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APRIL 1961

35 CENTS

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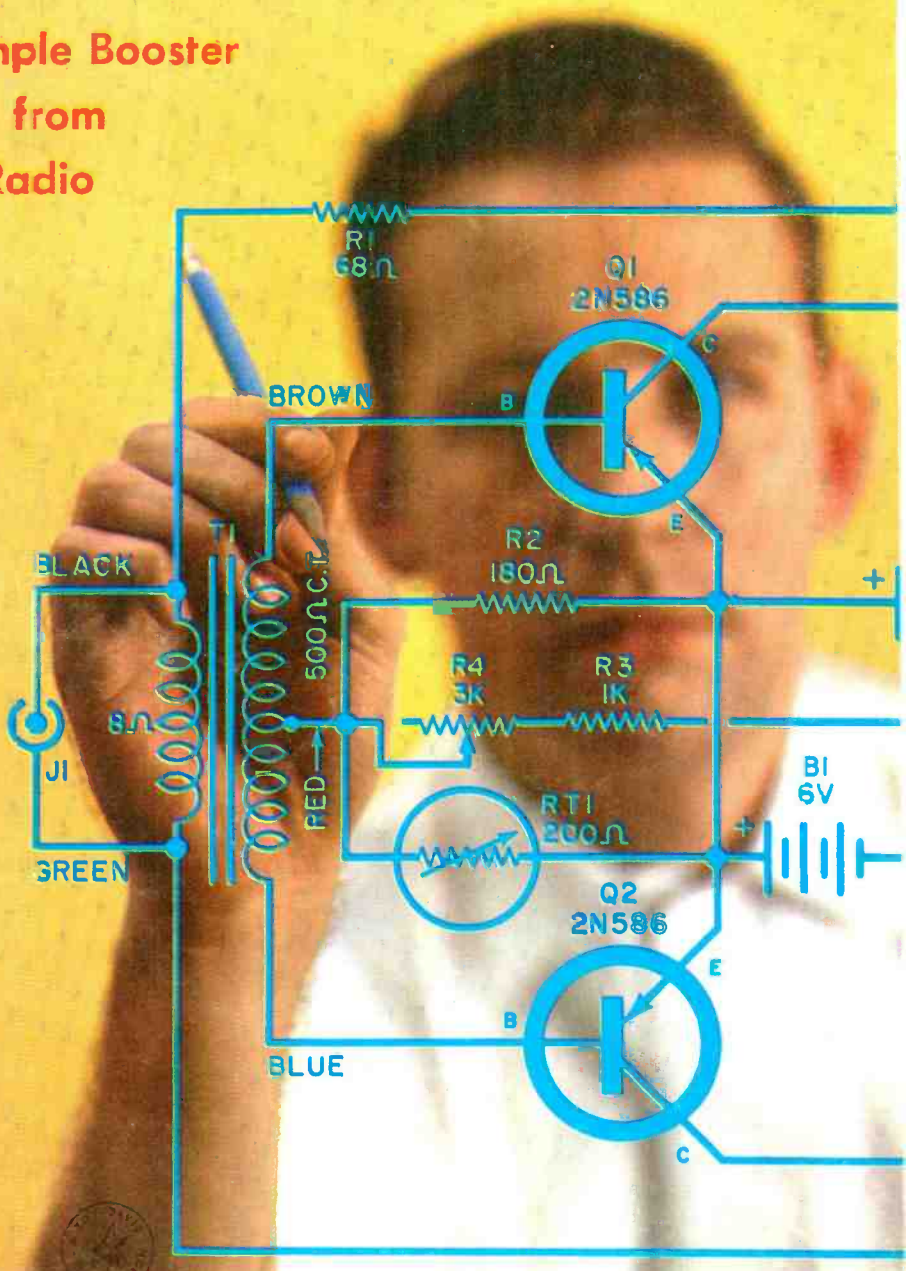
- How to Make Professional Dialplates
- Improved Sweet Sixteen Hi-Fi System

NEW SPACE ELECTRONICS column page 64



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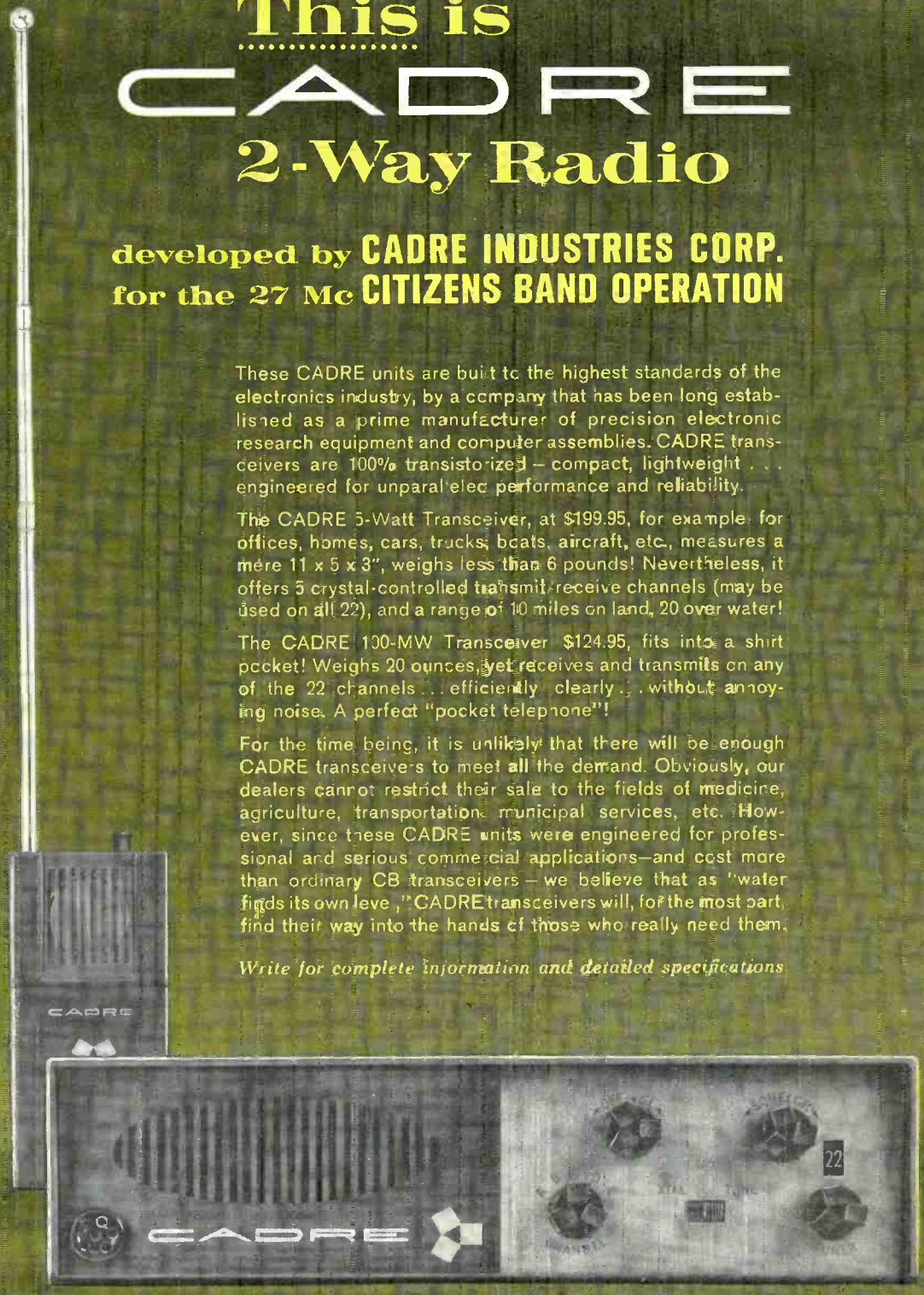

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VOLUME 14 NUMBER 4

ZIFF-DAVIS PUBLISHING COMPANY

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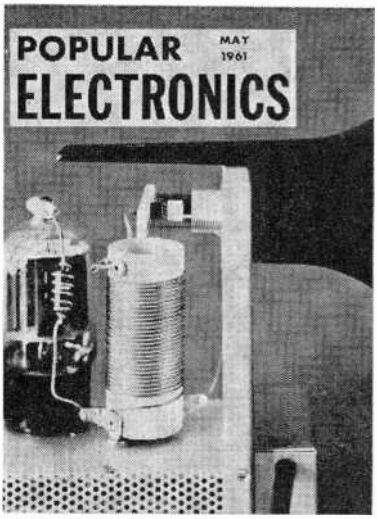

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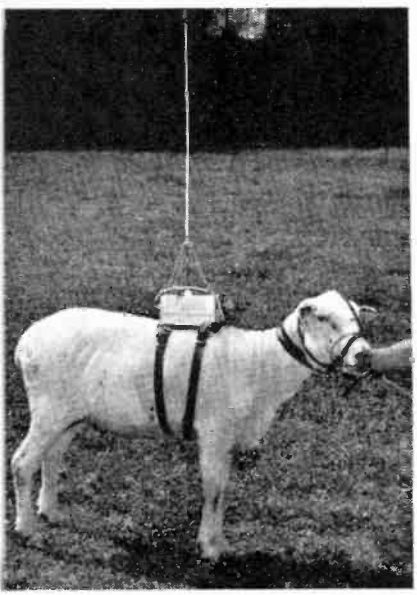

Authenticated News

CHOMP-COUNTING TRANSMITTER gives Australian scientists low-down on food intake of grazing sheep. In experiments at Ian Clunies Ross Animal Research Laboratory "down under," a transmitter strapped to a sheep's back signals a recorder in the lab each time the sheep's jaws open and close. The findings: as many as 120 jaw movements are made by a hungry sheep each minute. As the sheep's appetite decreases, however, it selects food more carefully, with longer pauses between jaw movements.

JUNIOR'S MARBLES have gone to work for Uncle Sam at the White Sands Missile Range in the manufacture of printed circuits. Previously, printed-circuit boards were etched by letting the laminated boards rest face up for 2½ hours in a ferric chloride etching solution. Results: uneven etching and undercutting. Now, the boards are placed face down on top of toy glass marbles in a solution heated to 80° C. As the tray holding the solution is agitated, granules of copper easily drop out of the etched portions of the board and settle at the bottom of the tray. Results: increased production and improved quality. The new technique was developed by the U. S. Army Signal Missile Support Agency.

UPI

A WIRELESS MICROPHONE, said to be the first truly workable system of its type, has been developed by Vega Electronics Corp., Cupertino, Calif. Design problems encountered with earlier wireless mikes have been licked in the "Vega-Mike": it is light in weight (7½ ounces), small in size (1" in diameter and 5" long), boasts good low-frequency fidelity, and lacks r.f. radiation dead spots. Actually, the unit is a completely self-contained, transistorized, battery-operated FM station; the neck strap which supports the mike also serves as an antenna. Power output of the Vega-Mike is less than 20 thousandths of a watt, but its useful range may be a half mile or more. Just think—Mary Martin need not shout in her Peter Pan role any longer!

TAPE RECORDING NOTHING is the aim of these B. F. Goodrich engineers as they put a new type of tire through tests at the Brecksville, Ohio, research laboratories. The tire's performance is captured by tape recorder and movie camera as the test car makes a sharp turn close by; the tape and film help the engineers analyze tire deformation and its effect on noise generation and wear. Goodrich engineers state that one sharp street-corner turn takes about as much off a tire's life as 10 miles of ordinary straight driving. If they succeed in developing a completely noise-free tire, the sound-effects industry will suffer a severe setback.

More on page 8

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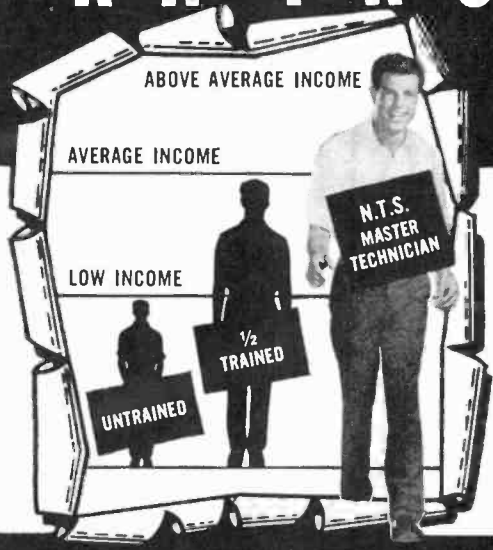

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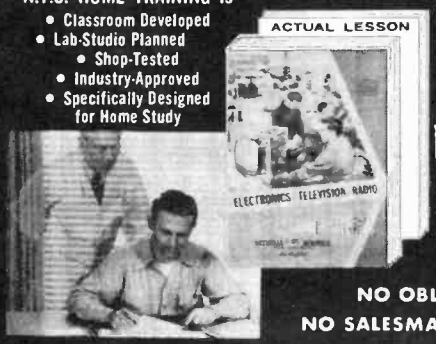

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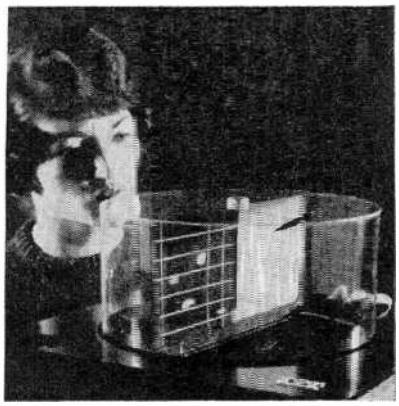


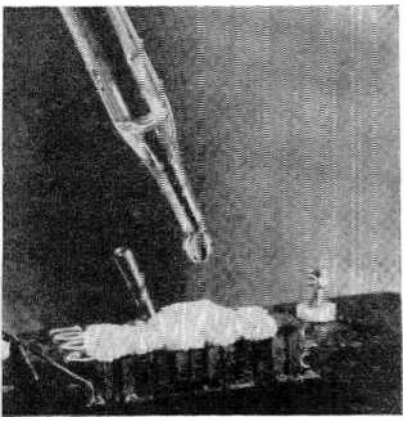
UPI

RADAR IN 3 D was shown for the first time by IT&T at a recent meeting of the American Rocket Society in Washington, D. C. Unlike other pseudo 3-D radars which require two radar pictures, IT&T's gadget shows radar targets positioned in space on a single display unit. It's all accomplished by means of flashing pinpoints of light on a rapidly rotating screen. An observer can follow the flight of aircraft, missiles, satellites or submarines, and future astronauts may be able to see the space around them as well as Flash Gordon can.

UPI

AN ELECTRIC TRANQUILIZER that anesthetizes patients for major operations has been developed by doctors at the University of Mississippi for the U. S. Army. Intended for battlefields as well as hospitals, the low-cost, lightweight gadget is easy to use. Two small electrodes are attached to the patient's head. Within 60 seconds, an a.c. current increased in frequency from zero to 700 cycles puts the patient to sleep. One minute after the juice is turned off, the patient awakens. The first operation utilizing the electric-current "sleeping pill" proved to be a success. However, applications for the device are somewhat limited since it cannot be used for head operations.

PISTOL-PACKING MAMA is quick on the draw as she wires a Minneapolis-Honeywell electronic computer. The electrically operated solderless wiring gun and the pretty miss do their share in hooking up one million feet of wire—requiring 1,400,000 electrical connections—in this super-fast "adding machine." Six-gun holsters may soon be seen as standard equipment on the assembly line and in powder rooms.



ICE OR STEAM can be produced by a thermoelectric device, smaller than a paper clip, which draws its power from two flashlight cells. Called a "Peltier cooler," the device was developed by Hughes Aircraft engineers and is used to cool experimental infrared detectors to –100°F with only two amperes of current. Hughes engineers devised a new technique of fabricating the thermoelectric material in a "cooler," making it possible to operate at one-tenth of the current previously required. A heat-controlled "oven" can now be built that will hold an even 70° temperature in weather varying from –40° to 180°F, while using less power than an automobile headlight. When d.c. current is passed through the "cooler," it either heats the oven or, when reversed, cools it. Quick-defrost refrigerators with no moving parts may soon be standard equipment in every American kitchen.

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FCC Report

By **ROBERT E. TALL**
Washington Correspondent

THE Citizens Radio Service was paid a unique tribute in the Federal Communications Commission's annual report to Congress. During the fiscal year ending in June, 1960, the Commission said, CB'ers were responsible for "most" of the agency's "workload and headaches" in the safety and special radio services.

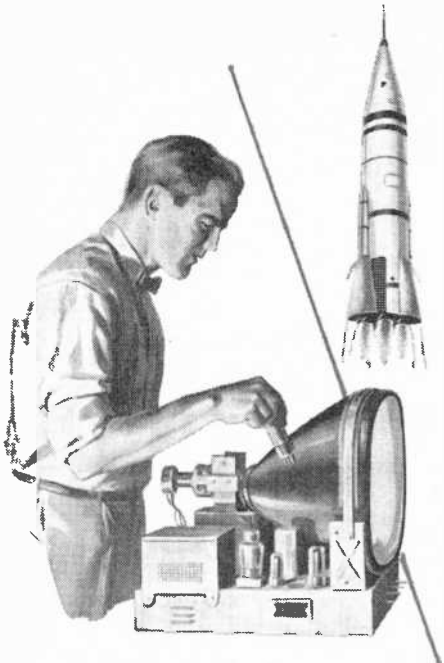
More "glowing accolades" can be expected during hearings before a Congressional appropriations group this spring. The number of CB stations will undoubtedly grow from the 100,000-plus figure of last June to more than 170,000 stations by the time Congress calls the agency on the Capitol Hill carpet.

Multiply the number of authorized CB stations by two or three transmitters each, and it's easy to see why the Commission advised Congress that its "task of administering this service" has "intensified."

The annual report did not really take off against the CB service—outside of its general recitation of CB troubles.

In language more restrained than most CB'ers would use about the Commission's enforcement activities, the agency reported that the opening of the Class D service "triggered a deluge of low-cost equipment into the hands of an eager public," and "improper procedural operations by uninformed users contributed toward an increased monitoring workload."

The Commission told the members of Congress that while rule changes instituted a year ago "clarified the operating requirements" in the CB service, a concentrated monitoring effort was necessary to check a massive drift toward illegal operations. In particular, the FCC said, the desire of CB'ers to communicate with distant stations, similar to amateur



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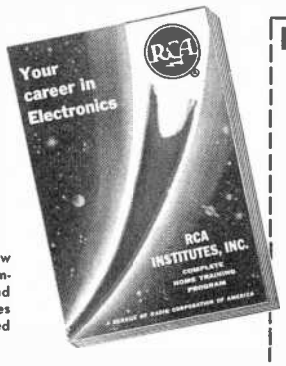

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operation, threatened to create bedlam on the band.

The agency's overall view was that the CB problem has been partly solved as regards long-distance (DX) communications, but that local hamming is up, if anything. Also, the service is still plagued by a good many off-frequency violations.

Actually, a close reading of the annual report (which can be bought from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D.C., for 45 cents a copy) shows clearly that the FCC has put up a lot tougher public front with respect to enforcing the CB service than was really justified.

In trying to ride herd on a total of more than 333,000 non-broadcast radio stations during the fiscal year—this excludes marine and amateur stations—the Commission's field people inspected only slightly more than 6500 stations, and issued violation notices to 1780 of them. There is evidence that not too many of these inspections involved CB'ers. While the number of stations in the non-broadcast category rose by nearly 100,000 during the year—a large part of which represented CB stations, the number of investigations went up by only about 400.

However, the report contained enough threads of information—mostly based on omissions—to paint a rather dismal picture of the Commission's work in enforcing the CB rules. And the Commission did note that "off-frequency citations" in the CB service "outnumbered all other services combined."

The possibility of setting up a Class D citizens-type radio service in the 450-470 mc. band has been recommended for study by the Indiana chapter of the Associated Police Communication Officers. This recommendation was made in their comments to the FCC dealing with some drastic proposals of the Commission for all two-way radio services in that band.

The organization asked that a frequency tolerance of .005% be established, and that other standards be adopted limiting operations to a 50-kc. band-width maximum, power input to 10 watts, and antenna heights to those of the present Class D service. —30—

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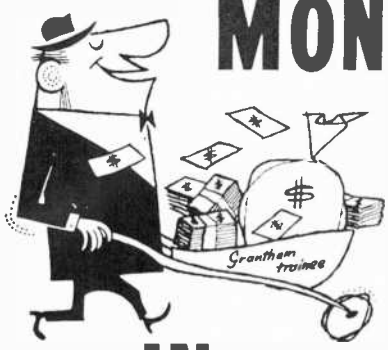

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This correspondence course is directed toward two major objectives—(1) to *teach* you a great deal about electronics, and (2) to prepare you to *pass* all of the F. C. C. examinations required for a first class commercial operator's license. We teach you step by step and have you practice with FCC-type tests which you send to the school for grading and comment. You prepare for your F. C. C. examinations under the watchful direction of an instructor who is especially qualified in this field.

In RESIDENT CLASSES

Grantham *resident* schools are located in four major cities—Hollywood, Seattle. Kansas City, and Washington, D. C. Regularly scheduled classes in F. C. C. license preparation are offered at all locations. New *day* classes begin every three months, and new *evening* classes begin four times a year. The day classes meet 5 days a week and prepare you for a first class F. C. C. license in 12 weeks. The evening classes meet 3 nights a week and prepare you for a first class license in 20 weeks. For more information about the Grantham resident schools, indicate in the coupon the city of your choice and then mail the coupon to the School's home office in Hollywood, Calif. Free details will be mailed to you promptly.

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

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.

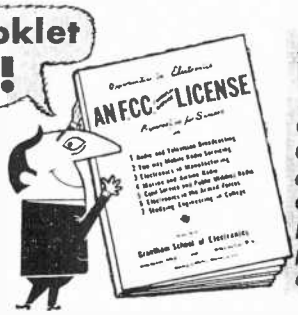
Get your First Class Commercial F.C.C. License by training at

GRANTHAM SCHOOL OF ELECTRONICS

HOLLYWOOD · SEATTLE · KANSAS CITY · WASHINGTON

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.



for FREE Booklet CLIP COUPON and mail in envelope or paste on postal card.

for FREE Booklet CLIP COUPON and mail in envelope or paste on postal card.

To: GRANTHAM SCHOOL OF ELECTRONICS
1505 N. Western Ave., Hollywood 27, Calif.

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, ☐ Kansas City classes, ☐ Hollywood classes, ☐ Seattle classes, ☐ Washington classes

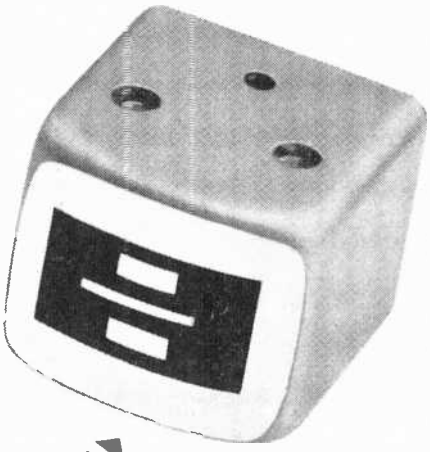
130

Hi-Fi Showcase

ALTHOUGH space prevents listing all new stereo/hi-fi products, some of the more outstanding are discussed below. For additional information on products mentioned, write directly to the manufacturers—addresses appear at the end of this column, on page 16.

Among the many features of ***Allied Radio***'s Knight KN-150 FM tuner is a circuit development called "dynamic sideband regulation" (DSR). Its purpose: to eliminate weak-signal distortion and even distortion caused by overmodulation at the FM station itself. Other features of this professional-quality tuner include a cathode-follower output which permits locating the tuner up to 100 feet from the associated amplifier, sensitive a.f.c. for drift-free tuning, automatic elimination of hiss and roaring between stations while tuning, and a front-panel level control for tape recording. Incorporating 10 tubes as well as a rectifier and a tuning indicator, the KN-150 is priced at $119.95. . . . With prewired and prealigned r.f. and i.f. stages on both AM and FM sections, ***EICO***'s new ST96 stereo FM/AM tuner can be used for separate FM and AM, FM/AM stereo, and (with an adapter) FM multiplex reception. On FM, frequency response ranges from 20 to 15,000 cycles; AM bandpass can be switched to either "wide" (14,000 cycles) or "narrow" (7000 cycles) for an overall frequency response of 20-9000 or 20-4500 cycles. Priced at $89.95 in kit form, the ST-96 is also available factory-wired and tested for $129.50.

Direct and reflected sounds are mixed in exacting proportions—20% and 80%—by a unique speaker system developed by ***Harman-Kardon.*** According to designer Stewart Hegeman, this "blend of direct and reflected sounds" duplicates "what actually occurs in the concert hall." Capable of handling 35 watts of integrated program material, the Citation X measures 36½" x 20" x 14¾".



Here's where Soundcraft Tapes with FA-4 outperform any other tape you can buy!

There is no fooling a recording head ...it knows! It can reproduce only that which your tapes are capable of recording. To thousands of professional and amateur tape recordists, one tape has proven its ability to reproduce sound with a quality that is unmatched. That tape is Soundcraft with FA-4 — the exclusive frequency adjusted formulation that captures the full dynamic range of sound. It costs no more to discover how well your tape recorder can perform.

REEVES SOUNDCRAFT CORP.

Great Pasture Rd., Danbury, Conn. ■ Chicago: 28 E. Jackson Blvd.
Los Angeles: 342 N. LaBrea ■ Toronto: 700 Weston Rd.

P.S. Your recording head will appreciate Soundcraft's permanent lubrication.

R-143A

Showcase

(*Continued from page* 14)

form and can be put together in less than 20 minutes using ordinary household tools. Price, $250.

A fully automatic hi-fi record player designed specifically for use in automobiles, the ***Norelco*** "Auto Mignon" is so simple it can be operated by children. Only one step using only one hand is required—push a 45-rpm record into the slot, and the "Auto Mignon" takes over from there. Fully tested under all road and driving conditions, the player has built-in shock absorbers to compensate instantly for car sway, abrupt braking, or bad roads. The player operates from either 6- or 12-volt systems, is small enough (5⅜" x 9 9/16" x 9¾") for installation in virtually any car, and sells for $57.50. A second Norelco hi-fi product, the Continental "300" tape recorder, is conventional in the sense that it operates from the usual 117-volt, 60-cycle line. But a long list of features puts it far above the ordinary: a 4-track stereo playback and monophonic record/playback unit, the "300" includes a tape-drive mechanism, record/playback preamplifier, power amplifier, wide-range speaker, and a dynamic microphone. Tape speeds are 7½, 3¾, and 1⅞ ips; a head gap of 0.0001" furnishes response to 16,000 cycles at the 7½-ips speed. A compact 15¾" x 13" x 6¾", the recorder is priced at $269.50.

If you're thinking of going stereo on a budget, you can't go far wrong with ***Radio Shack***'s "Realistic" SAF-24 amplifier. Priced so low that you might even want to consider it as an auxiliary amplifier, the SAF-24 provides all the essentials for true stereo operation. Input can be from crystal or magnetic phono, microphone, tuner, or tape deck; output is 12 watts per channel to any 4-, 8-, or 16-ohm speaker. Price, $54.95.

Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.
Electronic Instrument Co. Inc. (EICO), 33-00 Northern Blvd., Long Island City 1, N.Y.
Harman-Kardon, 520 Main St., Westbury, N.Y.
North American Philips Co. Inc. (Norelco), High Fidelity Products Div., 230 Duffy Ave., Hicksville, L.I., N.Y.
Radio Shack Corp., 730 Commonwealth Ave., Boston 17, Mass.

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19.95

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99.50 — 5.00 Down

HE-20 Deluxe Citizens Band Transceiver

13.50

RW-60 20,000 Ohms Per Volt Multitester

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HE-29

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Jamaica 31, N. Y.

Send me the FREE Lafayette 324 page 1961 catalog 610

Name.....

Address.....

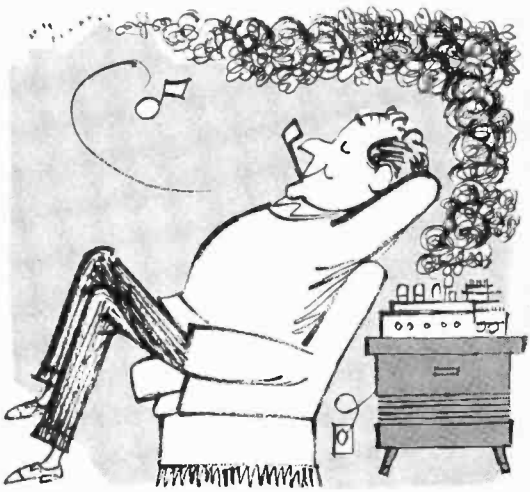
City..... Zone..... State.....

IT COULD HAPPEN TO YOU...

Somewhere it said: "Build this kit in an amazing 10 hours!" Looks like you're running into overtime because you spent the first 7½ hours sorting out the jumbled mess of small parts and hardware. Well, it's good training for looking for needles in haystacks.

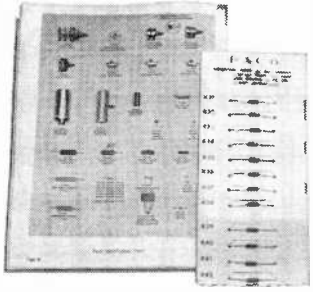
If drug manufacturers made the mistakes in labeling you find in some kits, the world would be a quieter, lonelier place. You know a selenium rectifier when you see one, and if this is a selenium rectifier, you're Thomas Alva Edison.

Let's see. On Page 5 it says; "See diagram Page 12." On Page 12 it says; "See instructions Page 5." Well, if you hold Page 5 open with your tongue, and Page 12 open with your left ear, that still leaves you three fingers on your left hand free for soldering and also...

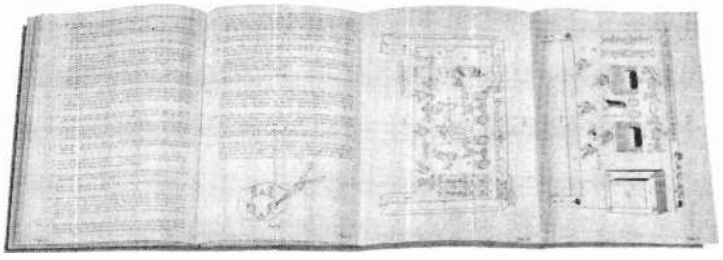


Don't look now, but while Heifetz fiddles, your amplifier burns. When the smoke clears, you'll probably find that the 100 microfarad electrolytic was shorted because it had not been pre-tested. All work and no play, makes Jack a very mad boy!

UNLESS THE KIT YOU BUILD IS A PACO



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

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

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Paco Electronics Company, Inc., Dept. PE-4
70-31 84th Street, Glendale 27, L. I., N. Y.
Please send me your complete illustrated catalog.

Name .....

Address .....

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

Letters from our readers

Foreign Broadcasts in English

■ Congratulations on the fine article in the January 1961 issue on English-language broadcasts from Europe. I'd like to see a supplement to this article covering similar broadcasts from other areas of the world.

ART FREGEAU
Bristol, Conn.

We're glad you liked "English-Language Voices from Europe." You'll be pleased to know that similar articles will be regularly featured in POP-'tronics, giving data on broadcasts in English from Asia and the Pacific, and from Africa and the Middle East, as well as from Europe.

Super Crystal Set

■ I think you'll be interested in hearing about the wonderful results I got with a "High-Power Crystal Set" (August 1960 issue). From my home in northeast Ohio, I received stations in Boston, Chicago, Cincinnati, Fort Wayne, Pittsburgh, and

Richmond. Boston came in so loud that it could be heard over a speaker, and I picked up two different stations in Chicago!

JACK KELLER
Kinsman, Ohio

North of the Border

■ I am a steady reader of POPULAR ELECTRONICS and I think there is no other magazine like it. But I run into trouble when I want to buy parts for a construction project—I always have to order them from the United States. Can you give me a few names and addresses of parts distributors in Canada?

BILL WILLIAMS
Quesnel, B.C., Canada

■ One of the problems we Canadians have is obtaining parts for construction projects. Would it be

possible for your advertisers to give the names and addresses of their Canadian representatives? Very few of them do, but I think there are enough Canadian readers to make it pay.

RICK LEIPERT
New Westminster, B.C., Canada

There are many Canadian parts distributors, and we're surprised that you haven't heard of at least one of them. Two of the biggest are in Toronto: Alpha Aracon Radio Co. Ltd., 555 Wilson Ave., Downsview, Ontario; and Electro Sonic Supply Co. Ltd., 543 Yonge St., Toronto 5, Ontario. Why not write to them for catalogs?

Cuban Ham Contacts

■ I'm writing to you because I'm in doubt about an FCC ruling. Now that the U.S. has broken off diplomatic relations with Cuba, are U.S. hams free to work Cuban hams?

TOM FOXEN
Le Mars, Iowa

We called the local FCC office, and were informed that U.S. hams are still permitted to maintain contact with licensed Cuban amateurs.

Pleased with "Combo"

■ I have built the "Combo Test Set" from plans in the December 1960 issue. Using a smaller box, hand-wound tuning coil, and some junk-box parts, the cost came to only five dollars or so. Now that I can monitor my signal, I know it sounds clear to the station contacted. My thanks to Paddy Labato, W8DLU.

HERMAN CROW
Lynwood, Calif.

Praise for "Min-O-Scope"

■ Although I am a ham and particularly like your articles in that field, I am also an Electronics Technician Third Class (U.S. Navy). For this reason, your articles on test equipment run a close second, and I think your recent construction article on the "Min-O-Scope" (August, 1960) was excellent. Incidentally, the Navy places great value on the oscilloscope as a test instrument in its elec-

tronics training courses. As an Electronics Technician, I can vouch for the fact that the ET's most reliable and useful tool is his 'scope.

PAUL H. BOCK JR.
Bethesda, Md.

Triode Valves Wanted

■ I have an old Radiola III regenerative receiver, made by Canadian Westinghouse Co., Ltd., that I am attempting to restore to operating condition. There are two WD-11 triode valves used in the set, and both of them have open filaments. Would you

or any of your readers know where I could get a replacement pair?

GRAHAM RIFE
536 Frederick St.
Preston, Ont., Canada

Leotone Radio Corp., 65 Dey St., New York 7, N. Y., tells us that the WD-12 will serve as a replacement for the WD-11 if the socket is changed or an adapter is used. They have WD-12's in stock at $2.50 each.

"Vibrator Substitute"

■ A recently published letter concerning the "Vibrator Substitute" in the October 1960 issue indicates that R_1 and R_3 should be 220 ohms and R_2 and R_4 should be 10 ohms. I quickly consulted the parts list in question and discovered that these were the values which were specified! What are the correct values?

G. P. KATONA
Corning, N. Y.

Resistors R1 *and* R3 *should be 10 ohms;* R2 *and* R4 *should be 220 ohms.*

Lightning Arrester Kits

■ Art Zuckerman's article on "Lightning" in your January 1961 issue mentions lightning arrester kits for home installation. Can you give me the name and address of the maker of such kits?

BENNETT SHIMP
Columbus, Ohio

The farmer's edition of the Sears-Roebuck catalog lists two lightning arrester kits which, by the way, should be called "air terminal kits." Another good bet is to contact your local electrical supplier.

Schematics, Anyone?

■ For some time now I have been looking for a schematic for a Triumph 830 oscillograph, and I wonder if any of your readers can help me. When I attempted to contact the manufacturer, I was advised that the company was out of business and that no information was available.

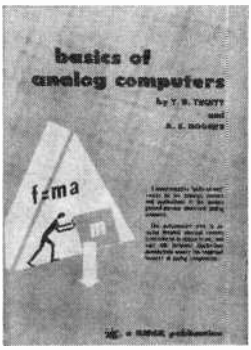
MICHAEL J. ASCHEMAN
Newark, Del.

Howard W. Sams & Co., Inc., 1720 E. 38th St., Indianapolis 6, Ind., may be able to help you—be sure to include the model number, manufacturer, and a complete description of the equipment with your request. -30-

POP'tronics Bookshelf

BASICS OF ANALOG COMPUTERS *by Thos. D. Truitt and A. E. Rogers.*

This book is a "must" for students, technicians, and engineers new to the analog computer field. A basic—but complete—analog computer course, the step-by-step presentation goes from simple ideas to basic analog devices, mathematical concepts, and a detailed explanation of the operation of modern, general-purpose computers. The book winds up with a section on practical applications of the analog computer. More than 400 illustrations are used to pinpoint the ideas discussed in the text.



Published by John F. Rider, Inc., 116 West 14th St., New York 11, N. Y. 375 pages. Cloth cover. $12.50.

SURPLUS RADIO CONVERSION MANUAL—VOLUME III *by William I. Orr.*

Hams and electronic experimenters will find this volume—as well as Volumes I and II in the series—invaluable in converting surplus armed forces' equipment into useful amateur and CB rigs. Mr. Orr provides complete information, schematics and photos for many of the conversions described; in some cases only the schematics are given. Much auxiliary equipment is covered in addition to the basic transmitters and receivers.

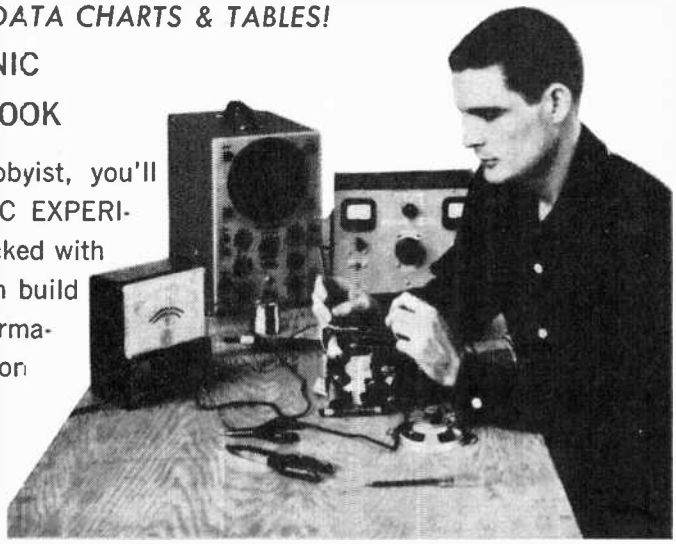
Published by Editors and Engineers, Ltd., Summerland, Calif. 88 pages. Soft cover. $2.50.

(*Continued on page* 24)

A DO-IT-YOURSELF GOLDMINE!

40 ALL-NEW PROJECTS! 20 DATA CHARTS & TABLES!

ALL IN THE 1961 ELECTRONIC EXPERIMENTER'S HANDBOOK



If you're an electronics hobbyist, you'll welcome the 1961 ELECTRONIC EXPERIMENTER'S HANDBOOK. It's packed with over 40 all-new projects you can build yourself, plus more than 20 information-packed charts and tables on circuits, resistors, transformers, capacitors, ham and citizens band radio, sound levels, and much more!

THESE ARE JUST A FEW OF THE EXCITING PROJECTS YOU CAN BUILD FROM THE COMPLETE DIAGRAMS AND EASY-TO-FOLLOW DRAWINGS:

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Ziff-Davis Publishing Company
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New York 16, N. Y.

Please send me a copy of the 1961 ELECTRONIC EXPERIMENTER'S HANDBOOK. I enclose $1.00 plus 10¢ to cover mailing and handling charges. (Canada and Foreign $1.25 plus 10¢ postage.)

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Bookshelf

(*Continued from page 22*)

COMMUNICATION ENGINEERING—OFFICIAL REGISTRY OF PUBLIC SAFETY RADIO SYSTEMS *(1960).*

Short-wave listeners who report on police, fire department, emergency, local government, highway maintenance, and forestry conservation stations will find this registry very useful. Divided into two parts, it lists the stations alphabetically and geographically by licensee and again by operating frequency. SWL'ers seeking verifications from such stations should keep this volume handy.

Published by Communication Engineering Book Company, Monterey, Mass. 182 pages. Soft cover. $4.00.

COMPUTER LOGIC (The Functional Design of Digital Computers) *by Ivan Flores.*

Describing and illustrating in detail just how a computer is put together, how it works, and how to use it, this book offers a complete block-diagram analysis of all the operational units of a digital computer. After a thorough analysis of all aspects of computer operation, the author traces a typical project in detail from the time the programmer receives the problem until the answer is obtained. Although an engineering degree is not needed to understand this book, some background in mathematics and science will be helpful.

Published by Prentice-Hall Inc., Englewood Cliffs, N. J. 458 pages. Hard cover. $12.00.

SERVICING TRANSISTOR RADIOS—Volume 6.

The latest in the series on transistor radios published by Sams, this volume covers 62 U.S. and foreign 1959-1960 models. The usual full "Photofact" treatment of each model, including photos, circuit data, and alignment instructions, is complemented by a section on techniques for servicing transistor circuits.

(*Continued on page 28*)

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

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

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

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

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build 20 Receiver, Transmitter, Square Wave Generator, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for television, Hi-Fi and Electronics.

Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the complete price of $26.95. The Signal Tracer alone is worth more than the price of the entire Kit.

THE KIT FOR EVERYONE

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

Many thousands of individuals of all ages and backgrounds have successfully used the "Edu-Kit" in more than 79 countries of the world. The "Edu-Kit" has been carefully designed, step by step, so that you cannot make a mistake. The "Edu-Kit" allows you to teach yourself at your own rate. No instructor is necessary.

PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle of "Learn by Doing." Therefore you construct, learn schematics, study theory, practice trouble shooting—all in a closely integrated program designed to provide an easily-learned, thorough and interesting background in radio.

You begin by examining the various radio parts of the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will enjoy listening to regular broadcast stations. learn theory, practice testing and trouble-shooting. Then you build a more advanced radio, learn more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a professional Radio Technician.

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

THE "EDU-KIT" IS COMPLETE

You will receive all parts and instruction necessary to build 20 different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic, mica, ceramic and paper dielectric condensers, resistors, tie strips, coils, hardware, tubing, punched metal chassis, instruction Manuals, hook-up wire, solder, selenium rectifiers, volume controls and switches, etc.

In addition, you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional electric soldering iron, and a self-powered Dynamic Radio and Electronics Tester. The "Edu-Kit" also includes Code instructions and the Progressive Code Oscillator, in addition to F.C.C.-type Questions and Answers for Radio Amateur License training. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guidebook, a Quiz Book, membership in Radio-TV Club, Free Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.

FREE EXTRAS

• SET OF TOOLS

- SOLDERING IRON
- ELECTRONICS TESTER
- PLIERS-CUTTERS
- ALIGNMENT TOOL
- WRENCH SET
- VALUABLE DISCOUNT CARD
- CERTIFICATE OF MERIT
- TESTER INSTRUCTION MANUAL
- HIGH FIDELITY GUIDE • QUIZZES
- TELEVISION BOOK • RADIO TROUBLE-SHOOTING BOOK
- MEMBERSHIP IN RADIO-TV CLUB: CONSULTATION SERVICE • FCC AMATEUR LICENSE TRAINING
- PRINTED CIRCUITRY

SERVICING LESSONS

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

FROM OUR MAIL BAG

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

Ben Valerio, P. O. Box 21, Magna, Utah: "The Edu-Kits are wonderful. Here I am sending you the questions and also the answers for them. I have been in Radio for the last seven years, but like to work with Radio Kits, and like to build Radio Testing Equipment. I enjoyed every minute I worked with the different kits; the Signal Tracer works fine. Also like to let you know that I feel proud of becoming a member of your Radio-TV Club."

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

PRINTED CIRCUITRY

At no increase in price, the "Edu-Kit" now includes Printed Circuitry. You build a Printed Circuit Signal Injector, a unique servicing instrument that can detect many Radio and TV troubles. This revolutionary new technique of radio construction is now becoming popular in commercial radio and TV sets.

A Printed Circuit is a special insulated chassis on which has been deposited a conducting material which takes the place of wiring. The various parts are merely plugged in and soldered to terminals.

Printed Circuitry is the basis of modern Automation Electronics. A knowledge of this subject is a necessity today for anyone interested in Electronics.

UNCONDITIONAL MONEY-BACK GUARANTEE

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

☐ Send "Edu-Kit" postpaid. I enclose full payment of $26.95.
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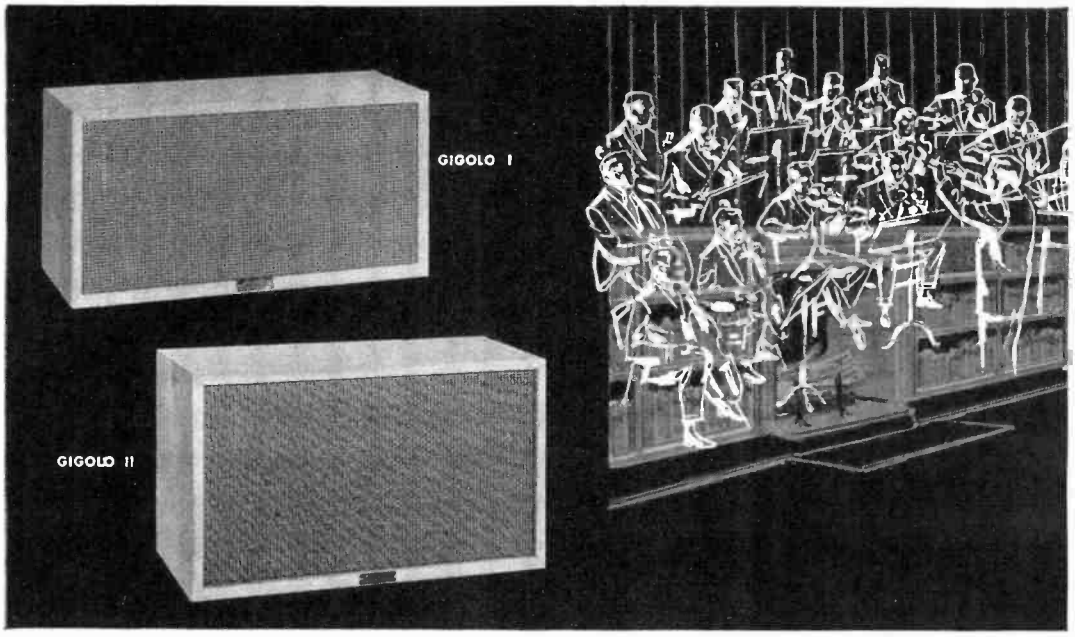
PROGRESSIVE "EDU-KITS" INC.
1186 Broadway, Dept. 579D, Hewlett, N. Y.

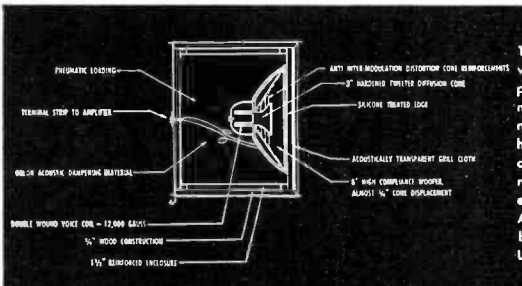


It is the belief of A. E. S. Inc., that we have developed the high fidelity industry's first performance duplicator, by this we mean, not just the unit to reproduce sound close to that of the real thing, but to give such a live performance that it would be considered not only reproduction but duplication, to the point of temporary deliverance to the live performance.

This may seem to be quite an elaborate statement, but along with our own opinion we have in the past two years had many customers who have purchased our Gigolo speaker write in and tell us of comparison tests conducted in their homes with originally purchased speaker systems costing in many cases well over $100.00, these units considered to be the industry's finest. Although their original system was a fine piece of reproducing equipment it was still only reproduced sound, where in the case of their newly purchased Gigolo the sound seemed to be alive.

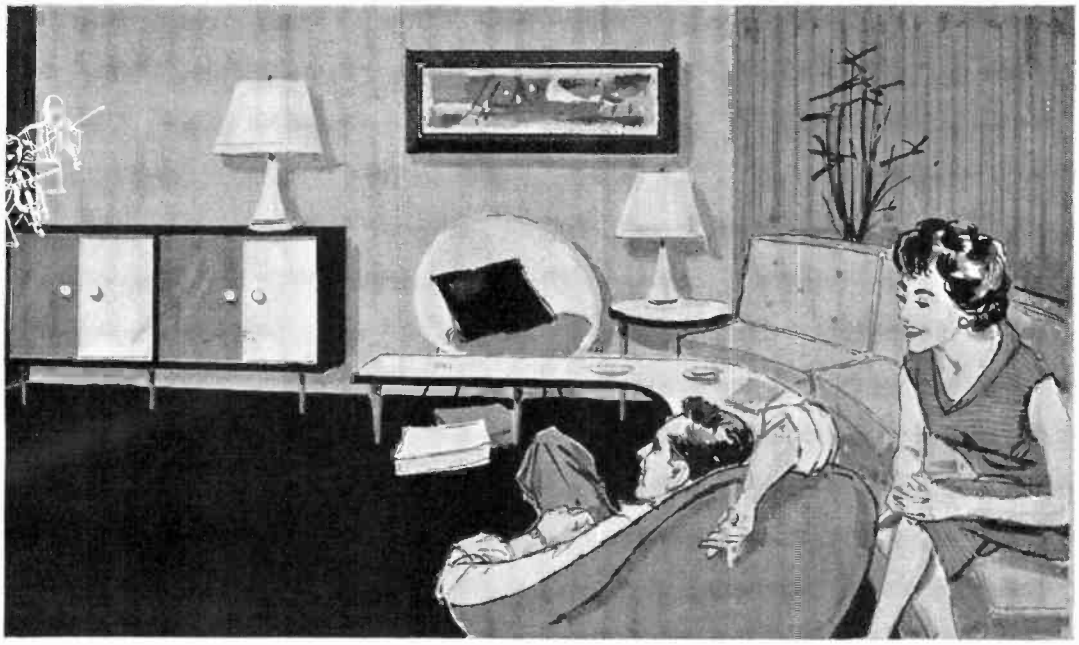
This remarkable performance plus the fact that we have sold in the past two years thousands of Gigolos, on a 100% GUARANTEE, cash return basis and have received only .5% (one half of one percent) returns, should prove that this is not just another advertising claim but a reality.

In the past, we have guaranteed the Gigolo to sound better than any bookshelf speaker manufactured for home use on the market today regardless of price or your money back. We still make this offer and at the original price of $15.00 each. Please place your order now to insure reasonably prompt delivery.



The GIGOLO I is constructed with a resonant resistant wood product of at least ¾" thickness throughout. Its outside dimensions are: 24" long, 12" high, 9½" deep. The heavy construction and the fine workmanship suggest a value far exceeding its low, low price. All units sold on 100% money back Guarantee. Price $15.00. Unfinished Only, F.O.B. Factory.

The GIGOLO II is made of the finest select natural birch. All the wood used for the enclosure is at least ¾" thick. Outside dimensions are 24" long, 13½" high, 12" deep. Our grill cloth is supplied by one of the country's largest manufacturers of acoustic grill material. Your GIGOLO II comes to you completely assembled and sanded ready for finishing in either blond, walnut, cherry, mahogany or ebony. All units sold on 100% money back guarantee. Price—$49.50. Unfinished Only, F.O.B. Factory.



AND NOW IN ANSWER TO THE QUESTION OF SO MANY THRILLED GIGOLO OWNERS "IF THIS IS WHAT YOU CAN OFFER FOR $15.00 WHAT CAN BE DONE FOR A REASONABLE AMOUNT MORE?" IN ANSWER TO THIS WE PRESENT THE GIGOLO II.

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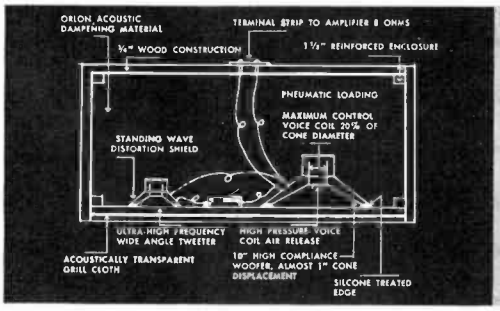
SPECIAL NOTICE

All units purchased from A. E. S. Inc., either the recommended Gigolo I for home use, or the Professional Model Gigolo II, are completely covered by our 100% MONEY BACK GUARANTEE. Upon receipt of your Gigolo, if you find any of the statements made in this advertisement were misleading or untrue, or if your Gigolo is not completely satisfactory either in workmanship or performance, including reproducing frequencies and handling power beyond your requirements you may return this unit to the factory for full purchase price refund.



A. E. S. Inc.
3338 Payne Ave., Cleveland 14, Ohio

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. . . . . Gigolo II—$49.50 Each

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City and State. . . . . .

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

Bookshelf

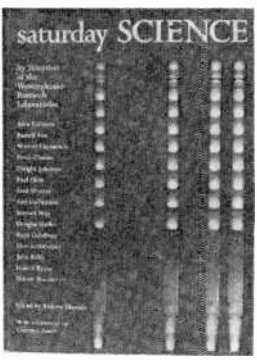
(*Continued from page* 24)

A cumulative index lists all receivers appearing in Volumes 1 through 6. Recommended for servicemen and repair-it-yourself enthusiasts.

Published by Howard W. Sams & Co., Inc., 1720 East 38th St., Indianapolis 6, Ind. 160 pages. Soft cover. $2.95.

SATURDAY SCIENCE *by scientists of the Westinghouse Research Laboratories;* edited by Andrew Bluemle

This book represents the work of 15 practicing research scientists. Treating both familiar concepts and the unusual, they share some of the significant discoveries that are now changing man's life on earth and shaping his future in space. The wide range of subjects includes nuclear physics, computer mathematics, and space propulsion. Many photographs, diagrams and charts illustrate the text.

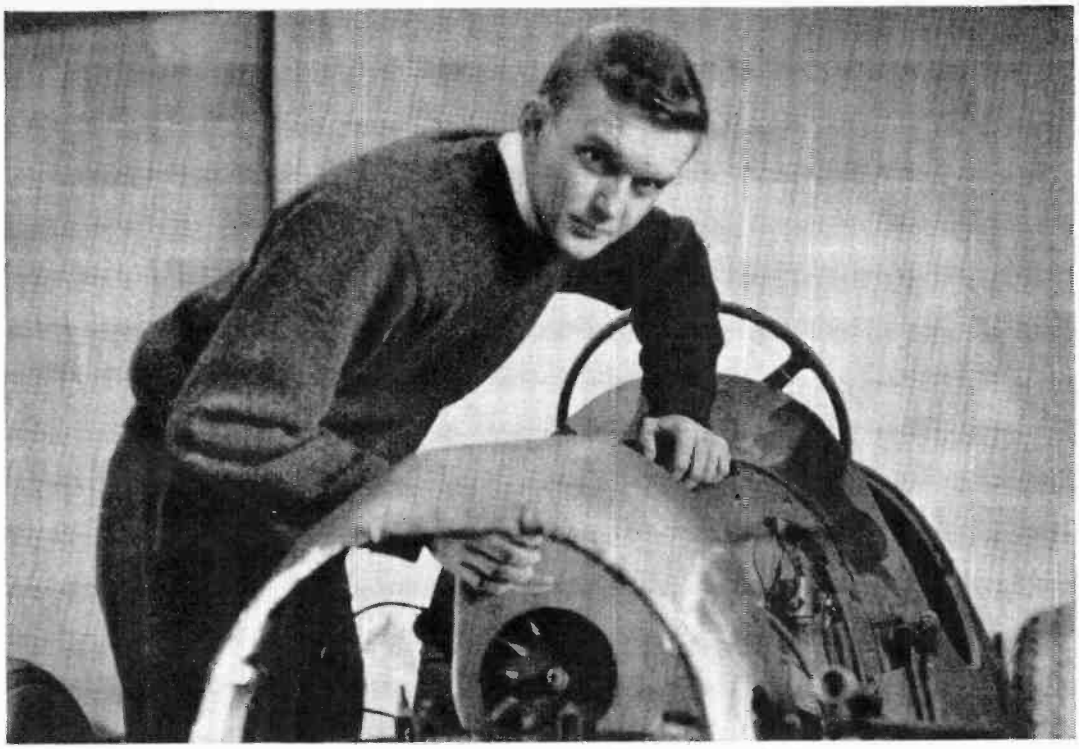


Published by E. P. Dutton & Company, Inc., 300 Park Ave. South, New York 10, N. Y. 333 pages. Hard cover. $5.95.

GETTING THE MOST OUT OF YOUR TAPE RECORDER *by Herman Burstein*

Written in language that the tape recorder user can easily understand, this book gives the answers to such questions as: What constitutes good performance? What can I do to get top performance out of my tape recorder? Why does one tape recorder perform better than another? Chock full of information, and with over 170 illustrations, the book provides a complete coverage of tape recorders and, perhaps even more important, tape re-

(*Continued on page* 118)



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Airman 2C Satterfield whose civilian hobby was building "hot rods," is presently enrolled in a 45-week electronic computer course at Keesler Air Force Base in Mississippi.

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An introductory text on the fundamentals of electricity and electronics for technicians in radio, television and industrial electronics. $9.25

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For those with little or no technical knowledge who wish to know the fundamentals of radio theory and servicing. $8.25

2404. FM RADIO SERVICING HANDBOOK, King

A practical guide to FM V.H.F. receivers, their design, construction, alignment and repair. $5.00

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An indispensable one-volume reference containing 55,000 entries drawn from over 100 branches of science and industrial technology, and 5,000 terms covering new advances in such fields as chemical substances, computers and automation, color TV, guided missiles, etc. Covers crafts: Pottery, bookbinding, textiles and more! $7.50

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2002. ELECTRONIC KITS DIRECTORY, Ziff-Davis Publishing Company

New 1960 edition lists over 750 kits, latest models, prices and features for hi-fi, ham radio, SWL, shop improvement, Citizen's Band, fun and education. $1.00

2006. ELECTRONIC EXPERIMENTER'S MANUAL, Findlay

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2351. RADIO PROJECTS, Marcus

10 easy-to-construct radios described in this book cover the field thoroughly and completely, progressing in difficulty from the simple crystal detector to the superheterodyne receiver. $3.85

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

2004. HI-FI ANNUAL & AUDIO HANDBOOK, Ziff-Davis Publishing Company

1960 edition. Prepared by the editors of Electronics World. An excellent advanced guide to theory, construction and circuitry. $1.00.

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First complete book on Citizens Radio operation. Covers Class D history, rules, applications, how it works. Many illustrations. $4.95

2901. HAM RADIO, Hertzberg

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Presents specific information on radio law, operating practices and theory for those studying to pass the FCC commercial radio operator exams of the various license grades. $6.25

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Describes and analyzes semi-conductors and transistors and how they behave. 300 pages, illustrated. $7.95

2000. STEREO-HI-FI GUIDE, Ziff-Davis Publishing Company

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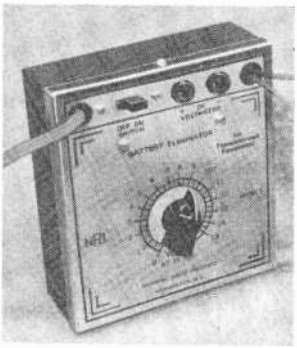
NEW products

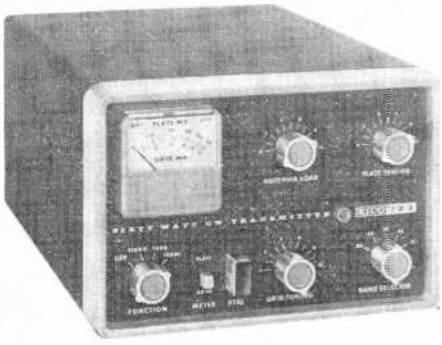
BATTERY ELIMINATOR

The Model 2 battery eliminator is the latest addition to NRI's line of basic radio/TV test instruments. A compact unit designed to take the place of batteries in transistor radios and other equipment, it supplies clean, filtered d.c. at output voltages from 0 to 15 volts. Special circuitry prevents damage due to short circuits. Priced at $13.67, the Model 2 is supplied complete with 40″ clip leads and plug-in jacks for an external voltmeter. (*National Radio Institute,* 3939 Wisconsin Ave., Washington 16, D. C.)



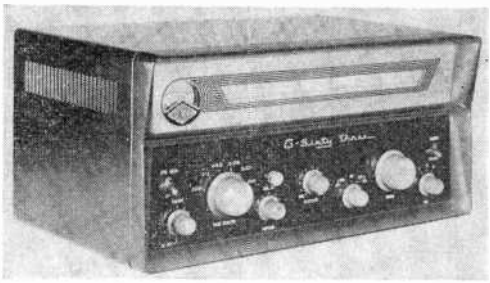
C.W. TRANSMITTER

Available either as a kit or factory-wired and tested, the EICO Model 723 60-watt c.w. transmitter is ideal for the Novice as well as the advanced ham who needs a low-power standby rig. Features of the 723 include a one-knob bandswitch covering 80, 40, 20, 15, and 10 meters; a one-knob off/standby/tune/transmit switch; a panel meter which can be switched into either the grid or plate circuit of the final; and a modulator/accessory socket for modulator input, antenna relay, VFO power take-off, and emergency power input. Weighing 15 pounds, the unit measures a compact 6″ x 8½″ x 9″. Kit price is $49.95; the wired unit sells for $79.95. (*EICO,* 33-00 Northern Blvd., Long Island City 1, N.Y.).



AMATEUR RECEIVER

Gonset's new G-63 receiver is an 80- to 6-meter, amateur-band-only, double-conversion superhet. Features include dual detectors (a diode for AM, a product detector for c.w. and SSB), temperature- and voltage-compensated oscillators, a drum-type tuning dial that shows only the band in use, and a "peaking" type Q-Multiplier which provides a continuously variable bandwidth down to 100 cycles. Finished in gun-metal gray with a front panel in black and satin aluminum, the G-63 sells for $239.50. (*Gonset Div., Young Spring and Wire Corp.,* 801 S. Main St., Burbank, Calif.)



NEW KIT LINE

Two new kits carrying the "Realistic" label are the first in Radio Shack's line of do-it-yourself projects. One kit, a dual-trace oscilloscope, provides for observation of two signals simultaneously—an amplifier input and output, for example. Flat from 10 cycles to 5 mc., the 5″ scope features push-pull vertical and horizontal amplifiers and sells for less than $80.00. The second kit, the Model 200 FM tuner, is actually a kit version of the company's FM-3 tuner; it has a cascode front end, 20–20,000-cycle response, and is priced at under $35.00. More detailed information on this new line of kits appears in Catalog 102,

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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.

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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.

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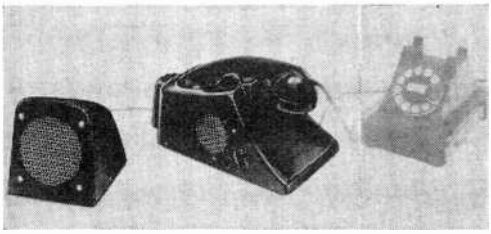
products

(*Continued from page* 32)

available from Radio Shack Corp., 730 Commonwealth Ave., Boston 17, Mass.

TELEPHONE AMPLIFIER

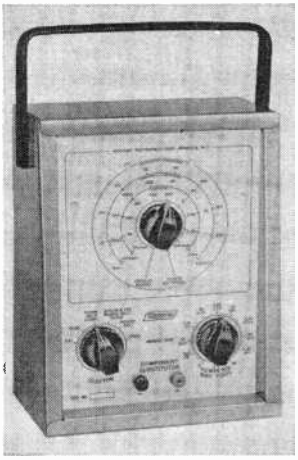
The Model TA-4 RMS "Ampli-Phone" is a highly sensitive telephone amplifier which enables you to take notes or even move about freely during phone conversations. Equipped with a remote 4" speaker, it reproduces the caller's voice with full-room volume. In addition, its



special parabolic front picks up all voices within the room, making it possibe for anyone to speak into the phone at a distance. The Ampli-Phone operates on 117 volts a.c. or d.c. and is priced at $39.95. (*Radio Merchandise Sales, Inc.,* 2016 Bronxdale Ave., Bronx 62, N. Y.)

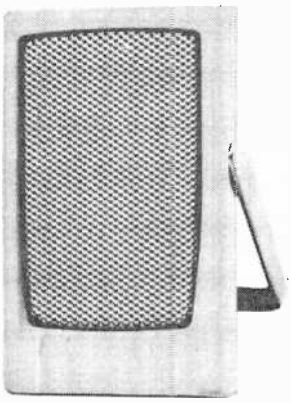
COMPONENT SUBSTITUTOR

The Model 500 component substitutor released by *Mercury Electronics Corp.,* Mineola, L. I., N. Y., will actually take the place of 44 different-valued resistors, both paper and electrolytic capacitors, power rectifiers, and crystal diodes. Specifically designed for servicemen, it is housed in a slope-front, hammertone-finish case; a specially designed metal carrying handle folds back to serve as a rest for the instrument so that it can be used in a conveniently tilted position. All controls are located on the front panel. The Model 500 sells for $29.95.



CAPACITOR MICROPHONE

Electronic Applications, Inc., Stamford, Conn., is importing (from Vienna) what is believed to be the first low-cost ($22.95) capacitor microphone for amateur recordists. The frequency response of the AKG C-14 is 30 to 18,000 cycles ±6 db. It is omnidirectional with a sensitivity of 3 millivolts/μbar and its high impedance makes it suitable for use with home recorders. The required polarizing current (160 volts) can be obtained from a pair of B batteries in series or taken from the recorder's circuitry.



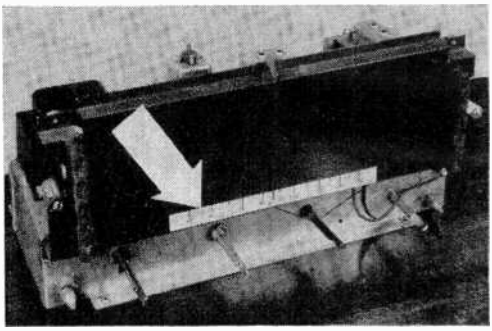
RESISTOR SUBSTITUTION BOX

Sencore's "Big 20" is a compact substitution box containing 20 power resistors for fast, on-the-spot substitution. Covering all of the values frequently encountered in radio, TV, and hi-fi circuitry, the resistors can be substituted in any circuit dissipating up to 20 watts. Switches select the desired resistance in values ranging from 2.5 to 15,000 ohms. Price, $12.75. (*Sencore-Service Instruments Co.,* Addison, Ill.) -30-

Tips and Techniques

RADIO ALIGNMENT AID

A radio with a slide-rule dial can be difficult to align when out of the cabinet because the frequency markings are on the set's dial window and not on the chassis dial plate. To remedy this shortcoming, cut out a narrow strip of paper and duplicate the calibration markings on the radio's dial window. Then glue the paper to the set's dial plate; place it so that

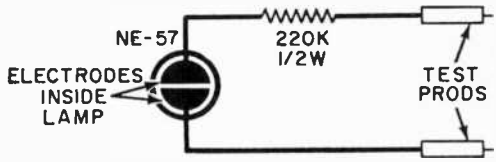


it aligns exactly with the scale on the dial window and where it won't be visible when the chassis is in the cabinet.

—Art Trauffer

NEON LAMP POLARITY CHECKER

An NE-45, NE-51, or NE-57 neon lamp can be used as a polarity checker for voltages between 80 and 500 volts. Simply connect the lamp in series with a 220,000-ohm, ½-watt resistor, and hook up a pair of test prods to each end of the series circuit as shown. Place the test prods across the unknown voltage and



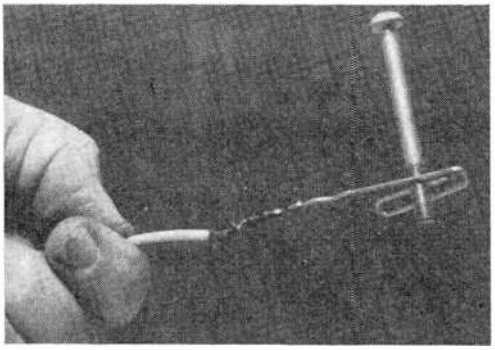
observe the electrodes inside the lamp. If the voltage being checked is a.c., both electrodes will glow. When d.c. voltages are checked, only the electrode connected

to the positive potential will glow. Do not use the checker for voltages higher than 500 volts since arcing may occur across the lamp's electrodes; voltages below 80 volts cannot be checked for polarity since the neon gas in the lamp will not ionize at such low potentials.

—Frank Wood

EMERGENCY SNAP-ON CONNECTORS

"Snap-on" electrical connectors can be quickly made from paper clips, and clipped on to any small screw or terminal



as shown. To make a connector, partially straighten out the clip and solder the connecting lead to the straightened end. In an emergency, when a soldering iron is not immediately available, simply wrap a piece of solder around the joint and hold a lighted match under it; the solder will melt in a few moments and provide a temporary joint between the lead and the connector.

—Glen F. Stillwell

METER LABELS

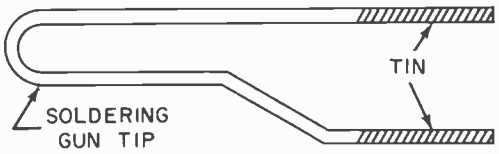
Attractive meter or panel labels can be made from decal transfers available from

radio supply houses. The decals are sold in sets covering different types of electronic equipment, with a number of identical decals supplied with each set. After a decal is in place on the meter face or panel, apply a thin coat of Japan gold size over it. The size can be bought at any art supply store—it will moisture-proof the decal and make the letters appear a glossy jet black.

—Clyde C. Cook

QUICK-HEATING SOLDERING GUN

Some quick-heating soldering guns have the bad habit of heating very slowly due to a poor electrical connection at the tip's contacts. The condition is usually caused

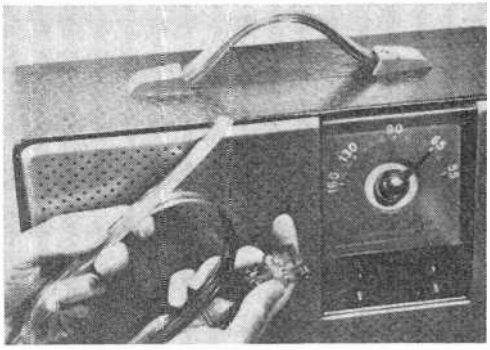


by oxidation of the copper at this point. If the terminals of the tip are tinned before being inserted in the gun, oxidation will be retarded.

—R. K. Dye

HANDLE FOR PORTABLE RADIO

If the handle on your portable radio is old and worn, you can replace it with one made from a solid plastic belt. All



you need do is remove the old handle, measure it, and cut off an equal length of plastic from the belt. Use two lengths of plastic, doubled up, if you have a particularly heavy radio.

—Robert Micals

"TABLE-RADIO" TWEETER

You can compensate for the lack of highs in your large console radio by playing a small table-model radio at the same time;

Tips

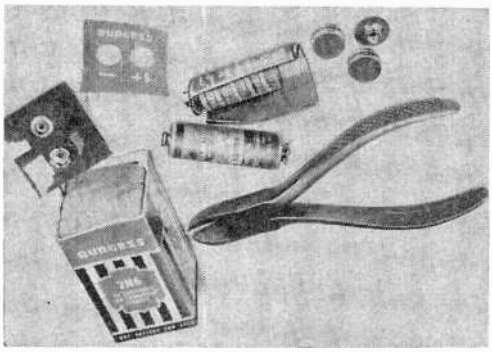
(*Continued from page* 37)

the smaller radio will usually have good treble response and will fill in the range not supplied by the console model. Place the smaller radio on top of the console or, for an interesting stereo effect, in another part of the room. Both radios are tuned to the same station, and the volume controls are adjusted for the desired balance of lows and highs. Best results are obtained when the speakers in the radios are in phase. For an improvement in tone and volume, try reversing the leads to the voice coil of the smaller radio.

—Carl Dunant

"SALVAGING" BATTERIES

Don't discard transistor-radio batteries that test "weak" or "bad"—you can salvage the batteries' contact clips for use as connectors in future construction projects and any individual cells that may still be operative. In alkaline or mercury batteries, one bad cell can cause the whole battery to test "bad"; dismantle

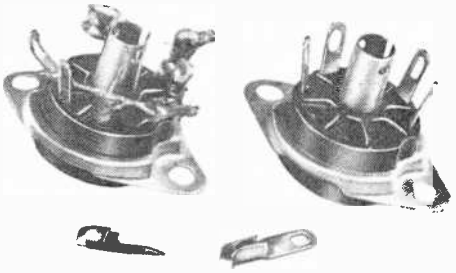


the battery, remove the bad cell, and you will have a good battery at a lower voltage. Batteries with voltages as low as 5 or 6 volts will operate 9-volt transistor radios satisfactorily. *—Lou Garner*

BROKEN TUBE SOCKET PINS

When a pin on a molded tube socket breaks off, there is no need to replace the entire socket. Just remove the defective pin by applying pressure to the small indent on the lug end of the pin and pushing the pin out of the socket; use a small screwdriver to do the job.

The indent is just visible at the point where the pin's lug enters the molded part of the socket. When the broken pin



has been removed, replace it with a good pin which you have carefully taken out of another socket.

—H. L. Davidson

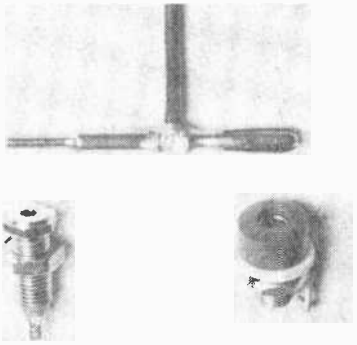
REPAIRING SPEAKER CONES

Torn or punctured speaker cones can be repaired with plastic rubber obtainable at local hardware or five-and-dime stores. To repair a tear, align the torn edges and apply the plastic rubber evenly along the length of the tear; if possible, apply a second coat of the plastic rubber to the tear on the other side of the cone. Holes can be mended by simply placing a small piece of paper over the hole and securing it with the plastic rubber.

—George Lockhart IV

TWO-WAY CONNECTOR PLUG

You can make two-way plugs for your headphones or test leads that will fit into both phone tip and banana jacks. Simply insert the threaded part of a banana

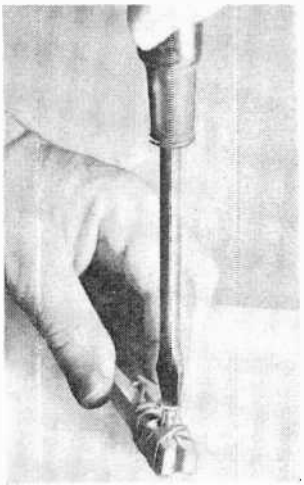


plug into the hollow sleeve of a phone tip. Then wrap the end of one lead from the phones or test prods around the center of the two plugs and solder them together as shown in the photo. You can also make a pair of two-way jumper leads by soldering these combination plugs at each end of a pair of flexible wires.

—Art Trauffer

CLOTHESPIN SCREW-STARTER

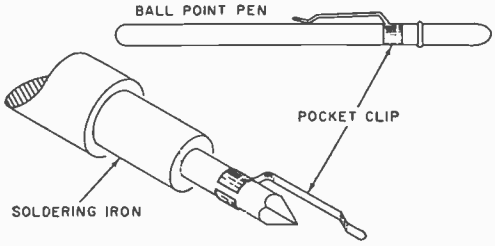
Starting machine or wood screws is easy with this screw-starter made from a spring-type clothespin. Just place the screw in the jaws of the clothespin —the jaws will take all the wear and tear your fingers would normally get. Wrap a heavy rubber band around the jaws as shown to hold the screw securely. Once the screw is started, you can simply unclamp the clothespin and drive the screw home.



—Glen F. Stillwell

HOMEMADE SOLDERING TIP

Would you like to be able to solder miniature components on printed-circuit boards with a large-size iron? You can make a small soldering tip out of the



pocket clip of a ball-point pen. All you need do is push the clip onto the tip of your iron and do your soldering with the end of the clip. Be sure that the clip fits snugly; crimp it in place with a pair of pliers if necessary. It will take a few extra moments for the new tip to heat up, but you'll be able to solder tiny parts without damaging them.

—George Finegold

BEST BUYS IN STEREO AND MONO HI-FI

New Stereo/Mono 4-Track Tape Deck RP100
Semikit (electronics in kit form) $289.95 Wired $395.00

New FM-AM Stereo Tuner ST96
Kit $89.95 Wired $129.95
Incl. FET

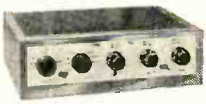
New 70-Watt Integrated Stereo Amplifier ST70
Kit $94.95 Wired $144.95

New 40-Watt Integrated Stereo Amplifier ST40
Kit $79.95 Wired $124.95

28W Integrated Stereo Amplifier HF81
Kit $69.95 Wired $109.95

FM Tuner HFT90
Kit $39.95 Wired $65.95
Incl. FET Metal Cover $3.95

AM Tuner HFT94 Incl. FET
Kit $39.95 Wired $65.95



Stereo Preamplifier HF85
Kit $39.95 Wired $64.95

Stereo Power Amplifiers

	Kit	Wired
100W HF89:	$99.50	$139.50
70W HF87:	$74.95	$114.95
28W HF86:	$43.95	$ 74.95

Stereo/Mono Changer/Player 1007 with stereo cartridge and dual sapphire styli $49.75

Bookshelf Speaker System HFS1 Kit $39.95 Wired $47.95

BEST BUYS IN CITIZENS TRANSCEIVERS, HAM GEAR, RADIOS

Citizens Band Transceivers from
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Wired $89.95

New 60W CW Transmitter #723
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Transistor Portable Radio RA6
Kit $29.95 Wired $49.95
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BEST BUYS IN TEST EQUIPMENT

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Model 1078 (7½ amps)
Kit $42.95 Wired $54.95

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Electronic SPEED MAIL

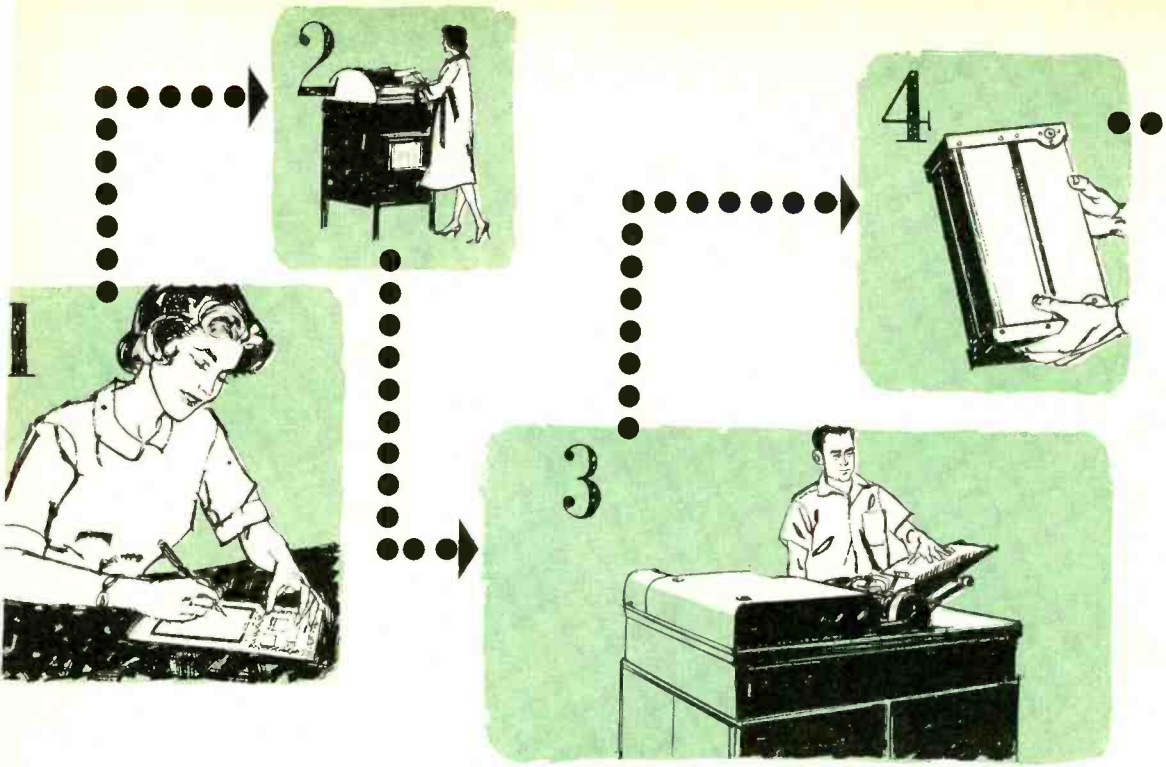
Speeding trains and transcontinental jets fade into oblivion as the U. S. Post Office turns to electronics to meet the challenge of the space age

By KEN GILMORE

LAST November 1, the Postmaster General gave the signal that put into operation one of the most revolutionary systems in the history of the Post Office Department. At the signal, a letter was inserted in a machine in Washington, D. C. Three seconds later, another letter, identical to the one in Washington, popped out of a machine in Chicago.

Hundreds of other letters—all official government mail—followed at the rate of one every four seconds for each pair of sending and receiving machines. Since there were four such pairs operating in each direction, letters flowed at the rate of one every second between the two cities. The long-awaited age of "Speed Mail"—the Post Office Department's name for this brand-new service—had begun.

Actually, the November operation was only a test. Although some 40 government agencies transmitted large amounts of official mail to check the system's



capabilities, *you* can't send letters by Speed Mail—yet. And you probably won't be able to for two or three years. But the experiments last fall did prove beyond the shadow of a doubt that the system is entirely practicable.

If present plans work out, "Speed Mail Centers" will be established in the country's 71 largest cities. Such a system would mean same-day or next-day delivery anywhere in the country. The limiting factor, of course, will be the time required to handle the mail at each end—pickup and delivery to the local post office at the sending end, local delivery at the receiving end. The actual transmission to the next state—or across the country—will take only a few seconds.

Let's see — step-by-step — just how Speed Mail will work. Say you live in Washington, D.C., and want to send a letter to a friend in Chicago. Within a few hours, your letter will go through 12 operations and be in your friend's hands.

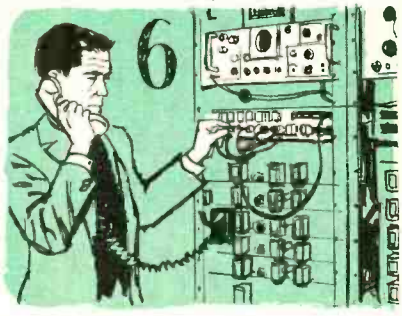
1 You'll write the letter on a special form, similar to the one used for "V-Mail" during World War II. Since part of the form will be trimmed away during the automatic handling process, you'll have to write only within the form's heavy black lines.

2 You put the letter in a mail box, or take it to the post office. There, instead of being dropped in a bag bound for Chicago, it is sent through a "coder" which stamps the date on it. The machine also marks the letter's destination —Chicago—on the outside of the envelope in a code that an electronic device will be able to read later in the process.

3 A trimming machine slits the sides and opens your letter; if you wrote only within the lines provided, no part of your message is cut away. To insure secrecy of the mails, letters are opened inside the machine so that no one can see their contents.

4 Your letter and between 450 and 500 others are stacked in a cartridge within the trimming machine. The cartridge, like every other letter-handling device in the process, is specially designed to provide secrecy.

5 The locked cartridge is slipped into place in a "reading" machine. An operator then pushes a button and several different operations begin. First, the cartridge is opened and the letters

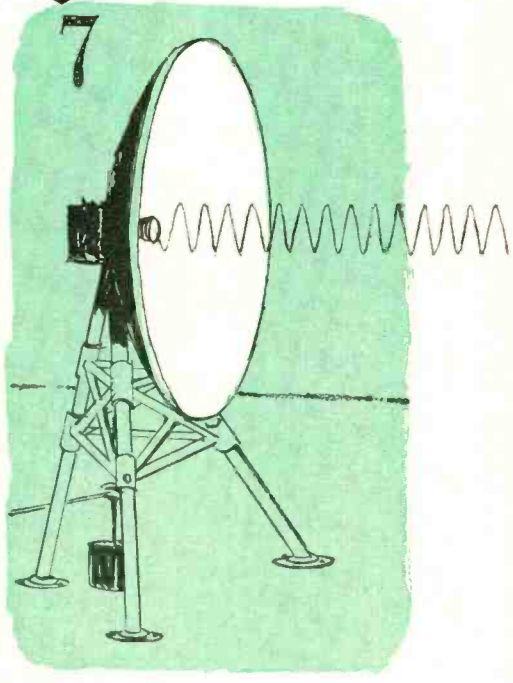


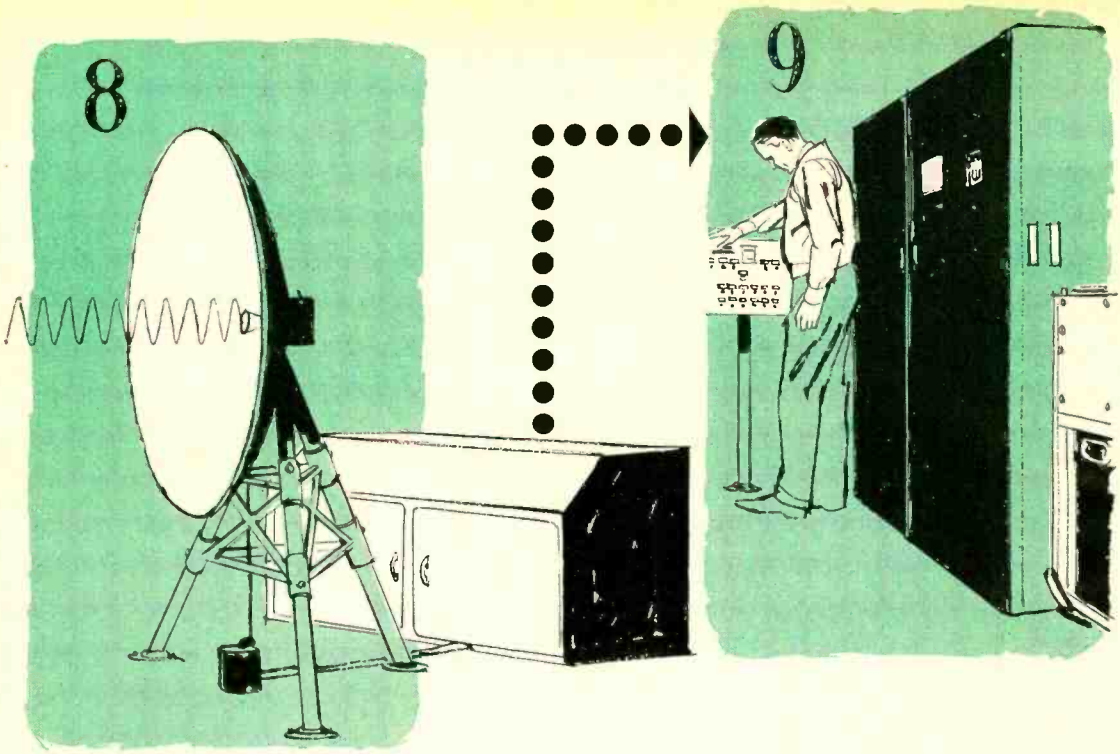
automatically removed, one at a time. Suction cups grasp each letter, pull it out flat, and move it under an automatic scanner.

As each letter slides into place, it trips a photoelectric cell circuit, which starts the scanning process. A facsimile beam sweeps across your letter, very much like the beam which sweeps across the screen in your television set and creates the picture.

6 The signal from the scanner is routed to the transmitter and mixed with the control signals. (As in television, a complete signal is formed which not only contains the modulation signal, but also the scan synchronization, start and stop printing signals, and so on.) The photoelectric cell has signaled a receiving machine in Chicago that your letter is on its way, and a facsimile scanner in Chicago has started to sweep in exact synchronization with the one in the transmitting machine.

Simultaneously, your original letter, already copied, is stacked in another locked cartridge, which cannot be opened except in the machine. When the operators are sure that the transmission has





been successful, the stored letter is destroyed.

7 The mixed, composite signal is routed through microwave links and coaxial cables to its destination.

8 & 9 At the receiving point, the electronic signal representing your letter is sent to a special xerographic printer. Here's how it works.

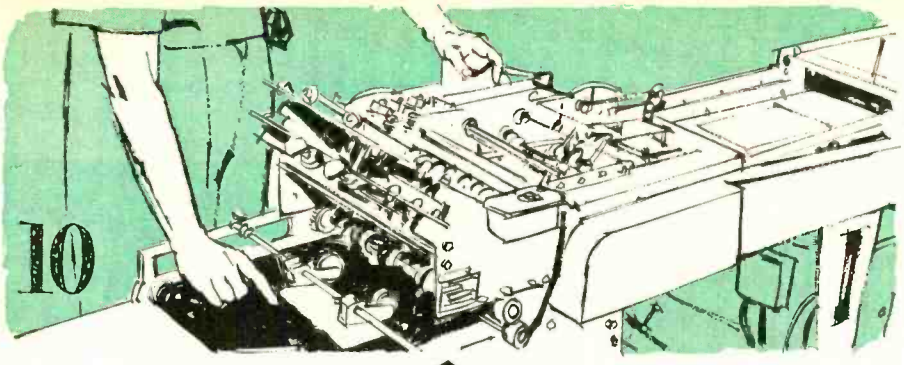
You'll remember that as the beam swept across your letter in the "reading" machine in Washington, it generated synchronizing pulses, one for each sweep. Those pulses kick off a beam in the receiver in Chicago, which sweeps across the face of a cathode-ray tube in exact synchronization with the reading beam. A scanning synchronization signal generated at the transmitter makes sure that the luminous spot at the receiver starts its sweep at exactly the same time as the one at the transmitter, so that each new "picture" starts at the same time.

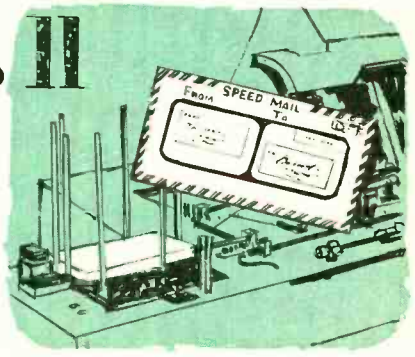
Now let's visualize these sweeping beams in slow motion. As the scanning beam in Washington makes its first sweep across the paper, it "sees" a combination of light and dark spaces formed by the pattern of your writing on the page. At each dark spot, the Washington transmitter sends out a signal.

Simultaneously, the beam in Chicago is sweeping across a selenium drum at the same rate. Since selenium is a photosensitive material, an electrostatic charge can be stored on its surface in the dark. Wherever light hits the surface, the charge will leak off; parts not struck by light remain charged.

Every time the beam sweeps across the selenium drum, it puts out a series of light flashes. And each time the scanning beam in Washington hits a dark spot—your writing—the beam in the printer in Chicago flashes and the selenium drum "charge" at that point leaks off. Thus, as the scanner in Washington moves down the page (it sweeps across the page 120 times for each inch of paper) and the drum rotates under its scanning beam at the same rate, a pattern of charges is built up on the drum, corresponding exactly to your writing on the original letter.

Of course, you can't see this pattern of electrical charges. To make it visible, the drum is sprayed with a dark powder





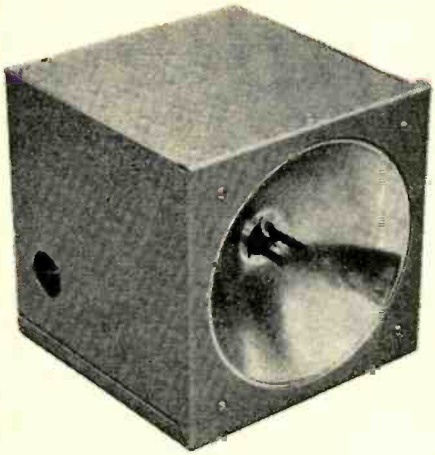
which is electrically charged so that it will stick only to the parts of the drum which correspond to the dark lines on your original letter.

The drum rotates, and this powdered portion is brought in contact with a piece of paper which is also charged to attract the dark powder. The paper pulls the powder from the drum, and the words and letters of your original message appear in black powder on the paper. The paper is then "baked" in order to fuse the powder with the paper.

10 As the completed letter comes from the oven, a signal from the transmitter in Washington trips a knife, which cuts the letter to size. It then passes through a series of rollers, is folded, and sealed.

11 For additional security, the folded and sealed letter is now automatically put into an envelope with two special windows—one for the address, the other for the return address. The envelope is also sealed.

12 Your "Speed Mail" letter is delivered to your friend through regular mail channels, only a few short hours after you wrote it. —30—



WHAT is probably the most common fire detection and extinguishing system—the overhead sprinkler—has one chief disadvantage. When a fire breaks out, the heat must reach a certain level before the sprinkler will activate; in the meantime, considerable damage can take place. The fire alarm to be described here will detect fires *before* any damage is done.

Detection is accomplished by means of infrared radiation. An infrared cell "discovers" the fire the instant it breaks out, converts this information into an electrical signal, and amplifies it. The alarm then operates an external warning system—such as a bell or light—and can even be used to control an overhead sprinkler system.

Due to its special circuitry, the alarm will respond only to the flame "flicker" and not to other sources of infrared such as sunlight or room lights. The unit will operate indoors or out, under natural or artificial light as well as in complete darkness. Parts cost about $30 or less, depending on the number of sur-

FAST ACTING FIRE ALARM

Fire-control action is almost instantaneous with this infrared-operated device

By **CHARLES CARINGELLA,** W6NJV

plus and junk-box components you can muster.

Construction. The alarm is housed in a 6″ x 6″ x 6″ box with a 5″ hole cut in one end to accommodate the reflector. Although there are many reflectors that would be suitable, the one in the model came from an auto junk-yard. It was originally used in an old-style headlamp of the type common before the days of "sealed beams."

The infrared detector itself (*PC1*) is mounted at the focal point of the reflector on a "U"-shaped bracket fashioned from a thin sheet of copper strip about ¼″ wide. To find the focal point of the reflector, point it towards a light, focus the image of the light on a small piece of white paper, and measure the distance from the back of the reflector to the surface of the paper. In the model, each leg of the "U" is 1″ long, since the focal point of the reflector proved to be 1″.

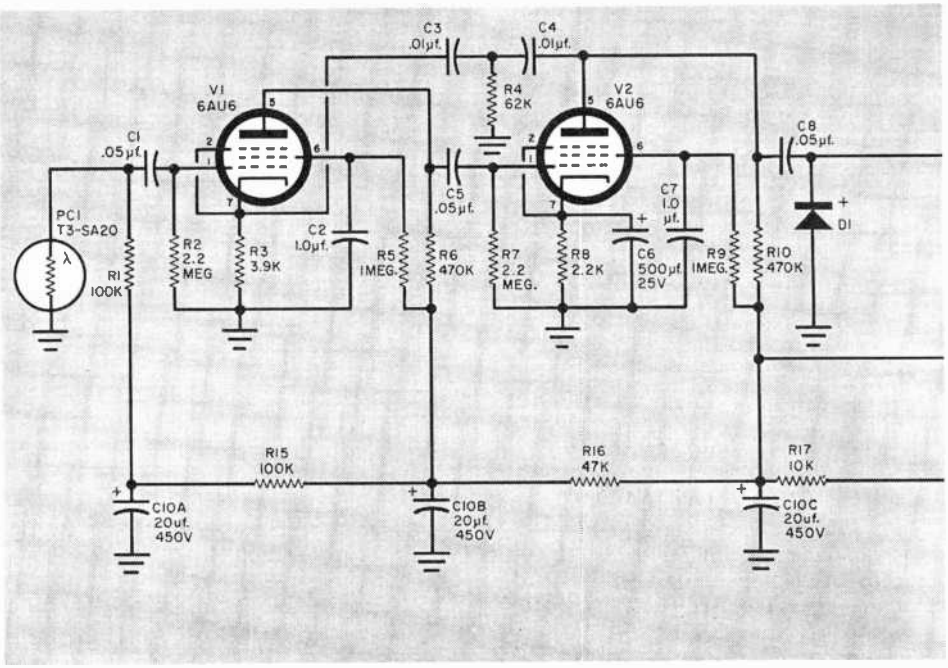
Before soldering the "U" bracket to the reflector, mount the detector by applying a small bit of melted wax to its back surface and pressing it down on the bracket just before the wax hardens. Be careful in handling the detector since it is very delicate.

The amplifier/relay circuit is built on a separate 1½″ x 4⅞″ x 5¾″ chassis; placement of the major components can be seen in the photos on page 49. The pin jacks, *J1* and *J2*, are mounted on the side of the chassis; a hole should be cut in the side of the cabinet to allow free access to them. The power cord is brought out the back through a ⅜″ rubber grommet.

Setting Up the Alarm. First, check the voltage at pin 7 of tube *V4*. It should measure about 350 volts d.c.

If an audio generator is available, a suitable test signal—say 30 millivolts at 30 cycles—can now be inserted at pin 1 of the first amplifier tube, *V1*. (Waving a flashlight back and forth across the front of the reflector or even burning a small piece of cardboard in front of the unit will accomplish the same purpose.) With the signal injected, the voltage across capacitor *C9* should build up to about 50 volts; with no signal

Culver Pictures



PARTS LIST

C1, C5, C8—0.05-μf., 400-volt capacitor
C2, C7—1.0-μf., 400-volt capacitor
C3, C4—0.01-μf., 400-volt capacitor
C6—500-μf., 25-volt electrolytic capacitor
C9—20-μf., 250-volt electrolytic capacitor
C10a/C10b/C10c/C10d—20/20/20/20-μf., 450-volt electrolytic capacitor
D1, D2—Silicon diodes (Sarkes-Tarzian K-200 or equivalent)
J1, J2—Insulated pin jacks
K1—5000-ohm plate relay, 3.2-ma. pull-in current (Potter & Brumfield LM-5 or equivalent)
PC1—Lead sulfide infrared photoconductive detector (Infrared Industries T3-SA20 or equivalent)
R1, R15—100,000 ohms
R2, R7—2.2 megohms
R3—3900 ohms
R4—62,000 ohms
All resistors ½ watt unless otherwise noted
R5, R9—1 megohm
R6, R10, R14—470,000 ohms
R8—2200 ohms
R11, R13—10,000 ohms
R12—1-megohm potentiometer
R16—47,000 ohms
R17—10,000 ohms, 1 watt
T1—Power transformer, 500 volts CT @ 20 ma., 6.3 volts @ 2 amp. (Triad R-3A or equivalent)
V1, V2, V3—6AU6 tube
V4—6X4 tube
1—6" x 6" x 6" aluminum utility cabinet (Bud AU-1039 or equivalent)
1—1½" x 4⅞" x 5¾" aluminum chassis (Bud CB-1629 or equivalent)
1—Parabolic reflector—see text
Misc.—¼" copper strip, line cord and plug, wire, solder, screws and nuts, etc.

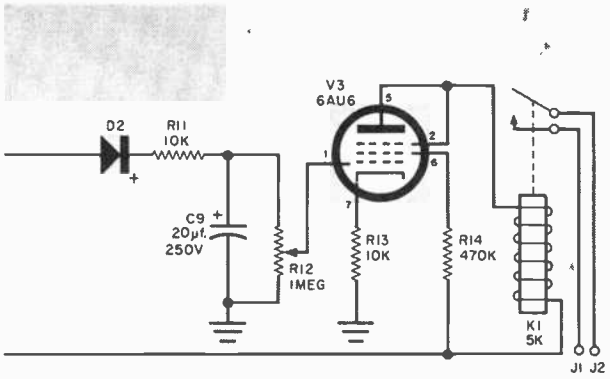
HOW IT WORKS

The "eye" of the fire alarm detector is a lead sulfide photoconductive detector (*PC1*) whose resistance changes rapidly in accordance with the varying radiation of a flickering flame. The detector is mounted at the focal point of a parabolic reflector which collects the energy from a relatively narrow field of view and focuses it onto the detector.

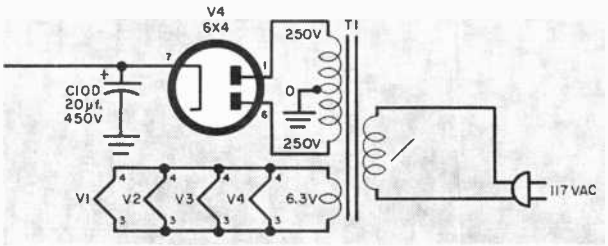
Resistor *R1* serves as the load resistor for the detector, and its function is exactly like that of a plate-load resistor in a vacuum-tube amplifier. The current through *R1* varies as the resistance of the infrared detector varies, and a resulting signal is developed across the load resistor. This signal is essentially an a.c. voltage which varies randomly in amplitude and frequency due to flame flicker. The fact that the flicker frequencies are concentrated mainly in the region below 50 cycles sets the design parameters for the amplifier section of the fire alarm.

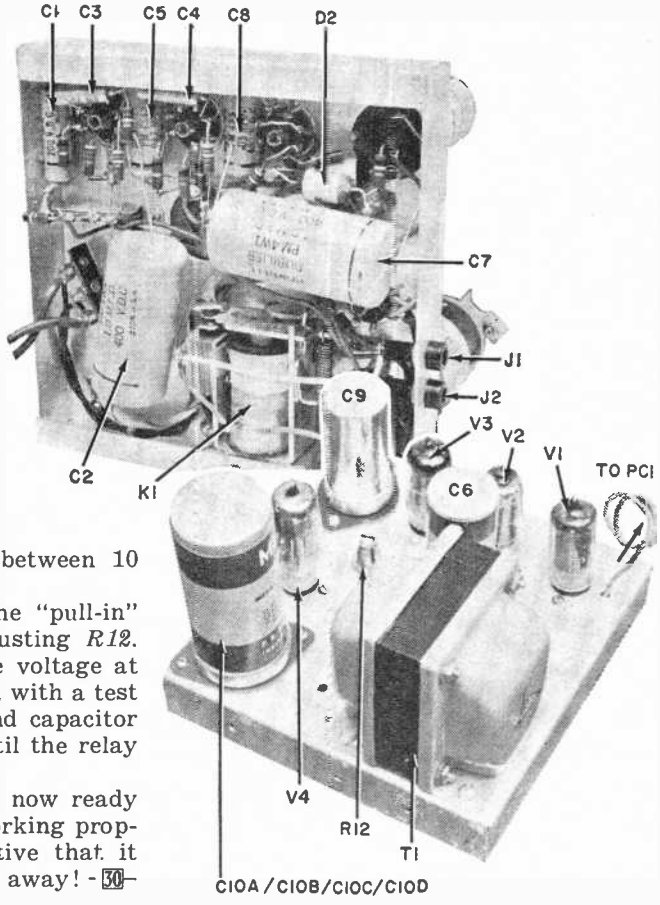
Tubes *V1* and *V2* form a conventional two-stage resistance-coupled amplifier (with the exception of the feedback network) having a voltage gain of approximately 10,000. The amplifier begins to cut off gradually below 10 cycles and will pass frequencies down to about 1 cycle. It also begins cutting off above 40 cycles, with almost complete rejection of frequencies at 50 cycles and above. (This fact enables the system to operate in a fully lighted room, since the detector would otherwise pick up the modulation in the lights.) Cutoff above 40 cycles is accomplished by the feedback network consisting of *C3*, *C4*, and *R4*.

The amplified signal from *V2* is rectified by a half-wave voltage doubler consisting of *D1* and *D2*, the output of which is fed into the integrating circuit *R12* and *C9*. Voltage across *C9* builds up gradually, but only when a number of recurring cycles are present due to flame flicker. The d.c. voltage across *C9* is then applied to the grid of the relay amplifier tube, *V3*. As this applied voltage increases, so does the current through the tube. When relay *K1*'s "pull in" current is reached, the relay closes and sounds the alarm.



Schematic diagram of infrared-operated fire alarm. Bell, lights, or any other warning device should be connected in series with jacks J1 and J2; circuit can also be used to control a standard overhead sprinkler system.





Parts layout should follow the schematic rather closely, with the amplifier and control tubes occupying half of the chassis and the power supply the other half. Potentiometer R12 is slotted for screwdriver adjustment.

present, it should drop to between 10 and 25 volts.

The next step is to set the "pull-in" current of relay *K1* by adjusting *R12*. Turn the control so that the voltage at pin 1 of *V3* reads zero. Then, with a test signal applied to the unit and capacitor *C9* charged, advance *R15* until the relay closes.

The infrared fire alarm is now ready for operation. When it is working properly, the device is so sensitive that it will detect a small fire 50 feet away! -30-

DARKROOM METER

Inexpensive instrument determines correct paper grade and enlarger exposure time

By **HERBERT FRIEDMAN**

IF YOU'RE ONE OF MANY who have put in a long session in the darkroom and still had very little to show for the time spent, you're ready for a darkroom meter. Properly used, such a device can save enough time and printing paper to pay for itself in a week or less. Even more important is the fact that your prints should take a decided turn for the better.

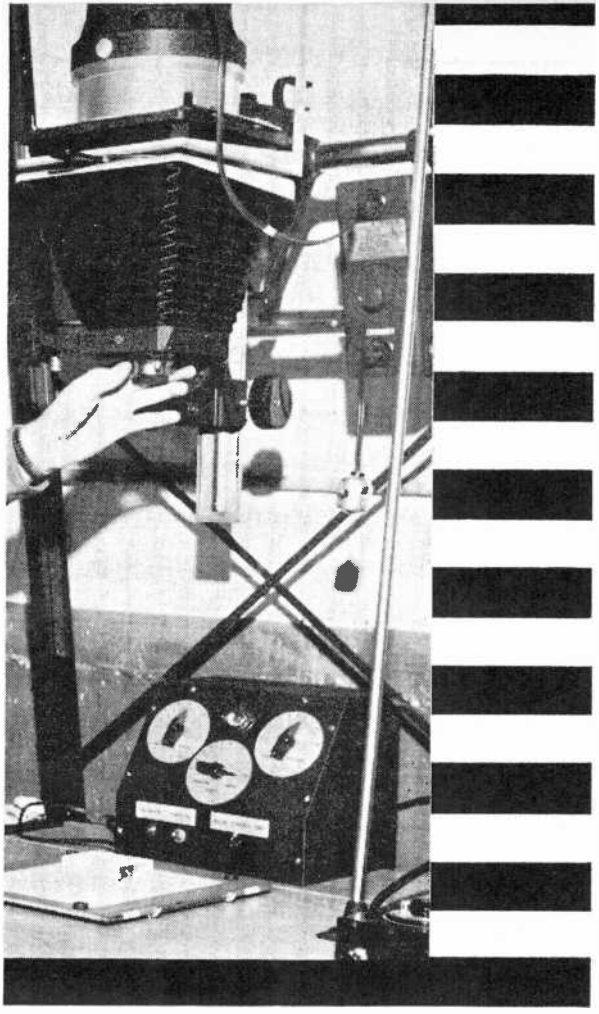
The darkroom meter pictured here indicates both the proper grade of paper and the correct exposure time. It uses no special parts, other than the photocell, and can be built for less than $20.

Construction Details. The meter is housed in an 8″ x 10-1/16″ x 8″ sloping panel cabinet. The sloping area is used only for the three indicating controls and the electron-ray tube; the dials are mounted on the front of the sloping area and are made as large as possible to reduce read-out error.

For ease in wiring, the power supply is built as a subassembly on an aluminum 2″ x 6″ x 4″ chassis. The mounting nuts of the *Power* switch (*S2*) and *Calibrate* control (*R1*) hold the power supply to the front panel.

Note carefully the wiring of the *Grade/Time* switch (*S1*) as shown on page 53. In the "Standby" position, this switch cuts off the B+ to the electron-ray tube and thus prevents fogging the enlarging paper.

The photocell (*PC1*) is mounted on an aluminum frame, made by bending a piece of aluminum into the shape shown



OPERATING INSTRUCTIONS

1 With the *Grade/Time* switch at "Standby," turn the darkroom meter on and let it warm up for two minutes.

2 Focus the negative on the easel with the lens "wide open."

3 Set the *Paper Grade* control to "CAL," and the *Grade/Time* switch to *Grade*.

4 Place the photocell under the maximum shadow area (maximum light) and adjust the lens diaphragm until the electron-ray tube opens.

5 Move the photocell under the highlight area (minimum light) and rotate the *Paper Grade* control until the electron-ray tube opens. The control setting will indicate the paper grade for normal results with the negative being used.

6 Set the *Printing Index* control for the type and grade of enlarging paper being used. For example, if the paper used is Kodabromide Grade 2, set the *Printing Index* control to "3200." (Refer to Chart C on page 123.)

7 Set the *Time* control to "10" seconds and the *Grade/Time* switch to *Time*. Place the photocell under the maximum shadow area, and adjust the lens diaphragm until the electron-ray tube opens. The enlarger is now set for a 10-second exposure.

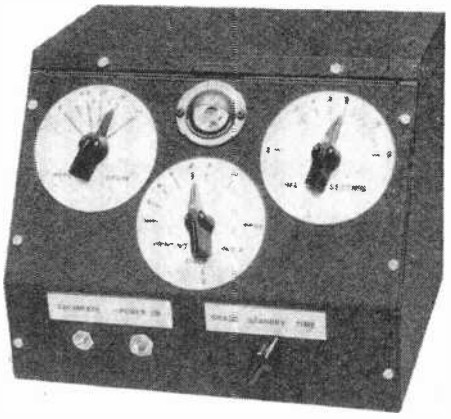
8 Since the electron-ray tube's green target glow is strong enough to fog printing paper, return the *Grade/Time* switch to the "Standby" position when making the exposure.

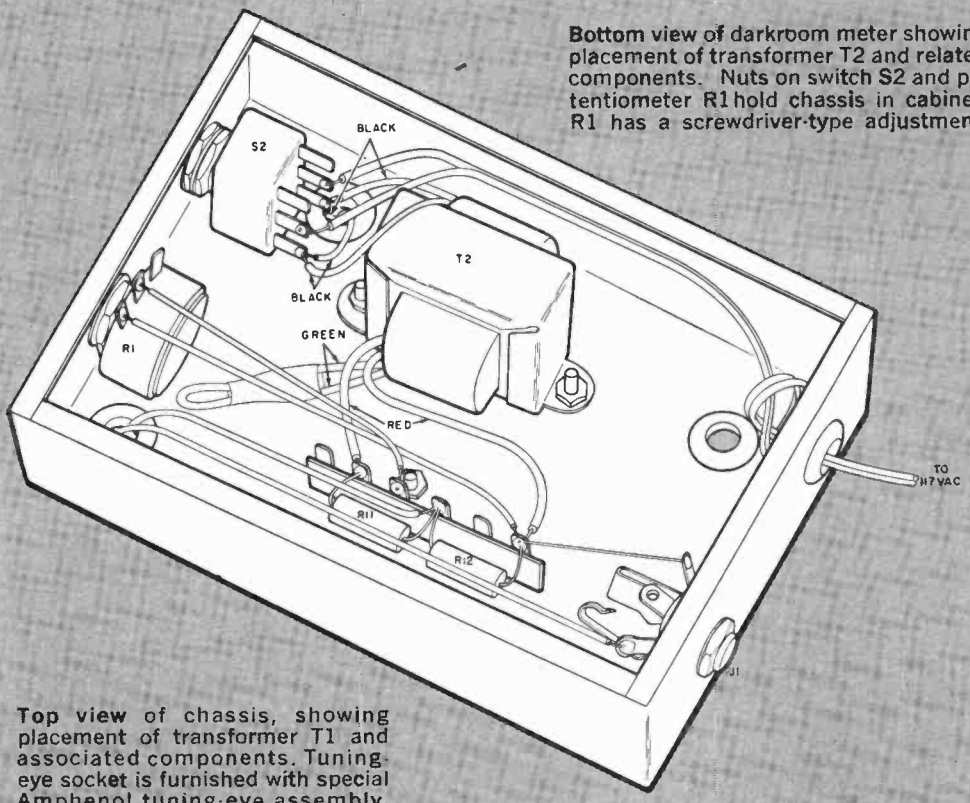
NOTE: If greater print density is desired, set the *Printing Index* control slightly lower than the value given in Chart C. If less print density is desired, set the *Printing Index* control to a higher value.

on page 54. The top surface of the photocell frame should extend approximately ⅞" above the printing easel.

After bending the aluminum to the required shape, drill a 7/32" hole in the center and paint the frame white, using an enamel spray paint. The photocell should be centered under the hole and held in place by a metal strip as illustrated. Wrap a few turns of plastic tape around the metal strip to prevent short-circuiting the photocell's leads. A three-circuit plug (*PL1*) is used for connecting the photocell to the instrument. The photocell leads are connected to the plug's tip and ring, isolating the photocell leads from ground.

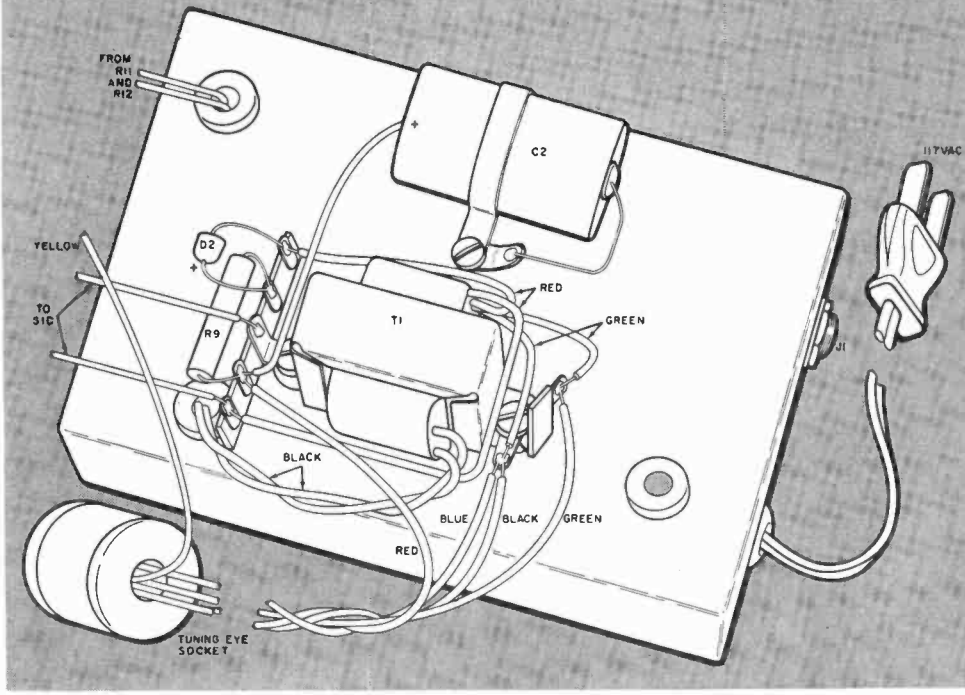
Other construction is generally straightforward. Note that the terminal

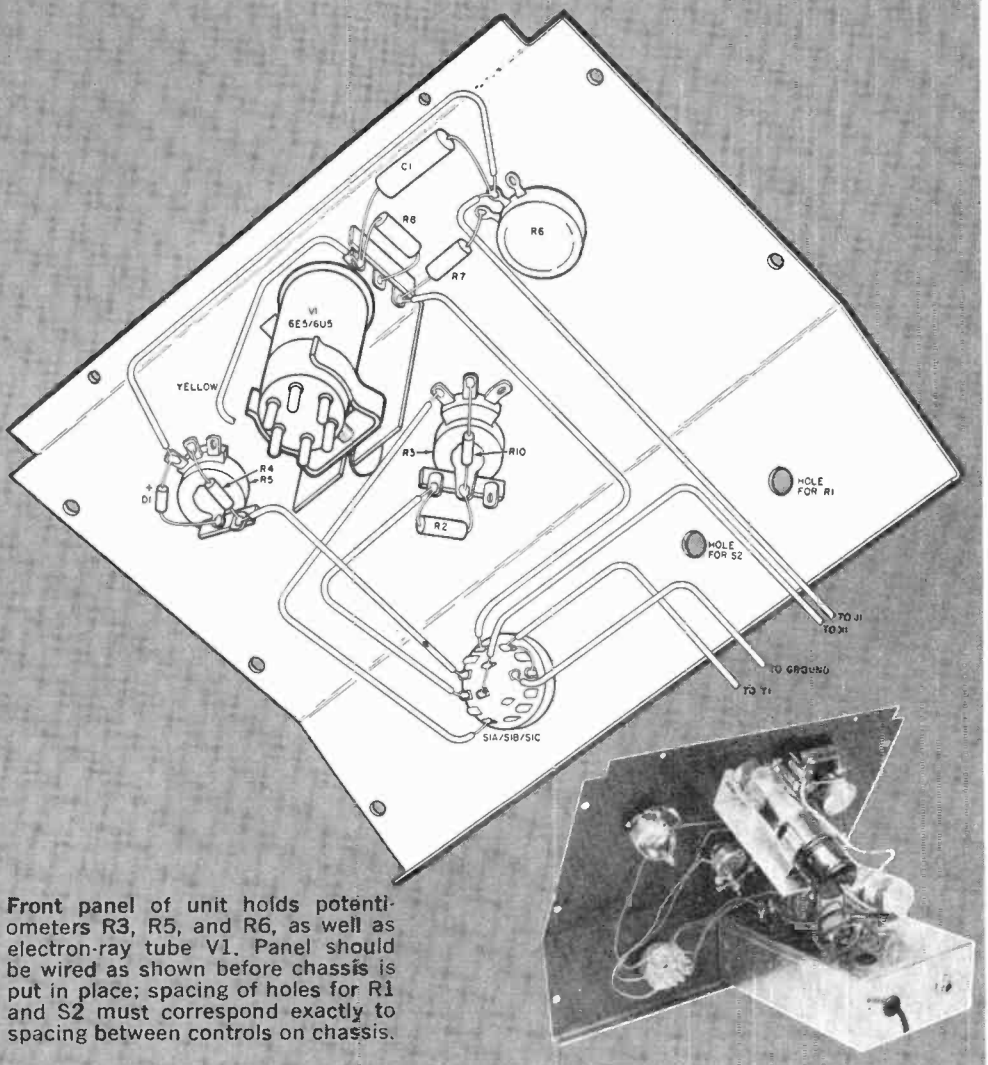




Bottom view of darkroom meter showing placement of transformer T2 and related components. Nuts on switch S2 and potentiometer R1 hold chassis in cabinet; R1 has a screwdriver-type adjustment.

Top view of chassis, showing placement of transformer T1 and associated components. Tuning-eye socket is furnished with special Amphenol tuning-eye assembly.





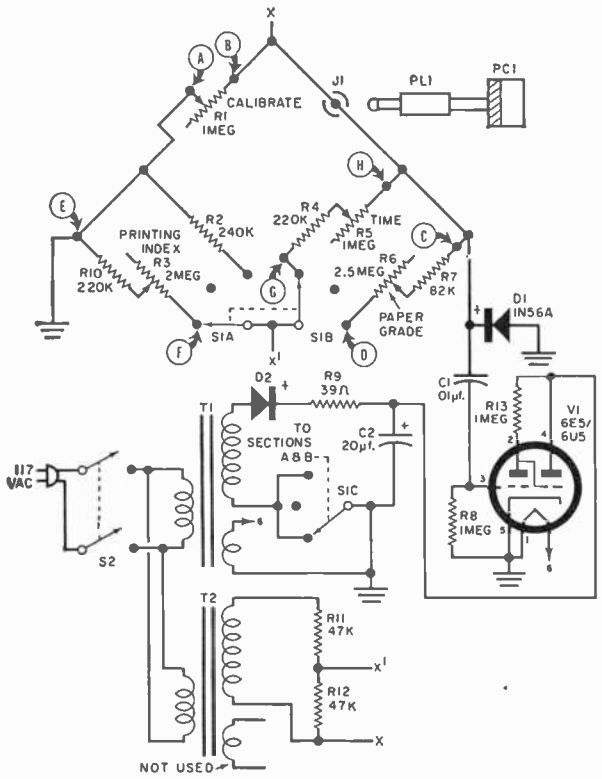
Front panel of unit holds potentiometers R3, R5, and R6, as well as electron-ray tube V1. Panel should be wired as shown before chassis is put in place; spacing of holes for R1 and S2 must correspond exactly to spacing between controls on chassis.

strips shown mounted on the rear of the potentiometers are actually soldered to the potentiometer cases. Watch polarity when soldering the crystal diode (*D1*), and use an alligator clip as a heat sink.

Control Calibration. Once the unit has been wired and all wiring has been carefully checked, you're ready to calibrate the various controls. To begin, place a circular piece of cardboard under the mounting nuts of the three indicating potentiometers (*R6*, *R3* and *R5*). Next, with the photocell unplugged, set the *Grade/Time* switch (*S1*) to "Standby"—the center position—and set all four potentiometers to their full counterclockwise rotation.

Place an ohmmeter across points *A* and *B* (see schematic) and rotate the *Calibrate* control (*R1*) for a reading as close as possible to 570,000 ohms. Next, place the ohmmeter across points *C* and *D*, and mark the counterclockwise position of the *Paper Grade* control (*R6*) as "CAL." Rotate the control to the resistance values in Chart A, and mark the dial accordingly. Note that the dial is labeled with both a brightness and a paper grade scale.

Now place the ohmmeter across points *E* and *F*, and mark as "S" the counterclockwise position of the *Printing Index* control (*R3*) to serve as a reference mark in the event the dial is removed.



HOW IT WORKS

The circuit is a simple four-arm bridge. One arm of the bridge is a photocell whose resistance depends on the amount of light falling on the cell. When the light on the photocell changes, thereby changing the resistance of the cell, the resistance of another bridge arm is varied to rebalance the bridge. By calibrating the variable bridge arm, the light intensity can be expressed in seconds and in paper grade.

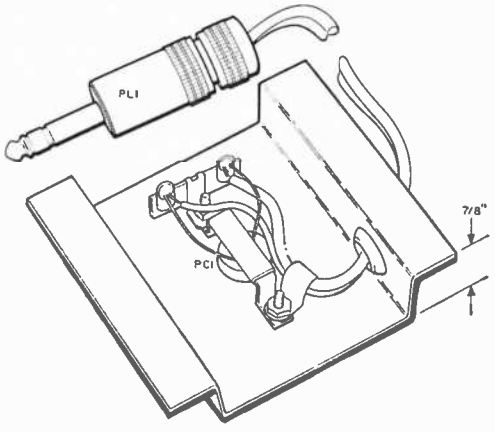
The electron-ray tube gives maximum "eye" opening when zero voltage is applied to the grid. When the bridge is unbalanced, the "eye" starts to close because of the voltage difference across the bridge. The diode in the electron-ray tube input circuit eliminates half of the a.c. cycle, thereby sharpening the electron-ray tube's indication.

Schematic diagram (left) and pictorial (below) give details of darkroom meter circuitry and photocell PC1's mounting assembly, respectively. Points labeled A through H in schematic are used in calibration procedure as explained in text.

PARTS LIST

C1—0.01-μf., 600-volt d.c. capacitor
C2—20-μf., 450-volt d.c. electrolytic capacitor
D1—1N56A crystal diode
D2—Silicon diode (Lafayette SP-197 or equivalent)
J1—Three-circuit jack for PL1—see below
PC1—Photocell (Lafayette MS-791 or equivalent)
PL1—Three-circuit plug (Switchcraft 170 or equivalent)
R1, R5—1-megohm potentiometer (IRC Q13-137 or equivalent)
R2—240,000-ohm, ½-watt, 5% resistor
R3—2-megohm potentiometer (IRC Q13-139 or equivalent)
R4, R10—220,000-ohm, ½-watt resistor
R6—2.5-megohm potentiometer (Ohmite "AB" CA2552)
R7—82,000-ohm, ½-watt, 5% resistor
*R8, *R13—1-megohm, ½-watt resistor*
R9—39-ohm, 1-watt resistor
R11, R12—47,000-ohm, 1-watt resistor
S1—Three-pole, 3-throw rotary switch (Mallory 3243J or equivalent)
S2—D.p.s.t. toggle switch
T1, T2—Power transformer; primary, 117 volts; secondaries, 125 volts @ 15 ma., 6.3 volts @ 0.6 amp. (Stancor PS-8415)
V1—6E5 or 6U5 tube
1—8" x 10-1/16" x 8" sloping panel cabinet (Bud C-1588 or equivalent)
1—2" x 6" x 4" chassis (Bud AC-431 or equivalent)
1—Tuning eye assembly (Amphenol 58-MEA-6 or equivalent)

**Part of tuning eye assembly*

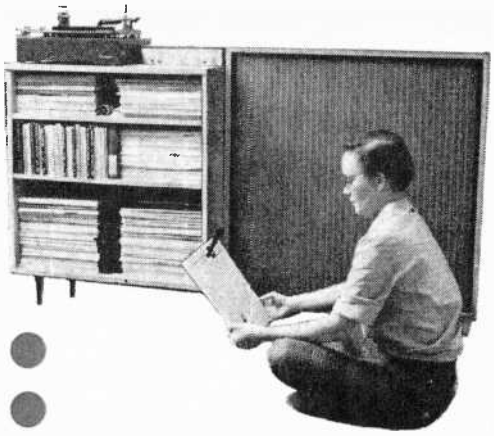


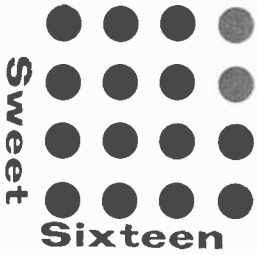
Rotate *R3* to a reading of 570,000 ohms and mark this position as "2000." The other positions are shown in Chart B. (Charts A and B are on page 122.)

Now place the ohmmeter across points *G* and *H*. Rotate the *Time* control potentiometer (*R5*) until the ohmmeter reads 520,000 ohms, and mark this position as "10" seconds. Then rotate the

(*Continued on page* 122)

Step-by-step instructions for adding a super-tweeter to the POP'tronics "SWEET SIXTEEN" speaker system





Sweeter with a Tweeter

By **JIM KYLE,** K5JKX/6

WANT to turn your "Sweet Sixteen" into a speaker system second to none? With an evening's work and an investment of less than $20, you can do it—by adding a super-tweeter.

Response of the basic Sweet Sixteen, described in the January 1961 issue of POPULAR ELECTRONICS, extends from below audibility to just less than 10,000 cycles. As a basic unit, it's hard to surpass. But for the more sophisticated listener, addition of a super-tweeter to extend the range up past 16,000 cycles can add a whole new dimension of sound.

One of the best comparison tests is to play a record of snare drums through the system. With response flat to 10,000 cycles the drums sound real but somewhat muffled. With the super-tweeter added, the drums seem to move out through the speakers into the room! This test, incidentally, is used by a number of professional critics and equipment reviewers to compare speakers, since the sound of snare drums is one of the most difficult to reproduce.

Hold That Transient! While addition of the tweeter will sweeten the sound of the entire system if done properly, it can destroy system performance if you're not careful. Here's why:

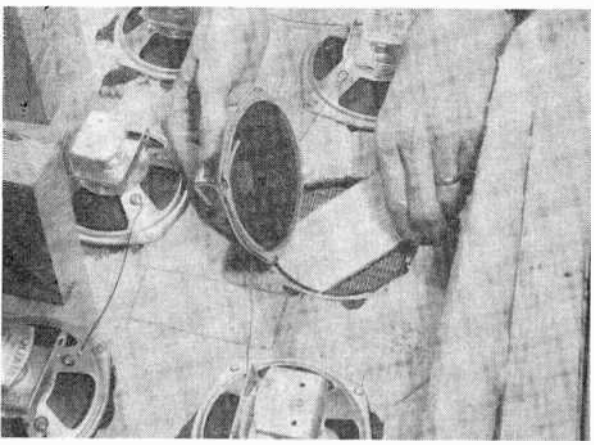
As explained in the original article, the Sweet Sixteen acts in different ways at the two ends of the audio spectrum. At the lower end, it behaves like a single, large cone moving a mighty mass of air. In the upper octaves of its range, it becomes 16 independent speakers moving together, preserving transient response because of the small mass of each individual cone. This excellent transient response in the mid-range is the major reason for the system's sweet sound.

Haphazard addition of a tweeter can completely destroy this characteristic, producing muddiness in the mid-frequencies. Conventional crossover networks made up of inductors and capacitors are major offenders in this respect, since the inductance and capacitance usually resonate at some one frequency and reflect an unrealistic load back into the amplifier.

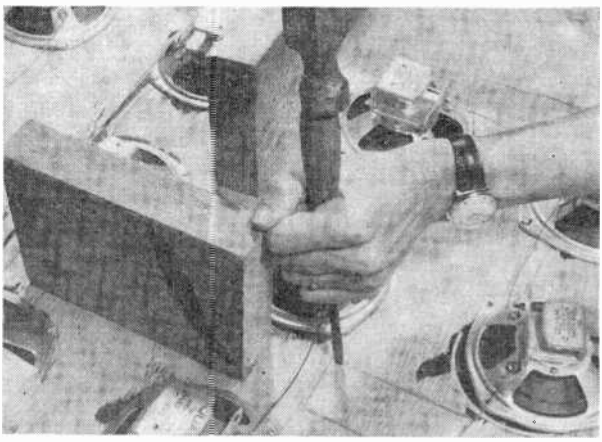
However, if you use capacitance-only high-pass crossovers, the excellent tran-

sient response of the system will be preserved. In addition, since frequency response will now extend beyond the limits of hearing in both directions, the result will be almost complete removal of the "loudspeaker wall" between the music and the listener.

Any tweeter used with the Sweet Sixteen must be a high-efficiency unit to be able to blend with the rest of the system. A Calrad type CT-3 was chosen by the author, but the S-307 (Olson Radio) or H90LX204 (Radio Shack) are similar and would also be suitable; other possibilities include the Electro-Voice T35B and University T202. The procedures described here are based on the use of the CT-3, so the size of the mounting hole and manner of installation may have to be altered slightly if you choose a different tweeter.



Backup block slid under front panel protects grille cloth from damage as tweeter hole is cut.



Chisel and hammer combination is best for making required cutout; tweeter placement is not critical.

Mounting the Tweeter. Place the Sweet Sixteen face down and remove the back, disconnecting the amplifier leads if necessary. To mount the tweeter on the front panel, it's necessary to cut another hole in the plywood.

Since the panel is already covered with grille cloth which cannot be removed without damage, this new hole can pose a problem. The author solved it by removing one speaker from the panel and sliding a small piece of plywood through the hole thus exposed into the space between the panel and the grille cloth (see photo at left). With the plywood acting as a "backup," it was then possible to cut the new hole with a sharp wood chisel.

Dimensions and placement of the new hole are shown on the drawing at right —don't forget to remove the backup block and to replace the speaker after the hole is cut.

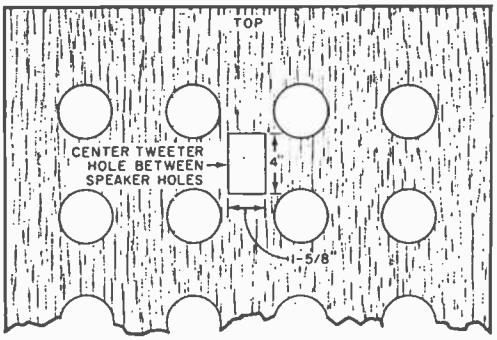
Since the original Sweet Sixteen used 5/16" plywood for front and rear panels, adding the CT-3 will cause the tweeter horn to project approximately 7/16" in front of its mounting lips. To avoid this projection, cut shims from scrap pieces of ¼" plywood and place two shims under each mounting lip. (If your Sweet Sixteen uses a ⅜" or thicker front panel, you won't need the shims.) Tighten the tweeter down with the four ¾" screws specified, and the job is half finished.

Crossing Over. The next step is assembly of the crossover network and presence control. Before this can be done, you must pick the proper value of crossover capacitor, and this value will be determined by the impedance for which your system is built. With a 16-ohm unit, use a 3-μf. capacitor. If your Sweet Sixteen is connected for a 4-ohm impedance, use a 12-μf. capacitor. For other impedance levels, divide 48 by the impedance level in ohms and the result will be the capaci-

tor value in microfarads. A miniature metallized-paper unit will serve very nicely, but do *not* use an electrolytic. Voltage rating of the capacitor need not be greater than 50 volts.

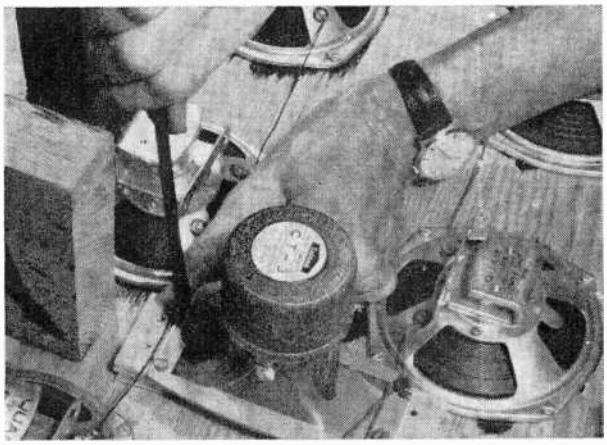
Solder the capacitor to one of the outside terminals of the 50-ohm wire-wound "presence control" potentiometer as shown in photo below, right. Connect 2-foot wires to the other capacitor lead and to the central terminal of the potentiometer.

Next, decide where on the rear panel you want to locate the presence control (the author chose the top center) and drill a $\frac{3}{8}$" hole from the outside of the panel. Cut away just enough of the acoustic padding to allow space for the potentiometer, and mount the control on the panel.

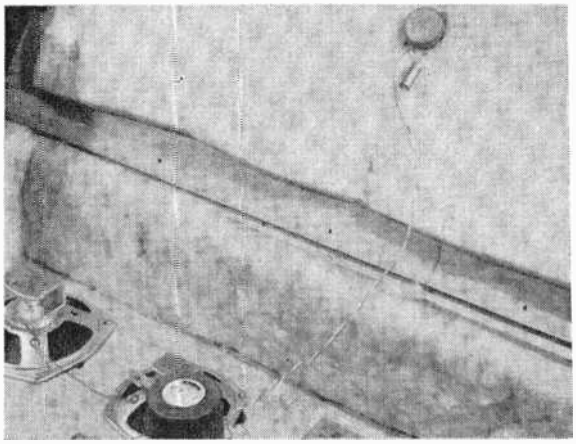


Cutout for tweeter should measure 4"x1$\frac{5}{8}$" as shown if a Calrad type CT-3 is used; other tweeters may require a different size hole.

Photos by John Kedroff



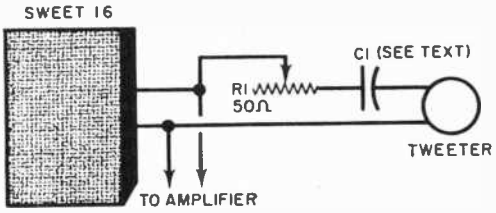
Screws hold tweeter securely to front panel; shims prevent unsightly bulge due to projections on horn.



Potentiometer and capacitor are added to prevent low frequencies from reaching delicate tweeter cone.

Connect the wire from the capacitor to one terminal of the tweeter, and attach another length of wire to the other tweeter terminal. Connect this new wire to one of the amplifier leads, and solder the wire from the presence control to the other lead as shown in the wiring diagram. Phasing is immaterial. Now replace the rear panel.

Final Touches. The only thing left to be done is to balance the super-tweeter with the 16 basic speakers. With the presence control at one end of the range, high notes will sound shrill; at the other end,



Schematic diagram of a recommended hi-pass filter for use with super-tweeter.

PARTS LIST

C1—Paper capacitor—see text
R1—50-ohm, 2-watt wire-wound potentiometer
1—Super-tweeter (Calrad CT-3 or equivalent)
4—No. 8 wood or sheet-metal screws, ¾" long
4—¼" x ⅝" x 1½" plywood shims—see text

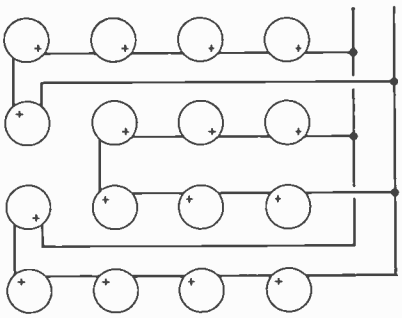
the modification will not be detectable. The proper balance is somewhere in between.

The procedure is simple. Play a record with drums, trumpets, or vocal performances. Set the presence control for least treble, then gradually increase it (amplifier tone controls should be in the flat position). When the drums *just begin* to sound "live," the trumpets "raspy" (like live trumpets), or the vocalists "breathy," you have the proper balance. Further adjustments should be made with your amplifier tone controls. -30-

MORE ABOUT THE "SWEET SIXTEEN"

Enthusiastic reader response to the "Sweet Sixteen" speaker system (described in the January, 1961, POPULAR ELECTRONICS) has exceeded our wildest expectations. Our offices have been deluged by literally hundreds of letters, and we've done our level best to answer each one individually. Since some of the points raised are of general interest, we thought you might like to hear about them, too.

One of the most frequent questions we have received concerns impedance—many speaker systems are rated at 8 ohms and readers want to use the Sweet Sixteen with existing systems. Several different arrangements will fill the bill, and a hookup which produces an impedance of 7 ohms is shown in the diagram. But we recommend wiring the Sweet Sixteen for 4 ohms as shown in the original article and paralleling it across the existing 8-ohm speaker; don't worry



about the slight apparent mismatch since speaker impedance ratings are only nominal anyway.

An allied question is that of which impedance to use with an amplifier when you have a choice. In this case, the 16-ohm hookup is recommended, since amplifier feedback taps are usually taken from the 16-ohm output. Connecting the system there will bring the speakers more under control of the amplifier's feedback loop.

The next most frequent inquiry has to do with the dimensions of the enclosure. They're not critical; in fact, hardly anything connected with this system is critical—and that's one of its greatest advantages. The box need not be square, and its depth can be whatever you like. Just be careful not to move the cones farther apart than twice their own diameter, or they may fail to couple properly to the air at very low frequencies. Wood thickness can be whatever is handiest, and the final decor can naturally be changed to suit your own taste. However, use of extra-heavy front and rear panels is unnecessary, since the internal bracing and 2" x 6" side rails provide all the physical strength needed.

Although the original article specified Quam Type 5A07 speakers, any similar unit should give equal results. Theoretically, using speakers from a number of different manufacturers should give a smoother response—slight differences in construction would tend to fill in "valleys" and to level "peaks." But using speakers from the same manufacturer does simplify the problem of speaker phasing.

Magnet weight isn't critical. In fact, the 0.65-oz. magnet of the 5A07 is heavier than needed. The only time magnet weight becomes important in a speaker is when the cone is traveling over a long path, and cone movement is imperceptible in the Sweet Sixteen.

Several readers have inquired about using a larger number of smaller speakers or fewer but larger units, and many have asked why the number 16 was chosen. The answers to these questions are interwoven.

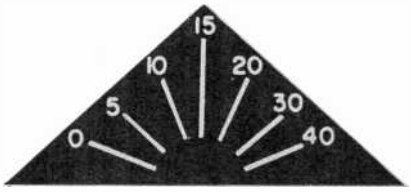
If a speaker much larger than 5" is used, cone mass will be larger and transient response will suffer in the upper mid-range. However, bass response will remain good and fewer speakers will be necessary (the author's first system of this type used two 8" and one 12" unit, giving response to 30 cycles and below). If a speaker much smaller than 5" is chosen, many more will be needed for adequate bass response, but treble response will be slightly better. The best compromise is obtained with 5" or 6" speakers, and the 5" unit was chosen so that holes could be cut with a drill rather than with a saber-saw.

Why 16 speakers? Without going into deep theory, it has been determined by experiment that bass response goes down approximately one octave every time the number of speakers is doubled. Thus, with response flat to 320 cycles for a single 5" speaker, two speakers are flat to 160 cycles, four to 80 cycles, 8 to 40 cycles, 16 to 20 cycles, 32 to 10 cycles, 64 to 5 cycles, and so on. To reach 1 cycle, you would need at least 256 speakers. Since true response to 20 cycles will meet all musical needs, 16 speakers were chosen.

By the same token, splitting the Sixteen for stereo use probably wouldn't give the results you would expect. The formula holds true only when all the speakers are close together, so a Split Sixteen would be flat only to 40 cycles, thus losing some of the essential bass.

Make Your Own DIALS and NAMEPLATES

By HERBERT FRIEDMAN



THOUGH it's easy to get professional components for home-built equipment, it has always been a problem to make good-looking labels to order. Now, however, making your own professional-quality dials and nameplates can be as easy as printing your favorite snapshot.

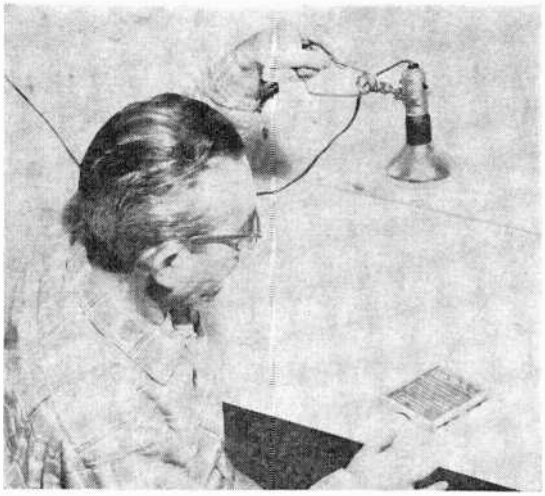
"Metalphoto," the photosensitive aluminum plate which makes it all possible, is processed with simple darkroom equipment and standard chemicals. A kit of twelve 4″ x 5″ plates, with the necessary chemicals, is available from the Metalphoto Corporation (6811 Superior Ave., Cleveland 3, Ohio) for $10.00 plus postage. Follow the techniques shown on these pages, and really dress up your next project.

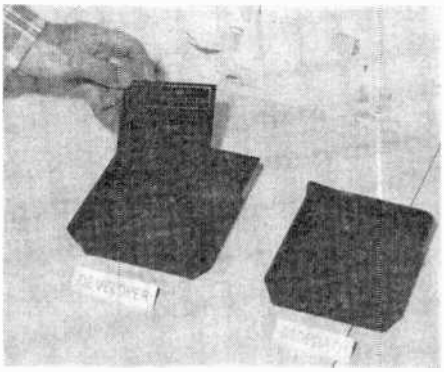
You'll find that it's easier to make a reversal plate . . .

. . . but it only takes a little extra time and work to make a positive.

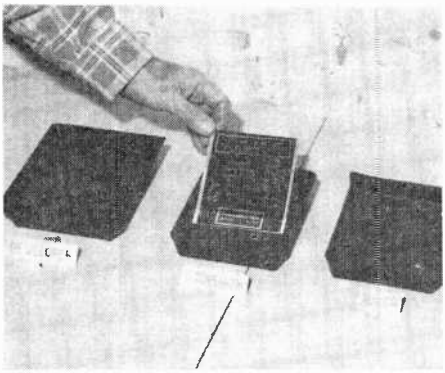
1 Start with a full-scale drawing of the dial or label, using India ink on tracing vellum. Lettering guides such as Lafayette Radio's F-78 set will give professional-looking results.

2 To make a reversal plate, lock the tracing in a printing frame (face towards the glass) with a Metalphoto plate (sensitized side towards the tracing). For a positive plate, make a negative (see instructions below, right) and substitute the negative for the tracing. Expose the plate according to the Metalphoto Exposure Guide. Like all photographic material, Metalphoto plates will "fog" if exposed to normal light, so use only a red safelight through Step 4.





3 Briefly rinse plate in water, then place it in developer for 6 to 8 minutes. Remove it when characters look sharp and clear.



4 Place plate in stop bath for 30 seconds, or sponge it for 30 seconds under running water. Immerse plate in fixer for 2 minutes. After fixing, room lights can be turned on.

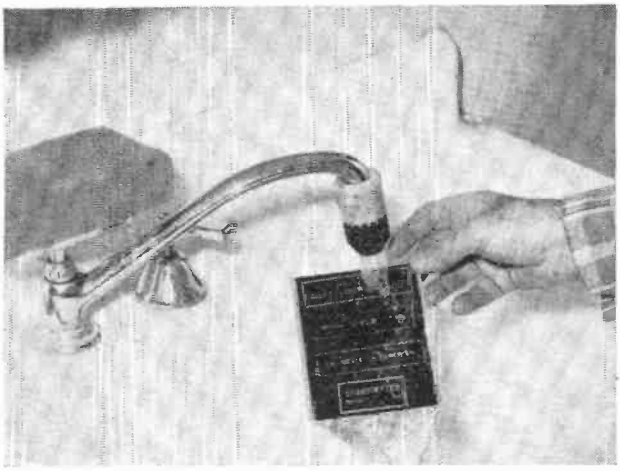
HOW TO MAKE A NEGATIVE

Lock the tracing in a printing frame (face towards the glass) with a sheet of high-contrast film such as Ansco Reprolith Ortho Type "B" (emulsion side towards the tracing). Expose the film, using a 15-watt bulb 3 feet from the frame (exposure time is 5 seconds with the above-mentioned film). Process the film according to the manufacturer's instructions, and be sure to use a high-contrast developer such as Ansco Reprodol. When the negative is dry, you are ready to make a positive plate.

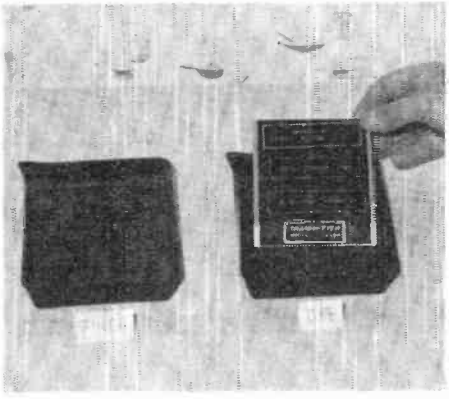
METALPHOTO EXPOSURE GUIDE

Light Source	Distance from Frame	Exposure Time
FOR REVERSAL PRINTING		
30-40 watt-second electronic flash	2′	1 flash
50-80 watt-second electronic flash	18″	1 flash
300-watt reflector photoflood	8′	5 seconds
100-watt bulb	15″	35 seconds
FOR POSITIVE PRINTING		
30-40 watt-second electronic flash	15″	1 flash
50-80 watt-second electronic flash	18″	1 flash
300-watt reflector photoflood	5′	5 seconds
100-watt bulb	15″	40 seconds

5 Sponge the plate once more under running water for about 1 minute. The dark areas should now be a rich brown, but they may be changed to dense black by placing the plate in the special image toner for 3 to 5 minutes. Use only glass, rubber, or plastic tray for toning. Then rinse again for 4 to 6 minutes in water.

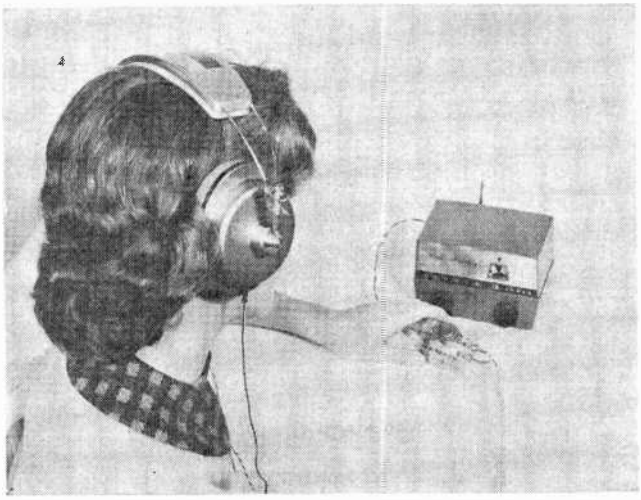


6 If you wish, you can now color your dial or nameplate by immersing it in a 150°F bath for about 5 minutes. Gold, copper, red, blue or green dyes are all available from Metalphoto at a small extra charge.



7 The last step is a 30-minute boiling which seals the silver image under a scratch- and solvent-resistant coating of aluminum oxide. Trim the plate with a paper cutter or heavy shears, and polish it with household furniture polish when dry.

NOTE: The water used for boiling and for making up all solutions should be distilled. Rinsing can be done with ordinary tap water. During processing, gently agitate trays from time to time.



By ART TRAUFFER

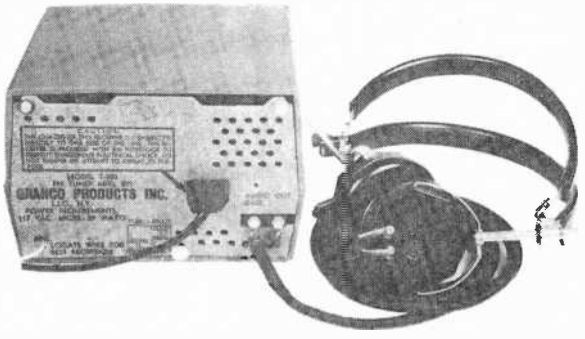
Private FM Listening

Inexpensive tuner and high-quality earphones deliver topnotch "fi"

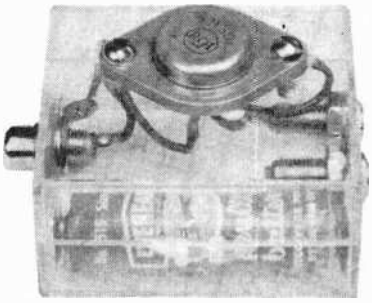
FOR private FM listening, you can't beat an FM tuner and a pair of high-quality earphones. With a simple setup such as this, you can listen to your favorite types of music as late as you please without disturbing others. Then, too, you can enjoy FM programing while you're saving up for a high-quality amplifier and speaker. And you'll still have the phones for private listening later on.

There are two types of earphones on the market suitable for FM listening purposes. One is the low-impedance type that uses voice coils and diaphragms or cones, just like dynamic speakers. The other is the crystal-type transducer with its cones connected to crystals. Although both of these types are capable of low distortion and wide-range response, do not expect quality reproduction with common magnetic phones that have flat metal disc diaphragms.

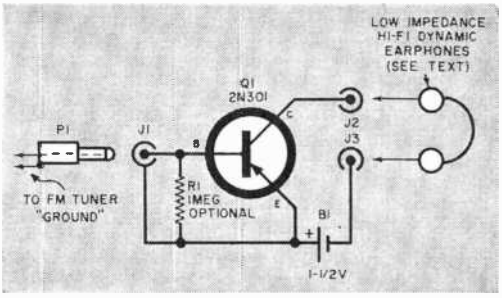
The photo below shows a pair of high-quality crystal earphones (Brush-Clevite) connected directly to an FM tuner. Since crystal phones have high impedance, they match the tuner output without the use of a transformer or an impedance-matching amplifier. There is no danger of shock while wearing the



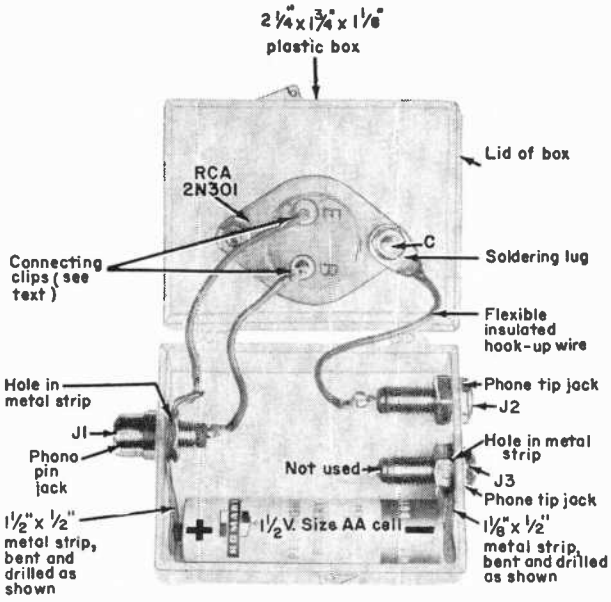
An FM tuner, such as the Granco T-300 shown here, can be fed directly to a pair of high-quality crystal earphones for private listening. Although the Granco tuner does not have a power transformer, capacitors feed output to phones and thus prevent danger of electric shock.



One-transistor amplifier actually operates as an impedance-matching device to couple high-impedance output of tuner to low impedance of earphones. Construction details are shown in open view (right).



Schematic diagram of one-transistor impedance-matching amplifier. Resistor R1 is optional and may be omitted, depending on output circuit of tuner.



phones because the tuner manufacturer has isolated the output terminals from the chassis with blocking capacitors.

The photo above, left, shows a music lover listening to FM with high-quality low-impedance dynamic earphones (Lafayette F-618). The small plastic box contains a simple amplifier which matches the low impedance of the phones to the high impedance of the FM tuner output and provides a small amount of amplification at the same time. Although an audio output transformer having a high-impedance primary and low-impedance secondary could be used to match the dynamic phones to the FM tuner, the transformer would have to be a high-quality unit to give hi-fi results.

Complete construction details for an impedance-matching amplifier are shown in the photos and diagrams on this page. The author used round-type phono cartridge clips for the pins on the 2N301 transistor. All holes in the plastic box were made by reaming with the point of a small knife blade and filing with a small rat-tail file. Note that the metal-strip battery clips also serve as connectors between the battery and jacks; phone tip jack *J3* should be an all-metal type.

Besides the Lafayette F-618 dynamic phones mentioned above, quality dynamic headsets are made by such companies as Allied Radio (Knight), Koss, Permoflux, and Telex. But regardless of whether you choose crystal or dynamic phones, you can be assured of some first-class private FM listening. -30-

SPACE ELECTRONICS

Have you ever stopped to think where our satellite program would be without electronics? The answer obviously is "nowhere." Without radio signals, for example, our satellites would be big chunks of scrap metal floating around in space.

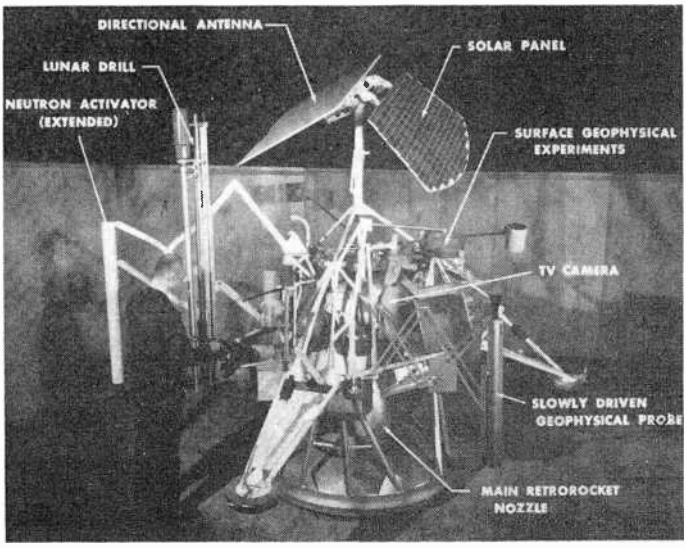
Only the rocket engines and propellants outrank electronics in importance. But even this is questionable—for without electronic guidance a rocket would never get to the right place at the right time. And, even if it did, how would we earthlings know it?

In short, without electronics, there could be no space program. Recognizing this "truth," the editors of POPULAR ELECTRONICS *plan to devote several pages each month to Space Electronics.*

CAN anyone hear satellites? This is the question most frequently asked by SWL'ers, experimenters, hams, and novices in space science. The answer is a very simple "yes." Many satellite signals—both American and Soviet—have been heard by curious listeners. In fact, as we shall show in one of our forthcoming columns, SWL-type verifications have been issued for about ten satellites.

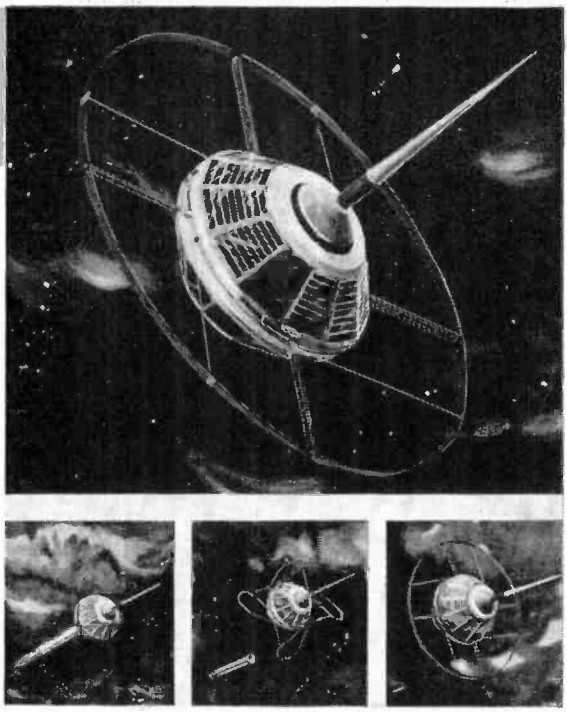
The Soviet satellite signals have been consistently easier to intercept. All of the Lunik and Sputnik satellites have had at least one transmitter operating within plus or minus 20 kilocycles of 20 megacycles (19.98 mc.—20.02 mc.). The listener need only spot the 20-mc. broadcast from Station WWV on the dial of an average short-wave receiver. He can then sit back and wait, for some time within the following two hours he will have a good chance of hearing a Soviet satellite.

Most listeners have been distressed to find that practically all of the American satellites transmit on frequencies near 108 megacycles. The power radiated by them has been low, generally less than ½ watt. However, many experimenters and radio amateurs, using modi-



The National Aeronautics and Space Administration has proposed sending seven spacecraft to the moon in 1963-1965. Given the code name, "Surveyor," these fully automatic satellites will soft-land on the moon and send back TV pictures of the surface. They will also conduct a number of other experiments to determine the content and texture of the lunar surface. The model shown here was developed by Hughes Aircraft.

By **OLIVER P. FERRELL**
Editor



As this column goes to press, a Juno II is being readied at Cape Canaveral. The payload is now called NASA S-45, but if the shot is successful it will become Explorer X. Destined to study the ionosphere, this unusual satellite will transmit on six different radio frequencies. The ring antenna will be used on the lower frequencies—it is designed to unfold after separation from the fourth stage.

RADIO SIGNALS FROM THE SATELLITES

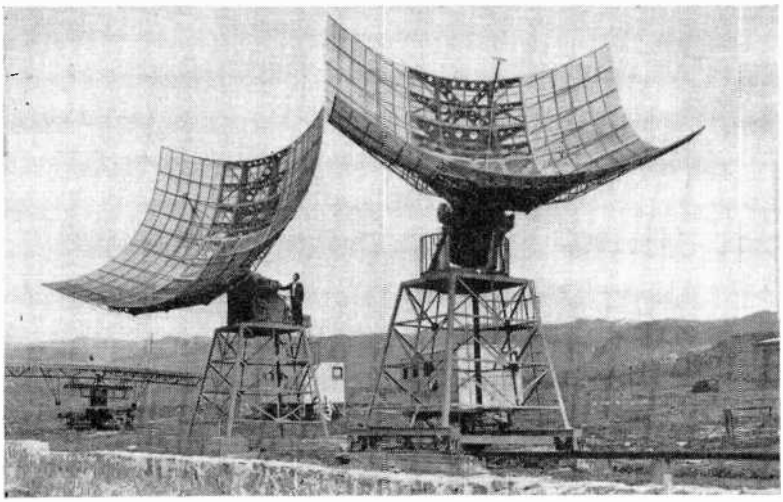
Name	Frequency(ies)	Power
Vanguard I	108.020 mc.*	10 milliwatts
Explorer VII	19.990 mc.*	600 milliwatts
TIROS I	107.990 mc.*	30 milliwatts
MIDAS II	secret	secret
Transit II-A	about 54, 162, 216 & 324 mc.	not reported
NRL Satellite	about 108 mc.	not reported
Echo I	107.970 mc.*	10 milliwatts
Courier I-B	107.970 mc.*	not reported
TIROS II	108.000 mc.*	30 milliwatts
	108.030 mc.*	30 milliwatts
	235.000 mc.	2 watts
	237.800 mc.	3 watts
SAMOS II	secret	secret
LUNIK IV	922.8 mc.	not reported
Explorer X	20.005 mc.	300 milliwatts
	40.010 mc.	100 milliwatts
	41.010 mc.	100 milliwatts
	108.270 mc.	20 milliwatts
	360.090 mc.	100 milliwatts
	960.240 mc.	10 milliwatts

Satellites are listed in the order launched. Explorer X had not been launched at press time, but is included because of number and variety of frequencies to be employed. Asterisk indicates that this is the beacon transmitter frequency.

fied FM converters and simple two- or three-element beams, have been able to verify American satellite radio transmissions.

But the listener must know when to listen and what to listen for. It is impossible in this first installment to discuss all the ways and means of knowing when to listen. Simplified methods are available to permit satellite tracking —when one or two check positions and the date and time of the launching are known. These methods will also be discussed in detail in one of our forthcoming columns. In the meantime, the table at left contains information on the frequencies and radiated power of the satellites known to be in orbit and transmitting as of February 20, 1961.

FM/TV DX Reflections. The 100-foot balloon (called Echo I) that is now circling our globe presents another possibility for DX'ing the FM/TV bands. Using the same principle as the Bell Telephone Laboratories in communicating between Holmdel, N. J., and Goldstone, Calif., that is, ignoring the earth's ionosphere and bouncing the signal off



These Soviet radio-telescope antennas are located in the Caucasus Mountains. Similar antennas are probably used to operate the telemetering transmitters on LUNIK IV.

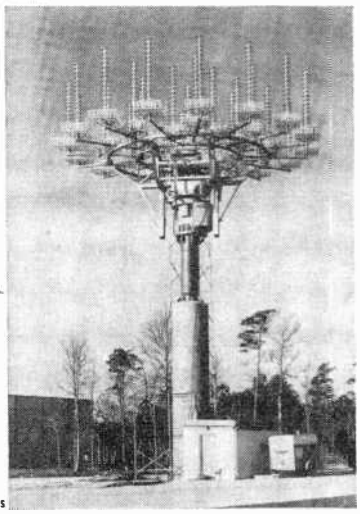
SOVFOTO

the satellite, a DX'er may be able to catch rare FM and TV signals.

The DX'er should spot his receiver on an unoccupied channel and await a satellite passage. As the satellite approaches overhead, midway between the distant transmitter (say 1000-2000 miles) and his receiver, there should be a "burst" of signal. Under average conditions it would not be unreasonable to expect to hear 25-30 seconds of an FM or TV signal—certainly enough during station break time for identification purposes.

Radio amateurs have not been able to use Echo I consistently because of the relatively weak power they are permitted to radiate. Even with highly directive antennas, their "effective radiated power" is always under 50,000 watts. Many TV and FM transmitters, on the other hand, are operating with an "effective" power above 350,000 watts. If the FM/TV

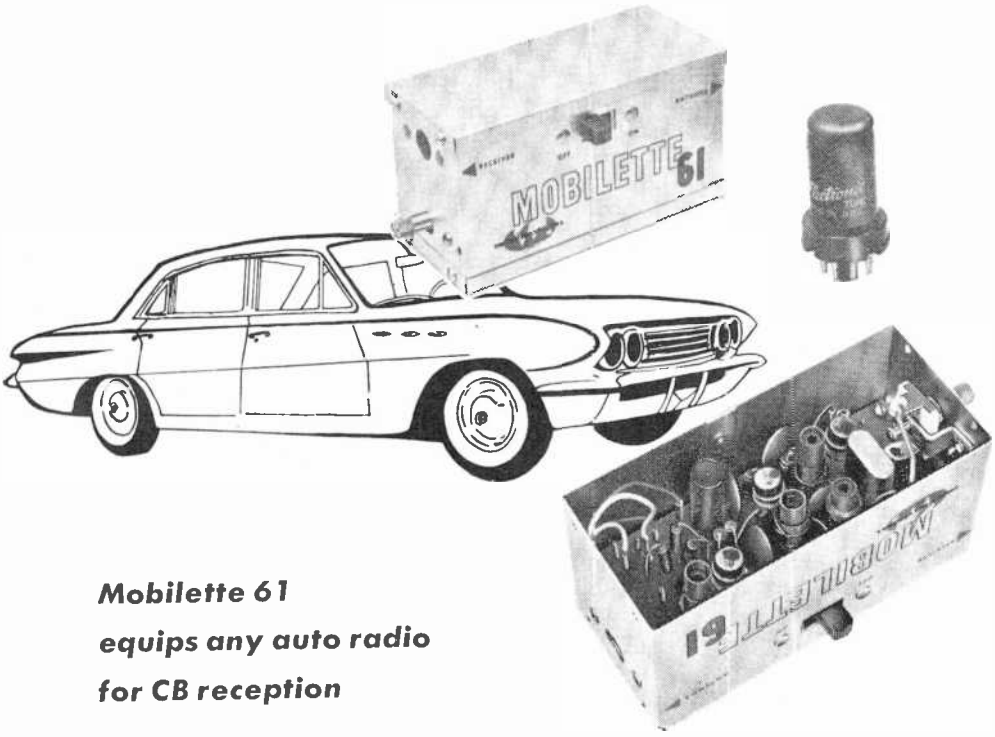
(*Continued on page* 106)



Two methods of satellite tracking. At right is the new 33-element helical beam antenna at Wallops Space Flight Station. Above is General Electric's optical tracker using a high-power telescope and special TV image pickup tube.

GB Electronics

Low-Cost CB Converter



Mobilette 61 equips any auto radio for CB reception

IF, like many CB'ers, you have an auto battery that's loaded down with a high-drain CB transceiver, you'll find the transistorized Mobilette 61 converter a blessing. Just switch off your power-hungry CB rig, and switch on the Mobilette 61 and your auto radio. Like magic, the converter will feed the CB channels into your auto radio—all you do is tune the radio to pick up the channel you want.

When you operate the Mobilette 61 with a low-drain radio, the battery drain will probably be between 1.5 and 2.2 amperes, almost the same as with the radio alone. Power drain of the converter is only a few milliamperes.

Made by International Crystal Mfg. Co., Oklahoma City, Okla., the Mobilette 61 (Model 630-112 for CB operation) sells for $22.95 and is supplied complete with all necessary interconnecting cables. (Other models cover individual ham bands and selected frequencies between 2 and 50 mc.) With the converter, you get a cigarette lighter plug for tapping power from your car's 12-volt electrical system. The converter works with 6-volt cars, too, but with slightly less gain.

Circuitry. Inside the Mobilette 61's little aluminum box you'll find a maze of components, including three transistors and a quartz crystal neatly arranged on a printed-circuit board. Transistor *Q1* operates as a broad-tuned r.f. amplifier (see large schematic on next page), while transistor *Q2* operates as an r.f. mixer.

Transistor *Q3* is connected as a crystal-controlled oscillator (see small schematic on next page). The output of *Q3* is fed into the base of *Q2*, converting the 27-mc. CB signals to an i.f. in the broadcast band. Incidentally, both of the schematics shown have been simplified by omission of the antenna and power

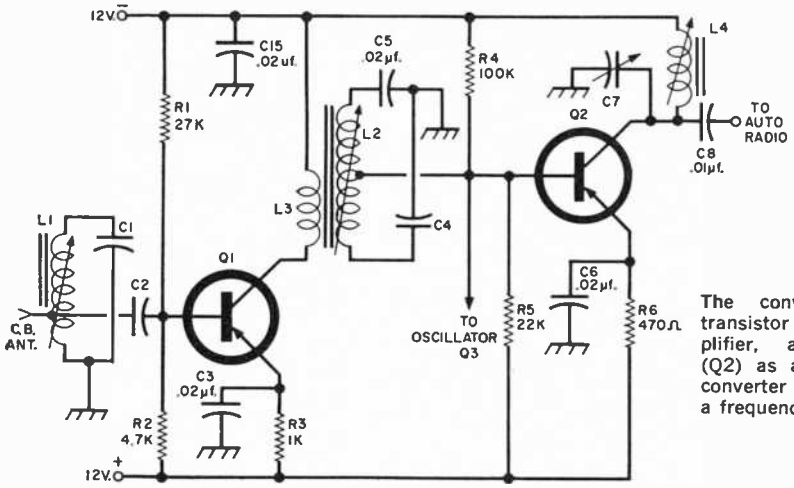
switching circuits; the values for some capacitors have also been omitted.

Installation. One problem with any piece of mobile equipment is installation—a lot of people are reluctant to twist down under the dash to install a new appliance. But with the Mobilette 61, the problem is minimized: the unit is less than 4½" long and less than 2½" in each of the other two dimensions. In all, it's only a little bigger—and weighs only a little more—than a couple of packs of cigarettes.

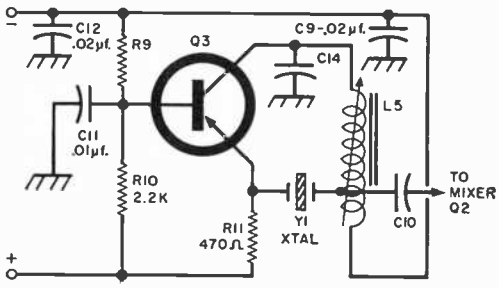
As you know, transistorized equipment must be properly polarized when it's installed in your car. To help you determine whether your car has a negative or positive ground, the manufacturer of the Mobilette 61 has supplied a list of over 25 popular make cars, indicating the polarity for each make back to the year 1940 in most cases.

If your car has a negative ground, you can install the converter "as is." With positive-ground cars, all you do is open the converter and switch two wires that are supplied with push-on connectors—no soldering is required.

Operation. Once the converter is hooked up, just flip a single switch on the converter to select either CB or BC-band reception. The switch connects the CB antenna to the converter for 27-mc. operation and disconnects the regular BC-band antenna from the radio.



The converter employs one transistor (Q1) as an r.f. amplifier, a second transistor (Q2) as a mixer. Output from converter to auto radio is at a frequency within the BC band.



Local oscillator Q3 is crystal-controlled for good stability. Its output is coupled through capacitor C10 to the mixer stage.

A separate CB antenna is recommended by the manufacturer but you can probably use your BC-band antenna for local reception—you will have to jumper the CB and BC-band antenna terminals inside the converter, however, to avoid unplugging the antenna jack when switching bands.

One other control, a "signal peaker," adjusts the antenna coupling to the converter. For best results, the signal peaker is adjusted with each CB channel tuned in on your auto radio. -30-

BIG SOUND FROM PERSONAL PORTABLES

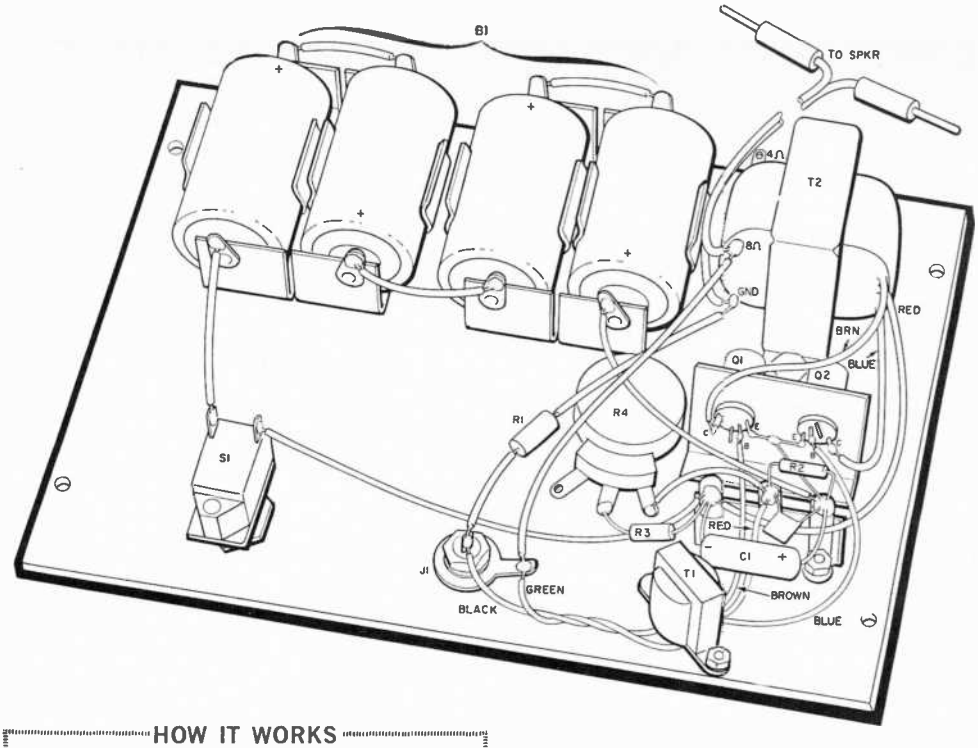
Compact amplifier/speaker combination improves tone and volume of small transistor sets

By JAMES E. PUGH, Jr.

ALTHOUGH a good many people would be lost without their small transistor portable radios, few would deny that these little wonders have their drawbacks—with only 50 to 100 milliwatts maximum output and a tone that is not usually outstanding, they could well stand some "hi-fi'izing." The amplifier/speaker combination shown here is intended to do just that. Called the Transi-Booster, this simple and relatively inexpensive unit will give a worthwhile increase in volume and improve the tone of practically any small portable.

The output of the radio is connected to the input of the Transi-Booster via a plug, jack, and cable arrangement. This makes it possible to enjoy good sound in your radio listening almost anywhere, and you can even control your radio from your favorite chair or sofa. Unplug the connecting cord, and your radio is again its old portable self, ready to accompany you wherever you go.

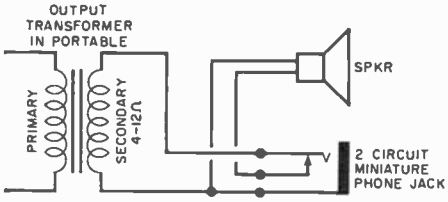
Construction. All parts except the speaker are mounted on one side of a piece of fiberboard, and the whole assembly is attached to the back of a

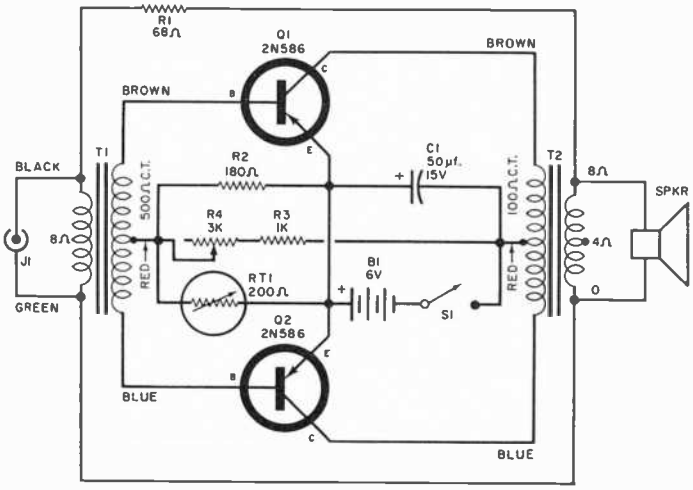


HOW IT WORKS

The Transi-Booster is essentially a push-pull transistor amplifier with overall negative feedback. The primary of transformer *T1* matches the output impedance of the radio at its earphone jack; *T1*'s secondary drives two transistors in Class B push-pull operation. Output transformer *T2* couples the ¾ watt developed by the transistors to a suitable speaker.

Resistor RT1 is a temperature-sensitive resistor (thermistor) which keeps the transistors properly biased over a wide temperature range; resistor *R1* provides negative feedback to improve the Transi-Booster's frequency response and reduce distortion.





Pictorial diagram (above, top) and schematic diagram (left) show simplicity of Transi-Booster circuitry; proper setting of R4 and effect of R1 are discussed in text. Small schematic (above) gives details for adding a phone jack to a transistor portable.

speaker baffle with wood screws. To avoid a muffled tone, about ¼ of the back of the baffle is left open.

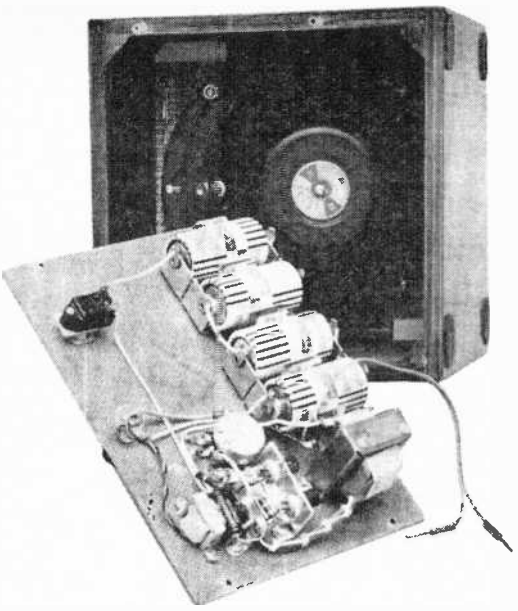
Begin construction by drilling all required holes in the fiberboard chassis, having first made certain that the parts will clear the edges of the baffle and the rear of the speaker.

Round, 3-pin transistor sockets are mounted on a small aluminum bracket bent to provide a $\frac{5}{16}$" lip for mounting to the chassis with two machine screws. If you want to reduce costs by sacrificing a little on appearance and convenience, you can solder the transistors to a six-terminal lug strip instead of using sockets.

Any speaker with a 3.2- to 8-ohm voice coil can be used with the amplifier—simply select the tap on transformer *T2* that corresponds with your speaker voice-coil impedance. The author used a low-cost coaxial speaker (Lafayette SK-97) that works quite nicely, but virtually any unit will be satisfactory.

Actual wiring is very simple and straightforward, following the schematic and pictorial diagrams. Be sure to use a pair of long-nosed pliers or similar heat sink when soldering the transistors and other small parts.

As a finishing touch, cement small pieces of felt to the four corners of the cabinet bottom to prevent scratches to furniture. Now wax the case and mount the amplifier board to the back with four small wood screws.



Completed unit is self-contained and fully portable. Felt pads glued to bottom of speaker baffle prevent scratched furniture.

PARTS LIST

B1—6-volt battery (4 size C cells in series)
C1—50-μf., 15-volt miniature electrolytic capacitor
J1—Phono pin jack
Q1, Q2—2N586 transistor (or equivalent)
R1—68-ohm, ½-watt resistor
R2—180-ohm, ½-watt resistor
R3—1000-ohm, ½-watt resistor
R4 -3000-ohm potentiometer, linear taper
RT1— Thermistor, 200 ohms at 25°C (Lafayette 22TD1 or equivalent)
S1—S.p.s.t. toggle switch
T1—Transistor input transformer; primary, 8 ohms; secondary 500 ohms CT (Argonne AR-164 or equivalent)
T2—Transistor output transformer; primary 100 ohms CT; secondary, 4 and 8 ohms (Triad TY-30X or equivalent)
1—PM speaker, 4- or 8-ohm voice coil—see text
1—Speaker baffle for 5" or 6" speaker
1—5¼" x 7⅜" x ⅛" fiberboard
1—1¼" x 1½" aluminum sheet
1—Subminiature phone plug (Lafayette MS-281 or equivalent)
1—Phono pin plug
1— 25' length of 2-conductor miniature parallel cable
Misc.—Transistor sockets, dual C-cell holders, 3-terminal tie point, felt pads, hookup wire, hardware

Installation. A phono pin jack mounted on the rear of the fiberboard chassis connects with the input cable from the portable. Make the cable any reasonable length, and terminate it with a phono pin plug at one end and a subminiature phone plug at the other.

If your radio doesn't have an earphone jack, install one to match the phone plug in some convenient place on its plastic case. Most transistor portables use a low-impedance earphone (4 to 12 ohms) with the output jack connected as shown on page 70. If yours is connected to another point for a high-impedance phone, it can be rewired as shown. Alternatively, transformer *T1* can be replaced with another one which has a primary impedance about the same as the earphone impedance; the secondary impedance should remain the same (500 ohms CT).

One of the features of the Transi-Booster is that it is designed to get the maximum service from its battery. As

(*Continued on page* 127)

How to understand and make a

FLIP-FLOP COMPUTER

By JULIAN M. SIENKIEWICZ
Managing Editor

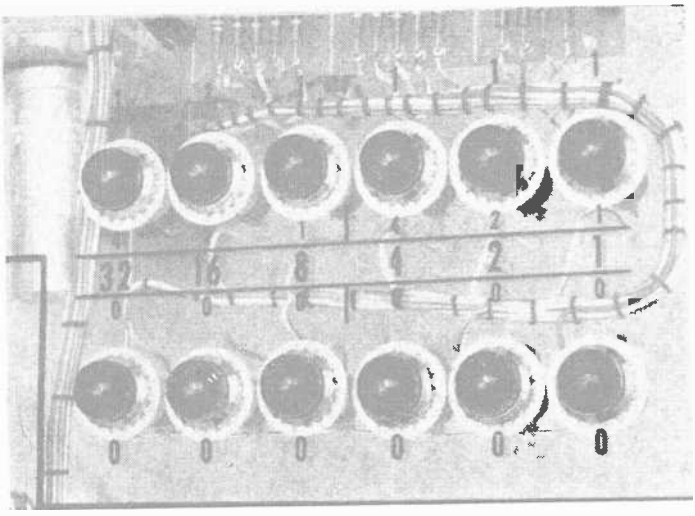
GOTTFRIED Wilhelm von Leibnitz, the seventeenth-century mathematician and philosopher, was one of the first to urge the use of a number system employing only two symbols—0 and 1. Genius that he was, Leibnitz laid down the mathematical groundwork for today's digital computers which actually rely on a two-symbol or "binary" number system for their operation.

Early computers used switches and relays—devices which are "binary" in nature. By this we mean that they are always in one of two states, either "on" or "off." This same condition can apply to modern-day tubes and transistors—they can be made to "conduct" or "not conduct." Expressed simply, a computer device is always in one of two stable states which can be used to identify the two symbols of the binary number system—"on" or "conducting" for "1," and "off" or "not conducting" for "0."

Binary Numbers. Let's compare the decimal numbers we know so well and use every day with binary numbers. Zero is expressed as "0" in both number systems, and so, too, is the number "1." From this point on, however, binary numbers differ radically from corresponding equal-valued decimal numbers. Why? Well, remember we said that the binary number system has only two symbols—"0" and "1." This means that there are no 2's, 3's, 4's, and so on, in the system. With binary numbers, we can use only combinations of "0" and "1" to express our conventional decimal numbers of 2 and higher.

Starting with the number zero in the decimal and binary number system, let's keep adding the number one so that we can compare the same quantities in the two different systems—see Table 1. Upon inspection, something will immediately appear to be odd about the binary numbers. Whenever we add "1" to "1," we end up with zero plus "1" "to carry." In the decimal system, a similar operation takes place. Whenever you add a "1" to "9"—you end up with a "0" plus "1" "to carry," or the number ten (10).

If you want to, you can continue the computations in Table 1 to convert any decimal number to a binary number. As this task takes a long time for high



Simple digital computers with their flip-flop counting circuits switch colored lights on and off to indicate totals. Arranged in sequence, the lights help the operator rapidly convert digital numbers into commonly used decimal numbers.

5 4 8 6 7 5 9 0 2 1 3 7 4 6 5 8 2 0 1 9 3 4

DECIMAL ADDITION	BINARY ADDITION
0	0
+1	+1
1	1
1	1
+1	+1
2	10
2	10
+1	+1
3	11
3	11
+1	+1
4	100

Table 1.

Decimal	Binary	Decimal	Binary
0	0	17	10001
1	1	18	10010
2	10	19	10011
3	11	20	10100
4	100	21	10101
5	101	22	10110
6	110	23	10111
7	111	24	11000
8	1000	25	11001
9	1001	26	11010
10	1010	27	11011
11	1011	28	11100
12	1100	29	11101
13	1101	30	11110
14	1110	31	11111
15	1111	32	100000
16	10000		

Table 2.

numbers, Table 2 gives all the binary number equivalents you will need to understand the remainder of the article. It would be good practice to check your own calculations against the table.

Simple Conversion. You can see that converting a decimal number to a binary number is time-consuming, if not tedious. Converting binary numbers to decimal numbers by the previous technique is even more difficult. Let's look for a simpler way to do it.

The first two columns of Table 3 give the decimal and binary number equivalents. The last two columns tell us that all the numbers selected are equal to some *power* or *multiple* of the decimal number 2. Therefore, each digit or symbol in a binary number represents some

Decimal Number	Binary Number	Power of 2	Power of 2 Simplified
1	1	2^0	$2 \div 2 = 1$
2	10	2^1	$2 = 2$
4	100	2^2	$2 \times 2 = 4$
8	1000	2^3	$2 \times 2 \times 2 = 8$
16	10000	2^4	$2 \times 2 \times 2 \times 2 = 16$
32	100000	2^5	$2 \times 2 \times 2 \times 2 \times 2 = 32$

Table 3.

power of 2 in the decimal system. This could be expected since we said earlier that there were only two symbols in the binary number system.

Armed with this information, we can now convert the binary number, 1101, to a decimal number. The binary digits of the number 1101 are actually coefficients of different powers of 2. This is shown graphically in the two top equations of Table 4. Keeping in mind that 2^3 equals 2 x 2 x 2, or 8, the equation, using powers of 2, can be simplified to (1 x 8) + (1 x 4) + (0 x 2) + (1 x 1). Since any number multiplied by 1 is the same number and any number multiplied by 0 is 0, we arrive at the bottom equation in Table 4 and the decimal number 13. Checking the decimal binary equivalent

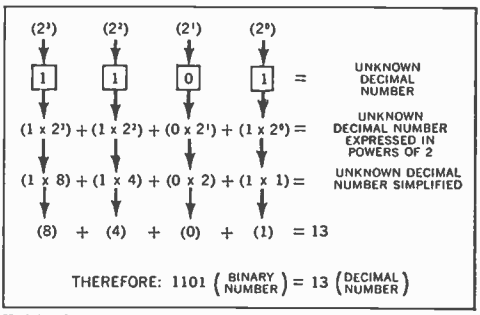


Table 4.

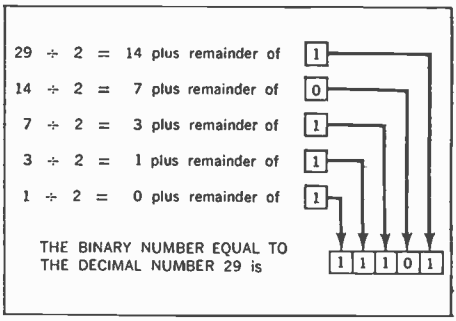


Table 5.

number chart, we see that our computation is correct.

A less tedious way to convert a decimal number to a binary number is to repeatedly divide the decimal number by 2; the remainder of each division is used to determine the binary number. In the example shown in Table 5, the decimal number 29 is reduced to the binary number 11101. An interesting fact about this method is that flip-flop circuits connected in series can perform this operation in a few microseconds.

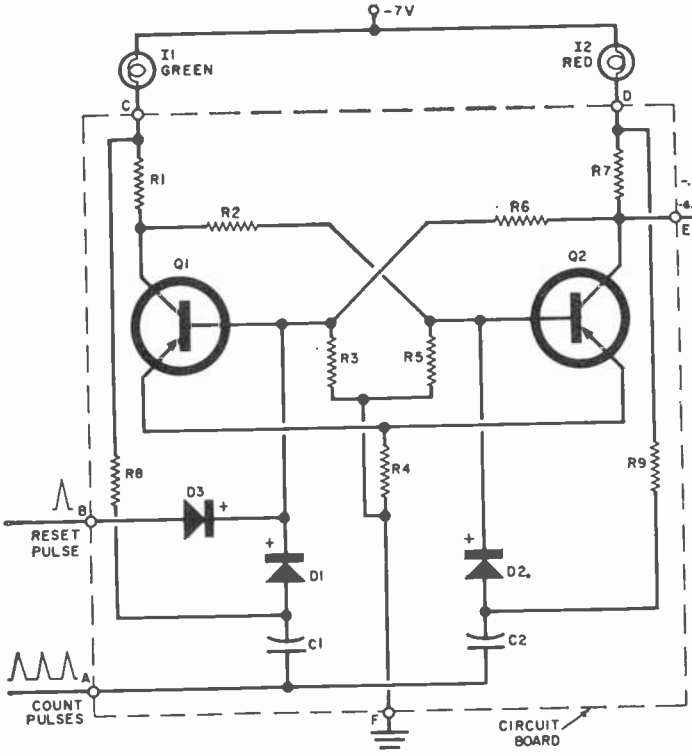
Counting with Flip-Flops. The circuit shown in Fig. 1 is identical to the flip-flop circuit discussed at the end of the article on "Flip-Flop Circuits" in the March issue of POPULAR ELECTRONICS. Note that all the components are mounted on a circuit board with the exception of indicator lights, *I1* and *I2*. If you build your own digital computer, you will want to mount all the circuit boards inside a chassis box and run leads to the indicator lights mounted on the front panel.

Now let's see how the flip-flop can count. First, we apply a positive reset pulse to terminal *B*. This positive pulse will cut off *Q1*, causing the green light, *I1*, to go out, and the red light, *I2*, to come on. (The red light is simply an indicator which tells us when the circuit is ready to receive the count pulses.) Use the green light only to determine the binary count—with the green light out, the count is 0; with it on, the count is 1.

Now we apply the positive count pulses to terminal *A* in the circuit board of Fig. 1. The first pulse cuts off *Q2* and turns on *Q1*, with the result that the green light comes on to indicate a count of 1. The red light will go out. At terminal *E*, the voltage drops from —0.8 volts d.c. to —6.8 volts d.c.—a negative pulse. If this pulse were applied to a second identical flip-flop circuit input count terminal, *A*, nothing would happen, since the flip-flop shown in Fig. 1 is sensitive only to positive pulses.

When the second count pulse is applied to the flip-flop, the green light goes out and the red one comes on. This indicates a count of zero. At terminal *E*, the voltage rises positively from —6.8 volts d.c. to —0.8 volts d.c. due to the action of the second count pulse which returned the flip-flop to its original state. The positive output pulse, which occurs once for each second or "even" count pulse, can be used to trigger the next flip-flop.

Now let's see what the flip-flop has done. It has divided the number of count pulses by two into positive pulses at its output terminal and its green light tells us when there is a remainder of 1. Look



PARTS LIST

C1, C2—0.05-μf., 200-volt paper capacitor
D1, D2, D3—1N34A germanium diode
I1, I2—#49 panel lamp (or #48)
Q1, Q2—2N554 power transistor
R1, R7—68-ohm, ½-watt resistor
R2, R3, R5, R6—1200-ohm, ½-watt resistor
R4—10-ohm, ½-watt resistor
R8, R9—10,000-ohm, ½-watt resistor

Fig. 1.

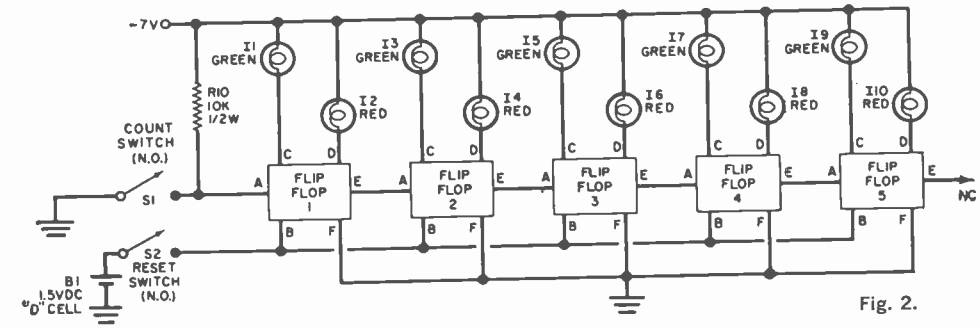


Fig. 2.

back at Table 5 and note that the flip-flop circuit in Fig. 1 performs the first step in converting a decimal number to a binary number. Thus, if we were to apply 29 count pulses to the count terminal *A* of the flip-flop, the output terminal would provide 14 positive output pulses to the next flip-flop for division by two, and the green light would be lit to indicate a remainder of 1.

If we connect several flip-flops in series, we can continue our repeated division by two until the lit and unlit green lights indicate the binary number 11101.

Flip-Flops in Series. The design of the flip-flop circuit in Fig. 1 permits the output pulse terminal *E* of the first flip-flop to be connected directly to the count pulse terminal *A* of the next flip-flop. Figure 2 is a schematic diagram showing the terminals of five identical flip-flop circuits connected in series. The simple arrangement of the circuit indicates that many more flip-flops can be added to get even higher counts.

Resistor *R10* keeps terminal *A* negative until count switch *S1* is closed mo-

(*Continued on page* 126)

New Life for OBSOLETE CONVERTERS

By **DONALD A. SMITH,** W3UZN

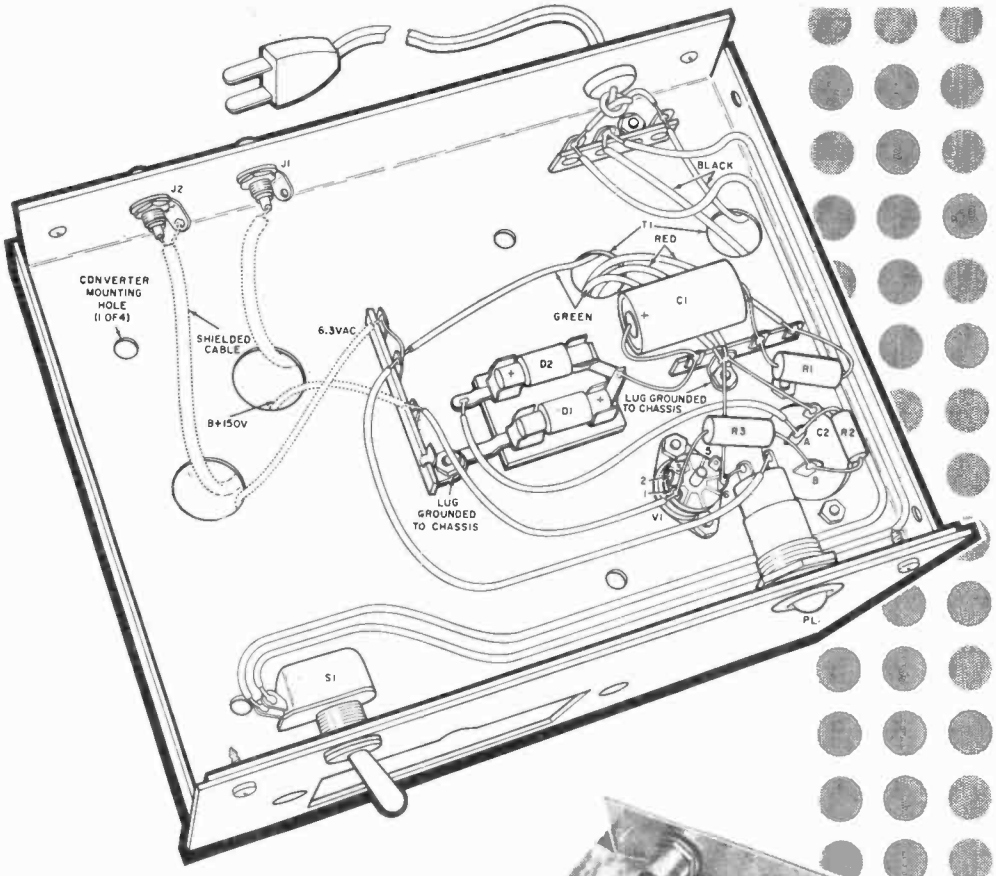
Add this simple a.c. power supply to an old mobile converter and tune in short-wave bands on your broadcast set

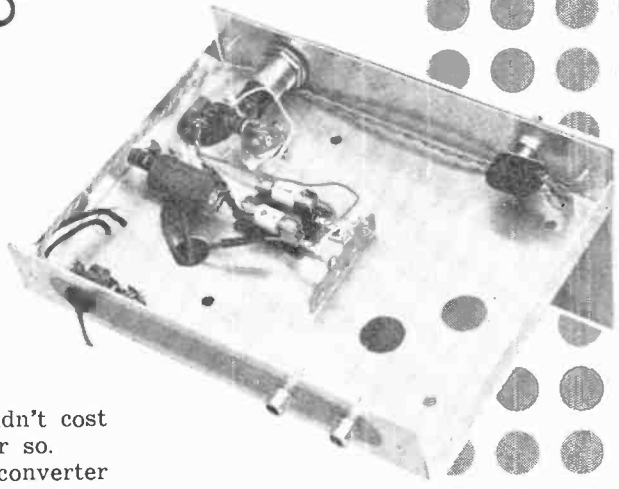
IF you would like to have a dual-conversion short-wave or amateur receiver at a bargain price, this is the project for you. All you need is a broadcast set, a small a.c.-operated power supply, and a used mobile vacuum-tube converter.

Mobile converters of this type, now being traded in for transistorized units, were originally made for general coverage of the short-wave bands or for certain ham bands. Although quite sensitive and selective, they are considered obsolete because they require a B+ supply as well as heater voltage.

Choose the model converter you want (many of the larger mail order houses have them), hook up your a.c.-operated supply to it, and you will be able to tune in many new bands on your broadcast receiver.

Actual cost of the complete setup will depend on the price of the converter. The author was able to obtain a Gonset 3002 converter, which tunes from 3 to





Power supply for converter is built on one half of utility cabinet's chassis; the converter itself will fit on the other half.

30 mc., for only $10.00 —since the converter's case was marred and scratched. The power supply and a new cabinet to house the converter and power supply cost only $15.00, making a total of $25.00. This is an exceptional case, but a similar used converter shouldn't cost you much more than $30.00 or so.

Drilling. The Gonset 3002 converter used by the author was removed from its cabinet and remounted in an 8½" x 6⅛" x 5" utility cabinet (LMB W-1C or equivalent) together with an a.c. power supply providing 150 volts d.c. at 10 ma. and 6.3 volts a.c. at 0.75 ampere. If you have a different converter, its chassis should be no more than 3½" high x 5" wide x 5" deep to fit in this cabinet.

Before the converter chassis is mounted in the cabinet, all necessary holes

should be drilled and punched in the cabinet's front panel and chassis as shown in photo at right. The large rectangular cutout is for the converter's dial, and the two small round holes on either side of it are for the converter's antenna trimmer and bandswitch, respectively. The two small holes at the bottom of the panel near the left and right edges are for the pilot lamp and a.c. power switch.

Now, following the pictorial diagram, drill the rear apron of the cabinet's chassis to mount the two antenna jacks (*J1* and *J2*). The bottom of the chassis is drilled and punched to mount the power supply components.

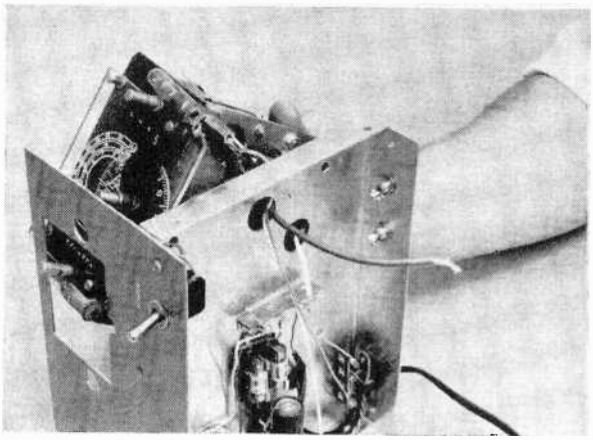
Next, the top of the converter's dial plate must be cut or filed down to the level of the dial's plastic window. Be careful not to get any metal filings between the plates of the converter's tuning capacitor or between any terminals.

Wiring. When drilling is completed, start assembly of the unit by mounting and wiring the power supply. Wiring is not critical but the pictorial diagram should be followed for ease of assembly. Be sure to observe polarity of diodes *D1* and *D2* and capacitors *C1, C2a,* and *C2b.*

Connecting and mounting the converter to the chassis is not difficult. However, the functions of the signal jacks and power cable on the converter must first be determined. When all the converter's power and signal leads have been identified, wire them to the chassis, once again following the pictorial diagram.

The Gonset 3002 is supplied with a three-wire cable and two jacks on the rear of its chassis. One wire in the cable is the B+ lead, the second is the 6.3-volt heater lead, and the third is a common ground for the first two leads. Trace out each of the three leads to be sure of their identity. You will find that the heater lead and B+ lead are connected to the converter's band selector switch which also functions as an on-off switch. The ground lead in the cable connects to the converter's chassis.

The two jacks on the rear apron of the converter's chassis, the antenna jack and the i.f. output jack, are both rewired to a pair of new jacks (*J1* and *J2*) at the back of the cabinet's chassis. Connect a short length of microphone or coax cable with its shield grounded between each pair of old and new jacks.



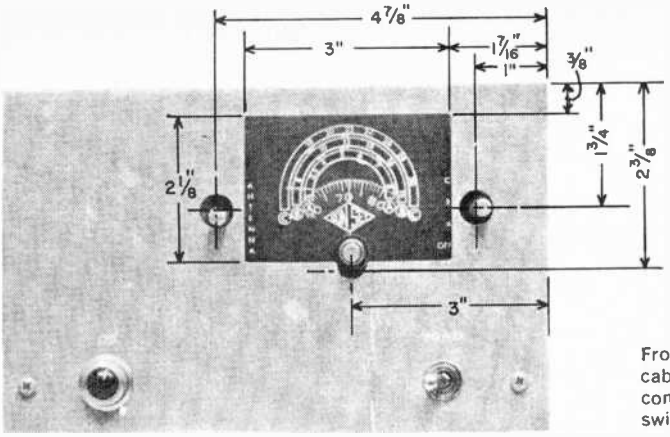
Mount converter on chassis after power supply is wired. Power and signal cables from converter pass through holes in the chassis.

Hook-Up. If your a.c.-operated receiver has antenna and ground terminals, connect them to the converter's i.f. output jack (*J2*) using a shielded cable—see block diagram on page 79. The converter can also be connected to receivers that do not have antenna and ground terminals, such as sets that use loopstick antennas.

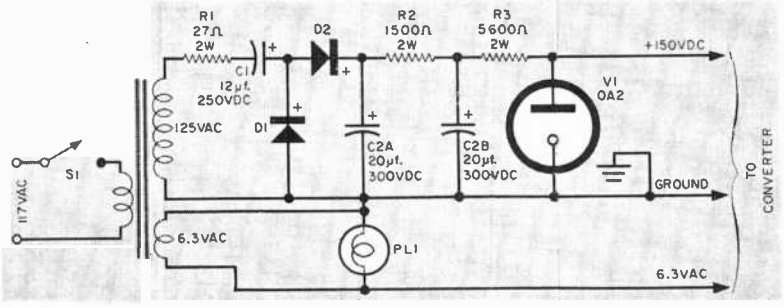
For loopstick sets, wrap a length of insulated lead around the radio near the loopstick and connect one end of the lead to the hot terminal of *J2*; there will be sufficient coupling between the lead connected to the converter and the loopstick antenna for proper operation. For battery-operated loopstick receivers, connect the end of the lead from *J2* to any metal part on the receiver, such as the speaker grille or phone jack.

Finally, connect an outside antenna to jack *J1*. Although mobile converters were designed to work on short whip antennas, a long-wire antenna will improve the operation of the unit.

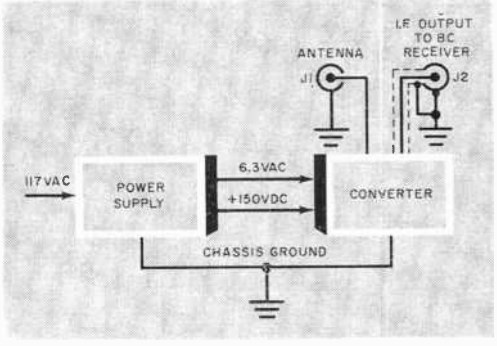
Tuning. Now tune the receiver to approximately 1500 kc. When both converter and receiver are warmed up, you will hear a hiss or weak signal in the receiver's speaker. Retune the receiver slightly in the region of 1500 kc., and peak the receiver's antenna trimmer for maximum volume.



Front panel cutting pattern for cabinet when Gonset 3002 converter is used. Lamp PL1 and switch S1 mount at bottom of panel.



Schematic diagram of power supply is shown above. Diodes D1 and D2 are connected as voltage doubler; tube V1 serves as a voltage regulator.



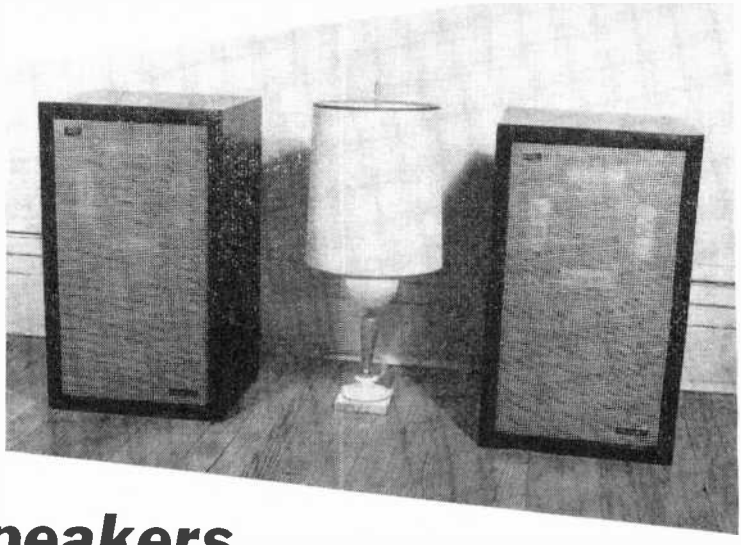
Block diagram at left shows converter and power supply ready to operate. An outside antenna and your BC-band receiver complete the setup.

The broadcast-band receiver need only be tuned once; thereafter only its volume control will be adjusted. However, note that the converter has an antenna trimmer; it should be peaked each time the converter is tuned to a new frequency.

If you want to use the receiver without the converter, simply set the converter's band selector switch to "Off" and turn off the power supply at switch *S1*. -30-

PARTS LIST

C1—12-μf., 250-volt electrolytic capacitor
C2a/C2b—20-20 μf., 300-volt electrolytic capacitor
D1, D2—Silicon diode, 200 PIV, 500 ma. (Motorola 1N1083 or equivalent)
J1, J2—RCA phono jack
PL1—Pilot lamp (G.E. 47 or equivalent)
R1—27-ohm, 2-watt resistor
R2—1500-ohm, 2-watt resistor
R3—5600-ohm, 2-watt resistor
S1—S.p.s.t. toggle switch
T1—Power transformer; primary, 117 volts; secondaries, 125 volts @ 50 ma., and 6.3 volts @ 2 amp. (Stancor PS-8421 or equivalent)
V1—0A2 tube
1—8¼" x 6⅛" x 5" utility cabinet (LMB W-1C or equivalent—see text)
Misc.—7-pin miniature tube socket, pilot lamp socket, hardware, etc.



Low-Cost Speakers for Stereo

Small woofer/tweeter combinations are ideal for small-room stereo setups

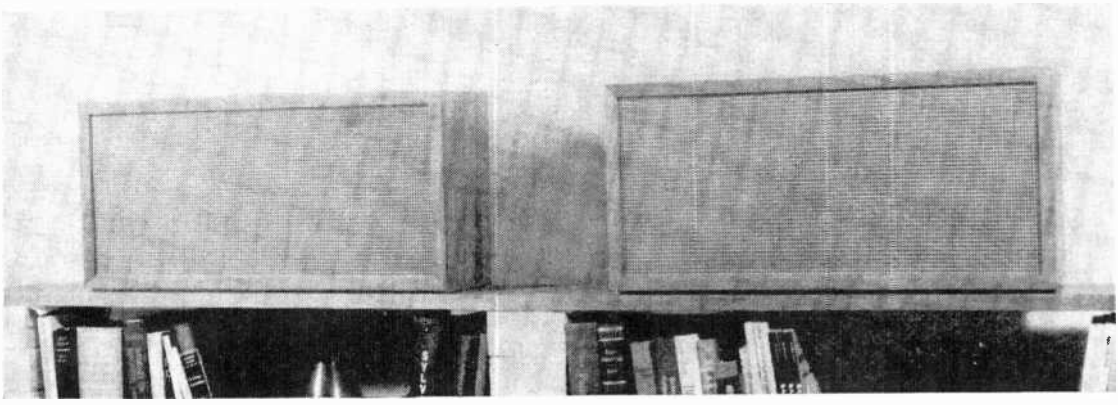
IF YOU'RE about to become the proud owner of a sparkling new "component" stereo setup, you'll probably want to give a good deal of thought to the speakers you choose for your system. Ideally, of course, you should pick the best speakers you can afford, but the fact that you need two of everything for stereo naturally pushes the over-all price just that much higher.

All things considered, some of the more inexpensive "bookshelf" speaker systems can give very satisfactory results. There have been marked advances in the design of such systems in recent years, and they offer the all-important property of easy maneuverability as well. And for stereo, being able to juggle speaker placement often means the difference between rather uninteresting listening and true stereo depth and perspective. Properly located with respect to the listener, such "bookshelf" speaker systems can sound surprisingly good.

Although there are many bookshelf speakers on the market, some fail to include a tweeter or have other shortcomings. Two of the newest, pictured here, are both imports: the Japanese-made Realistic "Electrostat 2" and the Swedish-made "Nordic I." Both use specially designed 8" woofers to cover the low- and mid-frequency ranges, and both employ a tweeter to extend high-frequency response and reduce intermodulation distortion. But there are also important design differences between the two systems.

Nordic I. The Swedish import features a number of interesting innovations. For one thing, the bass-woofer boasts a multilayer, sandwich-type, free-floating cone. Its edge suspension, damping, and sound-generating layers are each made of a different fiber. The result is a combination of hard and soft vibrating materials

Bookshelf-size speakers, such as the Realistic Electrostat 2 units at left, can be placed virtually anywhere in the listening room. Special electrostatic element extends high-frequency response to 25,000 cycles.



Each unit in this pair of Nordic I bookshelf speakers employs an 8" woofer and a 5" cone-type tweeter for response from 45 to 18,000 cycles. Distortion is reduced by means of a special, three-layer cone construction.

that—with the special edge treatment for the cone—make for a very efficient, low-distortion unit.

On the high-frequency end, a small 5" tweeter cuts in at about 5000 cycles (actual crossover occurs at 7500 cycles) to extend the range to 18,000 cycles. As its design suggests, the Nordic I is a fine performer—output is rich and full without a trace of stridency over the entire audio spectrum.

Supplied in either hand-rubbed teak or walnut, the Nordic I measures 10¾" x 22 15/16" x 7⅛" and is priced at $59.50. Further information can be obtained from the distributor, the Ercona Corporation, 16 West 46th St., New York 36, N. Y.

Electrostat 2. The new Japanese-made speaker system also employs a high-compliance woofer of special design to handle the low- and mid-frequency ranges. Crossover, again, is at 7500 cycles from a built-in crossover network, but in the Electrostat 2, the high frequencies—all the way to 25,000 cycles—are reproduced by a four-element electrostatic tweeter.

One of the tweeter's special features is a 120° sound dispersion which allows you to hear the full range of sound almost regardless of where you happen to be sitting in the listening room. Another feature is the addition of a level attenuator for controlling the balance between tweeter and woofer.

Like other electrostatics, the tweeter in the Electrostat 2 reproduces highs effortlessly and smoothly, adding to the warmth of the overall sound.

Measuring 22½" x 13" x 12", the Electrostat 2 is available in either mahogany (at $54.95) or teak (at $59.95) from Radio Shack Corporation, 730 Commonwealth Ave., Boston 17, Mass. —30—

Transistor Topics

By LOU GARNER

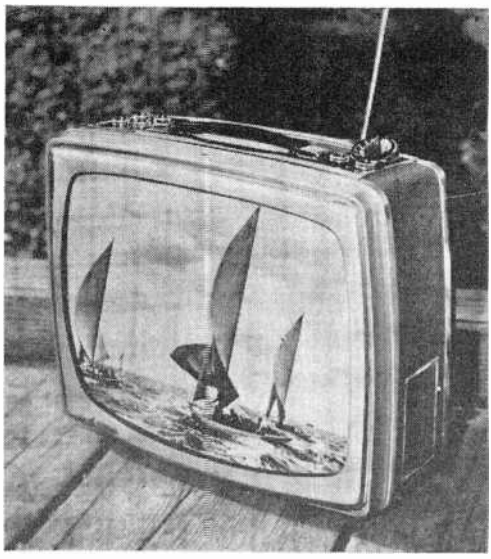
INTEREST in portable TV sets is starting to mount with the approach of the vacation season. If 1960 could be called the "Year of the Transistor Radio" (sales of these radios were at an all-time high last year), 1961 may well prove to be the "Year of the Transistor TV."

Transistorized television receivers are not new. The first sets were made within a couple of years after the transistor was invented. But these were custom-engineered, hand-assembled models using carefully selected transistors. Their performance, while adequate, hardly compared with standard tube-operated sets. On the other hand, their cost was astronomical; and no one seriously considered mass production and general sale.

• The Philco Corporation scored a "first" in 1959 with the introduction of the now-famous "Safari" 14, the world's first mass-produced, fully-transistorized (except for the CRT and high-voltage rectifiers) portable television receiver. The Safari is a compact, lightweight, moderately priced set, featuring a two-inch picture tube and a special optical system which enlarges the image to a size comparable to that obtained with a 14" direct-view tube.

Another major manufacturer, Motorola, scored a "first" in the last half of 1960 with the introduction of the world's first *large-screen* transistorized TV set. Dubbed the "Astronaut," the Motorola receiver looks much like a conventional tube-operated "portable" externally and has a 19" picture tube. Measuring 15½" x 18" x 12¾" overall, it weighs only 40 pounds, including the 5-pound silver cadmium "energy cell." Featuring a 40-mc. i.f. system and a mid-channel sensitivity of 15 microvolts, the set tunes all standard (V.H.F.) television channels. It can be operated on any standard 117-volt a.c. line or for up to five or six hours on its built-in rechargeable energy cell; when the Astronaut is plugged into an a.c. line, but turned "off," the energy cell is recharged automatically.

Three micro-alloy diffused high-frequency transistors are used in the tuner or "front-end" as the Astronaut's r.f. amplifier, mixer and local oscillator. (See Fig. 1.) Micro-alloy types are used in the three-stage i.f. amplifier strip. The remainder of the circuit employs more familiar transistor types, with *pnp* units



in all but the a.g.c. gate, sync separator, and horizontal buffer amplifier stages—where *npn* units are employed. Heat-sinked medium-power transistors serve in the audio and video output stages, with "hi-power" types in the horizontal output amplifier and power supply sections. The rectifier is a vacuum-tube high-voltage type. All together, the Astronaut has 24 transistors, 12 diodes and one vacuum tube in addition to the 19AEP4 picture tube.

As of this writing, Motorola and Philco are the only major U.S. manufacturers currently selling transistorized TV receivers, although several firms have models "in the works." A number of foreign producers have developed such sets, including that well-known Japanese firm, *Sony;* but, again, their sets are not yet available in the United States.

Readers' Circuits. Often, a relatively simple circuit can be employed for a wide variety of practical applications with only minor changes in lead connections or the addition of a few inexpensive components. As a case in point, reader Edgar N. Smith (907th Radar Squadron, SAGE, Bucks Harbor A.F.S., Machias, Maine) recently submitted a basic audio oscillator circuit which can be used for many projects with only a few modifications. Ed's basic circuit is shown in Fig. 2(A).

A single *pnp* transistor (*Q1*) is used in the common-emitter arrangement as a modified Hartley oscillator. In operation, transformer *T1* serves both to match the transistor's output impedance to the PM loudspeaker and to provide the feedback signal needed to start and sustain operation. Current-limiting resistor *R1* and control *R2* provide a signal feedback path as well as a source of base bias current. Operating power is supplied by battery *B1,* controlled by the s.p.s.t. switch *S1.* The circuit's operating frequency is determined by the transformer's characteristics and by the setting of potentiometer *R2* which serves as a tone control.

Readily available, low-cost components are found throughout. Transistor *Q1* is a CK722 unit, *R1* a ½-watt, 3300-ohm resistor, *R2* a standard 25,000-ohm potentiometer, and *S1* a toggle, slide, or rotary switch. Ed suggests a "replacement type" audio output transformer for *T1*—for example, the Stancor A-3856. Battery *B1* is a six-volt unit made up of four penlight or flashlight cells connected in series. The PM speaker is a 4" type having a 3.2-ohm voice coil. The circuit can be wired on a fiber or Bakelite board, on a small chassis, or in a plastic or metal box. Neither layout nor lead dress is critical.

A number of substitutions can be made to suit the builder's individual tastes or pocketbook. Almost any standard *pnp* transistor, such as the 2N107, CK768 or

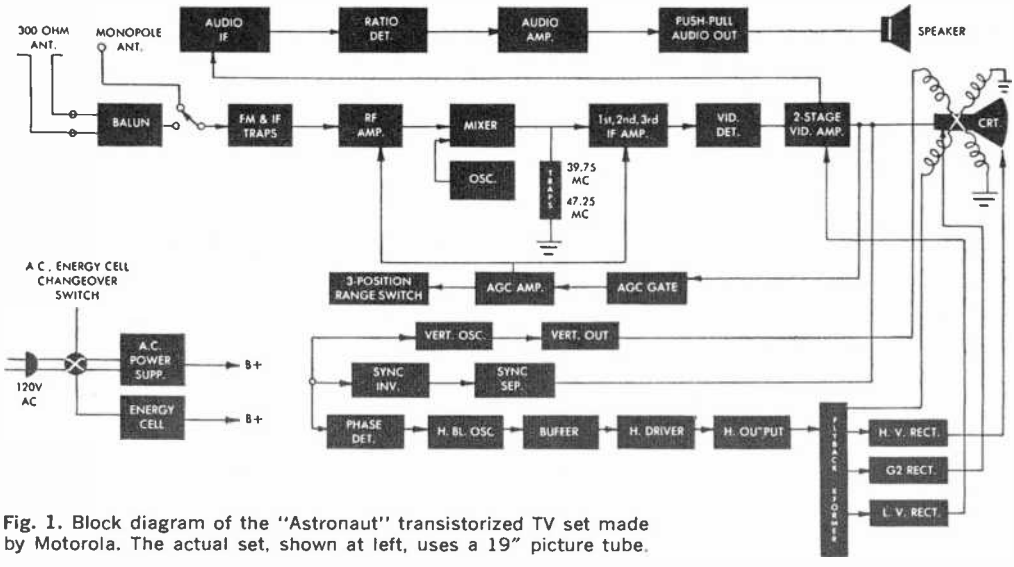
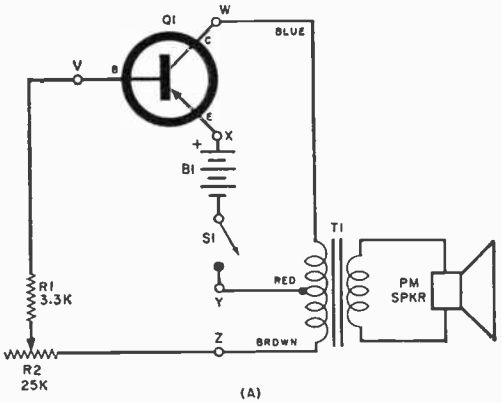


Fig. 1. Block diagram of the "Astronaut" transistorized TV set made by Motorola. The actual set, shown at left, uses a 19" picture tube.



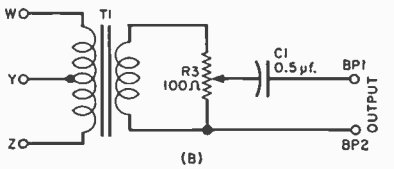
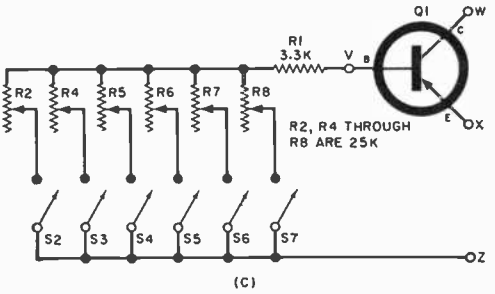
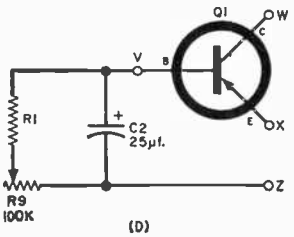


Fig. 2. A simple Hartley oscillator can be modified to perform other functions by changing the part of the circuit connected to points V, W, X, Y, and Z. As submitted by reader Edgar N. Smith, the basic circuit (A) can be changed to form an audio signal generator (B), a toy electronic organ (C), and an electronic metronome (D). Select taps on transformer T1 to reflect a 4000-ohm primary impedance.





2N109, will do for *Q1*. If preferred, *npn* units can be used simply by reversing battery polarity—suitable types are the 2N229 and the 2N170. Other battery voltages may be employed, although the higher voltages, in general, will deliver greater speaker volume (Ed has tried supply voltages from 1.5 volts—a single cell—to as high as 9 volts). Finally, a larger or smaller speaker may be used.

When assembled as a self-contained unit in a small box (a cigar box is fine), the basic circuit can serve as a point "tone source" for checking microphone placement during p.a. installation or when setting up for a recording session. But these are not the only applications: small modifications permit the circuit to be used as a code practice oscillator, audio test signal generator, toy electric organ, or metronome—see Figs. 2(B) through 2(D).

To use the basic circuit as a code practice oscillator, simply replace *S1* with a standard handkey. The loudspeaker can be retained or, if preferred, replaced with a pair of low-impedance headphones.

Figure 2(B) shows how the basic circuit can be employed as an audio signal generator. Connect a 100-ohm potentiometer (*R3*), a 0.5-μf., 400-volt capacitor (*C1*), and a pair of binding posts (*BP1* and *BP2*) across *T1*'s output winding in place of the PM loudspeaker. All other circuit connections remain as in Fig. 2(A). The output signal, while not a pure sine wave, is quite adequate for signal injection tests of hi-fi systems, p.a. amplifiers, record players, and intercoms.

The basic circuit can be turned into an intriguing toy organ simply by providing a series of push-button switches or keys (*S2* through *S7*) and individual potentiometers (*R2*, *R4* through *R8*, all 25,000 ohms) as shown in Fig. 2(C). Individual notes can be adjusted by the potentiometers as appropriate keys are depressed. As before, all other wiring is the same as in Fig. 2(A). With a little ingenuity, the circuit can be housed in a small toy piano.

Finally, by adding a 25-to 100-μf., 15-volt electrolytic capacitor (*C2*) and by replacing *R2* with a 100,000-ohm potentiometer (*R9*), the unit will serve as a

(*Continued on page* 124)

Track down squeaks, clinks, and thuds with...

VIBRATION PICKUPS

By LOU GARNER

VIBRATION PICKUPS are devices that change mechanical vibrations into electrical signals. Their action is similar to that of a microphone's when it converts sound (air vibrations) into a.c. signals. They can pick up a heartbeat, "listen" through a wall, or help track down a noise source.

Commercially available vibration pickups are generally in the $100-and-up price range. However, all it takes to make a pair of pickups yourself is an interesting evening's work and a modest investment for components.

There are two types you can build —high-impedance and low-impedance units. The high-impedance pickup is most sensitive in the mid-audio frequency range, while the low-impedance unit responds best to lower audio frequencies.

Low-Impedance Pickup. A modified permanent-magnet, 45-ohm, intercom-type loudspeaker mounted in a metal case makes up the low-impedance pickup (see illustrations on next page). Also in the case is a normally closed push-button switch; unless depressed, it effectively shorts out the speaker and thus prevents harsh noises when setting up the unit.

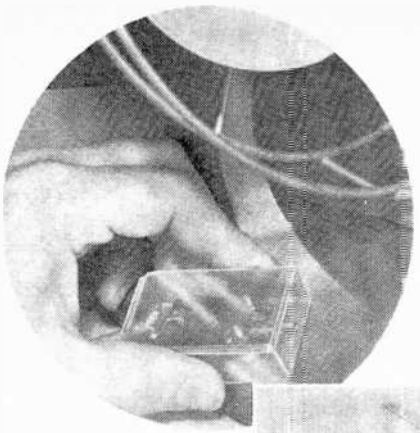
Cement a light plastic "cap" to the cone of the speaker. The cap's exact size is not critical, but it must fit on the rigid portion of the speaker's cone, and it must be large enough to project through a hole in the metal case. (The author used a cap from a "blister pack" of 45-rpm record adapters.) While the cement is drying, cut a circular hole in the case for the cap to pass through.

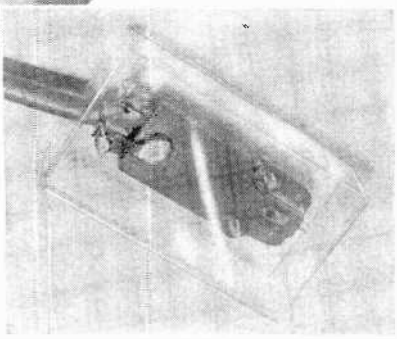
The cap does several jobs: it acts as a direct mechanical coupling between the vibrating object and the speaker's cone; it loads the speaker, peaking the low-frequency response and lessening its tendency to act as a microphone; and finally, it provides a smooth, non-scratching pickup surface. Vibrations are carried by the cap to the cone, thus moving the voice coil. The coil, vibrating in a magnetic field, generates an a.c. signal.

When using the low-impedance pickup, let the cap lightly touch the vibrating object and press the button. The output signal can be fed to either the high- or low-impedance input of an audio amplifier. Feed the amplifier's output to another speaker, a pair of headphones, a voltmeter, an oscilloscope, or a combination of these instruments.

Although most high-gain audio amplifiers (hi-fi, p.a., signal tracer, etc.) are suitable for amplifying the pickup's signals, they are not suitable for listening to heartbeats. For this purpose, you'll need a direct-coupled scope as the amplifier and indicator, and you will have to lower the scope's sweep rate. Many better-quality scopes have a set of terminals on the front panel for an external capacitor to lower the sweep frequency—one cycle might be a good starting point.

High-Impedance Pickup. The high-impedance unit is simply a high-output crystal phonograph cartridge mounted in





High-impedance pickup at right consists of phono cartridge mounted in plastic case. Above, unit is shown detecting vibrations in fan base.

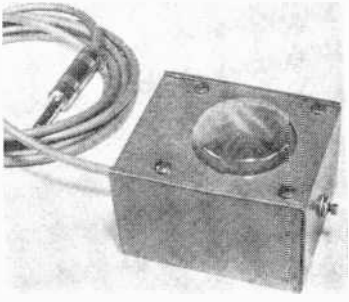
a small plastic case (see photographs at the left).

Drill mounting holes carefully so you won't crack the case. (The holes could be made with a hot nail, but you would have to trim away the excess raised plastic rim around the hole.) Use a length of shielded microphone cable with a suitable plug on one end to connect the pickup to an audio amplifier's high-impedance input.

When the high-impedance pickup is held against an object, any vibrations are carried to the cartridge case. The crystal bends with the movements of the case, and because of its piezoelectric properties, generates an electrical signal corresponding to these vibrations. The audio amplifier boosts the strength of this signal sufficiently to enable it to be listened to over a speaker or with earphones or to be observed on a scope. Noises in machinery or in cars are best detected with the high-impedance unit.

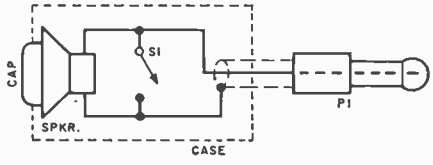
You can use your homemade pickups to listen to the "tick" of a watch, to locate a scraping noise in a machine, to check the effectiveness of shock-mounting a motor, or to find that squeak in the rear seat of your car. And you'll probably "pick up" other ideas as you go along. -30-

Low-impedance pickup, made from small 45-ohm speaker, uses plastic "cap" for mechanical coupling. The switch mounts on top of case.



PARTS LIST

P1—Connector to match amplifier's input jack
S1—S.p.s.t., normally-closed, push-button switch (Switchcraft 102 or equivalent)
Cap—Light plastic cap (see text)
Spkr.—2½-inch, 45-ohm speaker (Oxford 2CM-S-45 or equivalent)
1—4" x 2" x 2¾" metal box (Bud CU-3015 or equivalent)
1—36" shielded microphone cable
Misc.—Household cement, screws, nuts



Schematic diagram and parts list for low-impedance pickup. Switch S1 is normally closed.

Across the Ham Bands

By
HERB S. BRIER
W9EGQ

SELECTING A MULTIMETER FOR YOUR SHACK

YOU PROBABLY KNOW that a good multimeter is essential for servicing ham equipment efficiently. But if you are puzzled about what type to get, you are not alone. Electronics parts catalogs list dozens of multimeters in both kit and wired form, with any number of current, resistance, and voltage ranges. To add to the confusion, these instruments have ohms-per-volt ratings from 1000 ohms to 20,000 ohms or more, and vary greatly in price. However, a quick review of how a multimeter works should help you make your choice.

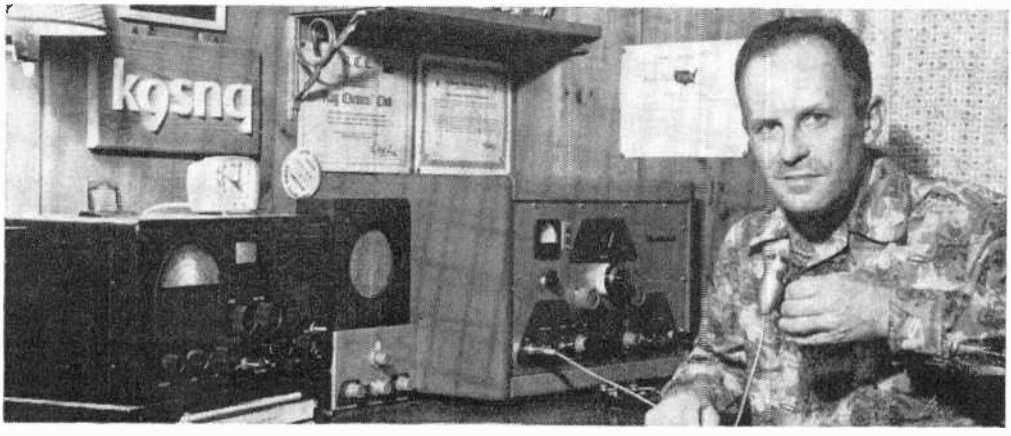
Voltage Measurements. Assume that you have a 1-milliampere d.c. meter. If you connect a 100,000-ohm resistor in series with the meter, it will require 100 volts across the combination to produce a full-scale meter deflection. (The voltage and resistance combination causes 1 ma. to flow through the meter, which has negligible resistance itself.) For lower voltages, the meter deflection will be proportional to the applied voltage.

The instrument we have just described is a voltmeter with a 1000-ohm-per-volt rating, which means that it has 1000 ohms internal resistance for each volt of its full-scale reading. In the same way, if you take a 50-microampere meter and insert a series resistance of 2 megohms, 100 volts will give a full-scale deflection, and you will have a voltmeter with a 20,000-ohm-per-volt rating.

In actual practice, a multimeter makes use of a milliammeter and a number of multiplier resistors which are switched in to provide different full-scale voltage ranges. Usually 0-1.5 volts is the lowest full-scale range, and 0-1500 volts is typical for the highest full-scale range.

If you measure the voltage across a low-resistance circuit, the 1000- and the

Orin Lloyd, K9SNQ, usually works the 75-meter phone band, while his c.w. exploits are mainly in the 80-meter band. As a Novice, Orin racked up 32 states on 40 and 15 meters.



Ham of the Month

Louise Moreau, W3WRE, "the lady known as 'Lou,' " of Johnstown, Pa., is a c.w. operator first, last, and almost always. Her only phone operation is a 10-minute stint on the weekly Cambria County radio amateur emergency 10-meter phone net—she is Emergency Coordinator for Cambria County. The rest of the time, look for W3WRE on 80-meter c.w. A regular member of several traffic nets, Lou has received several Brass Pounder League certificates for her superior message-handling ability. She is also an ARRL official relay station.

After midnight, Lou loves high-speed rag-chews on almost any subject—except housework and DX; try her on the history of wire telegraphy, Shakespeare, or ancient Greek plays. Lou has a war-surplus "Command" transmitter, modified for ham use, and a crystal-controlled transmitter she designed and built herself. She receives on an old National HRO—says it outperforms most modern ham receivers.

W3WRE's interest in anything connected with code has made her an authority on wire and wireless telegraphy—she has a collection of 76 different code keys up to 100 years old. Lou also has a collection of vacuum tubes, from a 1909 DeForest audion to modern, multi-grid tubes. She is a member of the DeForest Pioneers and the Morse Telegraph Club of America.

20,000-ohm-per-volt meters will give almost equal results. Suppose, however, you want to measure the plate voltage of an audio amplifier tube with a 270,000-ohm load resistor between its plate terminal and 250-volt power source. Although the actual voltage at the plate of the tube is 150 volts, it would measure only 72 volts on the 150-volt scale of a 1000-ohm-per-volt meter, and 142 volts on a 20,000-ohm-per-volt meter. Obviously the 20,000-ohm-per-volt meter gives a more accurate indication of the true plate voltage since very little current flows through the meter's relatively high internal resistance.

In a typical receiver, the a.v.c. voltage would measure a few volts if the meter circuit had a resistance of a megohm or more. But if you tried to measure the a.v.c. voltage with the 1000-ohm-per-volt low-resistance meter, it would present a virtual short across the a.v.c. line, and its pointer would not so much as quiver. Even the 20,000-ohm-per-volt meter would pull the a.v.c. voltage down to less than a quarter of its true value.

From the above, you can see that a very low current voltmeter is required for accurate measurements in high-resistance circuits. Fortunately, the required high sensitivity can be obtained by using a vacuum tube as a d.c. amplifier. The standard vacuum-tube voltmeter (VTVM) has a voltage-divider type of input circuit with a resistance of 11 megohms, permitting accurate voltage measurements even in high-resistance circuits. Like the multimeter, the VTVM requires a rectifier for a.c. voltage measurements. With either instrument, the internal resistance for an a.c. voltage range is lower than the corresponding d.c. range due to the loading of the rectifier.

Resistance and Current. The standard method of measuring resistance employs a series circuit of a battery, a variable resistance, and a milliammeter. After adjusting the variable resistance for full-scale deflection of the meter, connecting the circuit in series with an unknown resistance causes the meter reading to decrease in proportion to the resistance being measured. The usual 1000-ohm-per-volt meter will measure resistances up to a half megohm, the 20,000-ohm-per-volt meter up to 10 megohms, and the VTVM up to 100 megohms or more. As is the case with voltages, several resistance ranges are provided in commercial instruments.

Current ranges in conventional volt-ohmmeters are incorporated by switching suitable shunts across the indicating meter. However, VTVM's, as a rule, do not have current ranges.

Where economy is a prime considera-

tion, an inexpensive 1000-ohm-per-volt multimeter is adequate for most ham transmitter voltage and resistance measurements, although the more sensitive models are certainly preferable for reasons we've already mentioned. The VTVM definitely has its advantages, especially in trouble-shooting receivers, due to its ability to measure low voltages in high-resistance circuits. However, the VTVM requires a 117-volt a.c. power source, which makes it inconvenient for such work as checking out a mobile installation in the field. Also, a VTVM is often affected by strong r.f. fields, which upset its accuracy when used around a transmitter. These facts, plus its lack of current-measuring facilities, make the VTVM a close second choice to the 20,000-ohm-per-volt multimeter for the average ham. Lucky hams have both a multimeter *and* a VTVM.

KILOWATT R.F. VOLTMETER

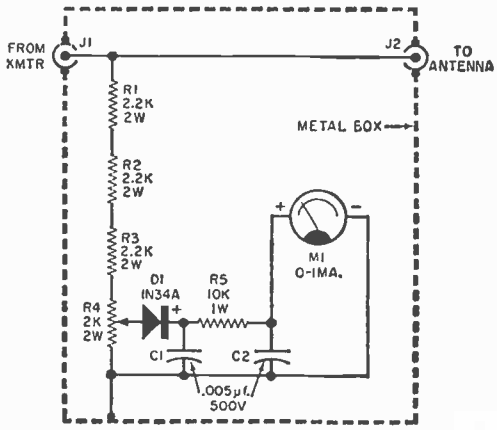
An r.f. voltmeter is a valuable accessory to any ham transmitter. Properly used, it can help you get more output from your transmitter than you could by adjusting the rig while watching the plate current meter alone.

The unit shown here is easy to build and works equally well with coaxial-fed and end-fed antennas. With the specified components, it will handle the full legal ham power in any mode of transmission when used with a matched 50- to 75-ohm antenna system. It will also give a useful indication at power levels under 25 watts, and will even handle the r.f. voltages on a mismatched antenna.

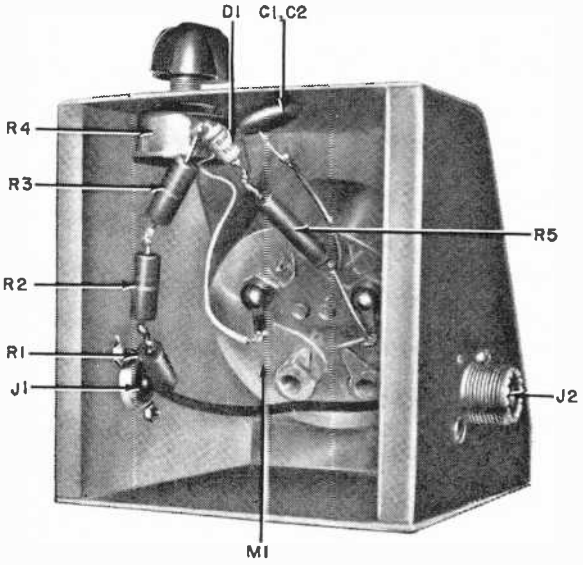
Construction. The r.f. voltmeter is housed in a 4½" x 4" x 4" aluminum universal meter box (Bud CMA-1936 or equivalent) which will accommodate 2", 3", or 4" meters. (It could be built right into your transmitter's cabinet if there is enough room.) The 1-ma. d.c. meter (*M1*) is mounted in the box's prepunched meter hole, and coax connectors *J1* and *J2* go on opposite sides of the box about 1½" from the bottom and rear.

Mount the 2000-ohm, 2-watt potentiometer, *R4*, (Ohmite CU or equivalent),

(*Continued on page* 119)



The r.f. voltmeter described here should be built in a metal box. All resistors must be composition rather than wire-wound units. Meter MI's scale need not be calibrated.



A utility cabinet will serve as the metal box, or you can house the unit in your transmitter's cabinet if there is room. Be sure that all wiring is short and direct.

New CB Heathkit

Model GW-10 tunes all channels, transmits on three

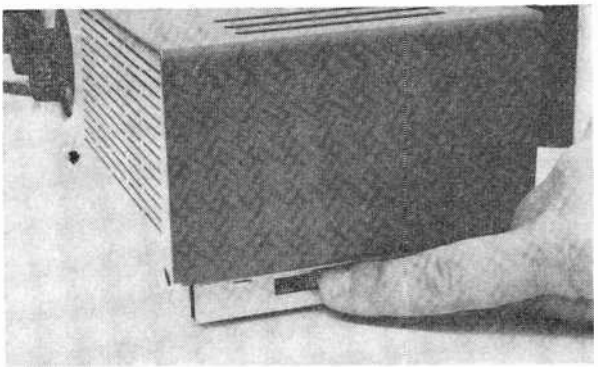
IS your workbench time worth $3.00 an hour? If so, take a crack at the Heathkit Model GW-10 transceiver. It sells for $62.95 as a kit and $99.95 wired. We assembled one in just about 12 hours —a saving of some $37.00.

Of straightforward design, the GW-10 is built around a 5-tube receiver and 2-tube transmitter. There is the usual doubling up in the audio/modulator stages so that the seven tubes are really performing 11 different functions. The receiver is a single-conversion unit with a 455-kc. i.f. channel. An RCA phono jack serves as the antenna input connector.

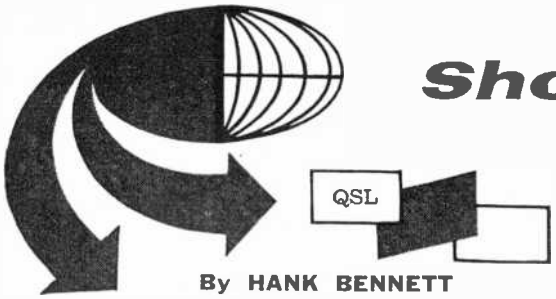
Power output of the GW-10 was measured at 2.9 watts into 55 ohms, a little better than you can get with the average CB transceiver. Modulation was full and very clean-cut. -30-

BOX SCORE				
	Excellent	Good	Fair	Poor
Talk Power	✓			
Selectivity		✓		
Sensitivity		✓		
Squelch	✓			
Noise Limiting	✓			
Stability	✓			
Operating Ease		✓		

Changeover from crystal to variable all-channel tuning is accomplished with this slide switch on the front panel.



One of the three transmit crystals is selected by a slide switch mounted on the right-hand side of the transceiver.



Short-Wave Report

By HANK BENNETT
W2PNA/WPE2FT

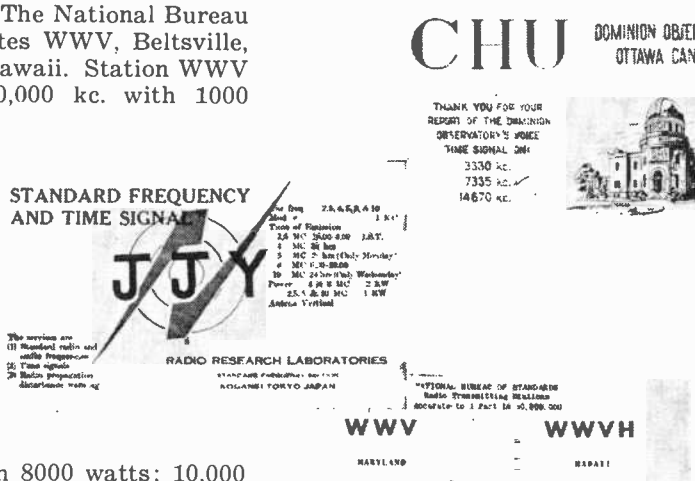
STANDARD FREQUENCY AND TIME STATIONS

MANY of our readers are well aware of the existence of certain Standard Frequency and Time Stations such as WWV and CHU. But some of you may not know about several other such stations which are also on the air. Let's run through the complete list of Standard Frequency and Time Stations with a brief resume of each. All times given are EST.

WWV and WWVH. The National Bureau of Standards operates WWV, Beltsville, Md., and WWVH, Hawaii. Station WWV is on 2500 and 20,000 kc. with 1000 watts; 5000 kc. with 8000 watts; 10,000 and 15,000 kc. with 9000 watts; 25,000 kc. with 100 watts. Station WWVH runs 2000 watts on 5000, 10,000 and 15,000 kc.

Operation of WWV is continuous except for a silent period of approximately four minutes each hour, starting at 45 minutes plus 0 to 15 seconds after each hour. Station WWVH is interrupted for approximately three minutes beginning at about 10 seconds after the start of each hour and at each 15-minute period thereafter; and also for periods of 34 minutes daily starting at 1900.

For time signals, the audio frequencies are interrupted precisely two minutes before each hour and resumed exactly on the hour and each five minutes thereafter. The voice announcement: "National Bureau of Standards WWV, when the tone returns Eastern Standard Time will be . . . AM (or: . . . PM)". Reports go to the National Bureau of Standards,



Colorful QSL cards will be your reward for sending reception reports to most of the standard frequency and time stations. If you're not sure that a particular station prints its own QSL's, type one out on a postcard for the station to sign and return to you.

Boulder Laboratories, Boulder, Colorado, for both of these stations.

MSF. The National Physical Laboratory operates MSF, Teddington, Middlesex, England, on 2500, 5000, and 10,000 kc. with 500 watts and on the long-wave frequency of 60 kc. with 10 kilowatts. The schedule reads: 0929-1030 on 60 kc.; continuous on the other frequencies. There is a break in transmissions from 15 to 20 minutes past each hour on all

Peter Lohner, WPE7LH, Gaston, Oregon, listens on a Hallicrafters SX-99 receiver aided by an RME DB-23 preselector. He has collected 41 veries to date.

channels except 60 kc. The call-sign is given three times in slow Morse code. The voice announcement: "This is MSF, Rugby, England, transmitting carrier and modulation frequencies on 2500, 5000, and 10,000 kilocycles." Verification is by letter.

GBR, GPB30, GIC37. Royal Greenwich Observatory, Time Department, Herstmonceux Castle, Hailsham, Sussex, England, radiates international time signals at 0500 and 1300 on GBR, 16 kc.; GPB30, 10,332.5 kc.; and GIC37, 1768 kc.

CHU. The Dominion Observatory, Ottawa, Ontario, operates CHU on 3330 kc. (300 watts) and on 7335 and 14,670 kc. (3000 watts) with continuous time signals. The voice announcement, given in the last 10 seconds of each minute, is: "Dominion Observatory, Canada, . . . hours, . . . minutes." Verification is by QSL card.

JJY. Radio Research Laboratories, 13-6 chome, ligura, Azabu, Minato-ku, Tokyo, Japan, operate JJY on 5000, 10,000, and 15,000 kc. continuously, and on 2500 kc. from 0159 to 1759. All outlets are rated at 2000 watts. The station is off the air from the 29th to 39th minutes of each hour. Verification is by card.

HBN. The Neuchatel Observatory, Neuchatel, Switzerland, operates HBN on 2500 kc. from 0210 on Saturday to 0200 on Tuesday, and from 0210 on Wednesday to 0200 on Friday; and on 5000 kc. from 0210 on Tuesday to 0200 on Wednesday and from 1210 on Friday to 0200 on Saturday.

LOL. Observatorio Naval del Ministerio de Marina Costanera Sud, Buenos Aires, Argentina, operates LOL on 5000, 10,000, and 15,000 kc. (each 2000 watts) daily except Sundays and holidays at 0600-0700, 0900-1000, 1200-1300, 1500-1600, and 1800-1900. A 1200-cycle tone is heard for the first four minutes of each five-minute period. The fourth to fifth minute is devoted to identification consisting of LOL in Morse code (given three times) and the Argentine time in a feminine voice.

OMA. Standard Frequency Station OMA, Prague, Czechoslovakia, operates 24 hours a day on 50 kc. at 5 kw. and on 2500 kc. at 1 kw.; also on 3170 kc. at 8 kw. between 1300 and 1900.

FFH. National Research Centre of Telecommunications, Laboratoire de Bagneux (Seine), France, (FFH), transmits on 2500 kc., 250 watts, on Tuesdays and Fridays at 0330-1130.

ZUO. Union Observatory South Africa, in Johannesburg, South Africa, (ZUO), is scheduled on 5000 kc. with 4 kw. and 10,000 kc. with 250 watts 24 hours a day, interrupted from 15 to 25 minutes past each hour. This station has been heard on 5000 kc. at 2230-2245 with identification in Morse code every 15 minutes.

It is believed that there may be a station operating from somewhere in China with the call BPV, but this has not yet been confirmed. Details, anyone?

In recent tuning, your Short-Wave Editor noted WWV, MSF, and HBN battling it out on 5000 kc. around 1800 with all three signals being easily read. Stations LOL and WWV (and, at times, WWVH) can be heard well on 15,000 kc. during early evening hours.

(*Continued on page* 112)

On the Citizens Band

By TOM KNEITEL, 2W1965

AMATEUR radio operators have been using "phone patches" for years, and, as evidenced by mail we've received, CB'ers are now trying to decide whether phone patches are legal, practical, and adaptable on 11 meters. A phone patch, in case you are wondering, is a gizmo used at a base station which hooks the transmitter and receiver into the regular landline telephone system. It permits the station to place "free" toll telephone calls for mobile units or other base stations.

Although Part 19 of the FCC Rules is silent about phone patching, FCC'ers have definite ideas on the subject. The way it was explained to yours truly was that "technically" it was "illegal," because CB is "supposed to provide communications for those parties unable to obtain communications in any other services." So if you want to place a telephone call from a car, you should use the regular telephone company "mobile radiotelephone" service. If you want to place a call from a base station to another CB'er out of your transmitting area, use the land-line telephone.

They're making CB rigs by the handful these days, and the YL in the photo at right will give you a peek at a new handy handful, the "Telepath" Model SC-A base station transceiver made by Seiscor (Box 1590, Tulsa, Okla.). Both receiver and transmitter sections are transistorized and packed into a 7" x 3" x 4" case. The receiver is a crystal-controlled superhet pushing a 2½" PM speaker. Transmitter output is 100 milliwatts over a range of one mile —the range can be extended to as much as 8 miles if you use an external antenna. A variety of power supplies are available for this tiny, 20-ounce rig.

The following worthy items are reprinted from "3-W Scribbler," official publication of the Bux-Mont Citizens Radio League (49 Ridge Ave., Sellersville, Pa.).

- *DANGER! When fueling your car, DO NOT TRANSMIT! Explosion is likely! (Some army vehicles have this notice posted on dashboard.) Why experiment?*
- *Have pity on the poor highway police. When you spot a radar speed trap, DON'T XMIT AND FOUL UP THEIR RADAR! They are unable to get a reading and hand out a speeding ticket.*

We looked into the radar item and learned that some police radar rigs have i.f.'s on 30 mc. A nearby transmitter

(*Continued on page* 108)

50-WATT STEREO AMPLIFIER AND CONTROL CENTER

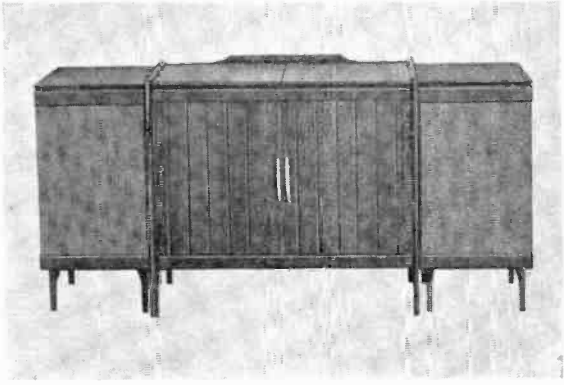
Get the most from your stereo system with this superb unit; power-packed 50 watts (25 w. per channel); complete tone, balance and stereo/mono function controls; five dual-stereo inputs plus separate monophonic mag. phono; mixed-channel center speaker output; luggage-tan vinyl clad steel cover. 31 lbs.

Kit Model AA-100 ..... **$84.95**
Assembled Model AAW-100 ..... **144.95**

GET BIG STEREO SOUND AT LOWEST COST WITH THIS COMPLETE STEREO-PHONO CONSOLE . . . NOW IN ASSEMBLED OR KIT FORM FROM $129.95 UP

Modest only in size and price, this new Heathkit Stereo-Phono Console amazes every listener with its room-filling, true-to-life stereo sounds. Proportioned to fit any room, it's less than three feet long and only end-table height, yet it houses a complete stereo-phono system with features usually found only in much larger consoles. There's *six* speakers . . . two 12" woofers for smooth "lows," two 8" speakers and two 5" cone-type tweeters for "mid-range" and "highs". The 4-speed automatic stereo/mono record changer is equipped with an "anti-skate" device and a turn-over diamond and sapphire styli cartridge. On the front panel are separate, dual bass and treble controls plus a concentric volume control. The handsome cabinet with solid genuine walnut frame, walnut veneer front panel, and matching "wood-grained" sliding top measures just 31¾" L x 17⅝" D x 26¾" H. Whether you buy the ready-to-play or kit form, the cabinet is factory assembled and finished. 70 lbs.

Kit Model GD-31 ..... **$129.95**
Assembled Model GDW-31 ..... **149.95**



COMPLETE 28-WATT AND 50-WATT STEREO CONSOLES

Enjoy incomparable Heathkit stereo with factory wired components in beautiful preassembled, prefinished cabinets . . . ready to use! The consoles are available in both 28 and 50 watt models, with money-saving optional kit plans. The 28-watt model (HFS-26) contains the Heathkit AJ-10 stereo AM/FM tuner, SA-2 stereo amplifier, AD-50A stereo record changer and two US-3 12" coaxial hi-fi speakers. The 50-watt model (HFS-28) contains the Heathkit AJ-30 deluxe stereo AM/FM tuner; AA-100 deluxe stereo amplifier; AD-60B deluxe stereo record changer; and two Jensen H-223F coaxial 2-way 12" hi-fi speakers. Specify walnut or mahogany.

Assembled Model HFS-26 . . . 215 lbs. **$475.00**
Kit Model HFS-27 . . . 215 lbs. **370.00**
Assembled Model HFS-28 . . . 264 lbs. **675.00**
Kit Model HFS-29 . . . 264 lbs. **550.00**
(Cabinets available separately, write for information)

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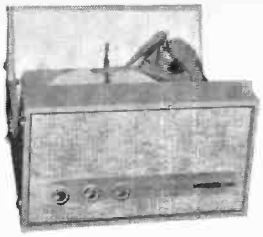


STEREO/MONO PORTABLE PHONOGRAPH

Now you can thrill to magnificent stereo wherever you are, wherever you go! The smartly-styled cabinet with two-tone aqua and white durable vinyl covering comes completely preassembled. In closed carrying position the speaker wing and main cabinet blend into a single handsome unit in dazzling aqua and white vinyl. In use, the detachable speaker-wing top may be spaced at any distance for maximum stereo effect. The completely preassembled automatic changer plays your favorite stereo and mono records at speeds of 16, 33⅓, 45 and 78 rpm, while controls on the amplifier section give you complete command of volume, stereo-balance and tonal quality. 28 lbs.

Kit Model GD-10 ..... **$69.95**

. look forward to the happy months ahead

of outdoor living with Heath equipment

PORTABLE 4-TRACK STEREO TAPE RECORDER

Plays and records 4-track stereo tape for endless hours of delight! Can even be used as a hi-fi center to amplify and control tuners, record players, etc. Has "record," "play," "fast-forward" and "rewind"; 2 speeds (3¾ and 7½ IPS); tone balance and level controls; monitoring switch for each channel to let you hear programs as they are recorded; pause button for editing; and two "eye-tube" recording level indicators. Speaker wings are detachable. Cabinet and tape mechanism are preassembled; all amplifiers and speakers included. 49 lbs.

Kit Model AD-49 ..... **$179.95**

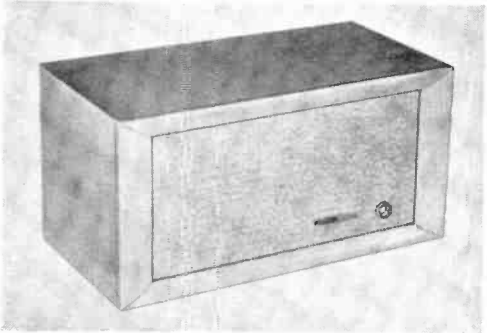
NEW LOW COST STEREO RECORD CHANGER KIT

Here's fine changer features at a budget price . . . oversize 11" turntable, "anti-skate" device, jam-proof mechanism and plug-in cartridge head. 4 speeds with automatic shutoff. Assembles easily, quickly with no special tools. Complete with your choice of three different, famous-name, diamond-styli stereo cartridges. 15 lbs.

Model AD-80C, Sonotone 8TA4-SD cartridge **$37.95**

Model AD-80A, GE VR-227 cartridge **41.95**

Model AD-80B, Shure M8D cartridge **42.95**



REVERBERATION SYSTEM

Add a thrilling new "cathedral" dimension to listening! Reverberation supplies the dimension of spaciousness to sound, as heard in concert halls, etc. where "echoes" enrich and reinforce the original sounds. The GD-61 adds reverberation acoustically, not by electronic mixing, thus it doesn't disrupt your present system and it may be placed anywhere for best listening effect. Can be connected to speaker terminals of hi-fi systems, radios, TV sets, etc. Control lets you add just the right amount of reverberation. The GD-61 consists of Hammond type IV reverberation unit, amplifier with power supply and 8" speaker. Preassembled birch cabinets in mahogany or walnut finishes. Measures 11½" H x 23" W x 11¾" D. 30 lbs.

Kit Model GD-61M (mahogany) or **GD-61W** (walnut) each **$69.95**

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3. HEATHKIT learn-by-doing Science Series for youngsters.

HEATH COMPANY / Benton Harbor, Michigan

TWO AND SIX METER TRANSCEIVERS

The "ham on the go" will find the new Heathkit "Shawnee" 6-meter and "Pawnee" 2-meter transceiver kits irresistible! Both of the handsome units offer complete AM and CW facilities with: single knob tuning . . . tracked VFO and exciter stages; 10 watt output; built-in low pass filter; three-way power supply built-in for 117 VAC, 6 VDC or 12 VDC with separate DC and AC plugs and cables included; dual-purpose modulator . . . 10 watts for high level plate modulation or 15 watts for PA operation; double conversion receiver . . . crystal controlled first oscillator; tuning meter . . . auto-switched for received signal strength or relative power output; VFO or crystals . . . front panel switch of VFO or four crystals for novice, CAP, MARS or net operation: "spotting" switch; complete shielding of power supply, final and receiver front end; ceramic microphone . . . push-to-talk with coiled cord. And many more outstanding features . . . write for information. 34 lbs.

Kit Models HW-10 (6 meter) and HW-20 (2 meter) each.....$199.95

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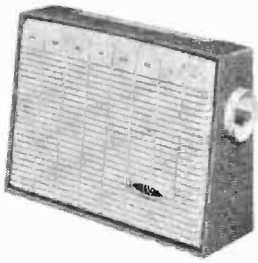
6-TRANSISTOR PORTABLE RADIOS

These award-winning, smartly-styled portables are ready to go anywhere! Both feature vernier tuning; 6-transistor circuit; 4" x 6" speaker for big set tone; prealigned transformers. 6 flashlight cells furnish power. (less batteries).

Kit Model XR-2P (plastic) . . . 6 lbs.....$29.95

Kit Model XR-2L (sim. leather & plastic) . . . 7 lbs.....34.95



"WALKIE-TALKIE" CITIZEN'S BAND TRANSCEIVER

Ideal companion for the outdoorsman . . . talk to friends up to a mile away. No license required . . . anyone can use it . . . Features 4-transistor circuit, superregenerative receiver, crystal controlled transmitter. Powered by single long-life battery. Case included. 3 lbs. (less battery)

Kit Model GW-30 each.....$32.95

Assembled Model GWW-30 each.....50.95

"WARRIOR" GROUNDED-GRID KILOWATT LINEAR

Attention Amateurs! Compare it feature for feature, the Warrior paces KW rigs at double this low price! Completely self-contained, the amplifier, HV, filament and bias supplies are built-in. Drives with 50 to 75 watts. no matching or swamping network required. Stable g-g circuit with up to 70% efficiency. Oil-filled capacitor and 5-50 henry swinging choke. Bands: 80 through 10. Max. power input; SSB—1,000 watts PEP; CW—1,000 watts; AM—400 watts (500 using controlled carrier mod.); RTTY—650 watts. Write for information.

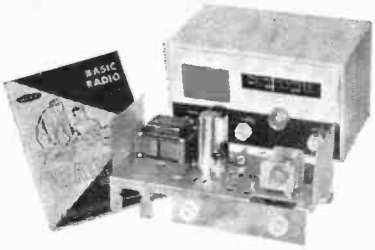
Kit Model HA-10 . . . 100 lbs.....$229.95

TRANSISTOR DEPTH SOUNDER

For summer boating fun and safety, the MI-10 is your best buy by far in a dependable depth sounder . . . and you can buy it in kit form or factory wired and tested, ready to use. Gives reliable depth indications to 100' or more over "hard" bottoms; somewhat less over "soft" bottoms. Rotating neon light gives clear indications on hooded dial face. Six long-life flashlight batteries are used for power. Transducer may be mounted through hull, or temporarily outboard. 10 lbs. (less batteries).

Kit Model MI-10.....$ 69.95

Assembled Model MIW-10.....107.95



HEATHKIT BASIC RADIO COURSE

Here's a new 2-part series in basic radio for youngsters and adults. "Basic Radio—Part I" teaches radio theory in everyday language, common analogies, and no difficult mathematics. Experiments performed with radio parts supplied result in a regenerative radio receiver. "Part II" of the series advances your knowledge of radio theory and supplies additional parts to extend your Part I receiver to a 2-band superheterodyne.

Model EK-2A . . . "Part I" . . . 8 lbs. $19.95

Model EK-2B . . . "Part II" . . . 4 lbs. . . .
Available March 24 . . . . . **$19.95**

Model AK-8 . . . Cabinet for Part II Receiver . . . 4 lbs. . . .
Available March 24 . . . . . **$3.95**

DELUXE CITIZENS BAND TRANSCEIVER

Get the GW-10 for superior 2-way communication: superheterodyne receiver with switch selection of crystal control of any one channel or continuous vernier tuning of all 23 channels; automatic "series gate noise limiter"; adjustable squelch control; press-to-talk mike with coil cord; illuminated dial. Crystal controlled transmitter has switch selection of 3 crystals (one furnished). Hardware supplied for under dash mounting. Built-in power supply, 117 V. AC and 6 or 12 V. DC models 11 lbs.

Kit Model GW-10 . . . . . $62.95
Assembled Model GWW-10 . . 99.95

3-BAND RADIO DIRECTION FINDER

Now, at big savings, a deluxe completely transistorized portable RDF in your choice of kit or assembled models. The DF-3 operates on marine beacon, standard broadcast and ship-to-shore bands to offer you both portable radio entertainment and reliable direction finding facilities. Featured are: 9-transistor circuit; 6 flashlight battery power supply; preassembled prealigned tuning section; new sense antenna for non-ambiguous bearings; lighted dial and tuning meter. 13 lbs.

Kit Model DF-3 . . . . . $ 99.95
Assembled Model DFW-3 . . . 169.95

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By
JOHN T. FRYE
W9EGV

Carl and Jerry

Therry and the Pirates

THE HUGE high school gymnasium was dark and empty except for a spotlighted basketball goal down at one end of the floor and the shadowy figures of Carl and Jerry standing beneath it. Carl was clad in his basketball uniform, but Jerry was wearing his usual shapeless sweater and fashionably beat-up cords.

"I must have been out of my cotton-picking mind when I let you talk me into this caper," Carl muttered while Jerry busied himself strapping a strange apparatus to the broad back of his athletic chum. Belts around Carl's waist and chest held a broomstick erect at his back so that the handle rose a few inches above his left shoulder. Fastened at the

top of the handle was a small aluminum chassis box with dials, jacks, and switches on the back of it. Two quarter-inch aluminum tubes stuck out the top of the box and went straight up, side by side and some six inches apart, for a distance of a couple of feet.

"You want to improve your free-throwing, don't you?" Jerry demanded, as he threw a switch on the little box. "Let's go over and sit down for a few minutes while those oscillators stabilize."

"Yeah," Carl agreed, seating himself gingerly on the substitutes' bench, "but I keep wondering if the Globetrotters started this way. Tell me again about this thing riding my back."

"The little box contains the tone-generating sections of two separate theremins," Jerry replied, stretching out on his back and closing his eyes. "You know what a theremin is and how it works, don't you?"

"I know it's a musical instrument played by just waving the hands near a couple of rods or plates. I think the motion of one hand controls the pitch of the tone produced, and the motion of the other controls the volume. But I've only a very foggy notion of how this is done."

"All right, let's think about the tone-generating portion first," Jerry suggested. "It consists of a couple of oscillators operating around 150 kc. In this case the oscillators are transistorized, because I copied them from a construction article on a transistorized theremin that appeared in the January, 1961, issue of *Electronics World.*

"The outputs of both oscillators are fed to a diode mixer that combines them and produces an audio signal with a pitch equal to any difference in frequency between the oscillators. One oscillator stays on the same frequency all the time. The other has a sense antenna, usually a metal rod or tube, connected to its frequency-determining circuit so that any capacity between this antenna and an object brought near it, like a

COMPLETELY NEW
DIFFERENT!
EXCITING!

Men-Women
17-55

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To help you EARN GOOD MONEY later in industry, DeVry's modern training provides a thorough grounding in basics . . . then develops your skill. Thus, there is no need for advanced education or previous technical experience at the start. Whether you train in your spare time at home or in our well-equipped Chicago or Toronto Laboratories, DeVry helps you become a well-trained technician, ready for a real career in Electronics.

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Please give me your two free booklets, "Pocket Guide to Real Earnings" and "Electronics in Space Travel!"; also include details on how to prepare for a career in Electronics. I am interested in the following opportunities (check one or more):

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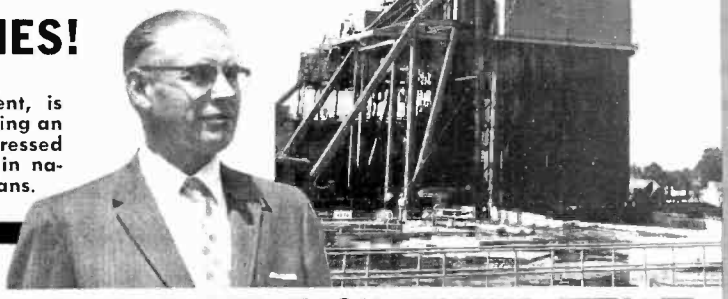
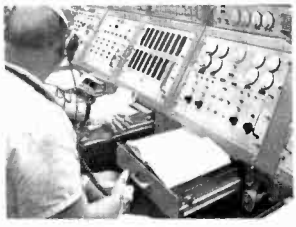
FROM BASICS TO OUTER SPACE ROCKETRY!

Not only the basic applications of electronics like Radio and TV, but also the satellites, space ships, guided missiles, all depend on Electronics Technicians who install, adjust, maintain and repair the equipment needed. What other job can be so exciting, profitable and promising? Yet many men, 17-55, can now train in the DeVry way at home for such jobs—without previous technical experience or advanced education.

DeVRY TECH PRESIDENT VISITS MISSILE FACILITIES!



Mr. T. J. Lafeber, DeVry's President, is shown here at missile test stand. During an inspection tour, he was deeply impressed with the role that is being played in national defense by electronic technicians.



THE COUNT DOWN! Here is a control panel for missile tests. Missile check-out and adjustment are largely the work of the Electronics Technician.

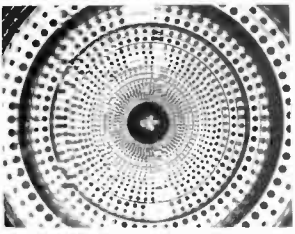
WHAT SOME DeVRY TECH GRADUATES ARE DOING!

Edward Hahn, Illinois, was a laborer. Now he is an Electronic Project Engineer with the Martin Company, a large producer of missiles.

Dale L. Gawthorpe, Illinois, left a clerk's job to take the DeVry program. He is now enjoying his work with automatic pilot equipment at Sperry Phoenix Company.

Charles Morishita, Oregon, worked as a farmer before taking DeVry's training. Now he builds and tests equipment at Lockheed's Space and Missile Division.

George D. Crouch, California, was a retail store clerk. He took the DeVry training program and today he is doing very well with his own business in the servicing field.



A RARE VIEW! This inside view of a ballistic missile is seldom seen by a civilian. It's a sight that greatly impressed Mr. Lafeber.

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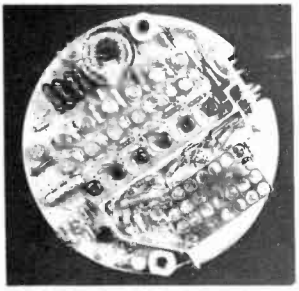

THE HEART OF THE MISSILE! Missile wiring soon becomes clear to a DeVry Tech man because he learns basic circuits by use of the "Electro-Lab," a training device that helps speed up learning.

DeVry Tech

4141 Belmont Avenue

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human hand, adds capacitance to the circuit and lowers the frequency of the oscillator. The *amount* of capacitance depends on how near the hand is held to the sense antenna—the closer the hand, the greater the capacitance.

"This, of course, changes the difference-frequency between the two oscillators and so changes the pitch of the tone produced by the instrument. Since the actual amount of hand-capacity is quite small, a circuit is used with the sense antenna that effectively amplifies this hand-capacity. When the variable oscillator is tuned to zero-beat the fixed oscillator with the hand away from the sense antenna, moving the hand toward the antenna from about a foot and a half away will cause the audio tone to go up several octaves from a very low pitch."

"I'm with you so far," said Carl, "but how does moving the other hand change the volume?"

"The volume control circuit uses another low-frequency oscillator," continued Jerry. "A resistor connects the tank circuit of this oscillator to a series-tuned circuit resonated near the oscillator frequency. The resistor and the tuned circuit form an r.f. voltage divider across the oscillator tank. A diode rectifies any r.f. voltage appearing at the junction point, and the d.c. thus produced is applied as bias to a transistor amplifying the signal delivered by the tone-generating portion. When do you think the least r.f. voltage will appear at the junction of the resistor and tuned circuit?"

"When the circuit is tuned to the resonant frequency of the oscillator," Carl answered promptly. "A series-tuned circuit has a very low impedance at its resonant frequency, but this impedance goes up rapidly as the circuit is detuned either way."

"Exactly right. The tuned circuit is adjusted to resonance with the left hand away from a metal plate that is connected to the tuned circuit. Under these conditions, practically no bias voltage is produced, and the amplifier works at full output.

"As the hand is brought nearer the plate," Jerry went on, "hand capacity causes the resonant frequency of this tuned circuit to go lower than the oscillator frequency. The impedance of the series-tuned circuit rises, as does the amount of bias voltage developed. This voltage reduces the output of the amplifier. In fact, when the hand is about an inch away from the volume control plate, the amplifier is completely cut off.

"Now this volume-controlling action is interesting, but it doesn't concern 'Therry' here. He just has two tone-generating systems, each with its own antenna, and without any volume control portions. Let's see if he's operating."

JERRY plugged a pair of stereophonic earphones into a jack at the rear of the aluminum box and moved his hand experimentally around the two antennas. Satisfied, he handed the earphones to Carl.

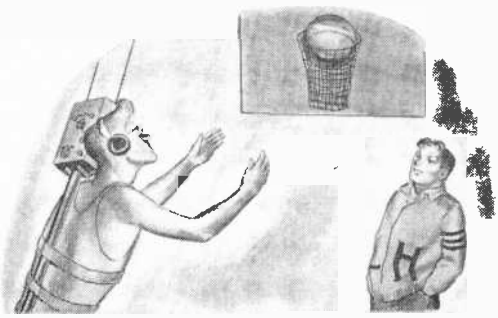
"I spent a lot of time making those two tone generators perform exactly

alike," Jerry said. "Notice that when I move my hand away from the middle of the two antennas along a line that keeps it equally distant from both, the tones heard in both ears stay exactly in step for all positions of the hand. But when I deviate from this line, even a little bit, the tones are different. The tone coming from the antenna nearest the hand is higher in frequency. Now let's see if Therry really works."

They moved to the foul circle, and Carl started pushing up shots at the basket. Jerry, wearing the earphones,

kept twisting the broomhandle until the antennas were in a position where the sound he heard when Carl made a basket was a single-tone *eeeooooop*. This was produced by the rapid movement of Carl's left hand going up at an angle from the bottom center of the two antennas and keeping equally distant from them until the ball left his fingers.

At this point Jerry placed the earphones on Carl's head, and connected a tape recorder to the output of one of the theremin units. Then he fed balls back to Carl while the latter continued pushing them up at the rim of the basket. Maybe it was chance, maybe it was that listening to the sound somehow unlocked the foul-shooting block that Carl had recently developed; but his percentage of goals went up sharply soon after he put on the earphones. Finally he hit eleven in a row, and then closed his eyes



tightly and lifted a twelfth straight through the hoop guided only by the sound in the earphones.

"I'll quit on that one," Carl said with a pleased grin as he began to unstrap the device from his back; "but I believe old Therry here helps. Anyway, let's all three of us do this some more every night until the big game Friday."

Jerry made an endless loop of tape carrying the theremin sound of a perfect shot, and each evening before Carl started practicing, Jerry would let this run a few times over the gymnasium sound system, to "prime the pump" as he put it. Carl's percentage of good shots not only continued at the same high level but actually improved.

The theory was that Therry permitted another sense to be brought to bear on the acquiring of a skill. Carl's eyes could follow critically the arc of the

ball; from his muscles and joints came a kinesthetic sensation of the wrong and right movements; and now his ears could hear the difference between hits and misses.

FRIDAY NIGHT the gym was filled to the rafters for the game with the Pottsville Pirates. The Pirates and the hometown Huckleberries had been traditional enemies for many years, and as far as either town was concerned this was the most important game of the season.

Jerry, as usual, was working the sound system; and he watched anxiously to see if Carl would be in the starting line-up. He breathed a sigh of relief as he saw his chum preparing to jump center against a rangy Pirate at least two inches taller, but he couldn't help thinking Carl looked a little naked without Therry strapped to his back.

The game was fought bitterly right from the start. At the half, the Huckleberries led by three points; but in spite of everything they could do, the Pirates relentlessly overhauled them and forged ahead by two full field goals at the end of the third quarter. When the Huckleberries came running out on the floor at the beginning of the last quarter, Jerry could see that Carl's jaw was set in a grim line.

Carl and the other Huckleberries played furiously, but the Pirates fought back just as hard. The battle raged up and down the floor as the seconds ticked away on the time clock. The score was 50 to 49 in favor of the Pirates. Finally, when the timekeeper was holding his pistol aloft with his eyes glued to the clock, Carl stole the ball from under the Pirates' goal and came charging down the floor. From far out, he leaped into the air and fired a desperate long shot at the basket as clawing Pirate hands tore at his wrists and the final gun rang in his ears.

The ball hit the backboard, fell down to the rim of the basket, rolled tantalizingly around it, then fell outside. A deep groan arose from the Huckleberry rooting section. But the referee was blasting away on his whistle and holding up two fingers while he waved Carl to the foul circle.

It was very quiet in the gymnasium as

Carl deliberately bounced the ball a couple of times before trying his first free throw. Jerry could see that the muscles in his shoulders were bunched with tension. When Carl attempted the shot, it did not even come close; and a murmur of disappointment ran over the crowd.

Up in the sound booth, Jerry made a quick decision. He switched the tape recorder into the p. a. system and started

the loop of tape on it moving past the tape heads. "Eeeeoooop, eeeeoooop, eeeeoooop!" was the sound that suddenly burst from the speakers, and hundreds of eyes turned to shoot indignant looks at Jerry. But the latter, watching his friend down on the floor, saw the tenseness go out of Carl.

Confidently Carl pushed the ball up in one easy, effortless motion. The ball swished through the hoop without touching it!

The ensuing overtime to break the tie was really anticlimactic. Nothing could stop the exuberant Huckleberries now, and the final score was 58 to 52 in their favor.

The fans swarmed around Carl and literally carried him off the floor. But as they surged past the sound booth, Carl looked at Jerry and threw up a long arm to make an appreciative, triumphant gesture with a circled thumb and forefinger. Therry was being given the credit for winning the game! -30-

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 .....

Space Electronics

(*Continued from page* 66)

DX'er uses a modest beam of only 6-db gain, however, he can work with "effective" powers near 1 megawatt!

"Passive" Satellites. Although there is much to be said for the "active satellite" which receives and transmits like a miniature relay station, many scientists are convinced that passive reflecting satellites have a definite place in the U. S. space program. The National Aeronautics and Space Administration (NASA) has plans to orbit another Echo-type balloon with about twice the reflective power of Echo I. This extra gain will result from increased size and reflectivity of the Mylar-aluminum foil surface.

Another line of thought concerning the Echo-type balloon is that such passive communication satellites should be *anything but* spherical reflectors. The U. S. Air Force has been studying unusual passive satellite designs that would be "100 times" more efficient in reflecting power than Echo I. It is interesting to note that if the latter experiments prove successful, FM and TV DX will become rather commonplace.

Space Facts. The Missile and Space Vehicle Department of the General Electric Company is currently distributing a comprehensive booklet on space data. Entitled "Space Facts," this 64-page booklet is jam-packed with figures, tables, and charts on the earth's atmosphere (how much, how far into space, etc.), the physics of space flight (or-

"In short, my plan is to develop the XM-7 rocket ourselves, launch it in 18 months, and claim Mars in the name of the Meredith Aircraft Corporation."

bit decay, thrust, re-entry problems, etc.), and bioastronautics (acceleration, impact, etc.).

One section is devoted to space communications, and shows the eight basic means of earth-to-space vehicle or satellite-to-satellite radio links. Distant range of one-way communication may be calculated from a fold-out table bound in the booklet.

Space Facts is really a handbook written for technicians and engineers who need basic information at their fingertips. Offered free (write Space Facts, Missile & Vehicle Dept., General Electric Co., 3189 Chestnut St., Philadelphia 4, Pa., Att. Mr. J. Hoffman), it will undoubtedly be in short supply. First come —first served.

Satellite Briefings. One of the many disappointments due to the failure of Pioneer VI (the projected lunar probe that exploded 70 seconds after launching on December 15, 1960) was the fact that a General Electric satellite tracking device had no chance to be tested. An optical tracker using a special TV camera tube attached to a high-power telescope, this G. E. system is so sensitive that it can take movies at night using only starlight. Following Pioneer VI to a lunar orbit would have been roughly equal to spotting something the diameter of a dime at a distance of 2500 miles!

The transmitters aboard TIROS II may be inactive by the time this column is in print—original plan for battery life was about 4 months, and TIROS II was launched on November 23, 1960. Both wide and narrow-angle TV camera lenses were present in the TIROS II, but the wide-angle TV lens was defocused during launching and only 86% (9524) of the photos relayed to earth are proving useful for weather analysis. Although the narrow-angle TV transmitter performed excellently, the photos are of comparatively little value without the orientation obtainable with the wide-angle lens. TIROS II also used a simple magnetic system to control the satellite spin axis, enabling ground observers to change the angle of the axis in space. The system was developed by RCA in cooperation with NASA. —30—

On the Citizens Band

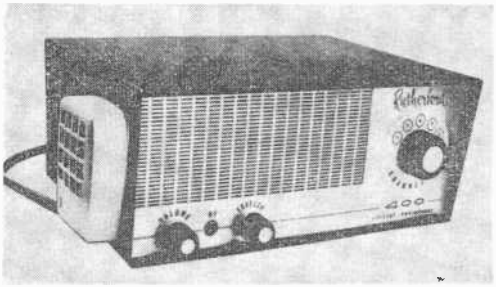
(*Continued from page* 93)

operating around the radar i.f.'s could possibly jam the radar receiver even though the police rig is enclosed in a metal case.

The Bux-Mont'ers, besides making useful revelations like the above, have also come up with what could be one of the dandiest gimmicks ever to emerge from a CB club. Ed Zitzer, 3W2603, Technical Editor of the "3-W Scribbler," is running a crystal swap-shop. Here's how it works.

Say a guy has a good crystal he doesn't use and would like to operate on a channel for which he has no crystal. He sends his unwanted crystal to the Bux-Mont club's swap-shop with a description of the unit it was made for, the channel number on which *he* would like to operate, the name of the unit he uses, and a 50-cent handling and service charge (per crystal). If the crystal he wants is not immediately available, it is sent to him as soon as it arrives at the shop from another CB'er. For further info, write Ed at 2721 Heather Lane, Glenside, Pa.

Another new transceiver is the R-400 which is available from Rutherford Electronics (8930 Lindblade St., Culver City, Calif.). The R-400 boasts an automatic noise limiter, adjustable squelch, and six



crystal-controlled transmit and receive channels. A direct-reading dial indicates the channel in use. Housed in an attractive black splash-proof case (see photo), the rig can be powered by either 6 or 12 volts d.c., or 117 volts a.c.

We recently dropped in at the Quartermaster Training Command, Fort Lee, Va., to say hello to a hearty group of on-Post CB'ers who are organizing into a full-fledged club under the leadership of Sgt.

Chuck Santee, 3W1849. The main hangout for the merry band, about 25 strong, is the Post TV Shop, where CB'ers George Stamos (5W2339) and Cliff Edwards (5W2346) can usually be found. Just about any hour during the day, you can listen to—or join in—over-the-counter rag-chews on subjects ranging from "Bermuda Belle" (the young lady taxi dispatcher who is often heard on channel 11) to why a 12AZ7 is a better substitute for a 12AV7 than the 12AV7 itself.

We understand that many military posts sport their own CB clubs, and we've been thinking about the advantages that would accrue if all these clubs formed some sort of association. When a military CB'er was transferred from one post to another, for example, he would have a ready-made group of buddies to welcome him. And a newspaper put out by such a group would be just fine for keeping military CB'ers in contact with former pals.

Use of 11 meters for racing is reported by R. B. Veilleux of Kenmore, Wash. Mr. Veilleux has two Heathkits, one in his 136 class inboard hydroplane and one in his auto. He says, "With this type of communications, the person observing a race from the car on shore can tell the 'skipper' of the hydroplane about various conditions occurring in the race that are not readily visible to him, such as who has dropped out, what (or who) went flying by, etc."

Keep it under your hats but several FCC folks have whispered (un-officially, of course) that there is nothing illegal about CB'ers using SSB (single sideband) on 11 meters. For those unfamiliar with the merits of SSB, a "5-watt" SSB station would be about 10 times more efficient than a regularly modulated station.

This is not to say that the FCC wouldn't start to shuffle around Part 19 if CB'ers started up on SSB, although there is just as good a chance that they wouldn't care. It is the *private* opinion of many FCC people that 11 meters is the "noise band" (as they call it) and CB'ers should be able to get away with practically any kind of carryings-on as long as they don't interfere with regular "commercial" stations. -30-

83 YX 929. Stereo Tape Record-Play Preamp Kit. $79.95 (less case)

One of the many great Knight-Kit stereo component kits. Professional quality; superb performance with virtually any 3-head tape transport; separate dual-channel recording and playback preamps; permits tape monitoring, sound-on-sound and echo effects. Packed with quality features for every possible stereo and monophonic function...

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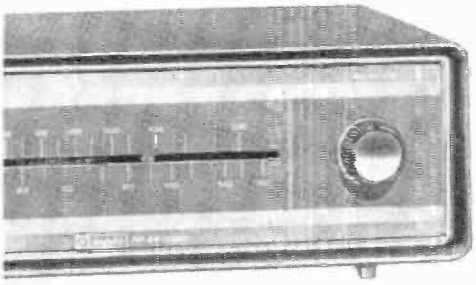
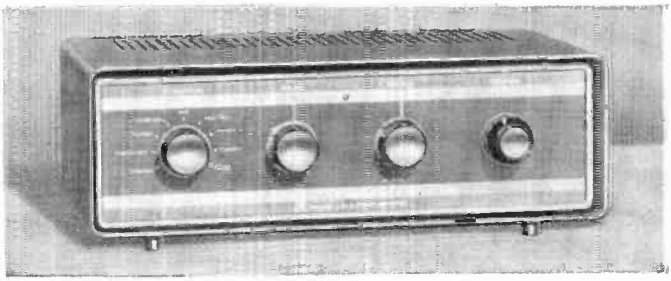


83 YX 928. FM-AM Hi-Fi Tuner Kit. $49.95

Typical Knight-Kit hi-fi value—incomparable at the price. With AFC, tuned RF stage on FM, multiplex jack. Straight FM tuner kit also available at $38.95. For deluxe Stereo FM-AM and FM tuner kits, see the Allied catalog...



83 YX 927. 20-Watt Stereo Hi-Fi Amplifier Kit. $39.95

Biggest bargain in quality Stereo hi-fi. Has special clutch-type dual-concentric level control; simplified control facilities; DC preamp filaments. Similarly styled 32-Watt Stereo Amplifier Kit with full frequency center channel available at a low, low $59.95...

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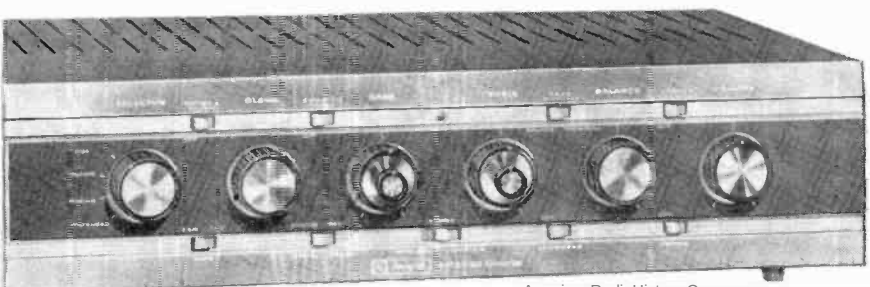

Super-power to drive any of today's speakers, a do-it-yourself stereo masterpiece, featuring: special "blend" control; full-range center channel; tape-source monitor; dual phasing switches; Stereo paralleling switch. For deluxe 40-watt Stereo amplifier at only $76.95, and 60-watt Stereo amplifier, see the Allied catalog...

83 YX 712-2. Superhet Citizen's Band Transceiver Kit. $79.95

Dual-conversion for highest sensitivity and selectivity; crystal-controlled operation on any 2 channels, plus manual tuning. Another Knight-Kit Citizen's Band Transceiver is available at an amazing low $39.95—see the Allied catalog for full details...

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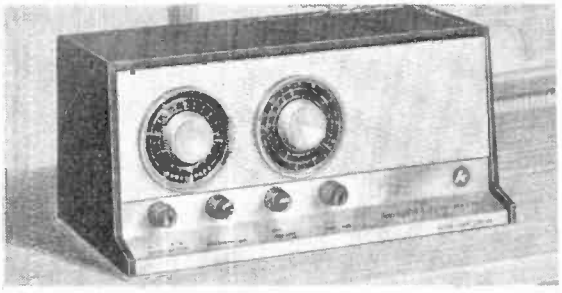

83 YX 258. 4-Band "Span Master"® Receiver Kit. $25.95

Fabulous performer for world-wide reception; thrilling shortwave adventures, plus fine Broadcast; band-switching, 540 KC to 30 MC; with cabinet. For additional receiver kits, radio-intercom, clock-radio, transistor radios, intercom systems, electronic labs and other great hobbyist Knight-Kits, see the Allied catalog...

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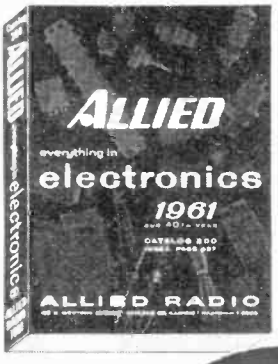
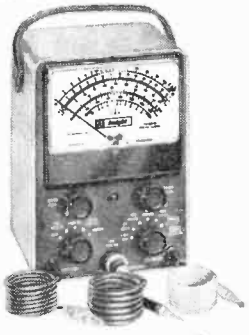


83 Y 125. Electronic VTVM Kit. $25.75

High sensitivity general-purpose VTVM; 11 meg input resistance; balanced-bridge circuit; 4½" meter. One of many fine instrument kits including 5" scopes, AC VTVM, tube checkers, signal tracer, audio generator, sweep generator, and others, described in detail in the Allied catalog...



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Short-Wave Report

(*Continued from page 92*)

The following is a resume of current reports. 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. Please send your reports to P. O. Box 254, Haddonfield, N. J., in time to reach your Short-Wave Editor by the eighth of each month.

Austria—*R. Austria* has been testing for several weeks from Moosbrunn with 50-kw. xmtrs as follows: on 6155 kc. at 0000-0400 and 1400-1600; on 7200 kc. at 0800-1030; on 7245 kc. at 0400-0600 and 1030-1400; and on 9770 kc. at 0600-0800. See the table on this page for a complete list of *R. Austria* (Osterreichischer Rundfunk) stations. Reports should go to P. O. Box 700, Vienna 50, Austria. *(WPE2DLT, WPE4BAX, WPE5AG, AS, RW)*

Azores—CSA97, Ponta Delgada, has been noted on 4875 kc. at 1715-1730 with pop music and Portuguese ID. *(WPE3AK)*

Brazil—A registered letter from the Bauru Radio Clube, S.A., informs us that Giacomo Perolo, one of our POP'tronics monitors, has been appointed as Shortwave Department Manager for ZYR31, 3275 kc., 1000 watts. The station is anxious to receive reports, especially from the U.S., and all reports will be verified if found to be correct. Veries will be mailed by surface mail unless you specify airmail and enclose an International Reply

SCHEDULE OF OSTERREICHISCHER RUNDFUNK

Station	Location	Kc.	Kw.	Time
OE120	Innsbruck/ Aldrans	6000	4	2330-1900
OE121	Kronstorf	6155	4	0800-1400 1800-2100
	Moosbrunn		50	0000-0400 1400-1600
	Moosbrunn		1	0400-0800
OE131	Kronstorf	7200	4	0000-0400
	Moosbrunn		1	0400-0800
	Moosbrunn		50	0800-1030
OE133	Kronstorf	7245	4	0600-0800
	Moosbrunn		50	0400-0600 1030-1400
	Moosbrunn		1	1400-1500
OE141	Kronstorf	9540	4	2100-2300
	Moosbrunn		1	1900-2100
OE142	Moosbrunn	9610	1	0100-0400
OE147	Kronstorf	9770	4	0400-0600
	Moosbrunn		50	0600-0800
OE152	Kronstorf	11785	4	1500-1800
	Moosbrunn		1	1100-1500 1800-1900
OE154	Kronstorf	11935	4	2300-0000
	Moosbrunn		1	2100-2300
OE171	Moosbrunn	17755	1	0800-1300
OE172	Moosbrunn	17765	1	0900-1100
OE180	Moosbrunn	21540	1	0500-0700
OE190	Fleckendorf	25615	20	0200-0400
OE191	Moosbrunn	25945	1	0600-0700

Coupon. Reports should be addressed as follows: Bauru Radio Clube, Shortwave Department, attention of Mr. Giacomo Perolo, Caixa Postal 446, Bauru (Est. de Sao Paulo), Brazil.

Canada—Due to a cut in appropriations in the International Service, *R. Canada* has suspended xmsns to Sweden (1400-1415), Norway (1415-1430), Denmark (1430-1445), Netherlands (1445-1500), and Italy (1600-1615) on 17,820 and 15,320 kc. In place of these xmsns, *R. Canada* has begun Eng. and French programs to Africa which are repeats of xmsns beamed earlier to eastern Europe and other areas. Left unchanged are the daily broadcasts to Australia, New Zealand, the Caribbean, and eastern Europe in Eng., French, Russian, German, Slovak, Czech, Hungarian, Ukrainian, and Polish. *(WPE1AW, BL)*

Congo—The Overseas Service of the National B/C Network of the Republic of the Congo, Leopoldville, is now operating regularly on 11,755 kc. to the U. S. and Canada at 1700-1900 daily. The broadcasts consist mainly of folklore, modern music of the Congo, and newscasts in Spanish, Eng., and French. *(WPE4BUJ, WPE6BID, WPE8BZL, WPE9AZI, and 112 other reporters!)*

Dominican Republic—*R. Caribe,* Ciudad Trujillo, is now on 3320 kc. in addition to 6210, 9486, and 15,064 kc. It has been noted at 1830-1900 with L.A. music. *(WPE3AK)*

Ecuador—HCJB, Quito, operates at 0000-0130 in Russian, German, and Spanish, and to the S. Pacific, British Isles, and Europe at 0130-0500 in Eng. and at 0500-0600 in Russian on 15,115, 11,915, 9745, and 6050 kc.; to Europe at 1400-1830 in Eng., French, German, Swedish, Spanish, and Russian on 17,890 and 15,115 kc.; to the Americas at 0900-1200 in Eng., German, and Russian on 17,890 and 15,115 kc. and at 2100-0000 in Eng. on 15,115, 11,915, and 9745 kc. *(WPE2DTO, WPE4BNW, WPE4CAE, WPE4CGX, WPE8CCF, WPEØBCA, VE3PE1EX, GD, RK, WM)*

England—The BBC beams its General Overseas Service to the U. S. at 1515-1715 on 11,860 kc., 1515-2100 on 9510 kc., and 1700-2100 on 6110 kc. Other Eng. xmsns are noted on 12,095 kc. at 1300-1400 (news at 1300) and on 9510 kc. (to Pacific areas) at 0200-0345 (news at 0200). *(WPE2DXB, WPE9IP, WPEØAE, WPEØAWX)*

Ethiopia—Addis Ababa is heard daily on 7220 kc. with Eng. at 1700-1730 and native language at 0100. *(WPE3NF)*

Formosa—*The Voice of Free China,* Taipei, operates in Eng. at 2030-2100 on 17,785, 15,225, 7255, and 6095 kc., at 0500-0550 on 17,785, 11,920, and 6095 kc., and at 0730-0825 ("The Little Dragon Show") on 15,225, 11,920, 9660, 7130, and 6095 kc. *(WPE8MS)*

Gabon—*R. Gabon,* Libreville, verified by card and sent the following new schedule: 0615-0730 and 1230-1600 Monday through Friday, 0615-0800 and 1230-1700 Saturdays, 0200-0800 and 1230-1600 Sundays, on 4777 kc.; and 0615-0730 daily (Saturdays to 0800, Sundays at 0200-0800) on 7270 kc. All xmsns are in French. *(WPE1BY, WPE1KO)*

Ghana—The Ghana B/C System, Accra, is now operating a new 50-kw. xmtr on 9525 kc. at 1245-1730. It was noted with Eng. news at 1600-1615. *(WPE2ALE, WPE3AK)*

Haiti—4VU, *R. Lumiere,* Cayes, has been noted on a new channel, 2410 kc., at 1753 with L.A. and French songs and a French ID at 1801. This station operates 65 hours weekly in Creole and French, 30 minutes only in Spanish. The power is 250 watts. *(WPE1BY, WPE3NF)*

India—An *All-India Radio* regional station at Bhopal, 4820 kc., can sometimes be tuned around 0735 with news in native language. *(WPE3NF)*

Ireland—A letter from Edward J. Roth, Director-General, R. Eireann, Dublin, reads in part: "At the present time there are no plans for regularly scheduled broadcasts on shortwave . . . into the northeast section of the U. S. A. It is largely a question of the lack of interest in shortwave radio in the U. S. not justifying the tremendous expenditure necessary for this type of service . . ." *(WPE1CR)*

SHORT-WAVE ABBREVIATIONS

Anmt—Announcement
BBC—British Broadcasting Corp.
B/C—Broadcasting
Eng.—English
ID—Identification
IS—Interval signal
kc.—Kilocycles
kw.—Kilowatts
L.A.—Latin America
N.A.—North America
R.—Radio
xmsn—Transmission
xmtr—Transmitter

Jordan—The Hashemite Jordan B/C Service, Amman, was to have started a directional broadcast to North and South America on a rhombic antenna last December. Have any of our readers heard this American broadcast as yet? An Arabic session was noted on 7155 kc. at 2230-2330. Reports go to P. O. Box 909, Amman, Jordan. *(WPE8MS)*

Katanga—*R. Katanga,* Elisabethville, 11,866 kc., is heavily reported at various times between 2300-0700 and 1100-1600 with classical and semi-classical music, some pop tunes, and anmts in French and native language. An Eng. ID is given about every 30 minutes. News in French is reported at 1500. *(WPE1KO, WPE1TX, WPE2BUM, WPE2DEY, WPE2DUQ, WPE4AVV, WPE4FY, WPE6BPN, WPE8ACA, WPE8MM, WPE8MS, WPE9BDZ, WPE9DK, WPE9MD, VE2PE6O, VE2PE7A, VE3PE7D, VE7PE2M, CB, HB, GF, ER, AWS)*

Liberia—ELWA, Monrovia, is heard well on 11,825 kc. at 1955-2245 on Tuesdays to North America. A North African xmsn is reported on 15,085 kc. on Fridays at 1640-1715 in Eng. and Portuguese. The 4770-kc. outlet has been tuned at 0140-0214 with music, news, and Eng. anmts; a similar program was heard on ELBC, 3255 kc., with Eng. news at 0200. *(WPE1KW, WPE2DFB, WPE3ALX, WPE4AVV, WPE4CHQ, WPE6BNN, WPE6BOM, WPE9DK)*

Martinique—*R. Martinique,* Fort-de-France, is heard at times between 1830 and 2107 on 2420 kc. with French news and music. *(WPE1KO, WPE2CRX)*

Mauretania—A station at Aioun el Atrouss

SHORT-WAVE CONTRIBUTORS

Stanley Schwartz *(WPE1AAC)*, Bridgeport, Conn.
David Eastman *(WPE1AW)*, Ashton, R. I.
Jerry Berg *(WPE1BM)*, W. Hartford, Conn.
Alan Roth *(WPE1BV)*, Bridgeport, Conn.
David Gerns *(WPE1CE)*, Concord, Mass.
Jim O'Mara *(WPE1CR)*, S. Boston, Mass.
Edward Bowker *(WPE1KO)*, Keene, N. H.
Johnny Chane *(WPE1KW)*, Winchester, Mass.
Bob Fink *(WPE1TX)*, Providence, R. I.
Richard Roll *(WPE2ALE)*, Hamburg, N. Y.
Peter Rader *(WPE2BUM)*, Greenwood Lake, N. Y.
Joseph Russo *(WPE2CRX)*, Toms River, N. J.
Robert Previdi *(WPE2DEY)*, New York, N. Y.
Michael Baumann *(WPE2DFB)*, Binghamton, N. Y.
Bart Lee *(WPE2DLT)*, Bergenfield, N. J.
Ronnie Breiger *(WPE2DTO)*, Englewood, N. J.
Steven Weinberg *(WPE2DUQ)*, Brooklyn, N. Y.
Michael Russo *(WPE2DXB)*, White Plains, N. Y.
Ed Kowalski *(WPE3AK)*, Philadelphia, Pa.
Vincent Pinto *(WPE3ALX)*, Philadelphia, Pa.
George Cox *(WPE3NF)*, New Castle, Del.
Fred Colley *(WPE4AVV)*, W. Palm Beach, Fla.
Stanley Kaplan *(WPE4BAX)*, Miami, Fla.
James Poore *(WPE4BNW)*, Byrdstown, Tenn.
Charles Douglas *(WPE4BUJ)*, Alma, Ga.
Ralph Colaianne, Jr. *(WPE4CAE)*, Tampa, Fla.
A. V. Dunaway *(WPE4CGX)*, Mableton, Ga.
Roy Lincoln *(WPE4CHQ)*, Morehead City, N. C.
Jim Maynard *(WPE4FY)*, Lexington, Ky.
Wayne Andrews *(WPE5ADU)*, Russellville, Ark.
William Bing *(WPE5AG)*, New Orleans, La.
Larry Nicholas *(WPE6BID)*, Sonora, Calif.
Jerry Rudmann *(WPE6BNN)*, Covina, Calif.
Jack Overcash *(WPE6BOM)*, Fairfield, Calif.
Shaler Hanisch *(WPE6BPX)*, Pasadena, Calif.
J. Art Russell *(WPE6EZ)*, San Diego, Calif.
Rob Wintersteen *(WPE7CB)*, Sunnyside, Wash.
Warren Studebaker, Jr. *(WPE8ACA)*, Cincinnati, Ohio
Ronald Luyster *(WPE8AGY)*, Flushing, Ohio
Ken Stewart *(WPE8BEL)*, N. Olmstead, Ohio
Clayton Nenno, Jr. *(WPE8BZL)*, Fairport Harbor, Ohio
Carl Denbow, Jr. *(WPE8CCF)*, Athens, Ohio
Joseph Bove *(WPE8CKW)*, Norwood, Ohio
Dan Wilt *(WPE8HF)*, Akron, Ohio
Lewis P. Johnson *(WPE8MJM)*, Minerva, Ohio
Mike Kander *(WPE8MS)*, Dayton, Ohio
Earl Kinmonth *(WPE9AGB)*, Joliet, Ill.
John Gunther *(WPE9AZI)*, W. Allis, Wis.
Nicholas Manusos *(WPE9BDZ)*, Lisle, Ill.
Chris Pinn *(WPE9DK)*, Lockport, Ill.
J. P. Arendt *(WPE9DN)*, Aurora, Ill.
Robert Frey *(WPE9IP)*, Niles, Ill.
Donald Gargar *(WPE9MD)*, Granite City, Ill.
John Beaver, Sr. *(WPEØAE)*, Pueblo, Colo.
Charles Rock *(WPEØAWX)*, Cambridge, Nebr.
Doug Carlson *(WPEØBCA)*, Minneapolis, Minn.
Dick Schreiber *(WPEØEH)*, Wheat Ridge, Colo.
James Howard *(WPEØEW)*, Kansas City, Mo.
Robert Viau *(VE2PE60)*, Sept Iles, Quebec
Frank Winstan *(VE2PE7A)*, Montreal, Quebec
Mike Ligeza *(VE3PE1EX)*, Scarboro, Ontario
Jim Westmacott *(VE3PE1EV)*, Ottawa, Ontario
David Digweed *(VE3PE5S)*, St. Catharines, Ontario
K. J. Loker *(VE3PE7D)*, Napanee, Ontario
Richard Laviolette *(VE7PE2M)*, Richmond, B. C.
Charles Blum *(CB)*, Wantagh, N. Y.
Heinz Bausback *(HB)*, Mundelein, Ill.
Glenn Day *(GD)*, Portland, Ore.
George Finnegan *(GF)*, Redwood City, Calif.
Ronald Killian *(RK)*, Chatham, N. J.
Burton Lang *(BL)*, Howick, Quebec
A/1C William Mest *(WM)*, APO, Seattle, Wash.
Edward Ryan *(ER)*, N. Bellmore, N. Y.
Albert Spindler *(AS)*, Tonawanda, N. Y.
Allen W. Smith *(AWS)*, Toronto, Ontario
S/Sgt. R. C. Watts *(RW)*, APO, New York, N. Y.
World Radio Handbook (WRH)

relays the main station of *R. Mauretanie* at Saint Louis, operating on 5055 kc. with 250 watts at 0200-0300 (Sundays at 0230-0330), at 0715-0830, and at 1455-1845. *(WRH)*

Monaco—*Trans-World Radio,* Monte Carlo, operates on a limited schedule with a tempo-

rary antenna on 9705 kc. at 0200-0300 daily and at 0330-0700 Sundays. They are also reported as being heard at 1630-1700 in English. *(WPE1CE, WPE2CRX, WPE8BEL)*

New Guinea—VLT9, Port Moresby, a new outlet on 9520 kc., was heard from 0045 to 0145. At 0145, programing closed on 9520 kc. and resumed on 6130 kc. *(WPE6EZ, WPEØAE)*

Nigeria—Western Nigeria Radiovision Service, Ibadan, 6050 kc., was heard at 1514 with many ads for American products. Reports go to WNTV-WNBS, Television House, P. O. Box 1460, Ibadan. The 3380-kc. outlet is expected to be in use shortly. *(WPE1BM)*

The Eastern Nigeria B/C Service, Enugu, is heard with good signals on 4855 kc. at 0030-0100 with music; then BBC news at 0100. *(WPEØEH)*

Radio Nigeria, Lagos, 4990 kc., has been tuned at 0008-0215 with Eng. religious services, American pop music; BBC news is heard at 0100. *(WPE2DFB, WPEØEW)*

Philippines—The P.I. B/C Service, Manila, has been heard on 3286 kc. at 0715. Dance music followed the ID. *(WPE1AAC, WPE1BY)*

Rhodesia—Federal B/C Service (African Service), Lusaka, is good on 9577 kc. at 2345-

SCHEDULE OF UNITED ARAB REPUBLIC (CAIRO)

Program	Kc.	Time	Language
Arabic Main Program	9805	2300-1830	Arabic
	15475	2300-0200	
		0600-0800	
		0945-1830	
Voice of Arabs	7050 & 11664	2200-2320	Arabic
		0400-0830	
		1130-1800	
Sudan	7050 & 11664	2330-0030	Arabic
		0900-1120	
North America	9795	2045-2145	Arabic
South America	9795 & 15475	1900-1945	Portuguese
		1945-2030	Spanish
		2045-2130	Arabic
Europe	11915	1400-1430	French
		1430-1500	Arabic
		1500-1600	German
		1600-1630	Italian
		1630-1730	English
Middle East	12050	1015-1100	Kurdi
		1100-1145	Turkish
		1200-1500	Persian
S. & S.E. Asia	17920	0530-0630	Arabic
		0630-0730	Indonesian
		0730-0800	Malawi
		0800-0830	Benghali
		0830-0900	English
		0900-0930	Ordi
		0930-1000	Bashtu
East Africa	17690	1015-1030	Sudanese
		1030-1130	Swahili
		1130-1200	Amheric
		1245-1330	Somali
West Africa	17690	1515-1630	Haussa
		1630-1715	English
		1715-1800	French
Dictation News	7050 & 11664	0100-0130	Arabic
		0130-0200	English
		0830-0850	Arabic

0105 in Eng. with pop music requests and news on the hour. *(WPE3NF, WPE4AVV, VE3PE1EY)*

St. Pierre and Miquelon Islands—If you have not logged this country, you might listen for the St. Pierre radiotelephone utility station on 18,000 kc (approximately) during morning hours and in the early afternoon. The IS is a few notes on a piano. *(WPE8AGY)*

Thailand—A veri from the Thai National B/C Station, HSK9, Bangkok, lists 50-kw. xmtrs on 7140 and 11,910 kc. with the N.A. beam at 2315-0015; Eng. news at 2325. Reports go to The Overseas B/C Division, Public Relations Department, Bangkok, Thailand. *(VE3PE5S)*

Tunisia—*R. Tunis* has moved from 11,970 to 11,925 kc. and is now much stronger and in the clear. This station can be heard around 1350 with a talk, and a clear ID in Arabic as "Huna Tunis." The schedule reads: 2330-0600 on 11,795 kc; 0600-1300 on 17,705 kc.; and 1400-1615 and 1645-1800 on 11,925 kc. *(WPE1BM, WPE8HF)*

United Arab Republic—All reports for Cairo should be sent to the Monitoring Department, United Arab Republic B/C Service, Cairo, Egypt, U.A.R. See table on page 116 for the complete Cairo schedule. *(WPE5ADU)*

Vatican City—The Vatican Radio carries Eng. to India, Pakistan, and Ceylon on Monday, Wedesday, and Saturday at 1100-1115 on 17,840 and 21,515 kc. Sunday Mass in Latin is broadcast at 0330-0500 on 11,740, 9645, and 7250 kc. Other xmsns include French at 0930 on 9646 kc., and native language at 0900 on 11,740 kc. *(WPE1CE, WPE7CB, WPE9DN)*

Windward Islands—The Windward Islands B/C Service, St. Georges, Grenada, is currently operating to Jamaica at 1600-1800 on 15,400 kc. and at 1800-2115 on 11,715 kc.; to the Windward Islands and Eastern Caribbean at 1600-1730 on 5010 kc., and at 1730-2115 on 3365 kc.; and to Grenada at 1600-2115 on medium-wave 1040 kc. *(WPE2DLT, WPE6BPN, WPE8BEL, WPE8CKW, WPE8MS, WPE9DN)*

Clandestine—*R. Cuba Independiente*, an anti-Castro station, is reportedly being operated by Cuban refugees aboard ship on 6132 kc. It has been heard around 1950 with political talks. *(WPE1BM)*

Medium-Wave Stations—While we do not usually cover broadcast-band stations, the following three listings may enable some of our readers to log new countries: XERF, Villa Acuna, Mexico, 1570 kc., can be heard well most nights with 150,000 watts and many religious and western music programs; ZNS, *The Voice of the Bahamas*, Nassau, is often heard on 1540 kc. overriding WPTR, Albany, N. Y., and KXEL, Waterloo, Iowa (both 50-kw. stations), from 1900 to 2100 when BBC news is given; *Radio Trinidad*, Port-of-Spain, may be heard signing on at 0459 with a march tune, then English programs until fade-out around 0533 on 730 kc. *(WPE8MS, WPE9AGB)*

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POP'tronics Bookshelf

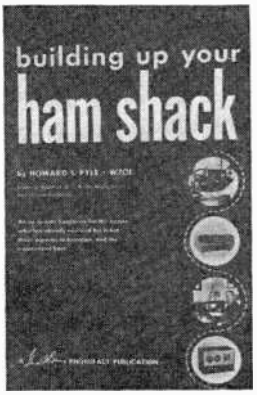
(*Continued from page* 28)

corder accessories. Using it as a basic text, the newcomer to hi-fi can learn all he needs to know about the subject.

Published by John F. Rider Publisher, Inc., 116 West 14th St., New York 11, N. Y. 176 pages. Soft cover. $4.25.

BUILDING UP YOUR HAM SHACK *by Howard S. Pyle, W70E*

Here is a book for Novices itching to send out their first CQ and long-standing amateurs who want to modernize their station equipment. It not only explains how to assemble a ham station and put it on the air, but it offers information on choosing advanced equipment for gradually up-grading a station. Suggestions on "trading up" will help in attaining this goal at minimum expense. Also included are suggestions on test and measuring equipment for your shack's workbench.



Published by Howard W. Sams & Co., Inc., 1720 East 38th St., Indianapolis, Ind. 128 pages. Soft cover. $2.50.

THE STORY OF STEREO: 1881 *by John Sunier*

Most hi-fi fans and music lovers regard stereo as being comparatively new. Actually, it isn't. This fascinating book on the history and development of stereo takes you back to 1881, when the first patent was issued, then brings you right up to the present. The basic principles of stereo are presented to give you a ground-floor introduction to the subject; applications of stereo on film, tapes and discs, and in broadcasting are covered in detail. The author concludes by describing stereo techniques in the home, industry, and medicine.

Published by Gernsback Library, Inc., 154 West 14th St., New York 11, N. Y. 160 pages. Soft cover. $2.95.

Free Literature

The fundamentals of monophonic and stereo high fidelity are explained in clear and simple language in a 36-page booklet published by EICO. The booklet covers such subjects as the basic nature of high fidelity, problems in hi-fi systems, and how to save money when buying equipment. Copies are available from EICO, 33-00 Northern Blvd., Long Island City 1, N. Y., for 25 cents each.

Supreme Publications now supplies servicing data for individual radio and TV sets of all makes. The charge for the material ranges from 40 cents to one dollar, depending on the number of pages involved. When you write to Supreme Publications (1760 Balsam Rd., Highland Park, Ill.) for information on a particular set, be sure to include the name of the manufacturer, the year it was made (if known), and the model number.

High-fidelity cartridges, tone arms, and accessories are described (and illustrated) in a new eight-page brochure available from Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill. Complete performance specifications and prices are given.

Two new catalogs covering every possible type of crystal used by hams, CB'ers, and electronic experimenters can be had for the asking—one from Texas Crystals, 1000 Crystal Drive, Fort Myers, Fla. (Catalog No. 860); the other from U.S. Crystals Inc., 1342 So. La Brea Ave., Los Angeles 19, Calif.

Allied Radio's new stereo tape and record catalog contains detailed listings of more than 1000 records and of over 400 two-and four-track tapes. Almost all major labels are covered. For your free copy, write to Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill., and request catalog No. 22 RR 999. -30-

(*Continued from page 89*)

on top of the box; use a composition unit for *R4* and not a wire-wound type. Ground one end terminal of *R4* by soldering a short lead between the terminal and *R4*'s shell. If necessary, scrape paint away from *R4*'s mounting area to insure a good ground to the box.

Join together the center terminals of *J1* and *J2* with as short a length of wire as possible. Shorten the leads of the 2200-ohm, 2-watt composition resistors, *R1*, *R2*, and *R3*, and connect them in series; then solder them between *J1* and the ungrounded end terminal of *R4*. Connect 1N34A diode *D1* between the center terminal of *R4* and 10,000-ohm, 1-watt composition resistor *R5*, with its cathode (+) towards *R5*.

Now, connect the other end of *R5* to the positive meter terminal and ground the negative meter terminal to *R4*'s shell. Bypass each side of *R5* to ground with a .005-μf., 500-volt ceramic disc capacitor; a dual bypass capacitor *C1-C2* is shown in the photo.

Operation. Connect the unit in the antenna feedline as close to the transmitter as is convenient. If you use a single-wire antenna, connect the r.f. meter's box to the transmitter cabinet with a short, heavy lead. Turn *R4* to the ground end of its rotation, and start tuning the transmitter in the normal manner. Then advance *R4* for a mid-range reading on *M1*.

Continue adjusting the transmitter plate tuning and loading controls for

Jack Ray, K4MZW, uses his Heathkit DX-100 and Gonset G-43 for both phone and c.w. operation.

maximum reading on *M1* without exceeding the rated plate current of the transmitter. Adjust *R4* as necessary to keep the pointer of *M1* on the meter scale. And don't be too surprised if maximum transmitter output occurs at a different set of final amplifier control settings than you have been using.

Be sure to check your transmitter's output for harmonics with a wavemeter or field strength meter, so you'll know that your increased power is on frequency.

News and Views

Lowell Ponte, WV6ORS, 511 Terracina Blvd., Redlands, Calif., works 15 meters almost exclusively with a Heathkit DX-40 transmitter and a National NC-300 receiver. He uses a home-built, two-element beam for transmitting, but, for some unexplained reason—no antenna relay, probably—he uses an 80-meter dipole for receiving. Lowell has worked six states, and his ambition is to build a better beam. . . . **Tom Walker, KN8UQB,** 134 Prospect Ave., Dayton, Ohio, has worked 29 states and Canada in seven months as a Novice. He operates on 40 meters with a Globe Scout 680-A transmitter and a Hammarlund HQ-129X receiver. . . . **S. Javad Mesbai,** Faculty of Letters, Shiraz, Iran, is a student at Shiraz University, and would like to correspond with American hams about electronics and ham radio. He writes beautiful English, incidentally.

Tom L. Kramer, KØVSV, Box 63, Edgewood, Iowa, worked 47 states, 46 of them confirmed, in his first year on the air. Thirty-eight states were racked up in the 5½ months he was a Novice on 40 meters. Tom rates his best DX as England and the Canadian Northwest Territories on 10-meter phone. This is not bad for a DX-40, which he feeds into his 40-meter dipole or 145' "long wire." . . . **Jack B. Ray, K4MZW,** 412 W. 4th, Tompkinsville, Ky., connects his Heathkit DX-100 to an "all-band" dipole for both phone and c.w. operation. He receives on a Gonset G-43 receiver. Jack has contacted 45 states and has cards from 39 of them; his best DX is France. Having heard many Novices on 20 meters, Jack suggests that it is a wise precaution to have a local ham check your transmitter for harmonics when you first go on the air.

Gary Weaver, WV6NMT, 1315 Corona St., Hermosa Beach, Calif., has worked 14 states in all call areas except "W1" on 40 meters in his two months on the air. He stirs up electrons with a home-brew 20-watter, which works like a kilowatt rig—almost. He receives with a converted and modified ARC-5 surplus receiver. Gary has also built a converter and a beam for 15 meters and is now working on the transmitter. . . . **Ron Selders, KN8VFK,** Route 1, Elkins, W. Va., has a 15-meter beam and 80- and 40-meter doublet antennas on "the farm" and has worked 38 states with his Heathkit DX-40 and Knight R-100 receiver. He also raised an English ham and a couple of Africans, but got so "shook

up" when they came back to him that he promptly lost them! Ron praises the transmit/receive switch described in our August, 1960, column. . . . **Bob Saltzman, WV2MOV** (13), and his dad, **Hank, WV2MOW,** 15 Baylor Circle, White Plains, N. Y., really keep the 15-meter Novice band occupied. They use a Viking Valiant transmitter screwed down to 65 watts, a Hammarlund HQ-100 receiver, and three antennas: a 40-meter folded dipole, a 15-meter dipole, and a 15-meter vertical. Bob has 11 countries and 30 states. Hank has 14 countries and 35 states. Both hope to have their General tickets by the time they read this report.

Richard Lust, KN9APW, 206 Wilson St., Mt. Horeb, Wis., is one of the 11 active hams in the little town of Mount Horeb. He works the three low-frequency Novice bands, using a DX-40 transmitter and a Hallicrafters SX-110 receiver. He has 80- and 40-meter dipoles about 30' high and is preparing to build a 15-meter beam. Dick's best DX is California on 80 meters; he has 41 states worked. . . . **Don Clayton, KN7NIZ,** 2117 S. Plumer, Tucson 9, Ariz., spends his time on 40 and 15 meters. His DX-40 transmitter feeds a home-built tri-band beam and a trap vertical, and he receives on a Knight R-100. With this combination, he has worked 38 states, Canada, Panama Canal Zone, Guam, and New Zealand. Don offers to help prospective hams get their tickets and will schedule you if you need Arizona. He recommends that DX-40 owners install a 3-ampere fuse in the 115-volt power line, to protect the power transformer if the 5U4GB rectifier flashes over.

Dick Zammito, KN3MHK, 338 Grandview Ave., Chambersburg, Pa., reports that the Cumberland Valley Novice Net meets Sundays at 8:30 p.m. on 3719 kc. They just rag-chew. Join the net or drop Dick a card. . . . **Bob Chapko, KN9YKN,** 1628 Monroe Ave., South Milwaukee, Wis., feeds a 2-element, 15-meter beam patterned after the one described in POPULAR ELECTRONICS, May, 1959, with his EICO 720 transmitter. Although mounted in the attic, it works remarkably well, as proved by his record of 45 states and three foreign countries. Bob receives on a Hallicrafters S-107, and he has a Windom antenna for the lower frequencies. . . . **Henry Goldman, WV2OVG,** 384 E. 194 St., Bronx 58, N. Y., uses a complete kit station. His receiver, a Lafayette KT-200 nine-tube superhet, is helped along by a Heathkit QF-1 Q-multiplier. He transmits on a Knight T-50 transmitter, which feeds an AMECO folded dipole antenna. In spite of lots of local interference from the Third Avenue "El" in the Bronx and Grand Central railroad, Henry has worked five states in one week on 40 meters.

Will I be able to use *your* report, picture, or construction item next month? Write to: Herb S. Brier, W9EGQ, "Across The Ham Bands," c/o POPULAR ELECTRONICS, One Park Ave., New York 16, N. Y. 73,

Herb, W9EGQ

Darkroom Meter

(*Continued from page* 54)

pot full counterclockwise, and mark this position as "S," again for reference.

The remainder of the calibration is performed in the darkroom.

Darkroom Calibration. Select a good negative with a wide tonal range which is known to require a normal #2 grade paper. Place the negative in the enlarger and focus the image on the easel.

Plug the photocell into the meter, turn on the power switch (*S2*), and set the *Printing Index* control to the proper value for the enlarging paper being used; refer to Chart C. If the paper being used is not listed in Chart C, assume an index of 3000 for a high-speed, blue-black projection paper. Set the *Time* control to "10" seconds.

Resistance	Brightness Scale	Paper Grade
82,000Ω	CAL ►	5
290,000Ω	4 ►	4
590,000Ω	6.3 ►	3
800,000Ω	10 ►	2
1.05 meg.	16 ►	1
1.6 meg.	25 ►	0

Chart A.

Resistance	Index
1.8 meg.	650
1.06 meg.	1000
800,000Ω	1500
570,000Ω	2000
450,000Ω	3000
400,000Ω	4000
315,000Ω	5000

Chart B.

Turn off all room lights, including the safelight. Place the photocell under the negative's maximum shadow area (maximum light) and adjust the lens diaphragm until the electron-ray tube opens.

With this diaphragm opening, make a

print in your normal manner, using a 10-second exposure. The result should be a print very close to "good." If you are not satisfied, modify the lens opening and make what you consider a "good" print, using a 10-second exposure. Then place the photocell under the same shadow area and adjust the *Printing Index* control until the tuning eye opens. The meter is now calibrated for 10-second exposure to your print quality standards. Mark the *Printing Index* control for the type of paper being used.

Paper	Grade	P.I.
Kodabromide	1	5000
Kodabromide	2	3200
Kodabromide	3	2000
Kodabromide	4	1250
Polycontrast	1, 2	1600
Polycontrast	3	1000
Kodak Opal	—	650
Medalist	all	2000
Ansco Jet	1	6500
Ansco Jet	2	5000
Ansco Jet	3	4000
Ansco Jet	4	2000
Cykora	1	3000
Cykora	2	2500
Cykora	3	2000
Cykora	4	1500
Indiatone	—	500

Chart C.

Leave the photocell under the same shadow area and open the lens diaphragm one *f*/stop. Rotate the *Time* control counterclockwise until the electron-ray tube opens. Mark this position as "5" seconds. Close the diaphragm down two stops from the 5-second position and rotate the *Time* control clockwise until the electron-ray tube opens. Mark this position as "20" seconds. Use half-stop adjustments for the 7- and 15-second positions; if properly made, the timing marks between 7, 10, 15 and 20 will be essentially linear.

Your darkroom meter is now ready to go to work. Although the step-by-step operating instructions given in the right-hand column on page 51 may appear involved at first glance, they are really quite simple. With a little practice, operation of the unit should soon become a routine affair. —30—

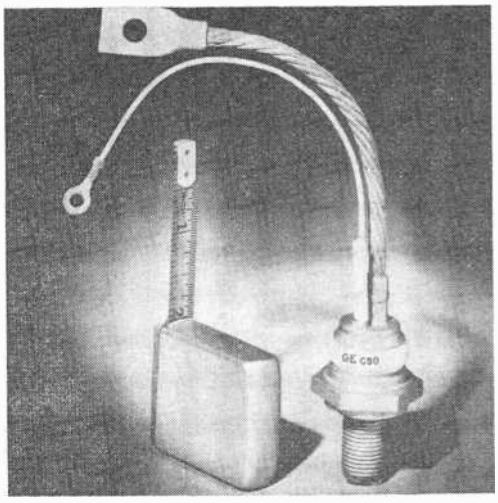
Transistor Topics

(*Continued from page* 84)

simple electronic metronome. See Fig. 2(D).

With experience, chances are you can dream up additional variations of the basic oscillator to meet your own special needs or fancies. If you develop something "special," drop yours truly a note showing the circuit and parts values—perhaps we'll be able to feature it in a future column.

Organic Semiconductors. In an earlier column we mentioned some of the work done both here and in the USSR towards the development of *organic* semiconductors. On April 18 and 19, a full-scale conference on this topic will be held at the Morrison Hotel, Chicago, Ill. Among the subjects to be discussed are molecular crystals, pyrolized polymers, photoconductivity, surface and contact effects, and organic semiconductor devices. The conference is co-sponsored by the Armour Research Foundation and McGraw-Hill.

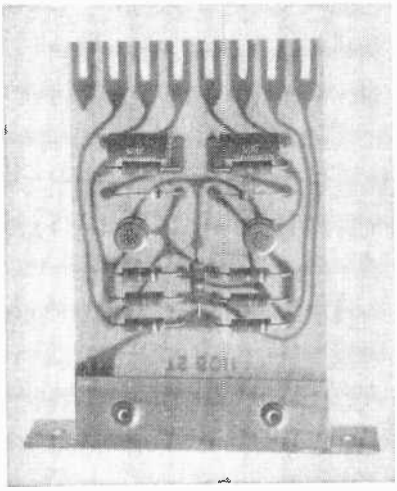


Silicon-controlled rectifiers in the "C50" series introduced by General Electric have forward current ratings of up to 70 amperes a.c. and 110 amperes d.c.

The work to date in this field is strictly theoretical and experimental, but . . . who knows? . . . perhaps one day we'll be able to "grow" our own semiconductor devices in backyard gardens.

Product News. A new line of digital packages designed and priced for the electronic experimenter is being offered by Tech Serv, Inc. (4911 College Ave., College Park, Md.). Called "Digibits," the complete series includes flip-flops, gates, indicators, etc., plus accessories. Counters, control, arithmetic and other digital networks can be set up at home or at school using these solid-state printed-circuit Digibits. Details and prices—which start at $8.95—are available from Tech Serv on request.

General Electric's Semiconductor Products Department (Liverpool, N.Y.) has introduced a new line of high-current silicon-controlled rectifiers. Known as the "C50" series, these units have a forward current rating of up to 70 amperes a.c. and 110 amperes d.c. Eight models are available, ranging from the C5OU with a peak inverse voltage rating of 25 volts, to the C5OD with a 400-volt rating.



Printed-circuit "Digibits" like the one above have been designed by Tech Serv, Inc. They are ready-made flip-flops, gates, and the like, for experimenters.

The Bendix Corporation (Red Bank Division, Holmdel, N.J.) is now produc-

ing improved versions of its 2N1136 and 2N1137 transistor series. These are germanium *pnp* power types capable of switching up to 400 watts and are designed primarily for use in d.c.-to-d.c. converter and d.c.-to-a.c. inverter applications.

New Booklets. Several manufacturers have published new booklets which should be in the technical library of everyone working with transistors and semiconductor devices. Here's a quick summary:

"Solar Cell and Photocell Handbook": a 100-page work published by the International Rectifier Corporation, 1521 East Grand Ave., El Segundo, Calif. Included are chapters on basic theory, characteristics, power supplies, and many, many practical applications. Price is $2.00, direct from the publisher or through franchised distributors.

"Application Guide—RCA Silicon Power Transistors": a 28-page booklet published by the Semiconductor Division, Radio Corporation of America, Somerville, N.J. The booklet describes the features and use of 16 different silicon power transistors, giving construction details, ratings, design procedures, and performance data. Price of the booklet, No. 1CE-215, is 50 cents. It is available direct from RCA or through any RCA distributor.

"Application Guide—RCA Silicon VHF Transistors": a 20-page booklet similar to the one above, but covering v.h.f. transistor types suitable for use to 300 mc. Typical oscillator and amplifier circuits are described and illustrated. The booklet, No. 1CE-228, sells for 50 cents, either direct from RCA or through local distributors.

"Interchangeability Chart #AO-2": a small folder published by the Electronic Transistors Corporation (9226 Hudson Blvd., North Bergen, N.J.). Japanese radio transistor types are listed, together with ETCO replacement type numbers. The folder is supplied free on a letterhead request.

That's it for now. We'll be back next month with more tidbits.

—Lou

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Flip-Flop Computer

(*Continued from page* 75)

mentarily to develop a positive count pulse. Dry cell *B1* provides the positive pulse through the closing of reset switch *S2* to ready all five flip-flops for counting. When *S2* is depressed, all green lights should go out and all red lights should come on. This indicates a count of zero.

Figure 3 shows how the red and green lights have been arranged on the

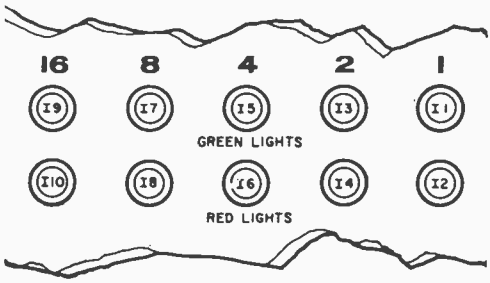


Fig. 3.

front panel so that they correspond to the positions of the digits in a binary number. Since flip-flop 1 performs the first division, its green light, *I1,* should be on the right. See Table 5. Flip-flop 2 performs the second division and its green light, *I3,* is second from the right, next to *I1.* The remaining green lights are positioned in like manner. The red lights are mounted below the green lights they mate with; thus, *I2* is below *I1,* and so on.

Read-Out. In Table 4, each digit represents a power of two. In like manner, so do the green lights on the control panel. Therefore, rather than go through a computation each time a green light goes on, let's label each light with the number which is equal to its power of two. This means that *I1* is 1, *I3* is 2, *I5* is 4, *I7* is 8, and *I9* is 16, as indicated in Fig. 3. To determine what number is lit up on the control panel, we simply add up the numbers over the green lights that are lit.

Using the computer to add now becomes a simple problem. Assume that we want to add the numbers 5 and 8. First, we press the reset button to bring the count to zero. Then we press the count button five times for a count of five, and

eight times for a count of eight. The flip-flops will see a total of 13 pulses and light up the green lights to indicate a count of 01101. We just add the numbers over the green lights—8, 4, and 1—and we get the correct answer, 13.

To speed up the insertion of numbers into the computer, switch *S1* can be replaced with a surplus telephone dial. One set of contacts on the telephone dial will pulse the circuit with switch closures in the exact amount of the number dialed.

The circuit of Fig. 2 offers the reader an excellent opportunity to learn about computers. Unfortunately, it cannot add past the number 31. For higher counts, more flip-flops must be used to give counts of 63, 127, etc. Even so, science fair students as well as teachers will find this transistorized digital computer an ideal portable training aid. Simple to build and understand, it can be a big help in visualizing digital computer operation. —30—

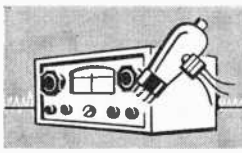
Big Sound from Portables

(*Continued from page* 71)

battery voltage drops with use, it will eventually reach a point where distortion will begin to increase rapidly. Potentiometer *R4* is provided to adjust the base bias voltage (and thus the collector current) as the battery weakens. This makes battery *B1 usable until its output voltage* is down to about 3 volts.

With a new battery, set *R4* to its maximum resistance position. Open switch *S1* and connect a milliammeter across its terminals, then adjust *R4* for about 6 ma. and mark the knob position. Do the same with the negative milliammeter lead connected to the 4.5- and 3-volt battery taps, and again label the knob position to aid in making adjustments later.

To operate the Transi-Booster, push the miniature phone plug into the radio earphone jack, turn volume to a comfortable level, and listen. If the Transi-Booster oscillates, reverse feedback connections by connecting *R1* to *T2*'s "0-ohm" tap and the lead from *T1*'s primary to *T2*'s 8-ohm tap. Unplugging the phone plug automatically reconnects the radio's own speaker and allows normal operation of the portable. —30—



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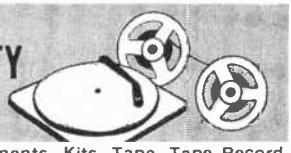

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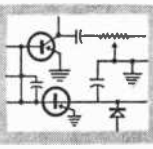

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