HOW TO USE TV TEST PATTERNS

POPULAR ELECTRONICS

JUNE 1961

35 CENTS

Building Plans for:

- Transistorized Heart Monitor
- Moisture Meter for Gardeners
- Underwater Fish Caller
- Magnetic Coin Tosser
- Musical Telephone Holder
- CB to Ham Band Transceiver
- Loudspeaker Metronome

This is CADRE 2-Way Radio

developed by CADRE INDUSTRIES CORP. for the 27 Mc CITIZENS BAND OPERATION

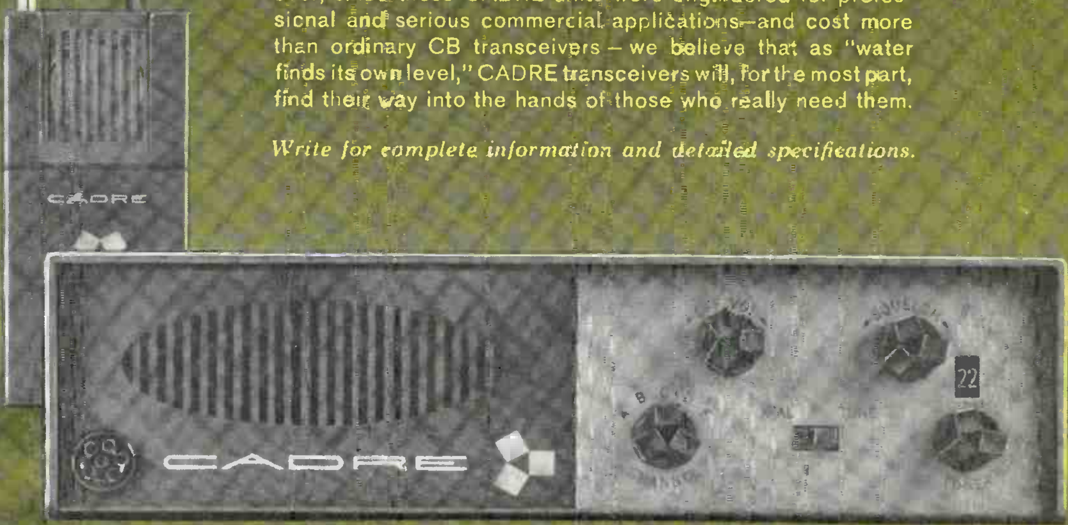
These CADRE units are built to the highest standards of the electronics industry, by a company that has been long established as a prime manufacturer of precision electronic research equipment and computer assemblies. CADRE transceivers are 100% transistorized – compact, lightweight . . . engineered for unparalleled performance and reliability.

The CADRE 5-Watt Transceiver, at $199.95, for example, for offices, homes, cars, trucks, boats, aircraft, etc., measures a mere 11 x 5 x 3", weighs less than 6 pounds! Nevertheless, it offers 5 crystal-controlled transmit/receive channels (may be used on all 22), and a range of 10 miles on land, 20 over water!

The CADRE 100-MW Transceiver, $124.95, fits into a shirt pocket! Weighs 20 ounces, yet receives and transmits on any of the 22 channels . . . efficiently, clearly . . . without annoying noise. A perfect "pocket telephone"!

For the time being, it is unlikely that there will be enough CADRE transceivers to meet all the demand. Obviously, our dealers cannot restrict their sale to the fields of medicine, agriculture, transportation, municipal services, etc. However, since these CADRE units were engineered for professional and serious commercial applications—and cost more than ordinary CB transceivers – we believe that as "water finds its own level," CADRE transceivers will, for the most part, find their way into the hands of those who really need them.

Write for complete information and detailed specifications.



CADRE INDUSTRIES CORP., Endicott, N.Y.

Prices appearing in this advertisement are suggested retail prices

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. Second-class postage paid at 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

JUNE 1961

VOLUME 14 NUMBER 6

ZIFF-DAVIS PUBLISHING COMPANY

POPULAR ELECTRONICS is indexed in the Readers' Guide to Periodical Literature

Special Feature

Electronic Construction Projects

Audio and High Fidelity

Amateur, CB, and SWL

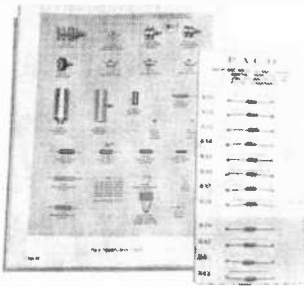
Electronic Features and New Developments

Departments

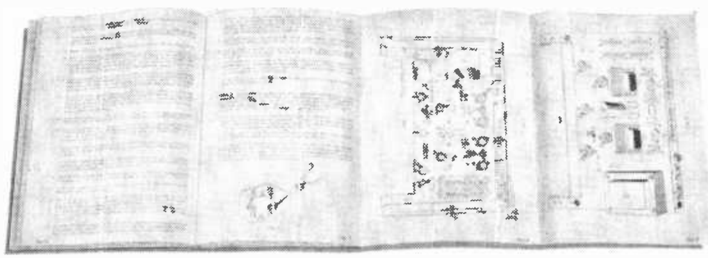
THIS COULD HAPPEN TO YOU...UNLESS

THE KIT YOU BUILD IS A PACO

COMPARE THESE PACO FEATURES:



No mistaken identity or endless searching. Parts are clearly pictured and labeled; resistors are neatly mounted and identified!



Step-by-step instruction book makes assembling a Paco Kit foolproof! Paco gives you giant, fold-out diagrams on corresponding instruction pages so you can see both at the same time.

PACO Model C-25
IN-CIRCUIT CAPACITOR TESTER KIT

Reveals dried out, shorted, or open electrolytics—in the circuit—with Paco's exclusive Capacity Dial. Instantly finds open or direct shorted capacitors without removing from circuit. Great time saver!

Specifications:

SIMPLE SEQUENTIAL TEST: reveals open or shorted capacitors, including electrolytic types.

ELECTROLYTIC DIAL: indicates actual electrolytic values while capacitor is in-circuit; any electrolytic which yields a capacity reading on Electrolytic Dial is automatically revealed as not open or shorted.

ELECTROLYTIC TEST: indicates in-circuit electrolytic capacity from 2 mfd to 400 mfd in two ranges; condenser is automatically proved non-shorted and not open if Capacity Reading can be obtained.

Model C-25: Kit, complete with PACO-detailed assembly-operating manual. Kit Net Price: $19.95

Model C-25W: Factory-wired, ready to operate. Net Price: 29.95

PACO Model DF-90
TRANSISTORIZED DEPTH FINDER KIT

Protect your boat against shoals and underwater hazards with this compact, easy-to-read depth finder. Transistors prolong battery life, provide utmost accuracy and portability. A boon to fishermen—locates hard-to-find schools of fish. A low cost safety device for every boat owner.

Specifications:

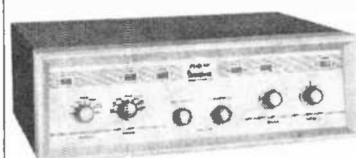
FULLY TRANSISTORIZED: 5 transistors, with a low battery drain for extremely long battery life.

HIGH INTENSITY INDICATOR: for sensitive, accurate response under all conditions.

FAST, EASY READINGS: made possible by means of over-sized scale calibrated at one-foot intervals from 0 to 120 feet.

Model DF-90: Kit, complete with PACO-detailed assembly-operating manual. Kit Net Price: $84.50

Model DF-90W: Factory-wired, ready to operate. Net Price: $135.50



PACO Model SA-40
STEREO PREAMP-AMPLIFIER KIT

Assemble a superb home music system with this true 40 watt stereo preamp-amplifier. Unmatched flexibility, less than 0.5% distortion, and handsome design make this the ideal component for music lover and audiophile alike!

Specifications:

MUSIC WAVEFORM POWER OUTPUT: 25 watts per channel (50 watts total).

RESPONSE: 30 cps to 90Kc. ± 1.0% db

HARMONIC DISTORTION: less than 0.5% at 20 watts per channel output.

Model SA-40: Kit, complete with black and gold case and PACO-detailed assembly-operating manual.................Kit Net Price: $79.95

Model SA-40W: Factory-wired, with black and gold case, ready to operate. Net Price: $129.95

PACO KITS BY PACOTRONICS

FREE! COMPLETE ILLUSTRATED CATALOG

Mail this coupon for the complete Paco catalog of electronic equipment kits, including test instruments, measuring instruments, and high fidelity components.

Paco Electronics Company, Inc., Dept. PE6
70-31 84th Street, Glendale 27, L. I., N. Y.
Please send me your complete illustrated catalog.

Name ....

Address ....

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

ZIFF-DAVIS PUBLISHING COMPANY, One Park Ave., New York 16, N. Y. William B. Ziff, Chairman of the Board (1946-1953); William Ziff, President; W. Bradford Briggs, Executive Vice President; Hershel B. Sarbin, Vice President and General Manager; Michael Michaelson, Vice President and Circulation Director; M. T. Birmingham, Jr., Vice President and Business Manager; Richard Kislik, Treasurer; Charles Housman, Financial Vice President.

BRANCH OFFICES: Midwestern Office, 434 S. Wabash Ave., Chicago 5, Ill., Jim Weakley, Advertising Manager; Western Office, 9025 Wilshire Blvd., Beverly Hills, Calif., William J. Ryan, Western Manager.

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

POPULAR ELECTRONICS

World's Largest-Selling Electronics Magazine

Average Net Paid Circulation Over 357,000

This month's cover photo by Irv Dolin

COMING NEXT MONTH

(ON SALE JUNE 27)

- **SHORT-WAVE LISTENING**
  Learn the best times to listen to short-wave broadcasts from Asia and the Pacific islands. Call letters, locations, and frequencies are given for all English-language stations in this area heard in the United States.

- **TRANSISTORS IN HI-FI**
  Will transistors ever edge out tubes in hi-fi as they have in other areas? Here's an informative look at some of the advantages transistors offer the hi-fi field as well as some of the problems they pose.

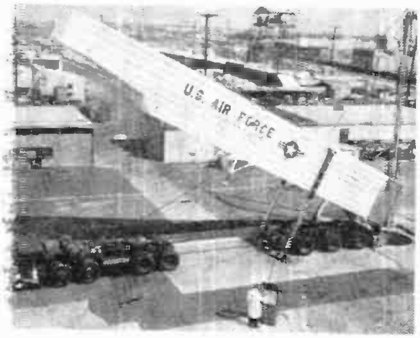
- **CB POWER METER**
  With maximum input on CB rigs limited to 5 watts, operating at peak efficiency is a "must." For about $10, you can build a meter which makes measuring CB power as easy as 1-2-3, and gives an SWR reading as well.

SUBSCRIPTION SERVICE: Forms 3579 and all subscription correspondence should be addressed to Popular Electronics, Circulation Department, 434 South Wabash Avenue, Chicago 5, Illinois. Please allow at least four weeks for change of address. Include your old address as well as new—enclosing if possible an address label from a recent issue.

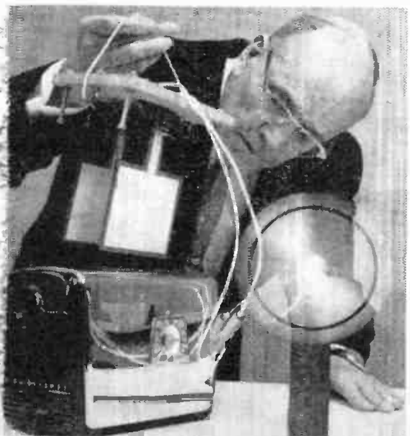
POP'tronics NEWS SCOPE

UNDERWATER VTVM—Specially constructed to meet military conditions aboard Polaris-firing submarines, the VR-2100 voltmeter is equally at home under water as on shore. Designed by the Cubic Corporation of San Diego, it has been explosion-proofed, can withstand 50G shock, and can operate in highly volatile acid atmospheres usually considered off-limits for such delicate electronic equipment. Incidentally, television repairmen will be able to combine pleasure with business when Scuba diving.

ELECTRONIC SPIDER—Raytheon engineers have come up with a unique spider-like packaging idea. Three diodes, a coupling network, a transistor and two resistors—comprising a basic computer building block—are squeezed into a case which would normally contain only a transistor. One such block, a logic unit, has seven leg-like leads to join it to other electronic elements in a modern data processing machine. So the next time you want to step on a spider, first make sure it's a logical step.



WHEELED MISSILE—The U. S. Air Force has taken to the nation's highways in order to transport its potent Minuteman ICBM to "hardened" underground sites. Minuteman, a three-stage solid-propellant missile capable of carrying a nuclear warhead, is moved from the assembly plant to the launching site in a motorized transporter. At the site, the missile in its 63'-long, 8500-pound container is raised to a vertical position by means of two erector actuators which can lift 108,000 pounds. Then the missile is gently lowered into the well-like concrete-lined tube from which it will be launched in the event of an emergency. After the emplacement of the missile, the container is lowered back on the transporter. The transporter-erector-emplacement system was developed by the Bendix Corporation.



TOASTING A NEW POWER SOURCE drives a small electric motor and its propeller. The power is derived from two thin plates which are heated like pieces of bread in a toaster. Even though removed from the heat source, these plates continue to produce electricity as long as the stored heat remains. It's been tabbed the "Austin effect"—after its discoverer, a Westinghouse engineering consultant. The power source is rechargeable in the same way as the battery in your car.

More on page 8

Do you WISH you were EMPLOYED in ELECTRONICS?

F.C.C. LICENSE—THE KEY TO BETTER JOBS

An F.C.C. *commercial* (not amateur) license is your ticket to higher pay and more interesting employment. This license is Federal Government evidence of your qualifications in electronics. Employers are eager to hire *licensed* technicians.

WHICH LICENSE FOR WHICH JOB?

The THIRD CLASS radiotelephone license is of value primarily in that it qualifies you to take the second class examination. The scope of authority covered by a third class license is extremely limited.

The SECOND CLASS radiotelephone license qualifies you to install, maintain and operate most all radiotelephone equipment except commercial broadcast station equipment.

The FIRST CLASS radio telephone license qualifies you to install, maintain and operate every type of radiotelephone equipment (except amateur) including all radio and television stations in the United States, its territories and possessions. This is the highest class of radiotelephone license available.

GRANTHAM TRAINING PREPARES YOU

The Grantham course covers the required subject matter completely. Even though it is planned primarily to lead directly to a first class FCC license, it does this by TEACHING you electronics. Some of the subjects covered in detail are: Basic Electricity for Beginners, Basic Mathematics, Ohm's and Kirchhoff's Laws, Alternating Current, Frequency and Wavelength, Inductance, Capacitance, Impedance, Resonance, Vacuum Tubes, Transistors, Basic Principles of Amplification, Classes of Amplifiers, Oscillators, Power Supplies, AM Transmitters and Receivers, FM Transmitters and Receivers, Antennas and Transmission Lines, Measuring Instruments, FCC Rules and Regulations, and extensive theory and mathematical calculations associated with all the above subjects explained simply and in detail.

OUR GUARANTEE

If you should fail the F. C. C. exam after finishing our course, we guarantee to give additional training at NO ADDITIONAL COST. Read details in our free booklet.

GET your first class commercial F.C.C. LICENSE QUICKLY!

Learn by Correspondence or in Resident Classes

Grantham training is offered by correspondence or in resident classes. Either way, we train you quickly and thoroughly---teach you a great deal of electronics and prepare you to pass the F.C.C. examination for a first class license. Get details now. Mail coupon below.

This booklet FREE!

This free booklet gives details of our training and explains what an F.C.C. license can do for your future. Send for your copy today.

Upgrade Your Income

To get ahead in electronics—first, you need the proper training; then, you need "proof" of your knowledge. Your first class commercial F. C. C. license is a "diploma" in communications electronics, awarded by the U. S. Government when you pass certain examinations. This diploma is recognized by employers. Grantham School of Electronics specializes in preparing you to earn this diploma.

Grantham training is offered in resident classes or by correspondence. Our free booklet gives complete details. If you are interested in preparing for your F. C. C. license, mail the coupon below to the School's **home office** at 1505 N. Western Ave., Hollywood 27, California—the address given in the coupon—and our free booklet will be mailed to you promptly. No charge—no obligation.

Grantham School of Electronics

HOLLYWOOD CALIF.

SEATTLE WASH.

KANSAS CITY MO.

WASHINGTON D. C.

RESIDENT CLASSES HELD IN FOUR CITIES

If you are interested in attending day or evening classes mail the coupon for free information to our home office in Hollywood, Calif.

(Mail in envelope or paste on postal card)

To: GRANTHAM SCHOOL OF ELECTRONICS
1505 N. Western Ave., Hollywood, Calif.

Gentlemen:
Please send me your free booklet telling how I can get my commercial F.C.C. license quickly. I understand there is no obligation and no salesman will call.

Name ____________ Age ____

Address ____________

City ____________ State ____________

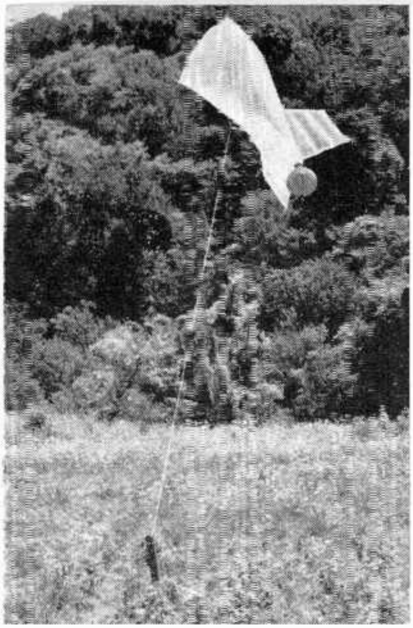
I am interested in: ☐ Home Study, ☐ Seattle classes ☐ Hollywood classes, ☐ Kansas City classes, ☐ Washington classes

13G

MAIL COUPON NOW—NO SALESMAN WILL CALL →

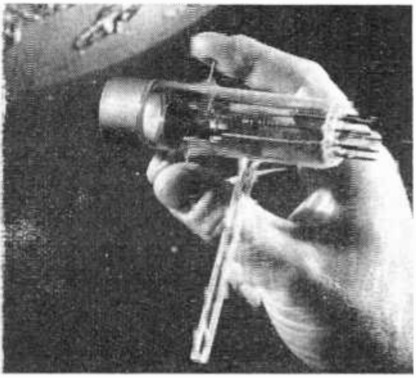
NEWS SCOPE

Continued

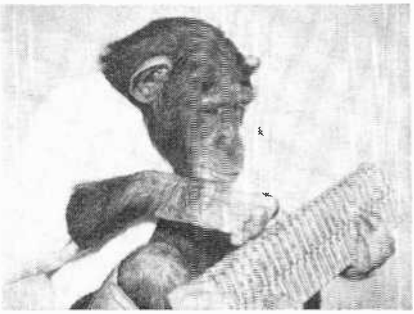


UPI

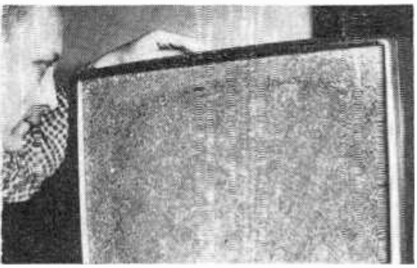
ON THE AIR—Filled with helium, this small blimp-shaped balloon carries a radio antenna wire some 55 feet above the ground as part of a lightweight and compact radio rescue beacon to help locate downed aircraft. Developed by the Crosley Division, Avco Corporation, in Cincinnati, the beacon sends out a signal—for 24 hours—that can be picked up thousands of miles away. It can be released by the pilot of the stricken aircraft or propelled free by the jar of a crash landing. The beacon, including the parachute, balloon, radio transmitter, antenna gear and catapult mechanism, is packaged in a container 36" long and 5½" in diameter. Total weight—40 pounds.



SPACE AIR SAMPLER—Ionization gauges intended to sniff the thin atmosphere in near space and to measure its density have been designed and built by Westinghouse for the National Aeronautics and Space Administration. Tested in an Aerobee Hi Rocket launched from Wallops Island, Va., one of these gauges provided direct measurements of pressures and densities at altitudes from 70 to 125 miles up. Until this experimental flight, efforts to adapt high-sensitivity ionization gauges to space probes had met with little success due to problems of bulk and susceptibility to vibration. The new gauges can survive the high G's at blast-off while not taking up too much room in a rocket's limited pay load. They are expected to be useful in gathering atmospheric data all the way up to 450 miles.



SPACE CHIMP DIGS TECHNOLOGY—Jerry, space-age research chimp for International Rectifier Corp., monkeys with one of the 20,000-volt rectifiers used in high-power radar missile warning systems and nuclear research. Jerry's main job is to assist scientists in studying the whole human physiological system in space and on earth.



UPI

IT'S A TOUGH BREAK for Sam Castle, Jr., shown gazing at his mysteriously damaged television set. Awakened from sleep by a crackling sound he was afraid meant a fire in the house, Castle found that the noise actually came from the glass pane front of his TV set. With each "pop," new cracks appeared in the glass, until it began to look like an ice-frosted window. Thus far, no explanation is in the offing for this phenomenon, or for similar events involving car windshields which occurred a few years ago. Mr. Castle's big problem is whether he should call in a TV repairman or a glazier.

Letters from our readers

More "Sweet Sixteens"

■ I've just finished building the "Sweet Sixteen" speaker system which appeared in your January 1961 issue, and it was really worth the effort. The quality is outstanding for such a low-cost unit; highs as well as rich lows are reproduced wonderfully. I think I'll try another one for stereo.

MORRIS MADURO
Panama, Rep. of Panama

■ I built a speaker system based on the one described in your January issue under the title "Sweet Sixteen." Instead of 16 speakers, I used 18—and built them into a cabinet already containing two 12" coaxial units. The resulting sound is equal to or far exceeds that of much more expensive installations. Some listeners prefer the added "boom" of the coaxial speakers, but more and more I am beginning to find that the small speakers alone provide the clear crisp tones which are such a pleasure to hear.

C. R. DAVENPORT
Indianapolis, Ind.

These are just a couple of the hundreds of letters that continue to pour in on the "Sweet Sixteen." We would also like to hear from readers who have added a tweeter to the original unit ("Sweeter with a Tweeter," April, 1961).

Audio Analgesia

■ I have some questions concerning the audio analgesia apparatus described by Charles Fowler in "The Noise That Banishes Pain" in the January

1961 issue. Any information you can give me will be appreciated.

(1) Must the system be stereo?
(2) Why does the author recommend Emory Cook records?
(3) What is the source of the white noise?

(Continued on page 14)

AT LAST!

RADIO-TV and ELECTRONICS TRAINING

.... AT A PRICE YOU CAN AFFORD!

*21 INCH
Receiver Kit included

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 Many More Shops This Year

This 38 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, a great many such shops are NOW IN BUSINESS AND PROSPERING. We are helping and training 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!

COMPLETE COLOR TV INSTRUCTION INCLUDED

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

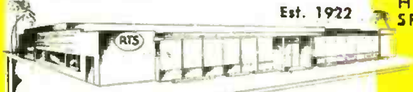
When you are ready and qualified to operate one of our RTS-Approved TV Repair Shops ***WE WILL SUPPLY AND FINANCE EVERY BIT OF EQUIPMENT YOU NEED TO GET STARTED*** plus an inventory of parts and supplies. In other words *we will stake you* . . . **AN OFFER NEVER MADE BEFORE BY ANY TRAINING ORGANIZATION.**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

1. An electric sign for the shop front.
2. Complete laboratory of test equipment.
3. Letterheads, calling cards, repair tickets, etc.
4. Basic inventory of tubes, parts, supplies.
5. Complete 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.

you build these and other units

*tubes excluded

RADIO-TELEVISION TRAINING SCHOOL
815 EAST ROSECRANS AVENUE
LOS ANGELES 59 CALIFORNIA
Est. 1922



ACT NOW!

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
815 EAST ROSECRANS AVE Dept. PE-61
LOS ANGELES 59 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)

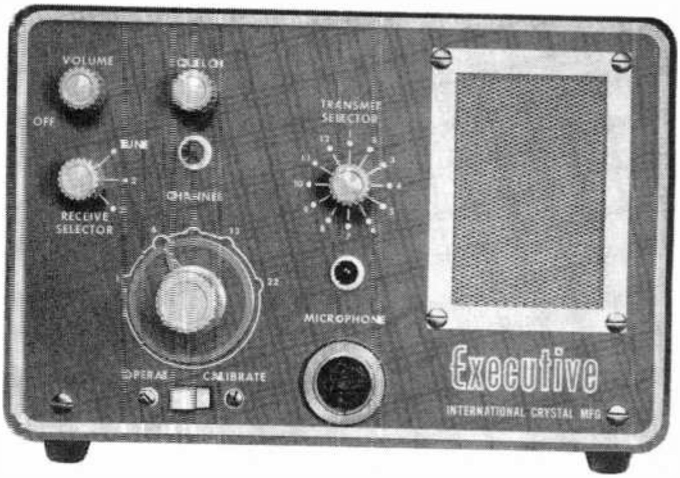
Name ______________________ Age ______

Address ______________________

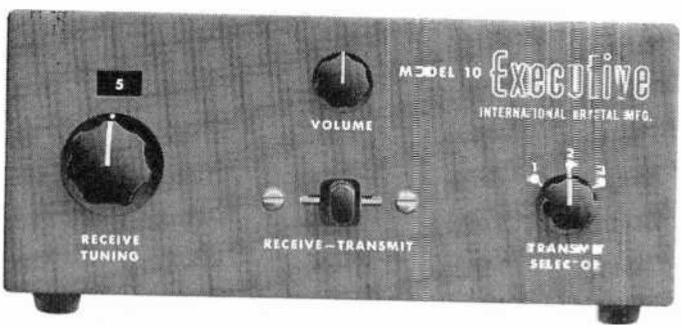
City & State ______________________

301

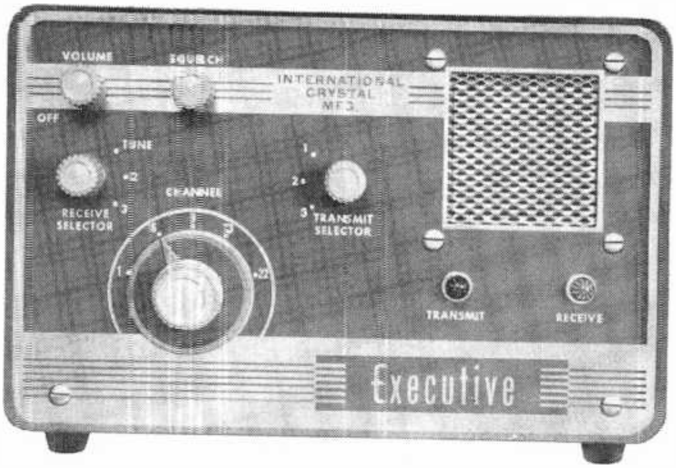
Mail This Coupon Now—No Salesman Will Call



MODEL 100
Available after June 15



MODEL 10
Available after June 15



MODEL 50
Available after April 15

Letters

(Continued from page 10)

(4) Is it possible for the volume of the white noise in the 'phones to cause ear damage?
(5) Would the system work as well if music were recorded on one channel of a stereo tape recorder and white sound on the other channel?

Since reading the article, I have rigged a turntable and FM tuner to play through separate amplifiers, using the tuner between stations to produce the white noise. I had to give supplementary local anesthetic to only two of the ten patients on whom I tried this apparatus.

R. S. DAVIDSON, D.D.S.
Pikeville, Tenn.

We will attempt to answer your questions in the order in which you presented them.

(1) It is necessary to have a stereo system in order that the volume of the white sound and that of the music can be controlled separately. Ideally, the patient should adjust the white sound so that the volume is loud, but comfortable—then bring in the music to a barely audible level.

(2) The Emory Cook records were recommended because they are a very convenient stereo source—white sound on one channel, music on the other.

(3) White NOISE is made up of all the frequencies in the audible spectrum, each present at the same intensity; white SOUND is white noise which has been "tailored" so that the intensity of each frequency is proportional to the sensitivity of the ear at the frequency.

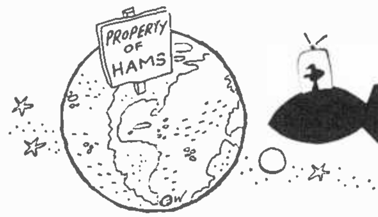
(4) Ear damage is unlikely if the white sound volume is kept below the "uncomfortable" level.

(5) There's no reason why a stereo tape system wouldn't work, but for best results you should use white sound *rather than white* noise.

For further information, write to Cook Laboratories, Inc., 101 Second St., Stamford, Conn., and ask for their booklet entitled "Audio Analgesia." Include 25 cents to cover cost of handling and mailing.

"It's a Ham's World"

■ I found the article entitled "It's a Ham's World" (February 1961 issue) very interesting, particularly the listings of clubs conducting courses in amateur radio code and theory. In our organization, the Taft Junior High School Radio Club (Oklahoma City, Okla.), we are currently studying code and plan to tackle theory soon.



I'd like to take this opportunity to recommend

Letters

(*Continued from page* 14)

another manual for the would-be novice: "Steps to a Ham License," published by American Basic Science Club, Inc., 501 E. Crockett St., San Antonio 6, Texas. Copies are 50 cents each.

DAVID GEESEKA
Oklahoma City, Okla.

Help Wanted

■ I would like to get some information on the Masterpiece VI, a short-wave receiver manufactured by the McMurdo-Silver Corporation of Chicago—which went out of business about 1939 or 1940. If any of the P.E. readers can help me, I would appreciate hearing from them.

STEPHEN A. LABAN, WPE2DXH
2676 Grand Concourse
New York 58, N. Y.

■ If any of your readers have circuit data on the Breting 45 receiver and would lend it to me, I would be very grateful and would return it promptly.

STEPHEN T. BEMIS
16 Williams St.
West Medway, Mass.

"Dirty" DX

■ I've just read "How to Get DX" by Fred E. Ebel, W9PXA, in the August issue, and I think that using a YL to make contacts is the dirtiest trick one amateur can play on another. I don't

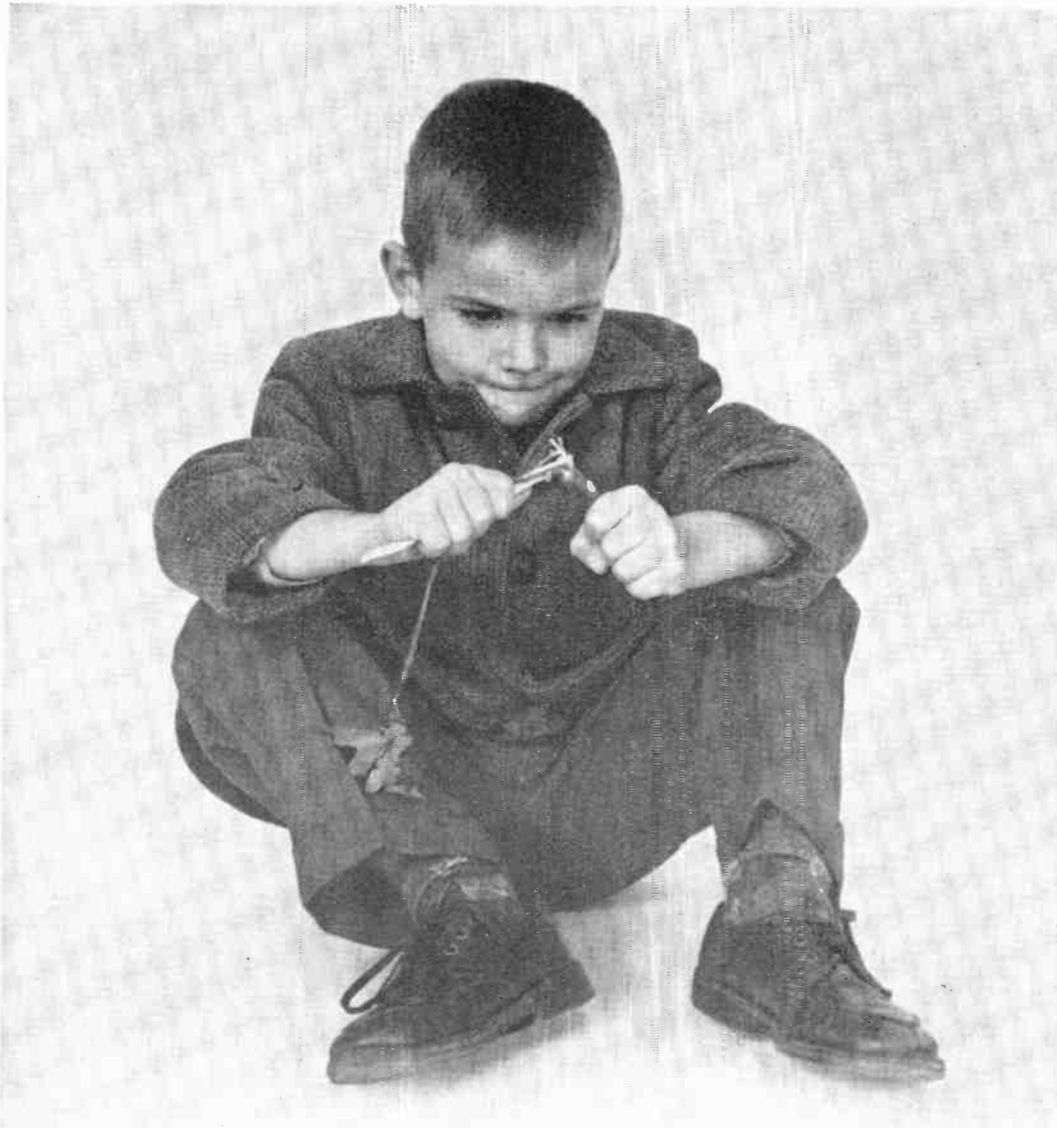
know if there is any law against this in the States but there is in Canada.

The following is a quotation from "The Radio Amateur Licensing Handbook (Canada)" by Jim Ketchin, Regional Supervising Radio Inspector, Department of Transport, Canada. "Any person without a Certificate of Proficiency may take part in radiotelephone transmissions provided the licensee retains physical control of the equipment and does the calling and signing off."

I think that if an amateur can't raise DX by himself he shouldn't use trickery to do so.

RICHARD DILLEY
Pointe Claire, Quebec, Canada

We're sorry you are so upset, Richard, but we meant it all in fun. As for violating the FCC Regulations, here in the U. S. anyone can transmit a message provided "a duly licensed amateur operator maintains actual control over the emissions, including turning the carrier on and off for each transmission and signing the station off after communication with each station has been completed." —30—



Hi-Fi Showcase

*A quick look at new products in the stereo/hi-fi field**

IN CASE you're thinking of adding a tape deck or deck/preamp combination to your hi-fi system, the new "Series 500" units from ***American Concertone*** should fill the bill admirably—every member of the series is intended for professional and studio use. The basic transport (Model M-506) is furnished with three fully shielded heads (it has space for a fourth) and three hysteresis motors. Produced in speeds of 3¾-7½ ips and 7½-15 ips, the transport sells for $349.50; the Model M-508 is equipped with a monaural preamp and sells for $520; and the Model M-507, priced at $645, includes stereo preamps. . . . From ***Allied Radio*** comes a stereo tape record/play preamp kit suitable for use with any quality 3-head tape deck. Although erase and record bias voltages are preset to match Allied's new KN-4000 stereo tape deck, both are adjustable to match heads on other quality transports. The Knight-Kit preamp permits stereo and monophonic recording and playback as well as "echo chamber," "sound-on-sound," and other special effects. Twin VU meters indicate recording and playback levels, and a 3¾-7½ ips equalization switch functions in both record and playback. Price of the 83 YX 929 kit is $79.95; factory-assembled unit (KN-4001) sells for $129.95.

Another new product from Allied is the Knight KN-850 12″ hi-fi speaker. A 3-way unit built in England to Allied's specifications, the KN-850 has a mechanical crossover at 2000 cycles, an electrical crossover at 5000 cycles, and an L-pad for precise adjustment of the high-frequency level to suit your taste. The 12″ model sells for $79.50; a 15″ version, the KN-815A, is priced at $89.95. . . . From ***Burgess Battery*** comes a product that has been over five years in the

**Write to the manufacturers listed at the end of this column for more data on products mentioned*

Showcase

(*Continued from page* 18)

making—high-quality recording tape. With the stress on tape uniformity, Burgess uses a special iron oxide powder and acetate or Mylar base to produce a tape with a micro-finished surface. In addition, a lubricant built into the coating is said to last the life of the tape, minimizing flake-off and keeping heads clean. Prices vary with reel size and tape thickness.

Two integrated stereo amplifiers are available from ***EICO*** in either kit or factory-wired form. Built to handle virtually any stereo program source—FM/AM; multiplex; tape heads; magnetic, crystal, or ceramic cartridges—both amplifiers include a variety of controls. The ST40 develops 20 watts per channel and is priced at $79.95 in kit form, $124.50 fully wired. The ST70 contains dual 35-watt amplifiers as well as a speaker phase-reversal switch, and sells for $94.95 in kit form, $144.95 factory-wired. . . . A fully integrated FM/AM tuner and stereo amplifier/preamplifier combination from ***Fisher*** follows the same general lines as the company's more expensive 600 and 800 stereo receivers. There's plenty of power in the 500-S's 45-watt stereo amplifier, and there are 13 inputs and 5 outputs on the rear panel, including a center-channel output for a composite stereo signal. Needing only a pair of speakers and a tape head or phono cartridge to form a complete stereo setup, the 500-S is priced at $349.50. . . . New from ***Harman-Kardon*** are a 50-watt stereo preamplifier/amplifier and an FM tuner, two companion pieces designed for custom installations. Features of the A500 amplifier include a front-panel ambiance control for regulating volume of a third-channel amplifier or reverberation device; blend control indicator lamps to show the exact degree of blend; and a tape monitor switch which permits monitoring tape while recording. On the F500 tuner, controls include an FM/multiplex switch with indicator lights, an interchannel muting defeat switch, and a local/long-distance range switch. Both

THE A.E.S. Gigolo

.....A MIRACLE IN SOUND

After two years of research and development, a speaker system we can offer to the public on a 100% MONEY BACK GUARANTEE. Compare the A. E. S. Gigolo, to any bookshelf speaker, regardless of price and if you do not feel that the Gigolo is the most outstanding unit you have heard, you may return it for a full purchase price refund.

Thousands of these gigolos are now in use all over the country. The acceptance has been unbelievable. Never before a sound so realistic to so many people in so many different homes! These are the facts that enable A.E.S. to make this bold offer.

Size —
24" wide, 12" high, 9½" deep.

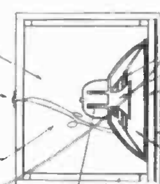
Power Handling Capacity —
The Gigolo is extremely flexible. May be used with small economy amplifiers of very low wattage, as well as with the highest power component amplifiers with satisfactory results.

Frequency Response —
The Gigolo will reproduce both high and low frequences in excess of the requirements of even the most critical home listener.

Order now to insure prompt delivery

Price — $15.00, F.O.B. factory
Unfinished only

Price subject to change within thirty days of the issuance of this magazine



ORDER BLANK

A.E.S., Inc.
3338 Payne Avenue, Cleveland, Ohio

Gentlemen please ship .... GIGOLOS.

I understand these units are guaranteed and if I am not satisfied I may return for a full refund of sales price, $15.00 each.

Name ....

Address ....

City and State ....

Enclosed find check .... money order ....

Showcase

(*Continued from page* 20)

units measure 5 7/16" x 15¼" x 12", excluding knobs; prices are $159.95 and $129.95, respectively.

An inexpensive, wide-range speaker system ideal for use as part of a stereo pair, ***Jensen***'s Model TF-3 is a four-speaker, three-way unit incorporating a 10" woofer, two special mid-range speakers, and a single tweeter. Prices are $99.50 (oiled walnut) and $79.50 (unfinished gum hardwood). . . . A lightweight version of the ***Norelco*** "Continental" tape recorder is a monaural record/stereo playback unit specially designed for hi-fi. Operating at 7½ ips only, the "Continental" 200 (Model EL3541) incorporates a narrow-gap 4-track record/playback head for playing back 4-track stereo tapes through an external hi-fi system or for recording and playing back 4-track monaural tapes. Furnished complete with microphone, the "200" also includes an output jack for monitoring purposes. The unit operates from any 117-volt a.c. source and is priced at $179.50.

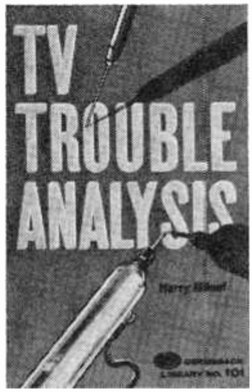
A compact stereo preamp/amplifier/receiver combination measuring 16¼" x 14" x 4½", ***Sherwood***'s S-7000 requires only the addition of speakers and a record changer to form a complete home stereo music system. With 19 front-panel controls and 9 inputs for maximum flexibility, the S-7000 incorporates an AM/FM receiver, two preamps, and two amplifiers delivering 24 watts per channel. As a bonus feature, two cathode-follower outputs and a front-panel tape monitoring switch equip the unit for stereo tape-recording setups. Price is $299.50; $307.00 in brown leatherette case.

American Concertone, Inc., 9449 W. Jefferson Blvd., Culver City, Calif.
Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.
Burgess Battery Co., Div. of Servel, Inc., Freeport, Ill.
Electronic Instrument Co., Inc. (EICO), 33-00 Northern Blvd., Long Island City 1, N. Y.
Fisher Radio Corp., 21-21 44th Drive, Long Island City 1, N. Y.
Harman-Kardon, 520 Main St., Westbury, N. Y.
Jensen Manufacturing Co., 6601 S. Laramie Ave., Chicago 38, Ill.
North American Philips Co., Inc. (Norelco), High Fidelity Products Div., 230 Duffy Ave., Hicksville, L. I., N. Y.
Sherwood Electronic Laboratories, Inc., 4309 N. California Ave., Chicago 18, Ill.

POP'tronics Bookshelf

TV TROUBLE ANALYSIS *by Harry Mileaf*

This book is intended to help the TV technician cut down his servicing time and increase his ability to pinpoint troubles on unfamiliar sets. After giving the reader a brief refresher course on current TV theory, the author explains the "theory of trouble": the reasons for component and circuit failure are analyzed, and these failures are discussed in terms of their effects on key waveforms and on the sound and picture of the receiver itself.



Published by Gernsback Library, Inc., 154 W. 14th St., New York 11, N.Y. 224 pages. Soft cover, $3.20. Hard cover, $4.95.

ALTERNATING CURRENT ELECTRICITY
by Alexander Efron, E.E., Ph.D.

Volume 10 in the Rider Basic Science Series, this book contains a complete treatment of alternating current theory. Techniques for generating alternating electromotive force are covered first, and concepts of the sine wave, cycle, frequency and period are carefully developed. Resistance, capacitance, and inductance—the components of a.c. circuits—are discussed next. The vector diagram approach is used, emphasizing the geometrical nature of the relationships. Chapters on a.c. measuring equipment, polyphase power, the transformer, a.c. motors and rectification complete the text, and an appendix is devoted to the "j" operator and complex numbers. Prob-

For serious-minded men desiring higher income and status-

CREI has developed a program of home study that is comparable in technological content to advanced residence courses in electronics. The program was developed hand-in-hand with leading companies and Government agencies contributing to the Nation's efforts in electronics, communications, missiles, and space exploration.

This CREI program in Electronics Engineering Technology may be completed in 2 to 4 years, depending on how much of your spare time you can devote to study. The courses are presented in easy-to-understand form. Our instructors will give you personal attention and assist you when you need help.

To qualify CREI graduates for advancement to key technical positions, CREI offers a complete program in electronics, including—

Automation • Instrumentation • Industrial Electronics Aeronautical Electronics • Guided Missiles • Radar Servo-mechanisms • Computers • Astronautics • Telemetering • Communications • Electronics Manufacturing • Field Engineering • Nuclear Engineering

A COLLEGE-LEVEL EXTENSION PROGRAM IN ELECTRONICS

There is a drastic need in the electronics industry for well-educated engineers and technical personnel. Although the great majority of students find ample opportunity for advancement with their present companies, CREI maintains a Placement Bureau to assist graduates and advanced students in finding more desirable positions. For many years, the demand for CREI graduates and advanced students has far exceeded the supply.

A few of the private companies and government agencies whose officials approve CREI for their own personnel:

- U. S. Navy (5,240 enrolled in extension program)
- Army, Air Force, Marine Corps, Coast Guard
- Columbia Broadcasting System
- National Broadcasting Company
- Federal Electric Corporation
- Florida Power & Light
- Pan American Airways
- United Airlines
- The Martin Company
- All America Cable & Radio
- Voice of America
- . . . and many others

QUALIFICATIONS FOR CREI. You qualify if you have a high school diploma or equivalent, and if you have had basic electronic training and practical experience in electronics. Available to Veterans.

CREI's Extension Division offers you a college-level home study program in electronics comparable in technological content to advanced residence courses.

Mail this coupon . . . today!

CAPITOL RADIO ENGINEERING INSTITUTE
ECPD Accredited Technical Institute Curricula • Founded 1927
Dept. 1206-H, 3224 16th St., N.W., Washington 10, D.C.
England: CREI London, Granville House, 132-135 Sloane Street, London S.W. 1, England

Please send me your course outline and FREE 56-Page Book "Your Future in Electronics and Nuclear Engineering Technology" . . . describing opportunities and CREI home study courses in Advanced Engineering Technology.

Check field of greatest interest
- ☐ Radar, Servo and Computer Engineering Technology
- ☐ Electronic Engineering Technology
- ☐ Communications Engineering Technology
- ☐ Television Engineering Technology
- ☐ Aeronautical Electronic Engineering Technology
- ☐ Automation and Industrial Electronics Engineering Technology
- ☐ Nuclear Engineering Technology

Name__________ Age______
Street__________
City__________ Zone_____ State______
Check: ☐ Home Study ☐ Residence School ☐ Korean Veteran

To obtain fast, immediate service and to avoid delay, it is necessary that the following information be filled in:

Employed by__________

____

Type of Present Work______
Education:
Years of High School______
Other__________
Electronics Experience______

____

Bookshelf

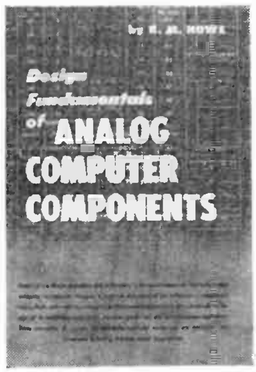
(Continued from page 24)

lems and review questions are given at the end of each chapter.

Published by John F. Rider Publisher, Inc., 116 W. 14th St., New York 11, N.Y. 104 pages. Soft cover. $2.25.

DESIGN FUNDAMENTALS OF ANALOG COMPUTER COMPONENTS *by R. M. Howe*

The scientists and engineers who use analog computers and all those who maintain analog computer installations will find this volume helpful in their work. Those familiar with general-purpose electronic analog computing techniques will gain the understanding they need of why analog-computer components are designed as they are and how component errors affect the problems solved by the computer. There are many photographs and drawings illustrating existing commercial equipment, circuit details, and computer components.



Published by D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. Hard cover. 268 pages. $7.50.

R/C PRIMER *by Howard G. McEntee*

Filling a long-felt need for a manual which would begin where the instruction booklets of commercial R/C equipment manufacturers leave off, this volume explains how to select, license, install, test, and maintain radio-control units. Emphasis is on model aircraft applications—a field which presents the most challenge to the R/C fan, and one chapter covers the special problems involved in

Bookshelf

(*Continued from page* 26)

model boating. The techniques described, however, apply to almost every use of radio control, and all but the most experienced R/C enthusiasts will find much useful information in this book.

Published by Kalmbach Publishing Co., 1027 N. 7th St., Milwaukee 3, Wis. 64 pages. Soft cover. $2.00.

DIAL CORD STRINGING GUIDE—VOLUME 8 *by the Howard W. Sams Engineering Staff*

A perennial favorite with servicemen, the Sams "Dial Cord Stringing Guide" Series makes an easy task of the otherwise tough restringing job. Volume 8, which brings the coverage of radio and TV receivers up-to-date through 1960, includes 214 dial cord diagrams of 1959-1960 receivers. The book also contains a comprehensive index of Volumes 5 through 8.

Published by Howard W. Sams & Co., Inc., 1720 E. 38th St., Indianapolis 6, Ind. 80 pages. Soft cover. $1.00.

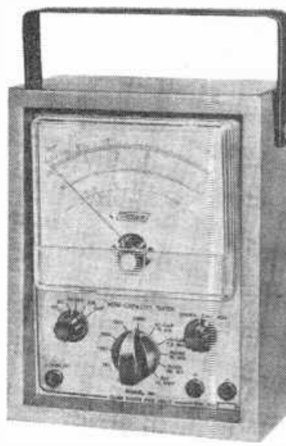
New Literature

The H. H. Scott "Guide to Custom Stereo" is designed to help you select the proper stereo system to suit your needs. This 14-page booklet explains stereo and high fidelity, then shows you how to choose components, use them, and place them in your home. Write to H. H. Scott, 111 Powdermill Rd., Maynard, Mass., for your free copy.

Sonotone's broad line of audio and electronic products is covered in a new eight-page 1961 catalog. The attractive-looking booklet features the latest ceramic and crystal cartridges, tone arms, magnetic (velocity) equalizers, mono and stereo tape heads, and ceramic microphones. Also displayed and discussed are rechargeable flashlight battery cartridges, loudspeakers, and electronic tubes. Write to the Electronic Applications Division, Sonotone Corporation, Elmsford, N. Y., for a copy. —30—

NEW products

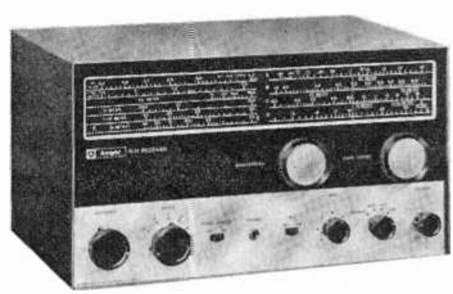
DUAL-PURPOSE TESTER



A combination VOM and capacity tester has been announced by *Mercury Electronics Corp.*, (77 Searing Ave., Mineola, N. Y.) Features of the Model 400 include a carrying handle which doubles as a support for the instrument, holding it in a tilted position; and a slope front projecting the 4½″ meter forward for even easier reading. The Model 400 has seven d.c. voltage ranges (0-15 to 0-7500 volts at 20,000 ohms per volt); six a.c. ranges (0-15 to 0-1500 at 5000 ohms per volt); five d.c. current ranges (0-15 ma. to 0-15 amperes). Capacity range is from .001 μf. to 80 μf.; resistance range is from 0.5 ohm to 10 megohms. The unit measures 5⅞″ x 7¾″ x 3½″. Price, $39.95.

FIVE-BAND RECEIVER KIT

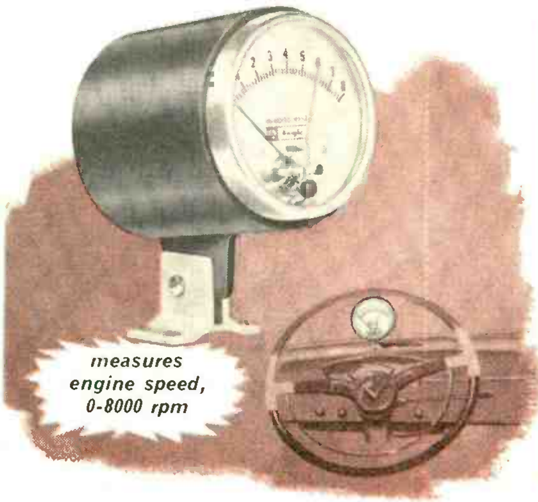
The superheterodyne circuit in the Knight-Kit R-55 receiver covers the 530-kc. to 36-mc. range in four bands, and

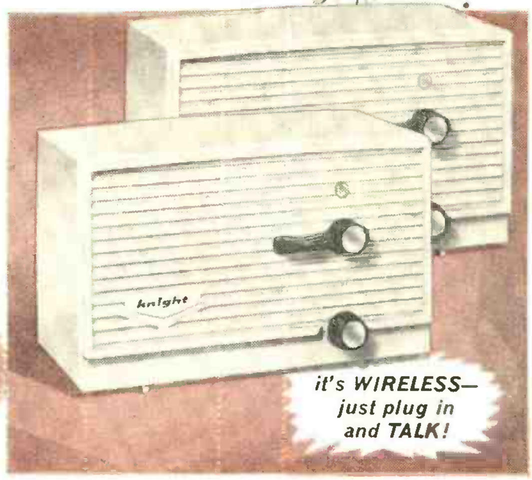


also has a 47-54 mc. (6-meter amateur band) range. The dual 1650-kc. i.f.

NEW–simply great knight-kits®
A PRODUCT OF ALLIED RADIO

talk of the kit world...only at ALLIED





New Money-Saving Electronic Tachometer Kit

3% Accuracy Regardless of Temperature or Voltage Variations

Until Aug. 1 **$19.95** No Money Down

Another KNIGHT-KIT *first*—a precision tachometer in money-saving, easy-to-build form. Helps you drive at your best engine speed efficiency, like the professionals. Transistor switching and Zener diode regulator contribute to exceptional 3%-of-full-scale accuracy, regardless of voltage or temperature changes. Operates with 4, 6 or 8 cylinder automotive engines; simple installation. Ideal also for outboard marine engines using battery or magneto ignition system from 2 cycle 2 cylinder and up. Big illuminated D'Arsonval meter; 0-8000 rpm scale; separate reference pointer may be preset to any desired speed. For 12-volt systems only. With cables, mounting hardware, wire and solder. Shpg. wt., 2 lbs.

83 Y 944. For negative ground systems (American cars).
83 Y 980. For positive ground systems (Foreign cars).
No Money Down. Introductory Price. EITHER TYPE............ **$19.95**

Deluxe Wireless Intercom System Kit at Lowest Cost

Works Anywhere Without Wires — No Installation!

PAIR **$37.90** No Money Down

This easy-to-assemble intercom operates without installation or wiring—just plug into any AC or DC wall outlet for step-saving communication! Change locations easily—anywhere. Ideal for home, office or store. In the home, you can communicate with nursery, garage, basement or patio. In office or shop, provides time-saving communication. Will operate between adjacent buildings that are on same electric-company line transformer. Perfect for baby sitting. Features power-line noise silencing circuit for absolutely quiet "standby"; premium quality throughout. Has Talk-Listen switch, with lock-on feature for constant listening. Handsome cream-toned plastic cabinet, 9 x 5½ x 5½". Can be used in systems consisting of 2 or more units, as desired. Shpg. wt., 3½ lbs.

20 YX 272-2. Complete 2-Station System. NET **$37.90**
83 Y 941. Additional Station. NET EACH **$18.95**

SEE DOZENS OF GREAT knight-kit BUYS in

Allied's Summer Sale Book!

Make your money-saving selections from page after page of great KNIGHT-KIT values and special offers! Save most on the best in build-your-own Stereo, hobby, instrument and Ham kits. Also see terrific closeouts on tape recorders, phonos, records and tape; specials in radios, cameras, TV accessories, Citizens Band radio, amateur gear, P.A., test instruments, tools and electronic parts. Send coupon today!

free

SAVE AS NEVER BEFORE on everything in Electronics—hundreds of special bargains—dozens of new products! Write for this big value-packed Sale Book today!

SEND FOR IT NOW!

ALLIED RADIO, Dept. 38-F1
100 N. Western Ave., Chicago 80, Ill.

☐ **Send FREE Allied Sale Book No. 205**

Ship me the following:
☐ 83 Y 944 Tachometer Kit. ☐ 20 YX 272-2 Intercom System
☐ 83 Y 980 Tachometer Kit. ☐ 83 Y 941 Intercom Station
$............ enclosed

Name________________________
PRINT
Address______________________
City____________Zone_____State_______

ALLIED RADIO

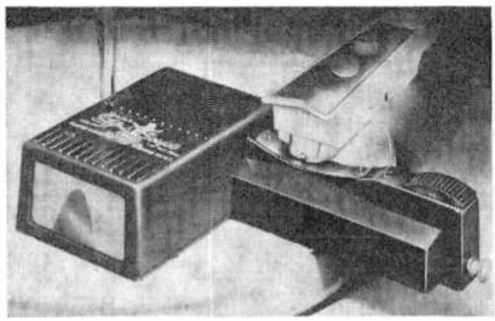
products

(*Continued from page* 30)

stages provide high image-ratio and sensitivity, and a fused, transformer-type power supply with filter choke assures good voltage regulation. Priced at $67.50, the kit is listed as Stock No. 83 YU 935. An optional crystal calibrator, which can be built right into the receiver chassis, sells for $10.95. (*Allied Radio Corp.*, 100 N. Western Ave., Chicago 80, Ill.)

STYLUS CHECKER

A new low-cost viewer helps record collectors guard against stylus wear. The Syl-A-Scope SG-33 magnifies the contours of a stylus and reflects the image



upon a large, illuminated, ground-glass screen. In most cases, it can be used without removing the stylus or cartridge from the tone arm. Listing at $6.75, this compact unit operates on two penlight batteries; a larger model, the SG-66 "Professional," operates on 117 volts a.c. and lists at $19.95. (*Robins Industries Corp.*, Flushing 54, N. Y.)

SLIDE RULE KIT

Special-purpose slide rules are easy to design and construct with a new kit placed on the market by Dyna-Slide. Ideal for those who must make recurring special calculations, the kit contains the parts for three 3" x 11" basic slide rule blanks (1-slide, 2-slide and 3-slide); a plastic scale-plotting ruler; a universal logarithmic chart; and a 25-page instruction booklet. Since the scales can be calibrated with the actual values they are to represent, it is not necessary to figure out decimal point placement. The

Learn RADIO, TELEVISION AND ELECTRONICS

by Practicing at Home in Your Spare Time

At No Extra Cost you get specially developed Electronic Training Kits for practical experience. Shop and laboratory practice at home make learning easier, interesting, faster. You do not need a high school diploma or previous experience.

Increasing Demand for Trained Men

This is the Electronics age. Men with Electronic know-how are in demand. They enjoy high pay and growing opportunities for advancement. Satellites, Radar, Automation in Industry, Missiles, Rockets, Planes, Stereo, TV, Radio, Two Way Communications for transportation are a few of the fantastic developments in the fast growing Electronics industry. If you are not completely satisfied with your work; if you are doubtful about your future, investigate Electronics.

High Pay, Prestige, Bright Future

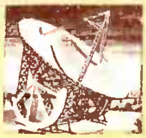
What branch of Electronics interests you? Thousands of successful NRI graduates prove that NRI's learn-by-practice method is the way to success. You start in your chosen career 'way ahead of the man who only learns from books. You do not need to give up your job. You do not need to go away to school. You learn at home, get practical knowledge from training kits NRI provides.

Train With the Leader

NRI is the world's oldest and largest home study Electronics school. You benefit from the experience NRI has gained from training men for 45 years. NRI offers you proven courses of home study in Electronics; Principles, Practices and Maintenance—Radio Television Communications—Radio Television Servicing.

Start Soon, Earn More

Soon after enrolling NRI shows you how to apply your knowledge to earn extra money doing Electronic repairs or servicing Radio and Television sets for friends and neighbors. Take the first step toward success now. Find out what NRI offers you. Mail the postage-free card. No obligation. Cost of NRI training is low. Monthly payment plan available. NATIONAL RADIO INSTITUTE, Washington 16, D.C.



NRI Has Trained Thousands for Success

"I get over twice the salary I made before enrolling. NRI training gave me a thorough understanding." H. ATKINSON, Austin, Tex.

"Now in charge of sound effects for CBC. NRI opened doors to greater opportunity for me." F. TUDOR, Toronto, Ontario.

"Averaged $150 a month spare time before I graduated. Now have my own full time business." F. W. COX, Hollywood, Cal.

NEW COURSE IN ELECTRONICS TURN PAGE

Cut Out and Mail—No Stamp Needed

64-PAGE CATALOG FREE

No Salesman will call. (Please PRINT) Dept. IED-4

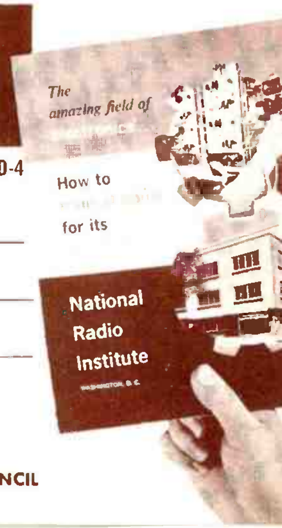
Name_________________________ Age____

Address_________________________

City______________ Zone____ State________

NRI National Radio Institute Washington 16, D.C.

ACCREDITED MEMBER NATIONAL HOME STUDY COUNCIL



PREPARE NOW—
Electronic Technicians Are In Demand

New NRI Home Study Courses in ELECTRONICS

PRINCIPLES—PRACTICES MAINTENANCE

Fast growing use of Electronics in industry, business and the military is creating good career opportunities everywhere. 4 to 7 Electronic TECHNICIANS are needed for every graduate engineer. This is the age of Automation, Missiles, Rockets, Computers, Radar, Microwave, hundreds of other devices where Electronics plays the key role now.

Job Counselors Advise Learning Electronics

Job counselors know the untrained man is last to be hired and the first to be fired. In this Electronics Age *you must be trained* to qualify for high earnings and advancement. To meet this growing demand for Technicians, NRI has developed a comprehensive course in Electronics—Principles, Practices, Maintenance. This training stresses fundamentals . . . the basic principles on which all Electronic equipment is developed, now or in the future.

Learn More to Earn More—Mail Card

NRI Electronics training gives you both theory and experience in an interesting, practical way. Train at home, at your own pace. Keep your present job until you are ready for a better one. Get complete information now. Move up soon to higher pay and a brighter future in Electronics—the growth industry of the '60's. Mail postage-free card.

SEE OTHER SIDE

SPECIAL TRAINING EQUIPMENT

At no extra cost NRI includes special training equipment. You get practical experience with Thyratron Tube circuits; Multivibrators; build a D'Arsonval type Vacuum Tube Voltmeter; work with pentode tubes, selenium rectifiers, oscillators, transistors, magnetic amplifiers; get practical experience in telemetry circuits used in earth satellites

and basic circuits used in digital and analog computers. You perform more than 100 experiments. You "learn-by-practice" from beginning to graduation.

Oldest and Largest School of its Kind

Get FREE 64-page catalog from NRI—oldest and largest home-study Electronics—Radio-Television School. It gives facts about careers in Industrial and Military Electronics, also tells about other NRI courses in Broadcasting and Communications, Radio-TV Servicing. NATIONAL RADIO INSTITUTE, Washington 16, D. C.

FIRST CLASS
Permit No. 20-R
(Sec. 34.9, P. L. & R.)
Washington, D.C.

BUSINESS REPLY MAIL
No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY

NRI National Radio Institute
3939 Wisconsin Avenue
Washington 16, D.C.

POSTAGE FREE CARD
MAIL NOW

(Continued from page 32)

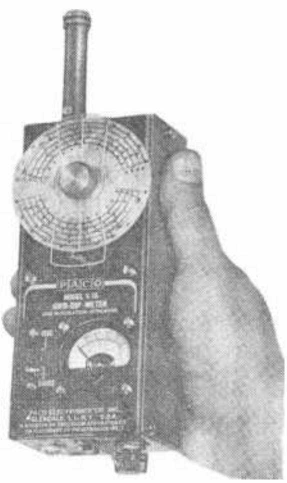
complete kit is priced at $8.50, and additional slide rule blanks are $2.50 each. (*Dyna-Slide Company*, 600 S. Michigan Ave., Chicago 5, Ill.)

RUST-PREVENTING TOOL WRAP

"Rust-Preventive Tool Wrap" eliminates the need for oiling or greasing to protect tools from rust. The chemically treated paper surrounds metal surfaces with a rust-preventing vapor which remains effective over long periods of time. Useful for sporting equipment, boat fixtures and motors, etc., as well as tools of all kinds, a 45-square-foot roll of the 18"-wide material sells for $2.00. (*Robbie's*, 443 Encinitas Ave., San Diego 14, Calif.)

GRID DIP METER KIT

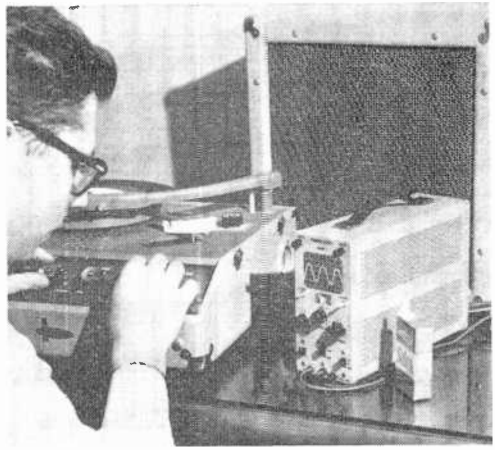
A new addition to PACO's line of high-fidelity and test instrument kits is the



Model G-15 grid dip meter. The unit functions either as a variable frequency oscillator or as an absorption wavemeter, completely covering the 400-kc. to 250-mc. range in eight bands. In addition, a modulation indicator gives both a visual and aural check of "on the air" speech level. Price of the kit, complete with a set of eight plug-in coils, is $31.95. The instrument is also available factory-wired for $49.94. (*PACO Electronics Co., Inc.*, 70-31 84th St., Glendale 27, Long Island, N. Y.)

"PRIMER-SCOPE"

Weighing less than six pounds, the "Primer-Scope" Mark I telephone-directory-sized oscilloscope is intended primarily for beginners but is also handy for professionals who don't require an advanced unit. The sweep operates over a range of 20 cps to 20 kc. with either internal or external synchronization, and a horizontal input is provided. Sensitivities are 250 millivolts per division for d.c.



signals, 6 millivolts per division for a.c. signals. Price, $69.95, complete with easy-to-understand training manual. (*Waterman Products Co.*, 2445 Emerald St., Philadelphia 25, Pa.)

"RADAR-LITE" LANTERNS

The redesigned 1961 line of Burgess "Radar-Lite" battery-operated lanterns incorporates many new features—including an over-size thumb switch, a gun-type lock to prevent accidental switching on or off, and an unbreakable polystyrene shield for the removable light-

head. Several different models are available. one of which is a 12-volt unit with twice the candlepower of the brightest 1961 automobile headlight. Prices range from $8.95 to $11.95. (*Burgess Battery Co.*, Division of Servel, Inc., Freeport, Ill.) —30—

Tips and Techniques

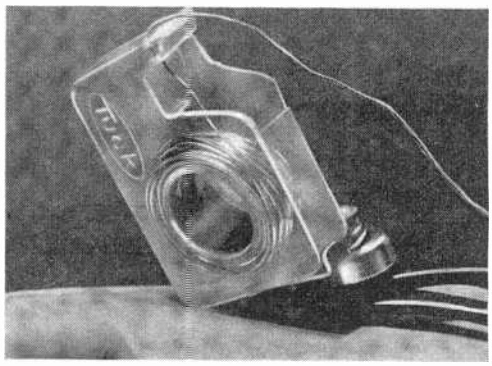
PIN CONTACT IMPROVER

Good electrical contact between a male pin plug and its socket is frequently lost as these parts wear. To regain it, you can coat the pin with silver or copper printed-circuit paint. For best results, renew the coating occasionally. This technique is particularly useful on coax connectors, where a small amount of contact resistance can mean an appreciable signal loss.

—John A. Comstock

HANDY SOLDER DISPENSER

If you're looking for a cheap but handy solder dispenser, try using an empty cellulose tape holder. Alter the holder by drilling a small hole for the solder below the holder's serrated cut-off flange as shown; wind the solder on the tape spool,



thread it through the hole, and the dispenser is ready for use. A small alnico magnet glued to the side of the dispenser will hold the dispenser to the metal sides of your workbench.

—Glen F. Stillwell

EMERGENCY RECEIVING ANTENNA

The "hot" side of the a.c. line makes an excellent emergency receiving antenna, and a receiver antenna circuit may be capacitively coupled to it through a piece of zip cord. Connect one lead of a 6′ length of zip cord to one of the prongs of an a.c. plug; the other lead at that end of the cord is cut off just before it enters the plug. Separate the leads at the other end for a distance of about 6″, forming two "stubs." The stub of the lead which is wired into the plug is cut off, and the exposed end taped. Strip the remaining stub in the usual way and connect it to the receiver's antenna post. Now insert the plug in an a.c. socket. If reception is poor, the wired prong of the plug may have been inserted into the ground side of the outlet; try reversing the plug.

—Charles Bautsch III

MINIATURE TUBE STORAGE

A 10-dram transparent plastic vial, available at most drug stores, makes an excellent storage container for either a 7- or 9-pin miniature tube. The tube fits neatly into the vial, and its type marking can be read right through the transparent wall—eliminating the need for labeling. Wads of cotton batting placed at the top and bottom of the tube act as shock absorbers.

—Leonard I. Kindler

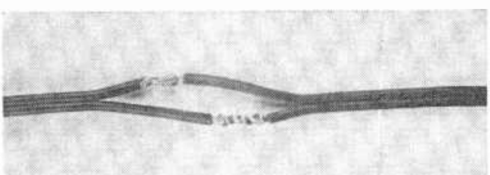
INEXPENSIVE "SEAM RIPPER"

An inexpensive sewing tool known as a "seam ripper" is useful both for building and tearing down equipment. It makes an easy job of removing the sheath covering coax or multi-wire cable or stripping cable harnesses from surplus gear being "cannibalized" for parts.

—Darrel Fogt

SAFER LINE CORD SPLICE

For a safer, neater line cord splice, you can stagger the joints in the two leads rather than making them side by side. There will be less chance of a short circuit, less tape is needed for a safe job, and the splice will be neater because the

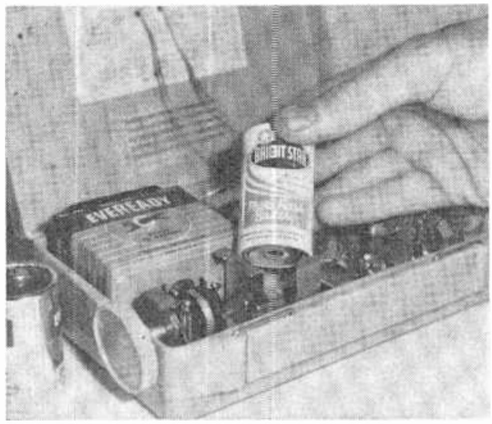


tape is spread out more. To make such a stagger splice, just cut the cord so that the joints will not be directly opposite each other; twist, solder and tape each joint; and finish the job with an overall tape wrapping.

—Carl Dunant

EXTENDED PLAY FOR PORTABLES

If your portable radio uses flashlight cells, you can enjoy many more hours of playing time before replacement is necessary by installing photoflash units



instead. Photoflash cells are longer-lasting and are designed to give more dependable performance toward the end of their life. They are available in both size "D" and penlight sizes.

—James Clifford

"TEAR-OFF" STORAGE CONTAINERS

"Tear-Off" polyethylene bags, available in rolls of various widths, make ideal storage containers for small pieces of test equipment, hardware removed from equipment being repaired, etc. These transparent bags effectively seal out dust and dirt, but allow a good view of their contents.

—H. Leeper

BREADBOARDING POWER TRANSISTORS

Fahnestock clips and miniature tube socket contacts make excellent connectors for breadboarding diamond (T-30) cased power transistors. Bolt one or two Fahnestock clips to the transistor case for the collector connection. Then carefully remove two contacts from a 7- or 9-pin miniature tube socket, make the appropriate connections to them, and slip them over the transistor's base and emitter pins.

—Royland Pettersen

from

ELECTRONICS
BOOK SERVICE

books on radio & tv servicing ...yours for a 7-DAY FREE EXAMINATION!

Here is a comprehensive selection of books covering the field of radio and television servicing—for your use and profit! You'll find practical guides, reference books, background and advanced texts to give you step-by-step procedures for finding troubles and repairing radio receivers, television and FM sets, setting up your own servicing business, designing and building, and much more—each book filled with descriptive illustrations and diagrams.

And you can have one or more of these top notch best sellers—for 7 days FREE!

Simply write your choices on the coupon below and mail it today. Read and enjoy your books for seven full days. If, after that time, you do not agree that they are everything you want, return them and owe nothing. Otherwise, send along your payment of our bill plus a small charge for postage and handling.

Here is the perfect way for every serviceman to build the library he must have. Order now!

2404. FM RADIO SERVICING HANDBOOK, King
This is a practical guide to frequency-modulated V.H.F. radio receivers, their design, construction, alignment and repair. Includes chapters on adaptors, aerials, and high-fidelity audio equipment. A good introduction to FM theory, kept as non-mathematical as possible. $5.00

2410. TELEVISION AND RADIO REPAIRING, Markus
This book shows how to test, repair and replace each component of TV and radio receivers, power supplies, resistors and condensers, coils, tuning devices, and speakers. Shows what servicing involves, how to get information and tools necessary. The book includes the T.V. Detect-O-Scope. $7.95

2422. HANDBOOK OF TV REPAIR, Hertzberg
The simple mechanical and electrical maladies which are the great majority of television set troubles — what you can do about them and what not to try. Covers tubes and testing, antennas, UGH converters, fringe-area reception, the set and the chassis. $2.50

2506. FUNDAMENTALS OF RADIO AND ELECTRONICS, Everitt, et al
All you need to know on electronics and radios is found in this book—including transistors and vacuum tube principles and circuits. A product of close collaboration among five radio authorities, it is perfect for self-study. 832 pp. $11.35

2402. PRACTICAL RADIO SERVICING, Marcus and Levy
Dealing with the common types of radios in use, a-c/d-c receivers, photograph players, and batter and three way portables. This book not only describes circuit fundamentals and servicing instruments and methods, but also gives graded job sheets giving valuable practical experience. Includes the indispensable Radio Detect-O-Scope. Illustrated. $8.95

2403. ELEMENTS OF RADIO SERVICING, Marcus and Levy
Gives practical, step-by-step procedures for finding troubles in radio receivers and making repairs. Readers with a background of simple radio theory can easily understand the book. Emphasizes over-all servicing procedures. $7.25

2406. ESSENTIALS OF TELEVISION, Slurzberg, Osterheld and Voegtlin
Comprehensive study of basic TV circuits. The operation of a color set and three monochrome receivers is described in detail from the antenna to the picture tube and loudspeaker. Features the sound section, waveforms, the picture tube, etc. Complete with illustrations, examples, questions, problems. $8.95

2409. TELEVISION FOR RADIOMEN, Noll
Here are the principles and essential mathematics of television. Detailed studies of cascade tuners, new video amplifier techniques, large screen picture tubes, modern deflection systems, latest antenna detail. Covers U.H.F., color TV, transistors, some topics not dealt with before. Construction, operation and servicing of television. $10.00

2411. TELEVISION SERVICING, Levy and Frankel
Explains how to find the section in which the trouble occurs and then to find the defective component. From the circuits discussed, which are employed in over 95% of TV receivers now in use, the reader gains an understanding of the principles involved. A knowledge of basic electronics is essential. $7.75

2423. BE YOUR OWN TELEVISION REPAIRMAN, Guth
Seventy-five percent of the time the only trouble with your TV set is a faulty tube. With this complete book, covering all manufacturers' models, you can easily replace the tube yourself. One dollar saves big repair charges. $1.00

2804. RADIO AND TELEVISION MATHEMATICS, Fischer
Whenever you need to look up the use of a formula or the correct substitution of numbers, you can find it here—rapidly. More than 700 step-by-step solutions of the usual problems encountered in radio, television and industrial electronics, including all those needed for FCC exams. $6.95

2419. BASIC TELEVISION, Grob
The basic book for training television servicemen and technicians. No mathematics other than simple arithmetic and algebra is needed. 660 pages with illustrations. $9.25

2420. TELEVISION FUNDAMENTALS, Fowler and Lippert
A simple nonmathematical presentation of the basic principles the radiotechnician must know in order to install and service television receivers. Sound treatment of each element of the system—from the antenna to the picture tube. $8.50

2424. TELEVISION SERVICING, 3rd Edition, Buchsbaum
Complete, most recent information on the design, construction, and servicing of both black-and-white and color sets. Shows how to locate and repair every conceivable trouble. $7.15

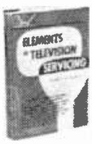
2427. COLOR TELEVISION FUNDAMENTALS, Kiver
This book can teach anyone familiar with monochrome television how to install and service color TV sets. All circuit discussions employ highly successful step-by-step approach. $7.25

2006. THE ELECTRONIC EXPERIMENTER'S MANUAL,
David A. Findlay

With a few dollars worth of basic tools and this book to guide you, you can explore the wonderworld of electronics experimentation more completely than ever before. 10 big sections, including exciting projects you'll build and use. $4.95

2412. TELEVISION AND FM ANTENNA GUIDE, Noll and Mandl

Two antenna experts tell you their secrets of antenna choice for best reception everywhere, including fringe and difficult areas. Discusses general characteristics, lengths spacings, and principles including impedance matching and loss factors. Several new types of antennae based on author's own experimentation included. $5.95



2425. ELEMENTS OF TELEVISION SERVICING FOR BENCH AND FIELD,
Marcus and Gendler

An up to date discussion of installation, servicing, and repair of TV receivers. An ample, practical guide designed for the serviceman familiar with radio reception. $8.15

2017. ELECTRONIC EXPERIMENTER'S HANDBOOK, 1961

A do-it-yourself goldmine! Includes 40 all-new projects — 20 data charts and tables on circuits, resistors, transformers, capacitors, ham and citizens band radio, sound levels—and more. Projects for your shop, for your hi-fi and audio systems, for the ham and SWL and for fun. $1.00

2413. CLOSED-CIRCUIT AND INDUSTRIAL TELEVISION, Noll

This text exhaustively studies theory and practice of closed-circuit and industrial television, present and potential. The technical section of the book covers TV transmission and its application to specific commercial equipment. $4.95

2007. COMPUTERS AND HOW THEY WORK,
James Fahnestock

A fact-filled guidebook to electronic computers. Covers the history of computers and explains the workings of every major computer system ever used. Must reading for career-minded students and electronics pros who want a more complete knowledge of this important field. $4.95

2358. MECHANICS VEST POCKET REFERENCE BOOK

Over 200 fact-filled pages including tables, charts, formulas, for every aspect of mechanical work. Also includes logarithm table, conversion factors on gears, U. S. versus foreign measurements, etc. $2.50

2012. JOBS & CAREERS IN ELECTRONICS, 1961

Your key to a top-paying position in electronics! Describes interesting jobs for engineers, technicians, technical writers. Includes five big sections on opportunities in electronics, planning a career, testing your aptitude, case histories of careers and spare time electronics. $1.00

2408. ESSENTIALS OF ELECTRICITY FOR RADIO AND TELEVISION, 2nd Edition, Slurzberg and Osterheld

This bcok provides the necessary background of electronics principles for an understanding of television, frequency modulation, and radio circuits. Electrical principles are explained in terms of electron flow. $8.25

2008. CLASS D CITIZENS RADIO,
Leo G. Sands

Now, with more than a million vehicles equipped for its use, Citizens Radio is a major phase of the electronics field. Here's the story on the whole field—its history, rules, and everything about how it works. Learn exactly what Citizens Radio is, its applications, what you need, FCC rulings, etc. $4.95

2415. MANDL'S TELEVISION SERVICING, Mandl

This standard textbook of television servicing includes recent information on transistor circuits, color TV, UGH and VGH receivers, cascade tuners, automatically focused tubes. A master table lists over 100 trouble symptoms, with possible causes and page number for full servicing instructions for that fault. $7.50

2502. ELEMENTS OF RADIO, 4th Edition,
Marcus & Marcus

This excellent one-volume course on the essentials of radio has sold over a million copies! It employs the unique "spiral" method of instruction and is profusely illustrated. $7.00

2011. STEREO & HI-FI DIRECTORY, 1961, Ziff-Davis

New! Over 1200 component listings, 800 photos; latest models, prices! Entire sections on every phase of stereo and monaural high fidelity. $1.00

FREE!

ENCLOSE PAYMENT NOW WITH YOUR ORDER AND YOU WILL GET AS A FREE BONUS A COPY OF THE HARD-COVER EDITION OF THE 1960 ELECTRONIC EXPERIMENTER'S HANDBOOK—

A $1.95 VALUE

FREE!

ELECTRONICS BOOK SERVICE
One Park Avenue, New York 16, N. Y.

Please send me the book(s) I have listed below for a FREE 7-Day Trial Examination. I understand that if I am not completely satisfied, I may return my selection(s) and I'll owe you nothing. Otherwise, I will send you payment for the book(s) of my choice, plus postage and handling.

NUMBER	TITLE	PRICE
	*TOTAL	

*New York City Residents, please add 3% sales tax.
(If you need more space for other titles, attach a sheet of paper with addl. list.)

☐ SAVE MONEY! Enclose payment in full for the book(s) of your choice and we will pay shipping charges. Same return privileges and prompt refund guaranteed.

☐ Please send me FREE CATALOG, when published. EF555

NAME ______________________
PLEASE PRINT CLEARLY

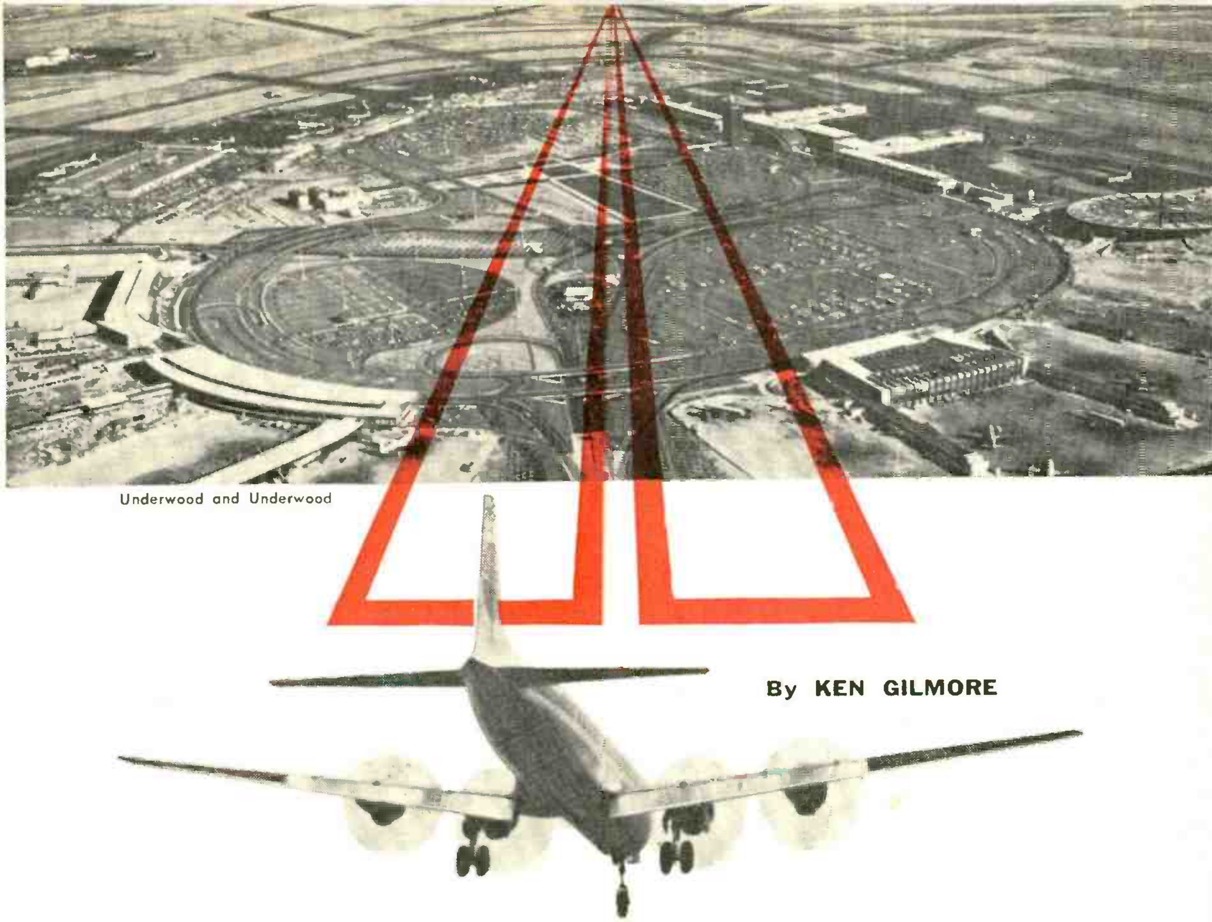
ADDRESS ______________________

CITY ______________ ZONE ______ STATE ______

(7-day free trial offer good only in U.S.A. and Canada. Foreign customers must enclose payment in full. Satisfaction guaranteed or money refunded.)

Listen to the EICO Hour, WABC-FM, N. Y. 95.5 MC, Mon.-Fri., 7:15-8 P.M.

©1961 by EICO, 33-00 N. Blvd., L. I. C. 1, N. Y.



Underwood and Underwood

By KEN GILMORE

THEY'LL FLY SAFELY

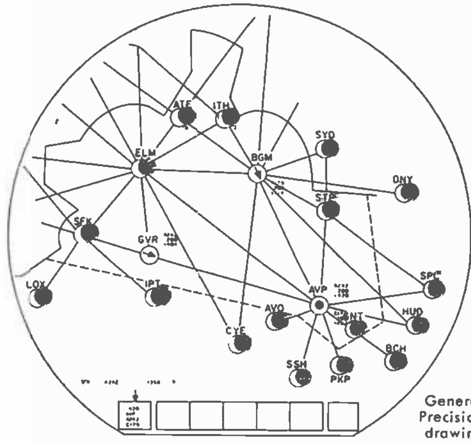
Tomorrow's jets will be safer than ever, thanks to a growing network of electronic air traffic control

ONE DAY a few months ago, a four-engined airliner with two experienced pilots in the cockpit circled an airport just outside of Atlantic City, N. J. Soon, the plane entered the traffic pattern and began its descent. A few minutes later, just above the end of the runway, the plane "flared out" perfectly, "greased" its wheels onto the runway, and rolled to a stop.

Sound like a perfectly normal landing? It was—except for one highly significant detail. *At no time during the approach or landing did either pilot touch any of the plane's controls.*

But completely automatic landing is only one in a long series of breakthroughs in aviation electronics which are making many of today's systems as obsolete as crystal sets. Scientists at the Federal Aviation Agency's research and development center near Atlantic City—where the "no-hands" landing took place—are working out

Automatic flight course display developed by IT&T enables pilot to navigate by looking at map (left) showing his course and position. With IT&T display, pilot can easily guide his plane along any course he wishes.



General Precision drawing

A second map—this one for the ground controller—is part G of the electronic brain shown on page 45. Arrows at points BGM and GVR, above, indicate position of two planes; black dot at AVP identifies it as the point of their potential conflict.

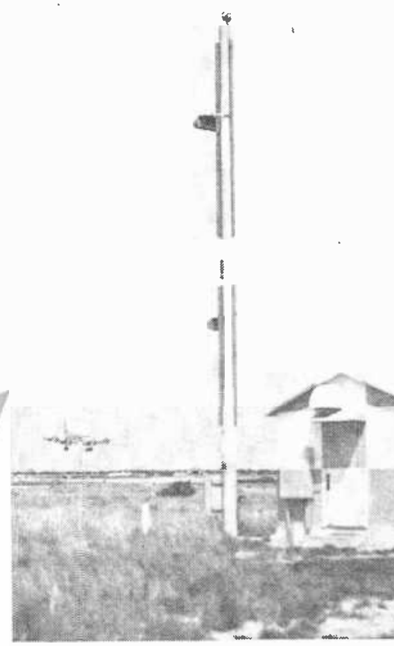
final details on a number of day-after-tomorrow electronic developments. Among them:

- a proximity warning device which will automatically avoid mid-air collisions
- three-D radar to tell ground controllers each plane's altitude, as well as its range and bearing
- automatic flight course displays which will show pilots both the plane's progress and its current position instantly
- automatic plane-to-ground and ground-to-plane communications in which pilots and controllers will communicate in less than a hundredth of a second, simply by pushing buttons
- a giant, interconnected "electronic brain" complex which will keep track of thousands of planes all over the country, noting slight variations from predicted speeds and courses, and spotting potential conflicts long before planes get close to each other

Traffic Control Plan. An advanced air-traffic-control plan, being brought into existence by devices such as those mentioned above, is rapidly becoming an absolute necessity. Although our present setup still does a good job—statistics show you're twice as safe today in an airliner as in your own car—it's swiftly going out of date.

The present system of air traffic control was designed in 1938, when fewer than 30,000 planes were in the air; most of them lumbered along at about 150 miles per hour. Today, we have 109,000 planes, each of which is in the air far more hours per day than were the old flying geese of a quarter century ago. In addition, many of today's craft zip along at speeds faster than that of sound.

Naturally, the basic 1938 system has been revised from time to time to keep up with the growing load. But essentially, today's operations stem from the same system that was in use before World War II, and which has just about reached its limit. Before 1975, when more than twice as many air miles will



Instrument landing systems in use at most major airports today employ three sets of transmitters on the ground, three receivers in each plane. One transmitter sends out a **localizer beam**, which tells the pilot that he is headed down the center of the runway. The second transmitter (at right) generates a **glide-slope beam** to signal the pilot that he is descending at the proper rate and in the proper path to make contact with the end of the runway. Other low-power transmitters (mushroom-shaped objects above) shoot signals straight up into the air to inform the pilot of his distance from the end of the runway. Although landings are instrument-controlled, present ILS systems require that pilots see the runways in order to land.

FAA photos

be flown each year, it will have broken down completely.

Obviously, we need a new system. To design one able to do a jet-age job, the FAA's research and development section was established three years ago. Now, it's spending 75 million dollars a year to attack the problem from every angle. Here's what your tax dollars are buying in the way of improved air safety.

Height-Finding Radar. In Atlantic City stands a sixteen-story-tall red and white tower that is the heart of the new ASHR-1 radar. With today's equipment, controllers can tell the direction and distance of planes in the area, but not the altitude. When two radar "blips" come together, controllers don't know if one plane is thousands of feet above the other, or whether the two planes are about to collide.

The ASHR-1, already proved successful in preliminary tests, will add this missing dimension. With height-finding radar in use, tragic mid-air collisions like the one which claimed 138 lives over New York City last December will become much more unlikely.

Proximity Detectors. Since the beginning of aviation, planes have flown on a see-and-be-seen basis. At speeds up to several hundred miles an hour, this is good enough. But when two supersonic jets are approaching one another on a collision course, by the time the pilots see each other it's often too late for them to do anything about it.

To appreciate this fact, remember that jets five miles apart are actually *less than fifteen seconds away from disaster!* Yet a plane five miles off is just a tiny speck, easily overlooked. And, because of its speed and size, a fast-moving jet takes additional seconds to bite into the thin air and change its course. Obviously, in less than perfect weather and with even faster planes in the offing, men's eyes and reflexes simply aren't good enough for the job.

The answer lies in proximity warning

devices. Working on radar principles, they will detect approaching aircraft many miles away and either signal the pilot or automatically take evasive action. Three such systems are now under development.

Automatic Course Display. Today's airline pilot navigates by *VOR*, or *v*ery-high-frequency *o*mnidirectional *r*ange equipment. This is a fine, accurate system, but it has one big limitation. The pilot must always fly directly toward (or directly away from) a VOR station. An indicator on the instrument panel tells him whether or not he is on course. In flying across country, he uses one VOR station after another along his course. Thus, many planes are flying from station to station on, for example, the crowded New York-to-Chicago route. Their VOR highway tends to hold them all on exactly the same course and actually increases the possibility of accidents.

Soon, there will be a gadget in the cockpit which will allow the pilot to fly any course he selects. He might, for example, elect to fly ten miles south of and parallel to the regular airways—a feat that would be very difficult under present conditions. Thus, an unlimited number of new airways would be opened up.

The heart of the new system will be a small computer which constantly takes bearings on VOR stations in the area and continuously plots the plane's position on a map. The pilot will see his course and present position drawn out before his eyes. If he wants to fly from Cleveland to Santa Fe, he can forget about VOR stations. He will simply guide the plane so that the course display equipment in front of him draws a line on the map between the two cities.

Automatic Communications. Under the present system, a pilot spends a lot of time reporting and talking to controllers, just as they do to him. Yet most of the messages are completely routine—the captain, for example, must report his position at regular intervals. When a device now under development is installed in planes, the pilot will simply push a button on his automatic communicator to transmit routine messages.

Using the same system, the controller will see the pilot's message appear on a panel in front of him. He will then

AIR TRAFFIC

A

C

Here's how air traffic control works today. Let's say the pilot of flight 201 prepares to leave New York. He checks with ATC—air traffic control—in New York (A) to see if his route is open. When his flight is cleared, a copy of the flight plan for our fictitious flight 201 is given to each controller in the center through whose sector the plane will pass, and at the same time the flight plan is teletyped to scores of other air controllers in other centers across the country. Each controller involved writes out a flight strip for 201 and posts the strip in front of him (B) along with those of all other planes scheduled to enter his sector.

The pilot gets his clearance from the tower and takes off. At first, he is under control of the tower (C). A few minutes later ATC takes over as 201's radar echo is picked up and tracked. A New York controller puts a small block of plastic called a "shrimp boat" (D) over the radar blip and writes "201" on it. The shrimp boat is moved every few seconds to keep up with the plane's progress on the radar scope.

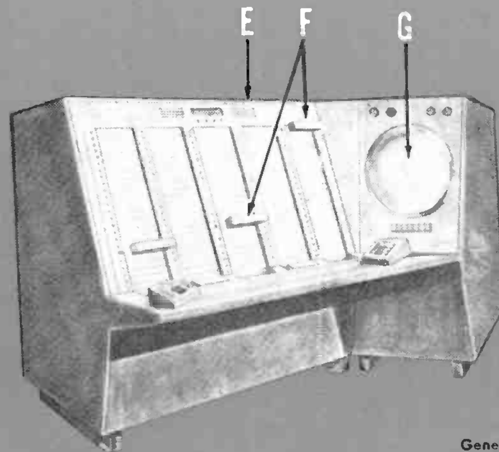
As 201 gets out of radar range, another controller in charge of the next sector keeps up

CONTROL
Today and Tomorrow

B

D

FAA photos



General Precision photo

with its progress by radio. He checks to see if 201 is on time. If corrections are necessary, he checks again for possible conflicts with other aircraft, and sends the corrected time on to other stations along the course.

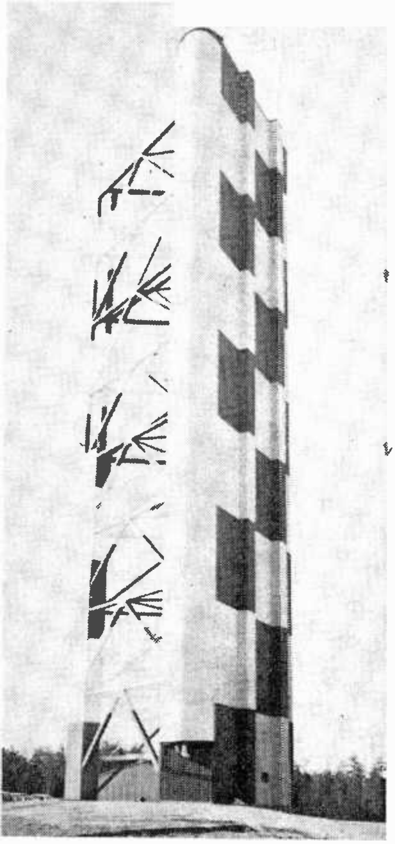
With thousands of planes now in the air, this cumbersome system is on the verge of breaking down. Controllers must spend most of their time bookkeeping rather than controlling. But soon a new system—DPC (data processing central)—will be helping to do the job better, faster, and more reliably. Here's how it will work.

First, the flight plan is stored in DPC's electronic brain. The computer checks for conflicts, and if none exists, clears the flight. It then automatically passes the word to other computers across the country. Each computer automatically prints a flight strip for every controller who will handle the flight. Each radar blip is electronically identified so that a controller knows at a glance which echo belongs to which flight; no more "shrimp boats" to take time or cause confusion.

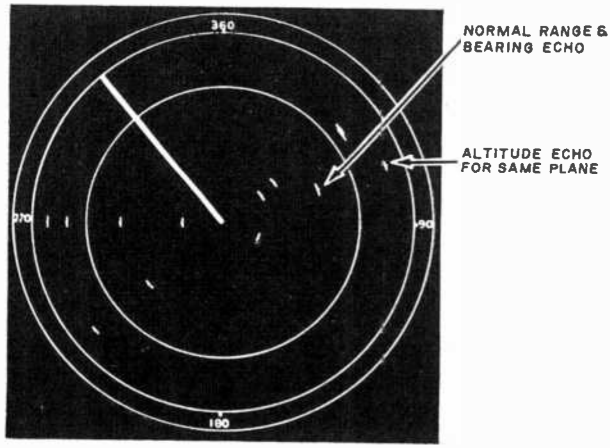
Updating of flight strips will be completely automatic. Let's say, for example, that flight 201 picks up a tailwind and arrives at a certain fix ahead of schedule. The computer notes it, refigures the entire course on the basis of this new information, and notifies every other computer along the flight course. Within seconds, on each flight controller's console (E) all across the country, automatic printing heads (F) run up lists of flight strips, stop at those for 201, cross out the old information, and print in the new.

If the new schedule creates a conflict, the computer in that district recognizes it automatically and flashes a red light to notify the controller. The controller in that sector presses a button and a map of the airways appears on the screen (G). On the map are shown the positions of flight 201 and the other plane in potential conflict. The controller suggests a possible solution to the computer. If this is all right, the computer okays it; if not, it indicates that there would be another conflict.

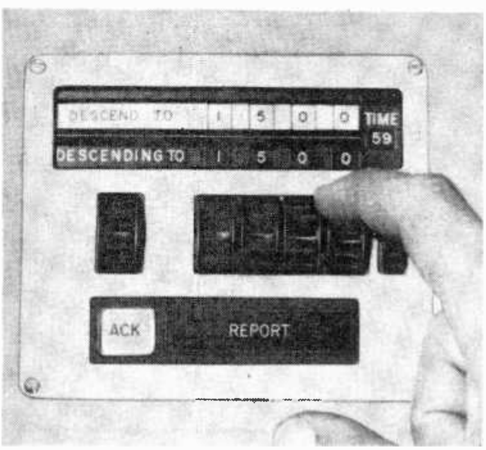
When the controller has decided on and cleared a solution, he will not even have to talk to the plane in question to put it on a new course. He will simply press a button on his automatic communicator, and the trouble will be averted.



Height-finding radar transmitter housed in tower at left has hundreds of microwave receiving horns distributed along its front edge. Horns detect angle at which a radar echo approaches the tower and feed this information to a computing circuit. Computer in turn combines information with distance data from regular radar receiver to compute altitude of all aircraft in the area. Altitudes are displayed on standard position indicator (below) in special ring at outermost edge.



FAA photos



Push-button air-to-ground and ground-to-air communicators will be standard procedure with devices now under development by Lear, Inc. Instrument above can display 64 separate words and phrases—more than enough for most routine communications.

push another button to answer, and his reply will appear on the pilot's instrument panel. The pilot will press an "acknowledge" button, flashing a light on the controller's panel and letting him know the message was received and noted. The entire operation will take only a few seconds, free crowded communications channels, and allow both pilot and controller to attend to other duties.

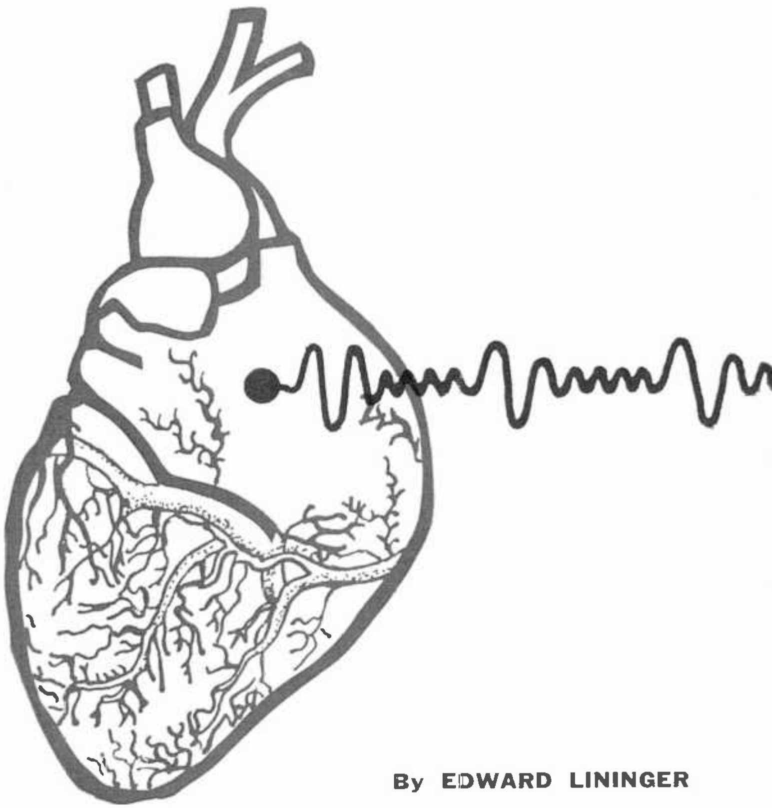
Enter DPC. Undoubtedly, the most important program under way for the improvement of our airways goes by the name of DPC—*d*ata *p*rocessing *c*entral. This system, when complete, will be made up of dozens of giant computers in air traffic control centers all over the country. Each one will be interconnected with all others, so that they can chat electronically back and forth and keep each other up to date as planes pass from one area to another.

The new system will keep tabs on every controlled plane in the air, noting its progress and making sure that it keeps out of every other plane's way. (See pages 44 and 45 for a detailed explanation of how DPC will work.)

(*Continued on page* 109)

LISTEN TO YOUR HEART

Electrical "signals" from the brain to the heart and other muscles are clearly audible on this easy-to-build four-transistor cardiac monitor



By EDWARD LININGER

EVER THINK of the human heart as an electrically operated pump? It is—and you can prove it to yourself and your friends with this simple transistorized cardiac monitor.

Actually, not only the heart, but all muscles of the body are controlled by minute electrical signals sent by the brain to the "motor" nerves. A sample of the voltages governing the heart can be picked up from the skin with electrodes, amplified, then coupled to an indicating device such as a meter. The heart action will be displayed as peaks of voltage occurring as the heart muscles contract.

The cardiac monitor does just this. In addition, it provides audio reproduction of signals to the heart or signals to muscles of the body which are between the skin electrodes. Basically a four-transistor amplifier, the monitor is neither tricky to assemble nor does it need any alignment. It can be constructed by the average builder for $19.00 to $25.00.

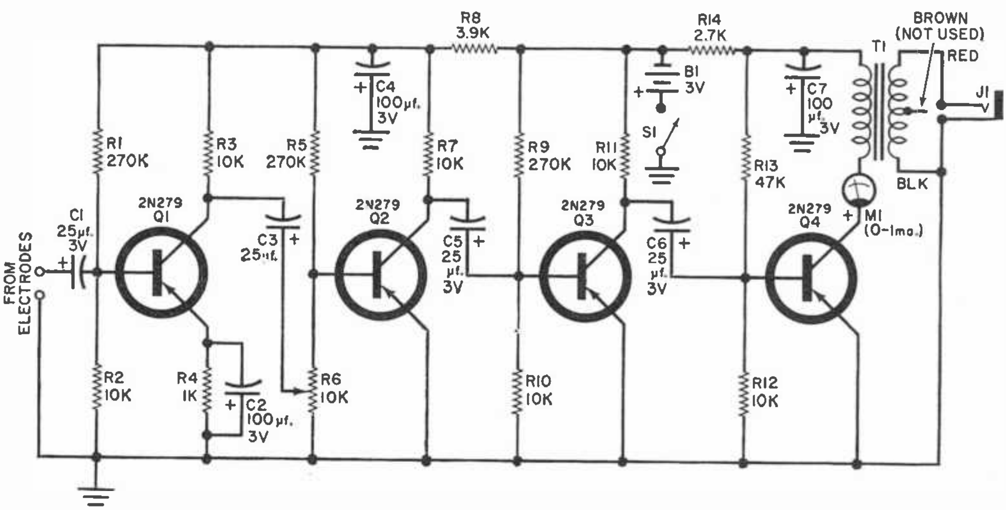
Construction. Begin by laying out and drilling all holes required in both the chassis and the front panel—a 6" x 9½" section cut from an open-end aluminum chassis. Attach the front panel to the chassis by means of the nuts on gain control *R6* and jack *J1*, then install the four terminal strips and transformer *T1*.

Drill holes as necessary to mount the transistor sockets chosen: one type

Fun to use, the battery-powered heart monitor furnishes visual as well as audible heartbeat indications. It is completely safe to operate, even for children.

bands are available at medical supply houses in the types illustrated. Alternatively, electrodes can be fabricated from brass, copper, or stainless steel; suitable dimensions are about 1¼″ x 2″. Attach the electrodes to the input leads using solder or alligator clips.

After double-checking connections, trim the transistor leads and insert the transistors in their sockets, paying special attention to the red dot that identi-

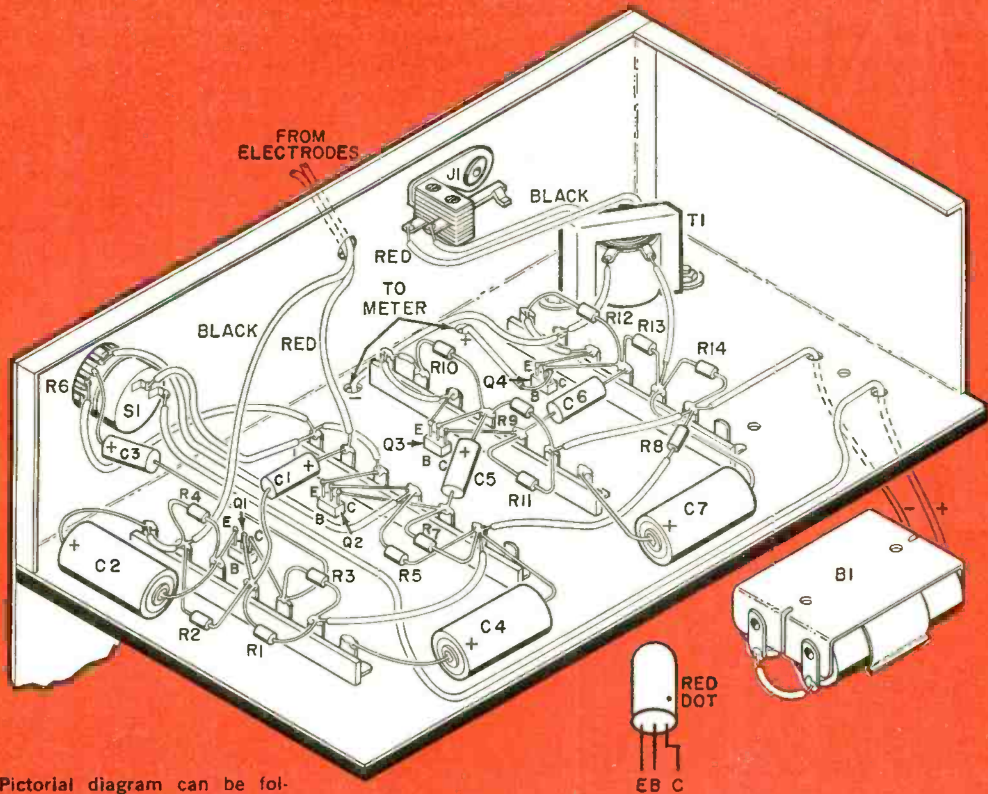


Schematic diagram of cardiac monitor. Note that all four transistors are identical.

mounts in a round hole, another in a rectangular hole which can be made with a special punch or by filing a pair of pilot holes with a small file. In any case, the sockets should be installed so that the collector pins are nearest the back of the chassis.

Wire the monitor in any convenient fashion, working from the first through the fourth stages. Attach the input leads last, using No. 18 or No. 20 hookup wire made into a twisted pair about 3½ feet long. Standard electrodes with elastic fies the collector in each case. With the switch off, install battery *B1*, which consists of two 1½-volt flashlight cells in series. Then plug a pair of low-impedance headphones into jack *J1*. As an extra precaution, you may want to attach a metal bottom plate to the chassis to reduce interference from the a.c. line.

Operation. Before the monitor can be put to use, it's necessary to prepare the "patient" for testing. The important thing is to reduce skin resistance by removing non-conductive material from



Pictorial diagram can be followed for ease in wiring. Be sure to observe polarities of battery, meter, and capacitors.

PARTS LIST

B1—3-volt battery—see text
C1, C3, C5, C6—25-µf., 3-volt electrolytic capacitor
C2, C4, C7—100-µf., 3-volt electrolytic capacitor
J1—Open-circuit phone jack
M1—0-1 ma. d.c. meter
Q1, Q2, Q3, Q4—Audio-frequency pnp transistor (Amperex 2N279 or equivalent)
R1—270,000 ohms
R2, R3, R7, R10, R11, R12—10,000 ohms
R4—1000 ohms
R5, R9—270,000 ohms
R6—10,000-ohm potentiometer with switch S1 (IRC Type Q13-116 and 76-1 switch or equivalent)
R8—3000 ohms
R13—47,000 ohms
R14—2700 ohms
S1—S.p.s.t. switch (on R6)
T1—Line-to-voice-coil transformer; primary, 500 ohms; secondaries, 6-8 and 3.2 ohms (Stancor A-8101 or equivalent)
1—9½" x 5" x 2" aluminum chassis (Bud AC-403 or equivalent)
1—6" x 9½" aluminum panel—see text
1—Headphones, 4- to 8-ohm impedance (Lafayette MS-429 or equivalent)
4—Five-lug terminal strips
Misc.—Transistor sockets, battery holder, electrodes, wire, solder, etc.

All resistors ½ watt

HOW IT WORKS

The amplifier of the cardiac monitor has four transistors and is powered by its own batteries. The incoming signal from the skin electrodes is capacity-coupled to the base of *pnp* transistor *Q1*. Resistor *R3* provides the load for this stage; resistors *R1* and *R2* are bias dividers; *R4* is a fixed bias resistor to stabilize current against temperature variations. Capacitor *C3* couples the signal into gain control *R6*.

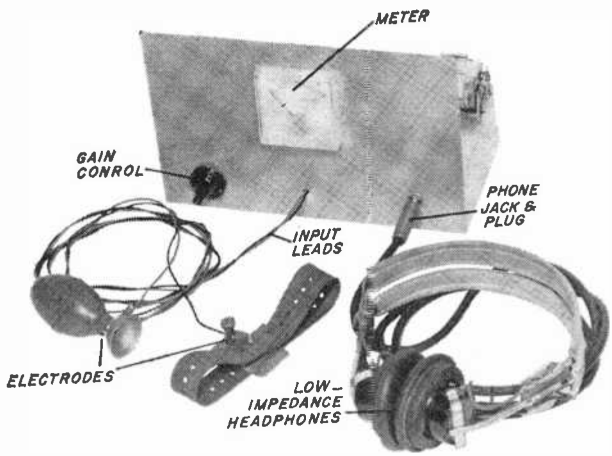
Transistors *Q2* and *Q3* operate in a similar fashion, but in *Q4*—the fourth stage—the collector current passes through meter *M1*. The meter responds to the low-frequency portion of the input signal waveform (inertia and damping of the meter needle confine its movement to the lower frequencies). The audio signal passed by output transformer *T1* is fed into low-impedance headphones connected to jack *J1*.

its surface. This can be done by scrubbing the skin on the inside of each forearm with Ajax scouring powder or Lava soap and a solution of salt and water. (Doctors rub the skin with an electrode paste containing pumice and salts until it is slightly reddened.)

Next, wet the electrodes with salt water and attach them securely to the inner side of each forearm with elastic or adhesive tape. If a suction cup of the type illustrated is available, it should be used on the left side.

Turn on the switch and, after waiting a few seconds for voltages to stabilize, advance the gain control. To obtain proper indications, have your subject crackling sound should be heard in the earphones accompanied by an erratic movement of the meter needle. Taking a deep breath should give the same result.

If you experience difficulty in obtaining a proper indication of the heartbeat on the meter, the trouble may be caused by 60-cycle interference from house wiring under the floor or in nearby appliances—especially fluorescent lamps. If hum is heard in the headphones, move the subject a few feet away and listen again. When a location giving a minimum hum level is found, try again for proper indication. For maximum signal from a muscle other than the heart,



Completed monitor, shown with electrodes used by author. Suitable electrodes can be made by hand (see text), but you'll probably find it more convenient to purchase a pair from your local medical supply house.

seated and relaxed—you can be your own subject if you are careful to remain quiet after each adjustment. Observe the meter needle for a movement, advancing the gain control to full if necessary. Needle movements should follow a definite sequence—a slight rise, then an abrupt drop, a quick rise, a pause; then the same pattern all over again.

Although the a.c. signal sent by the brain to the muscles contains frequencies as high as 100 kc., naturally only the portion in the audio range can be heard in the headphones. Note that you do not hear the actual *sound* of the heartbeat—this would require a microphone. What you hear is the voltage sent to the heart muscles, greatly amplified.

To pick up signals to arm muscles, for example, try clenching your fist or pressing one arm tightly to your side. A sharp place the electrodes so that the muscle lies between them.

Applications. Although the monitor opens an interesting field to experimenters by permitting study of electrical signals in the human or animal body, the basic design also has plenty of extremely practical applications. One very obvious use is in determining if heart action is present in victims of fires, drowning, electrical shock, and other accidents. In the hospital or home, an improved version could be used as a portable device to supplement the electrocardiograph by allowing continuous monitoring of a patient's heart action by medical personnel. More professional models based on this same design could be brought into the operating room to observe heart strength and frequency during an operation. –30–

HEADS...OR TAILS?

Inexpensive "no-cheat" device will flip coins electronically

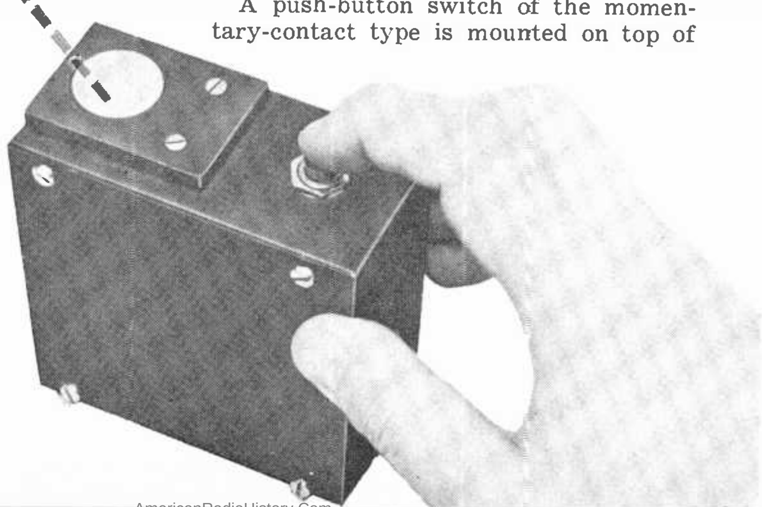
By HAROLD P. STRAND

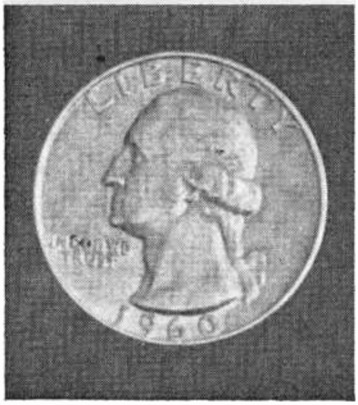
HERE'S an interesting device which could be a barrel of fun at your next party. A simple magnetic coin tosser, it can form the basis for an entertaining game of chance in which players bet on the way a coin will fall when it lands. As part of some other game, it can be used to decide which player starts off, or if a particular player should be allowed to continue his "turn" as long as "heads" keeps coming up for each play.

In fact, there is virtually no end to the "game" applications for this inexpensive gadget. And there's no chance to cheat with it, as there is when someone flips a coin and places it on the back of his own hand.

The device consists of an a.c. solenoid magnet which operates directly from the a.c. line, eliminating the need for batteries or a step-down transformer. The solenoid is fixed to the top of a utility box; a hole drilled in the top of the box allows a steel plunger to come through, the plunger being operated by the action of the solenoid.

A push-button switch of the momentary-contact type is mounted on top of





the box and serves to connect the a.c. line to the solenoid windings. When the circuit is closed by the switch, the steel rod plunger pulls up quickly with considerable force. If a quarter has been placed in the recess over the hole in the box, it will be thrown into the air for a distance of about two feet or more.

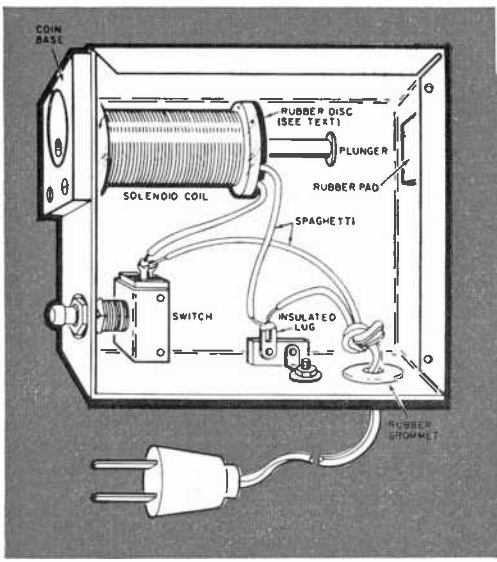
The coin is turned over many times in its flight upward due to the fact that the plunger does not strike it exactly in the center. The hole in the coin base is bored off center so that the plunger tends to flip the coin over rather than simply push it straight upward.

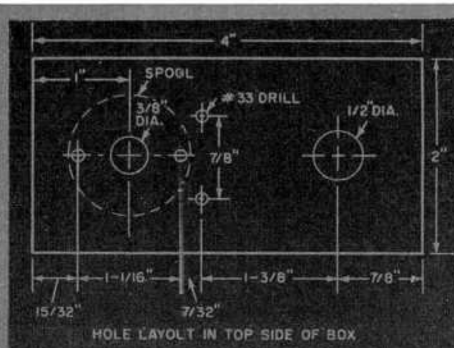
the inside top surface with *4-40* screws and two other holes to attach the small block of ¼" birch plywood, which acts as the coin base, to the box with flat-head *4-40* screws and nuts. Finally, bore holes in one side of the box for the rubber line-cord grommet and the screw which holds the terminal strip.

The core for the solenoid is made from a 2" length of brass tubing; the two ends are cut from ⅛" plastic and, once on the tubing, form a spool (or bobbin) upon which the coil is wound. (See Detail 2.) In the author's case, the end pieces were cut out on a jig saw and dressed round and smooth on a sanding disc; however, they can be virtually any shape—even square, if you wish. A center hole is drilled in each piece just large enough to permit a tight "press fit" on the tubing.

After the end discs have been pressed completely over the ends of the tubing, lightly peen the tubing with a small hammer to make a burr at each end which will prevent the discs from being pushed off by the winding.

Next, drill and tap two *4-40* holes





Detail 1.

Preparing the Parts. Begin construction by boring a ⅜" hole in the top of the utility box to clear the plunger and another ½" hole for the switch (see Detail 1 for size and location of holes). Drill two small holes for attaching the plastic end of the coil bobbin to

in one end of the spool to line up with those bored in the box for the screws that will hold the solenoid in place. Two holes are then drilled in the other spool end for the "start" and "finish" of the wire, as shown in Detail 2. Wrap a layer of paper masking tape around the brass tubing for insulation, bringing the tape all the way to the ends. You are now ready to wind the coil.

Winding the Coil. The winding can be done best with a winding machine or lathe, but the coil can also be wound in a hand-winding jig. However, since there are a large number of turns required, hand-winding would be quite tedious.

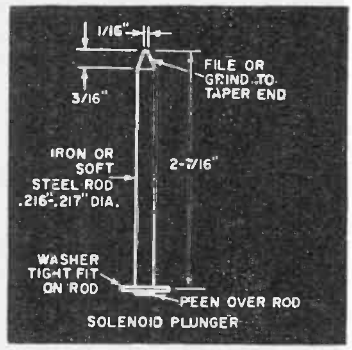
Use No. 30 or No. 31 Formvar wire for the coil and slip a piece of spaghetti over the "start" end of the wire, forcing about ⅛″ of the spaghetti through the "start" hole in the plastic end. Wind the coil as uniformly and smoothly as possible; the total number of turns needed is about 3600—the exact number is not too important as long as you approximate this figure. Feed the "finish" end out the hole drilled near the edge of the disc, and use another piece of spaghetti on the wire, again bringing about ⅛″ of the spaghetti through the hole.

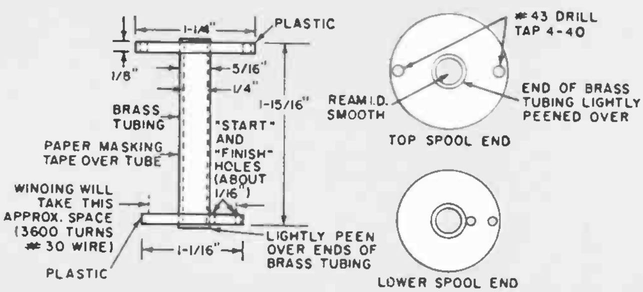
Assembling the Tosser. A disc of rubber, cut from an old inner tube, should be made up with a center hole and two slots to clear the leads. This is Pliobond-cemented to the lower end of the

BILL OF MATERIALS

1—4″ x 4″ x 2″ utility cabinet (Bud AU-1083 or equivalent)
1—S.p.s.t. momentary push-button switch, normally open (Hart and Hegeman 3391GL or equivalent)
1—2″ length of brass tubing, 5/16″ OD, ¼″ ID
1—2½″ length of soft iron or steel rod, 0.216″ in diameter
1—Washer, ½″ OD
1—1¼″ x 2½″ x ⅛″ piece of Lucite plastic (approx.)
1—2⅛″ x 1½″ x ¼″ piece of birch plywood or other hardwood stock
1—1-lb. spool #30 Formvar magnet wire
Misc.—Line cord with plug, one-lug terminal strip, scrap rubber from old inner tube, plastic spaghetti (about 1/16″ OD), 1/16″-thick felt, paper masking tape, screws and nuts, etc.

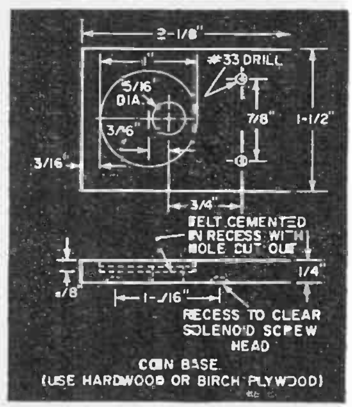
Detail 3.





DETAIL OF SOLENOID COIL

Detail 2.



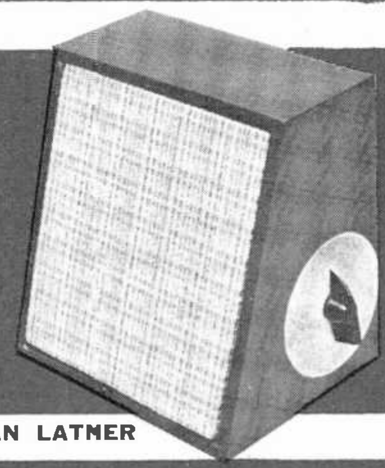
Detail 4.

spool to act as a bumper for the washer stop of the plunger.

The plunger consists of a piece of soft iron rod stock around 0.126″ in diameter and 2½″ long. (See Detail 3.) A washer is reamed out to make a tight fit over

(*Continued on page* 111)

TRANSISTORIZED METRONOME



Portable timekeeper works while you play

By NORMAN LATNER

ALMOST anyone who plays a musical instrument has at least an occasional need for a metronome. Commercial units are usually costly, but this reliable transistorized metronome is inexpensive enough to be practical for even the most casual user.

Completely portable, the instrument is powered by a small, but long-lasting, 9-volt battery. The tempo range (about 40-215 beats per minute) and sound are comparable to those of a commercial mechanical unit. Three low-cost transistors and a minimum of other components are used in the circuit.

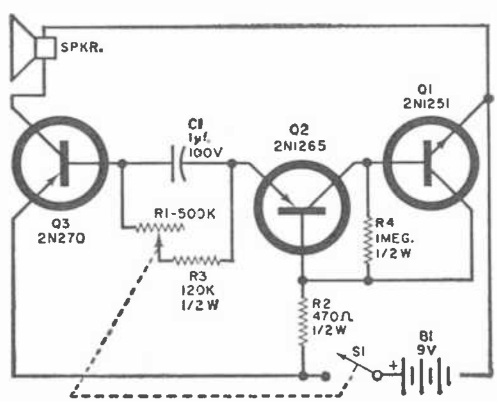
Construction. The loudspeaker baffle serves a dual purpose—it also houses the electronic section of the unit. Mount the speaker in the baffle, then proceed with the wiring of the electronic section.

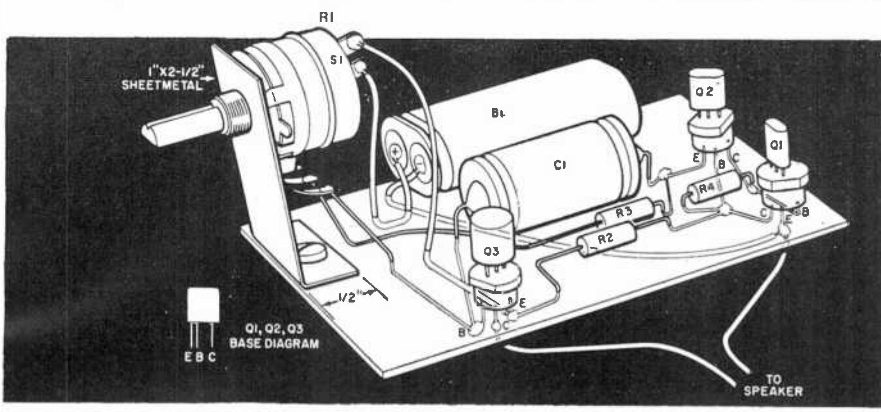
A 2-7/16" x 3⅜" piece of perforated board is used for the chassis. The tempo control potentiometer (*R1*) is secured to the chassis by means of an "L" bracket made from a 1" x 2½" piece of sheet metal. Make a 90° bend along the short dimension ½" from one end, then drill a ⅜" hole for the potentiometer shaft ⅝" from the other end. (See pictorial diagram.) Now bolt the bracket to the chassis and temporarily mount *R1*.

The transistor sockets are mounted by inserting their terminals through holes in the perforated board—bend the terminals slightly to hold the sockets in. Resistors *R2*, *R3*, and *R4*, and capacitor *C1* are mounted in the same way; leave one lead from *R3* at the top of the board, since it will be soldered to the potentiometer. Use a strip of plastic tape or a commercially available clip to hold the battery in place.

Now you're ready to complete the wiring. The battery connections may be soldered, or you can use a set of commercially available snap terminals—but make sure you observe the proper polarity. A pair of leads should be provided which can be connected to the loudspeaker when you are ready to mount the chassis in the baffle.

Drill a hole in the baffle large enough for *R1*'s shaft. If the threaded portion of the shaft is too short to pass through the bracket and the baffle, you'll have to





Lightweight lines in pictorial diagram indicate leads running under board. Mounting nut for potentiometer R1 also secures chassis to side of baffle.

countersink the hole. Make the countersunk area large enough in diameter to accommodate the potentiometer mounting nut and the tool which will be used to tighten it. Finally, the potentiometer-chassis assembly is mounted and the speaker connected.

Calibration. Make a paper dial for potentiometer *R1*'s pointer knob and rubber-cement it in place. Then turn on the metronome and allow about 30 seconds for it to stabilize. A clock or watch with a second hand is used to determine the number of beats per minute at appropriate settings of *R1*, and the dial is marked accordingly.

After you've finished the calibration, add a final touch to the instrument by putting a protective coat of clear nail polish or Krylon spray on the dial. -30-

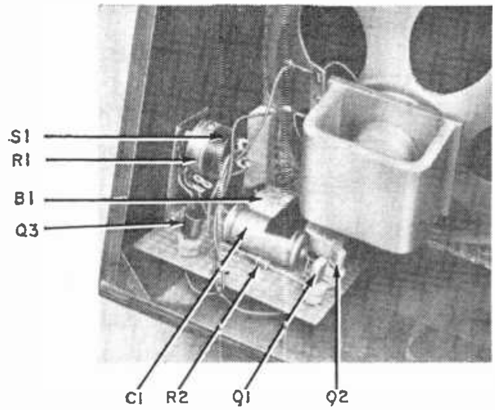
HOW IT WORKS

Transistors *Q1* and *Q2*, *npn* and *pnp* units respectively, are arranged to form a composite *pnp* transistor with a common base current gain greater than one. This composite transistor acts as a switch which closes when the voltage on *C1* is high enough. Capacitor *C1* charges through *R1*, *R3* and the base resistance of *Q3*. The "charge-discharge" pattern is a sawtooth wave and is fed to *Q3*, which acts as a common emitter stage. The speaker serves as the load resistance.

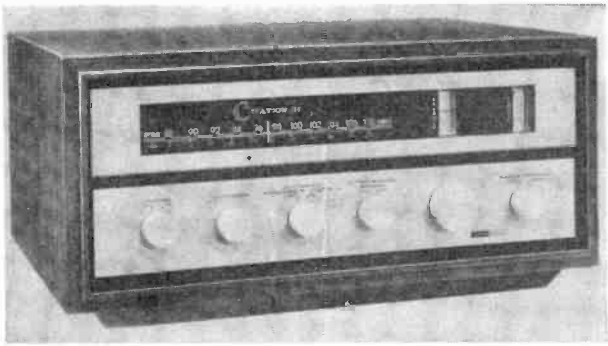
Almost any *pnp* transistor with a common emitter current gain of over 20 and a collector voltage rating of over 10 volts will do for *Q2*. Any *npn* unit with a current gain of over 45 and a voltage rating of over 10 can be used for *Q1*. Transistor *Q3* can be almost any *pnp* transistor, though some units will give lower sound output. If transistor substitution causes a change in the tempo range, the value of *R3* should be raised or lowered to correct the condition: a change of the order of 10,000 or 20,000 ohms should be sufficient.

PARTS LIST

B1—9-volt battery (Eveready 216 or equivalent)
C1—1-μf., 100-volt paper capacitor (Elmenco 1DP-5-105 or equivalent)
Q1—2N1251 transistor
Q2—2N1265 transistor } *see "How It Works"*
Q3—2N270 transistor
R1—500,000-ohm potentiometer (with S1)
R2—470-ohm, ½-watt resistor
R3—120,000-ohm, ½-watt resistor
R4—1-megohm, ½-watt resistor
S1—S.p.s.t. switch
Spkr.—6" PM loudspeaker (Lafayette SK27 or equivalent)
1—Speaker baffle
1—2 7/16" x 3⅜" perforated board (Lafayette MS304 or equivalent)
Misc.—Transistor sockets, knob, sheet metal, hardware, etc.



TUNER KITS COME OF AGE



Citation III

Model LT-10

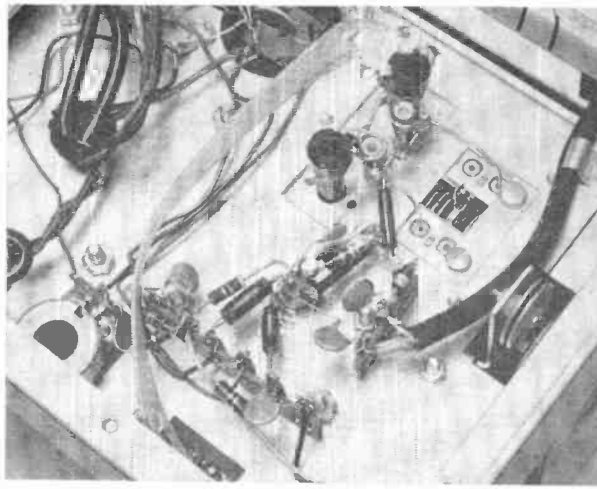
TOP: The Harman-Kardon Citation III FM tuner is more complex to assemble than the Scott kit, and more professional in appearance and performance. Since it costs $229.95 factory-wired, you save $80.00 by building your own.

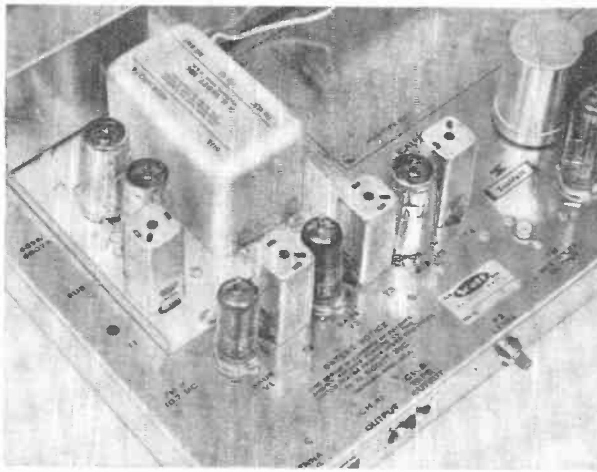
BOTTOM: The H. H. Scott LT-10 FM tuner kit ($89.95) is simple and foolproof to assemble. Scott has manufactured FM tuners of fine quality for many years—the LT-10 is no exception.

Of the eight FM tuner kits now on the market, the Harman-Kardon and Scott units represent new departures in both circuitry and packaging

TUNER KITS for quality FM reception have been on the market for several years. Dynaco, EICO, Heath, Allied Radio (Knight), Lafayette and PACO are some of the manufacturers that produce such kits. But now, thanks to Harman-Kardon and H. H. Scott, there is a sudden, explosive rebirth of interest in building FM tuners.

This interest centers around two ingredients—true hi-fi performance and foolproof assembly. The Scott LT-10 tuner is a medium-priced kit that could





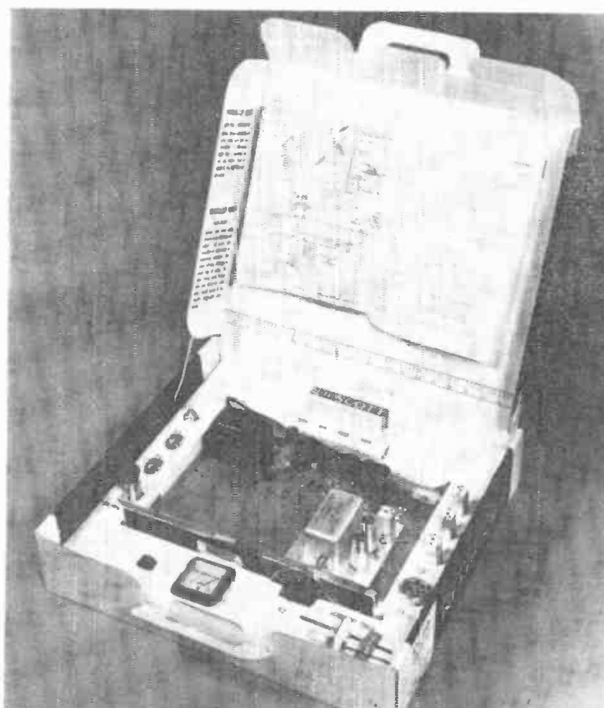
Under the Citation III chassis (at right, above) are the connections surrounding the Nuvistor r.f. stage; coil assembly is supplied partially pre-wired. The r.f. assembly of the LT-10 (right, center) is premounted and preassembled by the manufacturer; blank space on chassis is for a multiplex converter.

satisfy nine out of ten hi-fi enthusiasts. The Harman-Kardon "Citation III" is about the best your kit money can buy—it justifiably deserves the title "professional equipment."

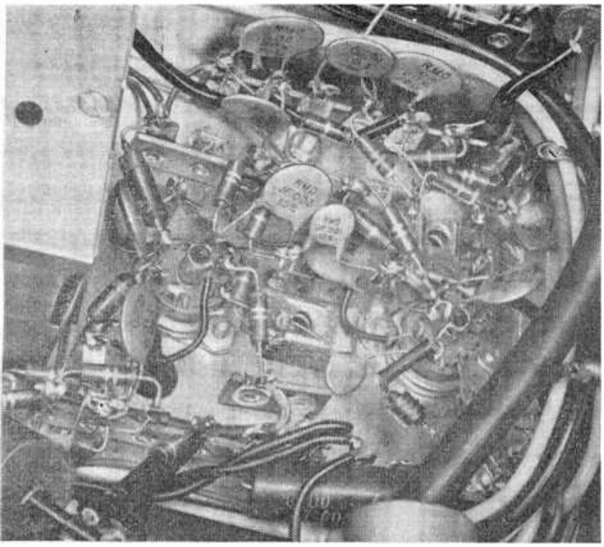
Citation III. That the Citation III can be safely assembled from a kit represents an amazing piece of ingenuity on the part of the Harman-Kardon people. From a circuit viewpoint, the unit is as up-to-date as tomorrow's newspaper.

In the first r.f. stage, to maximize tuner sensitivity, is an RCA 6CW4 Nuvistor—the subminiature vacuum tube originally developed to improve weak-signal TV reception. This r.f. stage is followed by a second r.f. stage connected in a grounded-grid circuit. Between them, these r.f. stages make the Citation III one of the two or three most sensitive tuners ever developed.

After the r.f. stages come the converter stage and three stages of wideband i.f. Only one of the r.f. stages is wired by the constructor; the other five stages are all pre-assembled by the manufacturer—the constructor sim-



Both tuner kits are marvels of packaging. Miscellaneous components for the Citation III are attached to a large card and bagged, while the Scott kit is boxed so that the carton itself can be used as a workbench.



Expect to spend nearly three hours wiring up the Citation III around the limiter and discriminator stages. Thirty-four resistors and capacitors are visible—go ahead, count 'em.

ply solders in the power connections and the input and output cables. Preassembly eliminates what could be a major headache in aligning as complex a tuner as the Citation III.

Two gated-beam tubes are fed the FM signal from the i.f. strip and are designed to act as cascade limiters. A conventional discriminator using crystal diodes follows the limiting stages. The tuner ends up with four triode stages (interchannel muting, a cathode follower after the discriminator, and dual-triode audio amplification).

If there are no wiring errors or omissions in the assembly of the Citation III, you can easily align this tuner in about five minutes—there are only *six steps!* The i.f. strip has been aligned by the manufacturer and is never touched. The Nuvistor r.f. stage is tuned up and the second limiter and detector are easily brought to balance using the two meters on the front panel.

Scott LT-10. When compared to the Citation III, the Scott LT-10 FM tuner kit is sheer, unadulterated simplicity. Circuit-wise, it is a superb example of how the hi-fi fan can readily obtain top-quality FM tuner performance with a minimum number of tubes. (There are only six tubes in the LT-10, including power rectifier; in the Citation III there are ten, not including rectifier.)

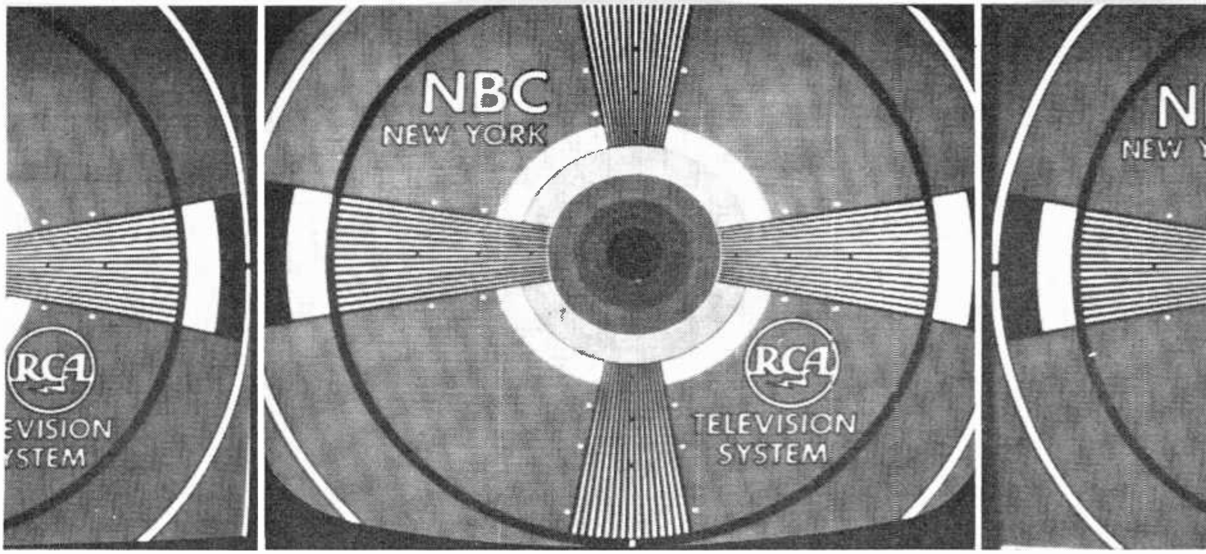
The LT-10 starts off with a cascade r.f. stage—a long-time favorite for sensitivity, low noise generation, and good weak-signal amplification. The converter stage is followed by two i.f. stages, a limiter and a ratio detector using crystal diodes. Audio output connections are made through a triode stage.

There are only three items on the front panel of the Scott LT-10—"on-off" switch, tuning meter, and tuning dial. On the top, or to the rear of the chassis, are controls for minimizing a.c. hum pickup, level or volume adjustment from the tuner, and a large blank space for a multiplex converter.

Unlike the procedure with the Citation III, the constructor aligns the i.f. stages in the LT-10. At first, the novice constructor might want to steer clear of this step and consider buying only a pre-aligned tuner. However, the wideband circuitry of the Scott, plus the amazingly easy tune-up process, makes it possible to get the alignment step down pat. You can spend more time reading the four pages of simplified instructions than it takes to do the complete alignment—which is not a bad idea, anyway. Once through the tune-up process is more than enough to get the tuner on the "nose."

Summing Up. You will need about eight hours to wire a Scott LT-10 and at least 12½ hours to wire a Harman-Kardon Citation III. For the price difference between the two kits, you buy more versatility (interstation muting, local-distant r.f. sensitivity, carrier centering meter, etc.) in the Citation. Both produce hi-fi sound with minimum distortion, and both are more than respectably sensitive—the Citation III a hair better in our opinion.

Each of these kits has many more features than can be described in the limited space of this article. We suggest that you get descriptive literature before making a choice (and don't forget the other tuner kit manufacturers—they may have something even more to your liking). But, no matter what you finally choose—FM tuner kits have "come of age." -30-



INTERPRETING TV TEST PATTERNS

Knowing what to look for in test patterns will help you adjust your TV set for a better picture

By J. K. LOCKE

HAVE your favorite TV stars appeared somewhat flat-headed lately? Do program titles run off one side of your TV screen so that you lose the first or last letter? Or perhaps your picture seems a little fuzzy, with less "snap" than it had when the set was new?

Whatever the difficulty, the TV test pattern transmitted by your local television station can help put you on the road to first-rate reception. If your set is simply out of adjustment, the pattern will help you readjust all front and back panel controls quickly, easily, and accurately. To be sure, you won't be able to clear up faulty interlacing, poor video frequency response, or some other technical defect with the controls. But still, the test pattern will tell you if troubles of certain kinds are developing, and warn you when service is necessary.

MEET THE TEST PATTERN

Before you can make any adjustments or even determine whether your set needs servicing, you must understand what each part of the TV test pattern means. Every component of the pattern—the various circles, rings, gray areas, wedges, and some tiny dots you may not have even noticed—can tell you something.

Aspect ratio is the ratio of the picture's width to its height. In television, the standard aspect ratio is 4 to 3. For example, a picture 20″ wide should be 15″ high.

The two large test pattern circles (see Fig. 1) help you set the aspect ratio accurately. When the black circle just touches the top and bottom edges of the frame and the white circle just touches the sides, the aspect ratio has been set properly.

Linearity is simply the measure of whether the scanning circuits are properly adjusted in the set. By way of explanation, the electron beam which scampers back and forth "painting" pictures on the tube travels at one rate of speed from top to bottom and at another from side to side. Each of these scanning speeds should be "even."

If the scanning picks up or slows down as it goes from top to bottom, the picture "bunches" near the top of the screen and stretches out at the bottom, or vice versa. This results in poor *vertical* linearity.

Poor *horizontal* linearity shows up when the speed of the sweep changes as it goes from one side of the screen to the other. Let's say, for example, that the sweep starts across at very high speed, then begins to slow down as it approaches the right edge of the screen. In this case, everything on the left edge would appear to be stretched out, and all objects on the right would be bunched.

Both horizontal and vertical linearity can be checked by a quick look at the test pattern. If both the white and black circles appear round to your eye, then the linearity in both directions is good. If the circles look misshapen, on the other hand, linearity is poor. Both horizontal wedges should be the same length, and both vertical wedges should be the same length (see A and B in Fig. 2). If either the horizontal or vertical wedges don't form a perfect pair, there's something wrong.

Brightness and contrast are easily judged by looking at the black dot in the center of the pattern (C in Fig. 2) and the four concentric circles around it (D). The dot should be a deep black and the outer circle a crisp white. The three circles in between should be evenly graduated shades of gray. Both brightness and contrast affect the overall balance, so both controls are used to get the black-and-white scale adjusted properly.

Focus—or lack of it—can be checked by looking at the narrow ends of the converging wedges. The lines should not blur, but you may not be able to get a focus so perfect that all of the lines are sharp all the way to the center. (This may be caused by poor resolution, which we'll talk about later.) You should, however, adjust the picture until the lines are as clear as you can get them. Don't be alarmed if the focus does not seem to be equally sharp over the entire picture. Television picture tubes, because of their construction, cannot be focused perfectly over their entire surfaces.

Resolution is a measure of the fineness of detail your set can reproduce. Let's say, for example, that a picture pattern of 300 horizontal lines is transmitted by your TV station. You can clearly see and—if you want to—actually count each one from the top to the bottom of your screen. Suppose, however, that the station increases the number and transmits a pattern of 325 lines. Now the lines become so fine on your set that they blur into a gray pattern, and you can no longer see the individual lines. Your

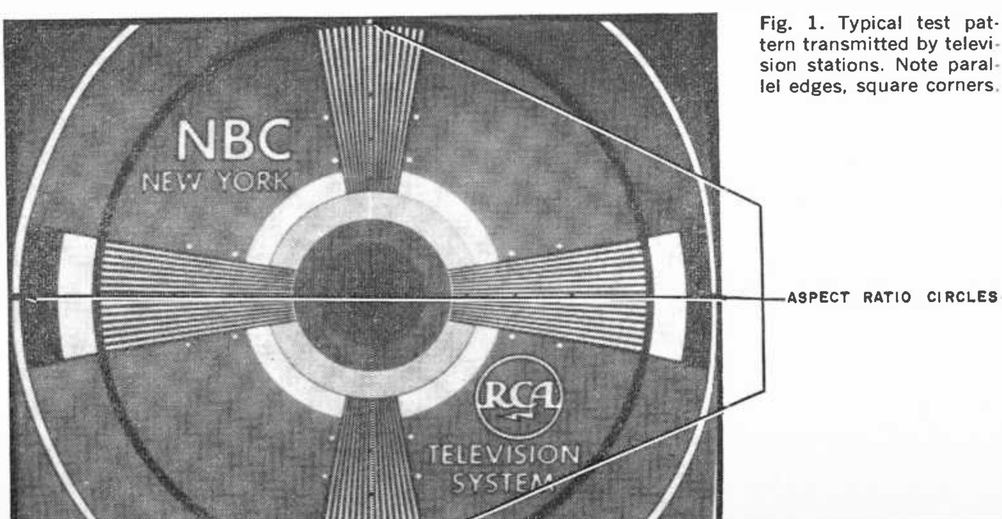


Fig. 1. Typical test pattern transmitted by television stations. Note parallel edges, square corners.

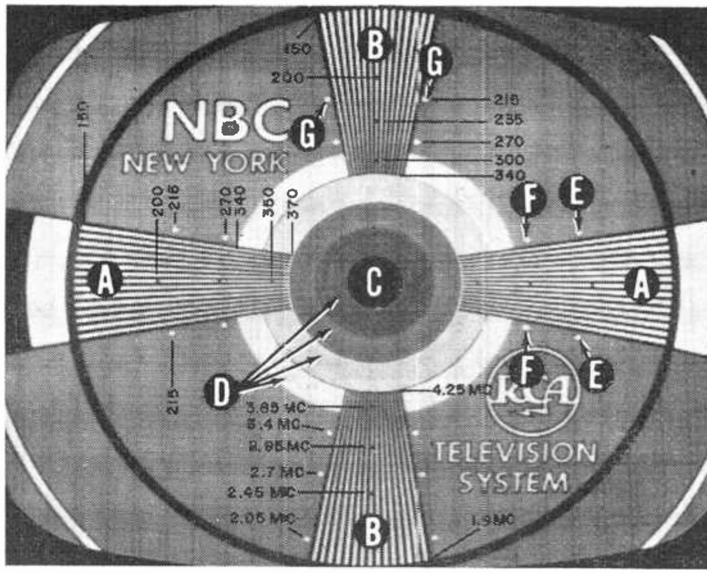


Fig. 2. This is how the test pattern should look on your set when it is properly adjusted. The corners are rounded, and part of the white circle is missing. See text for an explanation of letters and numbers.

set's maximum *vertical* resolution, then, is about 300 lines. *Horizontal* resolution works the same way; it is simply a measure of how many vertical lines you can count from one side of the screen to the other.

You can check the vertical resolution by looking closely at the horizontal wedges of the test pattern (A in Fig. 2). The tiny black and white dots serve as markers. If you can clearly see the individual white and black lines of the pattern at the outer edge, but the lines blur around the first set of white dots (E), then your set has a resolving power of only 215 lines. If, on the other hand, you can see separate lines all the way in to the next set of dots (F), your set is resolving 270 lines.

The horizontal resolution can be measured by looking at the vertical wedges (B in Fig. 2). Again, the dots are the guide—they represent not only resolving power but video frequency response as well. This is a useful measure, because horizontal resolving power is determined by the set's video frequency response. The first set of white dots nearest the outer circle on the top wedge (G in Fig. 2) represents a video frequency response flat to 2.7 mc. This is equivalent to 215-line resolution. (Incidentally, the test pattern used by TV stations for aligning their own equipment—see Fig. 3—shows frequency response to 7 mc., which represents a resolving power of about 550 lines.)

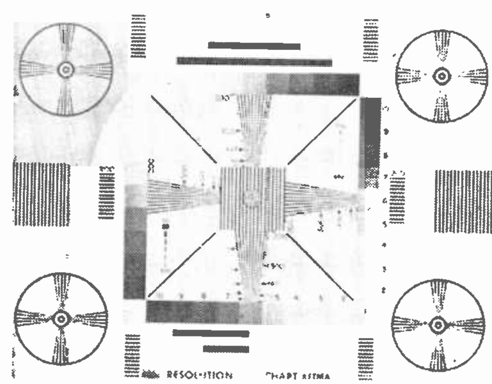


Fig. 3.

The test pattern on the set we used for some of these pictures is shown in Fig. 8. As you can see, the vertical wedges blur pretty badly at about the 2.7-mc. dots. This means that the set has video circuits which pass a 2.7-mc. signal, but not much more. The vertical resolution is good down to about 370 lines, but since the wedge is beginning to blur at the center, it is obvious it would not resolve a much finer pattern.

The test pattern in Fig. 8 is typical of that found on many sets now on the market; in spite of its fairly limited response, it has a pretty good picture. Of course, the picture will not have the crispness of that produced by a set with better resolution. The pattern of the set represented in Fig. 2 shows exceptionally fine resolution; note that all wedges are clear and sharp right to the very center, and contrast this with the pattern of Fig. 8.

It's a good idea to check and write down the vertical and horizontal resolution of your set. Then, from time to time, you can run another check to make sure they have not deteriorated. If they have, it might be a sign that your set needs a general overhaul, including realignment of its video circuits.

Incidentally, there is very little standardization of test patterns, so the dots on your screen may or may not represent the same resolution and frequency response shown here. If in doubt, ask your local station what figures the dots on their pattern represent.

WHEN TO MAKE ADJUSTMENTS

Almost any set which hasn't been adjusted for some time can stand touching up for a number of reasons. Sometimes, sets are accidentally thrown off course by cleaning. Sometimes, too, children may tamper with controls. But any set, regardless of its environment, needs occasional adjustment. Parts age, and aging causes changes in brightness, contrast, and even the size and shape of the picture. So for best televiewing, it's a good idea to check out the adjustments on your set periodically.

Since all sets don't have exactly the same controls, you may not be able to find one or more of those we mention. However, if your set lacks a particular control, it probably doesn't need it. New circuits in use in some sets make some of the older standard controls unnecessary.

Although all sets have most of the controls listed here, some have only a few within easy reach; you may have to take the back off to get at the others. One of the sets we used in preparing this article, for example, had the vertical size and linearity and horizontal size controls inside.

Here are some general rules and suggestions to follow in adjusting your set.

1. Most TV sets have a power interlock; when you remove the back, you automatically shut the set off. To make adjustments with the back removed, you'll have to use a special cord, called a "cheater," which TV men have developed for service work. But remember, *the interlock is there to protect you against high voltages.*

2. Look at the test pattern carefully before you remove the back of the set—the controls inside may not need adjusting.

3. Unless you know exactly what you are doing, don't try to adjust any control you find inside the cabinet other than those described here.

4. Let the set warm up for 15 to 30 minutes before you begin your adjustments. It takes that long for all parts to heat up to operating temperature.

5. A large mirror is helpful if you have one. You can reach around most sets and adjust them while watching the screen directly, but it's a lot easier to stand behind the set and use a mirror to see the picture.

6. All of the troubles we'll talk about can be caused by circuit breakdowns of one kind or another. If the procedure described won't cure the trouble, your set may need repairing rather than adjusting. If this is the case, suspect tubes first. A quick check at the local hardware or drug store do-it-yourself tube tester may uncover the trouble, and you won't need to call in the serviceman. If you do replace a tube, the set may need readjusting as a result.

HOW TO MAKE ADJUSTMENTS

Now, let's wrap it all up by going through the various adjustment steps one by one.

Brightness. Is your screen too bright, as in Fig. 4, or too dark (Fig. 5)? This is one of the simplest adjustments to make. You'll find the "brightness" control on the back panel of most sets. Adjust it until the picture is bright but the black areas are not washed out. The dot in the center and its four surrounding rings should shade evenly from black to white as shown in Fig. 6.

Contrast. The contrast control also helps to determine the general appearance of the picture. It is usually on the front of the set. Use this control in combination with the brightness control for best results, adjusting one, then the other, for the best picture. If the picture is

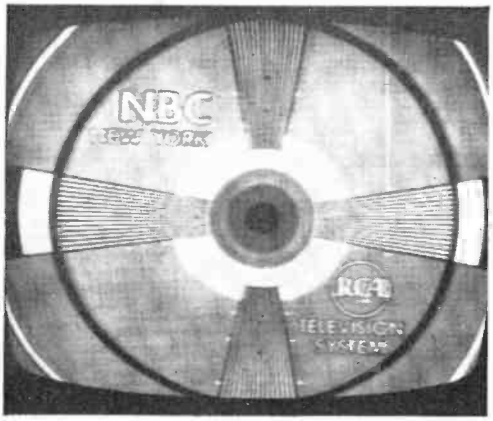


Fig. 4.

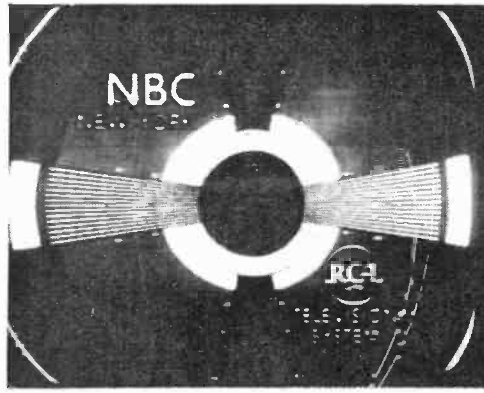


Fig. 5.

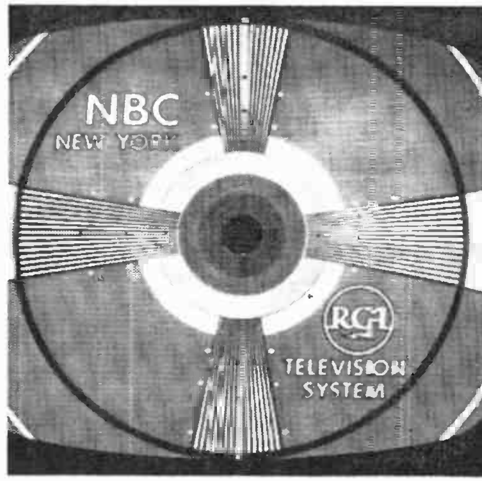


Fig. 6.

too contrasty, the darker shades of gray will merge into black. If there is not enough contrast, as in Fig. 7, the whole picture will appear in shades of muddy gray.

Horizontal Size and Position. If the picture doesn't go out to both edges of the screen, or if the reverse is true and you feel you're losing too much picture off the sides (as in Fig. 8) —we've lost the white circle completely here—the horizontal size ("width" on some sets) will quickly remedy the situation. Turn the horizontal size control until you see blank screen on both sides of the picture. Adjust the horizontal position control until there is exactly the same amount of blank space on each side. Now slowly turn the horizontal size until the white circle just fills the screen from edge to edge. (See Fig. 1.)

Vertical Size and Linearity. The vertical size ("height" on some sets) and linearity controls are used together. They interact—when you adjust one, it affects the other (Figs. 9 and 10). So go back and forth between the two until the test

(*Continued on page* 110)

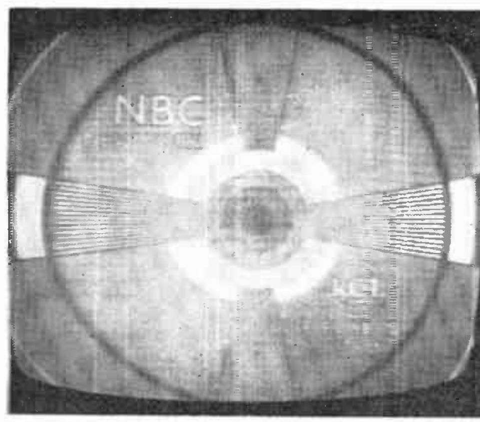


Fig. 7.

Fig. 8.

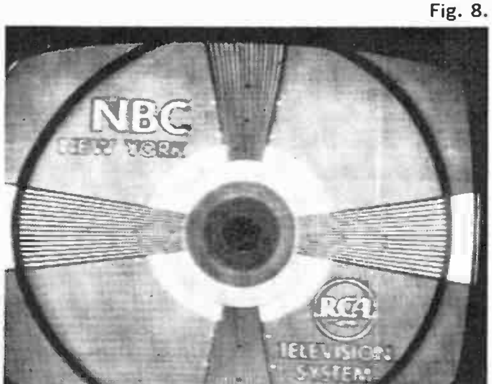
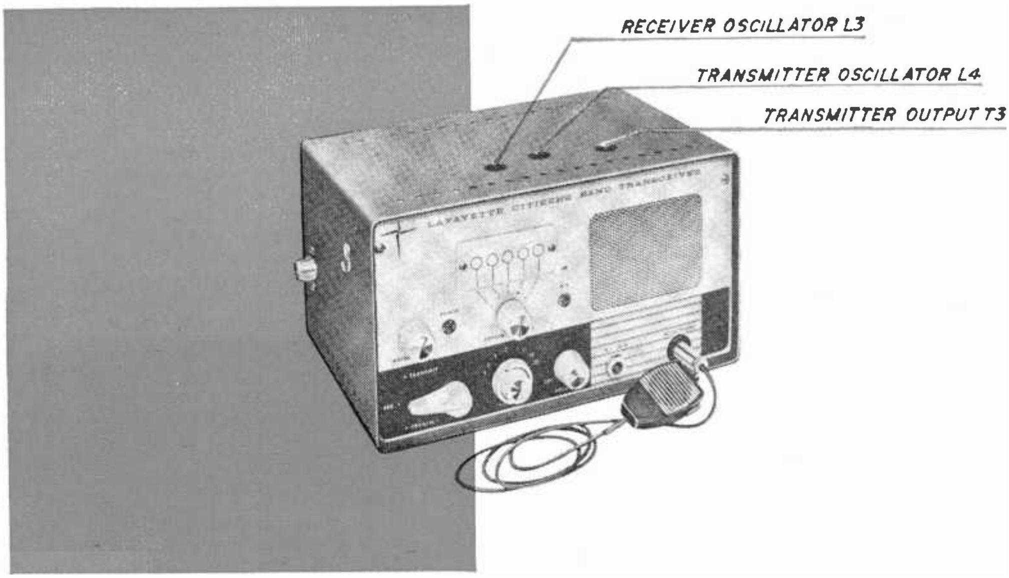


Fig.9.



CB RIG GOES "HAM"

Hints on converting a CB transceiver for operation in the 10-meter amateur band

By **EDWARD M. NOLL**, W3FQJ

IF YOU'RE one of the CB'ers who feels he's ready to step up to the more sophisticated world of the ham, you'll be happy to learn that there's no need to trade in your present CB transceiver. Assuming your transceiver is a typical moderately priced unit and incorporates a tunable receiver, it probably has all the essentials for 10-meter operation. The conversion described here involves a Lafayette HE-15A transceiver, but other rigs can be handled in a similar fashion.

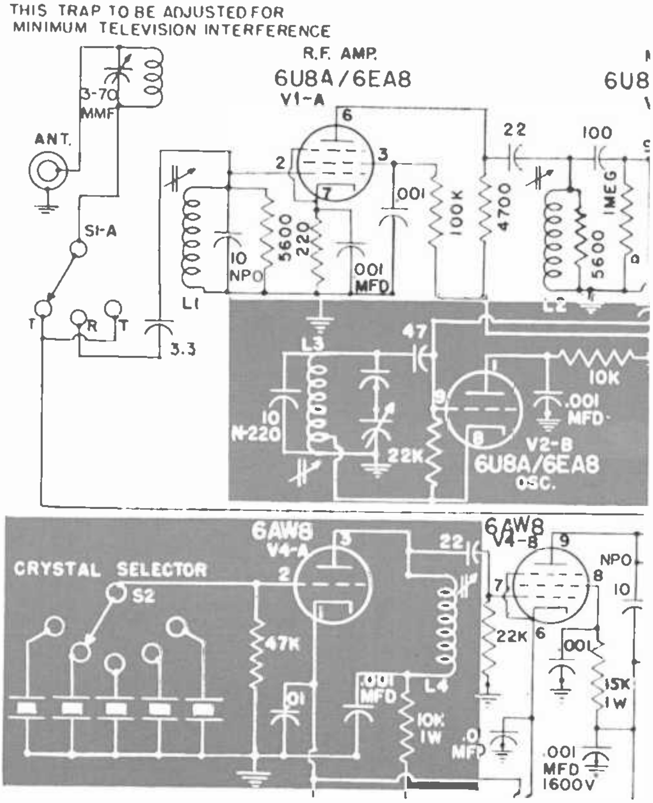
Aside from retuning the final, you'll have to change only two circuits. One is the crystal oscillator in the transmitter; the other is the bandspread section of the local oscillator in the receiver. (See Fig. 1.) Incidentally, the changes outlined here are not irrevocable—should you ever develop nostalgic feelings for your old CB rig, you can simply reconvert the transceiver.

In most cases, the transmitter section of the transceiver is easiest to change. Often, it is merely a matter of inserting a 10-meter crystal and retuning the oscillator and final. Depending on the circuit, it may also be necessary to change the value of a component slightly, or modify the crystal oscillator circuit to permit fast-starting with the available overtone crystals.

Modifying the receiver section will require peaking the resonant circuits of the r.f. amplifier and mixer, and setting the local oscillator to a higher frequency. This last step is important, since it is desirable that the receiver be capable of tuning over the entire 10-meter band, or at least a reasonably large segment of it.

Transmitter Section. It was found that most 10-meter crystals (third overtone type) started easily when the plate tank circuit of the crystal oscillator was retuned. If the oscillator is sluggish, however, some additional feedback should be incorporated. With the Lafayette HE-

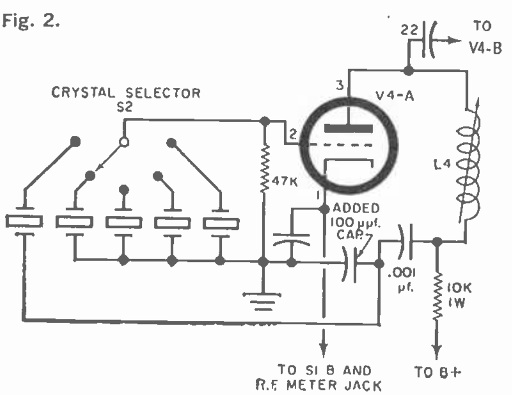
Fig. 1. Two circuits in the transceiver must be changed to shift operation from the Citizens Band into 10-meter ham frequencies. Modifications to local oscillator in receiver (circuit shown in color at far right) appear in Fig. 3, those to crystal oscillator in transmitter (circuit in color, below, right) are shown in Fig. 2. Also, the transmitter final must be retuned and the CB whip antenna shortened (see Fig. 4) as explained in the text.



15A, this was accomplished by rewiring one of the positions of the crystal selector switch for use as a Jones-type overtone crystal oscillator (see Fig. 2).

Specifically, a 100-$\mu\mu$f. capacitor was inserted in series with the 0.001-μf. capacitor which connects the bottom of tank coil *L4* to ground. Then the common side of one of the crystal socket terminals was removed from ground and connected to the junction of the two capacitors. Sluggish crystals inserted into this section of the socket started without trouble in every case.

Fig. 2.



No circuit changes were made in the r.f. power amplifier. However, to facilitate retuning the two transmitter stages without removing the chassis, two holes were drilled in the top of the case; a third hole permits retuning local oscillator coil L3 in the receiver section (see photo). By simply inserting a long insulated screwdriver through the two holes, you can adjust for peak performance at any given frequency. If you would like greater tuning precision than that offered by the NE-2 neon bulb, plug a 0-50 ma. meter into the r.f. jack.

Receiver Section. Making the receiver section operate on the 10-meter band is fairly simple—retuning the local oscillator coil (*L3*) pulls the receiver into the 10-meter spectrum. However, the frequency range over which the local oscillator can be tuned is only a fractional part of a megacycle for any particular setting of the tuning slug in *L3*. This may be acceptable if you anticipate working a limited section of the band, but circuit changes are in order if you want to utilize the full 10-meter spectrum.

The receiver section of the Lafayette transceiver was made to provide almost

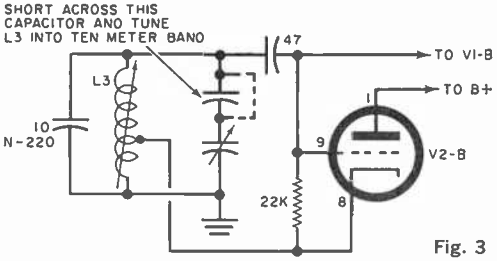


Fig. 3

ideal coverage of the 10-meter band by shorting out the small capacitor between the top of the tuning capacitor and the top of *L3* (see Fig. 3). There is no need to remove this capacitor and reconnect the leads—simply jumper across it. Then, if desired, CB operation can be restored by removing the jumper.

Maximum sensitivity can be obtained by slight retuning of the r.f. amplifier and mixer grid circuits (coils *L1* and *L2*, respectively). Note that *L1* must be tuned with the chassis removed because of its location.

Antenna Shortening. For top performance on the 10-meter band, your present CB antenna must be shortened. You can cut the antenna for either the specified frequency of operation or for the center of the 10-meter band to accommodate operation at various frequencies—use the following formula to determine the length of a quarter-wave antenna:

$$\frac{\lambda}{4}=\frac{2865}{f}$$

where λ (lambda) is the wavelength in inches and f is the frequency in megacycles.

If you're calculating the overall length of a quarter-wave whip antenna, be sure to measure between the point at which the transmission line is attached and the tip of the whip section, as shown in Fig. 4.

Crystal Frequency. Before selecting a crystal frequency, it's a good idea to monitor the 10-meter band in your vicinity—there are probably many fine local rag-chewers and radio clubs using this band. Many of these stations will have a dual location: one at home and another in a mobile unit operating at the same frequency.

If you use a crystal at a frequency that is isolated from most of the local transmissions, it may be difficult to establish contact with other low-power

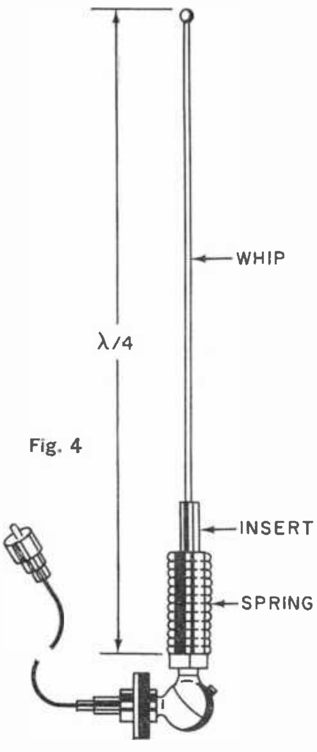


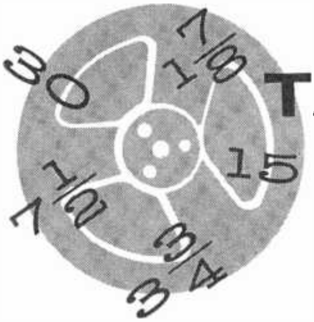
Fig. 4

rigs. For this reason, you'll be wise to select a crystal frequency that corresponds to the operating frequency of these local stations. In most areas, the high-frequency end of the band is used for local transmissions, the low-frequency end for long-distance or "DX."

Naturally, the distance that can be covered with such low-power transmitters is restricted. Since the input is unchanged, the range of reliable operation you can expect is approximately what you can obtain on the Citizens Band. When skip conditions are favorable, however, you may occasionally enjoy true DX communications. —30—

IMPORTANT!

Operation on both the Citizens Band and the 10-meter amateur band is strictly controlled by FCC regulations. You can tune or operate a transmitter on the 10-meter band only if you hold a valid General Class or higher amateur license. To tune the transmitter of a licensed Citizens Band station, you must hold a first- or second-class commercial radio operator license.



TAPE SPEEDS -Then and Now

By RICHARD A. FLANAGAN
Associate Editor

"STANDARDS" have a way of becoming so firmly entrenched that we often forget how they all started. Take record and tape speeds—the common long-playing disc, for example, flips around 33 1/3 times every minute for no very good reason. As it happens, we measure time in a rather arbitrary interval we call minutes. We also count in ten's—because, anthropologists tell us, we have ten fingers and ten toes—and 33 1/3 happens to be the result of dividing ten times 10 by 3.

Tape speeds have an even more interesting history. Although the first magnetic recording device was invented by Denmark's Valdemar Poulsen shortly before the turn of the century, it was the Germans who first perfected a device using what we now call "tape." Known as the Magnetophone, the German instrument "captured" by the Allies at the end of World War II boasted a frequency response from 20 to 10,000 cycles. To achieve response to 10,000 cycles and beyond, the Germans moved their tape at a speed of 77 centimeters per second.

At the Beginning. How 77 centimeters happened to be chosen as the speed for the original Magnetophone is probably lost somewhere in history. But one thing is certain: when the Americans set about to duplicate the Magnetophone after the war, they didn't attempt to change speeds. If the Germans had produced better fidelity at 77 centimeters than was previously possible, then 77 centimeters would stand. Naturally, the Americans converted from the metric to the avoirdupois system of measurement. The result, roughly, was a speed of 30 inches per second.

As tape recording grew in acceptance and use, tapes were recorded at this very speed—30 inches per second. And while there are a number of economic factors on the negative side of the ledger for the old 30-ips speed, no one will deny that it offers exceptional fidelity.

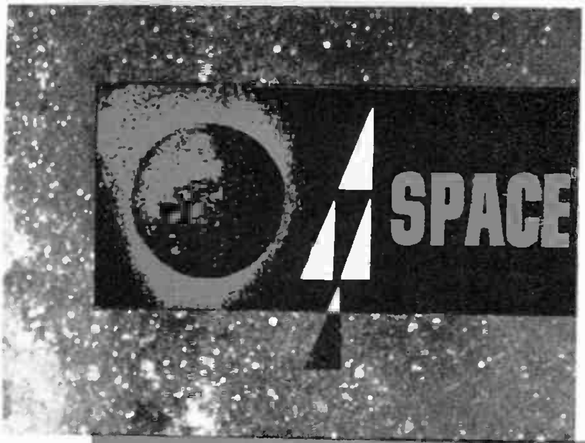
The Trend Downward. For other than the most exacting requirements, however, 30 ips is no longer really necessary. As tape heads improved, so, too, did knowledge of the tape recording process—as well as the manufacture of magnetic tape itself.

Today, outstanding fidelity can be realized at 15 ips (which, incidentally, is a speed that was reached precisely as you might guess—by dividing 30 by 2). For semi-professional and home recording, half of the 15-ips speed delivers excellent sound and offers the attractive advantage of twice the playing time from a given reel of tape.

And while the 7½-ips speed is often considered the slowest possible for hi-fi recording, very good results can be obtained at *half* this speed—the popular 3¾ ips.

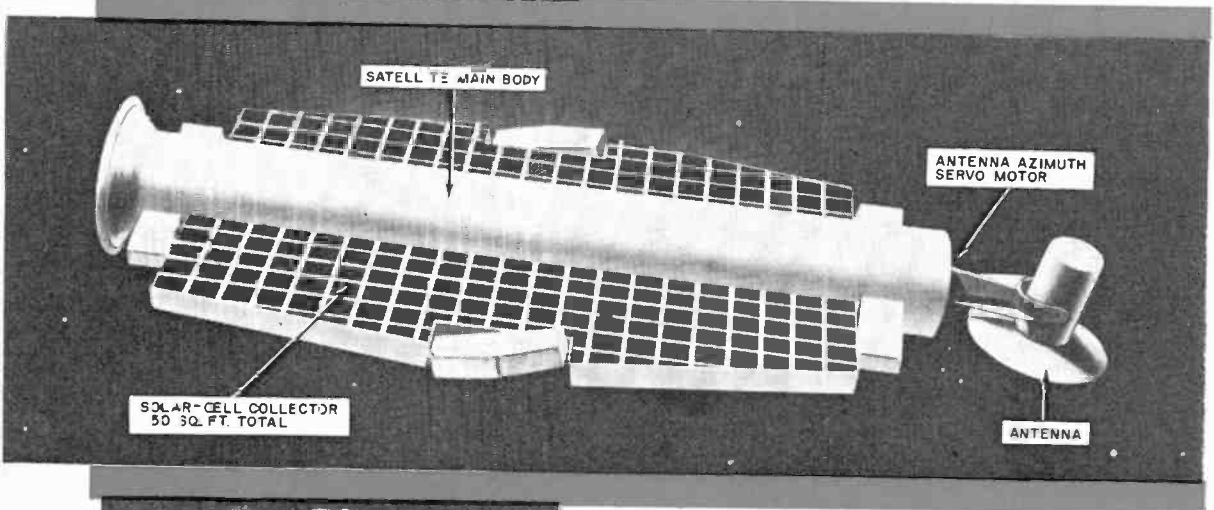
Yet even this isn't "bottom"—the new CBS tape cartridge, not yet available commercially, moves at *half* the 3¾-ips speed—a phenomenal 1⅞ ips! Only 3½" square and 5/16" thick, it plays for over an hour and boasts a frequency response approaching that of some 7½-ips equipment.

Unthinkable? To the designers of the original Magnetophone, perhaps. But to modern technicians, such performance is just another proof of the remarkable advances made in the art of magnetic tape recording during the decade or so of its existence. -30-

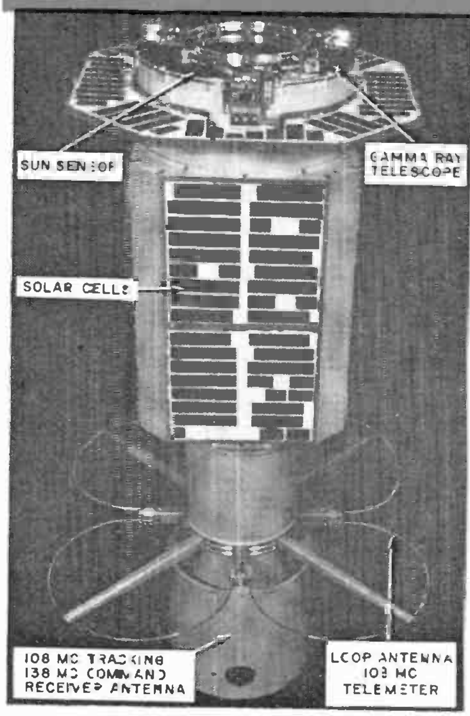


SPACE ELECTRONICS

By OLIVER P. FERRELL
Editor



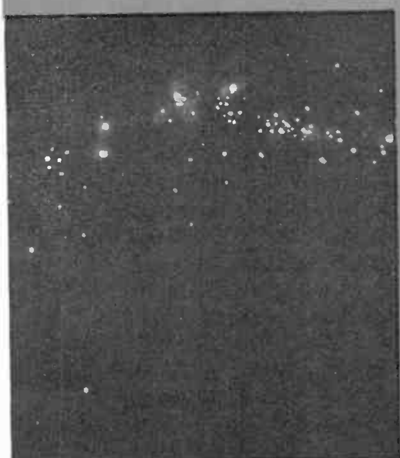
An all-purpose communications satellite has been proposed by RCA having the physical design shown above. Capable of relaying telephone, TV, telegraph or facsimile signals, it would orbit about 22,000 miles above the earth's surface, the antenna at far right automatically aiming itself at a particular point on the surface. Solar cells would recharge the receiver and transmitter batteries.

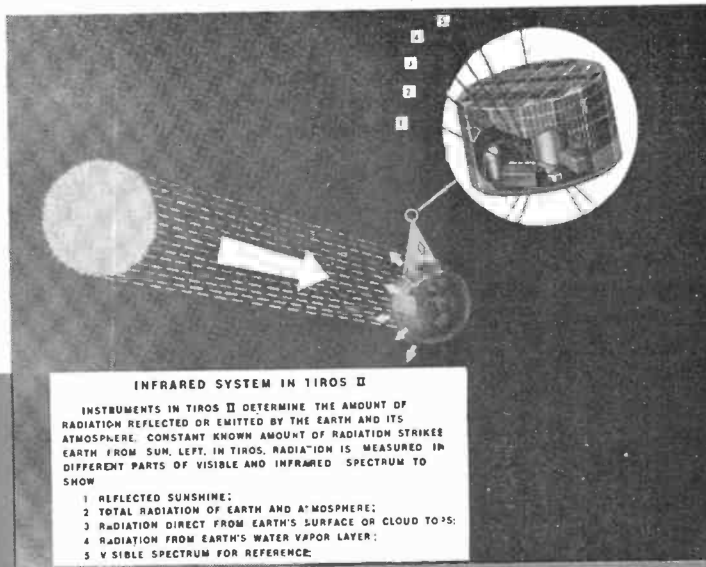


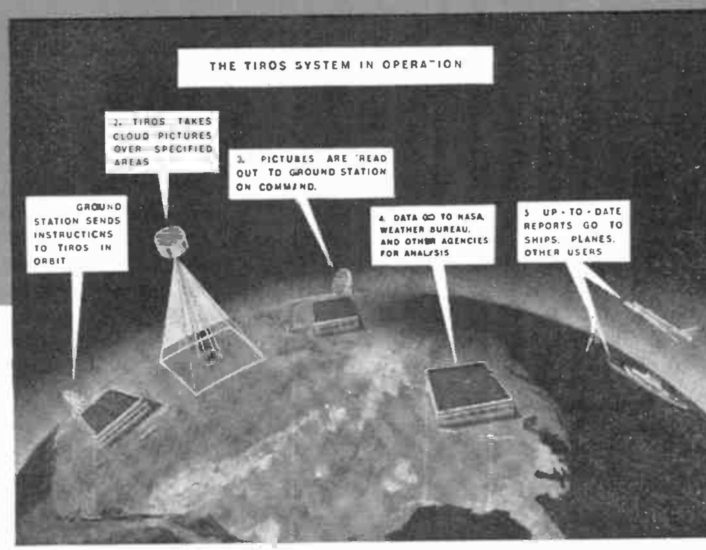
Scheduled for launching this spring, NASA's S-15 satellite is expected to transmit data to earthbound receiving stations on 107.97 mc.

AROUND the middle of March, 10,000-watt radar signals were bounced off the planet Venus and picked up by an 85-foot dish antenna in Goldstone, Calif. Using a frequency of 2388 mc. and a beam width of only 0.4 degree, the radar pulses took 6½ minutes to make the round trip.

Although weak radar echoes have been picked up before from Jupiter, Saturn, The TIROS II is typical of several satellites to be launched by NASA for weather studies. Data collected from TIROS observations are made available to all co-operating foreign countries.







As TIROS satellite orbits the earth, ground command stations tell it when and where to take TV pictures. Although the TIROS transmitters are now off the air, similar satellites are to be launched later this year.

Venus and the sun, this is the first time that they have been strong enough to be immediately recognizable. Credit for this extra margin of sensitivity goes to the maser amplifier (see POP'tronics, April, 1960, page 41) used to reduce receiver noise to an extremely small quantity.

Radar observations of Venus will tell us if this cloud-covered planet is really revolving and how fast, and they will give us some idea of the density of the clouds. The experiments are being undertaken by the Jet Propulsion Laboratory and the National Aeronautics and Space Administration (NASA).

New Signal on FM Band. The NASA S-45 satellite (mentioned in the April column, page 65) failed to achieve an orbit. Had this satellite gone into orbit, it would have provided SWL's and experimenters in space science with at least one easily identifiable (20.0-mc.) radio signal.

NASA has now scheduled for launching (as this column is being written) its S-15 satellite. This 82-pound satellite is destined to detect and measure the intensity of gamma rays while swinging around the earth in a 98-minute orbit. (Gamma rays are known to be generated by nuclear activity and are of such high energy levels that they are unaffected by magnetic fields—as radio waves are, for example.) The S-15 is really a "telescope," and will spend part of its orbit life in scanning the sun.

Although not a "glamour" satellite—in terms of the publicity-conscious Soviet launchings—the S-15 will provide one or two readable signals that may be heard with the aid of an outdoor antenna and sensitive FM broadcast receiver. A weak signal for tracking—about 20 milliwatts—will be radiated on 108.06 mc. A considerably stronger signal (125 milliwatts) relaying gamma-ray data to earth will be on 107.97 mc., and should be heard throughout most of North America with minimum difficulty. The two transmitters will probably not be in continuous operation, but will be controlled by ground-level command signals. Solar batteries (probably silicon cells) will recharge 12 nickel cadmium batteries, giving the satellite a "life" of about one year.


A novel "sun-seeker" has been devised by Technology Instrument Corporation. Silicon cells at base of long arm are shaded by disc to cast shadow, and voltage developed by the cells is fed into a bridge circuit, driving small motors that track the sun. Such a device can be used with satellites which rotate at about 2 revolutions per minute.

If the S-15 goes into orbit, check the top end of your FM tuning dial—this is one that can be heard.

Radio Signal Status. Three satellite signals may be deleted from the listing of "Radio Signals from the Satellites" which appeared on page 65 of our April column and was supplemented in May on page 76. The weak signal on 107.97 mc. from Echo I, the balloon reflector launched last August, is no longer heard; Samos II, a reconnaissance satellite, has ceased transmitting; and Discoverer XXI went off the air in late February. Frequencies used by the latter two satellites were never revealed by the Department of Defense.

Transit III-B and LOFTI, which never detached from their launch rocket, went into a wildly eccentric orbit. Radio signals were heard from both and proved to be of considerable value to American scientists. These two satellites re-entered the earth's atmosphere on March 30 and burned up.

The Russian Venus probe was heard with a very weak signal on February 22nd, but has not been heard from since. Soviet Sputnik IX, launched on March 9th to test recovery mechanisms, did not transmit on any of the usual channels.

Reading Matter. Albert Parry's new book entitled *Russia's Rockets and Missiles* (Doubleday & Co., Garden City, N. Y., 382 pages, $4.95) provides some thought-provoking reading on Soviet rocketry. Unlike many other communist claims of "prior invention," a Russian by the name of Tsiolkovsky really did pioneer the field of rocketry—well before Germany's Oberth and our own Robert H. Goddard. Parry analyzes what the Soviets have achieved (Sputniks, Luniks, etc.) through mid-1960, and presents some positive ideas on what the American research policy should be if we want to catch up. We recommend this book for its solid factual background and the digest of Soviet rocketry and satellite launchings.

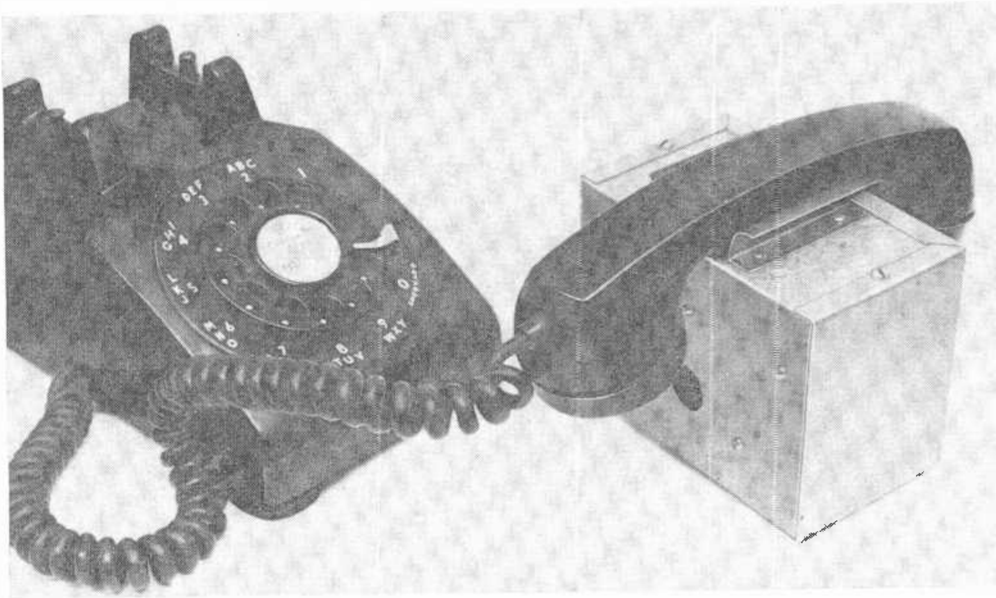
A somewhat similar book, called *Soviet Space Technology* and written by Alfred J. Zaehringer, has been released by Harper & Brothers (49 East 33rd St., New York 16, N. Y., 180 pages, $3.95). While Dr. Parry is a regular writer on Soviet affairs ("Missiles & Rockets" magazine), Mr. Zaehringer is president of the American Rocket Company and studies Soviet rocket activities as a hobby. His book is a faster-paced but less fact-filled account of what the Russians have done.

(*Continued on page* 108)

Musical Telephone Holder

By HERBERT FRIEDMAN

Electric music box "holds the phone" and entertains the caller

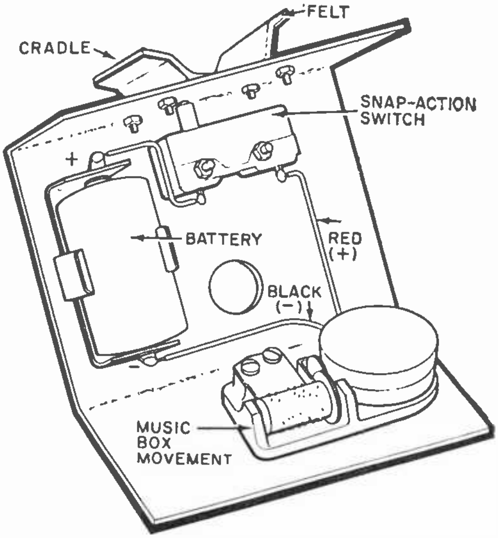


Snap-action switch in box controls music box movement, keeps it playing till phone is removed.

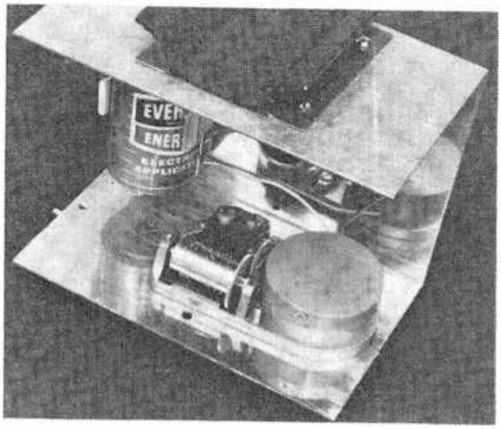
THE inexpensive electrically driven music box movements which have become available in recent years have made possible many interesting applications. These units never need to be wound, can be easily turned on and off by remote control, and will run for hours on a single 1½-volt flashlight cell.

One of these electric music box movements serves as the basis for the musical telephone holder described here. Designed to relieve the tedium of a caller who is "holding the phone," the telephone holder provides a musical diversion while he waits. A snap-action switch in the cradle of the holder, actuated by the weight of the telephone handset, automatically starts the music—and stops it when the handset is removed.

Construction. The movement, flashlight cell, and switch fit neatly into a 3" x 4" x 5" aluminum box. Two pieces of scrap copper or aluminum are bent into "L" brackets and bolted to the outside of the box, forming a cradle for the telephone handset. Measure the width of your



The parts layout is simple and neat. Optional felt on cradle prevents gear noises from being picked up by receiver. Glue four rubber feet to bottom of box to protect furniture.



Music box movement, flashlight cell and switch fit in 3" x 4" x 5" aluminum box. Inexpensive movements can be found to suit almost any taste; available pieces range from "How Dry I Am" to "Moonlight Serenade."

handset before mounting the brackets; dimensions vary from model to model.

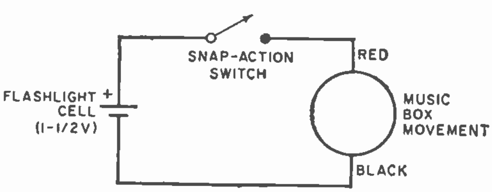
Center the switch plunger under the cradle—before mounting the switch, drill a hole in the top of the box to allow the plunger of the switch to pass through. Then finish the mechanical work by punching a ¾" hole in the side of the box, located so that the sound of the music box movement is directed to the telephone transmitter, and you're ready to wire up the unit.

The wiring couldn't be easier—the battery, switch, and movement motor are simply connected in series—but one precaution is necessary. Be sure to observe the proper polarity when hooking up the motor (its positive lead is usually red). If the motor is connected with reversed polarity, it will run backwards—and the movement may be damaged.

Electric music box movements are available from many mail order parts houses for less than two dollars (Lafayette Radio has a series priced at $1.88). The author used a Unimax 2HBQ-1 snap-action switch, but any s.p.s.t., normally open, snap-action type will do. Use a Bud CU-2105-A Minibox or equivalent for the case. A commercial battery holder, such as the Keystone #175 makes it easy to mount the flashlight cell.

Operation. When it's necessary to ask a telephone caller to wait, place the handset on the cradle (with the transmitter facing the ¾" hole). The music box will start, and continue playing until you lift up the phone again.

If you find that the gears in the movement make noise which is picked up by the telephone, lubricate them with a small quantity of Vaseline or Lubriplate. You might also isolate the handset from the box by lining the cradle with felt. —30—



Flashlight cell, switch and movement motor are connected in series. Battery polarity must be observed in hooking up the motor.

Your Connections Are Important

Careful grouping of hi-fi cables improves performance, reduces hum

By JIM KYLE, K5JKX/6

TOP PERFORMANCE from any audio system demands more than quality components. These components must be connected together properly to assure hi-fi without hum, noise, or distortion.

Naturally, each output must be connected to the appropriate input of another component; but there's more to proper cabling than that. The physical arrangement of the connecting cables plays an important role in determining the system's over-all performance.

In the interests of both good performance and a neat appearance, interconnecting cables should be grouped and laced. However, simply gathering all leads into a bundle and lacing them neatly is one of the quickest ways to assure *poor* performance. They must be separated by function.

Hi-fi cables can be classified into one of three groups: power and control leads, input lines, and speaker lines. Preamp output cables are grouped with the input lines.

A typical installation may include a turntable, a stereo tape deck, an AM-FM tuner, a stereo preamp, twin power amplifiers, and matched speakers. The cables involved with these units, by groups, include the following lines.

In the power lead group, you would find a tuner power line, one for the preamp, one to the tape deck, another for the turntable, and two more for the power amplifiers. This makes a total of six leads, all carrying 115-volt a.c.

In the input line group, there would be seven lines—two cables from the tone arm to the preamp, two from the tape deck, one from the tuner to the preamp, and two from the preamp to the two power amplifiers. All carry low-level audio.

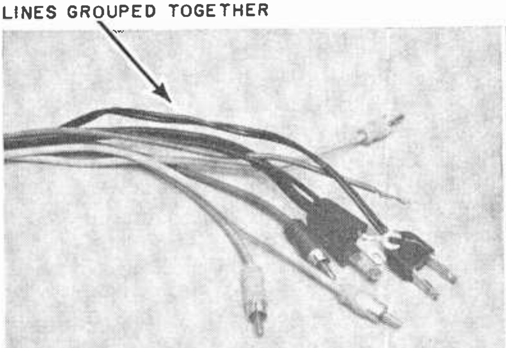
Finally, in the speaker group, you would have two pairs of leads.

If all fifteen leads were grouped into a compact bundle, the low-level leads would certainly pick up hum and noise from the 117-volt lines, despite protective shielding. However, if you separate them into three appropriate groups, signal levels and content in each group will be equal, and no interaction will result.

Once separated into groups, the cables should be laced. The manner in which this is done will vary, depending primarily on whether your installation is cabinet-enclosed or is one of the "open" type in which cables will be exposed to public view.

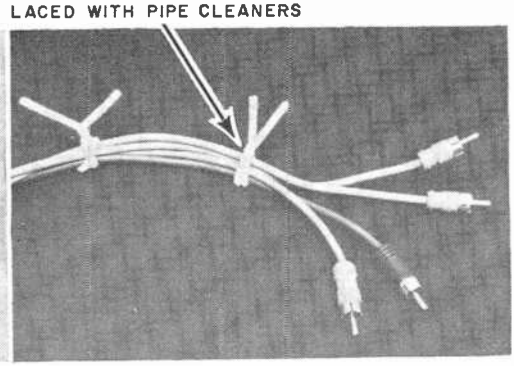
(*Continued on page* 107)

LOW LEVEL AUDIO CABLES AND POWER LINES GROUPED TOGETHER



BAD

LOW LEVEL AUDIO CABLES GROUPED TOGETHER AND LACED WITH PIPE CLEANERS



GOOD POWER CABLES AND SPEAKER LEADS ARE LACED IN SEPARATE GROUPS AND SPACED APART

ELECTRONIC FISH CALLER

Unique one-transistor "beeper" lures fish with underwater sound

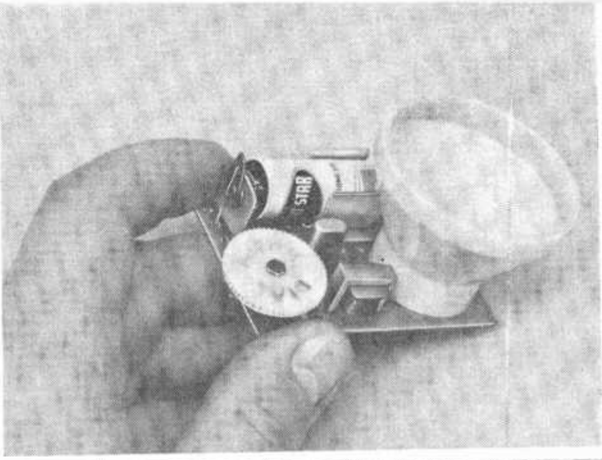
ANY sailor who has worked around sonar gear will testify to the fact that fish are attracted by certain man-made noises. The fish may believe that the sounds come from some source of food, such as another aquatic animal or a trapped insect, or their motivation may simply be curiosity. At any rate, the technique of calling fish with underwater sound really works, and has been successfully used by fishermen.

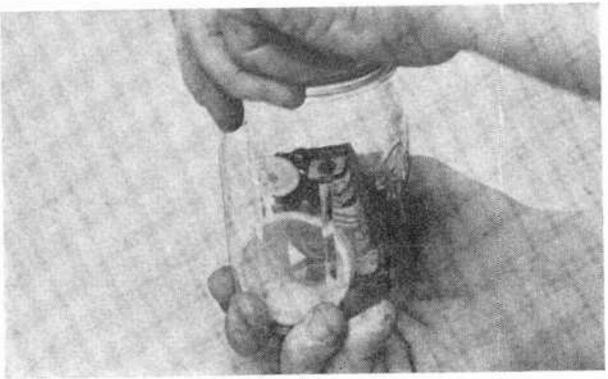
You can put together this neat little fish caller with a minimum of work and expense, and it should be well worth your while. The device produces a repeating, high-pitched "beep" which is attractive to many kinds of fish.

The Circuit. A single transistor (*Q1*) is used in a Hartley oscillator circuit (feedback produced by tapped inductance). Although the author used a Sylvania 2N1265, most *pnp* audio transistors will work just as well. The tone and basic repetition rate are fixed by capacitor *C1* and resistor *R1*, and potentiometer *R2* varies the repetition rate over the small range required. The crystal earphone is simply connected in parallel with the inductance (*L1*). Power is provided by battery *B1*, a penlight cell.

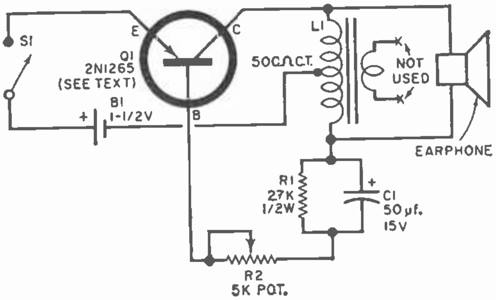
Construction. Begin by mounting the battery holder, earphone, transformer, transistor socket, and potentiometer on one side of a suitable perforated board. Fasten the earphone in place with cement, first removing the screw and back plate and passing the leads through two convenient holes in the board. You may not want to use a transistor socket, in which case transistor *Q1* can be mounted by simply pushing its leads through three holes in the board; these leads are later soldered directly into the circuit.

Mount potentiometer *R2* by bolting it down through the holes in its switch terminals—it will be necessary to use spacers between these terminals and the board or to bend the terminals down and out, forming mounting brackets. Install soldering lugs between the





Miniature components make completed unit extremely compact. Tiny potentiometer (R2 in diagram) includes built-in on-off switch (S1).



PARTS LIST

B1—Penlight cell
C1—50-μf., 15-volt subminiature electrolytic capacitor
L1—Subminiature output transformer; 500-ohm CT primary, secondary not used (Lafayette TR-99 or equivalent)
Q1—Audio-frequency pnp transistor (Sylvania 2N1265 or equivalent)
R1—27,000-ohm, ½-watt resistor
R2—5000-ohm miniature potentiometer with switch S1 (Lafayette VC-62 or equivalent)
S1—S.p.s.t. switch (on R2)
1—Miniature high-impedance crystal earphone (Lafayette MS-439 or equivalent)
1—1¾" x 2$\frac{7}{16}$" perforated board (half of Lafayette MS-304, or equivalent)
Misc.—Battery holder, transistor socket (if used), hardware, etc.

By JAMES J. BUCHER

mounting nuts and the bottom of the board for making connections to the switch (*S1*).

Only the three primary leads of the transformer are used, and the leads from the secondary may be cut off or taped up. The end of the battery holder nearest *R2* will be positive; mark it with a dab of red nail polish. When the battery is installed, its brass center terminal should be placed at the marked end; reversed polarity would damage the transistor.

The earphone specified in the Parts List comes with an interchangeable ear plug and mouthpiece (it may be used as a microphone in other applications). Discard the ear plug and finish the mounting job by cementing the mouthpiece (which will act as a speaker horn —amplifying the sound) in place.

The wiring is a simple job, but be sure to observe the proper polarity when hooking up the battery holder and electrolytic capacitor *C1*. If you install the transistor without a socket, be careful when soldering the leads; use a six-watt (or smaller) soldering iron—and use it sparingly.

Now install battery *B1*, flick on the switch, and your unit should operate. The author's model is adjustable from about 100 to 250 repetitions per minute, but an exact duplication of this range is not necessary.

How to Use It. To operate the fish caller, turn it on and seal it in a Mason jar or waterproof can, adding enough weight to make the assembly sink into the water. (A weighted plastic bag with the air squeezed out of it will also do.)

Suspend the device at fishing depth from a float or a hand line, drop in your bait, and await results. If nothing happens, pull up the fish caller and try a different repetition rate. If you notice an unusual disturbance near your boat, be cautious—you might have dialed in a whale, or even the Loch Ness monster! —30—

THE ZENER DIODE

By R. J. SHAUGHNESSY

NOW widely used as regulating elements in control and similar circuitry, zener diodes have yet to become part of the average hobbyist's or experimenter's stock in trade. However, by keeping a few simple facts in mind and becoming familiar with some of the zener's applications, you'll be designing your own special circuits in no time. In fact, you'll find that zener diodes can actually improve the performance of your older designs.

WHAT ARE ZENER DIODES?

Zener diodes, or silicon regulators—as they are also called, are simply semiconductor versions of the familiar vacuum-tube voltage regulators—the 0A2, 0B2, etc. However, while vacuum-tube regulators can provide regulation only at certain specific voltages and over limited current ranges, silicon regulators can be made to work at almost any desired voltage and over a wide current range.

From the outside, these devices look exactly like ordinary semiconductor diodes. Inside, too, their con-

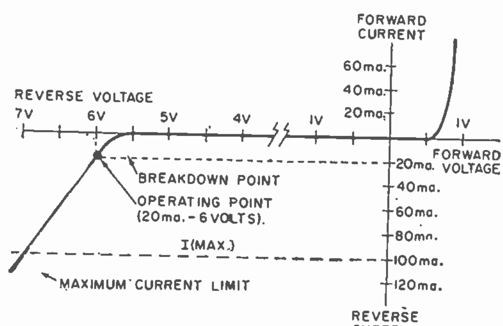


Fig. 1.

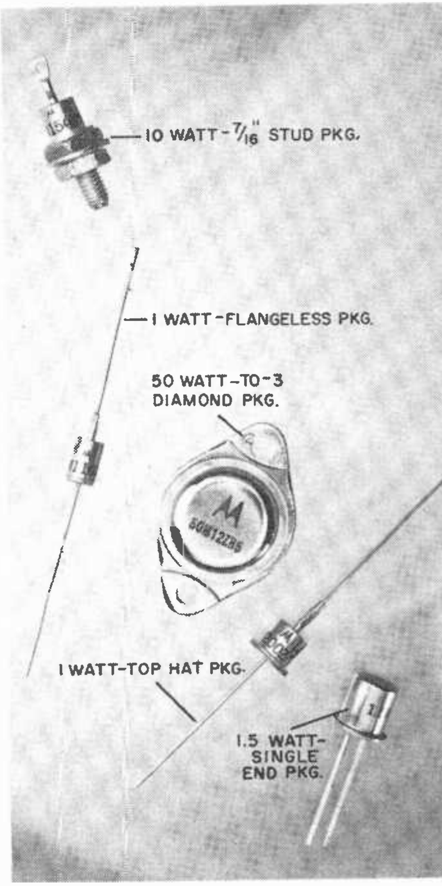
struction is much the same. In fact, you can even use them as rectifiers, provided the a.c. peak value does not exceed the characteristically low peak inverse voltage of the zener. The curve of Fig. 1 shows a typical 6-volt zener diode characteristic and will help make this point clear.

The forward side of the curve (anode positive) looks just like that of an ordinary diode; useful current flows as soon as the forward voltage reaches about 0.7 volt. In the reverse direction (anode negative), you can see that the zener would never make the grade as a really practical rectifier because of its low breakdown voltage. In this sense, it behaves as though it were a normal rectifier that had developed high leakage at this low voltage.

If this really were the case, however, the unit would very likely destroy itself through excessive current flow in a very short time. Not so the zener diode. The ability of this device to withstand high reverse currents and go on working while in a saturated state is actually its most important characteristic and makes it very useful in voltage-regulating applications, as we'll see shortly.

The curve also shows that breakdown occurs at about 6 volts, and that this voltage remains pretty constant even though the current varies from a few μa. to more than 100 ma.

Motorola photos



Like other semiconductor devices, zener diodes come in many shapes and sizes.

BREAKDOWN VOLTAGES

Ever wonder how the word "zener" came to be associated with these devices? The answer is simple: in the early days of semiconductor research, much of the information on breakdown mechanisms was derived from still earlier research on dielectric materials by Dr. Carl Zener. Later, when semiconductor researchers began to utilize breakdown effects in certain silicon devices, they called these devices "zener diodes" in recognition of Dr. Zener's pioneering efforts.

The point at which breakdown occurs can't be predicted exactly, although it can be controlled within certain limits. It is largely determined by the type of silicon used in the manufacturing process.

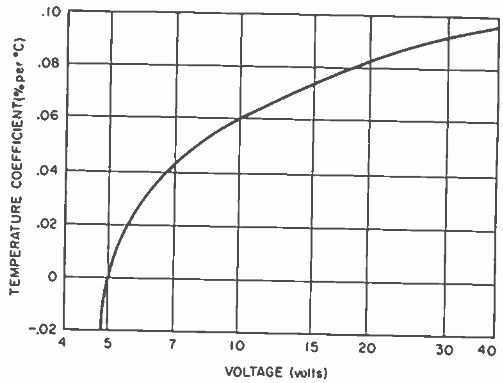
Breakdown of the crystal junction occurs in a natural distribution about the desired value. For example, a factory run of 6-volt units might have breakdowns in the range of 5.6 to 6.5 volts—a distribution span of about 15%. If closer tolerances are needed, the manufacturer must select special units from within this distribution. Naturally, because of the additional labor involved, these cost much more than regular units—especially if the desired tolerance is less than about 5%.

In practice zener diodes are readily available with voltage accuracies of 20%, 10%, and 5%. Very close tolerances can be obtained by connecting lower voltage units in series in special packaged assemblies called reference elements.

TEMPERATURE EFFECTS

As with all semiconductor devices, temperature plays an important role in the operation of zener diodes. A *temperature coefficient* is directly related to the saturation voltage, as shown in the curve of Fig. 2. The coefficient approaches 0.1% per degree centigrade at higher voltages, passes through zero in the region around 5 volts, and becomes negative at lower voltages. The importance of this effect can be appreciated

Fig. 2.



when we consider that a 10-volt unit at normal room temperatures (20°C) will measure 10.5 volts in an equipment cabinet where the temperature is 75°C.

This voltage change could be disastrous in certain applications. However, the danger can be avoided by selecting two lower voltage units with smaller coefficients. For example, if we had used two 5-volt units in series—each with a temperature coefficient of 0.002%—we would still have the desired 10 volts. But the change with temperature would be only a small fraction of a millivolt within the same range.

DYNAMIC AND STATIC RESISTANCE

The basic factor in the regulating ability of a zener diode is its *dynamic resistance.* This is an expression for the change in saturation voltage with a small change in current. It can be measured by observing the a.c. voltage developed across the diode when a small a.c. current is superimposed on the operating d.c. current. Because a.c. is used in these measurements, the term "a.c. resistance" might have more meaning than dynamic resistance, although both terms mean the same thing in this connection.

Values of dynamic or a.c. resistance vary from less than one ohm in high-current, low-voltage units to several hundred ohms in low-current, high-voltage units.

The d.c. or *static resistance* of a zener diode depends on its operating point and is simply the operating voltage divided by the operating current. In Fig. 1, this point has been set arbitrarily at 6 volts and 20 ma.; the static resistance is therefore 6/.02 or 300 ohms.

We can use the same curve again to obtain an approximate estimate of dynamic resistance. Select two values of saturation current that are spaced equal distances above and below the d.c. operating point; then draw vertical lines upwards from these points until the voltage axis is intersected. The dynamic resistance can now be found by dividing the peak-to-peak voltage by the peak-to-peak current. For the particular diode shown, this figures out to be about 10 ohms. In practical measuring equipment, the peak-to-peak current change is restricted to about 10% of the d.c. operating current.

ZENER DIODES AS CIRCUIT ELEMENTS

In essence, a zener diode is a device which, when saturated in the reverse direction, will maintain an almost constant voltage across its terminals. The most popular application for a device of this type is, of course, voltage regulation.

Figure 3 shows a zener diode connected as a shunt-

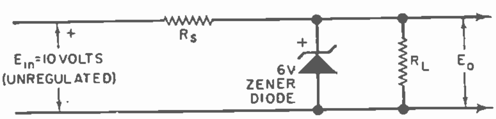


Fig. 3.

regulating element across a load represented by resistor R_L. To analyze the circuit operation, let's assume that the input voltage, E_{in}, increases and see how this affects the output voltage. Note that the positive terminal of the input supply is connected to the cathode of the zener, and that the current flowing in the series resistor R_S is the sum of the diode and load currents. Let us assume also that the diode's characteristic is that shown in Fig. 1.

You'll remember we said that dynamic resistance was associated with alternating or changing currents and voltages, and that it was the basic factor in the regulating ability of a zener diode. Now let's put these facts to work for us.

We have assumed that the diode in the circuit is the unit whose characteristic is shown in Fig. 1; its dynamic resistance therefore is about 10 ohms. Since we've set the operating point arbitrarily at 6 volts and 20 ma., the static resistance is 300 ohms.

Initially, conditions around the circuit are not changing and can be represented as shown in Fig. 4(A). We see the input voltage of 10 volts across two

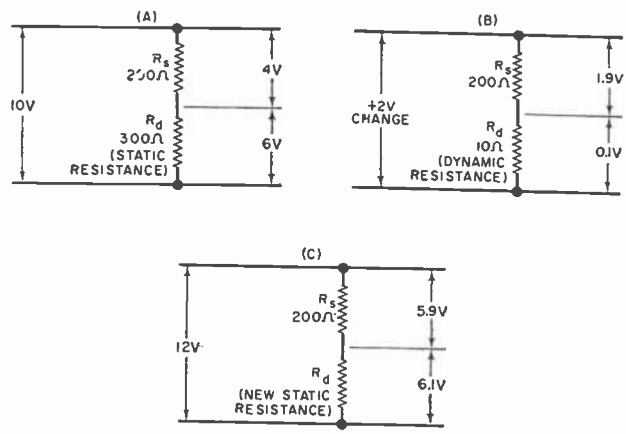


Fig. 4.

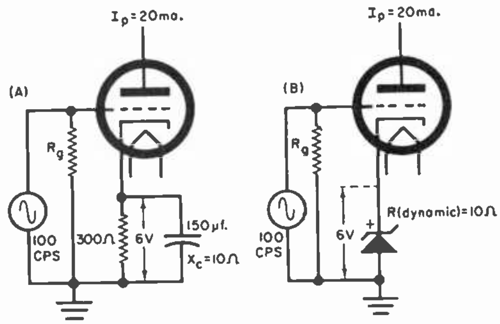
resistors—4 volts across R_S and 6 volts across R_D, which represents the parallel combination of the zener and the load resistor R_L. Now let's increase E_{IN} by 2 volts. Since the increase is a changing quantity and shifts the diode's operating point, we must analyze its effect on the circuit by means of the dynamic rather than the static resistance. Figure 4(B) shows how the 2-volt change will distribute itself around the circuit.

As soon as conditions settle down and become static again, the operating point will have shifted to a new position and the circuit voltages will now be the sum of the original voltages and those resulting from the 2-volt change. The new distribution will therefore be as shown in Fig. 4(C). Referring back to Fig. 4(B), it is obvious that lowering the dynamic resistance of the zener or increasing the value of R_S will improve the regulating action of the circuit. Increasing R_S, however, will mean a corresponding increase in input voltage to maintain the proper current levels.

USING ZENER DIODES

The fact that a zener diode will maintain an essentially constant voltage drop independent of current suggests its use as a source of grid-bias voltage. The circuit conditions of Fig. 5 are such that the tube

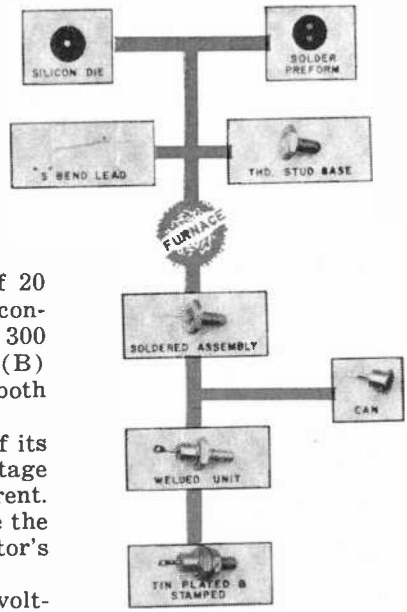
Fig. 5.



requires a bias of 6 volts at a cathode current of 20 ma. Figure 5(A) shows how this is obtained by conventional means with a cathode bias resistor of 300 ohms and a bypass capacitor of 150 μf. Figure 5(B) shows how a zener diode can be substituted for both of these components.

The bias voltage is the zener voltage; because of its low dynamic resistance, the diode will hold the voltage constant even during wide swings of plate current. The bypass capacitor is not needed either, because the dynamic resistance is roughly equal to the capacitor's impedance even at low signal frequencies.

Should you have need of a number of different voltages, you can build the voltage divider shown in Fig. 6 by connecting several zener diodes in series across a suitable d.c. supply. This divider would be useful



Major elements comprising zener diodes are fused in "furnace" before assembly.

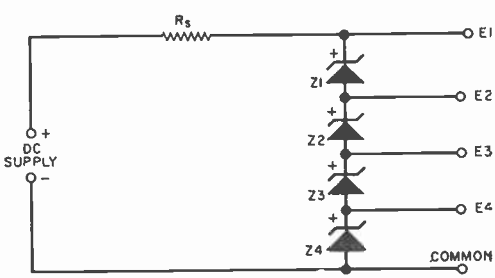


Fig. 6.

around the workbench as an accurate voltage source for calibrating meters or as a stable d.c. bridge supply. In fact, it's applicable whenever a dependable, long-lived voltage source is required.

In certain critical, vacuum-tube circuits, every possible precaution must be taken to stabilize key voltage points against drift. The effects of plate voltage drift are particularly troublesome in high-gain d.c. amplifiers, and call for regulation not only of the B+ supply but of the tube's a.c. heater supply also.

Figure 7 shows how zener diodes can be used as effective a.c. voltage regulators. Two diodes must be

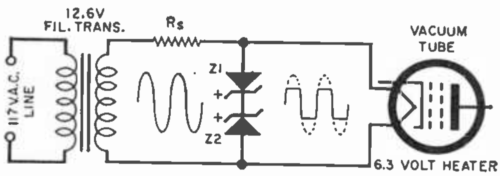
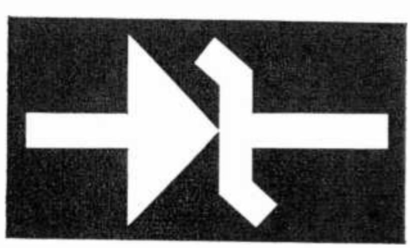


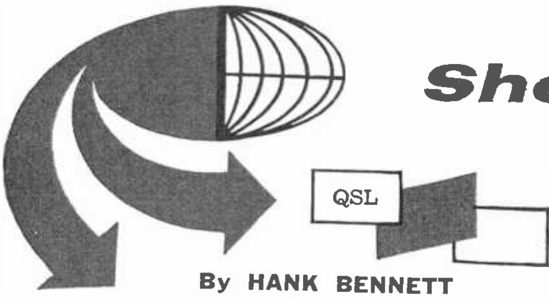
Fig. 7.

connected back-to-back in this application to prevent forward conduction in both at the same time as the a.c. waveform switches back and forth from plus to minus. With this arrangement, one of the diodes will always be biased in the reverse direction for either polarity of a.c. The diodes effectively clip the peaks of the waveform; as a result, the voltage at the heater is a flat-topped wave independent of line voltage changes.

As you might guess, special, double-anode units have been developed for this type of application. These units contain two zener diodes connected cathode-to-cathode inside a single package. This design simplifies mounting and can save considerable space in crowded chassis areas.

The application possibilities of zener's are far too numerous to be described individually here. But whatever the project being worked on, chances are that one or two of these devices, properly placed in the circuit, will improve its performance. Once you have used zener diodes and come to depend on their excellent performance and reliability, you'll wonder how you ever got along without them in the past. -30-





Short-Wave Report

By HANK BENNETT
W2PNA/WPE2FT

FALSE REPORTING

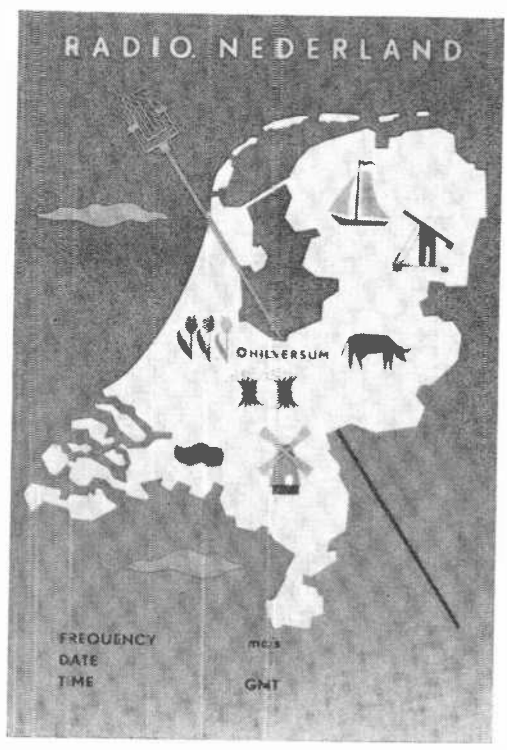
ONE OF THE DUTIES of your Short-Wave Editor is to check out all incoming reports. For most items, we use the *World Radio Handbook* and the *Foreign Broadcast Information Service* as standard references—about 90% of all reports are confirmed in this manner. Stations listed in reports but not listed in the reference books are personally checked on the air whenever possible. In some instances, we write to one of several veteran DX'ers and ask for verification of certain stations or information.

Once in a while, all evidence will point to a report as being obviously incorrect. This can be due to a misinterpretation by the listener of what he heard, or thought he heard. Everyone is entitled to a few honest errors. One of our most reliable reporters, for example, recently reported hearing a station in Africa; after further investigation he found that the station was behind the Iron Curtain, far removed from Africa.

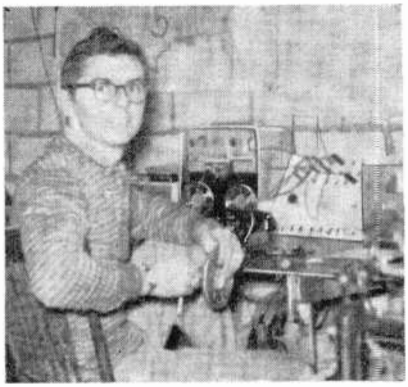
Then, again, there is always the chance that a report can be just plain phony. A guilty DX'er, when confronted by positive evidence of fraud, revealed that he only wanted to see his name in print. Deliberate false reporting is *not* the way to get your name listed—unless you are trying to have it listed in the blackball column.

Sometimes the wording of a report can determine whether we categorize it as honest or false. It is perfectly proper to copy schedules that are sent to you by the stations themselves so long as you indicate clearly that you are doing so. It is also okay to copy schedules from the *World Radio Handbook* or from club bulletins provided that you give your source of information—but the chances of getting your name into print this way are small since we have the same sources of information here.

Every month we receive reports from readers who have the schedule of a rarely heard station in their possession. They list the schedule or a part of it, but rather than stating that the station is on the air at that time, they state that



Radio Nederland's new QSL card is a real beauty—Holland appears in bright yellow on an emerald green and blue background. This card replaces the green, blue and white combination we considered colorful enough to feature on our January cover.



Thomas F. Carten, WPE1APS/KN1FZU, of Stratford, Conn., has snagged 34 countries and 25 veries with his shack full of equipment. He uses a Hammarlund HQ-145 receiver, Heath DX-40 transmitter, home-made control board, Revere tape recorder, Hallicrafters S-20, and an AM standby receiver.

they "heard" the station. This is obviously false reporting. Do *not* list a station as having been heard unless you have actually heard it.

One report received here recently listed many stations of a certain country as having been "heard." These low-powered stations, serving local audiences, very likely were on the air. But the low power and low frequency, combined with the reported times, virtually assured us that the reporter in question did not actually hear the stations; and a quick check in the *WRH* showed exactly the same listings. This reporter should have taken a few extra seconds of his time to indicate that he had copied the information from another source.

Deliberate false reporting is rare. True and correct reporting, happily, is evident in well over 90% of the reports coming in to us. But as a general reminder to all, we would like to emphasize the following three points:

(1) Report what you heard;

(2) If you copy information, be sure to indicate the source of your material;

(3) Don't waste your time—or ours—with dishonest reports.

(*Continued on page* 118)

Short-Wave Monitor Registration

If you haven't registered for your Short-Wave Monitor Certificate and call letters, fill out this form and mail it with ten cents in coin to: Monitor Registration, POPULAR ELECTRONICS, One Park Ave., New York 16, N. Y. Include *stamped, self-addressed* envelope so we can mail your certificate at once. If you live outside the United States, send two International Reply Coupons or equivalent value postage stamps. Canadians may send fifteen cents in coin.

(Please Print)

Name ....

Address .... City .... State ....

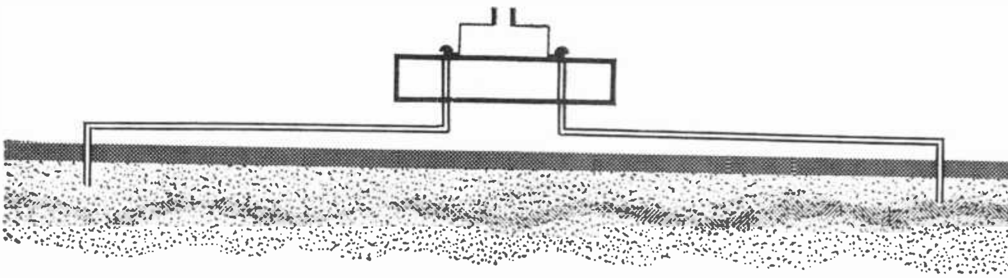
Receiver — Make .... Model ....

Make .... Model ....

Principal SW Bands Monitored .... Number of QSL Cards Received ....

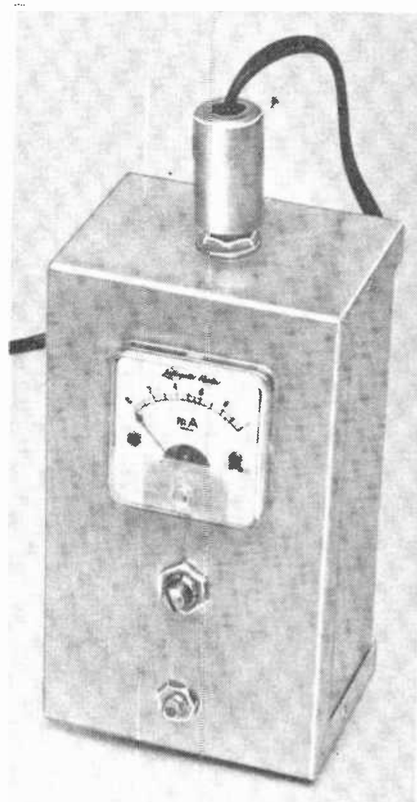
Type of Antenna Used ....

Signature .... Date



Build a SOIL MOISTURE METER

By RONALD WILENSKY



Simple ohmmeter circuit takes guesswork out of lawn watering

HAVE you ever wondered whether you were watering your lawn or garden more than necessary—or not enough? This handy "moisture" meter will help you determine just how much water the soil needs at any time—it will take some of the guesswork (and the unnecessary work) out of the job.

Essentially a simple ohmmeter, the unit works on the principle that the wetter the soil gets, the lower its resistance becomes. A miniature 0-1 milliampere meter (*M1*) is the heart of the device. Wired in series with a transistor battery *(B1)*, calibrating potentiometer *R1*, resistor *R2*, and a special probe, the meter functions as an effective soil resistance indicator.

Construction couldn't be simpler. The ohmmeter circuit will fit in an aluminum Minibox with plenty of room to spare. Lead length and component placement are not critical. The simplest way to make the 1½"-diameter hole for the meter is to use a Greenlee chassis punch, but the light aluminum is easily cut, and a few minutes work with a ¼" drill and a half-round file will yield the same results. The battery is mounted in a holder made of 1" sheet-metal stripping.

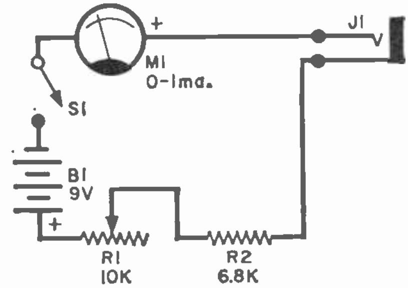
The probe is made from two lengths of coat hanger wire (paint removed) and a piece of scrap plastic or other insulating material. Construction details are shown in the pictorial diagram. A six-foot or longer length of zip cord, terminated in a phone plug, connects the probe to the meter box.

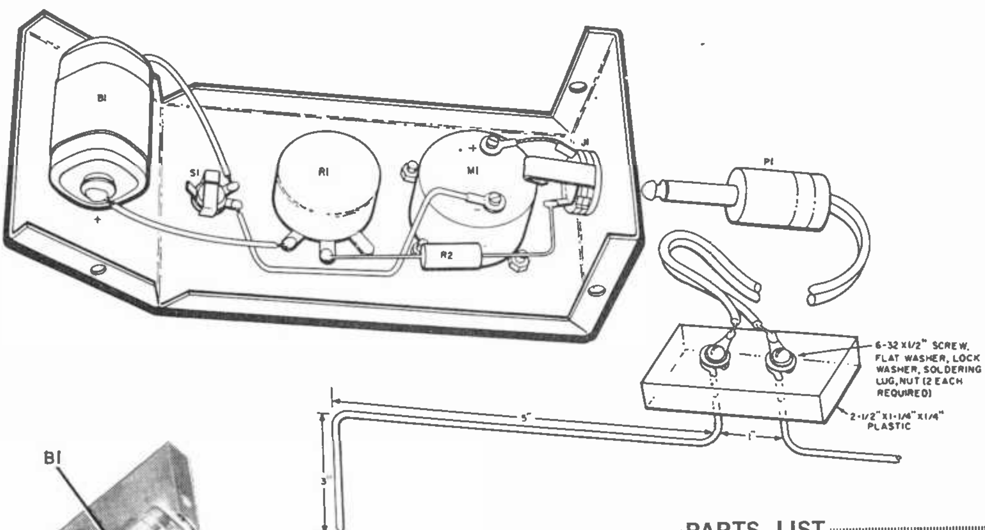
To use the soil moisture meter, you must first calibrate it. When your lawn or garden has been freshly watered, insert the prongs of the probe two inches into the ground; then adjust *R1* until the meter reads eight-tenths of full scale (0.8 ma.). You may want to mark *R1*'s position with a pencil in case the shaft is accidentally moved.

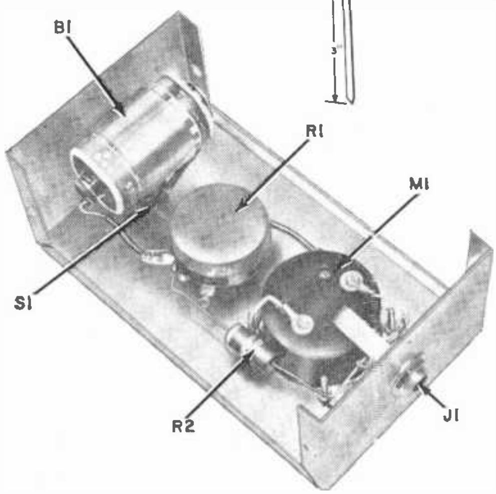
When you think the ground should be watered again, insert the probe at several different points on your plot and take readings by depressing *S1*. If most of your readings are much less than 0.8 ma., the soil needs water. If they're over 0.8 ma., hold off the watering for a day or so. (Exact scale readings will vary for different types of soil.)

If you'd like to use the moisture meter on several kinds of soil, or in garden

Wiring the moisture meter is easy but be sure to observe proper polarities when connecting meter M1 and battery B1.







All components fit nicely in a 5" x 3" x 2" aluminum box. The battery holder shown here is handmade, but a commercial unit may be used.

PARTS LIST

B1—9-volt transistor battery (Burgess P6 or equivalent)
J1—Open-circuit phone jack
M1—0-1 ma. miniature milliammeter (Lafayette TM-400 or equivalent)
P1—Phone plug
R1—10,000-ohm potentiometer, taper not important, slotted shaft (Mallory SU-20 or equivalent)
R2—6800-ohm, ½-watt resistor
S1—Miniature push-button switch (Lafayette MS-449 or equivalent)
1—5" x 3" x 2" aluminum box (Bud CU-3006A Minibox or equivalent)
Misc.—Hardware, zip cord, 2½" x 1¼" x ¼" plastic block, coat hanger wire, etc.

areas requiring varying amounts of water, you'll probably need more than one calibration point. In this case, it might be handier to use a potentiometer with a pointer and scale rather than the screwdriver-adjusted type shown, and jot down the different calibration readings on the side of the box. —30—

On the Citizens Band

By TOM KNEITEL, 2W1965

BET you didn't know that CB'ers share in a little piece of "space electronics." While digging through some "Proceedings of The I.R.E.," we came across a report by John D. Kraus of Ohio State University's Radio Observatory. The report, in Vol. 46 (pp 266-274, Jan., 1958), is called "Planetary and Solar Emission at 11 Meters Wavelength" and describes how we've received signals from the sun, Venus, and Jupiter on 11 meters. Jupiter came through with "clicks" and grinding noises, the Sun gave out with "solar" noise, and Venus produced a rumble.

The antennas used for this interplanetary DX included three right-handed helical beams 24 feet long by 11 feet in diameter. The helices had 2½ turns each and rotated on their axes. Another antenna used two colinear arrays, each consisting of two horizontal ½-wave elements separated from each other by 180 feet.

Hey—wait a minute! Don't those guys on Venus, Jupiter or wherever know about the "no DX'ing" rule? Their FCC citations will be arriving on the next "Discoverer"!

Wow! Whoopie! Zingo! Those Raytheon people sure know how to keep your attention while they demonstrate a set. As you can see from the photo, their RAYCOM CB rig has beautiful coloring and is 5 ft. 3. . . . I mean, it has 5 watts input. I couldn't bring myself to concentrate much on the set, but I did learn that it has five channels, an ANL, an excellent modulation circuit, and will run on 12 or 32 volts d.c. *and* 117 volts a.c. Bless Raytheon for giving your tired old CB Editor something to live for—their new RAYCOM, of course!

An anonymous reader has sent us a clipping from the San Jose (Calif.) *News*. The item is headed "Radioman Panics, Sets Off a Search," and relates how "a Woodside man sent police and amateur radio operators into a tizzy . . . by broadcasting for help." The CB'er kept pleading over the air that he was "being held by two men."

Two hours later, after he had aroused two sheriff's departments and several other CB'ers, his wife grabbed the mike. She said that she didn't know what the call letters were but there was no trouble and the station was going off the air. Then she pulled the switch.

When the sheriffs finally tracked down the station, they found that the "two men" were actually one landlady who was threatening the CB'er with eviction. The CB'er and his family lost the "battle" and spent the night in a motel. Since the FCC is always making such a fuss about mis-use of the 11-meter band, we wonder what action they took in this particular case.

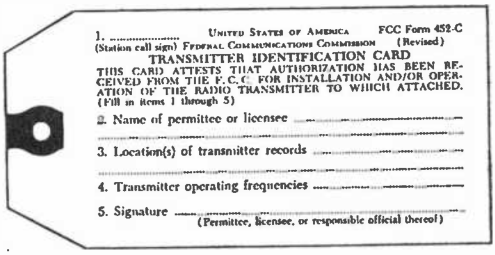
There's a mistaken belief among some mobile CB'ers that they can step up the output from their voltage regulators and

pump a little extra juice into the rig to squeeze out that extra watt or two. The cost of replacing a whole set of French-fried tubes each week makes it hardly worth finding out if this will work. It won't. True, you may run more power into the set, but you'll also overheat the filaments and damage the cathodes. In the end, you won't get anything more out of the rig than the tubes.

Speaking of mobile operation, which is very popular this time of year, we'd like to mention that last summer there were a number of instances when mobile CB'ers were stopped by the law for an explanation of their two-way radio equipment.

In many areas it's illegal to keep radio equipment in your car if it can receive police frequencies. And even though a CB rig can't do this, rural "speed trap" sheriffs are always on the lookout for itinerant motorists sporting whip antennas on their buggies.

Before you venture forth, you'd better double-check to make sure that you have your "FCC Form 452-C, Revised"


1. .... UNITED STATES OF AMERICA FCC Form 452-C
(Station call sign) FEDERAL COMMUNICATIONS COMMISSION (Revised)
TRANSMITTER IDENTIFICATION CARD
THIS CARD ATTESTS THAT AUTHORIZATION HAS BEEN RECEIVED FROM THE F.C.C. FOR INSTALLATION AND/OR OPERATION OF THE RADIO TRANSMITTER TO WHICH ATTACHED. (Fill in items 1 through 5)
2. Name of permittee or licensee ____________
3. Location(s) of transmitter records ____________
4. Transmitter operating frequencies ____________
5. Signature ____________
(Permittee, licensee, or responsible official thereof)

properly executed and attached to the rig. The "452's" are available from any FCC office.

One thing more—don't transmit while you're driving. This is also illegal in some places, but it's a dangerous habit no matter where you are. The rig you save may be your ohm! (Ouch!)

Another popular place for summertime CB activity is aboard small boats, and the Kaar Engineering Corp. (2995 Middlefield Rd., Box 1320, Palo Alto, Calif.) has designed a good-looking "monitoring poster" which they will supply at no charge to interested parties. The poster advises CB-equipped boats that Channel 13 is being monitored—see photo.

We had a chance to gaze into the CBCB (CB Crystal Ball) the other day at the Mahler Research Foundation's laboratories. Executive director Tracy Diers (2W4975/W2OQK/W2CXN) and engineer Herb Friedman (2W6045/W2ZLF) took us behind locked doors to give POP'tronics an exclusive scoop on a speech-scrambler they've perfected for CB.

It really works. You put one "scrambler" on a transmitter and one on a receiver, and nobody can understand what's going on except the stations in your system.

This appears to be the answer to the complaints of many "commercials" who don't want to be bothered by the gossipers on their channel. The gadget isn't ready for commercial distribution yet, but it is expected to be *very* inexpensive and easy to attach.

If you'd like some personalized "call letter" jewelry, license plates, decals, lapel pins, etc., drop a note to Chuck at K9TVA Enterprises, 6429 N. Glenwood Ave., Chicago 26, Ill., and ask for his catalog. There are a couple of dozen items in it worth looking over, and an order blank to boot.

Many readers have written to ask about the different call-sign prefix letters heard on 11 meters. Here's the story. Calls with "W's" were the original CB calls and were given out between September 1958 and December 1960. Some areas ran out of "W" calls, however, before the end of '60 and used "A" calls until the new "Q" system went into effect on January 1, 1961.

The "Q" calls will be assigned until the end of 1961, while "R" calls will be assigned for 1962, "S" for 1963, and so on, until "W" is reached again in 1967. Since CB licenses are valid for five years, no "Q" calls will be in use later than the

(*Continued on page* 112)

ADVANCED EXPERIMENTERS CORNER

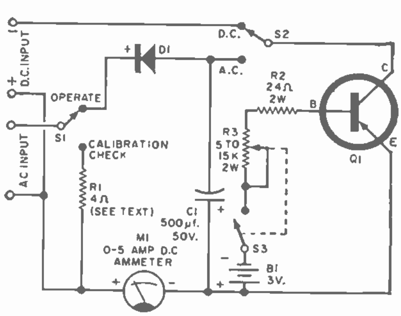
AC DC ELECTRONIC LOAD

By HAROLD REED

TWO inexpensive semiconductors and a handful of other components make a useful electronic load that will take the place of a whole drawer full of test resistors. Having provision for both a.c. and d.c. inputs, it can be used for test-loading low-voltage power supplies, generators, batteries, audio amplifiers, etc.

The collector-emitter resistance of power transistor *Q1* provides the actual load. This resistance decreases as *Q1*'s base current increases, and vice-versa. The base current is supplied by battery *B1* and controlled by adjusting potentiometer *R3*; switch *S3*, the base current cutoff switch, is ganged with *R3*. Resistor *R2* limits the base current. The current drain of the electronic load is read by meter *M1*.

Silicon diode *D1* rectifies the a.c. input and capacitor *C1* smooths out the d.c. pulses. The resulting d.c. is then fed to transistor *Q2* through *S2* (the a.c.-d.c. selector switch). Resistor *R1*, when switched across the a.c. input by *S1*, is used in checking calibration (see calibration procedure below).



Parts are not critical, but D1 and Q1 depend on maximum voltages and currents needed. Resistor R1 checks calibration.

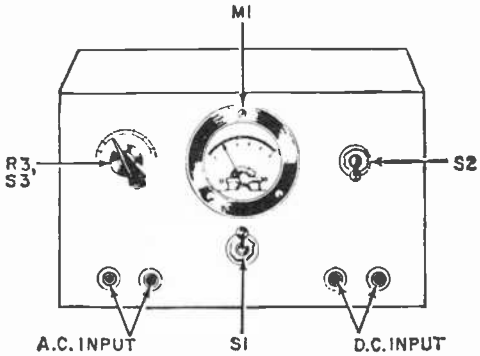
Hookup. For d.c. testing, set *S1* to *"Operate," S2* to *"D.C.,"* and *R3* to its maximum resistance. Connect the output of the device to be tested to the d.c. input terminals, being careful to observe the proper polarity. The setup for a.c. testing is the same, except that *S2* is set for *"A.C.,"* and the a.c. input terminals are used.

Turn on the equipment under test and slowly reduce the value of *R3* (thereby reducing the load resistance of *Q1*). An appropriate voltmeter (d.c., a.c., or audio) connected to the input terminals in use, together with the internal ammeter, will show the output and/or regulation behavior of the unit being tested under increasing load.

Calibration. To calibrate *R3* for specific amplifier load resistances, terminate the amplifier with a resistor of known

PARTS LIST

B1—3-volt battery (two 1½-volt flashlight cells in series)
C1—500-µf., 50-volt electrolytic capacitor
D1—1N1341 diode (see text)
M1—0-5 ampere d.c. ammeter
Q1—2N554 transistor (see text)
R1—4-ohm resistor (see text)
R2—24-ohm, 2-watt resistor
R3—5000 to 15,000 ohm, 2-watt potentiometer (with switch S3)
S1, S2—S.p.d.t. toggle switch
S3—S.p.s.t. switch
Misc.—Binding posts, transistor mounting kit, hardware, etc.



Suggested front panel layout for a.c.-d.c. electronic load. Components may be housed in any convenient metal box.

value (say 4 ohms) and connect an audio voltmeter across this load. Feed a 1000-cycle signal into the amplifier and adjust the output to some convenient voltage (say 4 volts). The resistor's power rating should be much greater than the power it will dissipate ($P=E^2/R$) to avoid undesirable heating.

Now disconnect the load resistor and connect the amplifier to the a.c. terminals of the electronic load, leaving the voltmeter in the circuit. Set the controls of the load for a.c. operation as described above, and adjust *R3* to obtain the same voltage—in this case, 4 volts. This position of *R3*'s pointer may now be marked "4 ohms." Repeat the procedure with other appropriate load resistances, such as 6, 8, and 16 ohms.

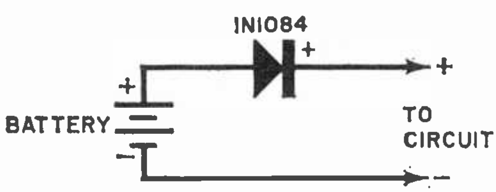
Resistor *R1* can be used to check the calibration at any time. A value of 4 ohms is shown for *R1* in the schematic, but any value at which *R3* is calibrated may be used. The calibration check is made using the same procedure as in the actual calibration, except that built-in-resistor *R1* is connected and disconnected by switch *S1*.

Choosing Semiconductors. The selection of diode *D1* and power transistor *Q1* depends on the voltage and current levels at which you will be working.

For *Q1*, a transistor such as the Motorola 2N554 (maximum voltage, 28 volts; maximum current, 3 amperes) is a good choice. In spite of the relatively high voltage and current maximums of the 2N554, the voltage-current product (power) should not exceed 10 watts on continuous duty; for instantaneous use, this figure can be increased to about 40 watts. Be sure to use the heat sink recommended by the manufacturer and to keep your tests as short as possible.

Diode *D1* should have voltage and current ratings consistent with those of the transistor. To match the 2N554, you'll find that the International Rectifier 1N1341 is a good bet. -30-

TRANSISTOR SAVER

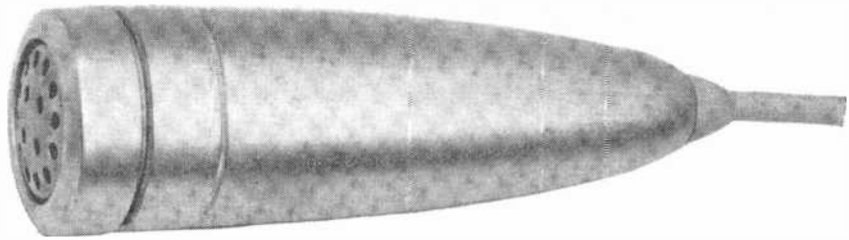


The "one-way" current-carrying property of a diode can be used to keep the transistors in an experimental circuit or in any transistorized piece of equipment from being ruined because of accidentally reversed battery polarity.

Simply place the diode in series with the battery's positive lead as shown in the diagram, and current will flow only in the direction indicated by the arrow in the diode's symbol. If it's more convenient to wire the diode into the negative battery lead, install it so that its positive side connects to the negative terminal of the battery.

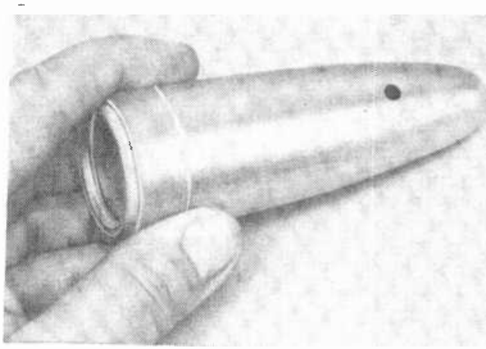
Though the diode presents a high resistance to current flow if the battery is connected in reverse, its resistance to current flowing in the correct direction is much lower. The voltage drop across a 1N1084 is only about ½ volt for a current of 30 ma., and it will be no more than 1 volt as the current is increased to 4 amperes.

The 1N1084 is not the only diode which can serve as a transistor saver, but check the one you plan to use for excessive voltage drop. A 1N60, 1N34A, 1N64, or 1N38B, for example, will develop a 4- or 5-volt drop with a current of 75 ma. —*George E. Lang*



FIRST MIKE KIT

CBS Electronics offers ceramic microphone in easily assembled form

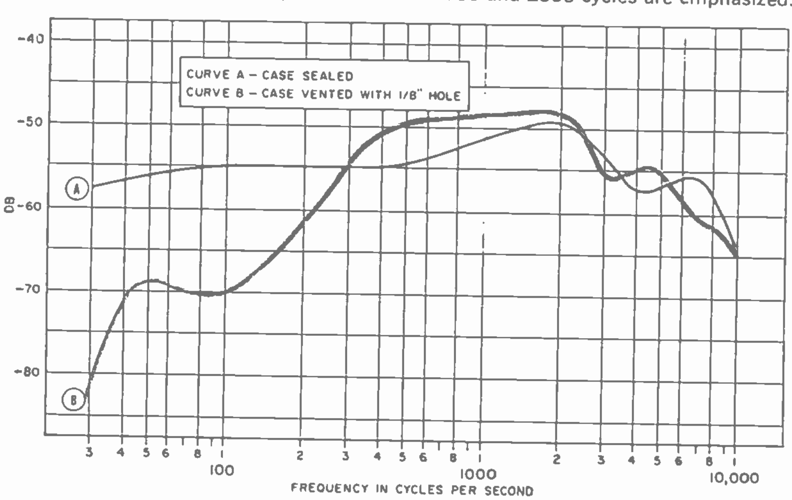


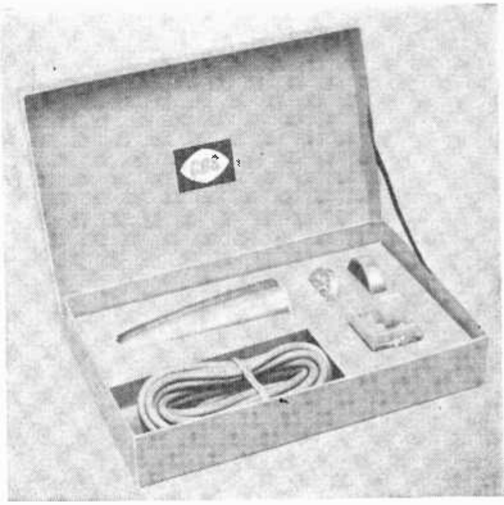
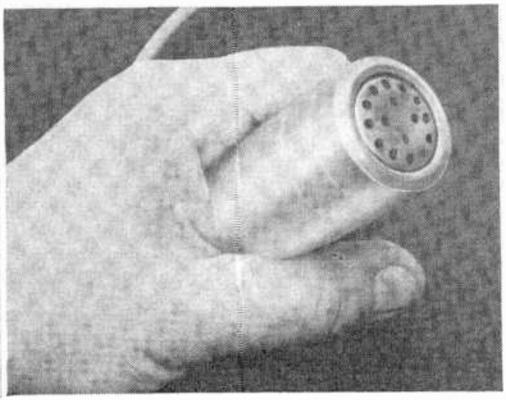
Circular hole in case can be closed up with small screw.

IT is getting so that just about everything in electronics is available in kit form. This "adage" holds true even with microphones, since CBS Electronics has just introduced the "Mark III" ceramic microphone kit. Selling for $7.50, the kit can be assembled in less than 20 minutes—there are only eight steps in the assembly process, including two solder connections. This kit is one of a variety of new items offered by CBS Electronics (Danvers, Mass.).

The "Mark III" is very sensitive and suitable for use with tape recorders, ham or CB transmitters, and dictation machines. Mounting of the ceramic element in the case is somewhat unconventional in that multiple vents

Response of "Mark III" microphone may be altered by use of small vent in case (see photo, above left). When case is vented, bass response is greatly attenuated and voice frequencies between 300 and 2500 cycles are emphasized.



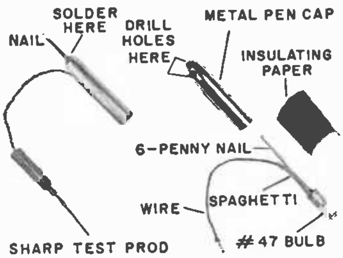
The eight pieces of the "Mark III" kit can be assembled in 20 minutes; assembled mike is semi-directional in position shown above, right; and omnidirectional when held vertically.

have been provided behind it to smooth out the response curve. Small bits of plastic foam are stuffed in the mike shell to eliminate a hollow sound.

In addition to these multiple vents, CBS recommends drilling a 1/8" hole in the lower part of the microphone case, and tapping it to accept a small screw. This special vent relieves pressure behind the diaphragm attached to the ceramic element. When the hole is open, bass response is reduced nearly 17 db at 100 cycles, making voices sound sharp and crisp. Closing the hole with the screw restores the bass response. The effect is similar to baffling and unbaffling a hi-fi speaker.

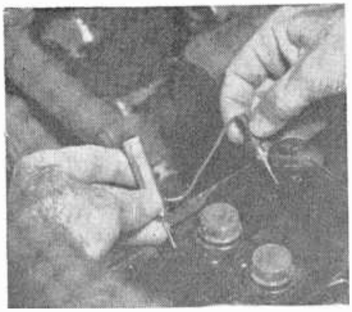
Assembling the "Mark III" takes much of the mystery out of microphones. We found it fun. —30—

STORAGE BATTERY TESTER

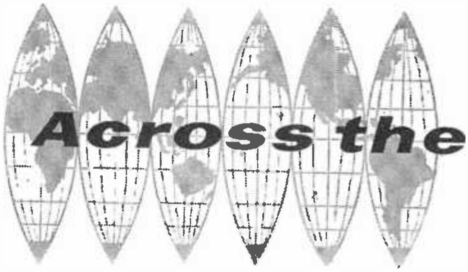


You can locate bad storage battery cells quickly with this simple tester made from a few junkbox parts. Just solder a 5" length of flexible wire to the base of a #47 (6-8 volt) bulb, and slide a 2" piece of spaghetti over the joint. Then sweat the head of a 6-penny finishing nail onto the bulb's center contact.

A metal pen cap houses the lamp assembly—make a hole in the tip large enough for the nail to pass through, and another one on the side, near the tip, for the wire. Now wrap the base of the bulb with insulating paper, and slide the cap over the assembly, maneuvering the wire through the side hole as you do so. With about 1" of the nail protruding through the tip of the cap, solder the nail to the cap. Finally, install a sharp test prod on the free end of the wire.



To test a cell, locate its two terminal posts by the bulges they make under the soft compound covering the top of the battery. Push the nail and the test prod through the compound so that each makes contact with a terminal, and note the brightness of the lamp. Check the other cells in the same way; if one of them shows a much dimmer glow than the others, it may be defective. —*I. C. Chapel*



Across the Ham Bands

By
HERB S. BRIER
W9EGQ

HOW TO AVOID VIOLATING AMATEUR REGULATIONS

EVERY FEW MONTHS, the FCC issues a list of hams who have lost their licenses for various lengths of time because of serious violations of the amateur regulations. The one thing these hams have in common is that their violations are almost always deliberate—so you need not waste any tears over them. It might be wise, however, to review some of the ham regulations which are often innocently violated, so that you won't be among the approximately 6000 hams who will receive some sort of violation notice this year.

Licenses and Photocopies. Amateur regulation 12.25 states: "The original operator license of each operator shall be kept in the personal possession of the operator while operating an amateur station." Many hams never seem to have their licenses with them when they operate mobile or portable, or want to operate another ham's station. When I pointed out this requirement to one such ham, he protested.

"I don't want to wear out or lose my ticket carrying it around with me," he said. "I'll get a photostat."

But 12.25 continues: ". . . No recognition shall be accorded to any photocopy of an operator license; however, nothing in this section shall be construed to prohibit the photocopying for other purposes of any radio operator license."

A photocopy of your license will come in handy if you want another ham to operate your station when you are absent and have your license with you. For example, you might want to go on a trip and arrange for another ham to use your rig so that you can work it from your mobile or portable transmitter—or from another ham's station. Before you go,

Ham of the Month

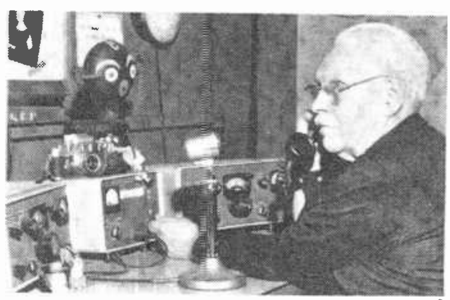


Photo by Frank, W9EJW

On the air, Elmer E. Taflinger, W9GRN, is called "Mike"—short for "Michaelangelo"—because he is a well-known artist and art teacher. Mike's interest in short-wave radio began during World War II, when he monitored enemy broadcasts to get prisoner-of-war lists for a newspaper. He received his ham license in 1949.

Mike's ham station is located in a downtown Indianapolis studio. His states-worked total matches the number of stars on his flag—48, but he worked Alaska and Hawaii many times before they became states. A good place to find W9GRN is on the 75-meter phone band late at night, after his art classes are over.

W9GRN's experience as an artist, magazine illustrator, art director for the theatrical productions of the late David Belasco, foreign traveler, lecturer, and art instructor provides him with an endless range of subjects to talk about. Most hams, on learning that Mike is an artist, first ask what his girl models wear while posing; they are less interested in the fact that Mickey Hargity, husband of Jayne Mansfield, began his climb to fame from Mike's modeling stand.

Mike is always ready to help prospective hams get their licenses—more than one Indianapolis ham credits his call letters to Mike's tutoring.

Floyd, KN5CWS, has a record of over 800 contacts, 50 of them representing DX from 17 countries and 5 continents. He uses a Johnson Ranger transmitter and a Hallicrafters SX-28 receiver.

Chet, WA2LOC, made over 300 contacts in 2½ months as a Novice on 40 meters. Since he became a General, his Heathkit DX-40 and Hallicrafters SX-99 have worked 22 countries on 20 meters.

post a photocopy of your license in a conspicuous place in your station (regulation 12.69). Also instruct the ham operating your station to have his own license with him, to use your call letters—not his own, and to keep up and sign your station log.

If you have difficulty getting a copy of your license made because the copying firm believes that making such a duplicate violates some federal law, show him this column or section 12.25 of the amateur regulations.

Operating Other Stations. There are two ways in which you can get into trouble operating someone else's station: (1) visiting a prospective ham who has a rig but no license and making a few contacts using your own call letters; and (2) visiting another ham and operating his station on an amateur band or mode of transmission not authorized by the other ham's *station* license or your own *operator* license.

The first situation is completely prohibited—no class of license authorizes anyone to operate an unlicensed station. In the second case, while any ham can operate another ham's station, you can do so only on bands and modes of transmission authorized by your own *operator* license or the other ham's *station* license—whichever has the most restrictions.

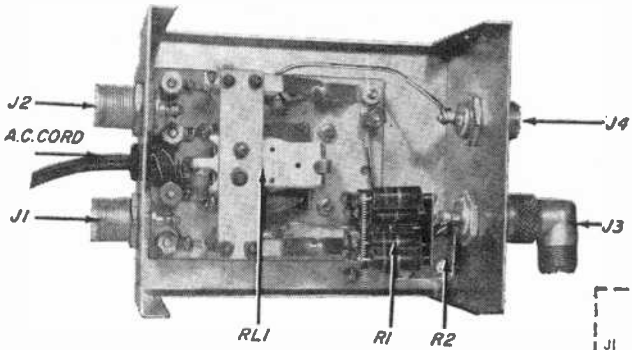
Mobile and Portable Operation. On c.w., you identify mobile or portable operation by following your station call letters with the fraction code symbol (DN) and the number of the call area in which you are operating. On phone, your call letters should be followed by an announcement of the geographical location in which the mobile or portable operation is taking place. For example: ". . . This is W3DEF operating mobile 3 miles north of Bethesda, Md."

Special rules govern mobile operation aboard a vessel on the high seas or an aircraft on an international flight. They require that you send "/MM" or "/AM" after your call letters on c.w. or announce "Aeronautical Mobile" or "Maritime Mobile" at the end of each phone transmission. Also on either phone or c.w., the name or number of the vessel or aircraft and its approximate geographic location must be given immediately prior to the sign-off at the end of each contact.

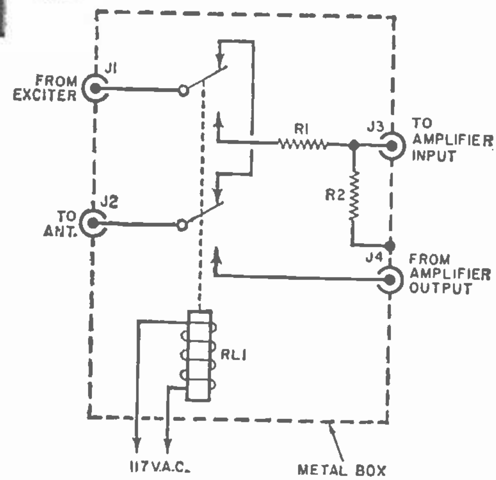
These special rules apply only to operation outside the continental United States. Mobile operation from boats and aircraft within the United States is treated like mobile operation on land. This is important, because U.S. mobile operation is restricted to the 10- and 15-meter bands in many areas, and is never permitted below 7 mc. (See regulation 12.90, paragraph 2.) If you operate from your boat or a plane in the U. S. and sign "Maritime Mobile" or "Aeronautical Mobile" instead of plain "Mobile," you might find yourself telling the FCC why.

LOW-POWER/HIGH-POWER RELAY

This month's construction project, a low-power/high-power relay, was built



Relay circuit for automatically switching r.f. power amplifier in and out of transmitter. If attenuation is not required, substitute a short bus wire for R1 and omit R2.



by Jim Manning, K9RUH, to permit feeding his antenna directly from his exciter for local contacts or from his power amplifier for DX contacts. It's an easy-to-build unit which lets you comply with FCC regulations by using the minimum transmitter power necessary for satisfactory communications.

When the relay is not energized, the exciter feeds the antenna directly. In the energized position, the output of the exciter is transferred to the amplifier input circuit (either directly or through the optional power attenuator) and the antenna is switched to the amplifier output circuit. The relay is connected to the 117-volt primary circuit of the amplifier's power supply and the switching takes place automatically when the amplifier is turned on.

Construction. Mount the 117-volt, d.p.d.t., antenna changeover relay (*RL1*) on one-half of a two-piece 3" x 4" x 5" utility box, using ½" spacers to center it. Then mount two coaxial connectors on each end of the box, keeping each set of connectors at least two inches apart; in this way, the chance of r.f. feedback between the input and output connectors is minimized. A ⅜" hole lined with a rubber grommet accommodates the coil leads.

Use No. 14 or No. 12 solid copper wire to connect the movable contacts of the relay to the connectors (*J1, J2*) on one end of the box. Join together the normally closed relay contacts, and connect the normally open contacts to the remaining coaxial connectors (*J3, J4*), keeping the leads short and well separated. These are the proper connections for driving practically any grounded-grid power amplifier with an exciter having an input power rating up to 200 watts.

PARTS LIST

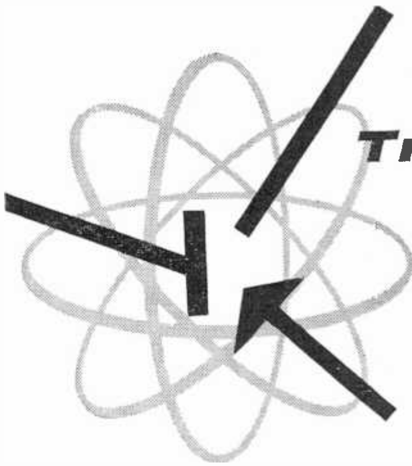
J1, J2, J3, J4—Chassis-type coaxial connectors (Dow-Key DKC-P or equivalent)
**R1—Ten 330-ohm, 2-watt, composition resistors connected in parallel*
**R2—Five 150-ohm, 2-watt, composition resistors connected in parallel*
RL1—D.p.d.t., ceramic-insulated antenna changeover relay; approx. 2" spacing between poles; 117-volt a.c. coil (Ameco #51 or equivalent)
1—5" x 4" x 3" two-piece aluminum utility box (Bud CU-2105A or equivalent)
**4—Squares of "flashing" copper; two 1½" and two ¾"*
Misc.—⅜" grommet, ½" spacers (four), #14 or #12 solid copper wire

**Parts used for optional attenuator*

Attenuator. To drive a grounded-cathode amplifier using tubes like 813's, 4-250A's, etc., with an exciter delivering much more than 10 watts output, you will need a power attenuator between the exciter and the amplifier to absorb some of the excess power.

To build the attenuator, place two 1½" squares of "flashing" copper to-

(*Continued on page 115*)



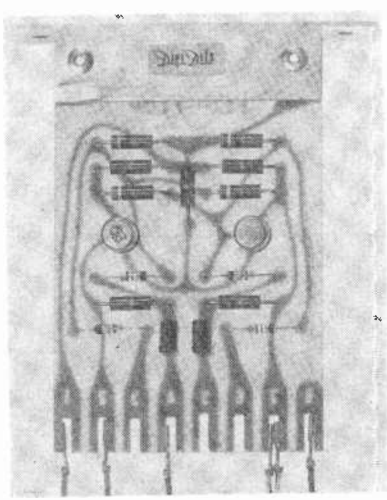
Transistor Topics

By LOU GARNER

NO MATTER how imposing they may appear, few—if any—digital electronic computers are inherently complicated. As discussed in an earlier column (October, 1960), their apparent complexity results from the multiple use of a few basic—and relatively simple—circuits. By way of comparison, a Citizens Band transceiver may use a greater *variety* of basic circuits than a typical computer. In the transceiver, each basic type of circuit is used only once or twice, while in the computer the same circuit may be repeated dozens—or even hundreds—of times.

With only a few basic circuits needed, the customary procedure has been to preassemble these basic circuits on individual circuit boards as modular *elements* using printed-circuit techniques. Each board or element contains all the resistors, capacitors, transistors and diodes needed for a specific circuit function. Afterwards, the designer interconnects as many—or as few—of these digital elements as are needed to assemble a computer, test instrument, or automatic control circuit.

With military and industrial users of digital elements demanding high-speed operation, tight tolerances, and stable performance over wide temperature ranges, circuit-board manufacturers—in the past, at least—have been forced to use silicon transistors and other expen-



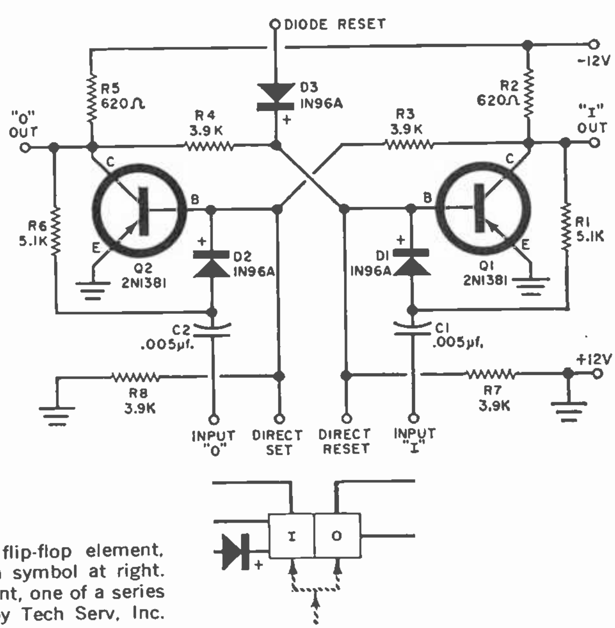


Fig. 1. Schematic diagram of DigiBit flip-flop element, shown with its functional block diagram symbol at right. Photo above shows typical flip-flop element, one of a series of low-cost digital elements produced by Tech Serv, Inc.

sive components in their products, with correspondingly high element prices. A single industrial-quality flip-flop, gate, or amplifier element, for example, might cost as much as forty or fifty dollars. With from two to as many as dozens of elements required for a single project, overall costs mount into the hundreds—or even thousands—of dollars.

Recognizing the increased interest in digital techniques on the part of hobbyists and educators, and realizing that the tight performance specifications demanded in military and industrial equipment needn't apply to elements designed

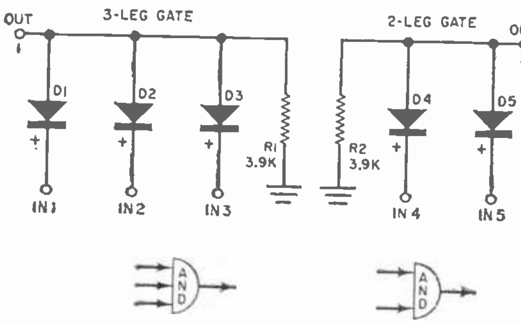


Fig. 2. Schematic diagram of DigiBit 3-leg and 2-leg diode "And" gates, with their corresponding block diagram symbols.

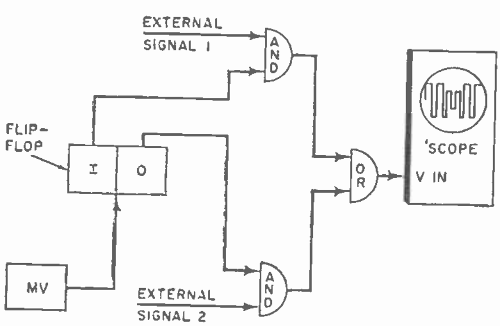


Fig. 3. Block diagram of a simple electronic switch made up of several DigiBit elements.

for hobbyist or school use, one manufacturer, Tech Serv, Inc. (4911 College Ave., College Park, Md.) has recently introduced a complete series of low-cost digital elements for the serious student and advanced experimenter. Dubbed *DigiBits,* these elements are offered in all the basic arrangements needed in digital circuit work, including flip-flops, "And" gates, "Or" gates, inverters, emitter followers, indicators, relay drivers, controls, and clocks (multivibrators).*

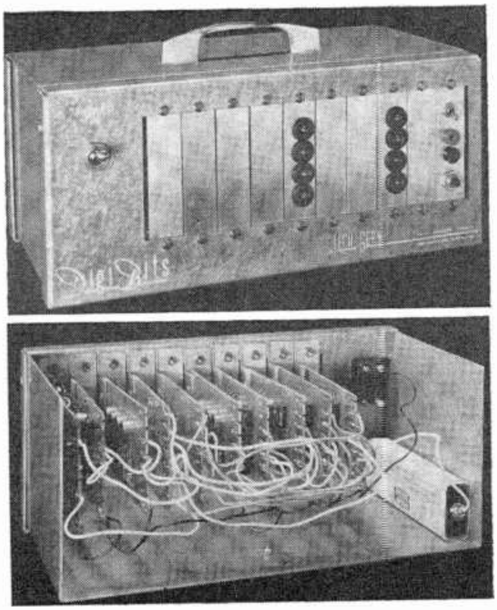
Although each circuit package is completely assembled and attached to a mounting bracket, the element prices are not appreciably more than the cost of the individual components (transistors, diodes, resistors, etc.) would be if they were purchased separately at regular net prices. Typical DigiBit prices range from $7.95 for a multivibrator or diode "Or" gate to $9.95 for a flip-flop or three-section inverter amplifier, with an overall average of less than $10.00 per element package.

The schematic diagram of a DigiBit flip-flop element is shown in Fig. 1, along with its functional block diagram symbol. The diode "And" gate element, shown schematically in Fig. 2, consists of both 2-leg and 3-leg gates mounted on a single circuit board and, if desired, can be used as a single 5-leg gate; the block diagram symbols appear below the schematic diagram.

Physically, the elements are quite easy to use. The mounting bracket serves as a ground connection for each circuit board, with individual connections made by means of solderless "Edg-on" jumper leads. Using these techniques, it's a simple matter to assemble a complete binary counter or test instrument in a matter of minutes. Operating power can be obtained from standard dry cells, except when a large number of elements are involved (here, the manufacturer recommends a storage battery or 12-volt regulated supply).

Although the DigiBit elements can be used for assembling complete digital computers, most individual experimenters probably will prefer to assemble simpler (and less costly) projects requiring, at the most, four or five elements . . . at least at the beginning. The range of possible projects is limited only by the imagination and skill of the individual hobbyist. Typical projects include electronic "games," simple counters, automatic controls for model railroads, and useful test instruments for the elec-

**DigiBits were mentioned briefly in our April column when they were first put on the market.*



External and internal views of low-cost, portable binary counter assembled with DigiBit elements. Solderless clip-type connectors are used to interconnect individual circuit boards.

tronics workshop, such as electronic switches, oscilloscope calibrators, square-wave generators, pulse generators, and so on.

One typical project is shown in block diagram form in Fig. 3. Here, a clock (or multivibrator) element is combined with a flip-flop, a pair of "And" gates, and a single "Or" gate as an electronic switch for an oscilloscope, permitting two external signals to be displayed alternately on the CRT. In operation, the multivibrator (*MV*) triggers the flip-flop and this, in turn, "unlocks" first one "And" gate, and then the other, allowing the two external signals to pass alternately to the "Or" gate, where they are combined and applied to the 'scope's vertical input terminals. In many cases, the flip-flop may be eliminated, with the multivibrator driving the two "And" gates directly; thus, only three elements are needed for assembling the instrument.

The complete line of DigiBit elements and accessories is described in a six-page folder, available from the manufacturer at no charge. In addition, Tech Serv offers a 55-page "Instruction and Applications Manual," priced at $1.00 per copy, postpaid—it describes a number of practical projects that can be assembled with DigiBit elements.

Reader's Circuit. Circuits submitted by readers and featured in this column are derived, originally, from several different sources. Most are modifications or adaptations of circuits which readers have seen described in books or magazine articles. A lesser number are circuits discovered "by chance" while experimenting with various breadboard arrangements. A still smaller number are original designs developed by investing long hours in study and laboratory tests. On occasion, though, we'll receive a circuit "discovered" by a reader in a

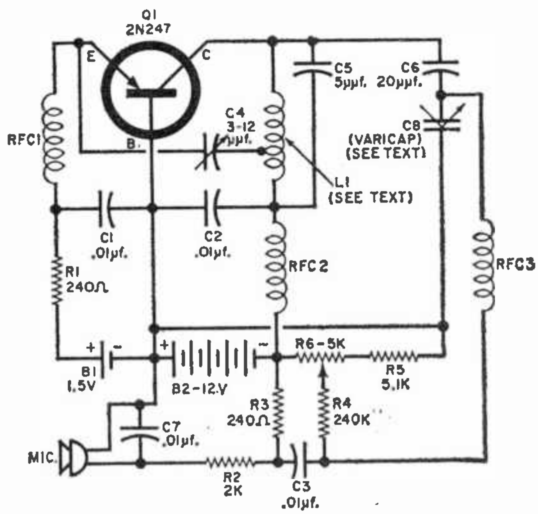


Fig. 4. Simple FM transmitter circuit sent in by reader/author E. G. Louis utilizes a power transistor and PSI Varicap capacitor.

manufacturer's technical bulletin or in a high-brow professional journal having limited circulation.

The simple FM transmitter shown in Fig. 4 was brought to our attention by reader/author E. G. Louis, who found it in a technical bulletin distributed by Pacific Semiconductors, Inc. (14520 Aviation Blvd., Lawndale, Calif.). This firm manufactures a number of interesting semiconductor devices, including a high-power r.f. transistor.

Transistor *Q1* is used in the common-base arrangement as a modified Hartley

(*Continued on page* 113)

By
JOHN T. FRYE
W9EGV

Carl and Jerry

First Case

IT seemed odd. For years Carl and Jerry had dreamed of how "super" it was going to feel to be out of high school. Now, with graduation only a week behind them, they were bored and ill at ease in their new freedom. Playing with electronics and performing entertaining experiments, into which they had entered with such zest before, had suddenly become "kid stuff."

The boys felt that they should be earning money to help with their college education. But since they were going to the university in the fall, there was no point in trying to get a regular job—even if they could have found one. Business conditions were still slack in the community, and a week's search had convinced them that no part-time jobs were available.

So they decided to go into business for themselves. They spent a whole half-day carefully lettering a sign and neatly erecting it in Jerry's front yard:

C & J Electronic Laboratories

Let Us Solve Your
Problem Electronically

(Please Use Basement Entrance)

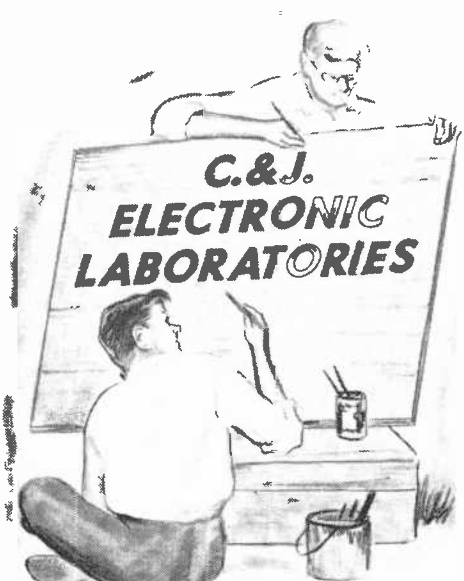
On this bright June afternoon Carl and Jerry were sitting in their basement laboratory hopefully waiting for the world to beat a path to their door; but they were genuinely surprised when they heard light footsteps descending the outside stairs and a young slip of a girl—she could not have been more than twelve or thirteen—stood framed in the doorway. She was dressed in a white blouse and loud-checked tapered pants, and she leaned with studied casualness against the door jamb. Peering in at them with a pair of blue eyes beneath a Veronica Lake mop of blonde hair, she said in a voice pitched surprisingly low for a child:

"Helooo, boys. I have a problem."

She waited expectantly. Jerry recovered first from his astonishment and invited, "Won't you come in and tell us about it?"

She minced over to the leather-covered couch in a walk that was a rather ludicrous imitation of the slinky gait of a 1930 movie vamp, then sat down and crossed her long thin legs.

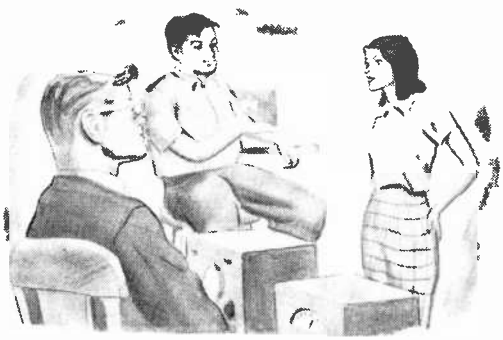
"Listen close, boys," she began in that strange, husky voice; "I'm expecting an important call and can't stay long. My name is Hall, Loree Hall, spelled



L-o-r-e-e; we moved into that big brown house across the street in March. Now I get a real blast out of detective programs on TV, but lately something has been clobbering my favorite program, 'The Private Eye Playboy,' on Channel 6 every Monday night. This interference occurs only when PEP—that's what I call 'Private Eye'—is on, and it completely blacks out the picture.

"At first I thought you two were causing the interference, since I'm told you noodle around with radio and stuff like that. But last Monday evening you were both out in front playing catch when it happened, so that gives you an air-tight alibi. What I want you to do is find out who or what is jamming my program and put a stop to it. No questions will be asked as to how you do it."

Carl and Jerry exchanged glances, trying to conceal their amusement. The



girl tugged a little coin purse out of her pocket and extracted two limp dollar bills, holding them out to Carl. "I have a good income, and I'm willing to pay any reasonable amount," she said with great dignity. "Please consider this a retainer."

"Aw—we can't—I mean—professional ethics do not permit us to accept a retainer until we decide to take your case," Carl sputtered, backing away.

"Very well," the little girl said as she stood up. "Suppose you come over tonight a little before 7:30 and see for yourself. I'll be expecting you, gentlemen."

Just as she reached the door, the boys heard a woman's voice calling impatiently: "Laura, where are you? You come here right now and finish straightening up your room!"

"I'm coming, Mother," the girl answered, in a voice that suddenly rose to a normal childish treble. She forgot her siren-slink and took the steps two at a time.

"Man, what a performance!" Carl chuckled. "I'd say that there is a little girl who has been over-exposed to TV dramas. What do we do?"

"Help the maiden in distress," Jerry answered promptly. "After all, she's our first and only client; so we can't be choosy. Anyway, my curiosity is aroused. I'll meet you here about a quarter of seven. Bring along your portable TV."

MR. and Mrs. Hall, a pleasant-looking young couple, were sitting on their front-porch glider when Carl and Jerry walked across the street.

"You must be the young men Laura says are going to help her with her television problem," Mr. Hall said as he shook hands with them. "I certainly hope you can. Her imagination scares me sometimes, but she's a good child and gets a lot of pleasure from her TV programs. Laura," he called, "you have company!"

The little girl, wearing a sheath-like dress that looked a little old for her, ushered them up the stairs to her large, airy bedroom. As she snapped on her TV receiver, she turned to them and asked in the voice that had returned to its low-pitched huskiness: "Like a drink, fellows? Coke? Pepsi? Lemonade?"

"No, thanks," Jerry replied without cracking a smile. "We never drink when we're on a case."

Soon the station-break flurry of commercials was over, and "PEP" began with a long-shot of a pretty girl sunbathing on a lonely beach. At this instant the picture suddenly flashed and turned to a negative, the white and black tones reversing. The condition persisted long enough for Carl to turn on his portable receiver and find that the picture on it was about the same. When he moved over near the door, however, the interference was not quite so bad. He manipulated the fine-tuning control far to one side and heard a voice faintly giving some call letters; then both pictures snapped back to normal.

"Hey, that's Eddy!" Carl exclaimed

(*Continued on page* 104)

Only Heath offers
Top Quality at the
Lowest Price, and....

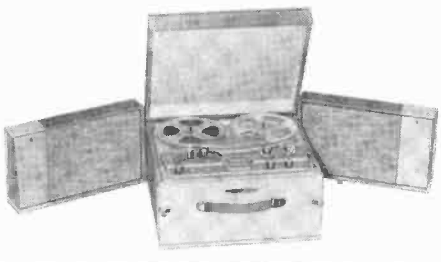
NOW—*we guarantee you*

At your service . . .

THE NEW HEATHKIT AUTOMATIC GARAGE DOOR OPENER!

Compare price, compare features, and you'll buy this latest Heathkit labor-saving wonder! Opens and closes all overhead track-type doors up to 8′ high automatically! Garage light turns on when door is open, stays on for short period after door closes! Safety release device. Adjustable operating force! Tone-coded "hi-power" 6 or 12 v transmitter and special receiver prevents interference. Easy one-man assembly. All parts included. 65 lbs.

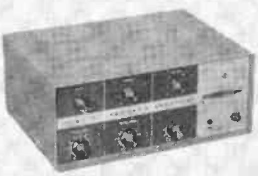
Kit GD-20 (mechanism, transmitter, receiver)... $11 dn., $10 mo. **$109.95**
Kit GDA-20-1 (extra transmitter) .... $2.50 dn., $5 mo.... **$24.95**



BIG-BUY PORTABLE 4-TRACK STEREO TAPE RECORDER

All-in-one monophonic or 4-track stereo tape record and playback! Two tape control levers; individual tone balance and level controls; monitoring switch for listening while recording; "pause" button for editing; two "eyes" to check recording levels. Also functions as "hi-fi stereo center" for record players, etc., or to feed tape music to separate hi-fi system. Parts for all amplifiers and speakers included; turquoise and white cabinet and 3¾"—7½" speed tape deck are assembled. Less mic.

Kit AD-40...49 lbs.... $18 dn., $16 mo. **$179.95**
Assembled ADW-40...49 lbs... $30 dn., $26 mo....... **$299.95**



NEW HIGH FIDELITY PA AMP.

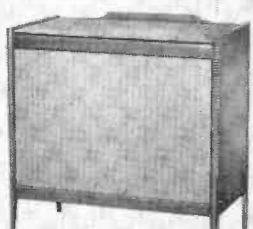
Heath exclusive; 20 watt *hi-fi rated* PA amp. Two inputs; equalization switches; electrical mixing; sealed "pads"; tape recorder, line, and voice coil output. Plug-in, low-Z mic. Xformers separate. 24 lbs.

Kit AA-31... $6 dn., $6 mo........ **$59.95**
Mic. Xformers, AN-11 **$11.95**

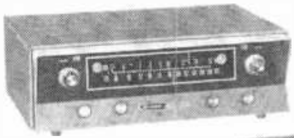
"LEGATO-COMPACT"

All Altec Lansing speakers! 2-12″ hi-compliance woofers; exponential horn and driver; range 30-22,000 cps; assembled. 800 cps network. 30 watts program; 16 ohm Z. Assembled, finished cabinets; 32″l x 19″d x 32⅜″ h 132 lbs.

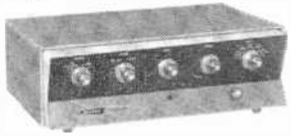
Kit AS-21U, unfin.. **$224.95**
Kit AS-21W, wal... **$229.95**
Kit AS-21M, mahog **$229.95**



HEATH COMPANY Benton Harbor, Michigan / a subsidiary of DAYSTROM, INCORPORATED



Introducing a new styling concept in two popular Heathkit Stereo Units



Here's a handsome matching pair for your new Heathkit stereo system! Both have new louvered wrap-arounds of luggage-tan vinyl-clad steel with contrasting charcoal-grey front panels framed with polished aluminum bezels . . . a regal new look to Heath's medium-price stereo line.

HEATHKIT AJ-11 AM/FM TUNER

Successor to the popular AJ-10, this new version features flywheel tuning, two "magic-eye" tuning indicators, adjustable FM automatic frequency control, AM "fidelity" switch for max. selectivity or fidelity, dependable 12 tube circuit, built-in power supply. 21 lbs.

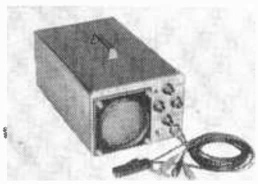
Kit AJ-11 ..$7 dn., $7 mo. **$69.95**
Assembled AJW-11.. $13 dn., $11 mo. **$129.95**

HEATHKIT AA-151 28-WATT STEREO AMPLIFIER

Here's the popular SA-2 model all dressed up in brand-new styling. Delivers 28 hi-fi rated watts (14 per channel) for plenty of power. Has clutched volume controls, ganged tone controls, 4 dual inputs. 28 lbs.

Kit AA-151. .$6 dn., $6 mo. **$59.95**
Assembled AAW-151 .$12dn.,$11 mo. **$119.95**

can build any Heathkit®!



IGNITION ANALYZER

Switch to primary, secondary, parade or superimposed patterns. See condition of plugs, points, wiring, coil & condenser. Plug-in ID-11 Timing Light available. 15 lbs.

Kit IO-20...$9 dn...... **$89.95**
Assembled IOW-20. **$169.95**

NEW TELEPHONE AMPLIFIER!

Hands-free phone chats! Ideal for conferences, dictation, etc. Place handset on cradle, unit turns on, instantly ready! All-transistor; long-lasting battery power. Easy to build. Ivory color.

Kit GD-71 .... 4 lbs... **$19.95**

LOW COST DEPTH SOUNDER

Best value in marine electronics. Detects fish, submerged objects, and bottom depth. Big 4¾" dial calibrated from 0-100'. 6-transistor circuit, battery powered. Corrosion & splash-resistant aluminum cab. Transducer included. 9 lbs.

Kit MI-10 $7 dn., $7 mo. **$69.95**

LOW COST 3-BAND MARINE RDF

Deluxe features at minimum cost. Covers 200-400kc beacons, 550-1600 kc broadcast, 1700-3400 kc marine band. Loop and "sense" antennas eliminate double null. 9-transistor circuit, battery powered. Pre-assembled tuning unit.

Kit DF-3 12 lbs. $10 dn. **$99.95**

You get guaranteed success with Heathkit!

Never before has a manufacturer of do-it-yourself kits guaranteed your success in completing a project. Heath does so and backs it up with an iron-clad, money-back guarantee! By making this guarantee, we hope to banish any doubt you may have about your ability to build a kit. How is such a guarantee possible? The careful planning that goes into the design of Heathkit equipment revolves around this paramount thought—anyone, regardless of background or experience, must be able to build any Heathkit. This same thought guides the writing of the detailed Heathkit assembly instructions with the world famous "check-by-step" system. These attributes plus the experience of a million customers attests to the fact that anyone can build a Heathkit. Order your favorite Heathkit today. Enjoy top quality equipment with savings of up to 50% and the satisfaction of doing it yourself. Get guaranteed success with Heathkit!

MONEY BACK GUARANTEE

The Heath Company *unconditionally guarantees* that you can build any Heathkit product and that it will perform in accordance with our published specifications, by simply following and completing our check-by-step instructions, or your purchase price will be cheerfully refunded.

FREE Catalog!

Contains complete descriptions and specifications on all of the above new models plus more than 200 other famous Heathkit items. Send for your free copy, use the coupon below; see how you can enjoy top quality equipment with savings of up to 50% with Heathkit!

Ordering Instructions: Fill out the order blank. Include charges for parcel post according to weights shown. Express orders shipped delivery charges collect. All prices F.O.B Benton Harbor, Mich. A 20% deposit is required on all C.O.D. orders. Prices subject to change without notice. Dealer and export prices slightly higher.

Please send the following items:

Item	Model No.	Price

Order direct by mail or see your Heathkit dealer.

Ship ☐ Parcel Post ☐ Express ☐ C.O.D. ☐ Best Way

HEATH COMPANY
Benton Harbor 10, Michigan

☐ PLEASE SEND MY FREE COPY OF THE 1961 HEATHKIT CATALOG

Name ____________

Address ____________

City ________ Zone ____ State ________

Carl and Jerry

(*Continued from page* 100)

as he unplugged his portable TV. "He's a ham who lives right behind you, Loree. Let's go see him, Jer."

The boys started for the door; then Jerry stopped short and looked down at the little girl. "Want to go along, Loree?"

Her face lit up, and soon the three of them were sitting in Eddy's ham shack waiting for the teen-ager to finish his conversation with another ham in a neighboring town. When the QSO was over, they explained the reason for their visit.

"My older brother and I have a ten-meter ground-wave sked every Monday night at this time," Eddy said, "but I've never had a TVI complaint before. The transmitter is thoroughly shielded; all leads coming out of it are filtered; the feed-line standing-wave ratio is 1/1 on this frequency; I have a very efficient ground; and the transmitter feeds the beam antenna through a low-pass filter that attenuates harmonic frequencies around 80 db. There's no TVI on *my* receiver. How does it look on that portable, Carl?"

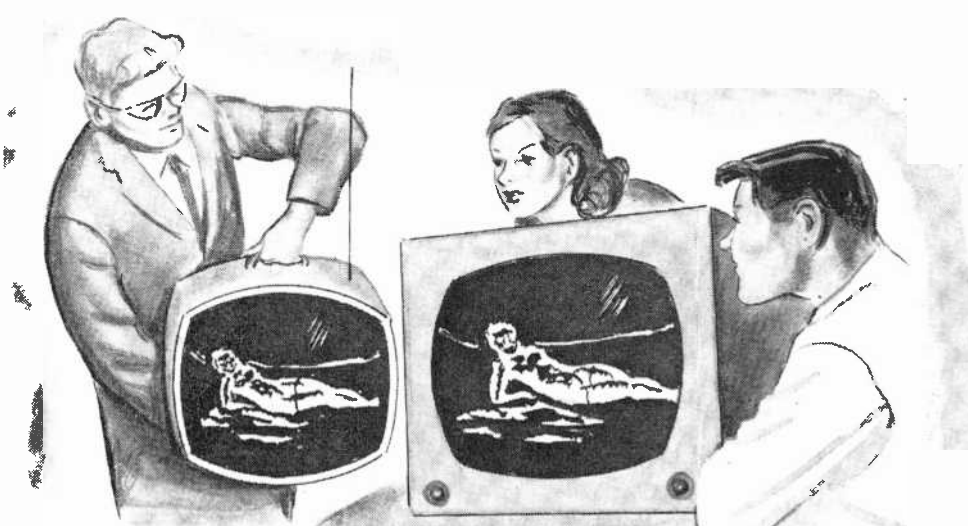
With the transmitter running full power, not even faint cross-hatching could be seen on Carl's receiver.

"Hm-m-m-m," Jerry mused; "Channel 6 interference is apparently coming from the third harmonic of your 28.7-megacycle transmitter frequency; yet no interference is picked up right here at your station. Something at Loree's house must be breaking some of your signal up into harmonics—all we have to do is find that 'something.' Carl, you go home and put your rig on 29.6-megacycle c.w. and start sending very long dashes in exactly ten minutes. Eddy, you start a continuous voice test on your present frequency at the same time. Both of you keep going until I call you on the 'phone. Loree, you come with me to pick up my transistor radio."

LAURA was obviously delighted to be included in these mysterious plans. She forgot her *femme fatale* role and skipped happily along beside Jerry to the lab, then back to her house.

Promptly at the appointed time, the picture on her TV blacked out. Jerry turned down the TV sound, tuned his little radio to 900 kc., and began moving around the room. As he came close to a small wire entering the window and running along the wall to a drawer of a bedside table, Eddy's voice came faintly from the transistor radio. "One, two, three, test for TVI," he droned and gave his call letters. Every few seconds the sound disappeared for an instant, then came back.

"Loree, where does this wire and that



one coming from the cold air register go?" Jerry asked excitedly.

The child turned red as she pulled open the drawer and revealed a little crystal radio receiver and a pair of earphones.

"My folks won't let me listen to my clock radio after ten," she explained, "but that disc-jockey program on the local station at ten-thirty amuses me. You know—the one where silly girls request a number 'for Jack and Mary, who make a wonderful couple' and stupid stuff like that. Well, I listen to it on this little crystal set my uncle gave me for my birthday a month ago. The TV repairman fastened an aerial up on the TV antenna tower for me—that's it coming in the window. He called the wire going to the register a 'ground,' I think."

Without replying, Jerry unfastened the wire from the antenna post of the crystal set. Instantly the voice disappeared from the radio and the interference from the TV picture. Replacing the wire brought it back. Jerry picked up the telephone on the bedside table and told Carl and Eddy they could shut down their transmitters.

"Loree," he said, turning to the girl, "you saw for yourself that Eddy's transmitter was virtually free of TV-interfering signals, called harmonics. But often when a very strong signal near a transmitter encounters a device that passes current in only one direction—we call this a nonlinear system—two things can happen: first, the clean signal can be broken up into harmonics that will cause interference near the nonlinear system; and second, *two* strong signals will be mixed in the system and produce two new frequencies representing the sum and difference of the frequencies of the strong signals."

"My, you're smart to know all that," Loree sighed as she fluttered her eyelashes admiringly at Jerry.

"Lots of things can constitute non-linear systems besides man-made rectifiers," Jerry went on. "All you need is a couple of pieces of metal with a little oxide, such as rust or corrosion, separating them. Poor connections in TV antennas, tower and mast joints, lightning arrestors, gutters and roof drains, electrical conduit, clothes-line, guy wires—these are only a few examples. A bad case of TVI was once caused by a clean-out poker hanging from a furnace pipe.

"The crystal detector in your little radio and that thirty-some-foot-long aerial wire were almost perfect for producing and radiating a ten-meter harmonic to black out Channel 6. When Carl and Eddy were both transmitting on frequencies 900 kc. apart, their signals were mixed in the detector and produced the difference frequency I picked up on my little broadcast receiver. That's how I hoped to find out what was causing the trouble, and it worked. I suggest you leave the aerial off your set when you're not listening to it."

"I will," Laura promised. "Now I know an amateur transmitter never causes TV interference unless there's a nasty old 'system' near the receiver."

"Unfortunately, that's not quite the case, Loree," Carl admitted as he came through the door. "Unless the ham transmitter is carefully shielded, filtered, and grounded, as Eddy's and mine are, it can send out harmonics directly from

the antenna; but there are cases, such as this one, where the ham transmitter might be blamed without reason."

"WELL," Laura said briskly, picking up her purse, "what do I owe you two? Your service has been most satisfactory."

"Oh—" Jerry began with a deprecating wave of his hand; but he stopped short as he saw Laura's father standing out in the hall shaking his head firmly from side to side. "Well, let's see, now: this case was very easily solved. We had no operating expense. Then there's our usual neighborhood discount. Our client was most charming and cooperative—I'd say two dollars would be fine."

Later, out on the porch, Mr. Hall explained: "Boys, the cruelest thing you can do to a little girl is to treat her as a child when she is feeling very grown up. Don't worry about the two dollars. You more than earned it, and I can do a little juggling with her allowance. But whether you want it or not, I'm sure you two have earned something else: the hero-worship of a little girl. That's quite a responsibility." -30-

Connections Are Important

(*Continued from page* 73)

In an enclosed installation, simply dress the cables of each group close to each other and secure them by twisting a pipe cleaner or a short length of solid hookup wire around the group every six inches or so. Coil any slack neatly and secure the coil in the same manner. Keep each group separated from the other groups by several inches.

In an open installation, dress the cables as before. Instead of using pipe cleaners or hookup wire to lace the group, however, use telephone-cord spiral wrap, available in many stores for about 50 cents a yard. The wrap can be obtained in a number of colors, chosen to complement the decor of the listening room.

Speaker lines are almost always immune to hum pickup. The best way to connect speakers while avoiding unsightly cabling strung around the room is to use flat, 300-ohm, TV twin-lead, placed under the rug. -30-

Space Electronics

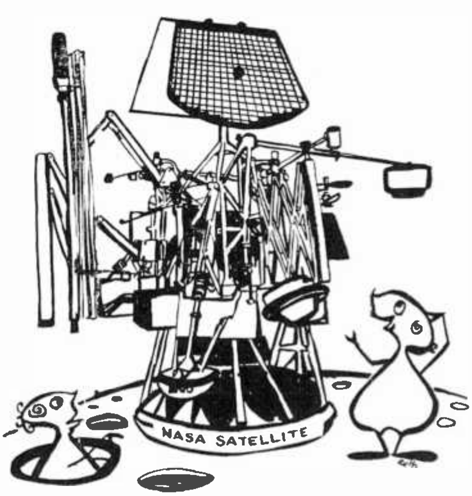
(*Continued from page* 70)

Satellite "Voices." To my knowledge, there is only one informative LP recording of what satellite signals really sound like. This is a 10" disc titled "Voices of the Satellites," sold for $3.95 through Taben Recordings, Box 224, Ardmore, Pa. The satellite radio signals were recorded by Professor T. A. Benham of Haverford (Pa.) College. Included are sounds of the signals from Explorer I, II and III, Vanguard I, plus Sputnik I and Sputnik II.

Professor Benham's narration on this disc tells much about the receiving conditions, the Doppler effects, sounds of telemetering, and—last but not least—the heartbeats of the Soviets' little dog Laika—a passenger on Sputnik II.

I use this recording to demonstrate the sound of signals from Vanguard I. This is the 10-milliwatt satellite still transmitting on 108.020 mc. whose solar batteries are likely to last another seven or eight years. Receiving this satellite is a good test of your FM receiver sensitivity—I have heard Vanguard I using the Scott and Harman-Kardon FM tuner kits.

"Voices of the Satellites" (although dealing with 1957-58 satellites) is a collector's item well worth the small investment it requires.



"That's funny, I thought earthmen would look a lot different."

Space Q & A. Here are the answers to some of the "space" questions you have been asking.

Q: Although the Soviets have frequently used telemetering signals near 20, 40 and 183 mc., haven't I seen newspaper reports of other frequencies being used?

A: During the first few days after the launching of Lunik I (Jan. 2, 1959), radio signals apparently associated with this satellite were heard on 70.2 and 212.0 mc. The recent Soviet Venus probe (announced as being on 922.8 mc.) may instead have been transmitting in the 120.0-mc. band. The Soviets have neither confirmed nor denied use of these frequencies.

Q: Is it true that we don't know the launching sites of the Soviet satellites?

A: Yes and no. Officially, the Soviets have not revealed this information, though it is more than likely that the launchings take place at large ICBM sites. Aralsk and Kapustin Yar are the most likely sites.

Q: A friend of mine has an SWL verification from Vanguard I. How did he get it?

A: George Jacobs, a good friend of the SWL's, took it on his own shoulders to supply veries through the facilities of the Voice of America; but he was forced to discontinue the practice due to the pressure of his other duties. No plans have been made to resume this service in the near future.

At Minus-One. Transatlantic television may not be far off now because of a new method of transmitting TV signals. Called "digital TV," the new system provides a better picture quality while using considerably less frequency space. Radio signals carrying digital modulation can easily be handled by present-day active satellite repeating equipment.

You had to be on your toes to hear the first Russian man-in-space aboard the Vostok satellite on April 12. Besides the beacon and TV transmitter on 143.62 mc., the Soviets used their old-favorite frequency (about 20.00 mc.) plus a brand-new frequency for c.w. transmission (9.019 mc.). -30-

They'll Fly Safely

(*Continued from page* 46)

Automatic Landing. As planes of the future approach their destination, pilots will take news on "knee-high ceiling, arm's-length visibility" as casually as they now hear that it's time for a coffee break. A pilot will simply fly into the proper position on instruments, flip on the automatic landing system and fold his arms. A few minutes later, he'll feel his plane "grease" onto the runway so smoothly that sleeping passengers won't even be awakened.

Today's pilot, of course, uses "ILS"—an instrument landing system—at all major airports in bad weather. But ILS is limited. The pilot must still be able to see the ground when he lands. If he doesn't break out of the "soup" at about 200 feet, he climbs again and heads for another airport. This costs money, upsets schedules, and, of course, lands passengers at a city where they didn't want to go. But it will be different with the new air traffic control systems.

How Soon? When will these advances be in operation? Some of them very soon. The first DPC will be installed in the Boston area in late 1962. Although this will be a somewhat limited version, a full-fledged system will be installed in New York about a year later. Others will follow as fast as they can be built, installed, and interconnected.

One system of automatic landing has performed hundreds of perfect landings in all kinds of weather at Atlantic City. Another kind, developed in England, is already guiding military planes and airliners into London airport. A third system is now being installed on aircraft carriers to bring in Navy planes under "zero-zero" conditions. Each of these systems has some disadvantage for regular civil use, but researchers in Atlantic City are trying to combine the best features to make one ideal system.

Thus, on the one hand, breath-taking advances in aviation present ever tougher problems of communications, navigation, and control. But the science of electronics is coming through just as fast with the hardware and systems to make air travel safer, faster, and more reliable for us all. —30—

Interpreting TV Test Patterns

(Continued from page 63)

pattern forms a perfect circle. Then you may have to touch up the horizontal size setting again. Also, it is possible that either circle may go slightly beyond the edge of the screen when all controls are properly set. The pattern in Fig. 2 indicates a well-adjusted set; the white circle overlaps the edges just a little—a perfectly normal situation. Incidentally, when these adjustments have been correctly made, aspect ratio is automatically correct.

Positioning Magnets. If you can't get a perfect circle in exactly the right position—perhaps the top, bottom, or one side of the picture (Fig. 11) doesn't quite reach the edge of the tube—try adjusting the positioning magnets. These magnets shift the entire picture around the

Fig. 10.

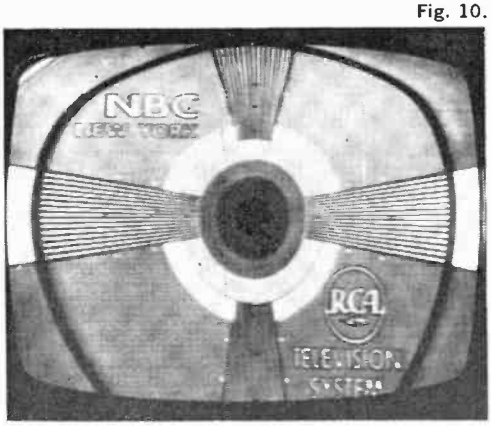


Fig. 11.

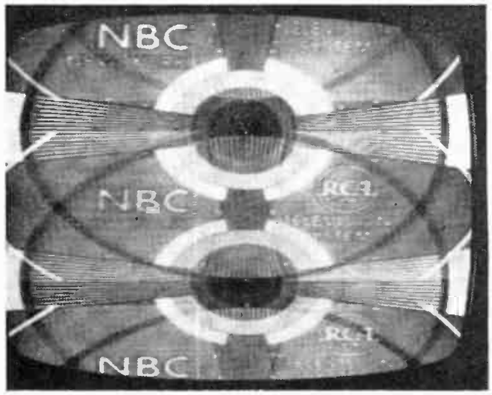


Fig. 12.

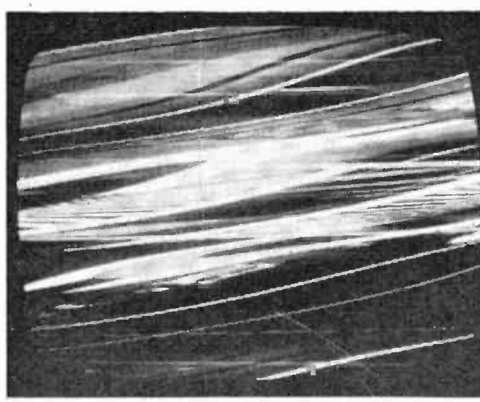


Fig. 13.

screen in any direction. By using both of them, you can get any combination of up-down and side-to-side movement you want.

Vertical and Horizontal Hold. After you've finished all other adjustments, it's a good idea to reset the horizontal and vertical hold adjustments. To set them most accurately, disconnect the antenna completely from your set and tune in a weak station. If it is weak enough, the picture may "roll over" (Fig. 12) or break up (Fig. 13), and there may be "snow." Readjust the vertical and horizontal controls for the steadiest picture possible under these conditions. The synchronization circuits are now in their most sensitive positions, and the picture is less likely to break or roll when signal strength fades momentarily or when a truck with noisy ignition passes your home.

Now, reconnect the antenna, check focus carefully, and sit back to enjoy really well adjusted television. —30—

Heads . . . or Tails?

(*Continued from page* 53)

the rod and then the end is peened a bit to prevent the washer from slipping off. The other end of the rod is ground or filed to a taper.

Place the plunger in the coil with the washer-end down and then attach the top end of the spool to the box with the screws. Cut a small piece of rubber inner tube and cement it to the box bottom directly under the plunger to act as a bumper when the rod falls.

The coin base for the quarter is made from a piece of 1/4" birch plywood or other suitable hardwood stock. A recess for the coin is created by boring down about 1/8" into the wood with a 1" wood bit. Bore a 5/16"-diameter hole in the bottom of the recess at the point indicated in Detail 4 to allow the plunger to come through, then drill and countersink two holes in the base for attaching the screws. A disc of thin felt is now cemented in the recess; its hole should line up with the 5/16"-diameter hole in the base.

Now place the base in position so that this hole will line up with the brass tubing of the solenoid. Then mark the position of the holes to be bored in the base for the attaching screws and drill these holes. Mount the base to the box, using flathead *4-40* screws and nuts.

Finishing Touches. Bring the line cord in through its grommet and attach a one-terminal strip or tie point to the side of the box with a screw and nut—the pictorial diagram shows all required connections.

Be sure to remove the enamel from the ends of the magnet wire before soldering—this can be done by holding a match under the ends for a second and then cleaning them with fine sandpaper. Handle the wire with care.

Attaching the side covers of the box using the self-tapping screws that come with it completes the coin tosser. When you operate the gadget, apply only momentary pressure to the switch button, as this is all that is needed to throw the coin. Holding the button down is also likely to overheat the coil, since it is designed for use in a momentary-contact circuit. —30—

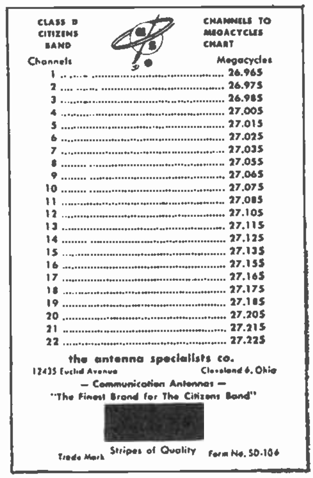
On the Citizens Band

(*Continued from page* 88)

end of 1966, and they will be re-assigned when the "Q-to-W" cycle starts again in 1968.

In case you haven't heard, CB north of the border is going for real. Yep—Canada's good ol' DOT (Department of Transport to us uninitiated Yankees—*their* equivalent of the FCC) has set up a new "General Services Band" smack in the 27-mc. region. DOT's licensing policy probably won't be finalized until sometime during the summer, but it looks as though our Canadian cousins will be CB'ing it by October or November.

A nifty wallet-sized card (Form No. SD-104) is available from the Antenna Specialists Co., 12435 Euclid Ave., Cleveland 6, Ohio, which shows the frequencies of all the CB channels on one side



CLASS D CITIZENS BAND — CHANNELS TO MEGACYCLES CHART

Channels	Megacycles
1	26.965
2	26.975
3	26.985
4	27.005
5	27.015
6	27.025
7	27.035
8	27.055
9	27.065
10	27.075
11	27.085
12	27.105
13	27.115
14	27.125
15	27.135
16	27.155
17	27.165
18	27.175
19	27.185
20	27.205
21	27.215
22	27.225

the antenna specialists co.
12435 Euclid Avenue Cleveland 6, Ohio
— Communication Antennas —
"The Finest Brand for The Citizens Band"
Trade Mark Stripes of Quality Form No. SD-106

and the states in each CB call area on the reverse. It's a handy thing to have, and it's free if you drop them a note and ask for one.

By the way, the same company also happens to make a darn nice line of CB antenna catalog—tell 'em we sent you.

All CB clubs are welcome to keep us posted on their activities by sending us their newspapers and press releases. Also, good-quality, sharp "glossy" photos of CB club activities will be appreciated—we'll be glad to use them in the column. —30—

Transistor Topics

(*Continued from page* 98)

oscillator. Emitter bias is furnished by battery *B1* through resistor *R1*, bypassed by capacitor *C1*, and through an r.f. choke, *RFC1.* Collector bias is furnished by *B2* through *RFC2*, bypassed by *C2* and through the tapped tank coil, *L1.* The feedback necessary to start and sustain oscillation is obtained from a tap on *L1* and coupled back through trimmer capacitor *C4* to *Q1*'s emitter. Battery *B2* also supplies a d.c. operating current to the carbon microphone cartridge (*MIC.*) through current limiting resistors *R2* and *R3*.

As we can see, the oscillator's operating frequency is determined by *L1*, shunted by *C5* and a network made up of fixed capacitor *C6* and a Varicap, *C8*. The Varicap's capacity varies with the voltage applied to it, providing a means of altering the instantaneous oscillator frequency and achieving frequency modulation. Voltage applied to *C8* has both d.c. and a.c. (audio) components. The d.c. component is obtained from voltage divider *R5-R6* and is applied through isolating resistor *R4* and r.f. choke *RFC3; R6* is made variable to serve as a tuning control. The a.c. signal is obtained from the microphone circuit, with that portion of the audio signal appearing across *R3* applied through d.c. blocking capacitor *C3* and *RFC3* to *C8.*

In operation, then, *C8*'s capacity—and hence the frequency of oscillation—is first determined by the adjustment of *R6*. Then, when a signal is developed by the microphone, an a.c. signal is superimposed on the steady d.c. bias, changing *C8*'s instantaneous capacity and varying the oscillator's frequency accordingly.

The entire circuit can be assembled on a small chassis or printed-circuit board and housed in a small plastic case. Good high-frequency wiring procedures should be followed throughout, with all signal leads kept short and direct. All components except *C8* are standard and should be available from your local distributor. You may have to contact a larger (mail order) distributor to obtain *C8*, which is a PSI Type V27 Varicap.

Except for *R6*, a standard potentiometer, the resistors are all ½-watt composition units. Standard mica or ceramic capacitors (working voltage not critical) can be used for *C1*, *C2*, *C3*, *C5*, *C6*, and *C7*; *C4* is a small 3-12 μμf. ceramic trimmer capacitor. Ohmite Type Z-28 coils serve as the r.f. chokes (*RFC1*, *RFC2*, and *RFC3*), and *B1* and *B2* are standard penlight cells—with a single cell for *B1* and eight in series for *B2*. Transistor *Q1* is a 2N247 *pnp* r.f. transistor, and any standard carbon microphone cartridge may be used. Coil *L1* is hand-wound, and consists of 10 turns of 20-gauge enameled copper wire on a ½"-diameter form, with a tap 3½ turns from the bottom (ground end).

With the component values specified, the unit's operating frequency is approximately 45 mc. In most applications, the radiation obtained from coil *L1* is adequate for short-range transmission and an external antenna is unnecessary. No data is available for modifying the transmitter for operation at other frequencies.

Semiconductor Book. A volume entitled "Semiconductor Devices," written by Rufus P. Turner, has been published recently by Holt, Rinehart and Winston, Inc. (383 Madison Ave., New York 17, N. Y.). Divided into ten major chapters, this excellent book covers the construction, operation, and application of all types of semiconductor devices.

Written for the individual with a basic knowledge of electronics, the book starts with a general discussion of the basic structure of semiconductor devices, then goes on to discuss individual types of devices and their practical circuit applications. Yours truly particularly liked Chapter 10, which covers test and measurement techniques.

We recommend this volume as a "must" for the technical library of technicians, practical engineers, and serious hobbyists. It sells for $6.95.

Product News. According to the Bendix Radio Division (Baltimore 4, Md.), some 17 leading railroads are now using the new Bendix transistorized "2R" receivers in their radio systems, including the B & O, C & O, Rock Island, Santa Fe, New York Central, Great Northern,

Northern Pacific, L & N, and Erie-Lackawanna.

An all-transistor sound system has been developed by the Grass Valley Group, Inc., of California, for use in Cinerama theaters around the world. Capable of a total audio power of 450 watts, it has good response to 20 kc.

General Electric's Semiconductor Products Department (Syracuse, N. Y.) has announced a 41% price reduction on three industrial models of silicon Unijunction transistors, Types 2N1671, 2N1671A, and 2N1671B.

An extremely low dynamic-impedance temperature-compensated Zener diode has been introduced by Motorola Semiconductor Products, Inc. (5005 East McDowell Rd., Phoenix, Arizona). Type 1N821A is designed for ultra-stable reference applications in digital voltmeters, precision high-stability oscillators, analog-to-digital converters, and similar industrial and military circuits.

A new 9-volt, governor-regulated, battery-powered motor is now available from Jonard International, Inc. (624 Madison Ave., New York, N. Y.). This imported unit requires only 25 ma. under no-load conditions, and should be useful for powering transistorized record players, tape recorders, and similar electromechanical devices.

That's the picture for now. See you next month . . .

—Lou

Across the Ham Bands

(*Continued from page* 95)

gether, and drill ten 1/16" holes spaced 3/8" apart. Parallel ten 330-ohm, 2-watt, composition resistors by sandwiching them between the two plates, pushing their leads through the holes, and soldering them. All but one of the leads protruding from each square should be trimmed off, and the remaining two leads used for connecting the resistors into the circuit. Then repeat the operation with two 3/4" copper squares and five 150-ohm, 2-watt composition resistors.

The 10-resistor unit (*R1*) should be connected from the relay to the center terminal of the coaxial connector (*J3*) feeding the grid circuit of the amplifier. Connect the 5-resistor unit (*R2*) from the center terminal of *J3* to the metal box.

Operation. Mount the relay unit on or near the power amplifier, and connect it between the amplifier, exciter, and antenna, as shown on the diagram. Use coaxial cables for the connections.

Relay coil *RL1* is connected to the 117-volt circuit of the amplifier, so that the relay will be energized when the amplifier is turned on. Operation of the amplifier and the exciter should be completely normal with the relay unit installed.

News and Views

Norman Kurtin, WV6NON, (12), 711 North Oakhurst Drive, Beverly Hills, Calif., has worked 28 states, with cards from 22 of them, in two months on the air. He excites a "long-wire" antenna that works only on 40 meters with a Heathkit DX-20 running 50 watts. Norm receives on a Hallicrafters S-38E. His two foreign countries worked are Macao, Asia, and Canada! . . . . **Peter J. Crosby, WA2EYD,** 108 Waverly St., Cattaraugus, N. Y., got bit by the ham bug after reading our column for the first time in November, 1958. It took him six months to get his Novice license, but he is now a General, and has been for some time. Feeding a Globe Scout 65A into an "all-band" trap doublet and receiving with a Hammarlund HQ-110. Pete has 45 states worked, 44 confirmed. His country total is six, including Canada, Puerto Rico, Cuba, Panama Canal Zone, and Venezuela. He is especially proud of that last one, since he worked Venezuela on 75-meter phone with his 50 watts. A WRL 755A variable-frequency oscillator helps Pete find holes in the ham-band QRM, and a Globe linear amplifier will soon boost his power output.

Don Fortner, K4SAO, 9 Saco St., Brandon, Greenville, S. C., uses a Globe Scout 680-A transmitter running 65 watts on c.w. and 50 watts on phone, feeding a 40-meter dipole or a 1-element, 15-meter beam. He has 47 states worked and 46 confirmed. And on 15-meter phone, he has worked 12 foreign countries, the rarest of which is a VQ3. Don's dad is K4OIM, and they are having a contest to see who can work all states first. But his dad's score is as mysterious as what Don is using for a receiver—he didn't tell us. . . . . **Thomas Brieaddy, WA2KLD,** 148 Ridgewood Drive, Syracuse 6, N. Y., has two transmitters: an EICO 720, which he uses on 40-meter c.w.; and a Globe Chief 90A, with an SM-90A screen modulator, which he uses on 40-meter phone. His antenna is a Mosley V-4-6 vertical. By the time you read this, Tom hopes to have retired his National NC-60 receiver in favor of a new NC-188. He divides his time about 50/50 on phone and c.w., and prefers a chat with a strong local to chasing DX.

Floyd Chowning, KN5CWS, P. O. Box 191, Clint, Texas, has worked 16 countries and 47 states in approximately 800 contacts during his eight months as a Novice. He feeds his

Viking Ranger into an 80-meter dipole, a 40-meter ground plane, or a 15-meter Cubical Quad antenna, and receives on a Hallicrafters SX-28A. Floyd needs Nevada, Rhode Island, and South Dakota, and will schedule anyone needing Texas on any 10-through-40-meter band. His Conditional Class license is on the way. . . . . **Ted Levy, KN8WNY,** 28 W. 8th St., Manchester, Ohio, operated for a few weeks with a home-brew 35-watter but stopped operation when he found it generated harmonics like a crystal calibrator. Then, with a new Heathkit DX-40 feeding a 15′ dipole, Ted worked nine states and Puerto Rico in four days. He receives on a Hallicrafters S-107, plus a Q-multiplier. . . . . **Ed Hilsenhoff, WV6ODH,** 1310 Harding St., Long Beach 5, Calif., spends half of his time on 40 meters and half on 80 meters. He uses a 45′ vertical antenna fed from a home-built 40-watt transmitter, and receives on a Hallicrafters S-38D helped along by a Q-multiplier. Ed had trouble with harmonic radiation from the transmitter, but cured it with the harmonic filters described in our May 1960 column.

Did you see **Lenore Conn, W6NAZ,** "Ham Of The Month" for November 1960, on NBC-TV's "This Is Your Life"? The telecast was on Sunday, Feb. 26, in most areas. Lenore was honored for her work in providing communications for men in isolated outposts and for the other reasons which prompted us to select her as our "Ham Of The Month." Congratulations, W6NAZ. . . . . **Bob McGraw, K4TAX,** 401 Main St., Martin, Tenn., works for Radio Station WCMT when he's not doing school work or hamming. Bob is a great believer in home-built equipment intermixed with kits. He uses a Knight T-50 transmitter to drive a pair of 6DQ5's in a home-built linear r.f. amplifier for AM and c.w. work, modulating the T-50 with a pair of 6L6's in a home-built circuit. For SSB, he has a home-built exciter, plus a Heathkit VOX system. A Knight VFO drives either "lash up," and he receives on a Knight R-100 receiver. A 135′ inverted-'V' antenna feed with open-wire feeders and a home-built antenna coupler completes the setup.

John Huetter, K8DZR, 3438 W. 113 Rd., Cleveland 11, Ohio, got on 20-meter c.w. about the first of the year and is still surprised at how well his low power does on the DX there. He runs 65 watts to a Globe Scout transmitter feeding either a Hy-Gain 12-AVS vertical on 15 and 20 meters or a 40-meter dipole on 40 and 15 meters. John receives on a Hallicrafters SX-99. He has 48 states and eight countries worked.

As announced last month, we will present a free one-year subscription to POPULAR ELECTRONICS to whoever sends in the best Novice station picture each month—the first winning entry will appear in the next issue. Also, as always, I look forward to receiving your letters and suggestions for construction projects. Address all communications to: Herb S. Brier, W9EGQ, c/o POPULAR ELECTRONICS, One Park Ave., New York 16, N. Y. 73,

—Herb, W9EGQ

Short-Wave Report

(Continued from page 84)

Current Station Reports

This month's résumé of current reports features many frequency and schedule changes as well as a number of new stations. All times shown are Eastern Standard and the 24-hour system is used. At time of compilation all reports are as accurate as possible, but stations may change frequency and/or schedule with little or no advance notice.

Angola—Luanda has moved from 17,795 kc. to 17,705 kc. and is heard well at 1600-1730 in Portuguese, parallel to 4955 kc. *(WPE4FI)*

CR6RD, Nova Lisboa, has moved to 9665 kc. and is fair at 0115 with gong and ID for Nova Lisboa. This one fades before 0200. *(WPE3NF)*

Bolivia—CP39, *La Cruz del Sur*, La Paz, is now on 11,765 kc. with a new 10-kw. xmtr. It has been noted weak-to-fair at 0600-0700, but is covered by QRM evenings. *(WPE4FI)*

R. Cochabamba, Cochabamba, 5610 kc., a new station, has been heard from 1942 with L.A. music and ads; ID is at 1945 and 2007 as *Uds. estan a la escucha de Radio Cochabamba*. This all-Spanish outlet is listed for 5870 kc., and s/off time is 2009. *(PY1PE1D)*

Another rare station, *R. Cobija*, Cobija (Depart. de Pando), 4497 kc., has been heard at 1955 with a musical show, from 2000 with a request program. Classical music is broadcast at 2044. All announcements are in Spanish. *(PY1PE1D)*

Brazil—*R. Cultura de Sao Paulo*, Sao Paulo, now on 17,815 kc., was tuned from 1200 until covered by KCBR at 1700. ZYE21, *R. Marajuaba*, Belem, has moved to 15,251 kc. after a short stay on 15,255 kc. and now operates at 0400-2100. *(WPE4FI)*

SHORT-WAVE REPORTERS!

Your reports will be read and processed faster if you send them directly to:

Hank Bennett, Short-Wave Editor
POPULAR ELECTRONICS
P. O. Box 254
Haddonfield, N. J.

Make sure you include your WPE call letters with your report.

R. Globo, Rio de Janeiro, 11,805 kc., now operates regularly from 0900 to 1730, irregularly to 2100. *(WPE4FI. WPE6AGA)*

R. Clube de Teresina, Teresina, 3385 kc. (new?) is noted from 0345 (Sundays from 0405) in Portuguese with fading by about 0430. *(WPE4HJ)*

Congo—*R. Leopoldville* is now scheduled on 11,755 kc. as follows: to Europe at 1400-1830 with newscasts in German at 1445, Lingala-Kikongo at 1515, Portuguese at 1545, Swahili and Tshiluba at 1615, Eng. at 1645, French at 1715, Spanish at 1745, and Italian at

1815; to N.A. at 1900-2130 with newscasts in Spanish at 1915, Eng. at 1945, French at 2015, and Portuguese at 2045. The mailbag is given on Sundays at 2045. Reports should be sent to *Radio Leopoldville*, Box 7699, Leopoldville, La Republique du Congo. *(WPE1ADI, WPE1APS, WPE1BBB, WPE1CE, WPE2LM, WPE3BCE, WPE3CCG, WPE4AJ, WPE4COK, WPE4FI, WPE6AA, WPE6BPO, WPE8BQH, WPE8HF/6, WPE8MS, WPEØAE)*

Dahomey—*R. Dahomey*, Cotonou, 4870 kc., is tuned at 0050 with native music, French world news at 0115, more music from 0130. Dual to 7170 kc. *(PY1PE1D)*

El Salvador—YSU, San Salvador, 6187 kc., is heard well at 2300 in Eng. and is asking for reports. This station and YSS, 9552 kc., seem to be the only active YS stations. *(WPE4FI)*

England—Two 100-kw. xmtrs, manufactured by Marconi Wireless Telegraph Co., Ltd., have replaced two units at the Daventry station of the BBC that were installed in 1953. *(WPE6EZ, WPE8OG)*

Finland—Helsinki has been noted on 15,190 kc. with an Eng. mailbag at 1100-1130. *(WPE9CD)*

Germany—*Deutsche Welle*, Cologne, is now scheduled on 11,895 kc. at 1215-1515 to Africa (with the 100-kw. Dakar on the same channel!) and on 21,730 kc. to S. Asia at 0745-1045, replacing 21,700 kc. Other schedules: to Japan on 17,815 and 21,735 kc. at 0445-0745; to the Middle East on 21,730 and 17,875 kc. at 0745-1045; to Eastern N.A. at 1900-2200 and to Western N.A. at 2200-0100 on 11,795 and 9640 kc.; to South America at 1730-2030 on 11,945 and 9735 kc.; and to Central America at 1615-1915 on 9735 and 5980 kc. and also at 2045-2345 on the same channels plus the unannounced 6140 kc. *(WPE1CHS, WPE2AXS, WPE2VB, WPE4BC, WPE4FI, WPE8BZP, WPE8MS, VE7PE1R)*

Ghana—Accra is now on 11,800 kc. and heard with fair strength at 1300-1630. *(WPE1AGM, WPE3NF, WPE4AIX, WPE4FI, WPE4HJ, WPE8CKW)*

Greece—The following Greek Forces stations have been heard: Jannina, 7079 kc., 2315-2333; Serrai, 7161 kc., 2354-0000; and Florina, 7284 kc., 2325-2330; all in Greek, mostly with talks. *(WPE1HC)*

Guatemala—TGJA, Guatemala City, has a harmonic on 11,980 kc. that is being heard irregularly at 1900-0000. *(WPE4FI)*

Iran—*R. Teheran*, now on 7030 kc., was tuned at 1545 with Eng. ID and news; also noted fair at 2130-0000. This is a move from 7285 kc. *(WPE3NF, WPE4FI)*

Ivory Coast—Abidjan has a new 100-kw. xmtr on 11,820 kc. and is heard well at 1245-1830; there is severe QRM from the BBC after 1330. Eng. news is heard at 1315. *(WPE1AGM, WPE3NF, WPE4BC, WPE4FI)*

Japan—New frequencies in use from Tokyo to N.A. at 1930 are 15,135, 17,725, and 21,520 kc. Being deleted from the schedule are 11,800 and 17,855 kc. *(WPE2CKI, WPE4FI)*

Kenya—ZGW76, Mombasa, 4965 kc., was tuned with music and chanting from 2224 to 2300, at which time there was an Eng. ID. *(PY1PE1D)*

ZGW71, Nairobi, 4934 kc., has been noted from 2330 with Eng. ID and news; weak. *(CB)*

Malaya—The BBC Far Eastern Station, Singapore, 11,820 kc., is being tuned from 1130 to 1150 s/off on Wednesdays with a pop music show, program preview, and close in English. *(VE7PE1R)*

FREE LEAFLET

Your Short-Wave Editor has a new leaflet available on time and standard frequency stations. Ask for a copy of Leaflet L, addressing your request to Box 254, Haddonfield, N. J. Please include return postage.

Monaco—This is the latest schedule from *Trans-World Radio*, Monte Carlo: 9705 kc. at 0230-0330 in Eng. (0330-0800 Sundays); 7110 kc. at 1030-1055 in German; 11,765 kc. at 1100-1125 in Russian; 11,715 or 11,845 kc. at 1130-1145 in Arabic (Monday, Wednesday, and Friday only); 6140 kc. at 1155-1210 in Eng. and at 1210-1255 in German; 6115 kc. at 1400-1425 in German and at 1500-1600 in Eng.; and 9625, 9690, or 9705 kc. at 1300-1325 in Swedish and at 1330-1355 in Norwegian. *(WPE2AXS, WPE2CKI, WPE3NF, WPE4FI, WPE6BOM)*

Mozambique—Lourenco Marques, 15,148 kc., is heard at 1200-1300 in Portuguese, and at 1300-1400 on Tuesdays and Fridays in French. *(WPE4FI)*

CR7BV, Lourenco Marques, has moved up to 4843 kc. and was noted around 2325 with pop music and English. A tentative logging is Porto Amelia, 9598 kc., heard weakly from 1423 to 1430 s/off with Portuguese music and language. *(WPE3NF)*

Netherlands—Hilversum operates at 1615-1705 on 15,445 kc. (replacing 9590 kc.) and 11,730 kc. to N.A. and on 6020 kc. to Europe. The "Happy Station Program" is beamed to Australia, New Zealand, and Pacific areas on Sundays at 0100-0200 on 9715 and 11,800 kc. *(WPE1CCC, WPE2BRH, WPE2CKI, WPE2EGU, WPE4CSZ, WPE6BAB, WPE8BAG, WPE8BZP, WPE9DS, WPEØATE, VE4PE2U)*

New Zealand—Wellington's current schedule reads: to Pacific Islands daily on ZL7, 6080 kc., and ZL2, 9540 kc., at 0100-0345; to Australia on the same channels daily at 0400-0645; to Antarctica on Sundays only at 0315-0345 on ZL3, 11,780 kc.; to Samoa in Samoan on Mondays at 1540-1555 and on Tuesdays at 0200-0215, and to the Cook Islands in Rarotongan on Wednesdays at 0210-0225 and Saturdays at 0300-0315 on ZL2, 9540 kc., and ZL7, 6080 kc. *(WPE8AGY, WPE8CJA, WPE9NY, WPEØARG, WPEØATE, WPEØBFP)*

Nigeria—The Western Nigerian Radiovision Service, Ibadan, has moved from 6049 kc. to 6185 kc. where it has been noted with Eng. news at 0530-0535. *(WPE3NF)*

Norway—*R. Norway* now airs "Norway This Week" in Eng. on Sundays at 0700-0720 on 6130, 11,850, 15,175, 17,825, 21,730, and 25,900 kc.; at 0900-0920 and 1200-1220 on 6130, 9610, 17,825, 21,730, and 25,900 kc.; at 1900-1925 on 6130, 11,850, 15,175, and 17,825 kc.; and at 2100-2125 (and Mondays at 0000-0025) on 6130, 9610, 11,850, and 15,175 kc. The Norwegian Home Service is aired weekdays at 0100-0200 (Sundays at 0200-0520) on 6130, 11,850, 15,175, 17,825, 21,730, and 25.900 kc., and weekdays at 1215-1600 (Sundays at 1220-1700) on the same channels (except 11,850 kc.) plus 9610 kc. *(WPE1BDB, WPE1CE, WPE2DXB, WPE2ESP, WPE4FI, WPE5BGP, WPE8MS, JE, SCDX)*

Pakistan—Karachi has been tuned on 15,195 kc. with the Home Service Eng. news at 0955; on 9645 kc. with native music and Eng. news at 0015-0140; and on 11,672 kc. with Eng. to Turkey at 1315-1400. *(WPE2CKI, WPE3NF, WPE9BHZ)*

Peru—Two very rarely reported stations are *R. Pasco*, Cerro de Pasco, 6130 kc., noted in the clear after 0100 in Calif.; and *R. Cuzco*, Cuzco, 6240 kc., heard in Brazil around 1800 with commercials, L.A. music, all Spanish. *(WPE6BPN, PY1PE1D)*

Pitcairn Island—Several months ago *World Radio Handbook* listed VR6AC, 14,000 kc., as being on the air with a religious broadcast. This station was logged last December, tentatively, and a report sent. The veri is in; the station okayed the report. It was heard around 2130, very weakly, with what sounded like an anthem. *(WPE1KW)*

Poland—Warsaw has discontinued all Eng. service to N.A., and has no plans for resuming it. *(WPE9WR, WPEØVB)*

Portugal—Lisbon is again active at 0500-1230 on 21,495 kc., replacing 15,380 kc. *(WPE4FI)*

Sarawak—Kuching is heard in Eng. at 0800

The listening post of Peter Collins, WPE2BXD, in Elmira, N. Y., boasts a Hallicrafters SX-99 receiver, a Heath DX-20, and an ohmmeter. Peter has a total of 40 stations logged, 30 verified.

with a BBC news relay and a variety music program at 0815. *(WPEØVB)*

South Africa—Paradys operates at 0600-1200 on 25,800 kc., replacing 21,495 kc., and at 0600-1100 on 15,235 kc., after which it moves to 15,300 kc. until 1500. *(WPE4FI)*

The 7185-kc. outlet has been noted in the Commercial Service in Eng. with world news at 2330-2335, music until 0000, then a weather report. *(WPE9NY)*

Spain—Malaga is being heard well on 6183 kc. (having moved from 6175 kc.) at 1600. *(WPE3NF)*

SHORT-WAVE CONTRIBUTORS

Tommy Natkin *(WPE1ADI)*, Stamford, Conn.
Jim Silk *(WPE1AGM)*, Madison, Conn.
Thomas F. Carten *(WPE1APS)*, Stratford, Conn.
Richard T. White *(WPE1BBB)*, Pawtucket, R. I.
Robert Anderson *(WPE1BDB)*, New Britain, Conn.
Thomas Lizak *(WPE1CCC)*, Fall River, Mass.
David Gerns *(WPE1CE)*, Concord, Mass.
Thomas Cardullo *(WPE1CHS)*, Somerville, Mass.
Bud Barto *(WPE1HC)*, Naugatuck, Conn.
Johnny Chane *(WPE1KW)*, Winchester, Mass.
Robert Newhart *(WPE2AXS)*, Merchantville, N. J.
Albert Mencher *(WPE2BRH)*, Bayside, N. Y.
Thomas Campanile *(WPE2CKI)*, Brooklyn, N. Y.
Jeffrey Fritz *(WPE2CVE)*, Wantagh, N. Y.
Bart Lee *(WPE2DLT)*, Bergenfield, N. J.
Ronnie Breiger *(WPE2DTO)*, Englewood, N. J.
Michael Russo *(WPE2DXB)*, White Plains, N. Y.
Michael Epstein *(WPE2EGU)*, Brooklyn, N. Y.
Frank Brandon *(WPE2ESP)*, Schuylerville, N. Y.
Elliott Feldman *(WPE2LM)*, New York, N. Y.
Ray Barber *(WPE2VB)*, Elmira, N. Y.
Joseph Clawson, Jr. *(WPE3BAR)*, Tarentum, Pa.
Donald Campbell *(WPE3BCE)*, Washington, D. C.
Arthur White *(WPE3CCG)*, Pittsburgh, Pa.
George Cox *(WPE3NF)*, New Castle, Del.
Gene Pearson *(WPE4AIX)*, Birmingham, Ala.
John Cobb, Jr. *(WPE4AJ)*, Cartersville, Ga.
Grady Ferguson *(WPE4BC)*, Charlotte, N. C.
Billy Piver *(WPE4CKG)*, Washington, N. C.
Donald Doyle *(WPE4COK)*, St. Simons Island, Ga.
Richard Snyder *(WPE4CSZ)*, St. Petersburg, Fla.
Roger Legge *(WPE4FI)*, McLean, Va.
Alan Knapp *(WPE4HJ)*, Roanoke, Va.
William Bing *(WPE5AG)*, New Orleans, La.
Lee Prall *(WPE5BGP)*, Tulsa, Okla.
Stewart MacKenzie *(WPE6AA)*, Long Beach, Calif.
Jerry Neves *(WPE6AGA)*, Pacific Grove, Calif.
John Hoogerheide *(WPE6BAB)*, Medford, Oregon
Jack Overcash *(WPE6BOM)*, Fairfield, Calif.
Shaler Hanisch *(WPE6BPN)*, Pasadena, Calif.
Bob Chamberlain *(WPE6BPO)*, Los Angeles, Calif.
J. Art Russell *(WPE6EZ)*, San Diego, Calif.
Ronald Luyster *(WPE8AGY)*, Flushing, Ohio
Lowell Shaffer *(WPE8BAG)*, Dayton, Ohio
James McDonald *(WPE8BQH)*, Cincinnati, Ohio
Bill Sweitzer *(WPE8BZP)*, Cleveland, Ohio
Dale Guthrie *(WPE8CJA)*, Wheeling, W. Va.
Joseph Bove *(WPE8CKW)*, Norwood, Ohio
Dan Wilt *(WPE8HF/6)*, Inglewood, Calif.
Mike Kander *(WPE8MS)*, Dayton, Ohio
Robin Fisher *(WPE8OG)*, Beach City, Ohio
Barry Norrgran *(WPE9BHZ)*, Lansing, Ill.
Charles Cowell *(WPE9CD)*, Peoria, Ill.
W. H. Foley *(WPE9CKR)*, Depauw, Ill.
Gene Staton *(WPE9CNA)*, Kokomo, Ind.
Jim Hall *(WPE9DS)*, Loves Park, Ill.
Mike Nielsen *(WPE9NY)*, Park Ridge, Ill.
Donald Sullivan *(WPE9WR)*, Villa Park, Ill.
John Beaver, Sr. *(WPEØAE)*, Pueblo, Colo.
Al Boettler *(WPEØARG)*, Ladue, Mo.
Bill Holscher *(WPEØATE)*, Webster Groves, Mo.
Tom Goez *(WPEØBFP)*, Ladue, Mo.
George Buchanan *(WPEØVB)*, Webster Groves, Mo.
Bill Barclay *(VE3PE1DZ)*, Scarborough, Ontario
Jim Roik *(VE4PE2U)*, Winnipeg, Manitoba
David Bennett *(VE7PE1R)*, Richmond, B. C.
Giacomo Perolo *(PY1PE1D)*, Bauru, Brazil
Charles Boehnke *(CB)*, Reno, Nevada
John Eisentrager *(JE)*, Fresno, Calif.
Sweden Calling DXers Bulletin *(SCDX)*

Madrid is noted on 7105 kc. at 2245 in Spanish and at 2315 in Slovak to Europe, and from 0130 to 0212 in Spanish to Eastern Europe. Do not confuse this station with several other outlets which also use the same channel during these times. *(WPE5AG, WPEØAE)*

Sweden—Here is Stockholm's summer schedule: 0730-0845 on 15,420 and 17,845 kc. in Eng. and Swedish; 0900-0930 on 17,840 kc. in Eng.; 0945-1100 on 15,240 and 17,845 kc. in Eng. and Swedish; 1115-1230 on 11,705 and 15,240 kc. in Eng. and Swedish; 1245-1400 on 15,240 kc. in Eng. and Swedish; 1415-1515 on 11,705 kc. in German and Eng.; 1530-1600 on 7210 in Eng.; 1615-1745 on 11,705 kc. in Spanish and Portuguese; 1700-1730 on 6065 kc. in German; 1800-1930 on 11,705 and 15,240 kc. in Spanish and Portuguese; 2000-2045 on 11,705 and 11,805 kc. in Swedish; 2045-2115 on 11,805 kc. in Eng. (to N.A.); 2045-2215 on 11,705 kc. in Portuguese and Spanish; 2130-2245 on 11,805 kc. in Swedish and Eng. (to Western N.A.) and 2300-2345 on 11,805 kc. in Spanish. The Home Service Program I is relayed at 0000-0400 and 1200-1700 on 6065 kc., and at 0400-0715 on 11,880 kc. Motala, 7270 kc., also relays Program I. except Sundays at 0200-1700 and daily at 1200-1700 when it relays Program II. They are most anxious to receive reports for the 1200-1700 xmsn on 6065 kc. *(WPE4CKG, WPE4FI, WPE9CKR, WPE9CNA, VE3PE1DZ, SCDX)*

SHORT-WAVE ABBREVIATIONS

anmt—Announcement	N.A.—North America
BBC—British B/C Corp.	QRM—Station interference
B/C—Broadcasting	R.—Radio
Eng.—English	s/off—Sign-off
ID—Identification	s/on—Sign-on
kc.—Kilocycles	veri—Verification
kw.—Kilowatts	xmsn—Transmission
L.A.—Latin America	xmtr—Transmitter

Tanganyika—Dar-es-Salaam is noted briefly at 2313 with Eng. news on 5050 kc. *(WPEØVB)*

Togo—Lome operates at 0100-0300 and at 1600-1700 (Saturdays to 1800). *(WPE4FI)*

Turkey—*TAT*, Ankara, 9515 kc., operates to N.A. in Eng. at 1815-1900; to Europe at 1645 on 7285 kc.; to S. E. Asia at 0845 on 17,820 kc. *(WPE2CYE, WPE2DLT, WPE2DTO, WPE3BAR)*

United Arab Republic—Damascus may use 6200 kc. rather than 5704 kc. around 2330 with an Arabic xmsn. *(WPE3NF)*

Windward Islands—The Windward Islands B/C Service, St. Georges, Grenada, is now operating on a new frequency of 11,955 kc. (replacing 11,715 kc.) at 1800-2115 for their evening xmsn to Jamaica. *(WPE4FI, WPE8AGY)*

Unidentified—WW2XAJ, 11,925 kc., has been noted at 1615-1800 as a steady 'whistle' behind *Deutsche Welle*. The tone is broken for four seconds every two minutes; the ID is given in slow Morse code at 25 and 55 minutes past the hour. *(Short-Wave Editor)* —30—

INDEX TO VOLUME 14 Jan.-June, 1961

FEATURE ARTICLES

HI-FI, STEREO AND AUDIO

PRODUCT REPORTS

TEST EQUIPMENT

THEORY

TRANSISTORS

—30—

ELECTRONICS MARKET PLACE

RATE: 60¢ per word. Minimum 10 words prepaid. August issue closes June 10th. Send order and remittance to Martin Lincoln, POPULAR ELECTRONICS, 1 Park Ave., New York 16, N. Y.

FOR SALE

UP To 80% Off—on Radio and TV Tubes—Largest Selection—Immediate Delivery. Write for complete tube listing. Tube Mart Discount House, Dept. P6, Electronic Building, Paterson, N. J.

AUTO Radio Distributor, Selling, Servicing, Becker Blaupunkt, FM-AM, other European, American Sets. Save 30%+ Square Electronics. 150-60 Northern Blvd., Flushing, N. Y.

CITIZENS' BAND! Add a Hushpuppy noise suppressor to your Heathkit, Lafayette, Globe, etc. transceiver. Squelch Action! Completely Wired. Guaranteed. $4.98. Western Mass. Electronics, Great Barrington 1, Mass.

GOVERNMENT Sells Surplus: Electronics; Oscilloscopes; Transceivers; Test Equipment; Radar; Sonar; Walkie-Talkies; Boats; Jeeps; Aircrafts; Misc.—Send for "U.S. Depot Directory & Procedures"—$1.00—Brody, Box 425(PE), Nanuet, New York.

SOMETHING for sale? Place a classified ad in this section. Low-cost, fast results. It's easy.

TV Tuners—Rebuilt or Exchanged $9.95 complete—all types—fast, guaranteed service. Send tuner with all parts to: L.A. Tuner Exchange, 4611 West Jefferson Blvd., Los Angeles 16, California.

GOVERNMENT Surplus Receivers, Transmitters, Snooperscopes, Parabolic Reflectors, Picture Catalog 10¢. Meshna, Malden 48, Mass.

WPE-SWL-CB-QSL Cards — Samples 10¢ — "Brownie" W3CJ1, 3110A Lehigh, Allentown, Penna.

DIAGRAMS for repairing radios or television $2.00. Give make, model. Diagram Service, Box 672-PE, Hartford 1, Conn.

BEFORE You Buy Receiving Tubes or Hi-Fi Components send now for your giant Free Zalytron current catalog—featuring nationally known Zalytron First Quality TV-Radio Tubes, Hi-Fi Stereo Systems, Kits, Parts, etc. All priced to Save You Plenty—Why Pay More? Zalytron Tube Corp., 220 W. 42nd St., NYC.

CITIZENS Band—Amateurs! Add squelch action to your transceivers. OZCO "Snoozer" quiets beyond belief! Compact, completely wired, guaranteed. Easily installed! Only $2.00 each, $3.95 pair, postpaid, tax included. OZCO Sales, Canaan, Connecticut.

NEW—16 Tested Transistor plans—25¢ with experiments, catalog. Laboratories, 1131-L Valota, Redwood City, California.

ELECTRONICS For The Home. Music Systems, Radio Telephones, Telephone Dial Exchanges, Television Cameras, Radio Controlled Devices. Hundreds of Items. Equipment Catalog 50¢. Hometronics, 8959 Wonderland Ave., Hollywood 46, Calif.

SOUND Operated Relay—For dictating or private use—Actuate recorder only when sound is present—literature and price. WJS Electronics, 1130 North Highland Ave., Hollywood 38, Calif.

POLICE Radar Detector. Stop before those radar speed traps. Fool proof, legal system. Complete diagrams and instructions $2.75. C. Carrier Co., 5880 Hollywood Blvd., Hollywood 28, Calif.

TELEPHONE Voice Switch (LS-500). Actuates automatically and unattended any tape or wire recorder. Pictorial installation instructions included. $23.75. Post paid US. WJS Electronics, 1130 N. Highland Ave., Los Angeles 38, Calif.

BE A Spy. Correspondence course on wire tapping, bugging, telescopic sound pickup, recording techniques, microphotography, and invisible photography. Lessons in surveillance, tailing, and use of equipment. Complete course $22.50. C. Carrier Co., 5880 Hollywood Blvd., Hollywood 28, Calif.

UNUSUAL Electrical Devices Wholesale. Literature 25c. Wellco Products. Box 3055, North Hollywood, California.

TV Camera. Build for less than $50. Construction Details $4.75. DB Enterprises, 8959 Wonderland Ave., Hollywood 46, Calif.

INVESTIGATORS! Do your own sound word. Write for free brochure of latest electronic equipment. WJS Electronics, 1130 N. Highland Ave., Los Angeles 38, Calif.

TELEPHONE Extension In Your Car. Answer your home telephone by radio from your car. Complete diagrams and instructions $2.00. C. Carrier Co., 5880 Hollywood Blvd., Hollywood 28, Calif.

EAVESDROP with a pack of cigarettes. Miniature transistorized FM Radio Transmitter. Complete diagrams and instructions $2.00. C. Carrier Co., 5880 Hollywood Blvd., Hollywood 28, Calif.

COLOR TV. Convert your black and white TV to color. Completely Electronic. No mechanical gadgets. Costs about $35. Complete construction details $4.75. DB Enterprises, 8959 Wonderland Ave., Hollywood 46, Calif.

JUNK Your Distributor and Voltage Regulator. Improve automobile mileage and performance. Construction details for transistorized distributor and voltage regulator. $4.75. No moving parts. DB Enterprises, 8959 Wonderland Ave., Hollywood 46, Calif.

GOVERNMENT Surplus, Radios, Jeeps, Walkie-Talkies, Boats, Binoculars, Telescopes, Etc.—Send For "Depot Locations & Procedures"—25¢—Delta, Box 2262, Dallas 21, Texas.

EXTENSION Dial Telephone For Ham Shack, Den, Patio, Garage, Basement, Etc.; Simple to Hook Up Anywhere. Instructions For Hookup included. $14.95—Telephone Handset Only, $5.95—Misc. Telephone Equipment, All Kinds, Price List 25¢—Delta Electronics, Box 2262, Dallas 21, Texas.

TINY Radio. No Tubes—Batteries or Transistors. Works forever. Send stamp for catalogue. Midway Radio, Dept. 6E, Kearney, Nebr.

WORLDWIDE All-Wave Low-Cost Portable Radio. Send stamp for catalogue. Western Radio, Dept. 6E, Kearney, Nebr.

TALK from House to Car or to any Radio with Walkie Talkie. Send stamp for catalogue. Western Radio, Dept. 6E, Kearney, Nebr.

WORLD'S Tiniest Transistor Radio—Many others. Send stamp for catalogue. Western Radio, Dept. 6E, Kearney, Nebr.

TALK to others—Miles Away with Low-Cost Radiophone—No license. Send stamp for circular. Western Radio, Dept. 6E, Kearney, Nebr.

HEAR Russia—Europe—the Whole World! Short-Wave Adapter works on any radio—no hookups. Send stamp for catalogue. Western Radio, Dept. 6E, Kearney, Nebr.

AUTOMATIC Time Switch, extension cord and three-way outlet. Beautiful cream finish. 6 foot cord, 0-4 hour time cycle. Rated 10 amps 125V A.C. Satisfaction guaranteed. $5.25 post paid. F. W. McKinnon, Dept. A4, 200 North Perry Street, Hagerstown, Indiana.

ELECTRONICS Research Surplus from leading midwest manufacturer. 2½ lbs.—$3.00. Palan Associates, 851—17th St. S.W., Cedar Rapids, Ia.

TUNNEL Diode Circuit Manual, 20 Practical tested circuits, theory, specifications, illustrations, test equipment $1.00 ppd. Steelman Electronics, 1040 S. Worth St., Indianapolis 41, Ind.

CITIZENS' Band. Diagrams and Information. Double transmitter efficiency and double your coverage with three stage RF lineup. Get rid of TVI headaches. Simplified method audio checking. Increase vibrator B+ supply 6 or 12 volt. Improve beam or ground antenna. Ignition noise problems. Mobile or home converter. Mobile field strength meter. Plus additional information. $1.00 C.B. Improvement Co., 70 Hill St., Bloomfield, N. J.

BARGAINS—Electronic Components—Books—Free list—ST Labs., 438 Third Ave., Newark 7, N. J.

CITIZEN-Banders! Build your own 11 meter antenna at a fraction of the cost of many high priced antennas. Non-directional, easy to build. For complete instructions and diagrams send $1.25 to Sherman Steel, 1468 Ducey Ave., Muskegon, Michigan.

CANADIANS—Tubes Wholesale—Write T.T.M., Box 91, Don Mills, Ont.

CITIZENS' Band—HE-15 & 15A owners, hear only the channel you tune. Dual conversion adapter available now in kit form. Complete parts, schematic and instructions, $14.95, with tubes, $16.95. $5.00 deposit for C.O.D. Available soon for other sets. Free literature. Bainbridge Radio, 2649 Bainbridge Ave., New York 58, N. Y.

SPECIAL! WPE—SWL—CB—QSL cards, 3 colors, $2.50 per 100—Free samples—Garth, Jutland, New Jersey.

CBERS'—Special 5 minute sand type timers. ± 15 sec. accuracy. Full 3½" high, red and white trim. 89¢ including postage. No C.O.D. or stamps please. F & S Electronic Service, 200 Maple Avenue, Graterford, Pa.

FREE Confidential Bargain Sheets Of Electronic Components—Lowest Prices in The Country—Knapp, 3174 8th Ave. S.W., Largo, Florida.

CB—WPE. Send Your Call and $1.00 for Three giant 11"x7" Call Signs. New! Cbers Business Cards, Samples Free. P.O. Box 933Q, Aurora, Ill.

WANTED

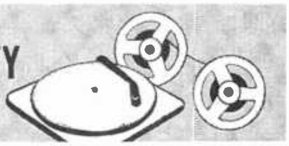
QUICKSILVER, Platinum, Silver, Gold. Ores Analyzed. Free Circular. Mercury Terminal, Norwood, Massachusetts.

WANT to buy good equipment and accessories? Place a low-cost classified ad in this space. For information, write: Martin Lincoln, Popular Electronics, One Park Avenue, New York 16. N. Y.

WANTED Circulated Indian Cents, Liberty V-Nickels And Buffalo Nickels Before 1936. 10¢ each In Large Quantities No Mutilated Coins Send To John J. Firpo, 2107 Van Ness, San Francisco 9, California.

TRIGGER—W9IVJ. We Buy Shortwave Equipment For Cash. 7361 W. North, River Forest, Ill., Phone PR 1-8616. Chicago TU 9-6429.

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. Cloverdale 8-4288.

DON'T Buy Hi-Fi Components, Kits, Tape, Tape Recorders until you get our low, low return mail quotes: "We Guarantee Not To Be Undersold." Wholesale Catalog Free. Hi-Fidelity Center, 220 PC-E.23 St., New York 10, N. Y.

PRICES? The Best! Factory-Sealed Hi-Fi Components? Yes! Send for free catalog. Audion, 25P Oxford Road. Massapequa, N. Y.

RECORDERS, Components. Free wholesale catalogue. Carston, 125-P East 88, N. Y. C. 28.

PROMPT Delivery, We Will Not Be Undersold. Amplifiers, Tape Recorders, Tuners, Etc. No Catalogs, Air Mail Quotes. Compare. L. M. Brown Sales Corp. Dept. P, 239 E. 24 St., N.Y. 10, N.Y.

SOUNDTASTIC! That's what our customers are saying upon receiving our prices on our latest High Fidelity Stereo and Monaural, Amplifiers, tuners, turntables, speakers, tape recorders, kits. All brand new with factory guarantee. Individual quotations only. No catalogues. Audio World, 2057 Coney Island Avenue, Brooklyn 23, New York. Dept. HR.

OVER 400,000 buyers and sellers will read your ad when placed in this space. It costs only 60¢ per word; minimum of 10 words including your name and address. Send order and remittance to: Martin Lincoln, Popular Electronics, One Park Avenue, New York 16, N. Y.

TAPE & RECORDERS

AMPEX, Bozak, Citation, Concertone, Crown, Magnecord, Presto, Norelco, Tandberg, Sherwood, Thorans, Scott, Shure, others . . . . Trades. Boynton Studio, Dept. PE, 10 Pennsylvania Ave., Tuckahoe, N. Y.

TAPE Recorders, Hi-Fi, components, Sleep Learning Equipment, tapes. Unusual Values. Free Catalog. Dressner, 1523PE, Jericho Turnpike, New Hyde Park, N. Y.

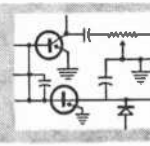
SOMETHING for sale? Place a classified ad in this section. Low-cost, fast results. It's easy.

RENT Stereo Tapes—over 2,000 different—all major labels—free catalog. Stereo—Parti, 811-G Centinela Ave., Inglewood 3, California.

WRITE Martin Lincoln, Popular Electronics, One Park Avenue, New York 16, N. Y. for information on how to place a classified ad in this section.

BUILD This Stereo Hi-Fi Magnetic Tape Playback, Equivalent in Essentials to $1000. Instrument. Complete Plans and Instructions Available. Send 10¢ For Description and Specifications. Merlyn Company (PE-7) Box 3053-A, Pasadena, Calif.

INSTRUCTION



SPECIAL Home Study course; end unemployment worries; prepare for FCC exams, TV servicing, Citizens Radio; Increase your income; 60 lessons, $5 down, $5 month. Experimental Kits. Write for Free booklet and sample lesson. Florida Technical Schools, Box 8145A, Jacksonville 11, Fla.

ENGINEERING Education for the Space Age. Northrop Institute of Technology is a privately endowed, nonprofit college of engineering offering a complete Bachelor of Science Degree Program and Two-Year accredited technical institute curricula. Students from 50 states, many foreign countries. Outstandingly successful graduates employed in aeronautics, electronics, and space technology. Write today for catalog—no obligation. Northrop Institute of Technology, 1179 West Arbor Vitae Street, Inglewood 1, California.

EXPERIMENT with natures electronics. Instructions—Stillwater, Box 337E. Morris Plains, New Jersey.

PHOTOGRAPHY For Pleasure or profit. Learn at home. Practical basic training. Long established school. Free booklet. American School of Photography, 835 Diversey Parkway, Dept. 253A, Chicago 14, Illinois.

TECHNICAL Writers earn $6500 to $18,000 annually. For job details and sample lesson, write DIAL, Box 245, North Syracuse, New York. Enclose $2.00 and brief history of education and work experience. Free Job Counselling.

EARN $150 Week as Electronics Draftsman. Send $2 first lesson, or $25 complete home study course. Prior, Inc., Dept. 12, 23-09 169 Street. Whitestone 57, New York.

REPAIRS and SERVICING

LET us wire and test any kit for you. Naczas Kit Service, 18 Wolfe Street. Manchester. New Hampshire.

WRITE Martin Lincoln, Popular Electronics, One Park Avenue, New York 16, N. Y. for information on how to place a classified ad in this section.

KITS professionally wired. Write Easton, 521 Alden Road, Muncie, Indiana.

INVENTIONS WANTED

INVENTIONS Wanted for immediate promotion! Patented, unpatented. Outright cash; royalties! Casco, Dept. BB, Mills Building, Washington 6, D.C.

INVENTIONS wanted. Patented; unpatented. Global Marketing Service, 2420-P 77th, Oakland 5, Calif.

WRITE Martin Lincoln, Popular Electronics, One Park Avenue, New York 16, N. Y. for information on how to place a classified ad in this section.

BUSINESS OPPORTUNITIES

I WANT A MAN who wants a business of his own. I will train you, supply the equipment, help finance you, start you rolling. This is not a risky get-rich-quick scheme. It is a legitimate business, exclusive protected franchise, proved successful by hundreds throughout the country. Send name, address and phone number to Marion Wade, 2117 North Wayne, Dept. 47M, Chicago 14, Illinois.

WRITE Martin Lincoln, Popular Electronics, One Park Avenue, New York 16, N. Y. for information on how to place a classified ad in this section.

BOOKS

BOOKS—All 10¢. 2000 titles, all subjects, catalog free. Cosma, Clayton, Ga.

SCHOOLS

ELECTRONICS By Sleep Teaching. $12.00 per lesson. The thorough way to train. Tape recorder included at no extra cost. Catalog 25¢. Electro-Sleep, 8959 Wonderland Ave., Hollywood 46, Calif.

SHOPPING GUIDE
Classified

A HANDY REFERENCE TO PRODUCTS AND SERVICES NOT NECESSARILY ELECTRONIC, BUT OF WIDE GENERAL INTEREST

PHOTOGRAPHY—FILM EQUIPMENT, SERVICES

OPTICAL-Science-Math Bargains—Request Free Giant catalog "CJ"—144 pages—Astronomical Telescopes, Microscopes, Lenses, Binoculars, Kits, Parts, Amazing war surplus bargains. Edmund Scientific Co., Barrington, New Jersey.

FREE! New 1961 catalog of all photographic books available. For your copy, send postcard with name and address to Catalog Popular Photography Book Service, One Park Ave., New York 16, N. Y.

STAMPS & COINS

105 Different U.S. stamps 25¢, Approvals included. Shelron, Box 907-H, New York 8, N. Y.

1960 United Nations commemorative stamps, all mint 4c and 8c commemorative sets only one dollar with request for approvals. Adults Only. Martin Stamp Co., Box 12-A, Gravesend Sta., Brooklyn 23, New York.

SELLING entire personal stamp collection. All foreign. Good condition. Assorted packets of 50—25¢ and self-addressed, stamped envelope. Popular Electronics, Box 107, One Park Avenue, New York 16, New York.

WANTED Circulated Indian Cents. Liberty V-Nickels And Buffalo Nickels Before 1936. 10¢ each in Large Quantities. No Mutilated Coins. Send To John J. Firpo, 2107 Van Ness, San Francisco 9, California.

EDUCATIONAL OPPORTUNITIES

DETECTIVE Profession. Home Study. Badge, Certificate, Future 4563-AG York, Los Angeles 41, Calif.

UNVEILED—Mysteries of Electronics. Amaze your electronics associates by learning seldom understood electronics circuits and theory. Subjects easily mastered without complex math. For complete 40 page booklet mail $1.00 to Comprehensive Electronics Publications, Box 203, Riverton, New Jersey.

BASIC course. Microphone technique: Recorded voice exercises, manual, lesson assignments. National Academy of Broadcasting, Washington 10, D. C.

LEATHERCRAFT

FREE "Do-It-Yourself" Leathercraft Catalog. Tandy Leather Company, Box 791-H-39, Fort Worth, Texas.

PLASTICS

NEW Liquid Casting Plastic, clear, colors. Embed real flowers, butterflies, photos, coins. Send 25¢ for two handbooks "How to Cast Liquid Plastics" and "How to Make Extra Money at Home." Castolite, Dept. G-108, Woodstock, Illinois.

EMPLOYMENT INFORMATION

HIGH Paying Jobs in Foreign Lands! Send $2.00 for complete scoop! Foreign Opportunities, Box 172, Columbus 16, Ohio.

EARN Extra money selling advertising book matches. Free samples furnished. Matchcorp, Dept. MD 61, Chicago 32, Illinois.

BUSINESS OPPORTUNITIES

BUY Direct from factories. Appliances, cameras, watches! Free details! Cam Co., 6810PE 20th Ave., Brooklyn 4, N. Y.

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.

FREE Book "990 Successful, Little-Known Businesses." Work home! Plymouth—455R, Brooklyn 4, New York.

GROW Mushrooms. Cellar, shed and outdoors. Spare, full time, year round. We pay $4.50 lb. dried. We have 29,000 customers. Free Book. Mushrooms, Dept. 334, 2954 Admiral Way, Seattle, Wash.

MAKE $25-$50 Week, clipping newspaper items for publishers. Some clippings worth $5.00 each. Particulars free. National, 81-DG, Knickerbocker Station, New York.

SOMEONE "borrowing" your personal copy of Popular Electronics each month? You ought to be taking advantage of Popular Electronics' convenient re-sale plan. Sell copies in your store . . . perform a good service for your customers . . . with no risk involved. For details, write: Direct Sales Department, Popular Electronics, One Park Avenue, New York 16, New York.

FRANCHISE Yourself with a reputable franchising firm, after surveying the full range of franchise offers published by N.F.R., the only recognized source. Write now for free "Franchise Profit Letter." National Franchise Reports, Dept. PE-528, 333 N. Michigan, Chicago 1, Ill.

A Second Income From Oil Can End Your Toil! Free Book And Oilfield Maps! National Petroleum, Panamerican Bank Bldg.—PE, Miami, Florida.

MISCELLANEOUS

WRITERS! Request Free sample Pink Sheets listing markets USA. Literary Agent Mead, 915 Broadway, N. Y.

"WINEMAKING," "Beer, Ale" Strongest methods. Illustrated. $2.20. Eaton Bookstore (Supplies), Box 1242-C, Santa Rosa, California.

SENSATIONAL Electric Wristwatch available under $100. Other bargains. Catalog free. Long's, Box 7943, Portland 12, Oregon.

TWO Legal "Will" Forms, Instructions Booklet, $1.00. National, Box 48313PE, Los Angeles 48, Calif.

UNDERPAID? Technical Writers Earn $240.00 Up Week. Easy Condensed course. $2.00 Tweco, P.O. Box 155, Indio, Calif.

POPULAR ELECTRONICS

Advertisers' Index

JUNE 1961

NOW! FAST ONE DAY SERVICE

BRAND NEW RADIO & TV TUBES

RAD-TEL'S FIRST QUALITY TUBES

SAVE up to 75%

ONE FULL YEAR GUARANTEE

THE SIGN OF RAD-TEL'S RELIABILITY

SERVICEMEN:

BUY DIRECT FROM RAD-TEL! YOU'LL SAVE PLENTY. YOUR ORDER SHIPPED WITHIN 24 HOURS AFTER RECEIVING AND PROCESSING. RAD-TEL SELLS ONLY BRAND NEW TUBES, NOT USED.

1st TIME OFFERED

NOW! RAD-TEL'S "SET TESTED" TRANSISTORS . . . AT FABULOUS LOW PRICES

A Rad-Tel "general purpose transistor" for each class. Similar to 100's specified in many projects. All transistors are grouped into 4 general classes:

LOW POWER AF TYPE DRIVER AND OUTPUT 39¢ ea.	LOW POWER RF MIXER AND IF 49¢ ea.	HI POWER AF UNITS 79¢ ea. CAR RADIO TYPE POWER OUTPUT; POWER SUPPLY TYPE HI POWER $1.39 ea.
SPECIAL PURPOSE	TETRODES, ETC. (Not available at this time)	

YOU CAN SUBSTITUTE AND replace with Rad-Tel transistors when working with transistor projects. Transistor substitutions are based on "similar operating characteristics." All Rad-Tel transistors have expensive features, broad tolerances and are tested in AM radio, as radio frequency converter at 1.5 KC and 450 KC intermediate frequency, AF as audio frequency driver. You're safe building numerous projects when you use Rad-Tel's "set tested" transistors. Each Rad-Tel Transistor is fully tested and guaranteed to give sound operating performance without confusing you with COMPLICATED NUMBERS AND CHARACTERISTICS. Here are just a few suggested transistor projects:

Solar Powered Radio,
Shirt Pocket Radio.
Carrier Power Receiver.
Sine, Square-Wave Generator,
Transistor Preamp for VTVM,
Regulated Power Supply,
Meter Sensitivity Multiplier,
Oscillator Audio & RF
Electronic Counters.
(Please note: Most projects, including diagrams, are appearing in current magazines. We don't have diagrams.)

Qty. Type	Price	Qty. Type	Price	Qty. Type	Price
QZ4M	.79	6AX7	.64	12AF6	.49
1AX2	.62	6BA6	.50	12AJ6	.46
1B3GT	.79	6BC5	.61	12AL5	.45
1DN5	.55	6BC7	.94	12AL8	.95
1G3	.79	6BC8	.97	12AQ5	.52
1J3	.79	6BD6	.51	12AT6	.43
1K3	.79	6BE6	.55	12AT7	.76
1LN5	.59	6BF6	.44	12AU6	.50
1R5	.62	6BG6	1.66	12AU7	.61
1S5	.51	6BH6	.65	12AV5	.97
1T4	.58	6BH8	.87	12AV6	.41
1U4	.57	6BJ6	.62	12AV7	.75
1U5	.50	6BK7	.85	12AX4	.67
1X2B	.82	6BL7	1.00	12AX7	.63
2AF4	.96	6BN4	.57	12AZ7	.86
3AL5	.42	6BN6	.74	12B4	.63
3AU6	.51	6BQ5	.65	12BA6	.50
3AV6	.41	6BQ6GT	1.05	12BD6	.50
3BA6	.51	6BQ7	1.00	12BE6	.53
3BC5	.54	6BR8	.78	12BF6	.44
3BE6	.52	6BU8	.70	12BH7	.77
3BN6	.76	6BY6	.54	12BL6	.56
3BU8	.78	6BZ6	.55	12BQ6	1.06
3BY6	.55	6BZ7	1.01	12BY7	.77
3BZ6	.55	6C4	.43	12BZ7	.75
3CB6	.54	6CB6	.55	12C5	.56
3CF6	.60	6CD6	1.42	12CN5	.56
3CS6	.52	6CF6	.64	12CR6	.54
3DK6	.60	6CG7	.61	12CU5	.58
3DT6	.50	6CG8	.77	12CU6	1.06
3Q5	.80	6CM7	.66	12CX6	.54
3S4	.61	6CN7	.65	12DB5	.69
3V4	.58	6CR6	.51	12DE8	.75
4BC8	.96	6CS6	.57	12DL8	.85

EACH TUBE INDIVIDUALLY & ATTRACTIVELY BOXED

Qty. Type	Price	Qty. Type	Price	Qty. Type	Price
4BN6	.75	6CU5	.58	12DM7	.67
4BQ7	1.01	6CU6	1.08	12DQ6	1.04
4BS8	.98	6CY7	.71	12DS7	.79
4BU8	.71	6DA4	.68	12DZ6	.56
4BZ6	.58	6DB5	.69	12EL6	.50
4BZ7	.96	6DE6	.58	12EG6	.54
4CS6	.61	6DG6	.59	12EZ6	.53
4DE6	.62	6DQ6	1.10	12F8	.66
4DK6	.60	6DT5	.76	12FM6	.45
4DT6	.55	6DT6	.53	12K5	.65
5AM8	.79	6EU8	.79	12SA7M	.92
5AN8	.86	6EA8	.79	12SK7GT	.74
5AQ5	.52	6H6GT	.58	12SN7	.67
5AT8	.80	6J5GT	.51	12SQ7M	.78
5BK7A	.82	6J6	.67	12U7	.62
5BQ7	.97	6K6	.63	12V6GT	.53
5BR8	.79	6S4	.51	12W6	.69
5CG8	.76	6SA7GT	.76	12X4	.38
5CL8	.76	6SK7	.74	17AX4	.67
5EA8	.80	6SL7	.80	17BQ6	1.09
5EU8	.80	6SN7	.65	17C5	.58
5J6	.68	6SQ7	.73	17CA5	.62
5T8	.81	6T4	.99	17D4	.69
5U4	.60	6U8	.83	17DQ6	1.06
5U8	.81	6V6GT	.54	17L6	.59
5V6	.56	6W4	.60	17W6	.70
5X8	.78	6W6	.71	19AU4	.83
5Y3	.46	6X4	.39	19BG6	1.39
6AB4	.46	6X5GT	.53	19T8	.80
6AC7	.96	6X8	.80	21EX6	1.49
6AF3	.73	7AU7	.61	25BQ6	1.11
6AF4	.97	7A8	.68	25C5	.53
6AG5	.68	7B6	.69	25CA5	.59
6AH6	.99	7Y4	.69	25CD6	1.44
6AK5	.95	8AU8	.83	25CU6	1.11
6AL5	.47	8AW8	.93	25DN6	1.42
6AM8	.78	8BQ5	.60	25EH5	.55
6AQ5	.53	8CG7	.62	25L6	.57
6AR5	.55	8CM7	.68	25W4	.68
6AS5	.60	8CN7	.97	25Z6	.66
6AT6	.43	8CX8	.93	35C5	.51
6AT8	.79	8EB8	.94	35L6	.57
6AU4	.82	11CY7	.75	35W4	.42
6AU6	.52	12A4	.60	35Z5GT	.60
6AU7	.61	12AB5	.55	50B5	.60
6AU8	.87	12AC6	.49	50C5	.53
6AV6	.41	12AD6	.57	50DC4	.37
6AW8	.90	12AE6	.43	50EH5	.55
6AX4	.66	12AF3	.73	50L6	.61
				117Z3	.61

59¢ ea. LOTS OF 5
RAD-TEL'S SELECTED KITS . . . UNBELIEVABLY LOW PRICED! WHILE THEY LAST!
79¢ ea.

- ☐ 50 ASST'D TIE LUGS. NO. 1
- ☐ 10 ASST'D F.P. CONDENSERS. NO. 6
- ☐ 50 ASST'D RADIO KNOBS. NO. 8
- ☐ 15 ASST'D T.V. COILS. NO. 13
- ☐ 20 ASST'D MOLDING SOCKETS. NO. 5
- ☐ 50 ASST'D BRACKETS & HARDWARE. NO. 17
- ☐ 15 SETS ASST'D CONNECTORS. NO. 15
- ☐ 25 ASST'D TRIMMERS. NO. 7
- ☐ 10 ASST'D TUBE SHIELDS. NO. 26
- ☐ 1 LB. PROX. NUTS & BOLTS. NO. 20
- ☐ 4 ASST'D SOUND COILS. NO. 18
- ☐ 20 ASST'D HI-WATT RESISTORS. NO. 9
- ☐ 7 ASST'D HORIZONTAL COILS. NO. 19
- ☐ 15 ASST'D BINDING POST TERMINALS. NO. 16
- ☐ 10 ASST'D T.V. SLUG TUNED COILS. NO. 25
- ☐ 10 ASST'D VOLUME CONTROLS. LG & SH SHAFT. NO. 2
- ☐ 8 ASST'D T.V. CONTROLS. SHORT SHAFT. NO. 21
- ☐ 8 ASST'D VOLUME CONTROLS. LONG SHAFT. NO. 22
- ☐ 10 ASST'D SWITCHES. DOUBLES. LONG & SHORT SHAFT. NO. 23
- ☐ 10 ASST'D T.V. PEAKING COILS. NO. 24

RAD-TEL TUBE CO. NOT AFFILIATED WITH ANY OTHER MAIL ORDER TUBE COMPANY

SEND FOR FREE TROUBLE SHOOTER GUIDE AND NEW TUBE & PARTS CATALOG

RAD-TEL TUBE CO.

DEPT. PE-661 55 CHAMBERS STREET, NEWARK 5, N. J.

TERMS: 25% deposit must accompany all orders, balance COD. Orders under $5: add $1 handling charge plus postage. Orders over $5: plus postage. Approx. 8 tubes per 1 lb. Subject to prior sale. Prices subject to change. No COD's outside continental USA.

SHIPPED ON APPROVAL

NO MONEY WITH ORDER — NO C.O.D.

Model TW-11—Tube Tester
Total Price $47.50
Terms: $11.50 after 10 day trial, then $6.00 monthly for 6 months if satisfactory. Otherwise return, no explanation necessary.

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 for each type of tube. **Thus it is impossible to damage a tube by inserting it in the wrong socket.**

• Free-moving built-in roll chart provides complete data for all tubes. 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 handsome, Saddle-Stitched Texon case. Only **$47.50**

Model 77—VACUUM TUBE VOLTMETER. . Total Price. . . . $42.50
Terms: $12.50 after 10 day trial, then $6.00 monthly for 5 months if satisfactory. Otherwise return, no explanation necessary.

Superior's New Model 77

VACUUM TUBE VOLTMETER

WITH NEW 6" FULL-VIEW METER

Compare it to any peak-to-peak V. T. V. M. made by any other manufacturer at any price!

• Extra large meter scale enables us to print all calibrations in large easy-to-read type.

• Employs a 12AU7 as D. C. amplifier and two 9006's as peak-to-peak voltage rectifiers to assure maximum stability. • Meter is virtually burn-out proof. The sensitive 400 micro-ampere meter is isolated from the measuring circuit by a balanced push-pull amplifier. • Uses selected 1% zero temperature coefficient resistors as multipliers. This assures unchanging accurate readings on all ranges.

AS A DC VOLTMETER: The Model 77 is indispensable in Hi-Fi Amplifier servicing and a must for Black and White and color TV Receiver servicing where circuit loading cannot be tolerated.

AS AN ELECTRONIC OHMMETER: Because of its wide range of measurement leaky capacitors show up glaringly. Because of its sensitivity and low loading. Intermittents are easily found, isolated and repaired.

AS AN AC VOLTMETER: Measures RMS values if sine wave, and peak-to-peak value if complex wave. Pedestal voltages that determine the "black" level in TV receivers are easily read.

SPECIFICATIONS

• **DC VOLTS**—0 to 3/15/75/150/300/750/1,500 volts at 11 megohms input resistance. • **AC VOLTS (RMS)**—0 to 3/15/75/150/300/750/1,500 volts. • **AC VOLTS** (Peak to Peak)—0 to 8/40/200/400/800/2,000 volts. • **ELECTRONIC OHMMETER**—0 to 1,000 ohms/10,000 ohms/100,000 ohms/1 megohm/10 megohms/100 megohms/1,000 megohms. • **DECIBELS:** −10 db to + 18 db, + 10 db to + 38 db. + 30 db to + 58 db. All based on 0 db = .006 watts (6 mw) into a 500 ohm line (1.73v). • **ZERO CENTER METER**—For discriminator alignment with full scale range of 0 to 1.5/7.5/37.5/75/150/375/750 volts at 11 megohms input resistance.

Comes complete with operating instructions, probe leads, and streamlined carrying case. Operates on 110-120 volt 60 cycle. Only **$42.50**

We invite you to try before you buy any of the models described on this page and the following page. 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, INC.
Dept. D-881 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 77 Total Price $42.50**
$12.50 within 10 days. Balance $6.00 monthly for 5 months.

☐ **Model TV-50A . . . Total Price $47.50**
$11.50 within 10 days. Balance $6.00 monthly for 6 months.

☐ **Model TW-11 . . . . Total Price $47.50**
$11.50 within 10 days. Balance $6.00 monthly for 6 months.

☐ **Model 70 . . . Total Price $15.85**
$3.85 within 10 days. Balance $4.00 monthly for 3 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.

Superior's New Model 70 UTILITY TESTER®

FOR REPAIRING ALL ELECTRICAL APPLIANCES and AUTOMOBILE CIRCUITS

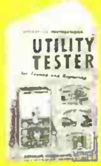
Model 70—UTILITY TESTER
Total Price...$15.85—
Terms: $3.85 after 10 day trial, then $4.00 monthly for 3 months, if satisfactory. Otherwise return, no explanation necessary.

As an electrical trouble shooter the Model 70:

- Will test Toasters, Irons, Broilers, Heating Pads, Clocks, Fans, Vacuum Cleaners, Refrigerators, Lamps, Fluorescents, Switches, Thermostats, etc.
- Measures A.C. and D.C. Voltages, A.C. and D.C. Current, Resistances, Leakages, etc.
- Will measure current consumption while the appliance under test is in operation.
- Incorporates a sensitive direct-reading resistance range which will measure all resistances commonly used in electrical appliances, motors, etc.
- Leakage detecting circuit will indicate continuity from zero ohms to 5 megohms (5,000,000 ohms).

As an Automotive Tester the Model 70 will test:

• Both 6 Volt and 12 Volt Storage Batteries • Generators • Starters • Distributors • Ignition Coils • Regulators • Relays • Circuit Breakers • Cigarette Lighters • Stop Lights • Condensers • Directional Signal Systems • All Lamps and Bulbs • Fuses • Heating Systems • Horns • Also will locate poor grounds, breaks in wiring, poor connections, etc.



INCLUDED FREE *This 64-page book—practically a condensed course in electricity. Learn by doing.*

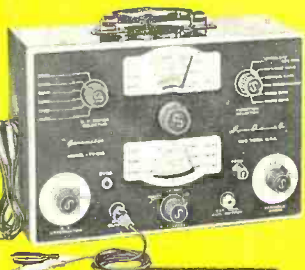
Just read the following partial list of contents: What is electricity? • Simplified version of Ohms Law • What is wattage? • Simplified wattage charts • How to measure voltage, current, resistance and leakage • How to test all electrical appliances and motors using a simplified trouble-shooting technique.
• How to trace trouble in the electrical circuits and parts in automobiles and trucks.

Model 70 comes complete with 64 page book and test leads

Only $15^{85}

Superior's New Model TV-50A **GENOMETER**

7 Signal Generators in One!



Model TV50-A—Genometer
Total Price $47.50
Terms: $11.50 after 10 day trial, then $6.00 monthly for 6 months if satisfactory. Otherwise return, no explanation necessary.

- R.F. Signal Generator for A.M.
- R.F. Signal Generator for F.M.
- Audio Frequency Generator
- Marker Generator
- Bar Generator
- Color Dot Pattern Generator
- Cross Hatch Generator

This Versatile All-Inclusive **GENERATOR** Provides **ALL** the Outputs for Servicing:

• A.M. RADIO • F.M. RADIO • AMPLIFIERS • BLACK AND WHITE TV • COLOR TV

R. F. SIGNAL GENERATOR: 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.

VARIABLE AUDIO FREQUENCY GENERATOR: Provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.

MARKER GENERATOR: The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency)

BAR GENERATOR: Pattern consists of 4 to 16 horizontal bars or 7 to 20 vertical bars.

DOT PATTERN GENERATOR (FOR COLOR TV): The Dot Pattern projected on any color TV Receiver tube by the Model TV-50A will enable you to adjust for proper color convergence.

CROSS HATCH GENERATOR: The pattern consists of non-shifting horizontal and vertical lines interlaced to provide a stable cross-hatch effect.

Complete with shielded leads

$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 page. If after a 10 day trial you are completely satisified 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, INC.

3849 TENTH AVENUE

NEW YORK 34, N. Y.