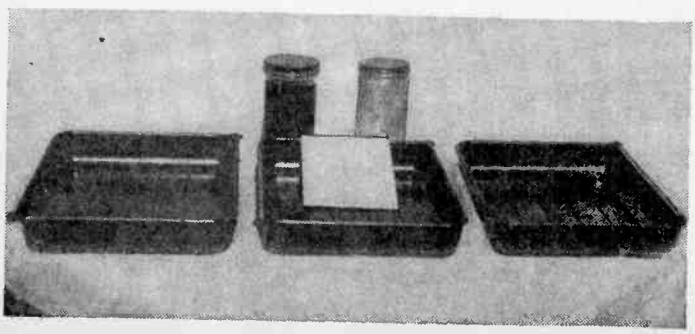
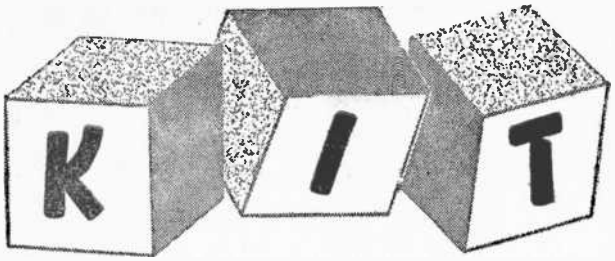


Photo developing trays can be utilized for dipping small plates or chassis sub-panels provided that the solutions are not left in the trays. The process should *only* be undertaken out in the open where there is plenty of ventilation to prevent the inhalation of the hydrogen gas fumes. Use tongs to move the aluminum around in the trays so that the caustic won't burn your skin.

These solutions are handy to have around for cleaning small parts, but they should be stored in a safe, dry place until they are needed.

—E. H. Marriner



BUILDER'S KORNER

STEREO has burst upon the high-fidelity scene with terrific impact. Manufacturers throughout the audio industry are rapidly converting their production to stereo phono pickups, amplifiers, preamps, speakers, tuners, etc. Steps are being taken to make the changeover as easy as possible financially for the present owner of a monophonic hi-fi setup.

Arkay's Model SA-25 integrated stereo-amplifier comprises a 20-watt "super-linear" amplifier with the Williamson circuit arrangement plus tone controls and *two* preamp-equalizing sections. The first preamp feeds the Williamson power amplifier; the second feeds a 6C4 tube wired as a cathode-follower output. The output from this second channel can be used to drive an additional basic amplifier and speaker system for stereo.

Putting It Together. As with a number of other manufacturers' kits, there is a possibility of confusion regarding the hardware nomenclature. *All* the electronic kit manufacturers would do well to illustrate their kit hardware, preferably with a "life-size" drawing.

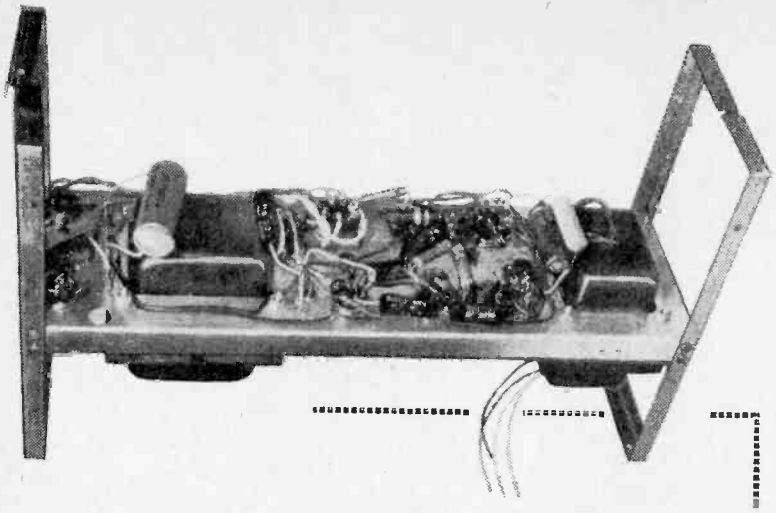
There were one or two minor discrepancies in the construction manual used by your reviewer which the manufacturer states have been eliminated in the later editions.

Arkay used a subassembly type of mechanical design for the basic and preamplifier sections. This type of construction cuts down on wiring time and eliminates a lot of unnecessary handling of the completed amplifier. The various subsections are shown in the photos. The power and output transformer can be seen mounted on the power amp subassembly.

One rough indication of the power-handling capacity of a basic amplifier is the physical size of its output transformer. The Arkay passes this test easily—its transformer is a husky job which should be able to push out the watts nicely.

Special Features. The numerous controls found on the Arkay front panel are not just window-dressing. They function well and are worthwhile additions to anyone's hi-fi rig.

There are two individual input selector-



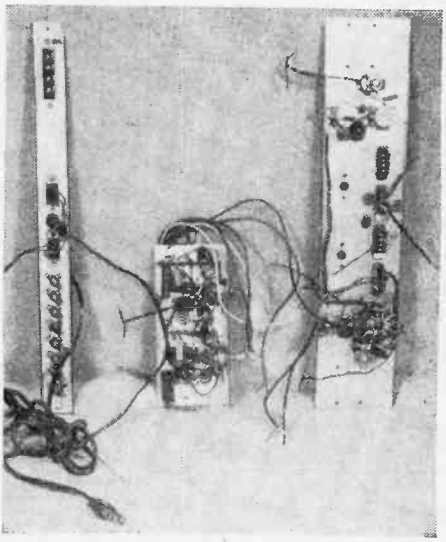
phono compensation switches. These select the program source—tuner, TV audio, tape head or magnetic phono. The tape head and magnetic phono inputs are both compensated to provide the correct playback characteristic.

Tone controls of the SA-25 are smooth in their action and provide ± 16-db variation on both bass and treble. The 4-position loudness control (which can be switched out) of the first channel is ganged to the volume control of the second preamp, thus enabling simultaneous gain control of both stereo channels.

Additional slide switches spotted about the front panel provide for two positions each of high cut (to eliminate scratch and other high-frequency noise) and low cut. The low-cut provision is particularly important in the new stereo setups because of the sensitivity of most stereo phono cartridges to turntable rumble.

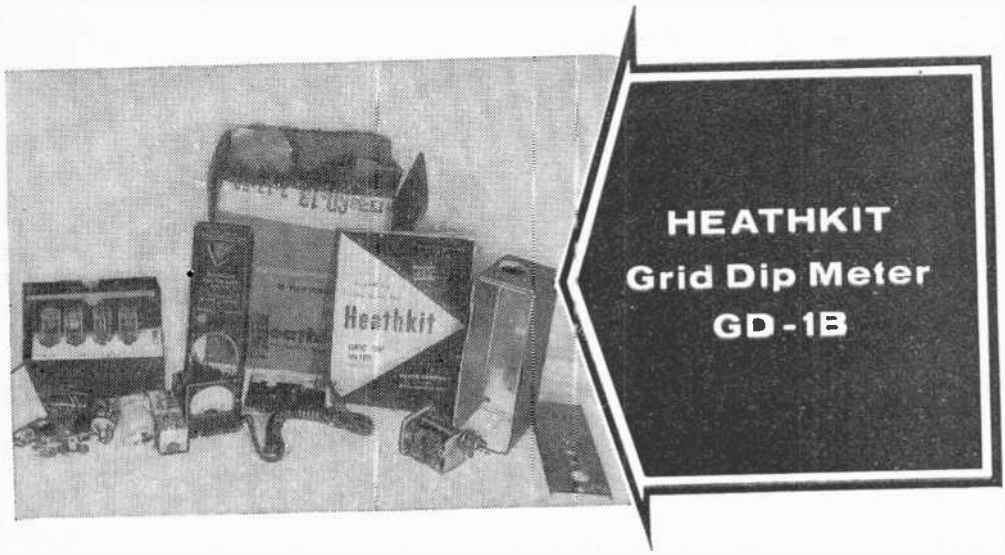
Comment. Encasing heat-producing elements in an attractive package is not easy. Arkay, however, has handled the problem well in the SA-25. The 6L6 output and rectifier tubes are placed at bottom and rear of the chassis. The case of the SA-25 slides over the assembled chassis and the rear grille work permits adequate ventilation without heating the case or front panel.

Provision of an on-off switch (and separate pilot lamp) for the stereo preamp channel enables the SA-25 to be used as an integrated hi-fi monophonic amplifier. This is an important consideration for those of you who do not wish to take the stereo plunge immediately.



The four subassemblies of the SA-25 are shown above. Largest section, at top of page, includes the complete basic amplifier and power supply. The three smaller assemblies, directly above, are bolted onto the square end brackets and then interwired. Completed unit slides into the cabinet provided.

THE "GRID DIPPER" is one of those multi-purpose instruments that one might find in a ham shack, experimenter's workshop, or even on the bench of a professional TV repairman. A check of the many uses for one of these electronic jack-of-all-trades will tell you why they are so popular. Heath's Model GD-1B is a *kit* grid dipper and it has many of the features and functions of more expensive models.



Basically, the grid dip meter is a variable r.f. oscillator which operates in the range from about 2 mc. to over 250 mc. (Additional coils can be obtained from the Heath Company, Benton Harbor, Mich., which will extend the frequency coverage.)

A microammeter is in the grid circuit of the oscillator tube. When the oscillator is coupled and tuned to a circuit resonant at the oscillator's frequency, energy is absorbed and the meter reading falls. It's this action that gives the grid-dip meter its name.

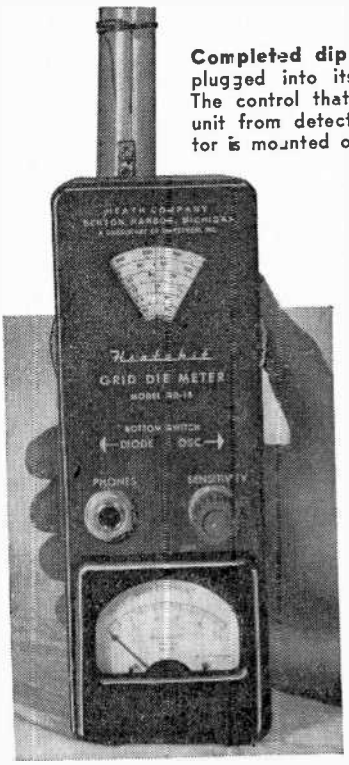
Putting It Together. As an old hand with Heathkits (having put together more than 20 over the past 10 years) this reviewer has, in general, the highest praise for Heath's construction manuals and components. Some minor difficulties were experienced with this little job, however.

For example, when installing the bottom plate components, it's a good idea to mount the tube socket bracket on the angle bracket previous to the installation of the latter.

If there are doubts as to the physical location of a particular tie lug or bracket, you can usually refer to a later pictorial view and clear up the question.

Special Features. In addition to its ability to check the resonance of circuits, the GDO will function as an r.f. oscillator

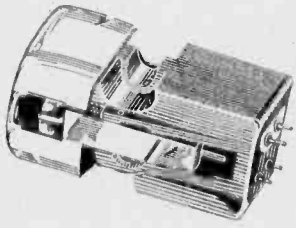
(*Continued on page* 115)



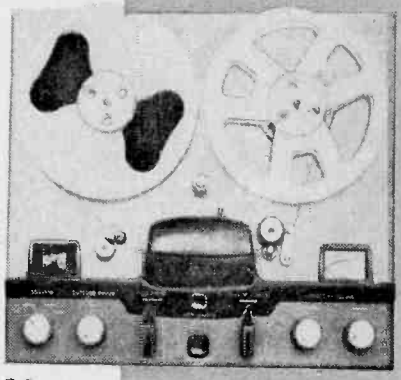
Completed dipper with coil plugged into its top socket. The control that switches the unit from detector to oscillator is mounted on back panel.

Hi-Fi Highlights

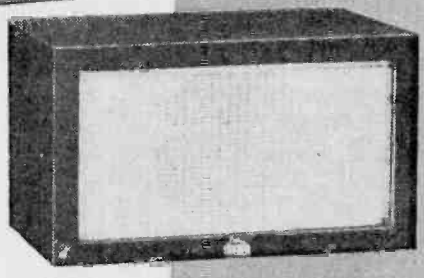
MANY READERS have been writing in to inquire about new and novel developments in high-fidelity equipment that they have heard about. To help supply such information quickly, POPULAR ELECTRONICS presents a roundup of the most interesting high-fidelity accessories crossing our desks in recent weeks. Each brief description is numbered and a box appears on page 111 along with additional items. Just circle the numbers in the box pertaining to the items that interest you and send the box in to the address given. You'll receive complete information on those items. —30—



20



21

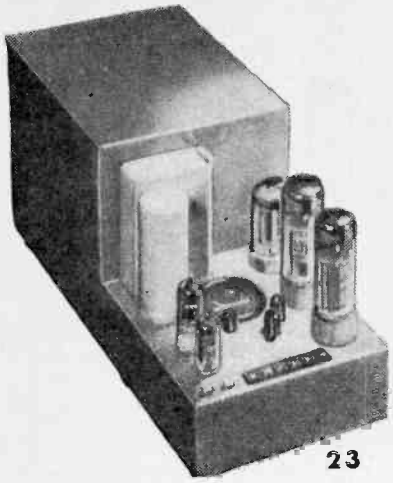


22

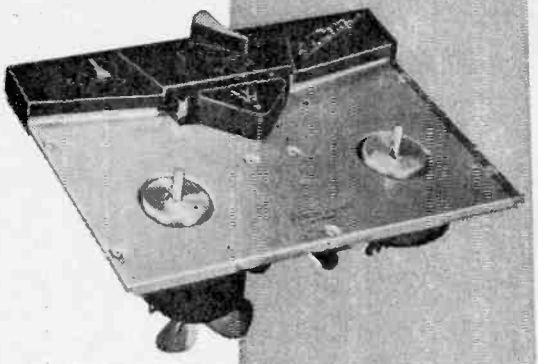
20 Variable reluctance stereo cartridge with 20 to 17,000 cps response features "floating armature" design, 0.7-mil diamond or 0.7-mil sapphire stylus. G.E.

21 Four-track stereo tape recorder offers 2- or 4-track stereo at flick of lever as well as automatic end-of-reel shut-off. Kit available for simple conversion of older "A" series recorders. Ampex Universal "A" (900 Series).

22 Stereo conversion system to provide second channel is comprised of 4-watt amplifier with two tone controls, speaker system, stereo ceramic cartridge to fit your record player. Walco.



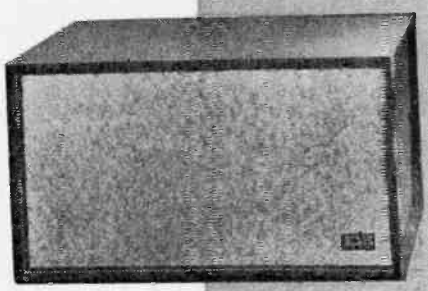
23



24

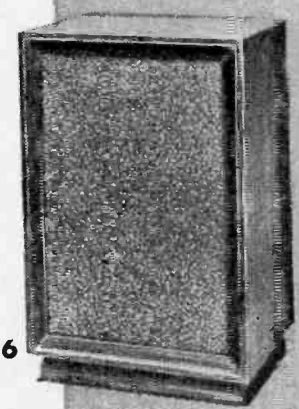
23 Using same basic design as larger model, this 30-watt power amplifier employs an "Ultra-Linear" circuit, terminal board construction, a meter indicator for tests and adjustments of bias setting. Marantz Model 5.

24 Stereo tape deck records and plays back stereo or monophonically. It has a two-knob control. Either channel may be erased independently. An on-off switch combined with speed control neutralizes drive when machine is off. Deluxe model has tape-out switch and program selection finder. Webster.



25

25 Two-speaker bookshelf system has response from 45 to 20,000 cps. It includes 12" acoustic suspension unit and cone-type direct radiator tweeter, LC crossover with provision for high-frequency adjustment. KLH Model 6.

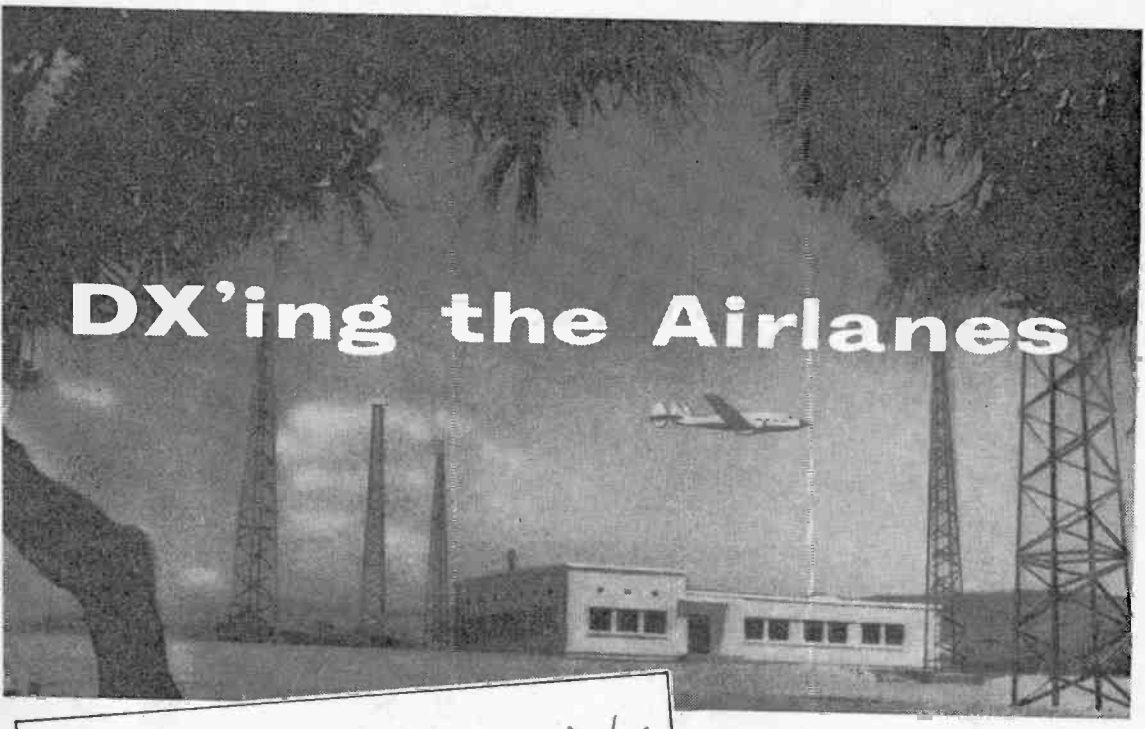


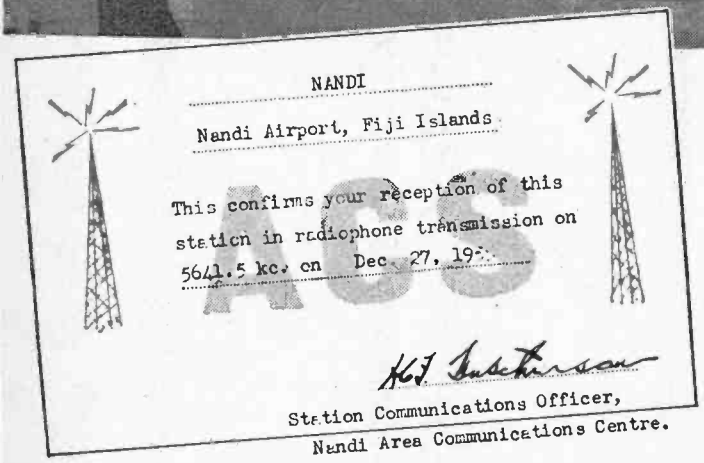
26

26 Enclosure has removable base to permit horizontal or vertical placement. Ducted port type, decorator styled in walnut, blonde, mahogany. Norelco FRS, in two models.

More hi-li items on page 111

DX'ing the Airlanes





By
ROGER LEGGE

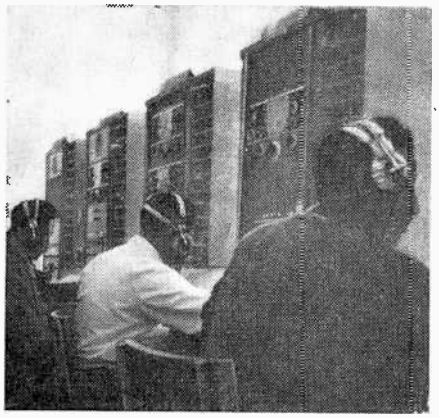
ALTHOUGH most short-wave listeners tune to the short-wave broadcast or amateur bands, there is another type of DX'ing which is growing in popularity—listening to the "air/ground" voice channels in the aeronautical bands.

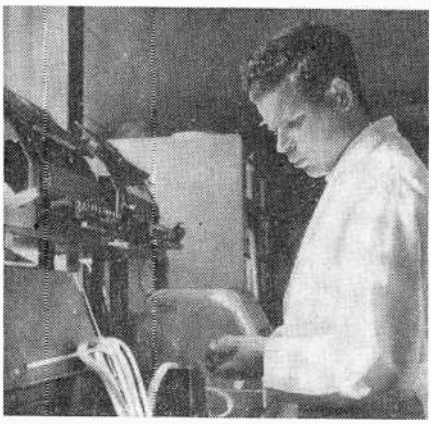
Airline and government stations operating in these bands are located at airports and check points throughout the world. They provide weather and other information. Airplanes in distant parts of the world can also be heard, advising stations along their route of position and ETA (estimated time of arrival).

Listeners can add many new countries to their logs on the aero bands, in countries that have no short-wave broadcasting stations . . . for example . . . in the Americas—Guadelupe, Martinique, Curacao, and the Cayman Islands . . . in Europe—Malta and Ireland . . . in the Pacific—Canton Island, Guam, Midway, Wake, and Norfolk Island.

The aeronautical bands are divided into "route" and "off-route" sections. "Route" bands are used by planes on the world civil air routes and airport stations on these routes which contact planes. "Off-route"

ROUTE	FREQUENCIES (kc.)	STATIONS
North Atlantic	5626, 5641, 8862, 8913, 13,264	Bermuda ("Kindley"), Gander, Goose Bay, Lisbon, London, Moncton, New York, Reykjavik, Santa Maria (Azores), Shannon (Ireland)
West Europe	4689, 6582, 8871	Amsterdam, Copenhagen, Frankfurt, London, Vienna
South Europe, North Africa	3467, 5551, 8930	Algiers, Barcelona, Casablanca, Geneva, Istanbul, Lisbon, Madrid, Paris, Rome, Tunis
Mediterranean	2854, 5589	Ankara, Athens, Beirut, Cairo, Damascus, Istanbul, Malta, Rome
South Atlantic	6612, 8879, 13,274	Dakar, Las Palmas ("Canarias"), Montevideo, Recife, Rio de Janeiro, Sal (Cape Verde Islands)
West Africa	5521, 8820, 13,304	Accra, Brazzaville, Casablanca, Dakar, Kano (Nigeria), Las Palmas, Leopoldville, Roberts (Liberia), Sal (Cape Verde Islands)
East Africa	5506, 8956, 13,335	Addis Ababa, Aden, Asmara, Hargeisa, Johannesburg, Kampala, Khartoum, Nairobi
Middle East	5604, 8845, 13,334	Ankara, Baghdad, Bahrein, Beirut, Bombay, Cairo, Damascus, Dhahran, Karachi, Teheran
Far East	5611, 8871, 13,284	Bangkok, Brisbane, Calcutta, Darwin, Djakarta, Manila, Perth, Rangoon, Saigon, Singapore, Sydney
West Pacific	5506, 8862, 13,354	Guam, Hong Kong, Midway, Manila, Okinawa, Taipei, Tokyo, Wake
South Pacific	5641, 8845, 13,344	Auckland, Brisbane, Canton Island, Honolulu, Nandi (Fiji Islands), Sydney
North Pacific	5521, 8939, 13,274	Anchorage, Cold Bay, Shemya, Tokyo, Vancouver
Central Caribbean	6537, 8837, 13,344	Barranquilla, Camaguey, Ciudad Trujillo, Curacao, Grand Cayman, Havana ("Boyeros"), Kingston, Maracaibo, Miami, Port-au-Prince
East Caribbean	5566, 8871, 13,344	Bermuda ("Kindley"), Havana, Kingston, Miami, Nassau, Port-of-Spain ("Piarco"), San Juan
Southeast Caribbean	5499, 8837, 13,344	Antigua, Barbados ("Seawell"), Caracas ("Maiquetia"), Granada, Guadeloupe, Martinique, Port-of-Spain, San Juan, St. Kitts, St. Lucia
Central America	5619, 10,021, 13,294	Belize, Guatemala City, Managua, Merida, Mexico City, Panama, San Jose, San Salvador, Tampico, Tegucigalpa
Western South America	6664, 8820, 13,314	Asuncion, Buenos Aires, Cali, Esmeraldas (Ecuador), Guayaquil, La Paz, Lima, Panama, Santiago
Eastern South America	5581, 8845, 13,344	Belem, Caracas, Cayenne, Georgetown ("Atkinson"), Montevideo, Paramaribo, Port-of-Spain, Rio de Janeiro, Sao Paulo
Military Air Transport Service	4724, 6730, 11,228, 13,215	
Atlantic Area		Croughton (England), Goose Bay (Labrador), Harmon (Newfoundland), Keflavik (Iceland), Kindley, (Bermuda), Lajes (Azores), Ramey (Puerto Rico), Sidi Silmane (Morocco), Thule (Greenland), Wheelus (Libya)
Pacific Area		Guam, Hickam (Hawaii), Johnston Island, Kwajalein, Midway, Okinawa, Tokyo





Radio communications room above is in Lima, Peru, and is set up in accordance with the standards of the International Civil Aviation Organization, an agency of the United Nations. At right is a technician inside the Gufunes Receiving Station at Reykjavik, Iceland.

Typical of Pan American Airlines radio rooms all over the globe is the one shown above, where a communicator keeps contact with airplanes en route.

bands are employed for off-route operations.

"Route" bands, used more extensively than the "off-route" frequencies, are: 2850-3025, 3400-3500, 4650-4700, 5480-5680, 6525-6685, 8815-8965, 10,005-10,100, 11,275-11,400, 13,260-13,360 and 17,900-17,970 kc. Aircraft and ground stations on each of the international air routes (for example, the South Pacific route) are assigned a "family" of frequencies, usually one each in the 2-, 5-, 8-, and 13-mc. bands. The 8-mc. channels provide the most productive DX'ing at present, followed by 5 mc. and 13 mc.

Assignments by frequency and route for the international airways are shown in the tables on pages 85 and 113. Some stations in these groups do not operate on 13 mc., but most of them use the 5- or 6-mc. and 8-mc. channels.

Since most aero stations operate with relatively low power (usually 0.5 to 2 kw.), the best time to DX is when there is darkness on all or most of the path between the transmitter and your receiving location. Stations in Europe and Africa are heard best during the late afternoon and evening hours in the United States, stations in the Americas during the evening and dawn periods, and those in the Pacific and Far East areas in the early morning and after sunrise, up to about 8 a.m., local U. S. time.

Airports and aircraft on U. S. domestic air routes will also be heard, but these generally operate on lower frequencies, usually 5 or 8 mc. during the day and 2 or 5 mc. at night.

Ground stations generally identify themselves by the city or island name, but some use the airport name, such as Maiquetia (Caracas), Boyeros (Havana), and Piarco (Trinidad). Aircraft are generally identified by the company name or initials, followed by the flight number, for example, KLM 781. Although most contacts are in English, occasionally French, Spanish or Portuguese can be heard.

The best way to log aero stations is to

(*Continued on page* 112)

Among the Novice Hams

By HERB S. BRIER, W9EGQ

THIS MONTH we will talk about the relative merits of plate and screen modulation in an amateur transmitter. As all Novices are authorized to use 'phone in the 2-meter band, this information is important. To supplement the discussion, we will also review some equipment—the WRL Globe Chief 90-A transmitter, SM-90 screen modulator and UM-1 plate modulator.

How a Modulator Works. To decide intelligently which type of modulator will best suit your needs requires some information on how a modulator works. In an amplitude-modulated transmitter, a steady *carrier wave* is emitted by the transmitter when no modulation is present. But when a sound strikes its microphone, the sound is converted into a corresponding audio signal, which is amplified and applied to the r.f. power amplifier tube being modulated.

Modulation can be applied to almost any element of the r.f. amplifier tube, usually to either the screen grid or the plate. It alternately increases and decreases the d.c. voltage applied to the element, and thereby varies the *amplitude* (strength) of the signal emitted by the transmitter. At the receiver, the modulation is removed from the received signal and converted back into sound through the loudspeaker.

To obtain 100% modulation, the peak value of the modulating signal must equal the d.c. voltage on the element to which the modulation is applied, so that the voltage swings from zero to twice its unmodulated value during modulation.

Plate Modulation. Assume that we wish to plate-modulate a transmitter running 500 volts at 100-ma. (50-watt) input to its final stage. At a normal plate-circuit effi-

Dave Formet, KN8HZN, has worked 44 states and 14 foreign countries in the Novice bands. See News and Views.

Bob Schafer, K3BWI, [below], operates out of Butler, Pa., on 10- and 15-meter phone and 21,105-mc. c.w. since he received his General Class license.

HELP US OBTAIN OUR HAM LICENSES

Prospective amateurs requesting help and encouragement in obtaining their licenses are listed here. To have your name listed, write to Herb S. Brier, W9EGQ, c/o POPULAR ELECTRONICS, One Park Avenue, New York 16, N. Y. Please print your name and address clearly. Names are grouped geographically by amateur call areas.

K1/W1 CALL AREA

Melvin E. Adams (14), 100 Cedarcliff Rd., E. Braintree 84, Mass. (Code and theory)

William C. Fredericks (15), 848 Broadway, Everett, Mass. (Code and theory)

Robert McNerney, 15 Bant Dr., Pawtucket, R. I. Phone: PA 3-8076. (General code and theory)

K2/W2 CALL AREA

Byron Wels, 6 Timber Lane, Levittown, N. Y. (Code and theory)

John Westergoard, Jr., R.F.D. No. 2, Pound Ridge, N. Y. Phone: PO 4-5888. (Code and theory)

Thomas A. Stouber, 1661 Radcliff Ave., Bronx 62, N. Y. (Code and theory)

Steven Rabinowitz, 2710 Webb Ave., New York 68, N. Y. (Code, theory and selection of equipment)

Stuart Wechter, 84-60 251st St., Bellerose 26, N. Y. Phone: FI 7-8321. (General code and theory)

K3/W3 CALL AREA

Ray Caffrey, P. O. Box 612, Wilkes-Barre, Pa. (Code, theory and selection of equipment)

Lawrence Wolken, 7021 Penn Ave., Pittsburgh 8, Pa. Phone: CH 2-3456. (Code, theory and selection of equipment)

K4/W4 CALL AREA

Virginia Mundy, Greenville, Ky. (Code and theory)

Andy J. Peppers, East Mill St., Boaz, Ala. (Code and theory)

William Mason, 3070 N.W. 186 TR., Opa Locka, Fla. (General code and theory)

Billy Holder, Route 2, Central, S. C. (Code)

Julian A. Freeman, Jr., 3 Accabee Rd., Charleston Heights, S. C. (Code and theory)

Jimmy Cox, 2405 Hill Ave., Gadsden, Ala. (Code)

Bobby Wyatt, 309 W. Mais St., Huntingdon, Tenn. (Code and selection of equipment)

K5/W5 CALL AREA

Bob Haney, Jr., 305 S. Mary, Crane, Texas. Phone: 3889. (Code and theory)

Jerry Lunday, 2105 San Pablo Dr., Dallas 27, Texas. Phone: EV 1-5655. (Code and regulations)

Bruce Green (13), 4201 Titanic, El Paso, Texas. Phone: SK 5-5107. (Code, theory and selection of equipment)

Thomas Green (39), 4201 Titanic, El Paso, Texas. Phone: SK 5-5107. (Code, theory and selection of equipment)

K6/W6 CALL AREA

Ron Weaver, 11491 Fir St., Lynwood, Calif. Phone: NE 1-3829. (Code, theory, regulations and selection of equipment)

Calvin Arbuthnott (22), 325 W. 73rd St., Los Angeles 3, Calif. Phone: PL 8-8244. (Code and theory).

Charles Guyson, Jr. (14), 5022 Loleta Ave., Eagle Rock 41, Calif. (Code, theory and regulations)

Paul Morris, 6423½ Miramonte Blvd., Los Angeles 1, Calif. (Theory and selection of equipment)

Wilfred E. Melanson, 210 74 26, U. S. Nav-RadFac (T) Bagobantay, APO 928, San Francisco, Calif. (Regulations and selection of equipment)

Bill Leslie, 2044 Fixlini St., San Luis Obispo, Calif. (Code and theory)

Phil D. Geer, 3517½ W. 108th St., Inglewood 2, Calif. Phone: OR 1-7348. (Code)

Lyle T. Wolf, 5519½ Radford, N. Hollywood, Calif. Phone: PO 1-0401. (Code and theory)

Mike Lesniak, 368 Marlow Dr., Oakland 5, Calif. Phone: NE 8-9660. (Code and theory)

Jim Stewart (15), 131 Florence St., Sunnyvale, Calif. Phone: RE 6-4069. (Code)

Mike Gilbertson, 9232 E. Sparklett St., Temple City, Calif. (Code, theory, regulations and selection of equipment)

Sam Faber (14), 11608 Wish Ave., Granada Hills, Calif. Phone: EM 3-1418. (Code, theory and selection of equipment)

K7/W7 CALL AREA

Douglas Cocke (16), 225 Linden St., Reno, Nev. Phone: FA 2-0947. (Code and theory)

David Hadley, 2729 N. 600 E., North Ogden, Utah. Phone: EX 2-0369. (General theory)

Rud L. Warner, 3447 So. 3450 W., Salt Lake City, Utah. Phone: AM 2-0170. (Code and theory)

Dennis L. Radke, 1040 Promontory Ave., Oregon City, Ore. (General theory and selection of equipment)

Brant Foote, Box 722, Moab, Utah. (Theory and selection of equipment)

Jeff Snyder, E. 2115 Rockwell, Spokane 27, Wash. (Code and theory)

Mike McIver, E. 2115 Rockwell, Spokane 27, Wash. (Code and theory)

K8/W8 CALL AREA

Robert Kozora, 515 Jefferson Ave., Cleveland 13, Ohio. Phone: PR 1-0097. (Code and theory)

Bud Webber, 2239 Lorain Dr., Lorain, Ohio. (Code, theory and selection of equipment)

Robert Krohn, 1263 Manss Ave., Cincinnati 5, Ohio. Phone: GR 1-2174. (Code)

Fred Crutch, 22001 Fairmont, Cleveland 18, Ohio. Phone: YE 2-0433. (Code and theory)

Bill Ertell, 15810 Delrey Ave., Cleveland 28, Ohio. (Code, theory and selection of equipment)

David Scott, 759 Coolidge St., Clawson, Mich. (Code and theory)

Mike Eyster, Jr., 1834 Nightingale, Dearborn 7, Mich. Phone: LO: 2-2123. (Code and theory)

Jim Avery (15), 767 Flowerdale, Ferndale 20, Mich. Phone: LI 1-5294. (Code and theory)

Ralph E. Matheny, Jr., Box 211, New Matamoros, Ohio. (Code and theory)

Michael Brill (13), 18276 Colgate, Dearborn, Mich. Phone: LO 2-4992. (Code and theory)

Roger Reckling (13), 141 N. Franklin, Dearborn, Mich. Phone: LO 1-6380. (Code and theory)

Dale Messerschmidt, 3243 Henry St., Muskegon, Mich. Phone: 312322. (Code)

Ronald MacDonald, 1601 N. Madison, Saginaw, Mich. (Code and theory)

Ken Chmiel, 2085 Bock Rd., Saginaw, Mich. Phone: SW 2-1142. (Code and theory)

Thomas E. Rast, 16 Hillcrest Dr., Charleston 2, W. Va. (Code and theory)

Tom C. Sawyer, 2866 Mountview Rd., Upper Arlington, Columbus 21, Ohio. Phone: HU 8-7345. (Code and theory)

John Bachman (15), 36 Chantal Ave., Wheeling, W. Va. Phone: WO 487-R. (Code, theory and regulations)

Michel Hill (15), 149 S. Charles St., Saginaw, Mich. Phone: PL 7-0639. (Code)

K9/W9 CALL AREA

Jay Pettegrew, Bradford, Ill. Phone: BR 4174. (Code, theory and selection of equipment)

Roger Trace, 706 S. Rush St., South Bend 18, Ind. Phone: AT 7-0614. (Code)
Ron Collins, 10419 S. 75 Ave., Oak Lawn, Ill. (Code and theory)
Richard Holmes (19), 3919 Madison Ave., Brookfield, Ill. (Code and theory)
Michael Strittmater (14), 2311 Winnebago, La Crosse, Wis. Phone: 4-2766. (Code and theory)
Jim Vingis, P. O. Box 241, Edwardsport, Ind. (Code and theory)
Dan Gagnon, 134 Grove St., Mundelein, Ill. Phone: MU 6-7235. (Code and theory)
Raymond Mathisen, 10950 Albany, Chicago 43, Ill. (Code and theory)
William Korte, 1028 Langdon, Alton, Ill. Phone: 2-2452. (Code and theory)
Jon Peters (19), 811 W. Oakdale Ave., Chicago 14, Ill. (Code, theory and selection of equipment)
David Jeziorski, 1232 Portage Ave., South Bend, Ind. Phone: CE 2-7840. (Code and theory)
Terry Martin (15), R No. 1, Box 581, West Chicago, Ill. Phone: SA 4087-M2. (Code, theory and selection of equipment)
Gerald Kuick (13), 1618 Hawthorne Ave., Two Rivers, Wis. (Code, theory and selection of equipment)
Rollin R. Rheinheimer, RR 1, Middlebury, Ind. (Code, theory and regulations)
Tom Kennedy (12), 1911 S. 9th Ave., Maywood, Ill. Phone: FI 3-1797. (Theory and regulations)
Edward W. Simpson, 18W040 Roosevelt Rd., Villa Park, Ill. (General code and theory)
Robert Wasitis, 505 N. 84, East St. Louis, Ill. (Code, theory, regulations and selection of equipment)
Robert Poole, 921 E. 62nd St., Chicago 37, Ill. (Code)
Wayne Olmsted, 1018 S. 5th, Springfield, Ill. (Code, theory, regulations and selection of equipment)
Buddy Carter (14), Box 117, Kewanna, Ind. (Code and theory)

KØ/WØ CALL AREA

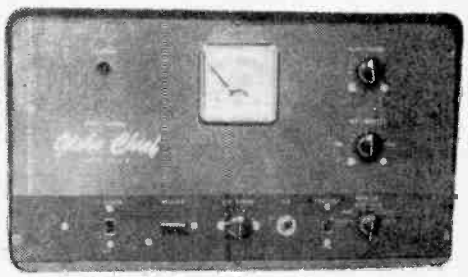
Howard Banks, Route 1, East Prairie, Mo. (Code and theory)
James D. McMechan, 216 Stanton Ave., Ames, Iowa. (Code)
Alonzo Harlow, 3725 S. Compton Ave., St. Louis 18, Mo. Phone: PR 2-4093. (Code and theory)
Gary Paster, 716 Cambridge, St. Louis 5, Mo. Phone: PA 7-2942. (Code and theory)
Bob Holen (15), Box 25, Forman, N. D. Phone: 5191. (Code and theory)
George Schueller, 176 N. Prince, Littleton, Colo. Phone: PY 4-4187. (Code and theory)
Jerry McCoy, 541 Myrtle, Kansas City 24, Mo. Phone: CH 1-4638. (Theory and selection of equipment)
Steve Grossman, 1228 Coffelt Ave., Bettendorf, Iowa. Phone: 5-3596. (Code)
Marvin L. Howe, 3031 S. Fork Ct., Wichita, Kan. Phone: MO 3-9367. (Code and theory)
Gare Karemer, 2 Meadow Acres, Ladue 17, Mo. (Code)

VE AND OTHERS

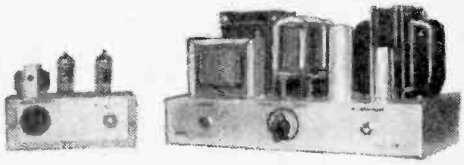
D. H. B. Cowley, 605 Albert Ave., Saskatoon, Sask., Canada. (Code, theory, regulations and selection of equipment)
Brian Hofstetter, 139 Hidden Valley Rd., R. R. #2, Kitchener, Ontario, Canada. Phone: SH 3-4682. (Code, theory and selection of equipment)
Nelson Lawson, 61 Beverley Ave., Mount Royal, Quebec, Canada. (Code)
Harry Brant (15), P.O. Box 237, Fonthill, Ontario, Canada. (Code and theory)
Les Beattie, Box 17, Pibroch, Alberta, Canada. (Theory and regulations)
Gary Galt, 602 Milverton Blvd., Toronto 8, Ontario, Canada. (Code, theory and selection of equipment)

ciency of 70%, its output is 35 watts. From Ohm's law, 500 volts at 100 ma. is equivalent to 5000 ohms; therefore, we must select taps on the modulation transformer to match a 5000-ohm load.

As we talk into the microphone and adjust the modulator gain control for 100% modulation, the instantaneous plate *voltage* will double on positive modulation peaks and decrease to zero on negative modulation peaks. At the same time, the plate current will swing over the same range of values; consequently, the *power* input to the modulated amplifier will swing from zero to four times its unmodulated value during modulation. And, if the modulated



WRL transmitter, screen modulator and plate modulator discussed on page 119.



stage is properly adjusted, the output will vary in exactly the same manner.

It requires power to swing the power input to the modulated stage in this manner. Assuming sine-wave modulation, this added power is half the d.c. input to the modulated stage, or 25 watts to plate-modulate a 50-watt transmitter. It is furnished by the modulator and appears as *sidebands* on the signal emitted from the transmitter. These sidebands are the intelligence-bearing part of the signal.

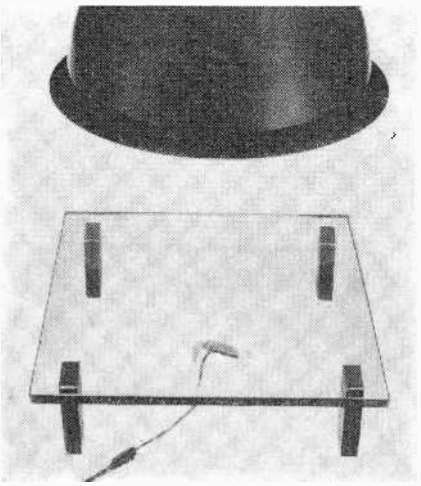
Notice that, although the instantaneous plate current of the modulated amplifier varies with modulation, it varies equally above and below its unmodulated value. Consequently, the average plate current, as shown on the plate milliammeter, does *not* vary during modulation.

Screen-Grid Modulation. If we modulate the d.c. input to the screen grid of the

(*Continued on page* 119)

PROTECT YOUR "SUN BATTERIES"

Due to occasional cloudiness or lack of time during the daylight hours, many experimenters must confine much of their "sun battery" experimenting to evenings.



Both 100-watt and 200-watt bulbs are commonly used as sun substitutes. If they are placed too close to the "sun batteries," however, the cells will be subject to heat in excess of the manufacturer's limit.

A sheet of ¼"-thick heat-absorbing glass, placed between the lamp and the sun batteries, substantially reduces the heat and also allows the lamp to be placed closer to the cells for increased efficiency. Heat-absorbing glass is sold in most glass shops for about 50 cents for an 8"x8"x¼" sheet.

To test the effectiveness of such glass, I placed a 100-watt bulb in an efficient reflector 6" above a thermometer lying flat on my bench. The thermometer reached a high of 142° F without the glass. When an 8"x8"x¼" sheet was placed between the lamp and the thermometer, the temperature dropped to a low of 98°, then slowly rose a few degrees as the sheet of glass became warm. —*Art Trauffer*

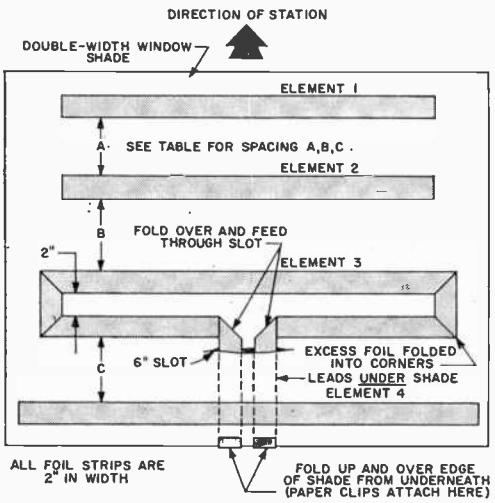
UNDER-THE-RUG V.H.F. ANTENNA

If an outdoor TV antenna installation is not feasible in your location, chances are you can still enjoy first-class reception with a high-gain, under-the-rug foil antenna. This is a wide-band folded dipole with two directors and one reflector to eliminate ghost images.

The array has a power gain of 5.0 compared to the dipole alone, and a front-to-back reception ratio of 100/1 to 1000/1 at the frequency to which it is tuned.

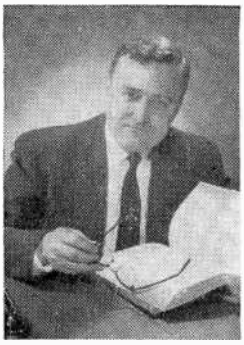
All elements are cut from heavy-duty aluminum wrapping foil, and cemented to an old double-width window shade with metal-to-wood cement. Connection to the leads is made with wire paper clips previously soldered to a suitable length of 300-ohm flat TV lead-in wire.

The assembly should be carefully oriented for best reception on the bare floor, then the rug rolled over it. If a rug pad is used, place the antenna *under* the pad. If you expect to receive signals from widely separated directions, two such antenna assemblies may be employed.—*W. McCormick*



ELEMENT DIMENSIONS AND SPACING

Channel Number	Director Length (Elements 1, 2)	Director Spacing (A and B)	Dipole Length (Element 3)	Reflector Length (Element 4)	Reflector Spacing (C)
2, 3, 4	7'4¼"	1'7¼"	7'7¾"	8' ⅜"	2'3¾"
5, 6	5'4⅞"	1'2⅛"	5'7½"	5'10⅝"	1'9¼"
7, 8, 9, 10	2'4¾"	6¼"	2'9¾"	2' 7½"	9½"
11, 12, 13	2'2¼"	5¾"	2'2¾"	2' 4¾"	8⅝"



CARL E. SMITH,
E. E., President

Interested In Electronics - TV - Radio

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
- Successful Electronic Training

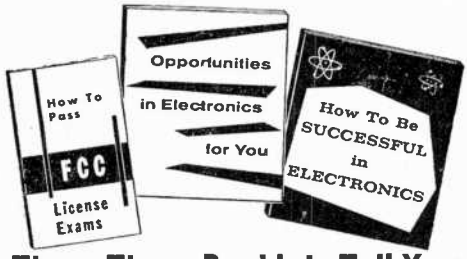
I can train you to pass the Valuable FCC exam in a minimum of time if you have any practical experience and a fair knowledge of mathematics.

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.

Get Your FCC Commercial License— or your money back

Your Guarantee

The Master Course in Electronics will provide you with the mental tools of the electronics technician and prepare you for a First Class FCC License (Commercial) with a radar endorsement. When you successfully complete the Master Course, if you fail to pass the FCC examination, you will receive a full refund of all tuition payments.

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

Desk PE-41, 4900 Euclid Ave., Cleveland 3, Ohio

Accredited by the National Home Study Council

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.....

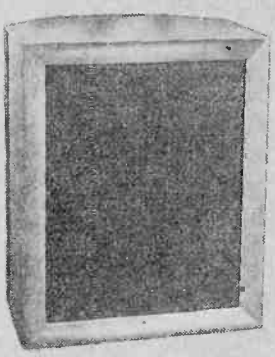
PE-41

build your own HEATHKIT *for fun!*

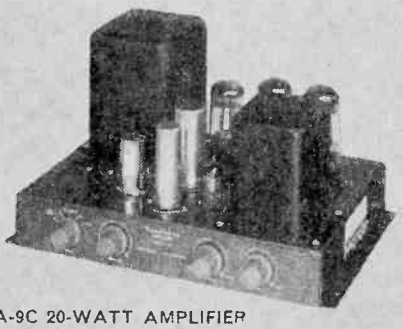
Don't let a lack of experience keep you from enjoying the fun and savings of "Do-it-yourself" kit construction. The easy-to-follow diagrams that come with every Heathkit insure your success. Let our experience be your teacher—and you'll save one-half or more over the price of "built-up" equipment of equal quality.

HEATH COMPANY A subsidiary of Daystrom, Inc. BENTON HARBOR 10, MICH.

"BASIC" SPEAKER SYSTEM



RANGE EXTENDER



A-9C 20-WATT AMPLIFIER

HEATHKIT "BASIC RANGE" HIGH FIDELITY SPEAKER SYSTEM KIT

This amazing speaker system can fulfill your present needs and still provide for future expansion. Fine hi-fi performance the result of using high quality speakers in an enclosure especially designed for them. Features two Jensen speakers to cover 50 to 12,000 CPS within ± 5 db. Power rating is 25 watts, and impedance is 16 ohms. Enclosure constructed of veneer-surfaced plywood, ½" thick, and measures 11¼" H x 23" W x 11¾" D. Precut and predrilled for quick assembly.

Model SS-2
$39.95

Shpg. Wt. 26 lbs.

HEATHKIT RANGE EXTENDING HIGH FIDELITY SPEAKER SYSTEM KIT

Designed especially for use with SS-2 "Basic" system. Contains 15" woofer and compression-type super tweeter. Extends basic unit to 35—16,000 CPS, ± 5 db. Impedance 16 ohms. Measures 29" H x 23" W x 17½" D, and is constructed of ¾" veneer-surfaced plywood.

Model SS-1B
$99.95

Shpg. Wt. 80 lbs.

HEATHKIT A-9C HIGH FIDELITY AMPLIFIER KIT

This model incorporates its own power supply and preamplifier. Plenty of power with full 20 watt rating. Four separate inputs, selected by panel-mounted switch, and separate bass and treble controls. Ideal for home or PA applications. Output transformer tapped at 4, 8, 16 or 500 ohms. Response within ± 1 db from 20 to 20,000 CPS.

Model A-9C
$35.50

Shpg. Wt. 23 lbs.

HEATHKIT HIGH FIDELITY FM TUNER KIT

Now you can have full-fidelity FM performance from 88 to 108 mc at reasonable cost. Features temperature-compensated oscillator—built in power supply, and beautiful cabinet. Components prealigned at factory!

Model FM-3A
$25.95
(with cabinet)

Shpg. Wt. 8 lbs.

HEATHKIT BROADBAND AM TUNER KIT

Tunes standard AM band from 550 to 1600 kc with fine sensitivity and broadband characteristics. Features include built-in power supply and low-distortion detector. All RF circuits prealigned for simplified construction.

Model BC-1A
$25.95
(with cabinet)

Shpg. Wt. 9 lbs.

HEATHKIT "MASTER CONTROL" HI-FI PREAMPLIFIER KIT

Provides extra amplification, selection of inputs, volume and tone controls, and turnover and rolloff controls, for Williamson-type amplifiers. Beautiful satin-gold enamel cabinet. Derives operating power from amplifier.

Model WA-P2
$19.75
(with cabinet)

Shpg. Wt. 7 lbs.

HEATHKIT 25-WATT HIGH FIDELITY AMPLIFIER KIT

Outstanding 25-watt Williamson-type amplifier employs KT66 tubes and Peerless output transformer, tapped at 4, 8, and 16 ohms. A fine amplifier for the "deluxe" system. WA-P2 preamplifier required for operation. Express only.

Model W-5M
$59.75

Shpg. Wt. 31 lbs.

HEATHKIT

Choose your own "Do-it-yourself" project from the world's largest kit manufacturer

HEATH COMPANY

A subsidiary of Daystrom, Inc.

BENTON HARBOR 10, MICHIGAN

Now you can have radio wherever you go — with the portable that plays anywhere!

Note: Prices are with cabinet less batteries.

HEATHKIT MODEL XR-1P TRANSISTOR PORTABLE RADIO KIT

This easy to build transistor radio is designed for lifetime operation. Features 6 name-brand (Texas Instrument) transistors for extra good sensitivity and selectivity. A 4" x 6" speaker for "big set" tone, built-in rod-type antenna, and uses 6 standard size "D" flashlight cells for extremely long battery life (between 500 and 1,000 hours). Cabinet is two-tone blue molded plastic with pull-out carrying handle. Measures 9" L. x 7" H. x 3¾" D. Transformers are prealigned eliminating special alignment equipment. Shpg. Wt. 6 lbs.

MODEL XR-1L: Identical to XR-1P except in leather case. Carrying strap included. Shpg. Wt. 7 lbs.

HEATHKIT BROADCAST BAND RADIO KIT

Covers 550 to 1600 kc with good sensitivity and selectivity. Has 5½" PM speaker for good tone quality. Features transformer power supply and built-in antenna. Signal generator recommended for alignment. Cabinet, as shown, available separately. Shpg. Wt. 10 lbs.

Model BR-2
$18.95
(less cabinet)

HEATHKIT CRYSTAL RADIO KIT

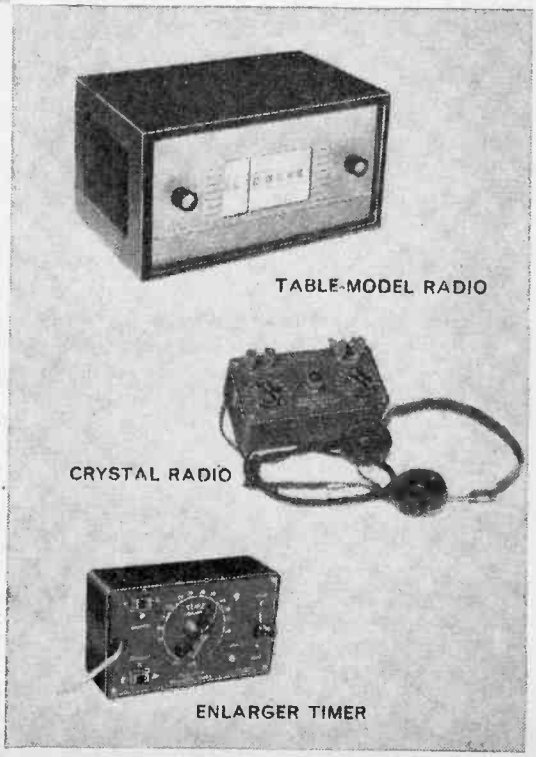
Features a sealed germanium diode to eliminate critical "cats whisker" adjustment. Employs two tuning condensers for good selectivity, and covers the broadcast band from 540 to 1600 kc. Requires no external power. Kit price includes headphones. Shpg. Wt. 3 lbs.

Model CR-1
$7.95

HEATHKIT ENLARGER TIMER KIT

The dial of this handy timer covers 0 to one minute calibrated in five-second gradations, so that the timing cycle of a photographic enlarger can be electronically controlled. Built-in relay handles up to 350 watts, and enlarger merely plugs into receptacle of front panel. Also provision for plugging in safe-light. An easy-to-build device that makes a fine addition to any dark room. Shpg. Wt 3 lbs.

Model ET-1
$11.50



HEATHKIT FUEL VAPOR DETECTOR KIT

The FD-1 is a safety device to detect fuel vapor in the engine compartment or other sections of your boat. The detector unit mounts in the area to be checked, and the indicating meter and controls mount on the control panel. Will operate intermittently or continuously, and indicates dangers of fire or explosion to protect your boat and its passengers. Models FD-1-6 (6 volts DC) and FD-1-12 (12 volts DC) operate from boat batteries. Kit even includes spare detector unit. Shpg. Wt. 4 lbs.

6-volt FD-1-6, 12-vt. FD-1-12

$35.95 each

HEATHKIT RF POWER METER KIT

This handy device measures the RF field in the vicinity of a transmitter, whether it be marine, mobile, fixed, etc. Requires no electricity, nor direct connection to the transmitter. Provides a continuing indication of transmitter operation. Merely place it in proximity to the transmitter antenna and it will produce a reading on its 200 ua panel meter when the transmitter is in use. Operates with any transmitter between 100 kc and 250 mc. Includes a sensitivity control for meter. Shpg. Wt. 2 lbs.

Model PM-1

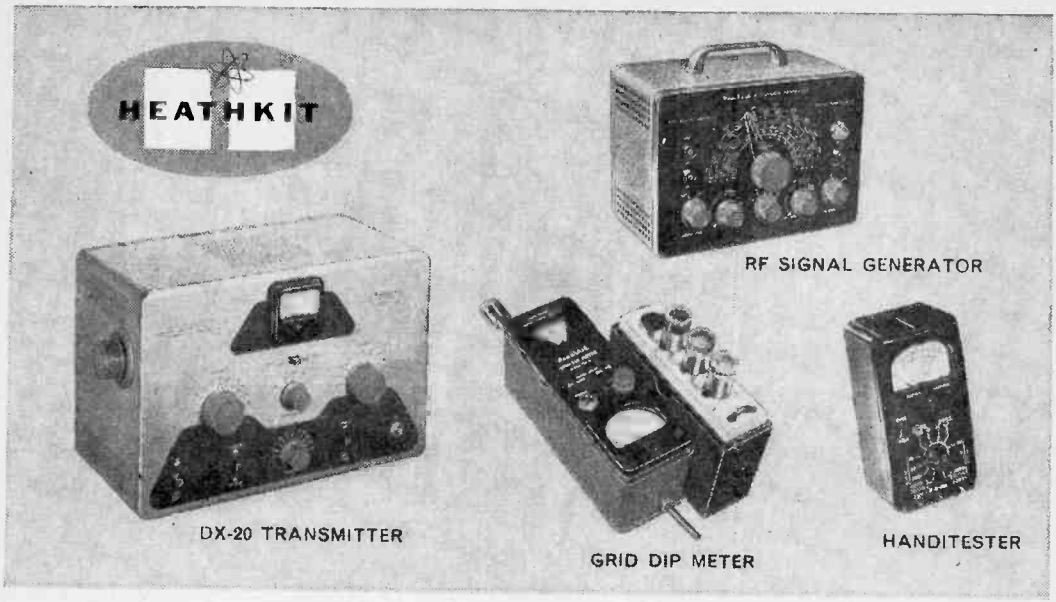
$14.95

HEATHKIT TRANSISTOR RADIO DIRECTION-FINDER KIT

The Heathkit Transistor Radio Direction-Finder model DF-1 is a self-contained, self-powered, 6-transistor super heterodyne broadcast radio receiver incorporating a directional loop antenna, indicating meter, and integral speaker. It is designed to serve primarily as an aid to navigation when out of sight of familiar landmarks. It can be used not only aboard yachts, fishing craft, tugs, and other vessels which navigate either out of sight of land or at night, but also for the hunter, hiker, camper, fisherman, aviator, etc. It is powered by a 9-volt battery. (A spare battery is also included with the kit.) The frequency range covers the broadcast band from 540 to 1600 kc and will double as a portable radio. A directional high-Q ferrite antenna is incorporated which is rotated from the front panel to obtain a fix on a station and a 1 ma meter serves as the null and tuning indicator. The controls consist of: tuning, volume and power (on-off), sensitivity, heading indicator (compass rose) and bearing indicator (antenna index). Overall dimensions are 7½" W x 5⅞" H x 5⅜" D. Supplied with slip-in-place mounting brackets, which allow easy removal from ship bulkheads or other similar places. Shpg. Wt. 4 lbs.

Model DF-1

$54.95



HEATHKIT DX-20 CW TRANSMITTER KIT

This Heathkit straight-CW transmitter is one of the most efficient rigs available today. It is ideal for the novice, and even for the advanced-class CW operator. It employs a 6DQ6A tube in the 50-watt final amplifier circuit, a 6CL6 oscillator and a 5U4GB rectifier. Single-knob band switching covers 80, 40, 20, 15, 11, and 10 meters. The DX-20 is designed for crystal excitation, but may be excited by an external VFO. Pi network output circuit is employed to match antenna impedances between 50 and 1000 ohms.

Model DX-20

Shpg. Wt. 19 lbs. **$35.95**

HEATHKIT GRID DIP METER KIT

An instrument of many uses for the ham, experimenter, or service technician. Useful in locating parasitics, neutralizing, determining resonant frequencies, etc. Covers 2 mc to 250 mc with prewound coils. Use to beat against unknown frequencies, or as absorption-type wave meter.

Model GD-1B

Shpg. Wt. 4 lbs. **$21.95**

HEATHKIT RF SIGNAL GENERATOR KIT

Produces rf signals from 160 kc to 110 mc on fundamentals on five 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 SG-8

Shpg. Wt. 8 lbs. **$19.50**

HEATHKIT HANDITESTER KIT

Measures AC or DC voltage at 0—10, 30, 300, 1000 and 5000 volts. Direct current ranges are 0-10 ma and 0-100 ma. Ohmmeter ranges are 0-3000 and 0-300,000 ohms. Sensitivity is 1000 ohms/volt. Features small size and rugged construction in sleek black bakelite case.

Model M-1

Shpg. Wt. 3 lbs. **$17.95**

HEATHKIT ETCHED-CIRCUIT VTVM KIT

Sensitivity and reliability are combined in the V-7A. It features 1% precision resistors, large 4½" panel meter, and etched circuit board. 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. X1, X10, X100, X10k, X100k, and X1 megohm.

Model V-7A

Shpg. Wt. 7 lbs. **$24.50**

HEATHKIT ALL-BAND RADIO KIT

This receiver covers 550 kc to 30 mc in four bands, and is ideal for the short wave listener or beginning amateur. It provides good sensitivity and selectivity, combined with good image projection. Amateur bands clearly marked on the illuminated dial scale. Employs transformer-type power supply—electrical band spread—antenna trimmer—separate rf and af gain controls—noise limiter and headphone jack. Built-in BFO for CW reception. Cabinet, as shown, available separately.

Model AR-3

Shpg. Wt. 12 lbs. **$29.95**

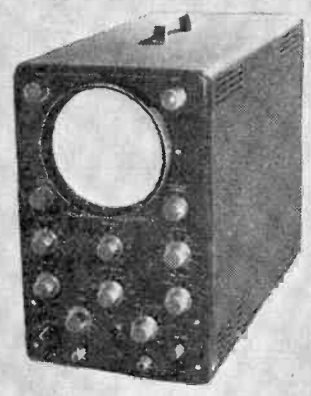
(less cabinet)

HEATHKIT "GENERAL PURPOSE" 5" OSCILLOSCOPE KIT

This oscilloscope sells for less than the previous model, yet incorporates features for improved performance. The OM-2 provides wider vertical frequency response, extended sweeo generator coverage, and increased stability. Vertical channel is essentially flat to over 1 mc. 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 design. A 5BP1 cathode ray tube is used. The scope features external or internal sweep and sync, 1-volt peak-to-peak reference voltage, three-position step attenuated input, and many other "extras."

Model OM-2

Shpg. Wt. 22 lbs. **$39.95**



"GENERAL-PURPOSE" SCOPE

VACUUM TUBE VOLTMETER

ALL-BAND RADIO

HEATHKITS

World's finest electronic equipment in kit form...

FREE 1958 CATALOG

Write today for this FREE CATALOG listing more than 100 "do-it-yourself" kits.

HOW TO ORDER...

Just identify the kit you desire by its model number and send check or money order to address below. Don't hesitate to ask about HEATH TIME PAYMENT PLAN.

Pioneer in "do-it-yourself" electronics

HEATH COMPANY A subsidiary of Daystrom, Inc.
Benton Harbor 10, Mich.

ORDER BLANK

Name_____

Address_____

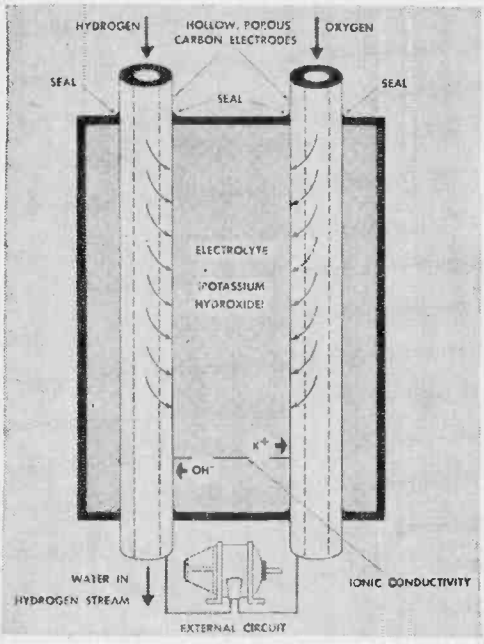
City_____ Zone____ State_____

SHIP VIA
- ☐ Parcel Post
- ☐ Express
- ☐ Freight
- ☐ Best Way

Quantity	Item	Model No.	Price
	☐ SEND FREE Heathkit Catalog		
		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 APO's must include full remittance. NOTE: All prices are subject to change without notice and are F.O.B. Benton Harbor, Mich.

Electric Power Directly From Gas



Simplified drawing above illustrates basic operation of the fuel cell. See story for details. The cell has about 1 volt potential and the current available depends upon its size, so by varying the number and size of cells, many combinations of current and voltage may be obtained. Basically, the cell is most efficient for high-current, low-voltage use. Photo at top of page shows Signal Corpsmen testing "Silent Sentry" radar powered by the new cell. The equipment is capable of spotting a single person a half-mile away in total darkness. The battery of cells (not visible) supplies power at 28 volts.

DIRECT PRODUCTION of electricity from gas on a practical scale is now an accomplished fact. Long a laboratory curiosity, the conversion of the energy in gas to electricity has been achieved by National Carbon Co. scientists with a fuel cell using hydrogen and oxygen to produce thousands of watts of power.

The secret of the cell's success lies in chemically treated, hollow, porous carbon electrodes, through which the gases enter the cell and which conduct the electricity produced by the electrochemical reaction. Hydrogen and oxygen enter the cell through the electrodes and diffuse through the porous carbon to the surface, where they come into contact with the electrolyte —potassium hydroxide. At the hydrogen electrode, the reaction with the electrolyte produces water and releases electrons which enter the electrical circuit. These electrons flow through the external circuit and return to the cell at the oxygen electrode where, in the electrochemical reaction of the oxygen and the electrolyte, the electrons are accepted. Ionic conductivity through the electrolyte completes the circuit.

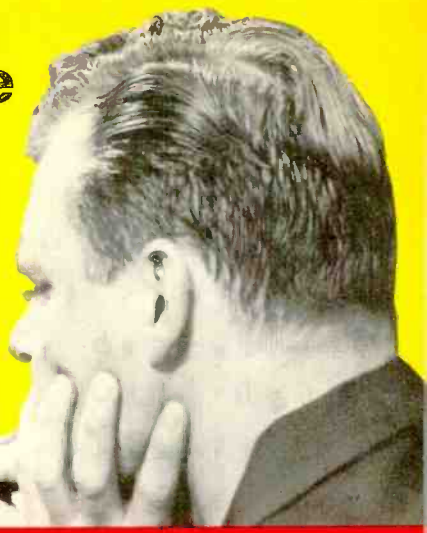
The inherent advantages of the fuel cell make it an ideal source of silent electrical power in remote locations where conventional fuels or water power are not available. It is expected to find application in military communications systems, mobile power units, standby power plants, etc. The Army Signal Corps is testing the cell in connection with its new "Silent Sentry" mobile radar set. -30-

Learn TELEVISION-RADIO

Servicing or Communications

by Practicing at Home in Spare Time

WITHOUT EXTRA CHARGE you get special NRI kits developed to give actual practice with TV-Radio equipment. You build, test, experiment with receiver or broadcasting circuits. All equipment yours to keep.



NRI Has Trained Thousands for Successful Careers in TV-Radio

Studio Engineer KATV
"Now Studio Engineer at KATV. Before enrolling, I was held back by sixth grade education." BILLY SANCHEZ, Pine Bluff, Arkansas.

All the Work He Can Do
"Since finishing NRI Course I have repaired 2,000 TV and Radio sets a year. NRI proved a good foundation." H. R. GORDON, Milledgeville, Georgia.

Has Good Part Time Business
"Quite early in my training I started servicing sets. Now have completely equipped shop. All equipment is paid for." E. A. BREDA, Tacoma, Wash.

Have the High Pay, Prestige, Good Future of a Skilled TV-Radio Technician

People look up to and depend on the Technician, more than ever before. His opportunities are great and are increasing. Become a TV-Radio Technician. At home, and in your spare time, *you* can learn to do this interesting, satisfying work—qualify for important pay.

A steady stream of new Electronic products is increasing the job and promotion opportunities for Television-Radio Technicians. Right now, a solid, proven field of opportunity for good pay is servicing the tens of millions of Television and Radio sets now in use. The hundreds of TV and Radio stations on the air offer interesting jobs for Operators and Technicians.

The Tested Way To Better Pay

See Other Side

CUT OUT AND MAIL CARD NOW

More Money Soon—Make $10 to $15 a Week Extra Fixing Sets in Spare Time

NRI students find it easy to start fixing sets for friends a few months after enrolling, pick up $10, $15 and more a week extra spending money. Many who start in spare time soon build full time TV-Radio businesses.

Act Now—See What NRI Can Do for You

NRI has devoted 40 years to developing simplified, practical training methods. You train at home, learn-by-doing. NATIONAL RADIO INSTITUTE, Washington 16, D.C.

SAMPLE LESSON AND CATALOG BOTH FREE

NO STAMP NEEDED! WE PAY POSTAGE

This card entitles you to Actual Lesson on Servicing, shows how you learn Television-Radio at home. You'll also receive 64-Page Catalog.

NATIONAL RADIO INSTITUTE, Dept. 8HD4
Washington 16, D. C.

Please mail me the FREE sample lesson and 64-Page Catalog. (No Salesman will call.)

Name_____ Age_____

Address_____

City_____ Zone____ State_____

ACCREDITED MEMBER, NATIONAL HOME STUDY COUNCIL

Technical "KNOW-HOW" Can Give You Interesting, Important Work
LEARN-BY-DOING with Kits NRI Sends at No Extra Charge

YOU BUILD AC-DC Superhet Receiver

NRI Servicing Course includes all needed parts. By introducing defects you get actual servicing experience practicing with this modern receiver. Learn-by-doing.

YOU BUILD Signal Generator

You build this Signal Generator. Learn how to compensate high frequency amplifiers, practice aligning typical I.F. amplifiers in receiver circuits. Make tests, conduct experiments.

YOU BUILD Broadcasting Transmitter

As part of NRI Communications Course you build this low power Transmitter, learn commercial broadcasting operators' methods, procedures. Train for your FCC Commercial Operator's License.

YOU BUILD Vacuum Tube Voltmeter

Use it to earn extra cash fixing neighbors' sets; bring to life theory you learn from NRI's easy-to-understand texts.

For Higher Pay, Better Jobs Be a Television-Radio Technician

Servicing Needs More Trained Men

Portable TV, Hi-Fi, Transistors, Color TV are making new demands for trained Technicians. Good opportunities for spare time earnings or a business of your own. Enjoy prestige.

Broadcasting Offers Satisfying Careers

4000 TV and Radio stations offer interesting positions. Govt. Radio, Police, Two-Way Communications are growing fields. Trained TV-Radio Operators have a bright future.

J. E. Smith, Founder

Train at Home the NRI Way Famous for Over 40 Years

NRI is America's oldest and largest home study Television-Radio school. The more than 40 years' experience training men, the outstanding reputation and record of this school—benefits you many ways. Successful graudates are everywhere, in small towns, big cities. You train in your own home, keep your present job while learning. Let us send you an actual lesson, judge for yourself how easy it is to learn.

No Experience Necessary — NRI Sends Many Kits for Practical Experience

You don't have to know anything about electricity or Radio to understand and succeed with NRI Courses. Clearly written, illustrated NRI lessons teach Radio-TV-Electronic principles. You get NRI kits for practical experience. All equipment is yours to keep. Mailing the postage-free card may be one of the most important acts of your life. Do it now. Reasonable tuition, low monthly payments available. **National Radio Institute, Wash. 16, D.C.**

FIRST CLASS
Permit No. 20-R
(Sec. 34.9, P. L. & R.)
Washington, D.C.

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY

NATIONAL RADIO INSTITUTE

Washington 16, D. C.

NRI Graduates Do Important Work

NRI Course Easy to Understand

"Opened my own shop before receiving diploma. I am independent in my own business." D. P. CRESSEY, Stockton, California.

Works on Color TV

"NRI changed my whole life. If I had not taken the course, probably would still be a fireman, struggling along." J. F. MELINE, New York.

See Other Side for More Information to Better Pay

SAMPLE LESSON
64-page CATALOG
both FREE

The March is on for Lektron's Fabulous

88¢ POLY-PAKS©

FREE! BUY 10 PAKS—PICK 11th FREE!

POLY-PAKS ARE EXCLUSIVE WITH LEKTRON
PROVED BIGGEST BUYS IN ELECTRONICS PARTS
KIT FIELD BY VOLUME OF "PAK" SALES!
SAVE $3 TO $30 ON EACH POLY-PAK!

2,000 PCS. HARDWARE. Nuts, screws, washers, etc. Wt. 2 lbs. Reg. $8..... 88¢

8 GERMANIUM DIODES. Long leads, glass sealed. Reg. $5 ..... 88¢

20 INSTRUMENT KNOBS. Raytheon. Bakelite, w/brass insert & set screws. Skirted, too! Wt. 2 lbs. Reg. $12..... 88¢

20 PRINTED CIRCUITS. Built-in R/C circuits. Integrals incl. Wt. 1 lb. Reg. $7..... 88¢

WORLD'S SMALLEST RADIO KIT. 2½ x 2 x 1". All parts, instructions. Wt. 1 lb. Reg. $3 ..... 88¢

0-60 MINUTE TIMER. For home, photo lab. Sounds alarm. Wt. 2 lbs. Reg. $6..... 88¢

SYLVANIA TV MIRROR. 8 x 12" stainless steel. Hundreds uses! Wt. 2 lbs. Reg. $4.. 88¢

40 HI-Q CONDENSERS. Finest porcelain. NPO's too; Wt. 1 lb. Reg. $6..... 88¢

60 TERMINAL STRIPS. Solder-lug & binding; to 20 terms. Wt. 2 lbs..... 88¢

30 POWER RESISTORS. WW. 5 to 50 W; to 10,000 ohms. Vitreous, too. Wt. 3 lbs. Reg. $15 ..... 88¢

6 FERRI-LOOPSTICK CORES. To 7", flat incl. Wt. 2 lbs. 88¢

50 PLUGS, RECEPTACLES. Audio, power, speaker, etc. Wt. 2 lbs..... 88¢

30 MOLDED CONDENSERS. Black Beauties, etc. Finest made! Wt. 2 lbs. ..... 88¢

35 TUBE SOCKETS. 4 to 9-pin; ceramic, mica, shield-based, too. Wt. 2 lbs. Reg. $6.... 88¢

150 CARBON RESISTORS, ½ to 2 W; 15 ohms to 1 meg. Insulated types incl. Wt. 2 lbs. 88¢

POSTAGE-STAMP MIKE. Crystal, 100 to 8,000 cps. Wt. 1 lb. Reg. $7..... 88¢

6 DIODES. Crystal & silicon. Some worth $10. Reg. $17. 88¢

6 TRANSISTOR SOCKETS. Mica-filled; for sub-mini tubes, too! ..... 88¢

10 PANEL SWITCHES. 115 VAC; SPST, SPDT, etc. Wt. 1 lb. ..... 88¢

50 KNOBS. Radio & TV. Asstd. colors, ins. Some worth $1 ea. Wt. 2 lbs. Reg. $17... 88¢

100-PART SURPRISE PAK. Asstd. radio & TV parts. Wt. 2 lbs. Reg. $10. .... 88¢

50-PC. CONDENSER SPECIAL. Molded, paper, ceramic, oil, mica, variable, discs. Wt. 2 lbs. ..... 88¢

65-PC. RESISTOR SPECIAL, WW, precision, carbon, variable, mini. Worth $15. Wt. 3 lbs. ..... 88¢

AUGUST VOLUME BONUS!
SPECIAL $5.00 ASSORTMENT OF RADIO PARTS
FREE WITH ANY $15 ORDER!

13-PC. TWIST DRILL KIT. 1/16" thru ¼" by 64ths. W/calibrated case. Reg. $3. 88¢

10 ELECTROLYTICS. Tubular and FP. Triples, too! To 1000mf & 500V. Wt. 3 lbs. 88¢

12 "POLY" BOXES. Clear plastic, hinged, w/snap locks. Asstd. sizes. Wt. 1 lb..... 88¢

7 SCREWDRIVERS & RACK. Plastic handles. 7 Different drivers w/wall rack. Wt. 2 lbs. ..... 88¢

4 OUTPUT TRANSFORMERS. 50L6, etc. Wt. 3 lbs. Reg. $8 ..... 88¢

"SUN" BATTERY. Similar to famed B2M. 1" long; for hundreds of "lite" projects. Reg. $2.50 ..... 88¢

15 ROTARY SWITCHES. Asstd. gangs. Wt. 3 lbs. Reg. $12 ..... 88¢

65 TUBULAR CONDENSERS. Paper, molded, oil, porc. .0002 to .5mf to 1,000V. Wt. 2 lbs. Reg. $12 ..... 88¢

MINI-METER. 1¾" dia. 0 to 6 Amps AC. Wt. 1 lb. Reg. $3 ..... 88¢

75 CERAMIC CONDENSERS. Hi-Q, discs, tubular; to .01 mf. Wt. 2 lbs. Reg. $11.. 88¢

30 DISC CONDENSERS. Wafer-thin! Mini builders note! To .01 mf. Reg. $5..... 88¢

35 PRECISION RESISTORS. 1%, ½ & 1 W. Carboloy & WW. Wt. 1 lb. Reg. $15.. 88¢

75 HI-Q CARBON RESISTORS. IRC, Ohmite, 1% too! ½, 1 W. 10 ohms to 10 megs. Wt. 2 lbs. Reg. $15..... 88¢

300-FT. HOOKUP WIRE. Tinned, asstd. colors, sizes. Wt. 2 lbs. Reg. $5..... 88¢

0000-9999 COUNTER. Veeder-Root. Double shafts. Reg. $5 ..... 88¢

60 COILS, CHOKES. IF, RF, ANT. Slug-tuned, too. Wt. 3 lbs. Reg. $15..... 88¢

15 VOLUME CONTROLS. Duals, too. To 1 meg; some w/ switch. Wt. 2 lbs. Reg. $13. 88¢

40 SUB-MINI RESISTORS. ¼" long. 15 values; 1/5 W. Reg. $6 ..... 88¢

TEN 3-SECOND TIMER mechanisms. Precision geared. Wt. 2 lbs. Reg. $30..... 88¢

4-IN-1 DRILL BIT. Copes, saws, drills, reams all shape holes ..... 88¢

EMERSON RADIO TUNER. 540 to 1600 KCS. Reg. $7. 88¢

5 HORSESHOE MAGNETS. Powerful, pocket types. Hundreds of uses..... 88¢

IDEAL FOR BEACH & BOAT!

FAMOUS Regency

VEST POCKET TRANSISTOR **RADIO** READY TO PLAY!

INCLUDING BATTERIES AND SENSITIVE PHONE **$14.95**

Lektron scoops the field with the "hottest" pocket transistor radio since the advent of the transistor! Designed and built by Regency, one of America's great names in radio. Uses an exclusive circuit with RF, DET and AMP stages. SMALLER THAN A PACK OF CIGARETTES!—only 3 x 2 x 1"—NO EXTERNAL ANTENNA OR GROUND —no hanging wires! Amazing sensitivity, volume and selectivity. Attractively designed two-tone styrene case. Variable tuning covers 540 to 1500 kcs. READY TO PLAY when you receive it! 1000-hour batteries and ultra-sensitive phone included in this fabulously low price! Gift packed. Wt. 1 oz.

3-TUBE AC-DC AMP.
Fully wired, ready for use. Reg. $5. Sep. vol., tone controls. Lowest price ever. **$2.99**
TUBES $1.91 EXTRA

12-HOUR "SPACE" CLOCK
Accurate timekeeper; needs only "pen-lite" battery for power. Litewight ... **$1.98**

3-IN-1 HI-Q MIKE
For hand, desk or stand. Professional quality. Crystal. 100-8,000 cps. Pop. U. S. maker. Reg. $8..... **$2.99**

SUPER SENSITIVE RELAY
Reg. $15
Only **$2.98**
Needs only "sun battery" for power. Specs: 4000 ohm coil. 500 micro-amp sensitivity. SPDT contacts.

SUPER SOLAR BATTERY
Reg. $10
Only **$2.88**
1¾" sensitive cell generates 22 mils of solar power. 2⅛ x 1¾ x 1" plastic case. Easily ganged.

TV ANTENNAS
Indoor types.
Reg. $7.50 ..... **$1.19**
Deluxe model w/switch. Reg. $9.50 ..... $2.88

WRITE FOR FREE 12-PAGE CATALOG OF BARGAINS!

BIG BUYS IN 'MINI' TYPE!

TELESCOPIC ANTENNA 8" to 3 ft. Chrome; w/jack **$1.69**
HEARING-AID PHONE Crystal, w/cord & plug **$1.19**
HEARING-AID PHONE 5,000-ohm, w/cord, plugs **$1.69**
3-SPEED PICKUP Flip-over cart., sapphire needles **$2.99**
MICROSCOPE 100/200/300 power; w/slides **$3.99**
PILLOW SPEAKER "Silent sound"; 3.2 ohm V.C.; cord **$2.69**
"MICRO"METER SALE! 1⅝" sq.; 0-1ma; bakelite **$3.99**

MINIATURE SPEAKERS 3-4 ohm v.c.
1½" square **$1.88**
2" square **$1.88**
P-N-P TRANSISTORS Reg. $5 ea. Famous make ..... 2 for **$1**
TRANSISTOR IF'S. 456 kcs, only ½" square ..2 for **$1**
10M ohm SIGMA RELAY W/R-C assembly. Reg. $8 ..... **$1.00**
3 VARI-LOOPSTICKS. 540 to 1500 kcs. Adj.....3 for **$1**
8-PC. NUTDRIVER SET Steel socket drivers, 3/16 thru 7/16" in T sizes; plastic handle, case..... **$1.00**

SIX-TRANSISTOR SUPERHET RADIO KIT

only **$17.99**

See it advertised elsewhere for many dollars more! Precision-engineered with sub-mini parts throughout. Built-in super-ferri antenna; 2½" PM spkr. PRINTED CIRCUIT complete with transformer-coupled PUSH-PULL output. External "personal" phone included. Handsome leather case, 6 x 3⅝ x 1½". Resistors, condensers, sockets, IF's, vol. control; installation, operating and service instructions. Less 6 transisters and diode. Ship. wt. 2 lbs.

12" COAX SPEAKER
12" woofer w/6 oz. magnet; 3" tweeter; built-in crossover network. Famous U. S. maker. 40-15,000 cps. 6-8 ohm v.c. Wt. 5 lbs. .....only **$8.88**

HI-FI 12" SPEAKER
Pop. U. S. maker. 40-12,000 cycles. 6-8 ohm v.c. Hvy PM Alnico magnet. Wt. 3 lbs. **$3.99**

POCKET MULTI-TESTER

3½ x 2 x 1½" bakelite case. 100 ohms/volt. Zero adj. 0/15/150/1000 AC-DC V. 0-150 ma; 0/100,000 ohms. W/test leads & battery. In orig. pack. $13 value **$6.99**

HOW TO ORDER: ORDER BY "BLACK TYPE" HEADLINES, i.e. ONE SUPER SOLAR BATTERY, $2.88

State price with each item. Send check or M.O. including sufficient postage; excess returned. C.O.D. orders, 25% down; rated net 30 days. (Canada postage, 45¢ 1st lb., 28¢ ea. addl. lb.) EXPORT ORDERS INVITED

LEKTRON 131-133 EVERETT AVE. CHELSEA 50, MASS.

AFTER CLASS

Special Information on Radio, TV, Radar and Nucleonics

SPEAKING OF MAGNETISM—Part 1

THE EXPRESSION "like poles repel and unlike poles attract," repeated often enough, tends to give a theoretical concept a reality it does not possess. You wouldn't think of using a screwdriver to tighten a hex nut just because it works so well on a slotted head. Similarly, the magnetic pole concept—good as it may be for explaining fundamental interactions between permanent magnets—fails miserably when you try to apply it to more complex magnetic phenomena.

The question is: can we do away with magnetic poles altogether? Yes, we can if we wish, but we do not have to go to this extreme. If we think of poles and their interactions merely as "rules of thumb" and use them properly, they can serve as helpful tools. But when we consider basic explanations, let's work exclusively with *magnetic fields* and *lines of force.*

Magnetic Field. For example, when an electron current flows through a vertical conductor passing through a sheet of cardboard (Fig. 1), iron filings sprinkled on the cardboard form concentric rings around the wire. This magnetism is just as "real" as the magnetism around a bar magnet. Yet, where are the poles?

Or consider a ring of iron magnetized by a coil through which an electron current flows (Fig. 2). A strong magnetic field exists inside the iron core but, again, where are the poles? *There just aren't any!*

Figure 3 illustrates another good example of the same kind of thing. Two U-magnets separated by a reasonable distance are generally conceded to be polarized individually. Each one has its own N-pole and its own S-pole.

With opposite poles facing each other, we push them together to form a closed ring. If the pole faces are very smooth so that

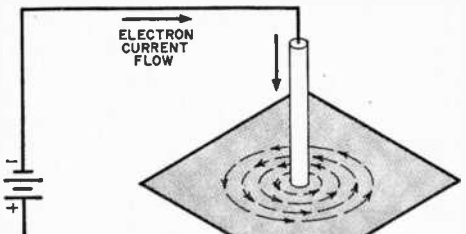


Fig. 1. The magnetic effect of a current passing down through a vertical wire. Iron filings sprinkled on cardboard sheet trace out the magnetic forces.

Fig. 2. The magnetism in a toroid or closed-ring solenoid.

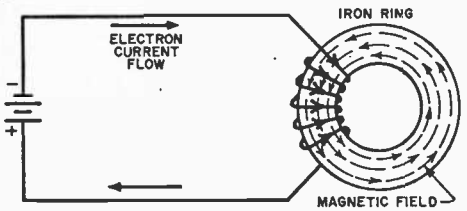
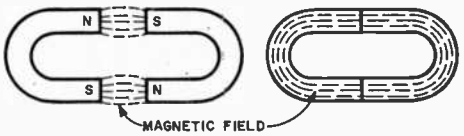


Fig. 3. Magnetic poles seem to vanish when two U-magnets are brought together this way.



48¢ ea. for any tube

$45.00 Per Hundred

STANDARD LINE ELECTRIC COMPANY

FREE POSTAGE IN U.S.A. & TERRITORIES

FREE TUBE BRIGHTENER ON ORDERS OF $10.00 OR MORE

ANNOUNCING OUR NEW PRICE SCHEDULE

Effective July 25, 1958 all tubes (Radio & Television receiving) will be sold and shipped at the fantastic price of only .48c ea. or $45.00 per hundred. Any "on hand" orders at that time will receive credit for future purchases.

THE TUBES ADVERTISED HEREIN ARE NOT NECESSARILY NEW TUBES BUT MAY BE ELECTRICALLY PERFECT FACTORY SECONDS OR USED TUBES AND ARE SO MARKED

All TV, & Radio Tubes are tested by our supplier under actual conditions in Rodia & TV chassis or in Hickock Tube Testers Model 533A.

And, of course, the famous Standard Line guarantee remains in effect: All tubes guaranteed to be replaced free if they fail to function efficiently within one year's time. (defective tubes must be returned intact, postage poid. Refunds will be cheerfully mode within five (5) days if not completely satisfied.)

0B2	3AL5	5V4GT	6BE6	6S4	7F7	12Q7	32L7GT
0Z4	3AU6	5W4GT	6BF5	6S8GT	7F8	12SA7	35/51
1A5GT	3AV6	5X4G	6BG6G	6SA7	7G7	12SG7	35A5
1A7GT	3BA6	5X8	6BH6	6SB7Y	7H7	12SJ7	35B5
1B3GT	3BC5	5Y3GT	6BH8	6SC7	7J7	12SK7	35C5
1C5GT	3BE6	5Y4G	6BJ6	6SF5	7K7	12SN7GT	35L6GT
1C6	3BN6	5Z3	6BK5	6SF76SG7	7L7	12SQ7	35W4
1C7	3BU8	5Z4	6BK7	6SH7	7N7	12SR7	35Y4
1H4G	3BY6	6A8	6BL7GT	6SJ7	7Q7	12V6GT	35Z4GT
1H5GT	3BZ6	6AB4	6BN6	6SK7	7R7	12W6GT	35Z5GT
1L6	3C2	6AC7	6BQ6GT	6SL7GT	7S7	12X4	#37
1LA4	3C86	6AF4	6BQ7	6SN7GT	7V7	12Z3	#39/44
1LA6	3CF6	6AG5	6BR8	6SQ7	7W7	14A7	#41
1LB4	3CS6	6AG7	6BS8	6SR7	7X6	14AF7	#42
1LC5	3DT6	6AH4GT	6BY5G	6T4	7X7	14B5	#43
1LC6	3Q4	6AH6	6BZ6	6T8	7Y4	14F7	#45
1LH4	3Q5GT	6AK5	6BZ7	6U4GT	7Z4	14F8	#47
1LN5	3S4	6AK6	6C4	6U5	8AWB	14H7	50A5
1N5GT	3V4	6AL5	6C5	6U8	12A8	14N7	50B5
1P5GT	4BC8	6AL7GT	6CB5	6V3	12AB5	14Q7	50C5
1Q5GT	4BQ7A	6AM8	6CB6	6V6GT	12AQ5	14S7	50C6G
1R5	4B58	6AN8	6CD6G	6W4GT	12AT6	17AX4GT	50L6GT
1S5	4BU8	6AO5	6CF6	6W6GT	12AT7	17DQ6	50Y6
1T4	4BZ7	6AQ6	6CG7	6X4	12AU6	19AU4	50Y7
1T5GT	4C86	6AQ7GT	6CG8	6X5GT	12AU7	19BG6G	#57
1U4	5AM8	6AR5	6CH8	6X8	12AV6	19C8	#58
1U5	5AN8	6AS5	6CL6	6Y6G	12AV7	19J6	#80
1V	5AQ5	6AS8	6CM6	7A4	12AX4GT	19T8	#81
1V2	5AS8	6AT6	6CN7	7A5	12AX7	19X8	117L7GT
1X2	5AT8	6AU4GT	6CN7	7A6	12AZ7	25AC5	117N7GT
2A3	5AV8	6AU5GT	6CU6	7A7	12B4	25AV5GT	117P7GT
2A5	5AW4	6AU6	6DG6	7A8	12BA6	25AX4GT	117Z3
2A7	5AZ4	6AU8	6DQ6	7B4	12BE6	25BK5	117Z4GT
2AF4A	5BK7	6AV5GT	6DT6	7B5	12BF6	25BQ6	117Z6GT
2B7	5BR8	6AV6	6E5	7B6	12BH7	25CD5G	807
2BN4	5BQ7	6AW8	6H6	7B7	12BK5	25CU6	9002
2D21	5BZ7	6AX4GT	6J4	7B8	12BQ6	25L5GT	9003
2E5	5CG8	6AX5GT	6J5	7C4	12BR7	25W4GT	9006
2X2A	5J6	6AZ8	6J6	7C5	12CA5	25Z5	
3A2	5T8	6BA6	6K6GT	7C6	12CU6	25Z6	
3A3	5U8	6BC5	6K7	7C7	12DQ6	#27	
3A4	5U4G	6BC8	6L6	7E6	12J5	#30	
3A5	5V4G	6BD6	6L7	7E7	12L6GT	#31	

ALL RECEIVING TUBES SENT POSTAGE PAID.

Please send 25c handling for orders under $5.00 Send 25% deposit on C.O.D. orders and please send approximate postage on Canadian and foreign orders.

Above is only a partial list — order any type at the same price or send for free tube list and order blank. We have over 5,000 tube types on hand or at easy access, including special purpose, industrial and transmitting tubes which are slightly higher.

ALL TUBES GUARANTEED ONE FULL YEAR...

NOTE: When ordering receiving tubes be sure to enclose 48c for each tube or $45.00 per hundred.

Thousands of TRADE-IN TVs

Please Specify Console or Table Model When Ordering

Reconditioned By Factory Trained Technicians! Guaranteed To Be In Working Condition When You Receive Them!

10"	$25.00	19"	$56.00
12"	$30.00	20"	$63.00
14"	$35.00	21"	$70.00
16"	$42.00	24" (when available)	$95.00
17"	$49.00	27"	$129.00

Get yourself a second set or buy some for re-sale!

All TVs sent motor freight or Railway Express F.O.B. our warehouse. Sorry, no A.P.O. shipments.

FREE INDOOR ANTENNA with each TV Purchase

below is our new price schedule of pix tubes. These famous make tubes contain all new parts with the exception of the glass bulb which does not wear out.

Any 10" Tube	$ 9.95	Any 16" Tube	15.95
Any 12" Tube	10.95	Any 17" Tube	18.29
Any 14" Tube	13.95	Any 19" Tube	20.29
		Any 21" Tube	24.29

Prices On Larger Tubes On Request

Remember

Only 48¢ ea.

$45 Per Hundred

ANY TYPE

ANY QUANTITY

Remember — NO Dud Required. All tubes guaranteed one year. Picture Tubes shipped F.O.B. Harrison, N. J.

STANDARD LINE ELECTRIC COMPANY

432 HARRISON AVENUE, HARRISON, N. J. · Phone: HUmboldt 4-4997

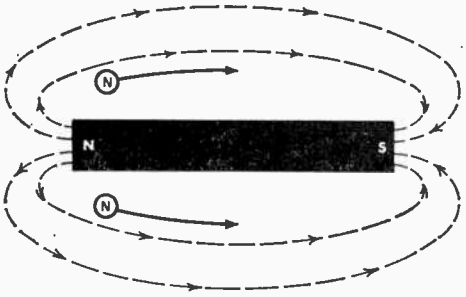


Fig. 4. Field direction is arbitrarily taken as the direction over which an isolated little N-pole would travel if it were permitted to do so.

really intimate contact can be established, *polar identity completely vanishes* and the magnetic field is entirely confined within the metal.

Fundamental Definitions. To help you follow the line of reasoning we are going to develop, and to make possible exact descriptions of magnetic phenomena in terms of fields rather than poles, we will need a few fundamental definitions.

Magnetic Field. This is a condition of space surrounding a magnet in which magnetic effects can be detected. The shifting of an iron filing when placed near a magnet indicates that the filing is being acted upon by the magnetic field.

Lines of Force. It is convenient to think of magnetic fields as being composed of individual lines of force. Lines of force as such have no real existence; they simply serve as descriptive aids.

Direction of Field. The lines of force comprising a field are not in motion if the source of the field is at rest. Yet, because a magnetic compass will always point in a given direction when placed in a field, we *arbitrarily* define field direction as the path that an isolated N-pole follows under the influence of the magnetic forces. (Notice that we have not completely abandoned the idea of poles since we use an N-pole to establish our arbitrary field direction. When we speak of an N-pole in this sense, we refer to that end of a magnetic compass which points in a northerly direction when it is free to turn.)

N-pole and S-pole. If we have to bring poles into our discussion at all, we should define them exactly. From the description of the direction of a field just given, we can safely define an N-pole as that end of a magnet from which the lines of force *emerge* into the air; in contrast, an S-pole is then the end into which the lines of force *re-enter* the magnet. (See Fig. 4.) Such a definition is perfectly consistent with the arbitrarily selected field direction based upon the path of an isolated N-pole under magnetic influence.

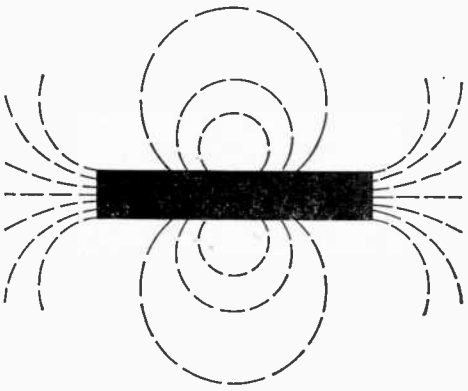


Fig. 5. Magnetic lines of force behave as if there were a force of mutual repulsion between them; and they act as if they were under tension, tending to contract to the smallest possible length.

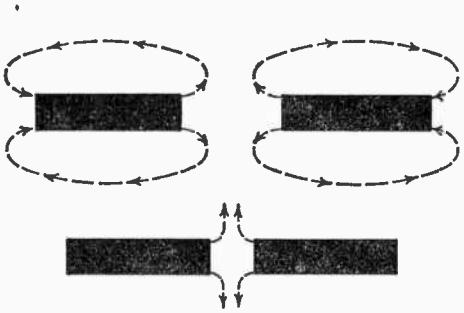


Fig. 6. When adjacent lines have the same direction, there is a force of repulsion between them that causes repulsion between their parent magnets.

Lines of Force. The notion of magnetic lines of force is due to the work of Michael Faraday (1791-1867). He thought of these lines as if they were real, and used them to interpret magnetic phenomena. Following his lead, we can see that these lines have some very definite properties.

1. Lines of force never cross each other.
2. Lines having the same arbitrary direction and lying adjacent to each other repel each other.
3. Lines of force are under tension and, like stretched rubber bands, tend to contract to the shortest possible length.
4. Lines having different or opposite directions appear to attract each other. If

these oppositely directed lines originate in two different magnetic bodies, the mutual attraction of the lines results in a mutual attraction of the bodies.

Figure 5 illustrates the first three of these properties. Lines "emerging" from the N-pole begin to spread apart by repulsion as soon as they appear in the air, and there is no tendency for one line to cross

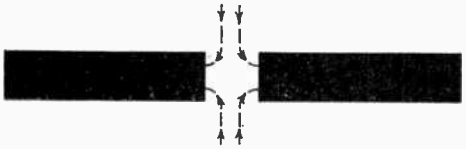


Fig. 7. The same effect is shown here as in Fig. 6 except that both sets of lines have been reversed in direction by turning them end over end.

any other. The curved lines above and below the magnet resemble inflated balloons seen in cross-section in that they appear to want to contract back into the magnet but cannot do so due to the mutual repulsion between them.

These properties explain simple interactions without any reference to poles at all. First examine the sequence in Fig. 6.

Two magnets separated by a substantial distance are placed so that the lines of force emerge from the two ends closest to each other; these lines follow independent patterns as though they were alone in space. As they are brought close to each other, it is evident that lines having the same direction will be adjacent and that repulsion will take place, not only between the lines of force, but also between the magnets themselves.

Exactly the same effect occurs when we bring the other two poles close to one another as in Fig. 7. Thus, we are not saying that "like poles repel" but we are attributing the interaction to something that occurs in the space between the magnets rather than in the ends of the magnets themselves. This is a fine but important distinction, as you will see.

A second possible condition, as in Fig. 8, is the one in which two magnets are positioned so that oppositely directed lines of force lie adjacent, either with the magnets end-to-end or side-by-side. The fourth property of lines of force tells us that attraction between magnetic lines, and hence attraction between the magnetic bodies, should occur. This explains why "opposite poles attract" without the need for referring to poles at all.

Attraction and Repulsion. You might reasonably comment at this point that nothing we have described by lines of force could not also have been adequately described using the pole concept. In a sense, you would be perfectly right, because the attraction and repulsion of poles is a usable tool in working with these simple and fundamental interactions.

However, we have shown that there are no poles in the magnetic field of a single current-carrying wire (Fig. 1) or in a closed-ring solenoid. Yet, if we place two parallel wires near each other, *there will be definite attractions and repulsions depending upon the direction of the currents through them.*

If there are no locatable poles, how will you predict the directions of the forces? Again, two pole-less ring solenoids adjacent to one another will also show the presence of magnetic forces. Without specifying pole

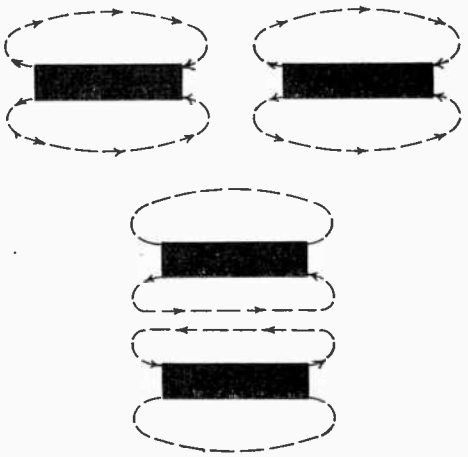


Fig. 8. Two conditions that result in attraction between magnets. In both cases, the directions of the magnetic lines of force are opposed.

position, can you predict the attraction or repulsion?

In next month's *After Class,* we will demonstrate how magnetic fields can be used to describe *all* interactions, regardless of poles or the absence of poles. As a matter of fact, we will include one phenomenon that forces you to arrive at the *wrong* conclusion if you use the pole concept but leads you directly to the correct answer if you employ the field idea. —30—

Build the Quizzomat

(*Continued from page 47*)

(*RL1*), 6-volt a.c. relay (*RL2*), buzzer, and transformer *T1*—are secured to the rear and side aprons of the chassis.

One terminal of each neon lamp should be grounded directly to the chassis by connecting it to a solder lug held by one of the Flushlite mounting screws.

Wire the answer switches and neon lamps first, then the buzzer and time-delay circuits. The octal socket of *RL1* is held above the chassis apron by two 1½" *6-32* machine screws which pass through two 1" brass spacers.

Answer Sequence. A good true-false quiz should have a random selection of answers. And the switch and code wiring chosen provides four different answer-sequence groups, which vary enough to prevent memorization. With the wiring as shown in the schematic diagram, the answers are given on page 46 for each of the four code-switch positions.

All you have to do when composing a series of ten quiz questions is to select the sequence code upon which it is to be based, then make up the questions so that the correct answers follow the true-false sequence of the chosen code. -30-

Hamming on the Highways

(*Continued from page 55*)

University of Hawaii comparing his curriculum with that of a senior at the University of Arizona who was driving back to class. And one day on my way home from a shopping trip at St. Louis, I had a long and interesting chat with a serviceman at Goose Bay, Labrador.

Mobile stations in this country make daily contact with stations in England, France, Germany, and Africa. I have a schedule with a Swiss journalist who is planning to put mobile equipment into his MG sports car for a trip to Monaco this summer.

Special Pleasure. Every ham with a car has probably thought about going mobile, but there are a few occupations where mobile operation is particularly rewarding. For instance, the salesman who is on the road day after day not only keeps in touch with his family by amateur radio but fills the lonesome hours on the road by chatting with other hams.

Many amateurs inducted into service

have found that by having transmitters in their cars they can follow their hobby in uniform. And many a husband on his way home from work gets special pleasure out of talking to his XYL (wife) who is at home getting dinner ready.

Important Functions. Mobile amateur stations serve many practical and important functions. No Civil Defense organiza-

High-power equipment in trunk of car. Antenna coil is at the left.

Row of mobiles at summer hamfest. These get-togethers allow operators to swap notes on equipment.

tion is complete without a well-trained corps of mobile operators ready to drive into a disaster area deprived of communication. In the last few months the mobile crew of our radio club assisted in a community fund-raising drive.

The fellows also coordinated search teams looking for an elderly man who became lost while picking berries in a heavily wooded section. With the arrival of the tornado season, they have been asked to work with the state police in setting up a storm warning program for the area.

Recognition of the importance of such mobile units is contained in the fact that many states now issue special license plates with amateur station call letters instead of the usual letter-number combinations.

The Fun of Mobiling. But it is the sheer fun of mobiling that attracts most of us into it. When I approach a large city, instead of trying to figure out the tortuous route shown on the road map, I call "CQ" and raise a station there. He gives me the short cuts that save many minutes, and more times than not I spend those minutes drinking a cup of coffee with him and his family after he has guided me to his door.

Recently I had a chance to repay this hospitality. One day at noon I contacted Bob, a student at Purdue University, just as he was driving away from his Arizona home to return to school after a vacation. I invited him to stop by when he reached Illinois since I lived only a few miles off his route. No sooner had we signed off than another station, a local one, called me and teasingly accused me of being an "Electronic Lorelei!"

Late the following day a strange car with the characteristic swinging whip roared into the driveway and a tall, blond fellow wearing glasses and an Ivy League shirt jumped out and waved at me. Before I had time to wave back, another tall, blond fellow wearing glasses and an Ivy League shirt emerged from the car.

I thought too much hamming had addled my little gray cells until Bob, W7VMQ, explained I had lured two of the well-known amateur radio triplets off their course along Highway 66. He introduced Charlie, W7VMO, and said that Dick, W7VMP, was already at school.

Mobile operation adds much to the fun of summer "hamfests." Usually several amateurs travel in a caravan of cars toward the picnic site, chatting back and forth, making wisecracks about the "deaf" cars passing them, and having a good time in general. A fixed transmitter at the picnic area stands ready to talk these mobilers in, and, when they see parked cars with graceful swaying whips, they know they have arrived.

"Loud" Talking. A few of my mobile experiences are more enjoyable as memories

than they were at the time. For example, one evening last summer a girl friend and I attended a drive-in movie. After the first few minutes of the feature we agreed it was a real dud, so I decided to show off my mobile rig. I turned down the car speaker, switched on the transmitter, and called a long and—I hoped—seductive-sounding CQ.

Even before I finished I noticed that people in the cars next to us seemed to be disturbed. Suddenly cars began honking, lights flashed on the screen, and my friend whispered hoarsely: "Carole, I can hear every word you're saying coming out of that speaker in the next car!"

It was true. Strong signals from my transmitter were getting into the theater amplifying system, and I was giving the sound track a good run for its money. With that antenna sticking up like the Eiffel Tower, there was no chance to hide. In a few moments the manager dropped by to ask pointedly if we would like to have our money back and go somewhere—anywhere —else and talk. We meekly promised to be quiet, and he let us stay.

In conclusion, let me say that as a girl I am never afraid or lonely when I am out in the car alone. How could I be? Zipping along with that antenna leaning in the wind, I have a wonderful feeling of freedom and companionship as I chat with people near at hand or miles away.

The Italians put it well: "Good company in a journey makes the way seem much shorter." —30—

Semiconductor Space Spanner

(*Continued from page* 64)

power amplifier collector current. Loading capacitor *C7* is used to set the collector current of the power amplifier at 8 ma. when in the "bottom" of the dip. If your particular installation incorporates an antenna coupler, it is a good idea to tune it, in conjunction with loading capacitor *C7,* for maximum power radiated by the antenna.

It is best to tune up with a *field strength meter.* This would consist of a 0-1 milliammeter connected in parallel with a crystal diode. A wire from each meter terminal should be strung up near the transmitter antenna.

If your station communications receiver has an "S" meter, the transmitter may be

tuned for maximum reading. Occasionally this method will produce false answers, however, so the field strength method is strongly recommended.

Good hunting and choice DX! The author is currently operating this transmitter on 11 meters (27.05 mc.) and 10 meters (28.15 mc.) and will keep an ear glued to the speaker listening for a "CQ-TR." —30—

What Goes In Between?

(*Continued from page 71*)

manual accompanying the preamplifier and power amplifier must be checked again at this point to determine the necessary requirements of cable and plugs.

Connecting the Speaker. The remaining chore (and it really isn't) is to connect the speaker. The power amplifier will contain a terminal strip offering a variety of output connections, usually *C* (*Common*), 4, 8 and 16 ohms. All you need do is check the speaker specifications to determine its impedance rating and connect it between *C* and the appropriate terminal to match your speaker (*R1* in diagram).

The wire for this can be 300-ohm TV lead-in or plain rubber-covered lamp cord or the equivalent. If the distance between speaker and amplifier exceeds 50 feet, a heavier wire is recommended. Shielded cable is not required since the line is at very low impedance—and not susceptible to hum pickup.

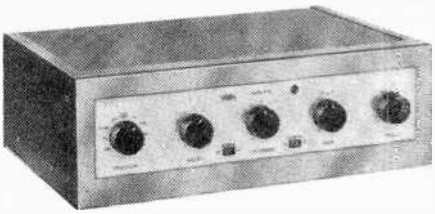
After wiring, plug in the power cords and check out all components. Should one unit fail to work, check the wiring for possible short circuits and interchange its shielded input lead with one that works. If the unit then operates properly, there must be a defective solder connection at either end of the lead you replaced.

If there is excessive hum, say, in the phono channel, and all hum adjustments have been made, try connecting a single wire lead from a cold water pipe in the house to the *shield* portion of the *phono* plug. Then readjust all hum controls.

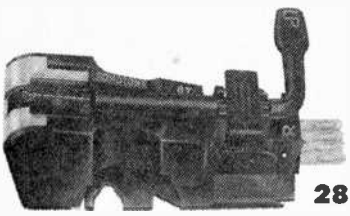
Should hum persist, change the position of the phonograph with relation to other components. You might find that the hum is being induced in the pickup itself by a power transformer of one of the other units. Make sure all plugs are pushed all the way in, tightly, and check all solder joints where shield and plug meet. —30—

Hi-Fi Highlights

(*Continued from page 83*)



27 **Thirty-watt** amplifier, kit and factory wired, features four equalization positions, three low-level inputs, three high-level inputs, concentric loudness and level controls. Output stage uses four EL84's in push-pull parallel. Eico HF-32.



28 **Ceramic** stereo cartridge has 0.3-volt output and is compatible with older LP records. The new turnover model shown will also play standard 78-rpm discs. Sonotone 8T.

POPULAR ELECTRONICS
P. O. Box 1873
CHURCH STREET STATION
New York 8, N. Y.

Please send me additional information concerning the products whose code numbers I have circled.

20 21 22 23 24

25 26 27 28

TOTAL NUMBER OF REQUESTS ☐

NAME .....

ADDRESS .....

CITY..... **ZONE**.... **STATE**.....

Squawk with the Transihorn

(*Continued from page* 77)

You could substitute a "standard" paging trumpet (such as a University Type MIL-45) for the "Cobra." An ordinary loudspeaker might be used for indoor applications, provided the speaker has a 45-ohm voice coil. A loudspeaker or paging trumpet with a low-impedance coil will do if you connect its leads to the transformer *secondary* (rather than across the blue and brown primary leads as in the schematic.)

Other transistors can be used in the circuit, such as the CBS-Hytron 2N256, Sylvania 2N307, or RCA 2N301. However, it may be necessary to experiment with bias resistors *R1* and *R2*, trying values from 47 to 120 ohms for best operation.

You can change the tone quality of the signal by substituting different-value coupling capacitors for *C1* and *C2*, or by connecting a capacitor (0.02 to 0.5 μfd. at 400 volts) across the transformer primary. Almost any 6-volt battery will do. —30—

DX'ing the Airlanes

(*Continued from page* 86)

tune across the 5-, 8- or 13-mc. bands until you find an active channel, then leave your receiver set on this frequency for a while, and log the various stations as they come on and go off. Most transmissions are short.

When stations call each other, they give the ID (identity) of the calling station *last*. For example, Wake will say "Guam from Wake," or simply "Guam—Wake." Since the ID's are brief, it sometimes takes a while to identify weak signals. However, an ID is usually given at the beginning and end of each contact. Using a tape recorder can be helpful; transmissions can be played back if station identification is missed.

Sometimes a rare country can be logged by studying airline schedules to determine when a plane is landing or taking off. For example, as there are only a few planes landing at the Cayman Islands, the airport station there is seldom in operation. But there is a flight leaving Miami for the Caymans on Saturday at 8 a.m. EST (Eastern Standard Time). By checking Cayman's 6537-kc. frequency at that time, Cayman can be heard contacting Miami to receive information on the plane's departure.

During the period around dawn, interesting reception can be picked up on: 8845 kc.,

from the South Pacific, including Auckland (N.Z.), Canton Island, Nandi (Fiji Islands) and Sydney (Australia); 8862 kc., from the West Pacific, with stations such as Guam, Okinawa, Taipei, and Wake; and 8871 kc., the Far East route (India to Australia), which is used by Bangkok, Darwin, Djakarta, Rangoon and Singapore. The 13,344-, 13,354- and 13,284-kc. channels of these groups are also in use at times during this

FREQUENCIES (kc.)	AREAS
5499	Southeast Caribbean
5506	East Africa, West Pacific
5521	West Africa, North Pacific
5536	West Pacific
5551	Europe, East Pacific
5566	East Caribbean
5581	Eastern South America
5589	Europe, Mediterranean
5604	Middle East, East Pacific
5611	Far East
5619	Central America
5626	North Atlantic
5641	North Atlantic, South Pacific
5671	North Atlantic
6537	Central Caribbean
6567	Caribbean, Europe
6582	Europe
6612	South Atlantic
6664	Western South America
8820	West Africa, Western South America
8837	Caribbean
8845	Middle East, South Pacific, Eastern South America
8862	North Atlantic, West Pacific
8871	East Caribbean, Europe, Far East
8879	South Atlantic, East Pacific
8888	North Atlantic
8913	North Atlantic
8930	Europe, East Pacific
8939	North Pacific
8956	East Africa
10,021	Central America
11,299	Europe
13,264	North Atlantic
13,274	North Pacific, South Atlantic
13,284	North Atlantic, Far East
13,304	West Africa, East Pacific
13,314	Western South America
13,324	North Atlantic
13,334	East Africa, Middle East, East Pacific
13,344	Caribbean, Eastern South America, South Pacific
13,354	West Pacific

period, but are less active than the 8-mc. channels.

Norfolk Island, a speck in the South Pacific, can be heard daily on 8888 kc. at 0650 EST, giving weather information to Sydney. Lord Howe Island follows on the same frequency at 0655 EST with its weather.

Late afternoon and early evening is another interesting time to tune in on: 8820 kc., used from West Africa by Dakar, Roberts (Liberia), Kano (Nigeria) and Sal (Cape Verde Islands); 8845 kc., for Middle East stations such as Bahrein Island, Beirut, Damascus and Teheran; and 8956 kc., for East Africa, including Khartoum and Nairobi.

One of the most active areas is the North Atlantic route. Gander (Newfoundland), Shannon (Ireland) and other stations can be heard contacting planes on 8862 and 8913 kc. during the day and early evening, and on 5626 and 5641 kc. during the night hours. Progress of planes flying the North Atlantic can be followed as they check with their contact stations.

In the "off-route" bands, the most interesting channels are the Military Air Transport System (MATS) frequencies: 4724, 6730, 11,228 and 13,215 kc. These are used by MATS stations and planes throughout the world. Listen for: Johnston Island, Wake, Midway and Okinawa in the early morning; Lajes (Azores), Keflavik (Iceland), Thule (Greenland) and Wheelus (Libya) in the afternoon and evening.

Verification of reception of many aero stations can be obtained by sending accurate reports to these stations. List the frequency, date, time, contacts heard, readability and strength. The reports should be addressed to: Officer in Charge, Aeronautical Radio Station——; followed by the airport name, city and country. Most of the airport names are listed in the Pan American Airways schedule.

Return postage should be sent with reports to these stations, since they do not ask for reports from listeners. U. S. SWL's can send a 7-cent airmail stamp to stations in the U. S. and U. S. Territories, and an International Reply Coupon (available at most Post Offices for 13 cents) to stations in foreign countries. Aero stations do not have printed QSL cards such as broadcast and amateur stations use, but will verify by postcard or letter, or on a prepaid reply card if you wish to include one for their convenience in replying. —30—

Kit Builder's Korner

(*Continued from page* 81)

or unmodulated signal generator. Or it can be set up as a wavemeter which will read the frequency of oscillation of an external circuit.

The GDO can also be used to determine unknown values of capacitance between 70 and 2000 $\mu\mu$fd., to measure the inductance of r.f. coils, to determine the Q of a tuned circuit, to pretune a transmitter, etc. The Heath manual devotes several pages to brief explanations and instructions on these uses. Your local library's technical section can provide you with additional data.

Comment. If you start construction of the GD-1B immediately after supper, you should have it ready to go before bedtime. Or if you're one of the slow-but-sure-type workers, it might take 1½ evenings.

As can be seen, the dipper is a compact handful. The tuning control is thumb-operated, and band-changing is accomplished by plugging in the appropriate range coil. The coils themselves are prewound and come in a neat storage box.

Reasonable care in wiring (wire placement is critical because of the frequencies involved) will reward the home constructor with a reliable instrument that deserves a place on any workbench. -30-

Electronics—Missile Control

(*Continued from page* 44)

the tilt or the azimuth changes from what it should be beyond certain limits, the officer only has to push a button which sends a signal to the missile and destroys it.

Importance of Radar. The new instrumentation radar, XN1, built by RCA and pictured on our cover this month, plays its part after the early ELSSE launch phase. Information from this radar feeds position information to an IBM 704 computer. The computer has been programed to predict where the vehicle would impact were the fuel cut at any time. The computer supplies information so that the range safety officer and Air Force officer know at all times where the vehicle would impact if either were to push a big red "destruct" button at the operating position. This is known as the impact prediction system.

When a missile is fired, the radar is directed where to point so that it will see

NUCLEAR ENGINEERING COURSE

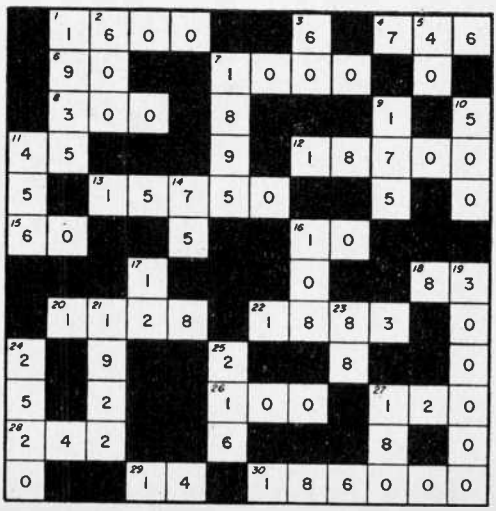
This fall will see the launching of the first home-study course in nuclear engineering. It will provide advanced education in the field to fill the predicted need for nuclear engineering technicians. The course will be given by CREI Atomics, Inc., 3224 16th Street, Washington, D. C., a subsidiary of Capitol Radio Engineering Institute.

the target. Information usually comes from sources close to the missile. This is known as target acquisition data and is provided to the XN1 which then gets on track. This is known as a monopulse radar.

The position of the "dish" is taken off digitally by digital pickup devices, and the range is also taken off digitally and is fed to the data transmission system in terms of frequency tones transmitted over regular land lines to the Cape where the computer is located. Another one of these radars situated at Grand Bahamas does the same thing and information is transmitted digitally through a submarine cable. The reason for using *digital* devices is that greater accuracy can be maintained and more precise bits of information transmitted dealing with elevation range.

The impact prediction system is only one of the many fascinating functions of electronics at the missile test center. Our congenial host, Harold Moriss, Manager of Instrumentation Engineering at RCA, explains the necessity of electronics as follows:

"In the six divisions of instrumentation which I have made in my organizational



Answer to crossnumber puzzle appearing on page 68.

setup, five of them are completely electronic, the sixth one is optics. Without those five that are completely electronic, we could make no measurements on the missile program at all. Things are happening so fast that the human mind cannot interpret or measure without electronics. Further, they're happening at a distance—in other words, we can't ride along piggyback on the missile to find out what's going on.

"We must make measurements and make these electronically and transmit them to the ground for later analysis. I think the key to the whole problem is speed and measurement at a distance. Of course the word *telemeter,* I believe, comes from the Greek which means to measure at a distance. This is precisely what we are doing with our radar systems of both pulse and c.w. type because they do the same thing. So, without electronics there would be no missile testing program."

Job Opportunities. We learned from Mr. Moriss that the engineers responsible for these fantastic devices were generally in their early 30's. In answer to our question, "What are the opportunities for young people who are willing to study electronics in this particular field?" he replied:

"I couldn't recommend any field more highly. We've just scratched the surface. I'm reminded of Columbus and the time he set out from Spain to see if the world was flat or round—this is about the position we're in regarding space work today. It's a magnificent opportunity for anyone with curiosity and ambition and who wants to find out about the unknown." —30—

Transistor Topics

(*Continued from page* 66)

frequency *p-n-p* transistor functioning as a combination mixer-oscillator.

The oscillator operates over a frequency range of 30.83 mc. to 37.5 mc., as the r.f. circuits are tuned from 88 to 108 mc. Thus, the local oscillator frequency is one-third of the FM carrier frequency plus 4.5 mc. As a result of the second and third harmonic and mixing action, two signals are obtained at the unit's output, an i.f. "picture" carrier and an FM "sound" carrier 4.5 mc. removed from the picture carrier. These output sig-

nals are coupled through a balanced output transformer to the TV receiver.

Both the "picture" and "sound" carriers are needed in TV sets employing an intercarrier-type audio system. Only the FM "sound" carrier is used in older sets with a separate sound i.f. strip.

Product News. Lafayette Radio (165-08 Liberty Ave., Jamaica 33, N. Y.) features a number of transistorized products and components in its latest catalog, including a new six-transistor receiver (FS-110), and a fully transistorized hearing aid selling for under 30 dollars (F-360). New transistor components include a receiver coil kit, subminiature earphones, and transistor audio transformers. For a free copy of the catalog, write directly to the firm.

At least two major manufacturers—Dahlberg and Zenith—have introduced transistorized *sun-powered* hearing aids. Built into special eye-glass frames, these units include small storage cells to permit operation indoors and at night.

RCA recently demonstrated a completely transistorized closed-circuit TV system. Designed for battery operation, the experimental system employed a portable receiver and a miniaturized TV camera.

Both Philco and Regency have introduced "personal" transistor receivers designed for earphone operation which retail for *less* than $20.00.

One final tip before closing. Before too long, automobile manufacturers will start announcing their new 1959 models. Watch for a variety of transistorized devices in the new cars!

See you next month. . . .

Lou

All-transistor Lafayette hearing aid is smaller than a pack of cigarettes.

Among the Novice Hams

(*Continued from page* 89)

r.f. amplifier tube, instead of its plate input, it will require very little audio power to modulate the screen voltage 100%. However, if the modulation is applied to the screen without first decreasing the screen voltage, the amplifier plate current will follow the screen voltage; but, as the plate voltage remains constant, the power output only doubles—instead of quadrupling—on modulation peaks. The result is a very distorted output signal.

By carefully adjusting the transmitter antenna loading to just beyond the point that gives maximum power output, and then reducing the d.c. screen voltage until the plate current is cut in half, the normal 70% efficiency of the amplifier is also cut in half. Consequently, the power output is quartered. Then modulating the screen causes the output to swing from zero to four times its unmodulated value at 100% modulation, as required for distortionless modulation.

Recommendations. A major disadvantage of screen modulation, compared to plate modulation, is the resulting lower output. Also, the screen-modulation characteristics of available tubes are not quite as good as their plate-modulation characteristics. Therefore, the audio quality from a screen-modulated transmitter is usually not quite as good as from a plate-modulated one.

Use plate modulation if you can afford it. But if first cost is most important, screen modulation gives excellent results at a cost of a loss of one-half to one "S unit" in signal strength.

A 90-Watt Transmitter. The WRL Globe Chief 90-A is a crystal-controlled, band-switching, c.w. (code) transmitter covering all the amateur bands from 160 meters through 10 meters, including the 80-, 40-, and 15-meter Novice bands. Its 6AG7 crystal oscillator drives a pair of 807 tubes in parallel to a maximum input of just over 90 watts. A *pi*-network tank circuit matches the transmitter output into the usual range of antenna systems.

The built-in power supply utilizes a 5U4GB rectifier. It delivers 475 volts at 235 ma. when the transmitter is loaded to its maximum rated power input of 90+ watts. At this input, the Globe Chief delivers 60 watts to the antenna on all bands up to 15

meters. On ten meters, where the 807's perform as frequency multipliers, the output power is 30 watts.

A mark on the plate milliammeter scale indicates what the plate current should be to obtain the maximum authorized Novice power input of 75 watts. This power input results in a solid 50-watt output on the Novice bands.

A "tune-transmit" switch permits tuning the oscillator without overheating the 807's or spotting frequencies without putting a full-power signal on the air. Modified grid-block keying virtually eliminates the painful shocks from the key that are always a possibility with the simple cathode keying generally used in inexpensive c.w. transmitters.

Screen Modulator. The WRL SM-90 screen modulator will convert practically any c.w. transmitter, except simple one-tube ones or those having a triode final, with a power input up to 100 watts or so into a screen-modulated phone transmitter. It can be fed from a high-impedance crystal or dynamic microphone, and employs a 12AX7 dual-triode speech amplifier to drive a 12AU7 "cathode-coupled" modulator.

The SM-90 plugs into the accessory socket of the transmitter, after a few wiring changes are made in the latter, and obtains all operating power from the transmitter. Unplugging the modulator and inserting a shorting plug in the accessory socket restores the transmitter to its original operating condition.

Universal Plate Modulator. The WRL UM-1 modulator was described fully in "Kit Builder's Korner," page 73, POPULAR ELECTRONICS, June, 1958. It can plate-modulate almost any c.w. transmitter with an input up to 100 watts. It takes a high-impedance crystal or dynamic microphone or a single-button carbon microphone.

News and Views

Charlie, KN2RDA, has made 63 contacts in 14 states, Austria, Canada, and Puerto Rico in three weeks of operation on 40 and 15 meters. He feeds a vertical antenna with his Heathkit DX-40 transmitter and receives with a Hallicrafters SX-100. . . . . Another 14-state man is **Terry, KN5POP.** His record is 80 contacts in a month with a DX-40 transmitter, Windom antenna, and Hallicrafters S-85 receiver. Terry tries to "QSL" 100% and offers to schedule anyone wanting a Texas contact. . . . . **Ray, KN4UQA,** waited six weeks for his Novice license to come after he took the test. K4AH, K4RSD, and KN4TPU have been his helpers and teachers. Thirteen

states worked and confirmed in three weeks on 40 and 15 meters indicate that his Knight 50-watt transmitter, Hallicrafters S-38E receiver, and 65′ folded dipole antenna are working well.

Ed, KN4RBQ, should have his General Class license by the time you read this. In his ten months as a Novice, his Johnson Adventurer transmitter pushed his signal into 20 states on 80 and 40 meters via a 75′ antenna, 15′ high. Ed listens with a Hallicrafters S-38D receiver, QSL's 100%, and gets a 60% return. He is president of the Powhatan Amateur Radio Club. . . . . **Mike, KN6KMM,** just passed his General Class exam after 2½ months as a Novice. In that time, he has worked 27 states, 24 confirmed, with Australia being his best DX. A Heathkit DX-20 excites either a 15-meter "ground-plane" antenna or a 66′ end-fed wire. A Heathkit AR-3, helped by a Q-Multiplier and a preselector (see POPULAR ELECTRONICS, February, 1956), does the receiving. Mike operates on 15, 40, and 80 meters. He offers to help prospective Novices obtain their licenses. . . . . **Pat, KNØOIW,** "wasted" five weeks after securing his license in getting on the air; so he worked 25 states the first 25 days. At the end of a month, he had 26, with 22 confirmed, in 95 contacts on the 80-, 40-, and 15-meter bands. Pat uses an Adventurer transmitter to excite a Windom antenna. His pet peeve is those "sincere" promises of a QSL card, immediately followed by no card—ever.

Mike, KN7CAZ, started out with a 15-watter lent to him by W7FON, a science teacher who helps many Novices get on the air. After six weeks with that rig, Mike graduated to a DX-40. Now, after four months on the air, he has 38 states worked, plus many contacts with Canada, Alaska, and Hawaii. Mike operates on 15 in the daytime and on 80 at night. He and his friend, Larry, KN7CFX, will schedule anyone needing a Washington QSL card. Mike's 200-odd contacts have netted him only 80 cards. . . . . **Bill, KN5MUS/MM,** keeps many of the stations he works confused with the "/MM" he tacks on the end of his call letters. The mysterious letters stand for "maritime/mobile," required because Bill does all of his operating from the tanker "S.S.R.E. Wilson," on which he is second engineer. FCC regulations keep him on 15 meters, where his WRL Globe Chief, 15-

Study Guide

Here's a tip for all those who are using the "License Manual" as a study guide in preparation for the General/Technician/Conditional Class examination. There are ten questions and diagrams in the Extra-Class section of the manual which you should study as well as those in the General-Class section. Many applicants overlook these questions and have trouble passing the examination as a result. A footnote to the General-Class section of the manual gives the numbers of the added questions.

meter dipole, and choice of a Hammarlund HQ-110 or Hallicrafters SX-100 receiver have pushed and pulled his signal in and out of 41 states, 35 confirmed.

Wes, KØJUV, and **Tex, K2VAB,** may be spending all their time playing chess with each other over the air. Contact either of them if you would like to play chess by radio. Wes divided his eight months as a Novice between the three low-frequency Novice bands. Now, he spends most of his "air time" chasing DX on 20 meters, starting at 4:00 a.m. His Globe Chief 90-A and S-38D have given him 250 confirmed contacts in 41 states and 17 countries. The antenna tuner described in POPULAR ELECTRONICS, November, 1957, helps the S-38D drag the signals in. . . . . **Tex, K2VAB,** now runs 240 watts to a Johnson Valiant transmitter into a "long wire" antenna and receives with a Hammarlund HQ-150. He has a D-104 microphone; so some of his 44 states and five foreign countries may have been worked on phone. . . . . **Dave, KN8HZN,** is desperately looking for Rhode Island, Delaware, and Nevada to complete his WAS as a Novice on 15 and 40 meters. His best DX is Israel and Australia, in a total of 14 foreign countries worked. All his work is done with a dipole antenna, WRL Globe Scout 680 transmitter, and Hallicrafters SX-99 receiver.

Alan, KN5KAW, is organizing the "Bleeding Fist Radio Club" for operators who, in spite of all their efforts, are unable to make contacts. His record is *one* contact in 10 months of trying. This single contact was made with a local with the aid of a telephone call to set it up. "Between contacts," Alan has changed transmitters and antennas. (If membership is retroactive, I am eligible, because I could not work out of the city for many months after getting my first license, even though my transmitter worked wonderfully at other hams' locations). . . . . **Russ, KN9LXV,** waited 70 long days to arrive after taking the examination, but in a week on the air, he has made 56 contacts in 16 states, using an Adventurer to drive a 66′ doublet on 40 meters. He offers to help prospective Novices get their licenses. . . . . **Stephen Cohen, K2CYZ,** (1900 Quentin Rd., Brooklyn 29, N. Y.), also would like to help prospective amateurs obtain licenses.

CANADIAN HAMFEST

The 1958 Alberta Hamfest will be held in Edmonton on August 23 and 24. A banquet, a picnic and special events with prizes will be featured. Everyone is welcome. For further information, contact the Northern Alberta Radio Club, Box 163, Edmonton, Alberta, Canada.

Contributors to News and Views: **Charlie Steinberg, KN2DRA,** (15), 3 Dunster Road, Great Neck, L. I., N. Y.; **Terry Griffin, KN5POP,** (16), Rt. 2, Mt. Enterprise, Texas; **Ray Linnville, KN4UQA,** 1106 E. Tunis St.,

Pensacola, Fla.; **John "Ed" Buck, KN4RBQ**, (16), RFD #2, Box 31, Powhatan, Va.; **Mike Cabourne, KN6KMM**, 9534 East Underwood St., Pico, Calif. (Tel.: OX-5-3900); **Pat Wintheiser, KNØOIW**, 61A Nassau, St. Peter, Minn.; **C. Mike Lamb, KN7CAZ**, (13), 557 24th Ave., Longview, Wash.; **William H. Riley, KN5MUS/MM**, (43), Tanker "S.S.R.E. Wilson," 162-B Teichman Rd., Galveston, Texas; **Wesley Reinhold, KØJUV**, 2627 Glaspell, Davenport, Iowa; **Tex Birnholz, K2VAB**, 634 High St., Newark 2, N. J.; **Dave Formet, KN8HZN**, 1733 Clarendon N.W., Canton, Ohio; **Alan Rayne, KN5KAW**, 4370 El Paso, Beaumont, Texas; **Russell Beard, KN9LXV**, R.R. 2, Mt. Carmel, Ill.

Let's read about what *you* did next month. Send a picture of yourself and your station, too, if you have a sharp one available. 73,

Herb, W9EGQ

▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲

Short-Wave Report

(*Continued from page 60*)

The following is a resume of the latest reports. All times shown are Eastern Standard and the 24-hour system is used. At time of compilation, all reports are correct. Stations change frequencies and/or schedules with little or no advance notice.

Albania—*Radio Tirana*, 6900 kc., carries English at 1700-1730 and again at 2330-0030. The latter xmsn is usually at good level. (*11, 390*)

Argentina—LRA, Buenos Aires, 15,345 kc., has an Eng. period at 1800-1900 followed by Spanish to 2000. Reception reports are requested. (*59*)

LRY, Buenos Aires, 9690 kc., is heard well at 1930-2330, with Eng. news presented at 2300 and 2325 Tuesday thru Saturday. (*59, 88, 313*)

Austria—*Osterreich Rundfunk*, Vienna, has an Eng. broadcast on 7245 kc. from 0430 to 0530 at good level. (*11*)

Belgium—*World's Fair Radio*, Brussels, operates in Eng. at 1930-2000 (except Wednesdays) (Saturday at 1815-2000) on 9745 kc. (to South America), and at 9655, 11,850, and 15,335 kc. (to N.A.) Reports go to *World's Fair Radio*, Post Box 26, Brussels 1, Belgium. (*RL, 192, 338, 386*)

Brazil—ZYR96, *A Voz do Brasil*, Sao Paulo, 9620 kc., is noted in Belgium from 1725 with commercials but is difficult to read after 1730 due to QRM from Rome. (*RV*)

ZYE2, *Radiodifusora de Macapa*, Macapa, 4915 kc., has been heard at 0330 s/on in Portuguese. Latin-American marimba and organ mood music noted to 0400. Signal good until 0415. A local government station, ZYE2 is rarely heard. (*61*)

Bulgaria—*Radio Sofia* has been found on 15,330 kc. at 2000-2030 and 2200-2230. At 2030 and 2230 Sofia left the air and Moscow took its place. This is to N.A. with Eng. news at the opening. (*59, 226, 378, 396, 420*)

Burma—Burma B/C System (*Myamna Athan*), Rangoon, is being reported on 15,365 and 9641 kc. as well as on the regular 11,764- and 7118-kc. channels for its Eng. period at

0915-1015 with news at 1000. Signals fair in western areas. (*396, 400*)

Canada—*R. Canada* operates to the USA at 2000-2040 on CKCX, 15,190 kc., and CKLP, 9585 kc., and to the Caribbean areas at 1645-1740 (Eng. from 1705) on CKUS, 15,105 kc., and CKNS, 17,820 kc. (*JH, 23, 399, 403*)

Dominican Republic—*La Voz Dominicana,* Ciudad Trujillo, has a special Eng. xmsm on Saturday at 2100-2115 on HI2T, 9735 kc., and possibly on HI4T, 5970 kc. The beginning of the program is devoted to information about the country; news to close at 2115. (*RW*)

Finland—The Finland DX Club has a monthly program over OIX5, 17,800 kc., and OIX4, 15,190 kc., on the first Tuesday at 1730-1800 (to S. America) and at 2300-2330 (to N.A.). After Sept. 22, the times will be 0630-0700 (to S. America) and 0830-0900 (to N.A.). Reception reports are welcome and correct reports will be verified by the regular Finnish B/C Co. card as well as by a card from the DX Club. Reports go to: Finnish B/C Co., Unionkatu 16, Helsinki. (*Finland DX Club*)

France—*Radio Paris* can be heard easily on 21,740 kc. during its French xmsn to Canada at 1230. (*416*)

Guatemala—TGNA, Guatemala City, 11,850 and 9668 kc., is believed to have shortened its Eng. xmsn to N.A. to 2200-2300 although the "Mailbag" is noted Wednesday at 2345. (*DJ, 405, 433*)

Hungary—*R. Budapest* is scheduled (through October) at 1900-2000 and 2200-2330 on 11,910, 9833, and 7220 kc. Music at 1930-2000 and 2230-2300, with a special Sunday musicale at 1730-1800 on 11, 910 and 7220 kc. only. (*338*)

Israel—*Kol Zion Lagolah (Voice of Zion),* Jerusalem, 9008 kc., has an Eng. xmsn daily at 1630-1730 with news followed by talks. A Hebrew lesson is noted on Monday and Wednesday. Reports go to: Box 754, Jerusalem, Israel. (*JF, 61, 416*)

Italy—*Radio Roma,* Box 320, Rome, broadcasts in Italian to So. and Central America at 1340-1400 on 21,560 kc.; to N.A. in Eng. at 1930-1950 on 11,900 and 15,400 kc.; to Western N.A. at 2205 on 11,900 and 9570 kc. They want reports and requests for musical numbers. (*61, 88, 386*)

Japan—NHK, Tokyo, is noted to Eastern N.A. at 1800-1900 and to Western areas at 0000-0100 over JOA24, 17,855 kc., and JOB21, 15,325 kc. The first half hour is in English. JOA20, 17,825 kc., and JOB5, 15,235 kc., have Eng. to Hawaii at 0200-0230. Other outlets noted in Japanese include JOZ3, 9595 kc., at 0245 and JKI2, 9655 kc., at 0310. The Armed Forces Radio Service at Camp Drake is noted on 11,750 kc. at 0345 and on 6160 kc. at 0400-0530 with U.S. network programs; news on the hour. (*WK, JS, 225, 338, 373*)

Lebanon—Beirut on 8036 kc. (varies) has English from 1000 to 1100 with news at 1000. This one is tough to log due to QRM. (*313*)

Liberia—ELWA, Monrovia, has extended the N.A. service as follows: 1800-1945 on 21,510 and 15,200 kc., and 2000-2145 on 21,510 and 11,986 kc. Tuesday only. (*JA, NK, 286*)

Mexico—XELZZ, Mexico City, 11,860 kc., now has an Eng. segment at 2100-2130 with "Record Round-up"; it closes with the news.

Further checks are being made to determine if this is a daily feature. XEOI, Mexico City, is definitely on 6110 kc., despite conflicting reports that it is on 6010 kc. It was noted at 2300 with pop records. (*420*)

XESC, Mexico City, 15,205 kc., can be heard often around 1830 or earlier with L.A. music and commercials in Spanish. The ID, given quite frequently, is *Heraldos de los Telas del Junco.* (*344*)

XERUU, Chihuahua, 15,300 kc., is noted in western areas at 1200-1700 with all Spanish programs, frequent ID, commercials, L.A. and N.A. music. The ID is *Radio Universidad* and the call is XERUU, not XELUU as thought by some DX'ers. (*61*)

New Guinea—The Australian B/C Commission, VLT6, Port Moresby, carries an Eng. newscast on 6135 kc. at 0400, usually relayed from either Australia or England. This 2-kw. station may be difficult to log. (*313*)

Panama—HOF31, *Reloj de Panama* (or) *Circuito R-P-C,* Panama City, 9685 kc., is noted evenings from 2230 to 0002/close with clock ticks, commercials, and music. This is the short-wave outlet of HOHM. The two slogans, given above, are interspersed. (*59, 396, 420*)

Peru—A new outlet is *Radio Loreto,* Iquitos, 9590 kc., heard at 1730-1930 with So. American and light music, and a religious program from 1930. No English has been noted to date. (*RV, 420*)

An unidentified station that has Spanish news at 2130-2135 on 9345 kc. has been giving the ID for *Radio La Cronica,* but it is believed that this is a chain relay and not OAX4J, which is further up the band. (*420*)

OAX4W, *Radio America,* Lima, has been on the move; it was once noted on 9415 kc. at 2222 and later on 9455 kc. at 0020-0100 in Spanish. (*59, 396, 420*)

OAX4K, *Radio Central,* Lima, 9545 kc., is noted with an all-Spanish xmsn at 1830-1950 with ID every 30 minutes as *Aqui Radio Central, la Emissora mas Popular.* (*59*)

Poland—*Radio Warsaw* operates to N.A. at 1930-2230 on 17,800, 15,275, and 11,705 kc. with

RADIO CLUBS YOU CAN JOIN

We continue to receive many requests for information on radio clubs. Here is a resume of the larger ones.

Newark News Radio Club (NNRC) issues a monthly bulletin covering the broadcast, ham, FM, TV, short-wave broadcast and short-wave commercial bands. Dues are $4.00 yearly. A sample bulletin can be obtained for 10 cents from the NNRC, 215 Market St., Newark 1, N. J.

Universal Radio DX Club (URDXC) issues a total of 19 bulletins yearly, covering the short-wave broadcast and ham bands. Dues are $3.00 yearly. A sample bulletin may be had by writing to URDXC, 21446 Birch St., Hayward, Calif.

International Shortwave Club (ISWC) issues a monthly bulletin covering the short-wave broadcast and ham bands. Information on dues and membership requirements can be obtained from ISWC, 100, Adams Gardens Estates, London, SE 16, England.

a talk on stamps at 2000 on the second and fourth Wednesday. The mailbag is presented on Mondays at 1930. (*JH, WH, 282, 291, 399, 420, 425*)

Sarawak—*R. Sarawak,* Kuching, carries Eng. news that is heard in Western areas at 0800 on 9565 kc. (strong) and 4945 kc. (fair). S/off at 0945. (*338, 400*)

South Korea—*The Voice of Free Korea,* Seoul, 11,925 kc., is noted at 0300-0330 in Eng., and until 0400 in Korean. This is a daily xmsn. (*409*)

South Vietnam—Saigon, 7260 kc., carries Eng. at 0115-0200, 0845-1000, and 1915-1945. The latter xmsn is not likely to be heard in the USA. Reports go to: #3, duong Phandinh-Phung, Saigon, Vietnam. (*409*)

SHORT-WAVE ABBREVIATIONS

anmt—Announcement
B/C—Broadcasting
Eng.—English
ID—Identification
kc.—Kilocycles
L.A.—Latin America(n)
N.A.—North America(n)
QRM—Station interference
R.—Radio
s/off—Sign-off
s/on—Sign-on
xmsn—Transmission from station

Spain—*R. Oviedo,* Oviedo, 7230 kc., is noted at 1110 with the "Ave Maria Hour," at 1125 with ID, at 1135 with request program. (*RV*)

Surinam—PZC, *R. Surinam,* Paramaribo, 15,406 kc., is heard well at 1815-2000 with mostly Dutch xmsns to the Caribbean areas. An Eng. newscast may be heard Mondays at 2000. Signal is usually good but careful tuning is needed. (*61, 286*)

Switzerland—*R. Switzerland* operates to Eastern N.A. at 2030-2215 on 6165, 9535, and 11,865 kc., and to Western N.A. at 2315-0000 on 9535, 11,865, and 15,305 kc. The mailbag session is aired on the last Sunday of each month and the DX program on the first Friday. Other xmsns: to Australasia at 0215-0445 on 11,865, 15,305, and 21,520 kc.; to Japan at 0745-0930 on 15,305, 17,704, and 21,520 kc; to India at 0945-1130 on 11,865 and 21,605 kc.; to Africa at 0945-1145 on 21,502 kc.; to the Far East at 1145-1330 on 17,784 and 21,605 kc.; and to the United Kingdom at 1345-1530 on 7210 and 9665 kc. (*MH, CQ, 303, 386, 403, 405, 406, 411, 425*)

Tangier—*Radio Eurafrica* has been noted testing on 11,458 and 9270 kc. from s/on at 1658-1705 (varies) to s/off 1728-1736 (varies), with anmts in Eng., German, French, Swedish, and Arabic. Reports requested. (*MM, 59*)

Thailand—A station believed to be the National Police Station in Bangkok has been heard on 7080 kc. at 0200-0230 in English. (*11*)

Union of South Africa—The S. African B/C Service, Johannesburg, 25,800 kc., is noted on Tuesday, Thursday, and Saturday from 1200 to 1230/fade-out with Eng. xmsn of talks and recorded music. This can be a real tough one to log due to propagation disturbances, especially for DX'ers in western states. (*61*)

United Arab Republic—The Cairo (Egypt)

outlet of the United Arab Republic B/C Service is tuned at 1120-1130 in the Swahili language and at 1130-1157 in other East African languages. This xmsn is fantastically similar to that of the station listed later in this column under "Clandestine." (*396*, Editor)

Vatican City—The *Vatican Radio* carries Eng. daily at 1000 and 1315 on 9646, 11,685, and 15,120 kc., as well as on Tuesdays only at 1100. (*383*)

Windward Islands—The Windward Islands B/C Service, Grenada, operates on 9550, 5010, and 3365 kc. to the Eastern Caribbean area, and on 17,915 kc. to Jamaica. The 9550 kc. outlet is used only for special daytime broadcasts. The 3365-kc. channel replaces 5010 kc. at 1730. (*286, 384*)

Yugoslavia—Belgrade is using a new outlet of 15,230 kc. at 0730-0800 with home news in Eng. and some orchestra music. (*226*)

Clandestine—*Voice of Free Africa* (possibly located in Egypt—Ed.) is noted on 17,892 kc., opening at 1200 with drums. ID is *Sawt ya Africa Hurru*, then political speeches in emotional tones in the Swahili language. (*396*)

Utility Stations—VZNF, Dep't. of Civil Aviation, Norfolk Island, broadcasts a weather report to Sydney, Australia, daily at 0050 on 11,290 kc. EIP, Shannon Airport, Ireland, has weather data for the North Atlantic areas daily at 0050 on 8828.5 kc. (*286*) —30—

SHORT-WAVE CONTRIBUTORS

Jim Alexander *(JA)*, Spring Lake, N. J.
J. B. Fisher *(JF)*, Portland, Maine
James Howard *(JH)*, Kansas City, Mo.
Mike Hakes *(MH)*, Decatur, Ind.
Werner Howald *(WH)*, Los Angeles, Calif.
Dennis Jacobs *(DJ)*, Port Angeles, Wash.
Nels Knutzen *(NK)*, Green Bay, Wis.
William Kirkpatrick *(WK)*, Oaklyn, N. J.
Richard List *(RL)*, Pittsburgh, Pa.
Mark Murphy *(MM)*, McDonald, Pa.
Chris Quigg *(CQ)*, Bethlehem, Pa.
Jim Snavley *(JS)*, Inglewood, Calif.
Roger Vlaminck *(RV)*, Ghent, Belgium
Randy Williams *(RW)*, Waynesboro, Pa.
Chuck Maxant *(11)*, Baldwin, N. Y.
Peter Risse *(23)*, Atlanta, Ga.
Grady Ferguson *(59)*, Charlotte, N. C.
John Beaver *(61)*, Canon City, Colo.
Jack Stephenson *(88)*, Oklahoma City, Okla.
Danny Ferguson *(192)*, Columbia, S. C.
Stewart MacKenzie, Jr. *(225)*, Long Beach, Calif.
William McK. Bing *(226)*, New Orleans, La.
Bob Kapsch *(282)*, Roselle Park, N. J.
Maurice Ashby *(286)*, Wichita, Kansas
Paul Edelson *(291)*, Brooklyn, N. Y.
Hank Reixach *(303)*, Springfield, Md.
Denny Avers *(313)*, Keyser, W. Va.
Esther Cottingham *(338)*, Redwood City, Calif.
Fred Colley, Jr. *(344)*, West Palm Beach, Fla.
David Buerger *(373)*, Milwaukee, Wis.
J. P. Arendt *(378)*, Aurora, Ill.
L. E. Kuney *(383)*, Detroit, Mich.
Riley Sundstrom *(384)*, Stockton, N. J.
Dan Wilt *(386)*, Barberton, Ohio
John Thresher *(390)*, West Nyack, N. Y.
Bob Palmer *(396)*, Spokane, Wash.
Nathan Reiss *(399)*, Bronx, N. Y.
August Balbi *(400)*, Los Angeles, Calif.
Creed Freeman, Jr. *(403)*, Fayetteville, N. C.
J. A. Fredricks *(405)*, Yakima, Wash.
Richard Flam *(406)*, Bellerose, N. Y.
Jack Allen *(409)*, Hanford, Calif.
Jimmy Cox *(411)*, Gadsden, Calif.
Joel Bowers *(416)*, Brooklyn, N. Y.
A. R. Niblack *(420)*, Vincennes, Ind.
George Fenerty *(425)*, Halifax, N. S.
Bill Fredericks *(433)*, Everett, Mass.

POPULAR ELECTRONICS

BARGAIN BASEMENT

SAVE ON THESE SPECIAL BUYS OF THE MONTH

METAL LOCATOR ENTHUSIASTS

This is for you . . . BC-1141-C amplifier, the electronic heart of the famous SCR-625 mine detector. This unit is brand new with 2-IN5 and 1-1G6 vacuum tubes, in steel carrying case with handle; net weight with batteries is only 10 pounds. It operates from internal batteries (not included) and is complete with schematic diagram of the whole SCR-625 detector set. Case measures 14" by 6" by 5" including hinged cover. Operating panel hinges out for easy access to interior shock mounted chassis. This is a 1000 cycle fixed frequency amplifier, brand spanking new, and a once-in-a-lifetime bargain at $5.95. Set of 3 spare vacuum tubes $1.00. Shipping weight 12 pounds.

Write for free government surplus bargain bulletin

JOE PALMER, P. O. Box 6188 CCC, Sacramento, California

MINIATURE POWER SUPPLY KITS

Each kit uses (2) transformers and dry plate rectifiers. Chassis may be floated or gnd. Size: 5"x5"x4½" h. Input: 115 V. 60 cyc. Simple assembly in less than 2 hours!

A-612—6 vdc. @ 1.5 amps., or 12 vdc @ 1 amp. Use for testing transistor ckts., or mod. R.R., bat. chgr., plating, etc. COMPLETE ONLY **$6.95**

A-175—175 vdc. @ 40 ma. and 6 or 12 vac. @ 1.2 amps. Fil. Ideal for hi-fi preamps., tuners, converters, etc. COMPLETE ONLY **$6.95**

P-68 —Fil. transf. 12.6 v. @ 1.5 amps. .....98 ea.

CS-6 —Rectifier. Brdge. 12 vac. to 6 vdc. @ 1 A. .....45 ea.

Orders shipped same day • Postpaid in U. S. only. NO C.O.D.'s

Satisfaction Guaranteed

ALECTRONIC LABS. 6511 N. FAIRFIELD AVE. CHICAGO

RADIO CONTROL Headquarters

For Models F R E E Send for FCC Form 505 & Catalog "P"

R/C RECEIVER 27¼ Mc, Compl. w. Relay, Tube, Acces. Wired $8.61; Compound Escapement **$3.95**

R/C XMITTER Hi-Power HAND-HELD, compl., $17.95; KIT 11.95

R/C TRANSMITTER & RECEIVER KIT; 27¼ mc. 5 watt 2-Tube Simple Transm. & 2-Tube Rec. incl. Drilled Bases, Wound Coil, Res., Cond., SIGMA Relay, Instruc..... **9.95**

HANDIE-TALKIE Transmitter & Receiver Chassis. New, Wired, with tube—2 Triodes..... **6.65**

SIGMA 4F RELAY: 8,000 ohm, $4.25.....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. $2.85.....HOLDER .15
2" METERS 0-1 Ma. $3.65....500 MicroA $3.95; 3 Ma 2.95

RELAY CONTROL UNIT incl. Sensitive 10,000 ohm Sigma Relay (1½ Ma) Thermal Bimetal Strip. Heating Element, Hi Z Audio Choke, Mini Alnico V Magnet, Neon Lamp. Resistors, Capacitors, only **99c**

TUBES: XFG1, RK61, 3A4, 3A5, 1AG4, 6K4 Transistor .99
RELAYS, 10K ohm, 2 Ma DC or 110V AS SPDT, 95c; SPST .85

GYRO ELECTRONICS 325-P CANAL ST. NEW YORK 13, N. Y.

POWER TRANSISTOR EXPERIMENTERS KIT!!!

1—CBS 2N255 Power Transistor
1—CBS 2N256 Power Transistor
1—Argonne AR-503 Transformer — 6 Watt 48 C.T. to 3.2 Ohm
1—Argonne AR-504 Transformer — 2 Watt 100 to 200 C.T.
1—4-Inch PM Speaker
5—Sub-Min Electrolytic Condensers
5—Asstd. Volume Controls
50—Asserted Resistors
10—Asserted Ceramic Condensers
5—Assorted Trimmer Condensers
25—Asstd. Terminal Strips
1—1N34A Diode
2—P-N-P Transistors
2—N-P-N Transistors

CBS Experimenters Handbook—Raytheon Experimenters Handbook

ALL FOR ONLY $11.95

GROVE ELECTRONIC SUPPLY COMPANY

4103 W. BELMONT AVE. CHICAGO 41, ILLINOIS

Include Postage W/Order—Send for Latest Argonne Catalog

ADVERTISERS INDEX

Classified

RATE: 50¢ per word. Minimum 10 words prepaid. September issue closes July 3rd. Send order and remittance to: POPULAR ELECTRONICS, 1 Park Ave., New York 16, N. Y.

FOR SALE

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.

NEW! Pocket radio transmitter uses transistor. Plans 25¢. Free literature on all our products available at factory prices. Springfield Enterprises, Box 54-E8, Springfield Gardens 13, N. Y.

WALKIE-TALKIE chassis $7.98. See our display ad in this issue. Springfield Enterprises.

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-E8, Springfield Gardens 13, N. Y.

CITIZEN'S 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-E8, 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.

GOVERNMENT Surplus Receivers, Transmitters, Snooperscopes, Parabolic Reflectors, Picture Catalog 10¢. Meshna, Malden 48, Mass.

GOVERNMENT Sells—Surplus Electronics; Walkie-Talkies; Test Equipment; Oscilloscopes; Radar; Sonar; Surplus Aircrafts; Boats; Jeeps; Misc.—You buy direct now from U. S. Government Depots at fractions of Army & Navy costs—Send for bulletin "Depot List & Procedure" $1.00. Box 8-PE, Sunnyside 4, N. Y.

TELEVISION Sets $11.95 Plus Shipping, Jones, 147 High Street, Pottstown, Pa.

1" MINIATURE Meters; Stock ranges Available, Details; Alco Electronics, Lawrence, Mass.

ASSEMBLE, repair, Fluorescent Fixtures. Free catalog—Kits, parts, etc. Shoplite, 650E Franklin, Nutley 10, New Jersey.

INSULATORS, New, Government Surplus, 250, Shipped Free, $4.95. Fitzpatrick Sales, 60 Curtiss Circle, Miami Springs, Florida.

USED Automobile Radios for Parts and Repairs $5.00, each. American Auto Parts, 2127 East Washington Street, Indianapolis, Indiana.

TRADEIN TV sets—hundreds shipped everywhere; $9 up—also color. Write Justis Bros., Newport, Del.

TELEVISION & Radio Tubes. Parts and Supplies at low prices. One Year Guarantee. Write Hi-Quality Tube Co., Inc., 284 Lafayette St., Rahway, New Jersey, for Free price list. Distributorship openings.

KITS—$2.98 each. Resistance box, Tube checker, Capacitance box. Special! Order 2—get one free. Includes instructions, new parts, surplus case. Hi Voltage probe—29¢, 3 Alignment tools—29¢. New, used, surplus parts assortment—$1.89. Allkit, Box 98, Midwood Station, Brooklyn 30, N. Y.

"15 TESTED One-tube Circuits," Transistor experiments and catalog—25¢. Laboratories, 1131-L Valota, Redwood City, California.

FREE Wholesale Catalog—We are not printers. Watches, Tools, Binoculars, Appliances, West Coast Sales, Riverbank, California.

SCHEMATIC drawing of any radio or television. Only 59¢ postpaid. Send make and model number. DX Radio Coop, Box 5938c, Kansas City 11, Missouri.

DIAGRAMS! Repair Information! Radios—amplifiers—recorders $1.00. Televisions $1.50. Give make model, chassis. TV Miltie, Box 101RA, Hicksville, New York.

WANTED

CASH Paid! Sell your surplus electronic tubes. Want unused, clean transmitting, special purpose, receiving, TV tubes, 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. W. WAlker 5-7000.

MERCURY, Platinum, Silver, Precious Metals. Ores Assayed. Mercury Refiners, Norwood, Massachusetts.

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, 1 Park Ave., New York 16, N. Y.

INVENTIONS WANTED

INVENTIONS wanted. Patented: unpatented. Global Marketing Service, 2420—77th, Oakland 5, Calif.

BUSINESS OPPORTUNITIES

BUY Wholesale! 25,000 Nationally Advertised Products. Get amazing Dealer Catalogs. Complete Details Free. American Wholesalers, 1841-DA Levee, Dallas 7, Texas.

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.

MAKE $25-$50 Week, clipping newspaper items for publishers. Some worth $5.00 each. Particulars free. National, 81-PE, Knickerbocker Station, New York City.

BECOME Tax Consultant. Licensed home training. Union Institute, Hoboken 3M, N. J.

EMPLOYMENT INFORMATION

JOBS on merchant ships. Big pay. Box 4092, Jacksonville, Fla.

HIGH Paying Jobs, Opportunities, foreign, U.S.A. All trades. Companies pay fare. For information write Dept. 57N, National Employment Information, 1020 Broad, Newark, New Jersey.

TAPE & TAPE RECORDERS

TAPE Recorders, hi-fi components, tapes. Unusual Values. Free Catalog. Dressner, 69-02F, 174 St., Flushing 65, N. Y.

RECORDERS, HiFi, Tapes. Free wholesale catalogue. Carston, 215-P, East 88 St., N.Y.C. 28.

HIGHEST Trade-In Allowances Toward Ampex, Concertone, Crown, Ferrograph, Presto, Pentron, Components. Accessories. Catalog. Boynton Studio, 10-PE Pennsylvania, Tuckahoe, N. Y.

DISCOUNTS to 50%, recorders, tapes, hi-fi components, consoles, photograph equipment. Request specific prices only. Long Island Audio & Camera Exchange, 3 Bay 26th Street, Brooklyn 14-L, N. Y.

CORRESPONDENCE COURSES

COMPLETE Correspondence Course in Radio, TV, & Electronics. Includes FCC 1st Class License Prep. Special Summer Rates. Enroll Now. Ascot—School of Electronics, Box 29092, Los Angeles 29, California.

HIGH FIDELITY

DISGUSTED with "Hi" Hi-Fi Prices? Unusual Discounts on your High Fidelity Requirements. Write Key Electronics, 120 Liberty St., New York 6, N. Y. EVergreen 4-6071.

ENCLOSURES you can build for better listening. Also stereophonic. Free list. Lorco Plans, 6705 Murray Ave., Cincinnati 27, Ohio.

CROSSOVER network kits complete with all parts and assembly instructions. 2500 cycles, 8 ohms; 5000 cycles, 16 ohms. $4.95 each, postpaid U.S.A. 6 decibels per octave. Highest quality components. Guaranteed. Write Watson Industries, Inc., 110 Mildred Ave., Venice, Cal.

ELECTRICAL EQUIPMENT & SUPPLIES

COMBINATION Voltage Tester and Automatic Pencil. Checks 80-550 Volts AC/DC. Pocket-size. $1.00 postpaid. Empire Elec. Ind. Corp., Box 11, Bethpage, New York.

MINERAL & PROSPECTING

NO Serious Treasure Hunter—or Rockhound can be without Grieger's Encyclopedia. Tells where to search, how to identify, how to cut and polish gems, how to market them. Write for Free booklet today: Grieger's, 1633 E. Walnut, Pasadena 96, Calif.

SPECIAL SERVICES

BOOK Manuscripts Considered for national distribution. All subjects welcomed. New authors encouraged. Atten. Mr. Blythe, Greenwich Book Publishers, 489 Fifth Avenue, N. Y., N. Y.

INSTRUCTION

ENGINEERING Degrees, EE Option Electronics earned through home study. Residence classes also available. Pacific International University (Operating as a College of Engineering only at present), 5719-J Santa Monica Boulevard, Hollywood 38, Calif.

CODE courses designed and tape recorded by former U.S.N. Operator and R.R. Telegrapher. Both sides 7" 1200' reels. Learning to Six W.P.M. or Six to Sixteen W.P.M. Response to courses enables reduced prices of $3.98 each. Postpaid in U.S.A. Elham Inc., P.O. Box 98, Hawthorne, California.

NAVY Electronics Training course, one of the finest compiled, is available to the public. Excellent electronics instruction for beginners. Designed especially for self-study. Used in training Navy Electronics Technicians. 512 pages. 280 diagrams and illustrations. 16 thorough quizzes with answers. This is a high quality course, containing excellent writing, artwork and printing. An outstanding bargain made possible by U. S. Government Printing and Price Control. For your copy send $2.00 to: New England Book Distributors, Box 311, Watertown, Connecticut.

ATTENTION Television Servicemen:—Here's a real trouble shooter for all makes. Not a book, not a kit, but a classified, step by step trouble tracker. Save time! Save money! Save "call-backs." Hundreds in use, shops, technicians on the job, "pros." Write for free brochure. National Technical Research Labs, 432 N. Washington Ave., Whittier, Calif.

LEATHERCRAFT

FREE "Do-It-Yourself" Leathercraft Catalog. Tandy Leather Company, Box 791—J27, Fort Worth, Texas.

MISCELLANEOUS

SONGPOEMS And Lyrics Wanted! Mail to: Tin Pan Alley, Inc., 1650 Broadway, New York 19, N. Y.

"WINEMAKING; Beer, Ale Brewing." Illustrated. $2.00. Eaton Books, Box 1242-C, Santa Rosa, California.

Attention Photographers

THE SECRET OF "BUYING SMART" costs you only a Dollar!

You've noticed how some people seem to have a knack for buying photo equipment. Before they go into a store they know the kind of equipment they want, the manufacturer, model, features, and the price. They've compared beforehand . . . and saved themselves time, effort and money.

What's the secret? For many it's the *Photography Directory & Buying Guide* . . . a handsome catalog of all photographic equipment on the market compiled by the editors of *Popular Photography*. It tells you everything you want to know about more than 5,000 products, from cameras and lenses to film and filters—for black and white or color, for movie or still photography. The cost? Only $1.00.

1958 Edition Has These Extra Features

Besides listing over 5,000 new photo products (and illustrating more than 1,000 of them), the *1958 Photography Directory & Buying Guide* includes helpful, simplified CAMERA COMPARISON CHARTS. These charts compare the prices, shutter ranges, lens speeds and other features of over 300 press, 35mm and reflex cameras. In addition, a special 16-page section on FOTO FACTS gives data and figures on filters, films, lenses, exposure and conversion scales. An exclusive bonus, PHOTO SHORTCUTS points out ways to save money when you shoot, light, print and process. A section on PORTRAIT LIGHTING SETUPS lists tested diagrams for lighting a model. As additional features, the 1958 *Photography Directory* suggests sample MODEL RELEASE FORMS and a roundup of the LATEST BOOKS ON PHOTOGRAPHY.

The new *Photography Directory* is now on sale. This 1958 Edition, priced at only $1.00, will sell fast! So to insure yourself of a copy, pick one up at your newsstand or photo dealer's now.

ZIFF-DAVIS PUBLISHING COMPANY
434 S. Wabash Ave., Chicago 5, Illinois

The Most Versatile All-Purpose Multi-Range Tester Ever Designed!

Superior's New Model 79

SUPER-METER

WITH NEW 6" FULL-VIEW METER

A Combination VOLT-OHM MILLIAMMETER.

Plus CAPACITY, REACTANCE, INDUCTANCE AND DECIBEL MEASUREMENTS.

Also Tests SELENIUM AND SILICON RECTIFIERS, SILICON AND GERMANIUM DIODES.

Model 79 — SUPER-METER . . . Total Price $38.50 — Terms: $8.50 after 10 day trial, then $6.00 per month for 5 months.

The Model 79 represents 20 years of continuous experience in the design and production of SUPER-METERS, an exclusive SICO development.

In 1938 Superior Instruments Co. designed its first SUPER-METER, Model 1150. In 1940 it followed with Model 1250 and in succeeding years with others including Models 670 and 670-A. All were basically V.O.M.'s with extra services provided to meet changing requirements.

Now, Model 79, the latest SUPER-METER includes not only every circuit improvement perfected in 20 years of specialization, but in addition includes those services which are "musts" for properly servicing the ever increasing number of new components used in all phases of today's electronic production. For example with the Model 79 SUPER-METER you can measure the quality of selenium and silicon rectifiers and all types of diodes—components which have come into common use only within the past five years, and because this latest SUPER-METER necessarily required extra meter scale, SICO used its new full-view 6-inch meter.

Specifications

- D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500.
- A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000.
- 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.
- 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.

The following components are all tested for QUALITY at appropriate test potentials. Two separate BAD-GOOD scales on the meter are used for direct readings.

- All Electrolytic Condensers from 1 MFD o 1000 MFD.
- All Selenium Rectifiers.
- All Silicon Rectifiers.
- All Germanium Diodes.
- All Silicon Diodes.

Model 79 comes complete with operating instructions and test leads. Use it on the bench — use it on calls. A streamlined carrying case included at no extra charge accommodates the tester, instruction book and test leads.

Only **$38.50**

SHIPPED ON APPROVAL

NO MONEY WITH ORDER — NO C.O.D.

SEE FOLLOWING PAGE FOR COMPLETE DETAILS

MOSS ELECTRONIC DISTRIBUTING CO., INC. DEPT. D-483 3849 TENTH AVENUE, NEW YORK 34, N.Y.

PRINTED IN U.S.A.

Superior's New Model 82

RAPID TESTER

The Very Best Value In Multi-Socket Tube Testers!

Model 82 — RAPID TESTER . . . Total Price $36.50 — Terms: $6.50 after 10 day trial, then $6.00 monthly for 5 months.

Production of this Model was delayed a full year pending careful study by Superior's engineering staff of this new method of testing tubes. We don't expect it to replace conventional testers but if you want to try this new type of tester, you can do no better than mail the coupon below. *Don't let the low price mislead you! We claim Model 82 will outperform similar* looking units which sell for much more—and as proof, we offer to ship it on our examine *before* you buy policy.

'rimarily, the difference between the conventional tube ester and the multi-socket type is that in the latter, the se of an added number of specific sockets (for example, n Model 82 the noval is duplicated eight times) permits limination of element switches thus reducing testing ime and possibility of incorrect switch readings.

'o test any tube, you simply insert it into a numbered ocket as designated, turn the filament switch and press down the quality switch — THAT'S ALL! Read quality on neter. Inter-element leakage, if any, indicates automatically.

FEATURES:

- ★ Dual Scale meter permits testing of low current* tubes.
- ★ 7 and 9 pin straighteners mounted on panel.
- ★ All sections of multi-element tubes tested simultaneously.
- ★ Use of 22 sockets permits testing all popular tube types and prevents possible obsolescence.
- ★ Ultra-sensitive leakage test circuit will indicate leakage up to 5 megohms.

$36.50

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-483 3849 Tenth Ave., New York 34, N. Y.

Please send me the units checked on approval. If completely satisfied I will pay on the terms specified with no interest or finance charges added. Otherwise, I will return after a 10 day trial positively cancelling all further obligation.

☐ Model 82 .....Total Price $36.50 $6.50 within 10 days. Balance $6.00 monthly for 5 months.

☐ Model TW-55 .....Total Price $26.95 $6.95 within 10 days. Balance $5.00 monthly for 4 months.

☐ Model 79 .....Total Price $38.50 $8.50 within 10 days. Balance $6.00 monthly for 5 months.

☐ Model TW-11 .....Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.

Name .....

Address .....

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

All prices net, F.O.B., N. Y. C.

SHIPPED ON APPROVAL

NO MONEY WITH ORDER

NO C.O.D.

Model TD-55 — TUBE TESTER . . . Total Price $26.95 — Terms: $6.95 after 10 day trial, then $5.00 per month for 4 months.

Superior's New Model TD-55
EMISSION TYPE

TUBE TESTER

For the Experimenter or Part-time Serviceman, who has delayed purchasing a higher priced Tube Tester.
For the Professional Serviceman, who needs an extra Tube Tester for outside calls.
For the busy TV Service Organization, which needs extra Tube Testers for its field men.

Speedy, yet efficient operation is accomplished by: 1. Simplification of all switching and controls. 2. Elimination of old style sockets used for testing obsolete tubes (26, 27, 57, 59, etc.) and providing sockets and circuits for efficiently testing the new Noval and Sub-Minar types.

You can't insert a tube in wrong socket
It is impossible to insert the tube in the wrong socket when using the new Model TD-55. Separate sockets are used, one for each type of tube base. If the tube fits in the socket it can be tested.

"Free-point" element switching system
The Model TD-55 incorporates a newly designed element selector switch system which reduces the possibility of obsolescence to an absolute minimum.

Checks for shorts and leakages between all elements
The Model TD-55 provides a super sensitive method of checking for shorts and leakages up to 5 Megohms between any and all of the terminals.

Elemental switches are numbered in strict accordance with R.M.A. Specifications.
The 4 position fast-action snap switches are all numbered in exact accordance with the standard R.M.A. numbering system. Thus, if the element terminating in pin No. 7 of a tube is under test, button No. 7 is used for that test.

Complete with carrying case **$26.95 Net**

Model TW-11 — TUBE TESTER . . . Total Price $47.50 — Terms: $11.50 after 10 day trial, then $6.00 per month for 6 months.

Superior's New Model TW-11
STANDARD PROFESSIONAL

TUBE TESTER

- **Tests all tubes,** including 4, 5, 6, 7, Octal, Lockin, Hearing Aid, Thyratron, Miniatures, Sub-miniatures, Novals, Subminars, Proximity Fuse Types, etc.
- **Uses the new self-cleaning Lever Action Switches for individual element testing. All elements are numbered according to pin-number in the RMA base numbering system.** Model TW-11 does not use combination type sockets. Instead individual sockets are used far 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.** Printed in large easy-to-read type.

NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier detects microphonic tubes or noise due to faulty elements and loose internal connections.

EXTRAORDINARY FEATURE
SEPARATE SCALE FOR LOW-CURRENT TUBES Previously, on 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 scale. The extra scale used here greatly simplifies testing of low-current types.

Housed in hand-rubbed oak cabinet **$47.50 Net.**

TRY FOR 10 DAYS

BEFORE **you buy!** ***THEN*** **if satisfactory pay in easy, interest free, monthly payments. See coupon inside**

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!

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.