

TOOLS AND TEST MEASUREMENT ISSUE

APRIL
1966

50
CENTS

POPULAR ELECTRONICS

BUILD

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Ultrasonic Waves**

**Check Your Stereo
With a Test Record**

BUILD

**Auto-Light Minder
Thinks for Itself**

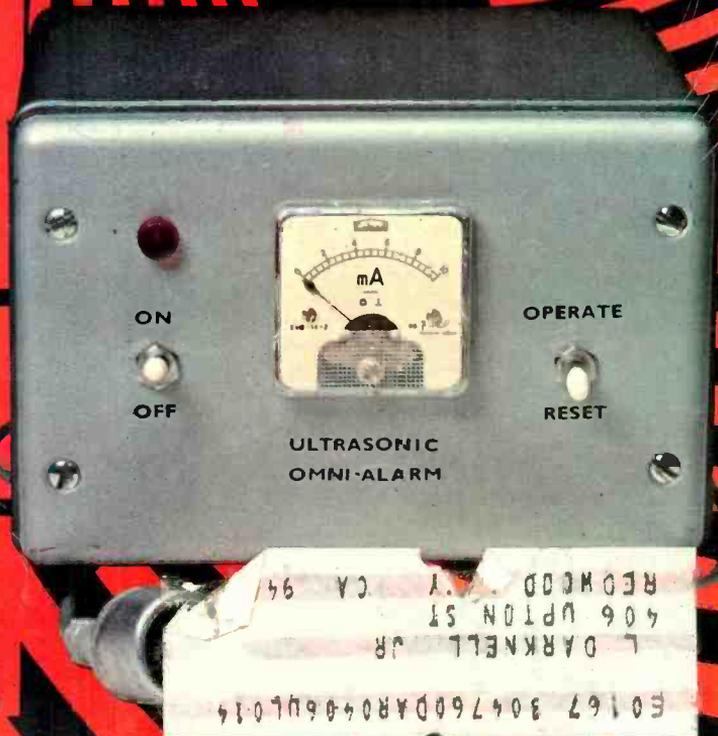
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M-124

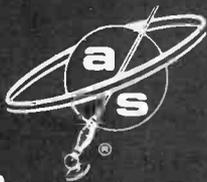
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April, 1966

POPULAR ELECTRONICS



POPULAR ELECTRONICS is indexed
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This month's cover photo by
Stanley Rosenthal

VOLUME 24

APRIL, 1966

NUMBER 4

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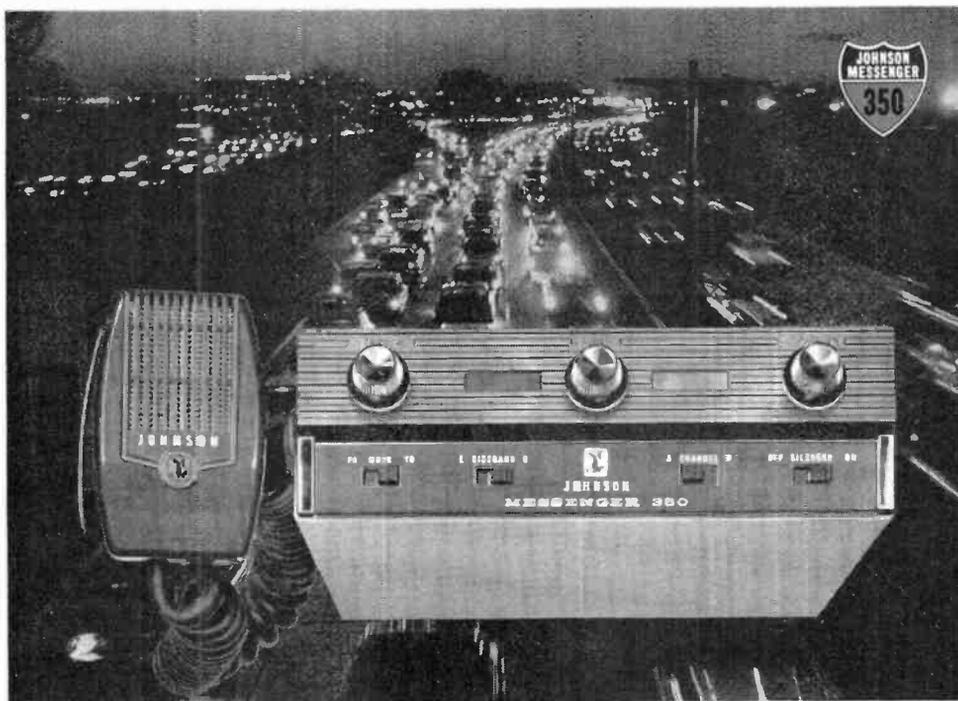
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CIRCLE NO. 4 ON READER SERVICE PAGE

LETTERS

FROM OUR READERS

Address correspondence for this department to:
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REVERB BONG AND BOO-BOO

With regard to "Reverb for Your Car" (February, 1966), under certain conditions of mounting and road shock, the springs bounce together and create a sound like a bass drum.

WILLIAM CARDER
St. Louis, Mo.

I believe the transformerless amplifier used to amplify the output of the reverberation



unit will work a lot better if diodes *D1* and *D2* are disconnected from the *Q5* emitter circuit.

WILLIAM ZUIDERVELT, JR.
Wescocville, Pa.

You're both quite correct. See page 20 to find out how Delco Radio solved the reverberation bong problem. The boo-boo is covered in "Out Of Tune" on page 10.

PARTS WANTED—OR EQUIVALENT

Would you please advise me where the Sylvania 10ES and 18ES miniature lamps—or equivalent—for the "Fail-Safe Transistor Power Supply" (October, 1965), can be obtained. I have not been able to get them locally, nor any equivalent due to lack of cross-reference information.

ANDREW DIDIUK
Winnipeg, Manitoba,
Canada

In attempting to make several projects in the past, I had to order a transistor or rectifier, such as Motorola MCR1304-4, or equivalent. Many times I couldn't get the original part, and didn't know what equivalent to buy. Where can I get a list of substitutes for transistors and rectifiers?

LEE NATWICK
Hutchinson, Minn.

I can't get the 5-prong polystyrene plug-in coil forms for the "Dual-Sensitivity Field

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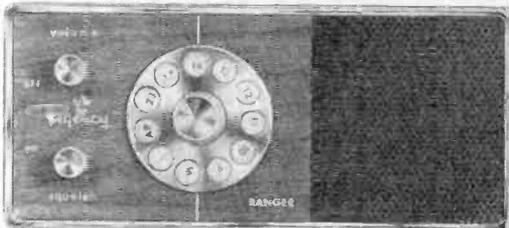
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CIRCLE NO. 35 ON READER SERVICE PAGE

LETTERS

(Continued from page 6)

Strength and Absorption Meter" (January, 1966). Where can they be purchased?

EDWARD J. BAADÉ
Lake Ronkonkoma, N.Y.

I want to build "The Tickle Stick" (February, 1966), but can't find a 160-µf., 10-volt electrolytic capacitor in any of my catalogs. Can you please tell me where I can get one?

MARK A. MURPHREY
Ashland, La.

Mark, if you can't get the electrolytic capacitor specified, don't knock yourself out; you can use almost any value from 100 µf. to 200 µf., and at a voltage rating of 10 volts or higher, so long as the capacitor physically fits into the tube . . . you have lots of room.

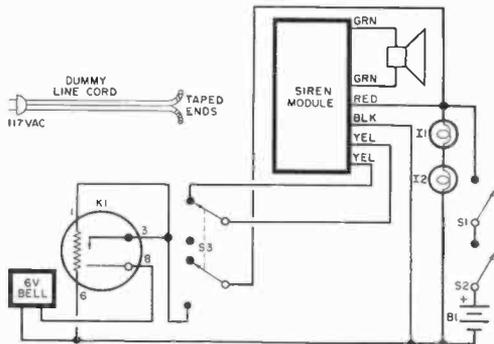
Just from a quick look at Allied Radio's catalogs, it would seem that they can satisfy Ed, Lee, and Andy, too. Ed, the coil forms are Catalog No. 46 Z 693 at 28 cents.

Lee, the Motorola rectifier is listed for \$2.00. Cross-reference parts lists should be available from time to time at the place where you buy your parts, and directly from various manufacturers. Watch the New Literature column in P.E. for free offerings. Datadex at \$3.95 is a very good transistor reference book with cross-reference data.

Andy, the 10ES and 18ES lamps are cataloged as 7 Z 414 and 7 Z 420, respectively, at 38 cents. The same lamps with base attached are available for 49 cents each and are cataloged as 7 Z 291 and 7 Z 297.

WHACKY PANIC BUTTON

I modified "Don't Panic . . . Press the Button" (January, 1966), and have had phenomenal success with it. To create more panic, I changed S3 from a momentary-off switch to a d.p.d.t. switch, and added a 6-volt bell and a delay relay. When the "victim" hits the SQUELCH switch, the siren dies down all right, but after a 5-second delay the bell



sounds off, causing the "victim" to panic and throw the switch again. This, of course, starts the siren up a second time. The relay, K1, is an Amperite 6N05T. A 6-volt lantern bat-

tery should be used to handle the bell's current requirements. A dummy a.c. line cord conspicuously plugged in increases the "victim's" frustration when the siren continues to wail even after the plug is yanked. No doubt even whackier circuits can be dreamed up for this project. It's a real panic!

WILLIAM A. RUSSO
N. Merrick, L. I., N. Y.

THE APARTMENT ANTENNA PROBLEM

Since I recently moved to an apartment, I have a problem with my receiver. I can't run an antenna outdoors because I am on the second floor of a six-story building, and I can't hook into the television cable in the building because of the QRM. What can I do to remedy the situation? I would like to listen to 80, 40, and 20 meters.

PAUL SLOPAK, JR., WPE2MDH
Rego Park, N. Y.

Paul, have you tried dropping a vertical line out of your window? You can raise or lower the line to obtain the best signal. Or



you may be able to get the tenant about two floors above you to let you support a center-tapped rig. If you can't get a long enough run for 80 meters, try tuning the vertical antenna with a loading coil.

ELECTROMAZE

Your "Electromaze Puzzle" (February, 1966), is probably easier to construct than to solve. I'll admit I had to peek at the answers a couple of times. Why not insert a few letters in different places to give extra clues?

JOSEPH LIBERTINI
Ocean City, N. J.

I think the Electromaze Puzzle is a good idea and the pattern is quite adaptable to electronic words.

E. JARREN
New York, N. Y.

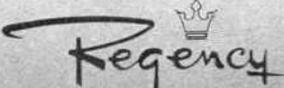
Thanks, E. J., for the endorsement. Joe, your honesty is admirable. Don't be ashamed; some of the editors also peeked. In the new Electromaze Puzzle appearing this month on page 63, put the letter "P" in the space 7 lines down and 3 spaces in from the left, and the letter "E" in the top line 12 spaces in from the left. It's always easier when you work with P.E.

(Continued on page 10)

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7900 PENDLETON PIKE
INDIANAPOLIS, INDIANA 46226

LETTERS

(Continued from page 9)

TRANSISTORS—PANACEA OR PANDEMONIUM

I am employed in the electronics field by a concern which manufactures instruments incorporating nothing but solid-state circuitry. It grieves me deeply to learn that some of your readers are unable to undertake some of the worthwhile construction projects which appear in your publication due to their inability to procure the needed semiconductors. I am hoping that you will print this letter in the interest of furthering the semiconductor experimentation cause.

There are basically only two groups of transistors in common use: the *pnp* and the *npn*. True, each of these have widely different characteristics; but, for the most part, a select few will do the job more than adequately in a great number of cases.

I would like to recommend two specific transistors, a germanium *pnp* and a silicon *npn*, which I have found serve well in practically any small-signal application. Both have low leakage, high gain, and fairly good frequency response. I do not suggest that these two units replace all transistors in every application, but they are quite inexpensive, easily obtainable, and surpass the specifications of most low-power "bargain-bag" or "entertainment" types. The *pnp*, a 2N404 by RCA, available from most RCA distributors for less than 50 cents, can be

used as a low-noise preamplifier, or as an oscillator to about 4 mc., or to drive a speaker to good volume. The *npn*, a 2N2925 by GE, is available for about 75 cents. It boasts a very high (approximately 300) *beta*, low noise, infinitesimal leakage, and a cutoff frequency of about 200 mc. What's more, the back-biased emitter-base junction of this unit makes a good 10-volt zener diode.

So why not tell your readers to grab a couple of each of these transistors and build that enlarger timer, stereo preamp, photoelectric relay, or CPO. I bet 'cha they'll work fine.

JAMES B. WOOD
San Jose, Calif.

OUT OF TUNE

Reverb For Your Car (February, 1966, page 50). Modify the schematic (Fig. 2) to show the cathode of *D1* connected to the anode of *D2* only. The diodes are not supposed to be connected to the horizontal line between *C6* and *R8*. However, the printed circuit board illustrations (Figs. 3 and 6) are correct as shown. While you're at it, reverse the polarity of *C6*; the negative side should face terminal *C*. Also change the secondary of *T1* in the parts list to 24 volts.

-30-

INSTANT

EMERGENCY COMMUNICATIONS

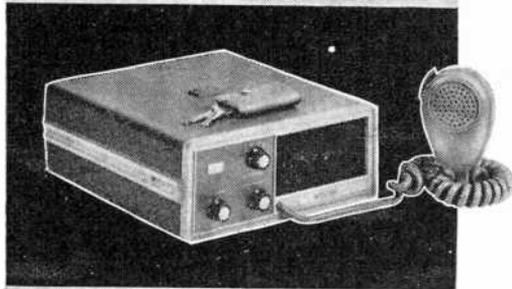
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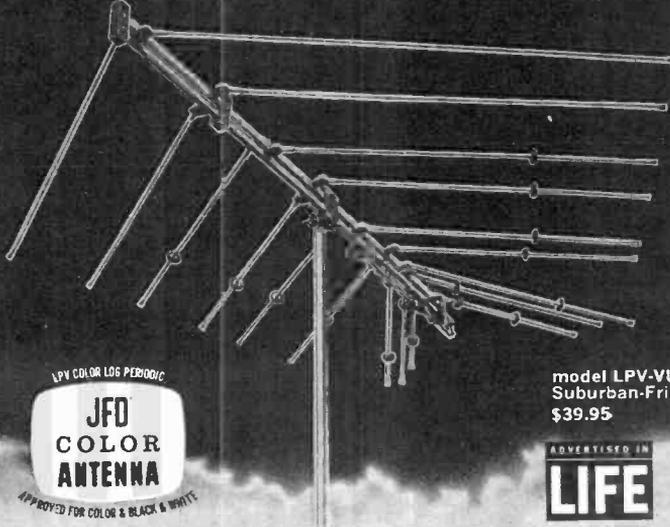
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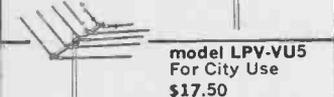
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CIRCLE NO. 28 ON READER SERVICE PAGE

PARTS

METHODS

IDEAS

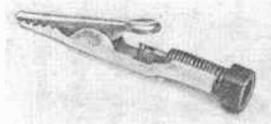
GADGETS

DEVICES

TIPS & TECHNIQUES

ALLIGATOR ADAPTERS FOR TEST PROBES

Ever try to hold two test probes and switch a VOM range at the same time? Of course it can't be done, so why try? I made up two of these alligator adapters for my probes using standard tip jacks (E. F. Johnson 105-800) and Mueller 60-HS clips. You remove the plastic sleeve on the back end of the clip and spread the collar-like opening wide enough to take the tip-jack body. Then solder a short length of wire from the tip jack connector to the clip and reclose the collar. Stick the probe tip into the jack, bite into the circuit under test with the alligator clip, and—look, Ma, no hands.



—Arthur Neil Jensen

DOTS AND DASHES . . . LOTS OF FLASHES . . . IN A PAN

If you want to practice land Morse code but have no telegraph sounder, you can do a pretty good job with a transmitting key mounted on a small metal tray or pan. Before fastening the key down, try different locations on the tray until you find a place where the clicks sound the loudest. You can also make louder sounds by increasing spring tension and contact gap, and by pressing harder.



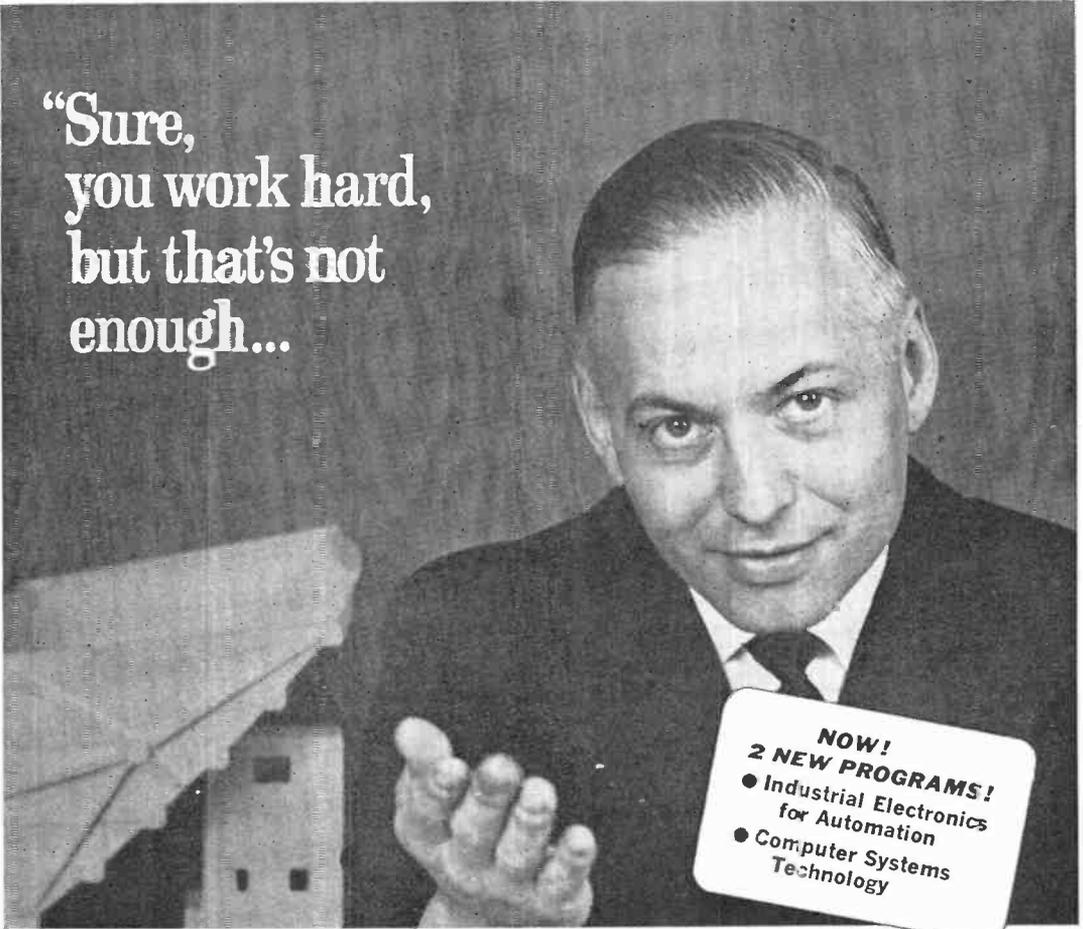
—Carl Dunant

ADD A 15-VOLT RANGE TO YOUR HEATHKIT VOM

If you have a Heathkit MM-1 VOM, you can add a 15-volt d.c. range for greater ease in measuring 6- and 12-volt d.c. potentials. A 200,000-ohm, 1%, 1/2-watt resistor and an additional test jack are all you need for this modification. Remove the instrument panel from

(Continued on page 14)

“Sure,
you work hard,
but that’s not
enough...”



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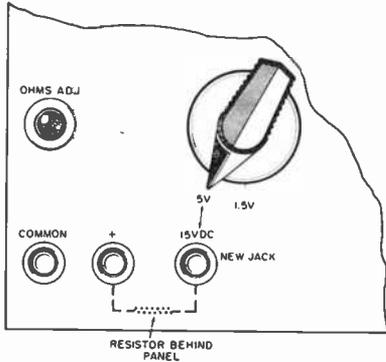
TYPE OF PRESENT WORK _____

- I am interested in Electronic Engineering Technology
 Space Electronics Nuclear Engineering Technology
 NEW! Industrial Electronics for Automation
 NEW! Computer Systems Technology

TIPS

(Continued from page 12)

the meter case and drill a hole to install the new jack approximately 1/2" to the right of the plus (+) jack. At the rear of the panel, solder the resistor between the new jack and the (+) jack. With the RANGE switch set



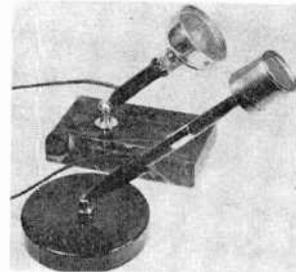
to "5 V," and the d.c. test lead in the new jack, a full-scale deflection will indicate 15 volts. With the d.c. scale essentially linear, a mid-scale reading will indicate 7.5 volts. Inscribe "15 VDC" on the front panel directly over the new jack, using white India ink or

paint. Compared to the 6- and 12-volt readings obtained on the 50-volt range, the new range provides an extra inch or two of deflection and throws the reading into a more accurate part of the meter. Input impedance is 300,000 ohms on the 15-volt range and 1 megohm on the 50-volt range.

—Jerry C. Sutton

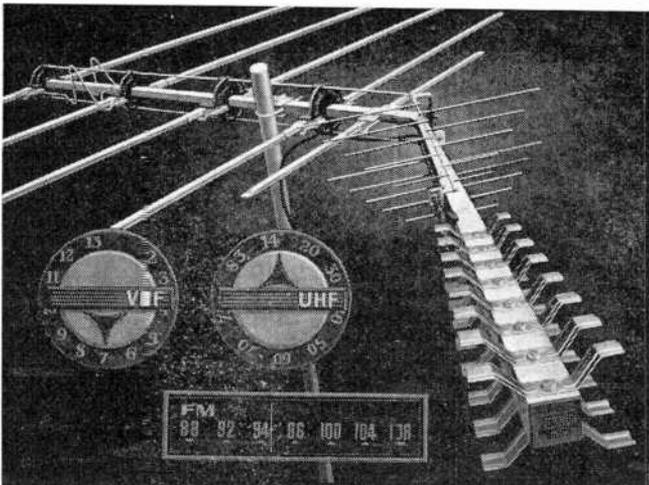
WHACKIEST MIKE IN THE SWIVEL PEN HOLDER

Pen holders make excellent swivel stands for both homemade and commercially available crystal microphones. You can glue a mike head onto the top of the pen or mount it directly in the pen holder. If you plan to use the pen case, remove the ink cartridge and drill a hole in the



side of the case for the mike cable to pass through. If you decide to mount the mike in the pen holder, locate the hole in any suitable position. One thing you won't be able to do with the pen when you're through is write.

—Art Trauffer



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Note from the illustration that the UHF section is hinged for individual orientation and maximum directivity. You get all the flexibility of separate antennas, without the losses from coupling separate antennas to a common downlead. Rugged square-boom construction and Golden Armor corrosion-resistant finish assure long life. Flat response across all 82 channels, low VSWR, excellent front-to-back ratio make PATHFINDER the antenna to answer every TV and FM reception need. Send coupon for complete information.

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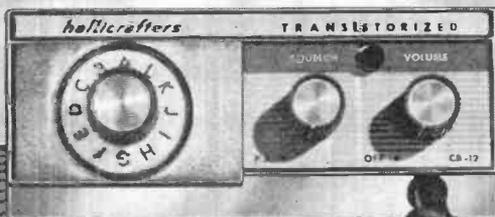
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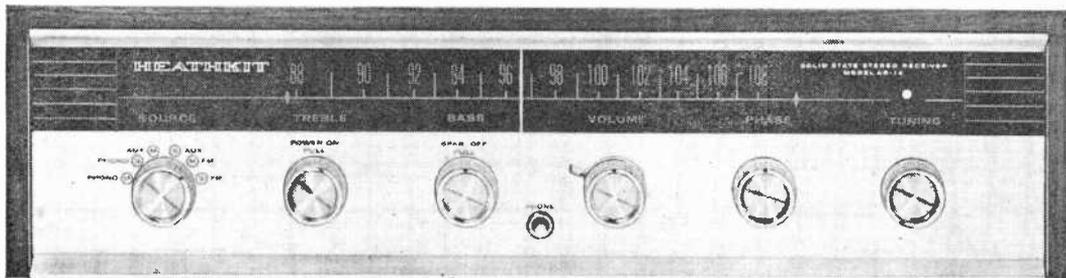
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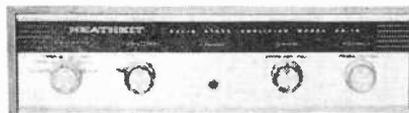
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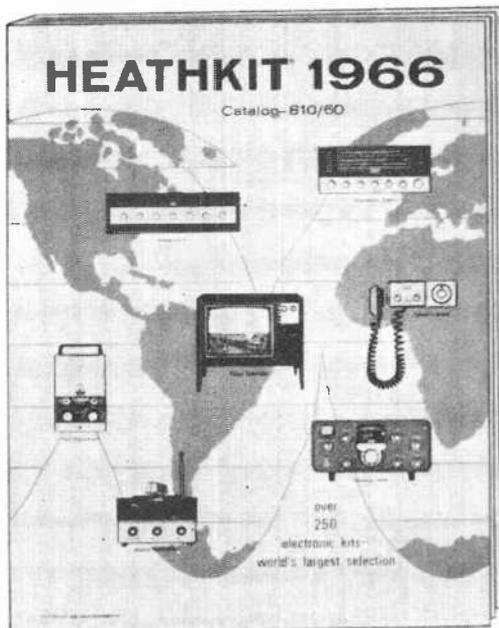
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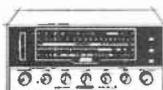
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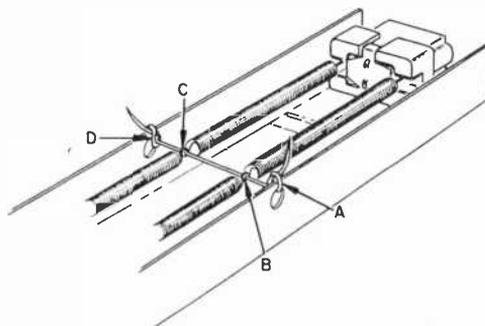
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CL-215

CIRCLE NO. 17 ON READER SERVICE PAGE

HOW TO DE-BONG

AUTO REVERBERATION UNIT



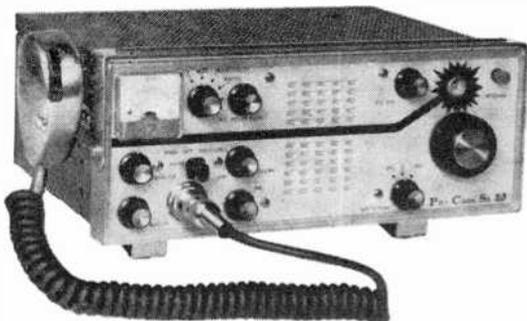
UNDER certain conditions of mounting and road shock, the springs inside an auto reverberation unit will hit the housing. When they do, the resulting "bong" from the speaker may make you think your car hit a land mine.

While the "Reverb for Your Car" (February, 1966) was installed in a 1962 Pontiac and slammed around with sudden starts and panic stops, *et al*, and no bong resulted, that's not to say it

can't happen. If you are unfortunate enough to find yourself being "bonged" out of your car, break a rubber band open and tie one end of it to point A (see drawing). Feed the other end through B and C and tie it to point D.

Information and drawing extracted from Field Engineering Service Bulletin provided by Delco Radio, Div. of General Motors Corp., Kokomo, Ind.

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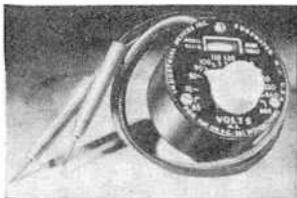
CIRCLE NO. 37 ON READER SERVICE PAGE

NEW PRODUCTS

Additional information on products covered in this section is available from the manufacturers. Each new product is identified by a code number. To obtain further details on any of them, simply fill in and mail the coupon on page 31.

"MINI-VOLT" VOLTMETER

Unlike the ordinary voltmeter, the "Mini-Volt" developed by *Industrial Devices, Inc.*, is said to be "abuse-proof," both mechanically and electrically. In place of the usual delicate meter movement, a virtually burnout-proof glow lamp and calibrated potentiometer are used in the "Mini-Volt." It has been engineered to eliminate "false indication" common to many test lamps, and the glow lamp is guaranteed for a minimum of 25,000 hours. The case is made of a light-weight impact-resistant plastic, and the 12" flexible test leads are heavily insulated. Another—but by no means secondary—claim made for the "Mini-Volt" is: uses unlimited.



Circle No. 75 on Reader Service Page 31

TRANSISTORIZED FM/FM STEREO TUNER KIT

All parts of the Heathkit AJ-14 FM/FM stereo tuner kit mount on one simple-to-assemble circuit board. Because the front-end is pre-built and aligned at the factory, the kit can be put together in six hours or less, according to *Heath*. Operation of the AJ-14 is cool and instant; it incorporates 14 transistors and 4



diodes. The 3-transistor front-end and four stages of i.f. provide an IHF sensitivity reading of $5\mu\text{v}$. for less than 3% total noise, distortion, and hum. (Harmonic distortion is less than 1%.) Frequency response: ± 1 db from 20 to 20,000 cycles for mono; ± 3 db from 50 to 15,000 cycles for stereo.

Circle No. 76 on Reader Service Page 31

FM EMERGENCY RECEIVER

Squires-Sanders, Inc. has announced the "FM Alert," an FM emergency receiver with provision for two crystal/receive channels plus tunable control. A 7-tube (12-tube performance) superheterodyne receiver with adjustable squelch and an illuminated slide rule



dial, it comes in two models—one covering 152-175 mc., the other 30-50 mc. The "FM Alert" utilizes a quadrature detector and high-gain i.f. to provide clean, quiet reception over a wide range of signal strengths and modulation levels. Sensitivity is $3\mu\text{v}$. or less for squelch control and 10 db S/N. A separate matching speaker can be used either at the receiver or at a remote location.

Circle No. 77 on Reader Service Page 31

AUTO HORN CONVERTER

Does the horn in your car sound just like everybody else's? You can give it a distinct Continental-style sound by installing a "Two-Tooter" electronic converter made by *Kinematix, Inc.* The tiny solid-state unit utilizes



the individual notes of the two horns found on most cars, but instead of their being sounded together, the "Two - Tooter" plays the single high and low notes in rhythmic alternation. Measuring only $6\frac{1}{2}$ " x $1\frac{3}{4}$ " x $1\frac{1}{4}$ ", the unit mounts under the hood in minutes and can be used with both 6- and 12-volt electrical systems. A variable repeat-speed control, inside the car, enables you to give an easily recognizable friendly greeting or an urgent warning, as needed.

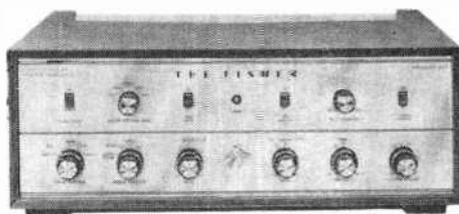
Circle No. 78 on Reader Service Page 31

BROADCAST MICROPHONE FOR HOME

Although the *Electro-Voice* 635A dynamic microphone is manufactured to the exacting specifications of film production, studio recording, FM-AM and TV broadcasting, it is now being directed to the attention of the home tape recordist. Light and slim, it can be held in the hand, used as a lavalier microphone or with a desk or floor stand. An internal shock absorber greatly reduces the pickup of cable, stand, or impact noises, and a four-stage filter eliminates "pops" and wind



If you had started wiring yesterday, today you would own an amplifier as good as a Fisher.



If you didn't start yesterday, why not today or tomorrow? No matter when you start it, you will finish the Fisher KX-200 StrataKit faster than you thought possible. Anyone can build it—even your mother—and end up with a magnificent 80-watt stereo control-amplifier. Once built, it will be fully equal in performance and reliability to its laboratory-wired prototype.

The StrataKit method of kit construction is an exclusive Fisher development that takes the uncertainty and work out of kit building. Large, detailed diagrams and clear, nontechnical language make everybody an expert, regardless of previous experience. Assembly proceeds in simple, error-proof stages (Strata). Each stage corresponds

to a *separate* fold-out page. Each stage has a separate packet of parts (StrataPack). The major components are factory-mounted on the extra-heavy-gauge steel chassis. Most of them are riveted for improved reliability. Wires are *precut* for every stage—which means every page. All work can be checked stage-by-stage and page-by-page before proceeding to the next stage.

The end result is a low-distortion 80-watt amplifier which is powerful enough for *any* music, *any* loudspeaker. The exclusive center-channel output and separate volume control eliminate the need for an additional amplifier with either a center-channel or a remote loudspeaker.

Five minutes of listening to the Fisher KX-200 you built will

convince you that it is one of the finest control-amplifiers available, easily worth \$250 or more. Yet the kit costs only \$169.50. (Walnut cabinet, \$24.95; metal cabinet, \$15.95.)

FREE \$1.50 VALUE! Send for The New Kit Builder's Manual, an illustrated guide to high fidelity kit construction, complete with detailed specifications of all Fisher StrataKits.

Fisher Radio Corporation
11-35 45th Road
Long Island City, N. Y. 11101

Name _____

Address _____

City _____ State _____

104

The Fisher

FISHER RADIO CORPORATION, INC., 11-35 45TH ROAD, LONG ISLAND CITY, N. Y. 11101. OVERSEAS AND CANADIAN RESIDENTS PLEASE WRITE TO FISHER RADIO INTERNATIONAL, INC., LONG ISLAND CITY, N. Y. 11101.

CIRCLE NO. 14 ON READER SERVICE PAGE

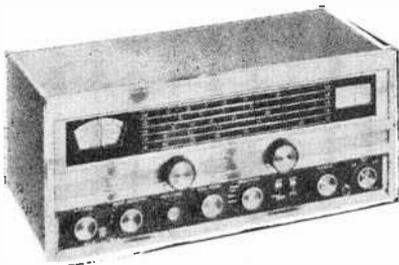
PRODUCTS (Continued from page 22)

noise. Response is 60 to 15,000 cycles; output, -55 db. The 635A is available in Lo-Z only.

Circle No. 79 on Reader Service Page 31

FOUR-BAND COMMUNICATIONS RECEIVER

Foreign, amateur, aircraft, marine, standard AM broadcast, and CB listening is provided by the *Hallicrafters* SX-130 communications receiver. Code (CW), voice (AM), and single-sideband (SSB) signals can be received over



the entire tuning range. A front panel control permits ready selection of either upper or lower sideband for simplified tuning of the SSB signals. In addition to having a circular main tuning dial and a slide rule electrical bandspread dial, the SX-130 features both crystal filtration and crystal-controlled selectivity. The 1650-kc. i.f. system insures excellent image rejection. Other features of the SX-130 include a built-in S-meter and a calibrated BFO.

Circle No. 80 on Reader Service Page 31

LOW-DISTORTION AUDIO GENERATOR

Producing a very low distortion sine wave signal over a wide range of frequencies (less



than 0.1% distortion from 20 cycles to 20 kilocycles), *EICO's* Model 378 audio generator can be used for any application where a stable, accurate audio sine wave is

essential. The complete frequency range is 1 cycle to 110 kilocycles, frequency accuracy $\pm 5\%$. Unlike most audio generators, the frequency-determining elements of the Model 378 are not continuously variable; they are set by positive-setting detent switches which select combinations of the network of 1% resistors and 2% capacitors. This method of tuning is said to insure highly accurate, repeatable setting. The frequency range is covered in five scales. Output level is variable from 0 to 10 volts r.m.s. The Model 378 comes both factory-wired and in kit form.

Circle No. 81 on Reader Service Page 31

MOBILE ANTENNA RESONATORS

Five models of "Super Hustlers" have been announced by *New-Tronics* for 10-, 15-, 20-, 40-, and 75-meter amateur band operation. These mobile antenna resonators reputedly have high power capability of maximum legal limit on SSB, and maintain minimum SWR over the phone portion of 10-40 meters and a 60-kc. width at 2:1 SWR on the tough 75-meter band. Exceptional performance is claimed possible due to the use of unique coils wound with wires containing 413 individual conductors completely insulated from one another. The "Super Hustlers" are designed for attachment to standard MO-1 and MO-2 masts. Stainless steel bases and various accessory items are available.

Circle No. 82 on Reader Service Page 31

HANDY UTILITY BOX

Designed to house experimental circuits and test equipment, *Olson Electronics'* new Model CA-324 utility box is made of sturdy Bakelite with reinforced corners. Brass inserts are imbedded in the corners to accept cover screws; the cover is aluminum for easy workability. Size: 3 $\frac{3}{4}$ " x 6 $\frac{1}{4}$ " x 2".

Circle No. 83 on Reader Service Page 31

FM COMMUNICATIONS RECEIVER

A low price tag is a special feature of *Lafayette Radio Electronics'* new 10-tube, 2-band FM communications receiver which tunes 30-50 mc. and 152-174 mc. with a sensitivity of 3 μ v. for 20 db quieting. Other features of the HA-520 include a tuned r.f. amplifier on both



bands, a nuvistor on the high band, built-in variable squelch, an illuminated slide rule dial, a 4" PM speaker with 1.2 watts of audio output, a front-panel 8-ohm headphone jack, and a transformer-operated power supply. The HA-520 is suitable for monitoring police, fire, and commercial radio services.

Circle No. 84 on Reader Service Page 31

INSULATING SCREWDRIVER SLEEVES

Want to make your screwdrivers shockproof and shortproof? You can insulate them from tip to handle with simple-to-install pre-expanded shrink-type sleeves available from *Southwestern Products Company*. These inexpensive plastic sleeves become quite tough within 24 hours from time of application and continue to harden until rigid. They are sold in sets of four.

Circle No. 85 on Reader Service Page 31

TURNER +2



VOLUME CONTROL

“Best CB Microphone in the World”

That's what many +2 owners say, and we're glad they're so enthusiastic. We're proud of the +2 ourselves. It's the only microphone on the market that actually increases the output of your microphone up to 50 times at the twist of a dial. It makes a world of difference on CB (and amateur), so why in the world don't you get one? List price . . . \$49.50



THE TURNER MICROPHONE COMPANY
946 17th Street N.E.
Cedar Rapids, Iowa

In Canada: Tri-Tel Associates, Ltd.
Export: Ad Auriema, Inc., 85-Broad Street,
New York, N.Y. 10004

This is the day you learn about guts!

It's your first jump. You're up 1,200 feet waiting to go. But all the training and all the practice never quite prepared you for the way you feel right now. Your pack never felt heavier. Yet, you never felt stronger.

You're ready.

There are five guys ahead of you. Now four. Now three. No one hesitates. You won't either. You're sure of your training. You're sure of yourself.

In 21 days of Jump School something happened to you. You learned things you never thought you would. You did things you never thought you could. It was tough. But it made you even tougher.

Okay. You're next.

Go!

During the long seconds before you feel the welcome shock of your chute opening, you learn about another thing:

Men call it "Guts!"

And if that's all Army Airborne training gives you, you'll still be miles ahead. But there is more. You can become a trained specialist in one of many exciting fields: electronics, communications, equipment maintenance, to name just a few.

Have you got what it takes?

Army

HAM HOBBY CLEARINGHOUSE

If you have a hobby or interest in addition to amateur radio and would like to talk about it on the air, you can contact other hams with the same hobby through this column. To be listed here, just send a legibly printed postcard to Ham Hobby Clearinghouse, POPULAR ELECTRONICS, One Park Ave., New York, N.Y. 10016, including on it your call letters, other hobbies, the frequencies you use, mode of operation, when you operate, and your name and address.

WB2AUM—Skydiving; 6 meters, AM; weekday evenings, all day on weekends. (Carl D. Wesche Jr., R.F.D. #3, Doansburg, Brewster, N.Y. 10509)

WB2FKR—Scouting, camping, collecting patches; 2 meters AM, and 6 meters; nightly from 2100 to 2400 EST. (Bill Singer, 252 North Boston Ave., North Massapequa, L.I., N.Y. 11761)

WB2SHU—Model rocketry, science fiction, collecting comic books; 7.166 mc. CW from 1600 to 1700 EST on weekdays, 1100 to 1300 EST weekends; sometimes 3.875 mc. AM. (Ronald Kinney, 8 Sparkill Ave., Albany, N.Y. 12209)

K3FSV—Model rocketry, chess, camping; 80 to 10 meters CW, daily. (Larry Widman, 7821 Park Ave., Elkins Park, Pa. 19117)

K3VMZ—Radio and optical astronomy, model rocketry, chess; 7.034 and 7.167 mc., 1600 to 1900 EST daily. (Dennis Ardinger, 401 Maplewood Dr., McMurray, Pa. 15317)

WA4UMN—All sports, especially basketball; 14.25 mc. SSB, 1500 GMT weekends. (Brent Blue, 580 Garden Dr., Louisville, Ky. 40206)

WB6RQR—Aeronautics, astronomy, meteorology, archery; 50.20 and 50.63 mc. (Bruce Bennett, 938 Kintyre Way, Sunnydale, Calif. 94087)

WA8MCQ—Science fiction, chess, experimenting; mostly 80 meters CW, some 40 and 20 meters CW, 15 meters phone; 1630 to 1800 EST weekdays, all day Saturday, 1300 to 2000 Sunday. (Mike Czuhajewski, Route 3, Paw Paw, Mich. 49079)

WN8SDY—Math, science, amateur rocketry, stamp collecting; 80 meters CW; weekdays from 0500 to 0700 EST, all day on weekends. (Chuck Spenn, Star Route, Indian River, Mich. 49749)

WN9QBK—Stamp collecting, camping, biology, medicine; 80, 40, 15 meters from 0200 to 0400 GMT weeknights and Saturdays. (Allan M. Huss, 8107 Kingston Ave., Chicago, Ill. 60617)

WN0NTT—Chess, coin collecting; 15 meters from 1600 to 2200 CST. (John Palmer, 1232 E. Magnolia St., St. Paul, Minn. 55106)

VE2BPN—Flying, photography, camping; 80 to 40 meters CW, afternoons only. (Richard Nadeau, 1123 Lincoln St., Sherbrooke, Quebec, Canada)

—30—



How to get the facts about the Army Airborne.

Your local Army Recruiting Sergeant has the full story. He'll tell you what it takes to qualify for Airborne training, and of all the opportunities it offers.

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Army

PE 4/66

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PACE I

SOLID STATE CB RADIO

only \$129⁰⁰



more talk power per dollar

3.5 watt output. This new solid state 6-channel mobile CB transceiver delivers the most talk power you can get from a 5-watt transmitter—3.5 watts at 100% modulation.

Outstanding mobile performance—Unique double conversion receiver, with noise limiting, provides excellent reception of even weak, distant signals.

All silicon transistor design, plus lifetime guaranteed glass-fiber circuit boards, combine to offer unmatched reliability, minimum current drain, and smallest possible size.

Write for Bulletin Pace I, and the name of your nearest Pace dealer.

From the makers of the famous PACE 5000

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Telephone (213) 325-8444

OLD WORLD STANDARDS BREAKING THROUGH

LITTLE did Heinrich Rudolf Hertz dream that someday his name would create havoc with magazine readers, editors, printers, and authors. If he were alive today, perhaps we could prevail upon him to change his name to Heinrich Rudolf Cycles. It might have sounded funny to Hertz, but it's no laughing matter to the electronics press. Starting with the June 1966 issue, **POPULAR ELECTRONICS** will join the trek to confusion and substitute Hertz for the time-honored and sensible "cycles."

POPULAR ELECTRONICS is not alone in this changeover. Readers will find that this international term of reference is appearing in other books and magazines. The Institute of Electrical and Electronics Engineers (IEEE), consistent with the recommendations of the International Organization for Standardization (ISO) and with the work of the International Electrotechnical Commission (IEC), has adopted this standard. And if that isn't enough justification for its use, also consider that the Conference Generale des Poids et Measures has adopted it, too!

Of course, "Hertzian" as a reference to electromagnetic waves went out of use several decades ago; just why it is being re-adopted has not been satisfactorily explained. Let's hope that "they" don't hit us next month with the metric system as a replacement for inches and feet.

So, in June, all references to frequency will be:

NEW		OLD
hertz	Hz	cycles
kilohertz	kHz	kc.
megahertz	MHz	mc.
gigahertz	GHz	gc.

*Installs
instantly!*

Hy-gain's new
CITIZENS BAND
"Magna-Topper"

- Alnico Magnet mount provides vise-like grip to any vehicle
- Easily moved from vehicle to vehicle
- Topper designed for maximum "Talk Power"

Now...excitingly different...highly practical...a superior performance Hy-Gain "Topper" with an Alnico base mount that allows instant installation on any car, truck, tractor, or other vehicle. No holes to drill, no special tools required...simply hook up the feedline to your CB transceiver, and you're ready to communicate loud and clear on any or all 23 channels. Unique base plate forms capacity connection to vehicle body to provide performance efficiency equal to that of permanently mounted antennas.

"Magna-Topper"...the most versatile mobile antenna ever! Superior performance top-loading design — exclusive Hy-Q loading coil—lifetime adjustable tuning rod—comfortable 29" overall height. Comes complete with 16 feet of coaxial cable and connector. Get yours today... Model TQRMB... **\$14.95 Net**



Powerful Alnico magnet in base mount holds antenna securely in place...even at speeds of over 80 MPH.

Hy-gain

**"TOPPERS"
FOR ANY
MOBILE
INSTALLATION**

DX "ROOF TOPPER"
For biggest TALK
POWER. 59" overall.
\$16.95 Net.

**SHORTY
"ROOF TOPPER"**
Powerful 19" model ig-
nores low garaging...
\$15.50 Net

"JIFFY TOPPER"
Mounts in trunk lip.
No exterior holes to
drill. **\$13.95 Net**

**AM-CB
"DUO-TOPPER"**
Replaces AM whip.
Outstanding on both
AM & CB. **\$14.95 Net**

"MARINE TOPPER"
Delivers 1.5db gain.
Mounts on any wood-
en or fiberglass hull.
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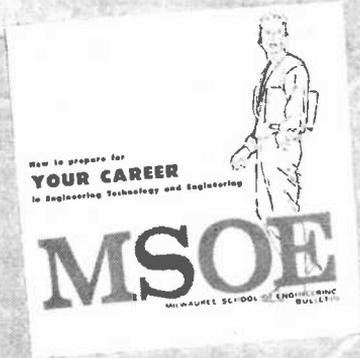
All "Topper" models
complete with mount,
coaxial cable and
connectors.

Available NOW from your
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8509 N. E. Highway 6—Lincoln, Nebraska 68501

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a space age career in
electronics?



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**ENGINEERING TECHNOLOGY
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Learn how you can prepare for a dynamic career as an electrical or mechanical engineering technician or engineer in such exciting, growing fields as avionics, missiles, reliability control, fluid mechanics, data processing, metallurgy, microelectronics, and advanced aerospace research.

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I'm interested in

Electrical fields Mechanical fields

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ELECTRONICS LIBRARY

ABC'S OF MICROWAVES

by H. Charles Woodruff

Introducing the subject of microwaves in language that is easy to understand, this book provides an excellent base from which to proceed to more advanced publications. After covering the historical development of microwaves, the author points out the characteristic effects that terrain, atmospheric conditions, reflected signals and other elements have on the transmission and reception of these ultrahigh frequencies. The operating principles of wave guides and couplings, cavity resonators, magnetron and klystron oscillators, and other microwave components are clearly presented. And a signal is traced through typical microwave equipment, stage by stage, together with a description of what takes place in each stage.

Published by Howard W. Sams & Co., Inc.,
4300 W. 62 St., Indianapolis, Ind. 46206.
Soft cover. 144 pages. \$1.95.

YOUR TAPE RECORDER

by Joel Tall and Martin Clifford

This is a very elementary and quite cursory treatment of tape recording. However, it is so non-technical that it can be safely recommended to anyone from 10 to 90 years old.

Published by Elpa Marketing Industries,
Inc., New Hyde Park, N.Y. Soft cover. 32
pages. \$1.00.

1966 WORLD RADIO TV HANDBOOK

edited by J.M. Frost

It is difficult to believe that the renowned "WRH" is now 20 years old. Still considered an indispensable aid to SWL's, the new updated volume has grown in size just as short-wave broadcasting has increased in importance. Besides containing schedules, frequencies, program details, etc., of all broadcasting stations throughout the world, the 1966 WRH is jam-packed with interesting facts on television, satellites, SWL clubs, standard frequencies, etc.

Published by WRH Co., Ltd. Available from
Gilfer Associates, P.O. Box 239, Park Ridge,
N.J. Soft cover. 302 pages. \$4.95. ~~50~~

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READER SERVICE PAGE

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additional information promptly
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Circle the number on the coupon below which corresponds to the key number at the bottom of the advertisement or is incorporated in the editorial mention that interests you.

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Mail the coupon to the address indicated below.

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VOID AFTER MAY 31, 1966

4

NEW LITERATURE

To obtain a copy of any of the catalogs or leaflets described below, simply fill in and mail the coupon on page 31.

Whether your pleasure is amateur radio, CB radio, or experimental electronics, the new 60-page catalog offered by *International Crystal Manufacturing Co., Inc.*, should serve as a handy reference in your home or lab. Hundreds of items are presented—from custom-made crystals to power supplies, single-sideband filters, coils, controls, and transformers, to CB transceivers and test equipment.

Circle No. 86 on Reader Service Page 31

Catalog CB-659, announced by *Mark Products Division of Dynascan Corporation*, describes Mark's complete line of Citizens Band base station and mobile antennas, mounts, and accessories. It consists of four 8½" x 11" pages plus inserts.

Circle No. 87 on Reader Service Page 31

H. H. Scott, Inc. discusses the advantages of using field-effect transistors (FET's) in receivers and tuners in a new 16-page bulletin. Also included is a reprint of an article entitled "Field-Effect Transistors for FM Front-Ends" which originally appeared in *ELECTRONICS WORLD*.

Circle No. 88 on Reader Service Page 31

Samples of dry transfer lettering and decals are included with an 8-page catalog on the subject put out by *Russell Industries, Inc.* Among the material available is a couple of MarKits® containing (1) an electronics glossary of over a thousand words, and (2) printed circuit pads.

Circle No. 89 on Reader Service Page 31

The Moody line of precision hand tools is thoroughly covered in a new 8-page catalog published by *Moody Machine Products Company, Inc.* Each tool is described—together with its use—and there are photographs of all products.

Circle No. 90 on Reader Service Page 31

If you don't already have a copy of *Lafayette Radio Electronics' 1966 Winter Catalog*, it's not too late to get one. The 108-page catalog, No. 662, features money-saving base and mobile CB and hi-fi stereo systems, portable radios, power tools, photographic equipment, and a new closed-circuit TV system.

Circle No. 91 on Reader Service Page 31

TELEX

for the ultimate in private listening



PERSONAL TV LISTENER

Enjoy Television in private without disturbing others. Full rich sound through comfortable individual ear phones. Others don't hear a thing. Ideal for late night viewing or keeping house quiet during children's programs. With extra ear set® two can listen.



TELEX 1200

- Superior sensitivity and response
- Extra rugged and tamper proof
- Field serviceable
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- Available with or without microphone boom
- Dynamic microphone and speakers

FIRST CHOICE OF EXPERTS FOR:

- Ham
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COMMUNICATIONS MICROPHONE

- Transistorized, noise-cancelling, dynamic
- Voice response characteristics proved superior by test
- Standard equipment on most new American aircraft
- Ideal for all communications
- Carbon noise-cancelling type also available. Both types FAA approved (TSO C58)

More Than 100 Telex Headsets, Microphones, Pillow Speakers and Private Listening Devices

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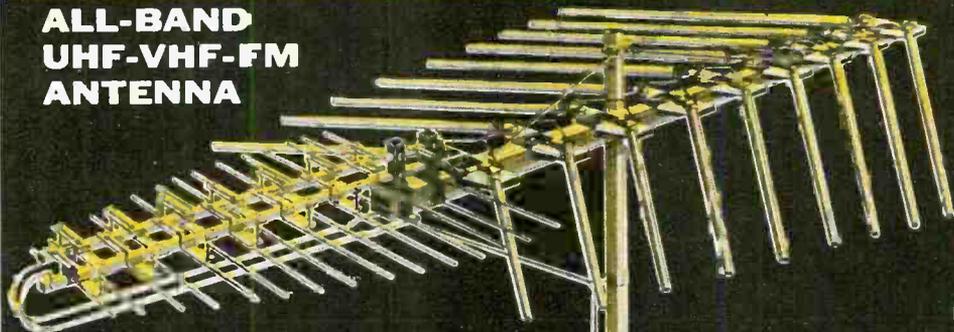
CIRCLE NO. 41 ON READER SERVICE PAGE

FINCO

COLOR-VE-LOG ANTENNAS

FOR UHF, VHF, FM RECEPTION

ALL-BAND UHF-VHF-FM ANTENNA

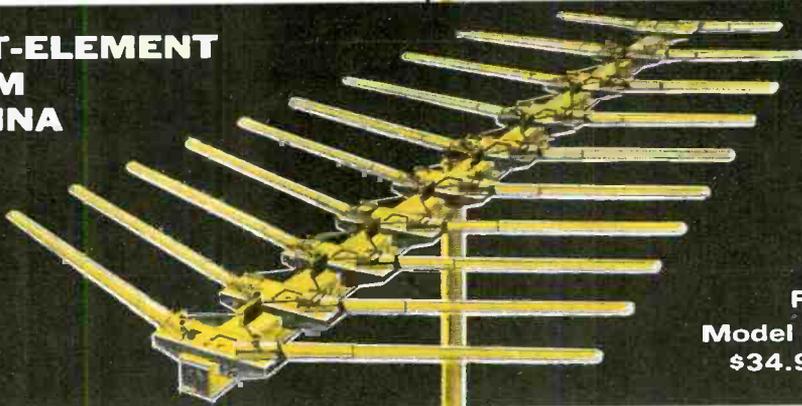


FINCO
Model UVF-24
\$59.95 list

The one antenna that does the work of 3! Gives startlingly clear black and white pictures and beautiful color on both UHF and VHF television channels — plus the finest in stereophonic and monophonic sound reproduction.

FINCO Model UVF-18—\$42.50 list
FINCO Model UVF-16—\$30.50 list
FINCO Model UVF-10—\$18.50 list

SWEPT-ELEMENT VHF-FM ANTENNA



FINCO
Model VL-10
\$34.95 list

FINCO's Color-Ve-Log challenges all competition! Its swept-element design assures the finest in brilliant color and sharply defined black and white television reception — as well as superb FM monaural and stereo quality

FINCO Model VL-18—\$54.50 list
FINCO Model VL-15—\$46.95 list
FINCO Model VL-7—\$23.95 list
FINCO Model VL-5—\$16.95 list

Featuring FINCO's exclusive Gold Corodizing

FINCO COLOR-VE-LOG

Prices and specifications subject to change without notice

THE FINNEY COMPANY • 34 W. Interstate Street • Bedford, Ohio

Write for beautiful color brochures Number 20-322, and 20-307, Dept. PE

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Choose Your Tailor-Made Course in N.T.S. "PROJECT METHOD" ELECTRONICS

Now! N.T.S. — one of America's oldest leading home-study and resident technical schools—offers you **GREATER CAREER OPPORTUNITIES IN ELECTRONICS.**



You can install and maintain electronic circuitry in missiles and rockets . . . specialize in microwaves, radar, and sonar.



You can succeed in TV-Radio Communications . . . prepare for F.C.C. License, service advanced satellites for industry and defense.



You can service and repair the electronic "brains" of industry — computers, data processing and other automation equipment.



You can become a highly-paid TV-Radio Technician, an electronics field engineer, or succeed in your own sales and service business.

CHOOSE YOUR FIELD—INSURE YOUR FUTURE!

1 ELECTRONICS-TV-RADIO SERVICING AND COMMUNICATIONS

A basic course thoroughly covering fundamentals of electronics, radio, TV servicing and communications.

2 MASTER COURSE IN ELECTRONICS-TV-RADIO, ADVANCED TV AND INDUSTRIAL ELECTRONICS

Qualifies you as a Master Electronics Technician — the Man in Demand.

3 FCC LICENSE COURSE

Preparation for this government license essential for many interesting jobs in radar, radio, television, communications, guided missiles, many others. Upon completion of this course, if you do not pass the FCC exam, your tuition will be refunded in full.

4 RADIO SERVICING (AM-FM-TRANSISTORS)

Train for radio sales and service with dealer or distributor.

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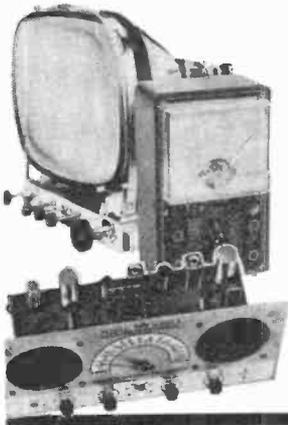
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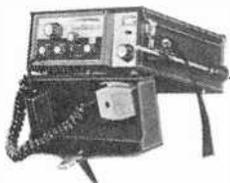


VERSATILITY



This is the Amphenol 650, a 5 watt solid state CB transceiver.

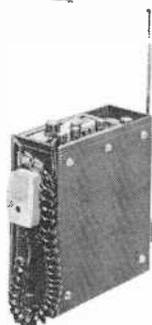
Here the same 650 is mounted in an Amphenol Portable Pak.



Fully portable—only 16 lbs.

with transceiver and battery.

Using this gutter-mounted antenna, the 650 becomes a rugged mobile unit.



This 40" telescoping portable antenna is ideal for field operation.

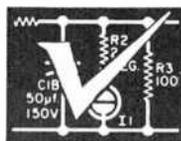
In CB, Amphenol means versatility. Choose from a wide line of solid state radios: hand-held or mobile, AC or DC, 100 mw to 5 watt. Add to these the industry's broadest accessory lineup—and you'll see why Amphenol CB equipment helps you do more jobs in more places. Your Amphenol dealer will show you how.



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CIRCLE NO. 2 ON READER SERVICE PAGE



OPERATION ASSIST

Through this column we try to make it possible for readers needing information on outdated, obscure, and unusual radio-electronics gear to get help from other P.E. readers. Here's how it works: Check the list below. If you can help anyone with a schematic or other information, write him directly—he'll appreciate it. If you need help, send a postcard to Operation Assist, POPULAR ELECTRONICS, One Park Avenue, New York, N.Y. 10016. Give maker's name, model number, year of manufacture, bands covered, tubes used, etc. State specifically what you want, i.e., schematic, source for parts, etc. Be sure to print or type everything legibly, including your name and address. Because we get so many inquiries, none of them can be acknowledged. POPULAR ELECTRONICS reserves the right to publish only those items not available from normal sources.

CW-52063A Model GF-12 aircraft transmitter, surplus, ser. 4525, made for Navy by Western Electric, circa 1943. Information on power supply and schematic needed. (Matt Storey, Box 435, Margaretville, N.Y.)

Electronic Labs. Model 204 electronic converter, vibrator type #11028; input, 115 volts d.c.; output, 115 volts a.c., at 150 watts maximum. Operating manual and parts list needed. (Ned W. Love, Box 405, Albemarle, N.C. 28001)

EICO Model 470 oscilloscope. Operating manual needed. (A.A. Freda, 4012 Blackthorn Ct., Birmingham, Mich.)

Surplus communications receiver, ser. CI H-46159-A, part of Navy equipment T.C.S.-6. Operating manual and schematic needed. (S. Abeyesundere, 19/3, De Fonseka Pl., Colombo 5, Ceylon)

Stromberg-Carlson receiver, circa 1929; tunes BC and s.w. to 19 mc. on 3 bands; has 7 tubes. Source for parts, schematic, and model number needed. (William C. Pierce, 514 Chatfield, Security, Colo. 80911)

Approved Electronic Instrument (AEI) Model A-100 r.f. signal generator; tunes 100 kc.-52 mc. on 6 bands. Parts values and schematic needed. (Frank Stehno, 7426 Rogers Rd., Omaha, Nebr. 68124)

Atwater Kent Model 55 receiver, ser. 3333689, circa 1927; tunes BC; has 7 tubes. Speaker plug and front dial plate needed. (Frank Alfano, Leetes Island Rd., Branford, Conn. 06408)

AN/SRC-1 "Marine Radio" transmitter-receiver, surplus, made by Smith-Meeker for the U.S. Signal Corps, circa 1944. **RCA** Model 8503 low-frequency receiver. Instruction manuals needed. (Phil Weingarten, 67-61 Alderton St., Forest Hills, N. Y. 11374)

Hallicrafters Model S-38 receiver, circa 1953; tunes 5.5 kc.-30 mc. on 4 bands; has 6 tubes. Tube layout and schematic needed. (Anthony Gottspower, 2760 Las Palmas Vista, Yuma, Ariz. 85364)

Telectro Industries RD-31D/U "Recorder Reproducer." Schematic or operating manual, take-up reel, cap screw for holding reel, and schematic or operating manual needed. (James R. Throop, 5408 Berry Hill Rd., Norwalk, Va. 23502)

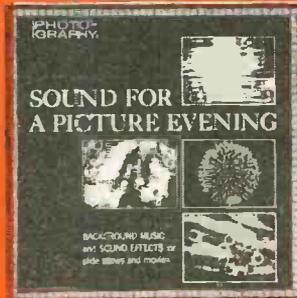
Mohawk Model 2540 receiver; tunes BC and s.w. on 4 bands; has 6 tubes. Schematic needed. (Gerald F. Levy, 108 Lomar Dr., Downsview, Ontario, Canada)

Heath Model AT-1 transmitter; covers 80 to 10 meters on 4 bands. Schematic needed. (Jim Wornick, 426 Stockbridge, Buffalo, N.Y. 14215, and Ross Lambert, 735 Kappock St., Riverdale, N.Y. 10463)

(Continued on page 96)

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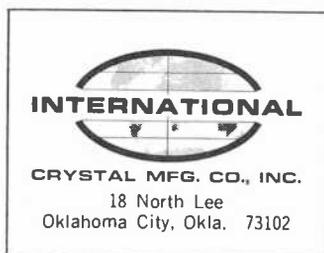
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BUILD THE
**ULTRASONIC
OMNI-ALARM**

*Fail-safe protection...
silent sound beam
triggers alarm when disturbed*

By DANIEL MEYER

YOU CAN'T hear it; you can't see it; you can't feel it; you can't smell it; and you can't taste it; but you can make it work for you. It really isn't mysterious, it just seems that way. What is "it"? The beam in the Ultrasonic Omni-Alarm, an all-purpose, all-sensing, always-ready alarm system. The system can be used as an intruder alarm, fire alarm or as a counter or controller in an industrial process or production line. It can also be employed to demonstrate the use of ultrasonic sound, and should make a good science project.

The alarm consists of a transmitter that broadcasts an inaudible ultrasonic beam of "sound" and a receiver on the



same chassis that detects this "sound." The "sound" is a 25-kc. note, which is about 10 kc. above most people's hearing range. In many respects the system is similar to the common light source and photocell alarm system, but with several

important advantages. The ultrasonic beam cannot be "fooled" with a flashlight, nor is it affected by sunlight. Ultrasonics works equally well in pitch darkness and in broad daylight.

Two transducers, one from the trans-

PARTS LIST

C1, C5—100- μ f., 15-volt electrolytic capacitor*
 C2—30- μ f., 15-volt electrolytic capacitor*
 C3, C7, C9, C11—0.05- μ f., 50-volt ceramic disc capacitor*
 C4—0.003- μ f., 5% polystyrene capacitor*
 C6, C8, C10—0.01- μ f., 50-volt ceramic disc capacitor*
 C12, C13, C14—5- μ f., 15-volt electrolytic capacitor*
 D1, D2—1N34 germanium diode (or equivalent)*
 D3, D4—50-volt PIV, 750-ma. silicon rectifier*
 I1—Neon pilot light with built-in resistor
 K1—Printed-circuit-type d.p.d.t. relay (Price Electric 206-14P or equivalent)*
 K2, K3—Relay—see text
 L1—15- to 25-mh., variable inductor with 10% tap (DEMCO 3E-027-1)*
 M1—0-15 volt d.c. voltmeter (Lafayette 99 G 5047 or equivalent)
 Q1, Q6—2N3706 transistor (Texas Instruments, or equivalent)*
 Q2, Q3, Q4, Q5—2N3708 transistor (Texas Instruments, or equivalent)*
 R1, R4, R6—470-ohm, $\frac{1}{2}$ -watt resistor*
 R2—47,000-ohm, $\frac{1}{2}$ -watt resistor*
 R3, R19—4700-ohm, $\frac{1}{2}$ -watt resistor*

R5, R18—1000-ohm, $\frac{1}{2}$ -watt resistor*
 R7, R11, R15—100,000-ohm, $\frac{1}{2}$ -watt resistor*
 R8, R16—10,000-ohm, $\frac{1}{2}$ -watt resistor*
 R9, R13—27,000-ohm, $\frac{1}{2}$ -watt resistor*
 R10, R14—2200-ohm, $\frac{1}{2}$ -watt resistor*
 R12—10,000-ohm trimmer resistor (CTS X-201 or equivalent)*
 R17—15,000-ohm, $\frac{1}{2}$ -watt resistor*
 R20—Resistor—see text
 S1, S2—Miniature s.p.s.t. toggle switch
 SO1—2-prong socket (optional)
 T1—Low-voltage transformer: 110- to 120-volt primary; 20-volt CT secondary (Stancor TP-2 or equivalent)
 1—Chassis (Bud CU-465 or equivalent)
 1—Circuit board (DEMCO #128)*
 2—25-kc. ultrasonic transducers (DEMCO E-25)*
 Misc.—Wire, solder, nuts, bolts, connectors, spacers, etc.

NOTE: Most of the parts listed above are standard and should be available from your local dealer. If you have any difficulty in obtaining them, you can contact DEMCO, Box 16297, San Antonio, Texas 78216 for the following: a kit of all the parts marked with an asterisk for \$20; an etched and drilled fiberglass circuit board like that shown in the photo for \$3.50; any of the parts used—price list available from DEMCO on request.

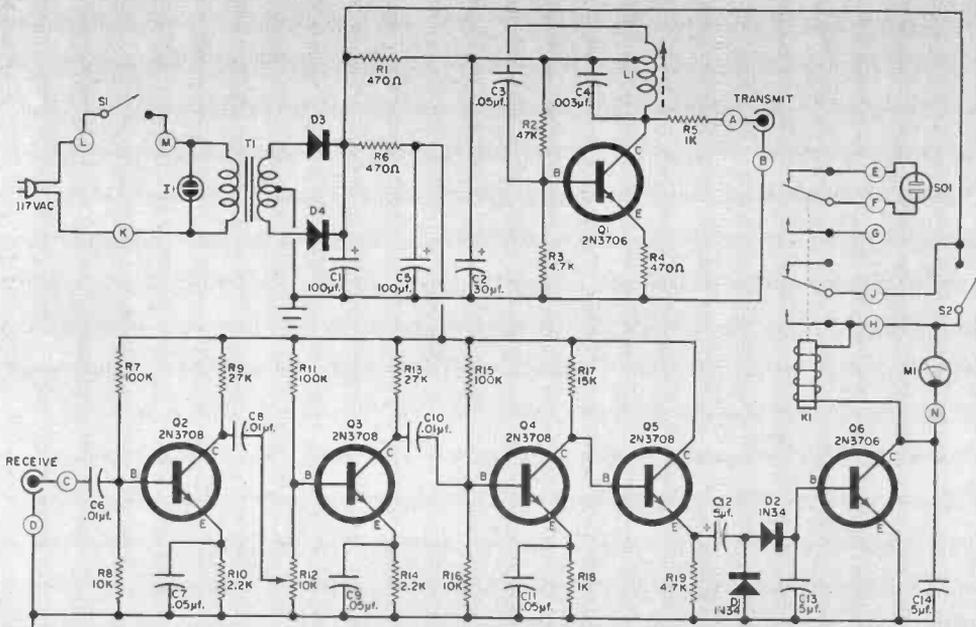


Fig. 1. One-transistor oscillator, Q1, generates an ultrasonic signal which is beamed through the air and back to the receiver, Q2 to Q6. Alarm sounds when beam is interrupted.

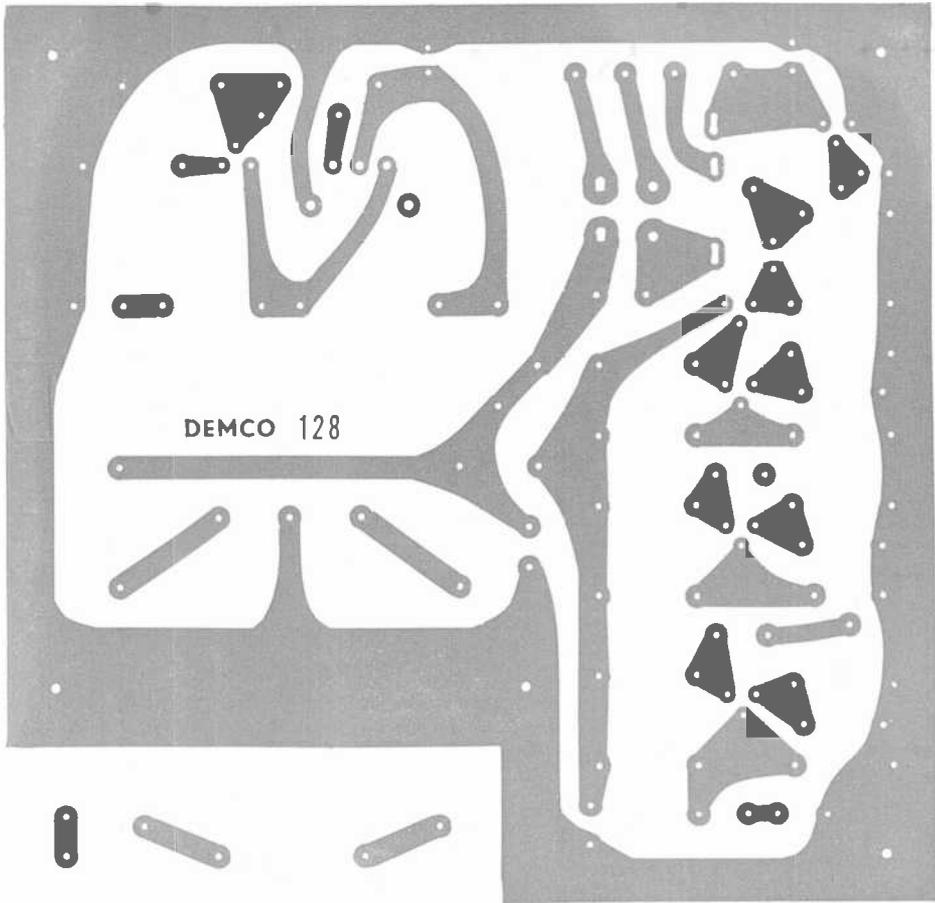


Fig. 2. Actual size photo of conductor side of printed circuit board. Components can be mounted on any type of chassis, but care should be exercised to prevent stray leakage, or coupling.

mitter and one from the receiver, can be placed up to 50 feet apart to protect a large area. Any interruption of the beam causes an alarm. Even a fire in the area between the transducers can create enough air turbulence to set off the system.

How It Works. The transmitter portion is nothing more than a single transistor oscillator circuit ($Q1$) which directly drives the output transducer connected to terminals A and B (Fig. 1). Coil $L1$ and capacitor $C4$ make up a resonant tank tuned to 25 kc. Feedback from the coil to the base of $Q1$ through $C3$ helps sustain the oscillations. Resistor $R8$ isolates the transducer from the tuned circuit and prevents variations in the transducer and its cable capacitance

from affecting oscillator operation too much.

The receiver, consisting of transistor circuits $Q2$ through $Q6$, picks up the signal from the input transducer, amplifies it, and energizes relay $K1$. Transistors $Q3$ and $Q4$ are conventional common emitter amplifier stages. Potentiometer $R12$ acts as a level and sensitivity control. Transistor $Q5$ is used as an emitter follower and provides the low output impedance needed to drive the half-wave voltage-doubler rectifier consisting of $D1$, $D2$, $C12$ and $C13$. The resulting d.c. voltage is used to turn $Q6$ "on." Transistor $Q6$ drives the alarm relay.

The circuit is arranged so that the relay is held in at all times when there is a signal present. A drop or absence of signal causes the relay to open, and the

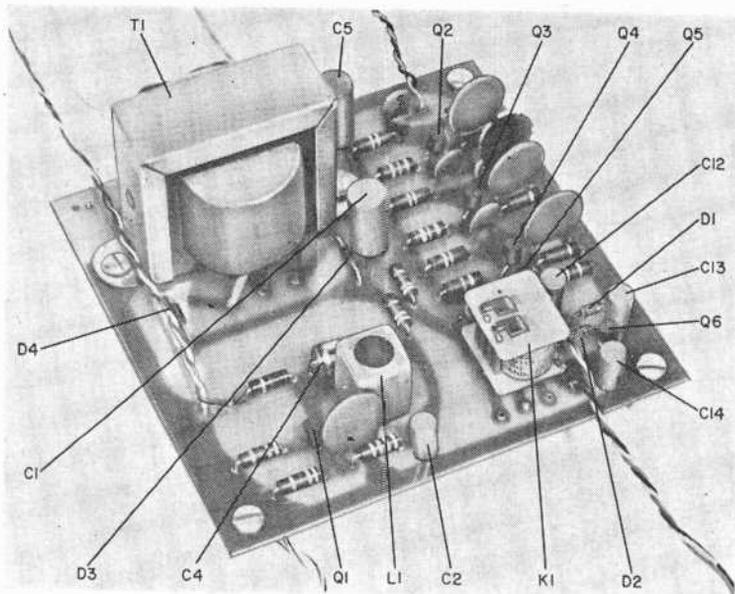


Fig. 3. No attempt at conserving space is made. Relatively large open areas reduce undesirable coupling between transmitter and receiver. Component location on the board is easy to determine, but the callouts sprinkled around the photo may give you more confidence as you drop in each part. Be sure to observe polarity of diodes and electrolytics.

alarm to sound, or a counter to operate, etc. This is a type of "fail safe" operation, in that a defect in the system, power failure, transducer failure, circuit failure, etc., will cause the alarm to sound. The circuit is compromised if the same power source is used to activate

operate. With the switch in this position, the relay will kick in and out every time the sound beam is on and then broken. For counting or other activities requiring self-resetting, the switch should be left in the *Reset* position. But for alarm purposes, the switch should be

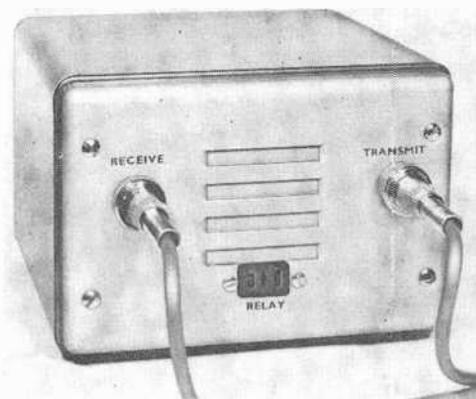


Fig. 4. By locating the receiver and transmitter output and input connectors on the rear cover, the entire package takes on a clean professional look.

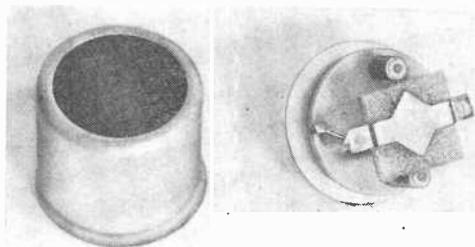


Fig. 5. If vibration of hardware in the transmitting transducer creates an audible sound, carefully open case and insert small piece of foam plastic.

placed in the *Reset* position only long enough for the relay to kick in.

Once the relay is "on," move the switch to the *Operate* position; relay contacts *J* and *H* will continue to complete the relay circuit and hold the relay "on" until the beam is interrupted. When the beam is broken, the relay opens. The relay will not close even if the beam is restored, and the alarm will sound continuously until the switch is manually

the external alarm. However, this condition can be easily remedied, as described in the installation instructions.

Switch *S2* must be placed in the *Reset* position (closed) before the system will

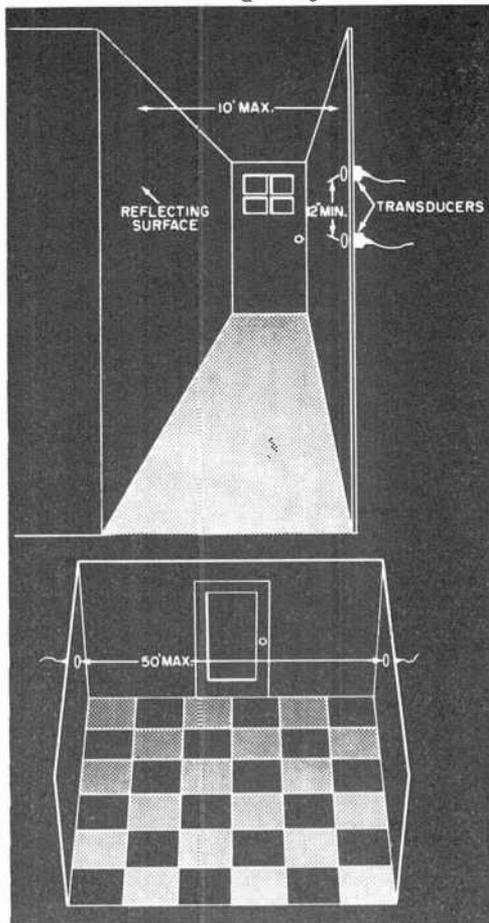


Fig. 6. To cover a narrow passageway, both transducers can be mounted on the same wall; for a wider area, up to 50', the direct-path technique is used.

placed in the *Reset* position once again.

Power for the transmitter and receiver is derived from the 117-volt line, stepped down by *T1*, rectified by *D3* and *D4*, and filtered by *C1*, *R6*, and *C5*, and by *R1* and *C2*. Actually, any 12-volt d.c. supply, able to deliver about 50 ma. of current will do. Batteries can also be used.

Construction. Although an etched and drilled circuit board is available, you can make your own board, using the actual size photo (Fig. 2) as a guide, or mount the parts in any manner more convenient for you. If you do change the layout, avoid stray coupling between the transmitter and receiver sections, but in any event observe polarity of electrolytic capacitors and diodes.

After all the parts are mounted on the circuit board, connect wires to points *A* through *M*. These should be about 8 inches long. Twist together leads *A* and *B*; *C* and *D*; *E*, *F* and *G*; *K*, *L* and *M*; and *J*, *H* and *N*.

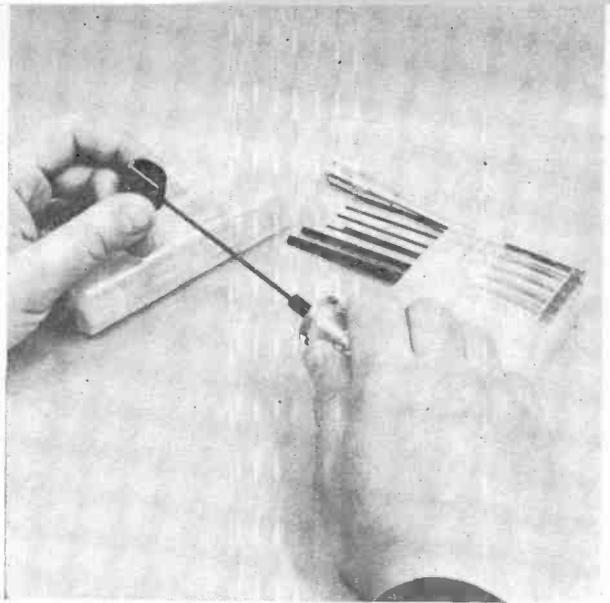
Mount the switches and meter on the front panel, and the transducer connectors and alarm connector on the back panel, as shown in the photos. Use shielded microphone cable and appropriate connectors for the transducers. For a 50-foot spread, each cable need be only 25 feet long. A phono plug connects the transducer to the cable. Any type of cabinet can be used to house the circuit.

Adjustment. Mount the transducers about 20 feet apart. Turn the sensitivity control fully clockwise (viewed from the knob side) and turn on the power. Place *S2* in the *Reset* position and advance gain control *R12*. As the control is turned counterclockwise, the meter reading should increase; and at approximately 8 volts, the relay should be heard to click in. If the relay does not close—or if the reading doesn't reach 10 volts—at the full counterclockwise position of the gain control, the slug in *L1* should be adjusted.

Use a nonmetallic alignment tool to turn the slug about halfway into the coil form. Now slowly turn the slug out of the form and watch the meter reading. When the reading reaches 10 volts, reduce sensitivity and keep adjusting until a peak or maximum reading is obtained. Turn the alarm *off* and back *on* to be sure that the adjustment is stable. If the meter reading does not return to the same place or is zero, tune for the second highest reading.

If you find that the best transmitter adjustment causes the transmitting transducer to make audible sounds, damp the transducer. The high drive level can cause the crystal or internal parts of the transducer to "sing" at an audible frequency. Carefully open the transducer case by straightening the crimped edge on the back of the transducer to remove the cover. Then carefully insert a piece of foam plastic (not rubber) under the crystal as shown in Fig. 5. The pad should be approximately $\frac{3}{8}$ " square by
(Continued on page 82)

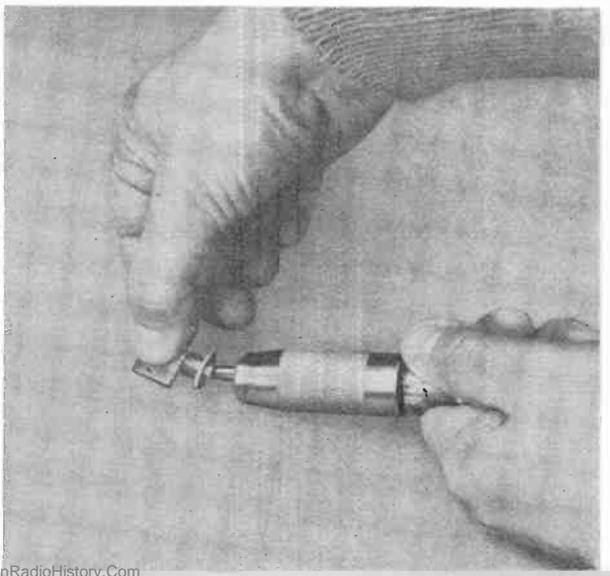
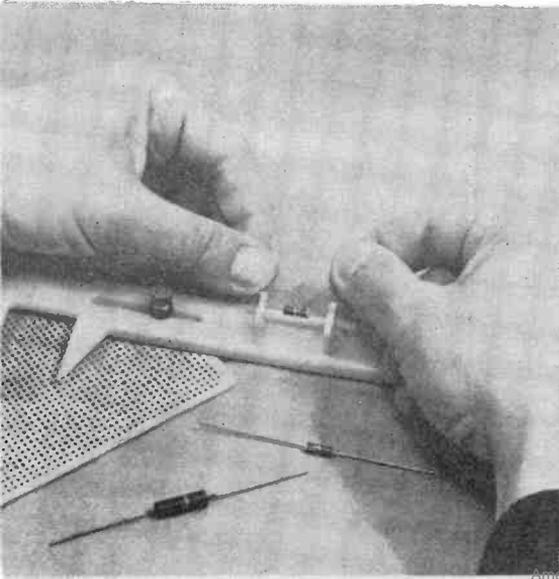
TOOLS OLD NEW AND REMEMBERED

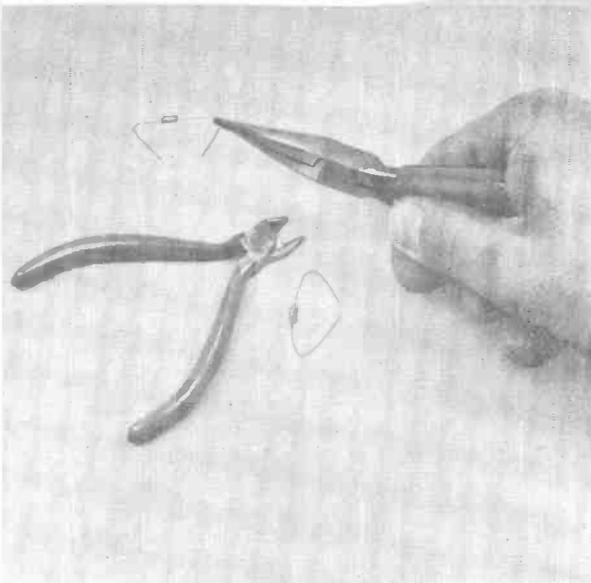


FOR THOSE UNSETTLING SETSCREWS The experimenter/hobbyist is now faced with the necessity of keeping four different screw-tightening tools on his workbench. In addition to the commonly-used slotted head screws, Phillips, and Allen hex, the Bristol multiple spline is making a renewed appearance. Many WWII electronic instrument knobs used Bristol setscrews (such as the BC-221 knob in the photo above). Xcelite, Inc., (Orchard Park, N.Y.) has just added a set of nine Bristol splines to its line of see-thru plastic boxed tool kits. The set includes a high torque handle and extension.

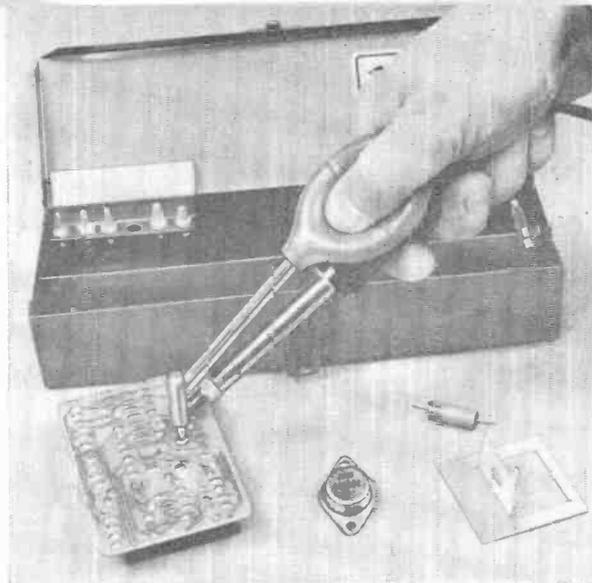
FOR PRINTED CIRCUITS This plastic calipers combines a pair of adjustable trammel points and a wire or lead bending jig. The user adjusts the points to coincide with the holes in the printed circuit card. As this measurement is being made, the wire bending jig is automatically adjusted to the same width. After the points are set, a resistor or capacitor is placed midway between the uprights of the jig and the leads are bent to right angles. Called the "Davey Former," this hand item is manufactured by Davey Products, Fairfield, Conn.

IN BEHALF OF UNSCARRED PANELS The meticulous craftsman has every reason to detest the knurled finish nuts commonly seen on toggle switches. Most hobbyists are tempted to use a pair of gas pliers to tighten these nuts in place—often marring an otherwise perfect panel. There's a simple solution to the problem of the knurled finish nut—the Knurl-Tite wrench. This wrench (it is sold in three different sizes) has collet-type jaws that slip around the nut. A quarter-turn clamps the nut for tightening. Available from Walsco, Rockford, Ill.





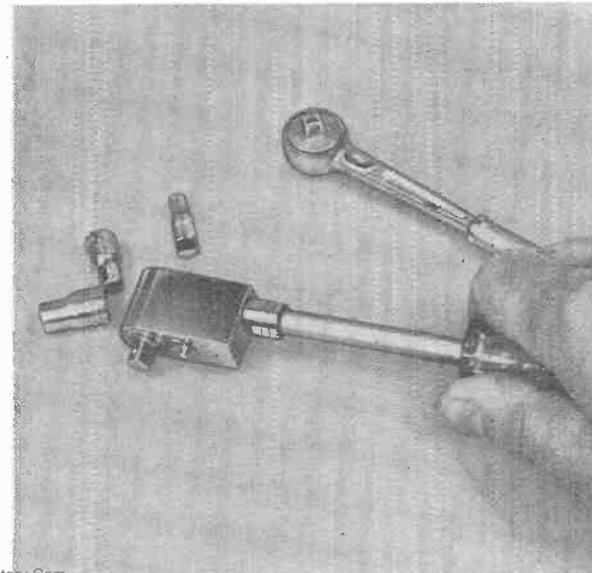
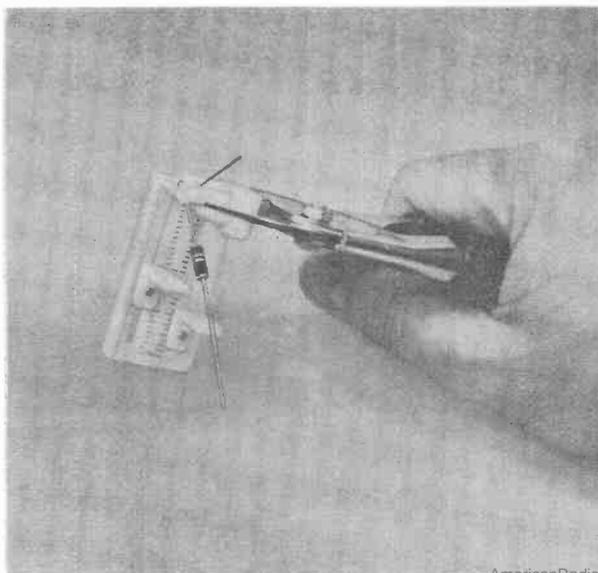
BE HAPPY IN YOUR WORK If you plan on doing a lot of kit wiring—especially around printed circuits, transistors, and integrated circuits—investigate the convenience of pliers with built-in coil springs to keep the jaws open. For only a few extra dimes, long-nose, end-cutting, round-nose, and diagonal-cutting pliers can be purchased with light spring-loading. Crescent and Krauter make excellent pliers. Shown above are two of the special electronic pliers sold by Krauter for delicate work around small-signal solid-state devices. The needle-nose pliers have a cutting edge near the tip.



DESOLDERING DELUXE The problem of replacing printed circuit components has been simplified by the "desoldering" iron. Most of these irons work by first melting the solder and then sucking it up into the iron. The waste solder can then be expelled into a waste can. A small rubber bulb provides just the right amount of vacuum pressure for this work. Just brought to our attention is the desoldering kit above. It contains an iron, six different-size desoldering tips, stand, and tip cleaning tool—all in a handy steel case. Manufactured by Endeco, 5149 East 65th St., Indianapolis, Ind.

CUTTING AND FORMING This pair of pliers serves two purposes—it can cut and then form or bend resistor and capacitor leads for use in printed circuits. The length of each lead and point of the right-angle bend is preset by the adjustable "stops" visible in the photo. With a little practice, the user can trim and bend leads on a mass-production basis. Although the pliers are high-priced, some experimenters with a passion for neatness have used them to good advantage. Produced by James Electronic Tool Co., Box 1482, Palo Alto, Calif.

IN HARD-TO-REACH CORNERS This novel right-angle device is a spinning ratchet that accepts the standardized $\frac{1}{4}$ "-square sockets commonly used in electronics work. Unlike other right-angle tools that require leverage—sometimes very difficult to get in tight corners—the handle rotates (ratchet-fashion) for breakaway or tightening. A slip lever on the pawl permits setting the rotation for "on" or "off." This ratchet is strong—100 inch pounds is the recommended maximum torque. Manufactured by Amtronix, Inc., Box 44, Chula Vista, Calif.



THE SARASOTA MYSTERY

FIRST FOLLOW-UP

*Things have not been
standing still
in the mysterious world
of Hydronics
and Wallace Minto*



SCIENTISTS do not have a “pat” answer for the unusual underwater transmission capabilities of Hydronics. As reported in this magazine last month (page 50), a retired inventor-scientist-experimenter, Wallace L. Minto, has discovered a new method of communications, similar to sonar and radio waves, but actually identical to neither. Minto has labeled his through-water communications “Hydronics,” and a somewhat similar phenomenon that seemingly defies resistance and insulation “Plasmonics.”

A few weeks ago, Minto attempted and succeeded in something new—receiving the Hydronics waves out of the water when the transmitter was immersed. The circumstances surrounding this test were essentially those shown at left.

Suspended some 90 feet below the boat was a Hydronics transmitter—sealed in a waterproof canister. The radiated signal was a continuous tone and could be intercepted by the receiver on a nearby dock. The “catch” seems to have been the antenna, masked in an attaché case with a lead wire coming out the side. When the attaché case was looking end-on toward the transmitter, the tone signal could be heard loud and clear; but when the case (antenna) was rotated broadside, the signal died out.

As before, Minto was forthright in discussing his latest development: “I am aware of the basic physical laws [and] I know there is no way to account for my demonstrations. Nevertheless, my associates and I *are* doing these things [and] I am demonstrating *facts*.” Minto added, “We have *shown* and we will continue to *show* any serious-minded scientist who cares to take the trouble to come and see just what we can do.

It is evident that no one—possibly not even Minto himself—fully understands just what Hydronics might become to underwater communications.

—Ken Warner

TEST MEASUREMENTS PROFILE

*The reliability of your test measurements
can never exceed
the accuracy of the instrument used*

By **JOHN H. DRUMMOND**

Technical Editor

THE experimenter/hobbyist arbitrarily limits his "adventures" into building and designing electronic equipment if he limits the usefulness of his test equipment. Every reader probably has either a VOM or VTVM, but even these versatile pieces of test gear will not do everything.

Rather than reiterate the desirable functions of various pieces of test equipment, this article tells you how you can most conveniently measure any one of eight basic electronic properties: voltage, current, resistance, capacitance, in-

ductance, impedance, power, and frequency. Knowing how to select the right piece of equipment to do a specific job is half the battle.

No attempt is made in this article to tell you what equipment—or whose equipment—to buy, nor in specific detail just how a measurement should be made. The latter information is contained in the operational manual that comes with every good piece of test equipment, and you'll be better able to decide what to buy when you have an insight on test equipment in general.

MEASUREMENT	UNIT	INSTRUMENT	SPECIFICATIONS
Voltage	Volts (d.c.)	VOM (Volt Ohm-Milliammeter)	This is probably the most common electronics measurement. A self-contained portable unit, the VOM uses a circuit comprising a moving coil meter and a network of series resistors to measure d.c. voltage. Accuracy is generally $\pm 2\%$ of the full-scale reading. Sensitivity of the VOM in measuring d.c. voltage is rated in ohms per volt. A VOM sensitivity of 20,000 ohms per volt is the minimum for electronics work. Some VOM units have much greater sensitivity.
"	Volts (a.c. r.m.s.)	"	Same as above, except that a bridge rectifier is used in the VOM to convert a.c. to d.c. Optimum (and most common) sensitivity is 5000 ohms-per volt.
"	Volts (d.c.)	VTVM (Vacuum-Tube Voltmeter)	The VTVM incorporates a direct-coupled voltage amplifier stage to vastly increase meter sensitivity and reduce circuit loading effects. Usual input resistance of the VTVM is 11 megohms (constant not per volt). The VTVM must be connected to a 117 volt a.c. line for power. Several self-contained, battery operated voltmeters are being offered the experimenter, one of which has an input impedance of 10 megohms.
"	Volts (peak, or peak to peak)	Oscilloscope or VTVM	Peak voltages are most easily read when displayed on an oscilloscope that has been calibrated for such measurements. A few VTVM's are scaled for peak and peak-to-peak readings.



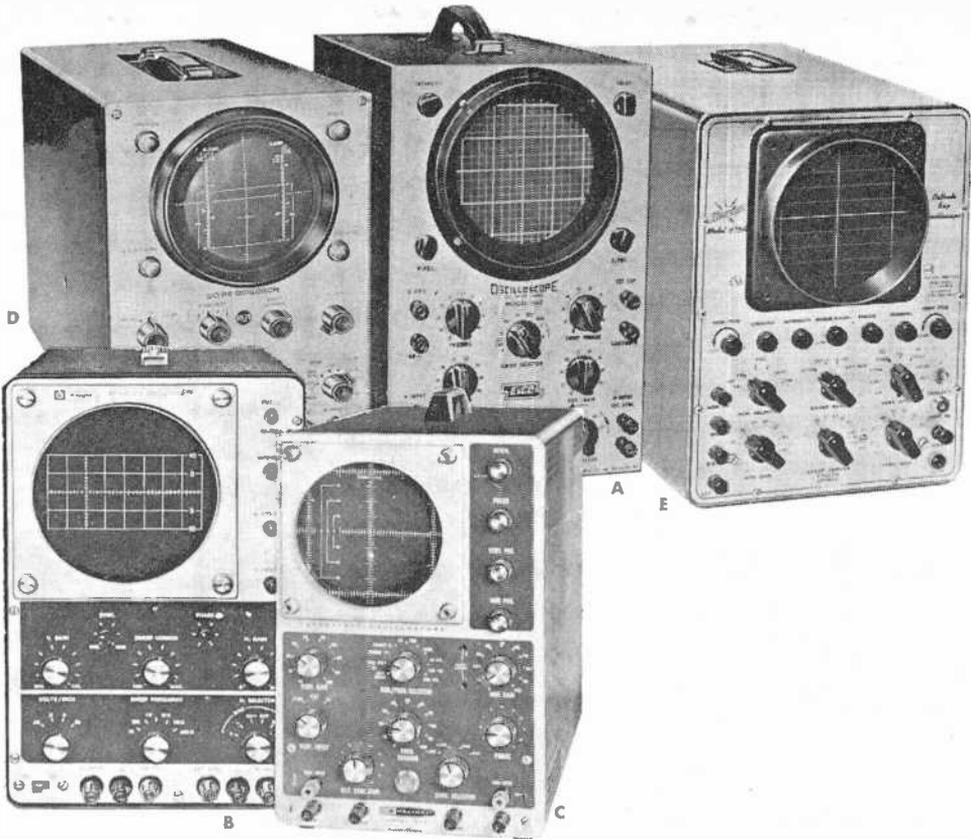
Typical volt-ohm-milliammeters (VOM's) with required sensitivity and accuracy for electronic circuit measurements: (a) Triplet 630-PL; (b) B&K "V-O-Matic" 360; (c) Heathkit MM-1; (d) RCA WV-38A; (e) Simpson 260; (f) Lafayette 99 R 5004.

MEASUREMENT UNIT		INSTRUMENT	SPECIFICATIONS
Current	Amperes, d.c. (Milliamperes, d.c.)	VOM	The heart of every VOM is a low-range d.c. milliammeter. Through the use of shunt resistors, the full-scale range of the meter can be adjusted to read currents from under 1 milliampere to about 5 or 10 amperes.
"	"	VTVM	Because of the very high constant input resistance or impedance of the VTVM, this instrument cannot be used to measure current flow directly.
"	Amperes, a.c.	Snap-Around Ammeter	Outside of direct in-series measurements, a.c. flow is easily measured by "snap-around" probes that sense the magnetic fields around a conductor. Current flow up to 100 amperes or more can be measured. The common VOM or VTVM cannot be used for measuring a.c. flow directly.
Resistance	Ohms, or Megohms	VOM	The ordinary VOM has a built-in voltage source (battery) and a current flow measuring meter. Using these two parameters and Ohm's law, the value of an unknown resistance can be determined—and the meter scale calibrated in ohms rather than current flow. Resistances down to about 1 ohm and up to about 20 megohms can be measured. Special precautions and special VOM circuitry are necessary in working with transistor circuits.
"	"	VTVM	Through the use of its built-in power supply, the VTVM can be employed to measure resistances. In most VTVM's the accuracy of resistance measurements above 10 megohms is much better than in the VOM.
"	"	Bridge	Most bridge-type test instruments are related to the Wheatstone bridge, which is really a method of balancing the value of an unknown component against a carefully calibrated built-in component. Not commonly used by the experimenter/hobbyist.

MEASUREMENT	UNIT	INSTRUMENT	SPECIFICATIONS
Capacitance	Farad (Microfarad, Picofarad — μ f. or pf.)	Capacity Checker	Out-of-circuit capacitors are usually measured by an a.c. bridge in moderate-priced test instruments. By balancing the unknown capacitor against a known capacitor in the checker (Wien bridge), a close approximation of the unknown value can be obtained. To find very low capacitances, a more elaborate arrangement is used involving r.f. oscillator circuits.
"	"	In-Circuit Tester	Capacitance values can be approximated with an r.f. oscillator circuit without removing the capacitor from the circuit. This instrument will also detect shorts and opens and is particularly useful in checking electrolytics.
Inductance	Henry (Millihenry, Microhenry —mh. or μ h.)	Q-Meter or Inductance Bridge	Inductance is usually measured with a "Q" meter or inductance bridge. The basic circuit is a Maxwell bridge or Hay bridge, a variation of the basic Wheatstone bridge. In both circuits, the inductive reactance of the unknown inductance is balanced against the capacitive reactance of the bridge circuit. The instrument's scale is calibrated to read directly in the desired unit of inductance. Many commercial testers combine the functions of different bridge circuits by switching, to provide greater accuracy of measurement at different measuring ranges. Some also provide separate scales for impedance and capacitance measurements as well.
Impedance	Ohms	Impedance Bridge	Impedance, like inductance is measured by a bridge circuit which is a variation of the basic Wheatstone bridge. The essential difference is that a calibrated standard impedance is used to balance the unknown impedance instead of a resistance. Impedance bridges have an accuracy of $\pm 1\%$ or better, and are available for precise measurements at power frequency, audio frequency, and radio frequency.



This assortment of vacuum-tube voltmeters (VTVM's) includes kits and factory-wired units: (a) Heathkit IM-13; (b) Precise Electronics 905; (c) Lafayette 38 R 0101; (d) EICO 232; (e) Knight-Kit (Allied Radio) KG-620; (f) RCA "VoltOhmyst" WV-77E.



Examples of general-purpose wideband oscilloscopes: (a) EICO 460; (b) Knight-Kit (Allied Radio) KG-635; (c) Heathkit IO-12; (d) RCA WO-91B; (e) Hickok 675A.

MEASUREMENT UNIT		INSTRUMENT	SPECIFICATIONS
Frequency	Cycles, audio	None	The experimenter/hobbyist has very few occasions to determine an unknown audio frequency. Although there are a few direct-reading frequency meters available for laboratory use, there is none of particular interest to the experimenter. Frequency can be measured using a calibrated audio oscillator, oscilloscope, and Lissajous figures.
"	Cycles, r.f. (Kilocycles or Megacycles; kc. or mc.)	Surplus Gear	For under \$100, the experimenter can purchase a surplus Signal Corps BC-221 or U.S. Navy LM frequency meter. Either of these heterodyne frequency meters will enable very accurate determination of unknown radio frequencies in the spectrum of 125 kc. to 20 mc. (and above). There are no experimental equivalents for either of these units.
Power	Watts, audio	AC-VTVM	For hi-fi and audio measurements, a special adaptation of the VTVM is used. The circuits are similar, but the a.c. VTVM has built-in load resistors—generally 4, 8, and 16 ohms. This instrument would also be calibrated in db and may be used to grade amplifier gain and sensitivity.
"	Watts, r.f.	Output Meter	At low r.f. output levels (under 25 watts), a number of modestly priced output meters are sold that read output in watts. At higher output levels, a laboratory-type is required.



Service-type capacitor testers for measuring capacitance and checking internal leakage: (a) B&K 801 "Capacitor Analyst"; (b) Heathkit IT-11 capacitor checker; (c) Simpson 383A "Capacohmeter"; (d) EICO 965 "FaradOhm" bridge analyzer; (e) Sprague "Tel-Ohmike" TO-6; (f) Knight-Kit KG-670.

These audio generators can be used when making frequency measurements: (a) Lafayette TE-22; (b) Heathkit IG-72; (c) RCA WA-44C; (d) EICO 378.



CONFUSED S-UNITS ABOUT

*Some answers to why
an S9 signal
is sometimes not even S7
much less 10 db over*

By **MARSHALL LINCOLN**



IT MIGHT happen like this. Joe Ham, WØXYZ, is chewing the rag with his buddies on the air, and they get to comparing signal reports. Bob, who lives about a mile away, says Joe's signal is 10 db over S9. Sam, who lives clear across town, says Joe is pounding in at 30 db over S9, and Ed, just down the block, says Joe's signal is just S9. Which one of these guys is wrong, or has a bum receiver?

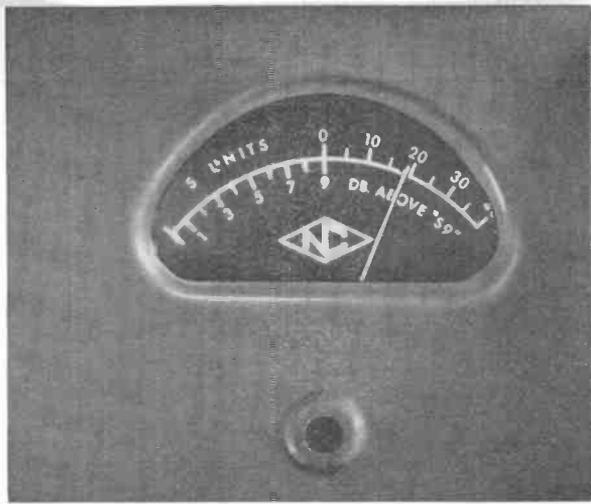
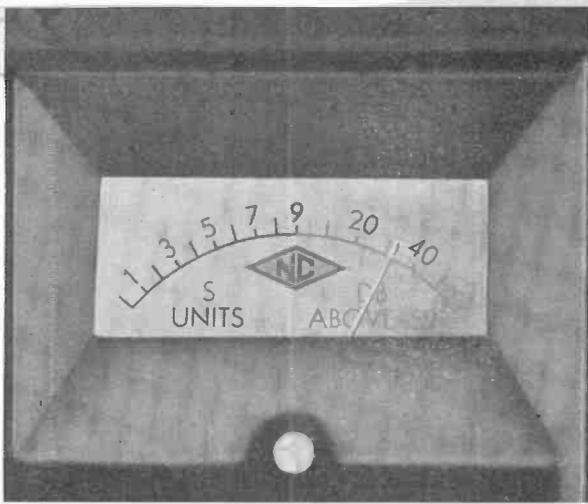
Maybe none of them. Or, maybe all of them!

The reason is that even if these guys lived side by side and were using the same model of receiver and the same type of antenna, they still might not get the same readings! Using different receivers and different antennas, they definitely will get different readings.

How come? It's just that an S-meter (signal strength meter on the receiver) doesn't really *measure* actual signal strength. But, it does indicate the *relative* strength of signals getting into the receiver. This means that a signal is shown to be stronger, weaker, or the same strength as another signal, without a definitive *measurement* of the *actual strength* of either signal.

A signal which deflects your S-meter to S7 is two S-units weaker at the *input to your receiver* than one which deflects the meter to S9. Since most manufacturers calibrate S-meters so that one S-unit represents either 5 or 6 db change in signal strength, the S9 signal is 10 to 12 db stronger than the S7 signal at your receiver.

Calibration Variations. An important variable which causes S-meter reports to



be inconsistent is the fact that receiver manufacturers do not have a common calibration standard. Also, each manufacturer has his own calibration method. Plus, variations in components may cause S-meters in two receivers of the same make and model to perform differently.

The folks at the National Radio Co., for example, calibrate S-meters so that S9 indicates approximately 50 microvolts input signal to the receiver. This company told the author that, "strictly speaking, the decibel readings over S9 should be in a nonlinear scale, but ours are put into a linear scale for simplified reading and for averaging purposes."

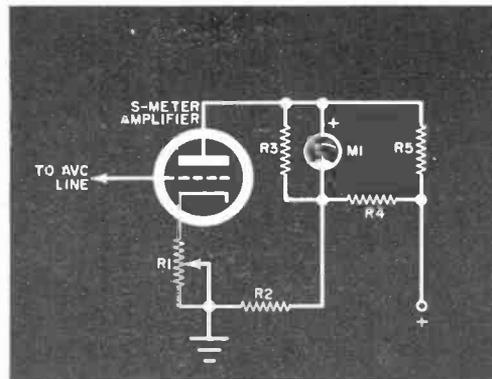
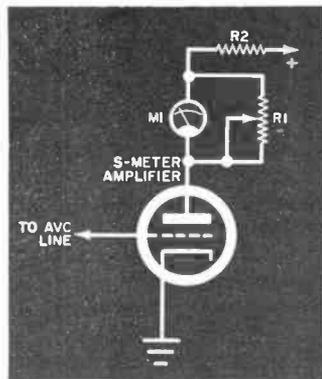
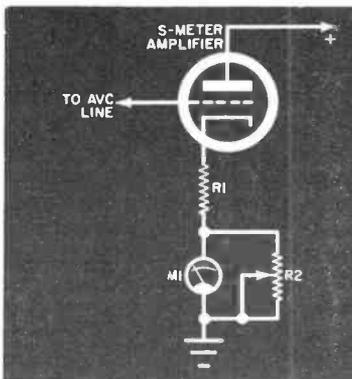
Swan Electronics Corp. says that its meters are calibrated to read S9 with an input signal strength of 100 microvolts at 50 ohms at 14 mc. The S-units are spaced at 6-decibel intervals. This company cautions that "production variations, particularly in tube characteristics,

will cause considerable change in these figures ..."

The R. L. Drake Co. uses a 50-microvolt input signal at the antenna terminals to determine the S9 point. Calibration is at 50 ohms impedance, but each S-unit equals 5 db!

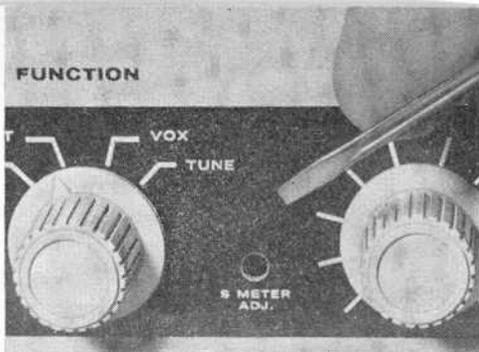
Hallicrafters also uses 50 microvolts at the antenna terminals of the receiver to set S9, and makes each S-unit equal approximately 6 db. Measurements are made at 50 ohms impedance at 5 mc. The company adds: "This approximation will have a variation of plus or minus 5 db on a new receiver, and, as the tubes age, the variations may be still greater."

The standard for S-meters at Collins Radio Co. is approximately 100 microvolts at 50 ohms through a 6 db pad for S9. This may vary, says the firm, from about 90 to about 115 microvolts, depending upon adjustments in the i.f. section of the receiver.



The only difference between these two S-meter circuits is the position of the meter. In both cases the meter reads backward—increasing signal strength means less current.

To make the meter read forward—increase in strength means more current—the meter circuit must be revised as shown here.



Hidden away on every communications receiver is the S-meter adjustment. If this adjustment is not properly set by the operator, the S-meter is always off.

the r.f. gain control. Change this setting and you change the meter indication.

How about the condition of the S-meter amplifier tube? When it gets weak, the meter indications are affected, even though overall receiver performance doesn't change. So don't overlook this tube whenever you check your receiver tubes.

How S-Meter Circuit Works. Generally, the S-meter is connected, through an amplifier tube, into the a.v.c. line. When a.v.c. voltage increases, as it will when a stronger signal comes into the receiver, the meter reads upscale.

Two typical S-meter circuits used in communications receivers are shown on p. 55. Essentially they are the same, except that one circuit has the S-meter, usually a 0-1 milliammeter, in the cathode circuit, while the other has the meter in the plate circuit.

The amount of current flowing through the S-meter amplifier tube, and hence through the meter itself, is determined by the a.v.c. voltage, which is applied to the tube's grid as well as to the r.f. and i.f. stages controlled by a.v.c. action. A strong signal produces a larger negative voltage on the a.v.c. line than a weak signal, and reduces the current flow through the S-meter amplifier tube. In this case the S-meter will read backwards—strong signals will be indicated on the left end of the scale and weak signals on the right end of the scale.

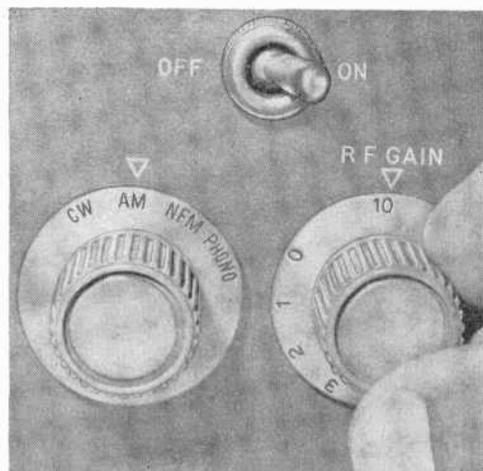
One way to make the meter indicate increasing signal strength as the meter needle deflects from left to right is to use a special meter built backwards from the conventional meters—one in which the needle rests normally on the right end of the scale, and moves to the left as current through the meter increases. Another way to achieve the same result is to use a conventional meter, but mount

(Continued on page 97)

Most S-meter readings are at the mercy of the r.f. gain control setting. In practically every communications receiver, the control must be full on.

More Woes. As if there aren't enough variables in the S-meter situation already, let's see what else can affect S-meter readings. How about the S-meter adjustment pot on your receiver—how long has it been since you checked to see if it was set properly? This potentiometer is adjusted to produce a zero reading on the S-meter scale under certain conditions—generally with the antenna terminal shorted to ground, or with the r.f. gain control set at minimum, or both. Check the manual for your receiver for the exact procedure. You may find that your S-meter has been off by several S-units, because of tube and component aging.

While you're looking in the manual, check to see what the manufacturer has to say about the setting of the r.f. gain control during receiver operation—this can have an effect on S-meter readings. Generally, the r.f. gain control must be in the maximum gain position for the S-meter to read according to the manufacturer's specs. With the r.f. gain reduced, a stronger input signal will be required to produce a given S-meter reading. However, even with the r.f. gain reduced, you still can use the S-meter for *relative* indications just as you would with full r.f. gain, as long as all readings are made with the *same* setting of



TEST OUT YOUR HI-FI AT HOME

*All the measurements
in the world
don't mean a thing
if your stereo hi-fi
doesn't sound right*

By HANS FANTEL



MAYBE YOUR stereo system is all it's cracked up to be. Or maybe it's coming apart at the seams. You can find out with a test record.

A test record tells you whether your stereo system can get all the music possible from your records. "It shows how your phonograph measures up against a fixed standard," says Emory Cook, a pioneer audio engineer who has produced more test records than anyone else in the business. "It's like putting test patterns on TV. It sets up a basis for comparison."

Until recently, most test records were forbiddingly technical. You had to be an engineer to interpret the results, and you needed a scope and a good VTVM. The chief purpose of these discs was to provide a lab standard. Cartridge designers used them to see how well their cartridges would track tricky groove patterns.

Lately, however, a new breed of test records has sprung up—not lab tools, but records designed for home use. Rather than testing cartridge performance alone,

the new test records provide a quick performance check for your *entire* stereo hi-fi system. And the only instruments you need are your ears.

Within the 30 minutes or so it takes to run through a test disc, you'll have a clear idea of the condition and quality of your sound system. You'll be able to rate it objectively as "good," "no good," or "so-so." Besides, these records are fine for spotting hidden trouble—the kind that creeps up on you slowly. Components age so gradually that you might not notice the piecemeal decay of quality. But a test record spotlights such sneaky shortcomings. Right away it tells you if everything still works "as good as new."

What Makes a Good Test Record. Different test records vary in the number and type of test included. But look for the following basic features: (1) phasing, (2) balance, (3) frequency response, (4) stereo separation, and (5) cartridge tracking. They're "musts" for any stringent system check.

In one form or another, test records designed for home use cover most of these items. Some even add additional features, such as tests for turntable rumble, flutter, and wow. But two among the recent crop of test records are particularly outstanding. One is the CBS Laboratories Record STR-101, titled "Seven Steps to Better Listening," priced at \$5.00. The other is a special disc produced by HiFi/Stereo Review magazine, selling for \$4.98. You can order these records directly from their manufacturers. For the Columbia disc, write to CBS Laboratories, 227 High Ridge Road, Stamford, Conn. 06905. The HiFi/Stereo Review Test Record is obtainable from Ziff-Davis Publishing Company, 1 Park Ave., New York, N.Y. 10016.

These two discs stand out on two counts. First, they present the test material in a way that makes it especially useful for home testing without instruments. Second, both records introduce new techniques to improve the accuracy of these tests.

Other entries in the field are undoubtedly quite useful, if not as versatile and accomplished as the Columbia and Hi-Fi Stereo Review releases. Westminster's "Testing Testing Testing," for example, "lacks a narrator to identify and explain the various test bands. Vanguard's Stereolab Test Record provides the most elaborate frequency test of all, but leans rather heavily on the engineering side. Though it can be used strictly as a listening test, it is mainly intended for calibrating frequency response with a meter. The same holds true of Command's "Stereo Checkout" (CSC-100), but this record provides test tones only to 10,000 cycles (while others go as high as 15,000 cycles) and is tagged at \$5.98.

You can also get a 7-inch, 45-rpm test record specifically designed to help you adjust the mid-range and tweeter-level controls on many speaker systems. In addition, the record lets you balance your speakers and compensate for room resonances. Being limited to these functions, this disc is less versatile than most other test records, but it does serve a special purpose. The instructions on the jacket are clear and simple. You can order this \$1.25 record from KSC Systems, Inc., P.O. Box 303, Knicker-

Most audio experts agree that the CBS Laboratories STR-101 test record is just about tops for checking the performance of a mono or stereo hi-fi. This record can be obtained via mail order or purchased in some of the larger record stores or hi-fi equipment salons.



There are nine different tests on the HiFi/Stereo Review test record.

The flip side of the record has several bands of heavily instrumented brass and percussive music. This record is also available via mail order or in some of the larger record stores.



Westminster's SRX test record has two unusual features. Besides the usual level and phase setting bands, there is a set of test tones recorded according to the intensities dictated by the Fletcher-Munson curve. The flip side has a variety of sound effects.



Both sides of the Vanguard VSD-100 test record are identical and, with proper care, this record should last a lifetime. While the ear can be used to evaluate your system with this record, a more precise method would be to use an a.c. VTVM output meter.



The melodious voice of sometime TV announcer Charles Stark narrates the test bands on this Command CSC-100 test record. Graph paper is supplied with each test record so the user can plot the frequency response characteristics of his own hi-fi setup.



bocker Station, New York, N.Y. 10002. Just one caution: because of the particular test tones chosen, this record won't work if the crossover frequencies of your speaker systems just happen to be at 100, 1500 or 7000 cycles.

Phasing and Balance. These are good tests to start with. Because if your system is unbalanced or out of phase, it will also throw off your judgment on the later tests. Besides, any audio technician will tell you that half the complaints about "poor stereo" are quickly cured by adjusting balance and phasing.

At the onset, most records provide channel identification. The announcer says: "This is the left channel." If you hear him saying it from the right speaker, you know it's the *wrong* speaker. In that case, reverse channels.

Now you're ready for speaker phasing. This is to make sure that your two speakers are pushing or pulling at the same time. Most records contain a band with deliberately out-of-phase test tones in left and right channels. These tones alternate with test tones properly in phase. If the out-of-phase recording sounds stronger and richer than the in-phase recording, you know that your speakers are out of step. You can often remedy this condition simply by throwing the "phase reverse" switch on your amplifier. Of if your amplifier has no such switch, just reverse the wires at the rear of *one of your speakers*.

Next in the test sequence, you check balance. Most test records present identical tones in both channels. You stand or sit midway between the speakers and have someone adjust the balance control until both speakers sound exactly equal in volume. At that point, the test tone will appear to come from an imaginary sound source midway between speakers.

This type of balance test—a key feature of most test records—works only if you have matched speakers. If, for example, one of your speakers puts out more highs than the other, it will sound closer and louder, even though its base and midrange are perfectly balanced to the other channel. Sometimes you can even things out between unmatched speakers by fiddling with the tone controls. With a bass-shy speaker on one

(Continued on page 88)

FOR PROFESSIONAL TESTING

If you want to supplement your ear tests with instrument readings of frequency response, you will need an output meter with a scale calibrated in decibels. A simple VOM suffices to measure output across the speaker terminals—one channel at a time. But if you want to test your cartridge alone—without your amplifier—you need an a.c. VTVM to provide the signal amplification necessary for a clear reading. And as a signal source, you need one of the more technical test records.

The basic procedure is simple. Most test records begin frequency runs with a so-called reference tone. You adjust the gain of your amplifier (or VTVM) so that the meter reads 0 db for the reference tone. Ideally, the meter should remain at or very near 0 for all other test tones. This means that you have "flat" frequency response. Most likely you don't. But by plotting on a chart just how many decibels the meter rises or falls at various frequencies, you can plot the frequency response curve of your equipment.

Among the many test records available for this type of checkout, Vanguard's Stereolib Test Record (VSD-100, \$2.98) offers a frequency run from 30 to 15,000 cycles, in addition to tests for channel balance, phasing, flutter, noise, and distortion. Columbia's excellent "Stereophonic Frequency Test Record" (STR-100, \$8.50) runs through 30 spot frequencies between 20 and 20,000 cycles, which are suitable either for ear-testing or for calibrating your system with an output meter. This disc also offers sweep frequency tests (for detecting rattles and resonances), channel separation tests, phasing, and cartridge compliance and tracking tests.

An unusually elaborate test record is Folkways' "Sounds of Frequency" (FPX6100, \$5.79), a mono disc with frequency runs for both 78 and 33½ rpm in small intervals all the way from 15.6 to 22,500 cycles. It is the only record in this group with square-wave tests to measure the ability of your cartridge and amplifier to respond quickly to extremely sharp, percussive sounds, and it also contains a test band for intermodulation distortion. However, to interpret these last two items, you need an oscilloscope to show the waveforms generated, and an IM distortion meter.

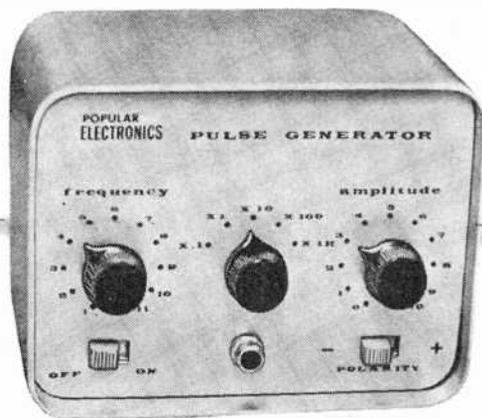
A specialized group of professional-type test records is issued by Cook Laboratories, Inc., of Stamford, Conn. One of these discs is the Series 60 Chromatic Scale Record. Unlike other test records, it doesn't contain test tones at round-number frequencies (e.g., 30, 100, 400 cycles, etc.). Instead it has the regular musical scale from a low C of 32.7 cycles to a high C at 6372 cycles. Cook's Stereo Crosstalk and Interaction Test Record (Series 301) is devoted entirely to testing stereo separation and channel interference at various frequencies throughout the range, and for those with an IM distortion meter, Cook offers a special Intermodulation Distortion Test Record.

For a general stereo checkout, Cook's Series 302 record contains the usual frequency run, balance, and crosstalk tests. For special types of frequency checks, Cook's Series 12 has two different types of frequency runs: one equalized according to the standard RIAA curve, the other recorded "flat" without equalization. All discs in the Cook series are priced at \$4.98.

Though most of these records are intended for professional engineers, advanced audio amateurs—especially those designing their own equipment—may find them helpful.

ADVANCED EXPERIMENTER PROJECT

PULSE GENERATOR



*Variable amplitude and frequency trigger
for counting, testing, and experimenting*

By **DON LANCASTER**

A GOOD commercial pulse generator can sport a \$200-and-up price tag. Here is a versatile unit you can build for less than \$15 . . . or as little as \$2.00. If your workshop is well-stocked, chances are you will only need to buy one \$2 part. The circuit is simple, foolproof, and easily built in one or two evenings.

The Pulser produces a free-running series of sharp trigger pulses, variable from 0 to 10 volts in amplitude and with a variable repetition rate of from one pulse every ten seconds to 11,000 pulses per second. It has five overlapping scales and a choice of pulse polarity. It is battery-operated and draws less than 0.0005 ampere, and it puts out almost 8 watts of peak pulse power.

To boot, the Pulser has a low-output impedance and is short-circuit-proof. You can run it all day into a dead short. The rise-time is quite snappy—only 50 nanoseconds. Pulse width varies from scale to scale, but always stays at roughly $\frac{1}{1000}$ of the repetition time.

Applications. An important experimental use for the Pulser is as a trigger source for multivibrators and counter circuits. If you have a scope, here is a

convenient pulse source for resonance demonstrations, time constant experiments, and "Q" measurements. It is dandy for testing radio control modules and escapements, and doubles as a trigger source for experimental transistor and SCR power inverter circuitry.

The lower repetition rates are tops for timing displays, exhibits and flashers. For example, you can use the Pulser to trigger an SCR lamp controller. Set the Pulser to 58 cycles and the bulb will smoothly oscillate at a 4-cycle rate. Place a photocell and amplifier in front of the light, and you'll wind up with an ultra-low-frequency audio oscillator.

The Pulser easily drives a speaker and produces a series of "pock-pock-pock" sounds to enable you to check out speakers and output transformers. You can also use it as a signal injector for all sorts of audio testing and troubleshooting. And, finally, you can use the "pocks" themselves; the unit will serve as a metronome or as a darkroom timer.

How It Works. It's all made possible by a new semiconductor which sells for \$2 . . . a *four-layer diode*. Unlike ordinary diodes, the four-layer diode is a

voltage-sensitive switch. It is normally off, leakage current is negligible, and it snaps on when it "sees" 12 volts. It stays on as long as there is significant current (more than 1 ma.) left in the circuit. In the on state, the impedance is so low that you must limit the current externally; otherwise the diode will destroy itself. Just like a true diode, the four-layer diode operates only in the forward direction.

Add two resistors, a capacitor, and a battery to the diode, and you have a pulse generator, as shown in the simplified circuit of Fig. 1. Capacitor C takes on a charge from B1 through R1. When the charge reaches 12 volts, the diode snaps on, producing a sharp spike across current limiting resistor R3. This spike is the output pulse and is almost 10 volts high; its width is $R3 \times C$.

As the capacitor discharges (very rapidly, since R3 is much smaller than R1), less and less current flows through the diode, and it finally turns off when the capacitor voltage drops close to zero.

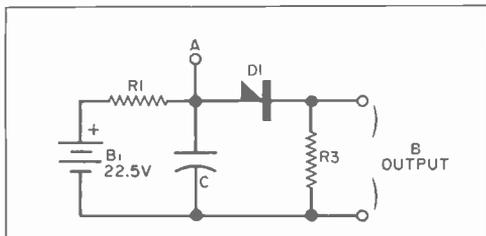


Fig. 1. Four-layer diode conducts when the capacitor charges up to about 12 volts, and stays "on" as long as there is more than 1 ma. of current flow.

As battery current through R1 in this circuit is held to about 0.5 ma., it cannot hold the diode on; the capacitor recharges, and repeats the cycle.

One output pulse is produced for each charge and discharge cycle. The waveforms in Fig. 2 show the exponential charge-discharge waveform at point A in the simplified circuit, the sharp output pulse at point B, and their relationship to the on-off time of the diode.

Figure 3 shows the entire circuit of the Pulser. You can change the frequency by varying R2 or by switching in different capacitors. Potentiometer R2 provides a continuously variable frequency range, on the order of 11 to 1. Each of the five capacitors is ten times

PARTS LIST

(Diagram on page 62)

- B1—22½-volt battery
- C1—30-µf., 15-volt electrolytic capacitor
- C2—3-µf., 15-volt electrolytic capacitor
- C3—0.3-µf., 200-volt Mylar capacitor
- C4—0.03-µf., 200-volt Mylar capacitor
- C5—0.003-µf. mica capacitor
- D1—Four-layer diode (Motorola M4L3054)
- J1—Phono jack
- R1—47,000-ohm, ½-watt resistor
- R2—500,000-ohm, 2-watt potentiometer (linear taper)
- R3—250-ohm, 2-watt potentiometer (linear taper)
- R4—3.3-ohm, ½-watt resistor
- S1—S.p.s.t. slide switch
- S2—Single-pole, five-position wafer switch (Mallory 3215J or equivalent)
- S3—D.p.d.t. slide switch
- 1—3" x 4" x 5" case, approx. (Zero Z58-78-52 or Bud CU-2105A or equivalent)
- 1—4" x 5" dialplate (an anodized hard aluminum Metalphoto dialplate with POPULAR ELECTRONICS on it is available from Reill's Photo Finishing, 4627 North 11th St., Phoenix, Ariz. 85014; in silver color for \$3.50, or in blue, red, or copper for \$4, postpaid in U.S.A.)
- Misc.—Battery holder; 10 nylon countersunk washers (4); nuts and bolts; knobs (3); wire; solder; etc.

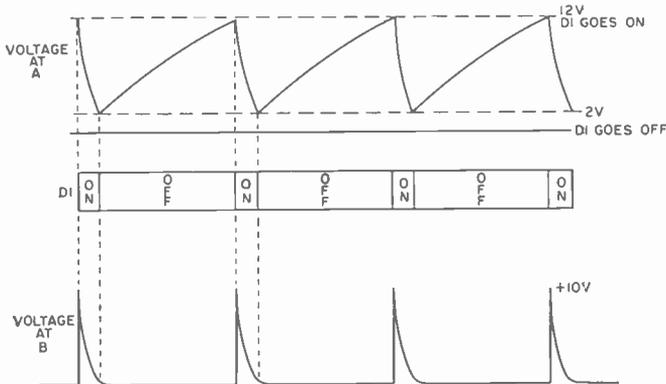


Fig. 2. Typical capacitor charge-discharge waveform is present at point "A" in Fig. 1. At output "B," the rise time is so fast that you'll need a fairly good scope to see it. When the diode is "off," the capacitor has a chance to build up a charge until it is large enough to trigger the diode into conduction. Current flow through the diode is relatively so very large that the capacitor discharges and cannot take on a new charge until the diode stops conducting.

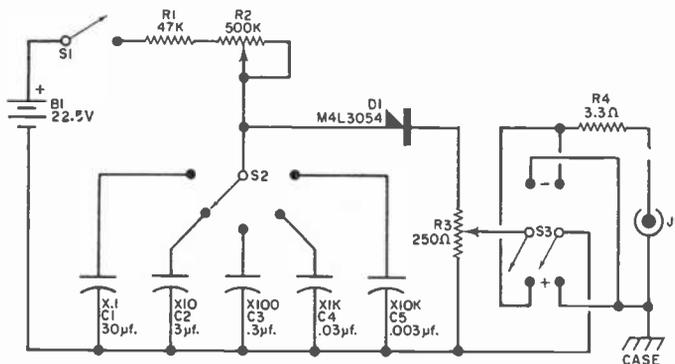
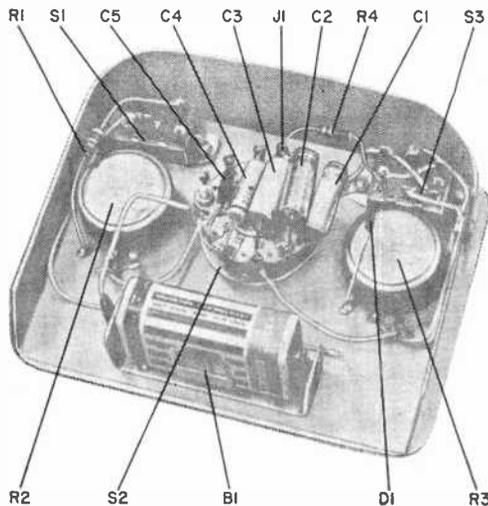


Fig. 3. Frequency depends upon battery voltage and amount of resistance and capacitance in the circuit. Combination of R1 and R2 provides an 11 to 1 spread within each of five decade ranges. Pulse repetition rate can be varied from 1 every 10 seconds to 11,000 each second.

its neighbor, and they provide five frequency ranges in decade steps from x 0.1 to x 10,000.

In spite of its simplicity, this RC configuration makes it possible to select any frequency within the Pulser's range. Potentiometer R3 varies the output pulse amplitude; it works like a volume control. Switch S3 performs the simple task of reversing output pulse polarity. And to make the whole thing short-circuit-proof, R4 limits current drain to a safe value.

Construction. You can build the Pulser in a plain-Jane fashion in a 3" x 4" x 5" Minibox, or assemble the unit in a deep drawn aluminum case, as shown in the photos. Any chassis will do; the one shown here was made from a piece of 5" x 7" x 1/8" soft aluminum.



Only electrical connection to the chassis is at J1. The unused side of S2 conveniently serves as a terminal strip for the negative capacitor leads.

The switches, battery bracket, and chassis sides are "pop"-riveted in place, but you can use 6-32 x 1/4" machine screws and nuts if you wish. If you can't find an exact holder for the 22½-volt battery, you can modify an ordinary penlight-cell holder (Keystone 139) by extending the contacts with solder lugs. (Note: no part of the circuit, including even one side of the battery, comes in contact with the case, except for outer portion of J1.)

The dialplate is drilled to match the openings in the chassis for the controls and output jack; the nuts on J1, R2, R3 and S2 hold the plate in place. Four feet for the bottom of the case can be made from four #10 nylon countersunk washers and four #6 panhead sheet metal screws. The screws through the front two feet also go through the chassis, and hold it in place.

Wiring is a cinch. All unused terminals on S2 are tied together and used to secure the negative ends of the capacitors.

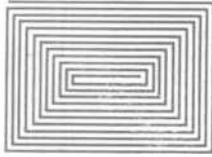
Modifications. Any reasonable value can be employed for any of the parts, but the battery supply should be 22½ volts or more. Use linear pots; avoid ordinary volume controls. Audio controls with their log tapers will give you a nonlinear scale.

Larger tantalum capacitors can be used to extend the range on the low end. The high end is limited by D1 and cannot be increased.

The scales are only accurate to ± 15 percent, and will vary with battery voltage and the exact values of capacitors used. If you need greater accuracy, go to a line-operated, zener-regulated supply and pick your capacitors.

ELECTROMAZE PUZZLE

By
**ROBERT C.
RADFORD**



Here's a new kind of crossword puzzle designed to test your knowledge of electronic terminology. Refer to the clues given and fill in the word called for by the first clue. Start at the arrow. Thereafter, fill in each new word called for by the following clues perpendicular to each preceding word. The last letter in each preceding word will be common to the first or last letter of each new word, and all words will read vertically downward or from left to right. The tenth word will have a letter in common with the word at the first exit. Nine more correct entries will take you to the word at the second exit, which will also share a letter with the last of these nine words. In each case, the first or last letter of the exit word will be the first or last letter of the next word. An additional nine correct entries will put you at the final exit for a perfect score. The Editors invite your comments on this type of puzzle.

Solution appears on page 107

CLUES:

- 1 Test equipment used for measurements and waveform display on a fluorescent screen.
- 2 Synonym for electrical power.
- 3 Device that converts chemical energy into electrical energy.
- 4 A bar or heavy uninsulated wire used as a common connecting point.
- 5 Support on which electron tubes are mounted.
- 6 Abbreviation for type of receiver predating the superhet.
- 7 Device used for circuit protection.
- 8 Reciprocal of impedance.
- 9 To tune circuits for resonance at a given frequency.
- 10 An uncharged electrical particle present in all atomic nuclei except in hydrogen nucleus.
Exit 1. Inert gas producing a bright glow when ionized.
- 11 To coat the tip of an iron with a thin layer of solder.
- 12 Call' wout on a closed ring.
- 13 Point at which an effect is first produced, observable, or otherwise indicated.
- 14 Slang for the positive side of an energized circuit.
- 15 A chart showing the interrelation between two or more variable quantities.
- 16 The mating connector of a jack or receptacle.
- 17 Abbreviation for the unit of current measurement.
- 18 Spherical aberration in a lens or mirror resulting in a blurred image.
- 19 Colored or transparent insulating mineral that readily separates into very thin leaves.
Exit 2. Frequency-dispersal radar.
- 20 Abbreviation for a radar system that provides precision approach information for aircraft landing.
- 21 The constant monitoring of a specific radio frequency.
- 22 Retarding effect of a circuit
- 23 Unit of inductance spelled backwards.
- 24 Section of an electronic network.
- 25 The current gain of a transistor amplifier.
- 26 Abbreviation for modulation used in broadcast-band radio.
- 27 In a radio receiver, the stage immediately preceding the first i.f.
- 28 An angle included within an arc equal to the radius of a circle (approximately 57.3 degrees).

HELP on the Open Road

or

Have Every Licensee Policed

By W. STEELE

CB IS CONTINUING on its meteoric course, and if the road signs are correct, CB tranceivers will soon be stock equipment on all cars. Your license plate may not only serve to register your car, but also to list your channel number.

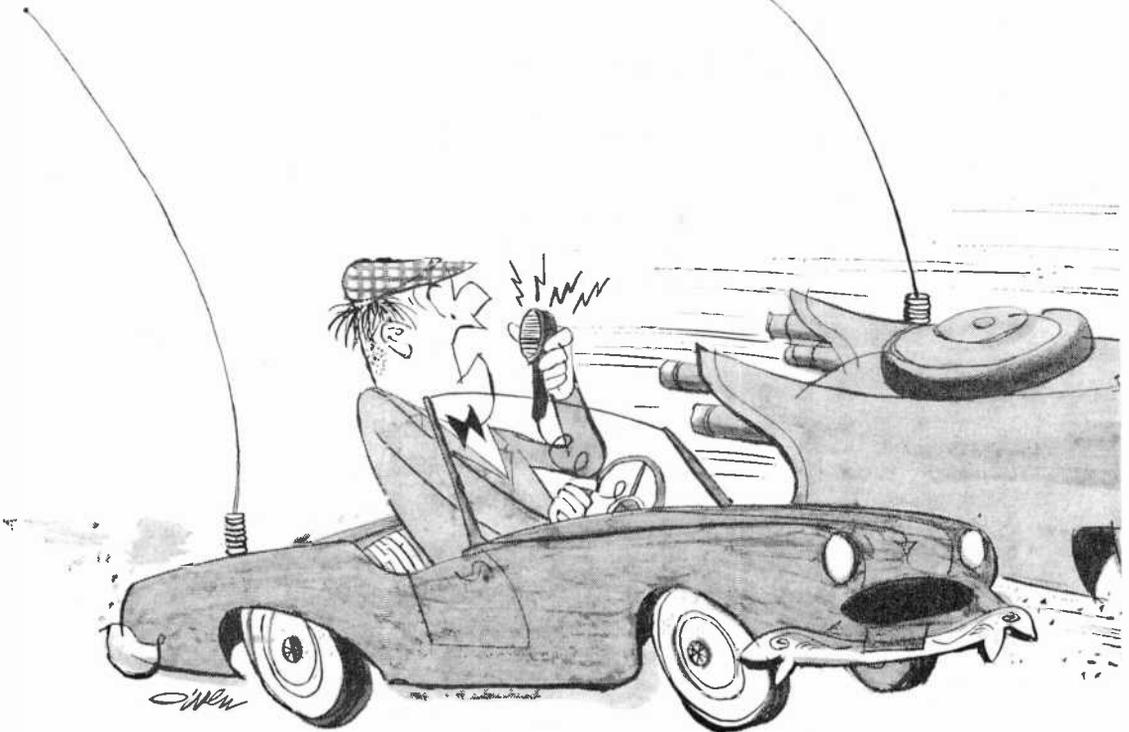
When this time comes—not too soon, we hope—drivers will be able to shun the fist-waving, nose-thumbing, and swearing that is currently the vogue in inter-car-munications. CB will give every driver a voice, and added to the woes of traffic tickets will be FCC citations for mis-use of your CB rig.

As a matter of fact, those hand signals that we use—or are supposed to use—will be replaced by polite phrases, such as, "Sorry I cut you off, old chap-

pie!" Or, "My, what a shame—weren't you aware that the light had turned red?" Or, "Pay no attention to that oncoming truck—you have every right to your share of the roadway."

We can soon expect that pedestrians will equip themselves with walkie-talkies—making it that much easier for a driver to clearly announce, "Get out of the way, stoopid!" But then, someday a genius in Detroit will invent a little button that can be conveniently mounted on the steering wheel of your car. It'll make a loud raucous noise, and you won't have to turn on the CB rig, or even say a word.

-30-



BUILD THE TRANSISTORIZED AUTO-LIGHT MINDER



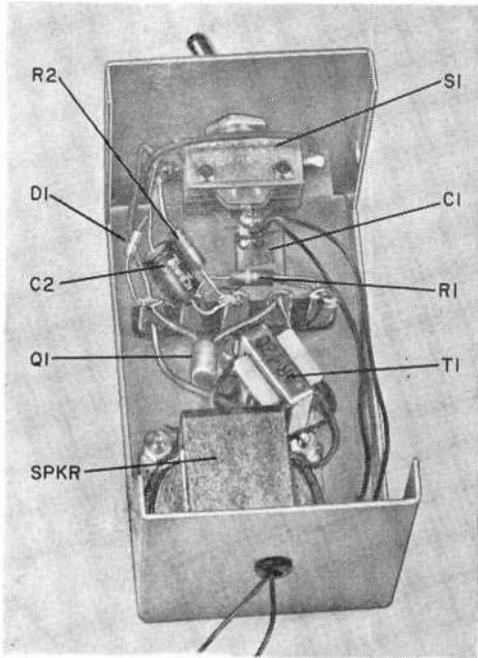
*Dual-mode light sentry
ends
dead battery ills
from
forgotten lights*

By ROBERT G. PERSING
RCA Laboratories
David Sarnoff Research Center

HAVE YOU EVER left your car in a parking lot and returned several hours later to find that you forgot to turn your lights off and that your battery has run down? Join the club. This kind of negligence seems to be most prevalent on rainy, overcast days or at dusk when many people have their lights on. For only \$7, and a few hours of your time, you can build the "Auto-Light Minder" and eliminate the problem forever.

When you install the Auto-Light Minder in your car, it will sound an alarm if you leave your lights on after you turn off the ignition. Turn the lights off, and the alarm will stop. It's that simple. And there is a circuit for every car, whether it has a 6- or 12-volt positive or negative ground system.

The Auto-Light Minder also has a reverse mode of operation, which lets you intentionally leave your lights on when the ignition switch is off . . . without sounding the alarm. But when you turn on the ignition switch, the alarm sounds off to remind you that you are trying to start your car at the same time your lights are on, and also to alert you to the fact that the alarm is not set to work in a forward mode. The Auto-Light Minder is foolproof, and it never "forgets."



Simplicity of construction and small number of components enable you to quickly assemble the light minder and to end forgetting to turn the lights off.

PARTS LIST

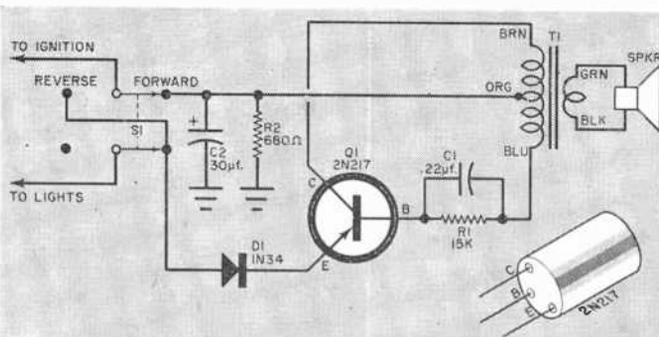
- C1—0.22- μ f., 25-volt (minimum) electrolytic capacitor
- C2—30- μ f., 15-volt (minimum) electrolytic capacitor
- D1—1N34 diode
- R1—15,000-ohm, $\frac{1}{2}$ -watt resistor
- R2—680-ohm, $\frac{1}{2}$ -watt resistor
- Q1—2N217 transistor (for positive ground electrical systems, use a 2N647—see text)
- S1—D.p.d.t. switch
- T1—Output transformer: 400-ohm, center-tapped primary; 11-ohm secondary
- 1— $1\frac{1}{2}$ " 11-ohm speaker
- 1— $2\frac{1}{4}$ " x $2\frac{1}{4}$ " x 4" box (Premier PMC 1003 or equivalent)
- Misc.—Terminal strip, grommet, machine screws and nuts, wire, etc.

How It Works. The Auto-Light Minder is essentially a one-transistor oscillator circuit that works when battery voltage is applied only to the emitter of *Q1*. Battery voltage is fed to the unit from two possible places in the car: the ignition system and the light system. Sometimes this voltage comes from either one of these places and sometimes it comes from both places.

In the forward mode of operation, battery voltage from the ignition system is connected to the collector, and battery voltage from the light system is connected to the emitter; if the ignition switch is on, and the lights are on, both the collector and the emitter of *Q1* are at the same potential. Under these conditions, the circuit will not oscillate, and the alarm will not sound. If the ignition is turned off, and the lights are left on, the collector is returned to ground through part of *T1*, *R2* and *C2*, and develops the bias voltage necessary for the circuit to oscillate. If you turn the lights off, the supply voltage is removed from the emitter and the circuit ceases to oscillate. Diode *D1* protects the transistor against a reverse battery voltage.

In the reverse mode of operation—you merely flip *S1* to obtain either the forward or the reverse mode—the voltage from the light system is completely disconnected from the Auto-Light Minder, and the lights can be turned on without triggering the alarm. However, when the ignition is turned on, it will place the necessary voltage on the emitter of *Q1* and cause the alarm to sound. To shut off the alarm, throw *S1* into the forward position and you won't be bothered again unless you shut off your engine and leave your lights on.

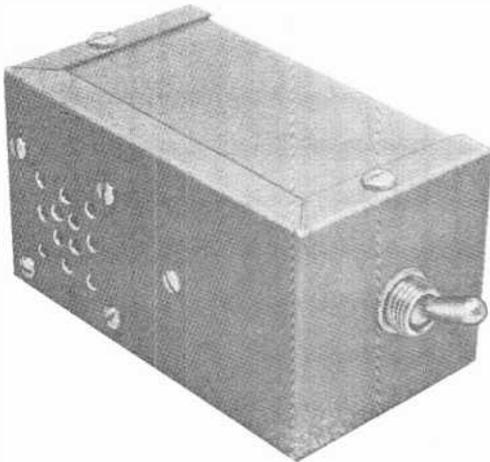
The negative ground Auto-Light Mind-



One-transistor oscillator "sounds off" when the full-battery voltage is applied to the emitter only. In the "Forward" position of *S1*, the alarm will sound if the lights are on and the ignition switch is off. In the "Reverse" position, the lights can be left on without sounding the alarm only if the ignition switch is off. Just as you are not likely to forget to turn off your lights with this device, you are not likely to have difficulty starting your car because you are trying to do so with the lights on.

er shown is easily adapted to a positive ground system, with only three minor—but very important—differences in the wiring: (1) a 2N647 *npn* transistor is used for *Q1*; (2) the positive side of electrolytic capacitor *C2* is connected to the ground lug of the terminal strip; and (3) the anode of diode *D1* is connected to the emitter of *Q1*, and the cathode goes to *S1*. The instrument can be operated in either 6- or 12-volt systems without any circuit changes.

Construction. All components are mounted in a small metal box. Begin construction by drilling holes to mount the tiny speaker, switch, terminal strip, and grommet. The approximate location of the components is shown in the photograph. Drill several small holes for the



Completed unit should be located within easy reach of the driver. Only two wires connect the alarm to the lights and ignition system. Ground the case.

speaker grille and insert a piece of grille cloth or wire mesh between the speaker and the box to prevent possible damage to the speaker.

One side of the transformer can be held in place with one of the speaker mounting screws, and the other side with the same screw that is used to mount the terminal strip. All the small components are connected either to the terminal strip or to the switch. Be sure to use a heat sink when soldering the diode and transistor leads.

The wires going from *S1* to the ignition switch and to the light switch should be well insulated and flexible to withstand vibration. These leads should be sufficiently long to avoid strain and should be marked to insure correct connections to the ignition and light systems.

Installation. A location near the driver's seat is desirable in order to keep *S1* within easy reach. Do not block the speaker opening. In most cases, under the dash near the steering column is the best place for the unit. A couple of self-tap screws will hold the box in place. Before drilling holes in the dash for the screws, make sure that your drill or screws will not damage any wires or instruments behind the dash.

The lead to the ignition system should be connected to the ignition switch terminal which is connected to the ignition coil. If you have difficulty in getting to the ignition switch, you can make this connection at the ignition coil; but be sure to make it on the top side of the primary winding of the coil, and not the side going to the distributor.

Connection to the light system should be made at the light switch terminal which is connected to the taillights. Since the taillights go on when the parking or driving lights are on, the "Auto-Light Minder" will work on the high and low beams, and when the parking lights are on.

Be careful not to create a short circuit while you are installing the unit. Disconnect one side of the battery to be on the safe side. An accidental short with a screwdriver or wrench will cause sparks to fly and possibly destroy or fuse the points of contact.

To check for correct operation, set *S1* in the forward position with the ignition switch off, and turn on the lights. The alarm should sound. Turn on the ignition switch, and the alarm will stop (it should not be necessary to start the car). Now flip *S1* to the reverse position, and the alarm should sound. Turn the ignition off (*S1* still in the reverse position and the lights still on), and the alarm will stop. Return *S1* to its forward position, turn your lights off, and then forget about forgetting to turn off your lights.

-30-

ENGLISH-LANGUAGE BROADCASTS TO NORTH AMERICA

Prepared by **ROBERT LEGGE**

TO EASTERN AND CENTRAL NORTH AMERICA			
TIME—EST	TIME—GMT	STATION AND LOCATION	FREQUENCIES (MC.)
MORNING BROADCASTS			
7-7:30 a.m.	1200-1230	Stockholm, Sweden	15.195
7:15-7:45 a.m. (Tues., Sat.)	1215-1245 (Tues., Sat.)	Helsinki, Finland	15.185
7:15-8:15 a.m.	1215-1315	Melbourne, Australia	9.59
7:15-8:15 a.m.	1215-1315	Montreal, Canada	5.97, 15.32
7:30-8 a.m.	1230-1300	Copenhagen, Denmark	15.165
9-10 a.m. (Sun.)	1400-1500 (Sun.)	Prague, Czechoslovakia	15.285, 17.825
EVENING BROADCASTS			
5-9:45 p.m.	2200-0245	London, England	6.195, 7.13, 9.51
5 p.m.-1 a.m. (First half hour of each hour)	2200-0600	Moscow, U.S.S.R.	7.15, 9.685
7-7:30 p.m.	0000-0030	Tirana, Albania	7.265
7-8 p.m.	0000-0100	Sofia, Bulgaria	6.07
7-8 p.m.	0000-0100	Tokyo, Japan	15.135, 17.755
7:30-8 p.m.	0030-0100	Budapest, Hungary	6.235, 9.833
7:30-8 p.m. (Mon., Thurs.)	0030-0100 (Tues., Fri.)	Kiev, U.S.S.R.	7.12, 9.685
7:50-8:10 p.m.	0050-0110	Vatican City, Vatican	5.985, 7.25, 9.645
8-8:20 p.m.	0100-0120	Rome, Italy	7.12, 9.685
8-9 p.m.	0100-0200	Berlin, Germany	5.97, 9.56
8-9 p.m.	0100-0200	Prague, Czechoslovakia	5.93, 7.345, 9.795
8-10:45 p.m.	0100-0345	Madrid, Spain	6.13, 9.76
8-11 p.m.	0100-0400	Havana, Cuba	6.17
8:15-8:45 p.m.	0115-0145	Amman, Jordan	9.557
8:15-9:15 p.m.	0115-0215	Berne, Switzerland	6.12, 9.535
8:30-9 p.m.	0130-0200	Beirut, Lebanon	9.575
8:30-9:20 p.m.	0130-0220	Hilversum, Holland (relayed by Bonaire)	9.59
8:30-9:30 p.m.	0130-0230	Bucharest, Rumania	9.57, 11.935
8:30-9:30 p.m.	0130-0230	Budapest, Hungary	6.235, 9.833
8:30-9:50 p.m.	0130-0250	Cologne, Germany	6.075, 9.64
8:45-9:15 p.m.	0145-0215	Stockholm, Sweden	9.705
9-9:30 p.m.	0200-0230	Copenhagen, Denmark	9.52
9-9:45 p.m.	0200-0245	Lisbon, Portugal	6.025, 9.74
9-11:30 p.m.	0200-0430	Quito, Ecuador	9.745, 11.915, 15.115
TO WESTERN NORTH AMERICA			
TIME	TIME—GMT	STATION AND LOCATION	FREQUENCIES (MC.)
6-7:45 p.m.	0200-0345	Melbourne, Australia	15.22, 17.84
6:50-7:50 p.m.	0250-0350	Taipei, Taiwan, China	11.825, 15.345, 17.725
7-7:30 p.m.	0300-0330	Seoul, Korea	11.925
7-8 p.m. (Mon.-Fri.)	0300-0400 (Tues.-Sat.)	Buenos Aires, Argentina	9.69
7-8 p.m.	0300-0400	Tokyo, Japan	11.78, 15.135
7-9 p.m.	0300-0500	Peking, China	9.457, 11.945
7-10:30 p.m.	0300-0730	Moscow, U.S.S.R. (via Khabarovsk)	7.255, 9.64, 11.755
7:30-8:30 p.m.	0330-0430	Accra, Ghana	6.11
8:15-9:15 p.m.	0415-0515	Berne, Switzerland	6.12, 9.535
9-9:40 p.m.	0500-0540	Cologne, Germany	6.145, 9.735
9-10 p.m.	0500-0600	Havana, Cuba	6.135



SHORT-WAVE LISTENING

By **HANK BENNETT**, W2PNA/WPE2FT
Short-Wave Editor

THE MYSTERY OF "THE BLUE EAGLE"

IN RECENT MONTHS we have received many reports from monitors on a station announcing as *The Voice of the Blue Eagle*. By and large, most of the reports came from areas in the eastern portion of the United States, with a scattered few from as far away as the Canadian Maritimes. Frequencies listed have ranged from 19,100 kc. to 535 kc.

Several monitors tried to obtain information on this station from various FCC offices only to be informed that (1) it is a pirate station of which the FCC is aware, or (2) no information is available, or (3) it is a government operation.

It was thought by some that the station was shipboard in East Coast Atlantic waters. However, a recent item in the short-wave column of the North American Short-wave Association stated in part, "... it is not shipboard but, rather, located eastcoast-mainland . . . it seems to have definite

government ties . . ." Yet, an overseas publication said flatly, "It's a pirate station." And so it goes.

How can the mystery be solved? Well, let's try to make an educated guess.

We have received the following information from a reporter in Virginia: "Two Super Constellation planes are being equipped by the U. S. Navy to provide television service in Vietnam. One station on Channel 9 would provide programs for U. S. servicemen; another station on Channel 11 would beam programs of the South Vietnamese government. Broadcasting is [or was] scheduled to begin in early 1966. Transmitters will also be established to operate on AM, FM, and the short waves. The planes contain receivers for relaying ground transmissions from the *Voice of America* and other sources. Frequencies for short-wave transmissions are not yet known, but 1000

(Continued on page 108)



You don't have to wait for the official ARRL Field Day in June to operate Field Day style. Last October three SWL's set up a station in Wilmington, Del. An antenna was erected, and a Lafayette HE-40 and a Globe receiver installed in their tent, with a Zenith "Trans-Oceanic" in reserve. The generators were located behind the equipment, outside of the tent. At the end of the one-night stand, the three operators had 50 countries logged, of which 30 subsequently verified. The operators were (l. to r., below): Glen Crawford (with Popular Electronics), Pat Lennon, and Chet Kedzierski.

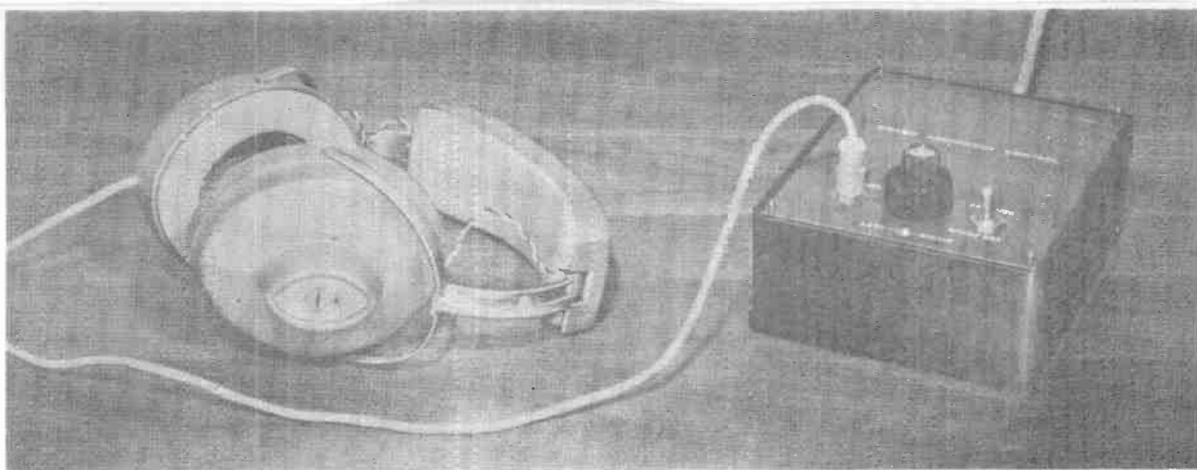


BROADCASTS FROM CENTRAL AND SOUTH AMERICA

Prepared by **BILL LEGGE** and **BOB HILL**

Most of the countries of Central America, South America, and the West Indies do not operate international broadcasting stations. Nearly all of the short-wave broadcasts in these countries are intended for reception within a country. These stations therefore operate with relatively low power, generally use nondirectional antennas, and transmit in the language of the country. They are becoming increasingly difficult to pick up in North America due to interference from high power international broadcasting stations operating in other areas of the world, but it is possible for a persistent listener to hear stations in most of these countries by knowing where and when to tune. The following listing gives the best times and frequencies.

COUNTRY	STATIONS & CITY	TIME—GMT	FREQUENCIES (MC.)	LANGUAGES
ARGENTINA	R.A.E., Buenos Aires	2300-0000	9.69	English
BOLIVIA	R. Altiplano, La Paz	0200-0600	5.045	Spanish
BRAZIL	R. Tupi, Sao Paulo	2200-0300	11.77	Portuguese
	R. Bandeirantes, Sao Paulo	2200-0300	11.925	"
	R. Tupi, Rio de Janeiro	2000-0400	15.37	"
BRITISH GUIANA	R. Demerara, Georgetown	0000-0215	3.265	English
BRITISH HONDURAS	R. Belize, Belize	0100-0400	3.30	English
CHILE	R. Balmadeca, Santiago	0000-0500	9.60	Spanish
	R. Cooperativa, Santiago	0000-0430	9.70	"
	R. Minería, Santiago	2300-0400	11.96	"
COLOMBIA	R. Nacional, Bogota	0000-0500	4.955	Spanish
	R. Santa Fe, Bogota	0000-1000	4.965	"
	R. Sutatenza, Sutatenza	2300-0315	5.075, 5.095	"
COSTA RICA	R. Reloj, San Jose	0000-0600	6.21	Spanish
	TIFC, Faro del Caribe, San Jose	1115-1400	9.645	"
CUBA	R. Havana Cuba, Havana	1800-1900	15.34	English
DOMINICAN REPUBLIC	R. HIN, Santo Domingo	2200-0400	4.91	Spanish
	R. Santo Domingo, S. Domingo	2200-0500	6.09	"
ECUADOR	R. Nacional, Quito	0000-0500	4.94	Spanish
	HCBJ, Voice of the Andes, Quito	1400-1500	15.115, 17.89	English
		1830-2030	15.405, 17.89	"
EL SALVADOR	R. Nacional, San Salvador	2200-0400	9.552	Spanish
FRENCH GUIANA	RTF, Cayenne	1030-1130	3.385	French
GUATEMALA	R. Nacional Tikal, Flores Petan	0200-0500	6.205	Spanish
	R. Nacional, Guatemala City	1800-2300	15.17	"
		(irregular)		
HAITI	4VEH, Cap Haitien	1130-1400	6.12, 9.77	English
HONDURAS	HRRH, Santa Rosa de Copan	0100-0500	5.96	Spanish
	HRQ, R. Suyapa, San Pedro Sula	1200-1300	6.125	"
MARTINIQUE	R. Antilles-Guyane, Fort de France	0000-0230	3.315, 4.895	French
MEXICO	XEWW, Mexico City	1145-1400	6.165, 9.515	Spanish
	XERR, Mexico City	1300-0600	15.11	"
NICARAGUA	R. Mundial, Managua	0000-0400	5.965	Spanish
PANAMA	La Voz del Barú, David	1100-1300	6.045	Spanish
PARAGUAY	R. Teleco, Asuncion	2100-2300	11.852	Spanish
	R. Encarnacion, Encarnacion	2200-2400	11.947	"
PERU	R. Nacional, Lima	1145-1300	6.082, 9.562	Spanish
		0100-0500	"	"
SWAN ISLAND	R. Americas, Swan Island	1000-1300	6.000	Spanish
URUGUAY	R. Carve, Montevideo	0000-0300	6.156	Spanish
	R. Sarandi, Montevideo	0230-0330	11.885	"
		(irregular)		
VENEZUELA	R. Rumbos, Caracas	0000-0600	4.97	Spanish
	R. Barquisimeto, Barquisimeto	0000-0430	4.99	"
WINDWARD ISLANDS	Windward Islands BC Service, Grenada	2000-2200	15.135	English



CERTAIN solid-state hi-fi/stereo amplifiers require special consideration when stereo headphones are to be used. If you own one of these amplifiers, here is "how-to-build-it" information on a universal speaker/headphone control unit—which, incidentally, can also be employed with any conventional tube-type stereo amplifier. With this control unit, you can remotely select speaker or headphone operation—and adjust headphone volume level—without leaving your easy chair.

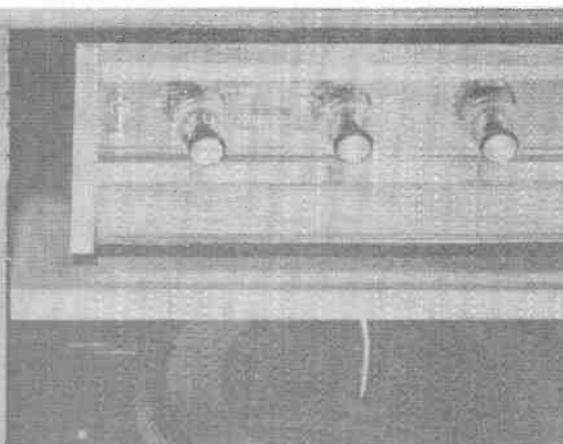
Stereo headphones offer the hi-fi enthusiast the optimum in stereo realism—in complete privacy—without having to sit in a fixed listening location. The stereo listener is not bothered by the usual household sounds, and conversely, others can read or watch television undisturbed.

Some stereo amplifiers incorporate a built-in, standard, 3-conductor phone jack for stereo headphones, while in several of the new solid-state stereo amplifiers a special circuit for stereo headphones must be devised. A typical example of the latter is the Heath Model AA-21 or AA-21C.

BUILD A Stereo Headphone Control Unit

*Ideal companion for
transistorized amplifiers
combines safety
from burnouts
with maximum convenience*

By **CHARLES CARINGELLA**



No Common Grounds. The Heath AA-21 requires that the speaker "common" line in the left channel be completely isolated from the "common" line in the right channel. The "common" terminal in the output of each channel is electrically above chassis ground. Each "common" line is returned to ground within the amplifier through a 0.18-ohm resistor. Both resistors are part of networks which provide a form of current feedback. Therefore, the common-terminals cannot be tied together with one "common" line into a 3-wire stereo headphone circuit, nor can the common lines be grounded to the AA-21 chassis. This means that two wires must be run to each speaker. You cannot run one "hot" wire to each speaker and use a single "common" return.

Conventional stereo headphones are sold wired to a 3-conductor phone plug. One conductor is connected to the left-channel earphone and another conductor to the right-channel earphone. The "common" return leads for both earphones are tied together to the third conductor, which also serves as the grounding sleeve, in the phone plug.

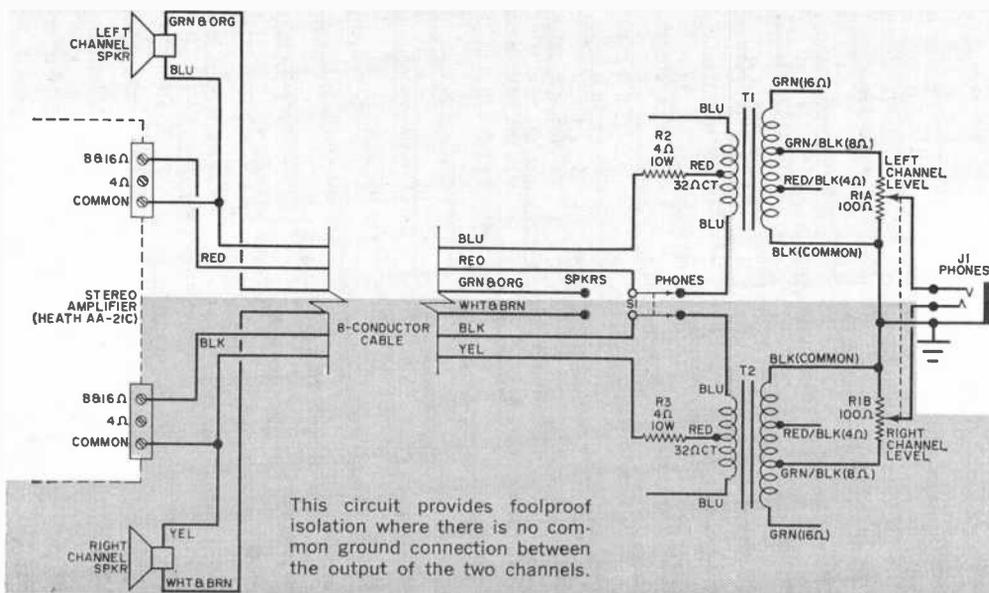
Obviously, such stereo headphones cannot be used directly with the amplifier described above since the "common" leads are tied together. The stereo headphone control unit shown in the schematic diagram allows headphones to be

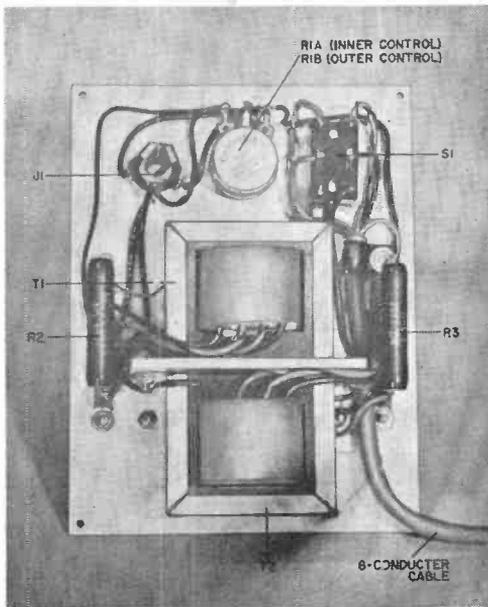
used with such an amplifier, without modifications to the amplifier or to the headphones. The control unit adapts the "4-wire" output of the amplifier to the "3-wire" headphone set.

How It Works. Complete isolation between channels is made possible by using two transformers, *T1* and *T2*. The primary of *T1* is connected to the output of the amplifier left channel and the primary of *T2* goes to the right channel.

PARTS LIST

- J1*—3-conductor, open-circuit, standard phone jack (Switchcraft 12B or equivalent)
- R1a/R1b*—Dual 100-ohm potentiometer with concentric shafts (*R1a*—Centralab "Fastatch" F1-100; *R1b*—Centralab "Fastatch" R1-100, Centralab FFS012, $\frac{3}{4}$ "-long sleeve shaft, Centralab RFS102, $1\frac{1}{8}$ "-long inner shaft)
- R2, R3*—4-ohm, 10-watt wire-wound resistor
- S1*—D.p.d.t. toggle switch
- T1, T2*—Transistor output transformer; primary impedance, 32 ohms, CT; secondary impedance, 4, 8, and 16 ohms (Merit A-2745 or equivalent)
- 1—Length of 8-conductor cable—as required (Belden 8448 or equivalent)
- 2—6-lug terminal strips (Cinch-Jones 2006 or equivalent)
- 1—Angle bracket, made from $\frac{1}{8}$ "-thick sheet aluminum
- 1—5" x $6\frac{1}{2}$ " panel, made from $\frac{1}{8}$ "-thick sheet aluminum
- 1—6-13/16" x 5-9/32" x 2-5/32" black molded plastic instrument case (Harry Davies 260 or equivalent)
- 1—Set of dual concentric knobs
- 1—Plastic cable clamp for $\frac{1}{4}$ "-diameter cable





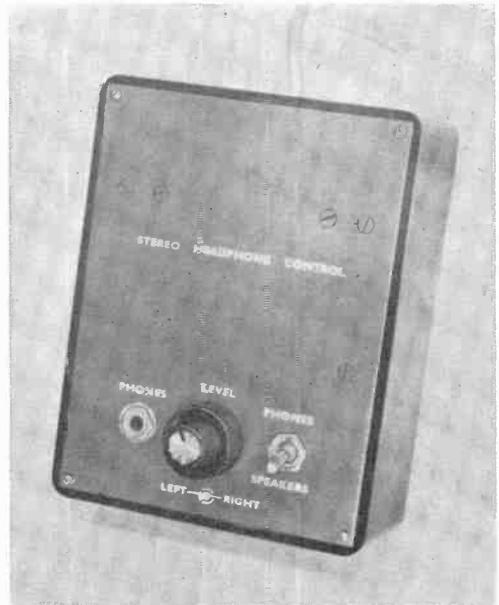
The author made a simple aluminum bracket to mount the two transformers back to back. Remainder of internal wiring is obvious from this rear view.

The secondary windings of *T1* and *T2* drive the stereo headphones. The secondary "common" leads are tied together and connected to ground. Concentric potentiometers *R1a* and *R1b* serve as the volume level controls. Dual knobs are attached to the concentric shaft and it is possible to adjust the two volume controls individually or simultaneously. Switch *S1* selects either speaker or headphone operation.

An 8-conductor cable connects the headphone control unit to the amplifier. Almost any length of cable can be used. It is possible to run the cable across an average-size room (25-30 feet) without noticeable high frequency loss.

Resistors *R2* and *R3* are connected in series with the primaries of *T1* and *T2* for amplifier protection against overload at low frequencies. The Heath AA-21 is designed to operate into a minimum of 4 ohms resistive load. Since the d.c. resistance of the primaries is quite low, resistors *R2* and *R3* must be used in series with the windings. You can omit *R2* and *R3* if the control unit is used in conjunction with some of the other stereo amplifiers.

Construction. The completed control unit is housed in a molded plastic instru-



A 25' length of cable connects the control unit to your amplifier. You can place unit alongside your easy chair and switch from speakers to headphones.

ment case as shown in the photos. A 5" x 6½" front panel is made from ⅛"-thick sheet aluminum. After all the necessary holes have been drilled, the panel can be sprayed with lacquer of a suitable color. Instrument decals can be added for a finished "professional" appearance.

An inside view, showing the location of all components, can be seen on this page. Parts layout is not critical. Transformers *T1* and *T2* are mounted on an L-shaped bracket also fabricated from ⅛"-thick sheet aluminum.

The multi-conductor connecting cable has an outside diameter of approximately ¼". A suitable hole should be drilled in the top side of the instrument case to allow the cable to pass through.

Using the Control Unit. Only one adjustment is necessary, and that is, properly phasing the left and right channels. For proper operation, the two earphones should be "in phase." This means that the diaphragms in the earphones should move in and out at the same time when they are driven by identical signals.

If you own a Heath AA-21, you have probably "phased" the speakers properly by following the procedure outlined in the instruction manual. The AA-21 is

(Continued on page 92)



SOLID STATE

By LOU GARNER, Semiconductor Editor

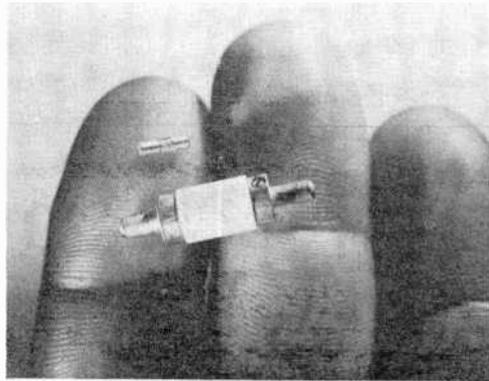
UNLESS you're an advanced experimenter, student, or ham, new developments in the microwave field may seem far removed from your day-to-day interests. Yet, the advanced technique of today can become rather commonplace within a relatively short time.

The transistor itself is but one example. When first developed, the transistor was an expensive, difficult-to-use laboratory curiosity. In less than five years after its introduction, however, medium-priced units became available for hobbyist applications and, today, the transistor is perhaps the most popular of all experimenter components.

In our opinion, something similar will occur with the new generation of semiconductor devices now being investigated by Bell Telephone Laboratories (New York, N.Y.). These devices, which may one day replace medium-power special-purpose vacuum tubes in microwave applications, have already generated as much as 60 milliwatts of continuous r.f. power in the 2-11 gigacycle range (2000 to 11,000 megacycles).

Three types of devices are now under study at Bell Labs: a bulk *gallium arsenide* device, a *silicon avalanche diode*, and a *Read avalanche diode*. All three have been operated as self-excited oscillators, generating microwave frequencies when driven by a d.c. voltage. In addition, they have been used as amplifiers in conjunction with external stabilizing circuitry.

A common characteristic of these devices is that their operating frequency is determined, in part, by the transit time of the electrons through a region in the semiconductor material. The transit time is generally comparable to one cycle of the device's operating frequency. In contrast, the time required by electric charges traveling through the junctions of other solid state devices, e.g., conventional transistors and tunnel diodes, corresponds to only a small fraction of a cycle. Thus, it is possible to design the new structures in such a way that the volume of the material actively used in generating microwave energy is greater than that of conventional devices operating at the same frequency. This al-



The relative size of two transit time devices being investigated at Bell Labs for use as microwave generators and amplifiers is shown above. The smaller device contains a tiny wafer of gallium arsenide. The larger device is used to house either a Read diode or a silicon pn junction diode.

lows the new devices to operate at relatively higher voltages and power levels. Appropriately, they are called "transit time" devices.

The bulk gallium arsenide device consists simply of a piece of *n*-type gallium arsenide to which two metal contacts have been affixed. (See Fig. 1.) At Bell Labs, continuous microwaves have been generated in bulk gallium arsenide in the frequency range of 2-3 (gc.), with outputs exceeding

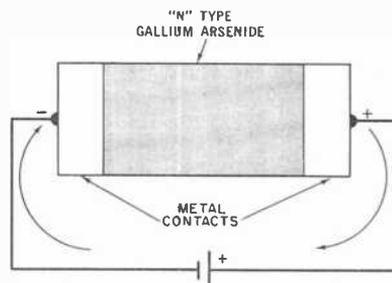


Fig. 1. Bulk gallium arsenide device is made by sandwiching *n*-type gallium arsenide between two metal contacts. The arrows show the current flow.

60 milliwatts and efficiencies of between 5% and 6%. Furthermore, amplification of signals in the 2-10 gc. range was achieved with gains of 4-5 db at bandwidths of 600-700 mc.

Both the silicon and the Read transit time devices are made from semiconductors containing a junction which is reverse-biased to produce avalanche breakdown. (Avalanche is a high field discharge caused by internal secondary emission which is not destructive to the junction.) The avalanche region is either inside or adjoins the high field *transit* region.

The Read avalanche diode was first proposed by W. T. Read of Bell Labs in 1957. Made of silicon, this diode has a complex internal electrical structure consisting of alternate *p*, *n*, *i*, and *n* semiconductor layers, thus forming a *pnip* device. Using a Read diode, scientists have generated continuous oscillations at 5.2 gc. with an output of 19 milliwatts and an efficiency of 1.5%.

Don't rush to your corner distributor to buy test units. These transit time devices are still in their experimental stages. But you might check with your distributor in two or three years.

Manufacturer's Circuit. Since we talked about field-effect transistors (FET's) in this column, a number of readers have requested that we show some circuits. In anticipation of the day when low-cost FET's will be available in quantity for experimental purposes, here's a hi-fi tone control (Fig. 2) you can experiment with.

One of several related circuits suggested

by Siliconix, Inc. (1140 W. Evelyn Ave., Sunnyvale, Calif. 94086), the tone control features a single FET as a high-impedance buffer amplifier, with frequency response controlled by RC tuned feedback loops. Gate bias for *Q1* is established by source resistor *R8*, bypassed by *C5*, while *R7* serves as the *drain* load. Capacitors *C1* and *C6* are, respectively, the input d.c. blocking capacitor and output coupling capacitor.

In operation, part of the input signal is applied through isolation resistor *R1* to the bass tone control network, *C2*, *R2*, and *C3*. The bass response is determined by *R2*'s setting in conjunction with the feedback signal coupled from *Q1*'s output through *R6*, and which appears across *R5*. Resistors *R6* and *R5* form a voltage-divider network. Similarly, the rest of the input signal is applied across the circuit's *treble* control, *R4*. Treble response is determined by *R4*'s setting, the value of *C4*, and by the output signal fed back to *R4*.

Except for *R2*, the 1-megohm potentiometer used as a bass control, and *R4*, the center-tapped 500,000-ohm potentiometer used as a treble control, all resistors are half-watters. Capacitors *C2*, *C3*, *C4* and *C6* are small ceramic types, while *C5* is a 25-volt electrolytic. Transistor *Q1* is a 2N2843 FET. Operating power is supplied by a 22-volt battery or a conventional line-operated d.c. power supply.

The circuit can be wired on a conventional chassis, on a perforated phenolic board, or on a special etched-circuit board, as preferred. The completed tone control can be used as a separate circuit for experimental

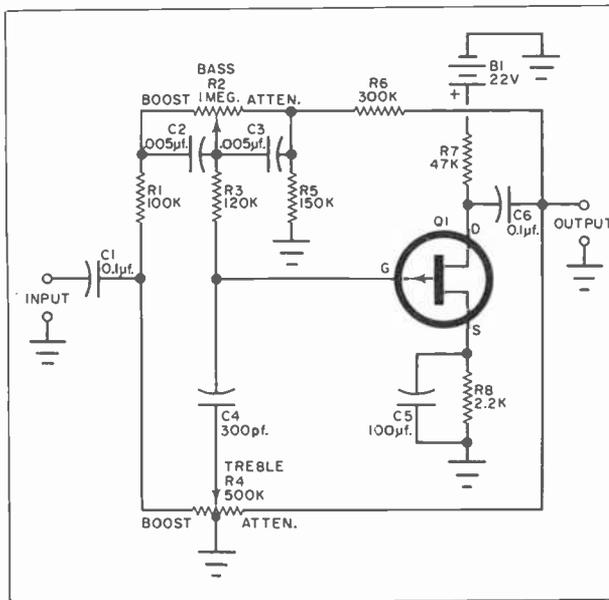


Fig. 2. Hi-fi FET tone control by Siliconix, Inc., uses a twin-T notch filter to obtain 40-50 db attenuation at the notch frequency when output load impedance is near infinity. Circuit can also be used in a negative feedback loop of another FET amplifier to produce narrow bandpass characteristics.

purposes or, depending on individual needs, as part of a more complex audio preamplifier design.

Transitips. With low-cost transistors, SCR's and similar devices in plentiful supply, many hobbyists are likely to forget that the common diode is an extremely versatile and useful device. The diode's ability to rectify a.c. and to block d.c. of reverse polarity can be utilized in a number of control circuits. One such circuit is shown in Fig. 3. Here, a 2-wire control line is used to operate any one of three relays at will.

The relays, *K1*, *K2*, and *K3*, are similar types. All of the diodes, too, are similar, and can be general-purpose units. Networks *R1-C1* and *R2-C2* are of the simple a.c. filter type, and *C3* serves as a d.c. blocking capacitor. Actual values must be determined by circuit requirements, types of relays used, and mode of operation.

Let's see how the circuit works. Suppose we wanted to close relay *K1*. We would simply apply a d.c. voltage of the indicated polarity to the control line. Under these conditions, *D1* is biased in its forward direction, permitting a current flow through *K1*'s coil, and thus actuating the relay. At the same time, *D2*, being reverse-biased, blocks any current flow through *K2*'s coil. Relay *K3* would not operate either, because of the presence of *C3* with its d.c. blocking action.

To actuate *K2*, we need simply to reverse control line polarity. Relay *K2* would then close, while *K1* and *K3* would remain open. To actuate *K3*, we would apply a low-frequency a.c. signal to the control line.

Filter networks *R1-C1* and *R2-C2* would act to prevent the application of adequate signal to energize their respective relays. On the other hand, the a.c. signal passing through *C3* would be rectified by bridge rectifier *D3* through *D6* and applied to *K3*'s coil, actuating this relay. Thus, the a.c. would activate *K3* without affecting the state of *K1* or *K2*.

With a proper choice of component values, we could also actuate *all three* relays simultaneously, by applying a low-frequency a.c. signal to the control line. Under these conditions, filters *R1-C1* and *R2-C2* would become less effective, permitting the control signal to be rectified by diodes *D1* and *D2*, and thus actuating their respective relays. Relay *K3* would continue to operate as with a higher frequency signal.

With a variety of control signals to choose from, component values could be selected to permit the following modes of operation:

- (1) Relay *K1* contacts closed with d.c. of a given polarity, other relays open.
- (2) Relay *K2* contacts closed with d.c. of reverse polarity, other relays open.
- (3) Relay *K3* contacts closed with high-frequency a.c., other relays open.
- (4) Relays *K1*, *K2*, and *K3* closed with medium-frequency a.c.
- (5) Relays *K1* and *K2* closed with low-frequency a.c., relay *K3* open.

And it's all done with the aid of diodes!

Unless I'm reading my calendar wrong, Spring is about ready to bust out all over . . . have you planned any "sunny day" projects?

—Lou

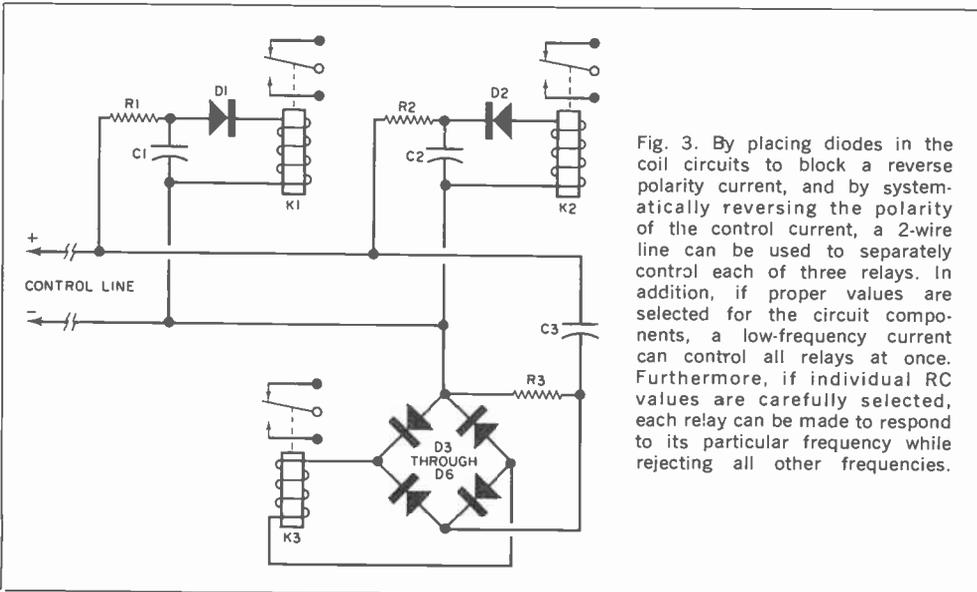


Fig. 3. By placing diodes in the coil circuits to block a reverse polarity current, and by systematically reversing the polarity of the control current, a 2-wire line can be used to separately control each of three relays. In addition, if proper values are selected for the circuit components, a low-frequency current can control all relays at once. Furthermore, if individual RC values are carefully selected, each relay can be made to respond to its particular frequency while rejecting all other frequencies.



ON THE CITIZENS BAND

By **MATT P. SPINELLO**, KHC2060, CB Editor

MANY READERS have asked your CB Editor for information on organizing emergency and rescue squads in their areas. Most of the questions have dealt with the types of equipment that should be available in addition to CB transceivers. It is not an easy matter to define what might be termed the average CB rescue squad or patrol since each group is designed primarily to serve its particular portion of the country. The team in Colorado, for instance,

MODERN CB RESCUE SQUAD

which uses a special group of walkie-talkied donkey riders and airplanes for search and rescue in mountainous regions would have no use for the equipment used by CB-equipped skin divers who cover the eastern coastline. Similarly, a CB motor scooter patrol from California might find the going a little rough on a search mission in the northernmost chunk of Minnesota—in January.

It is obvious, then, that a squad employed in any given area is built around the terrain and types of disasters or emergencies they will encounter. Groups in tornado country rely heavily on gasoline power generators, floodlights, and small boats. Those in snowbound areas obviously equip themselves with warm clothing, food supplies,

blankets, tire chains, and possibly the little jug formerly carried by Saint Bernards. All groups carry first aid kits to cover smaller emergencies.

Among the groups spread across the country, one that might be considered typical and highly active is the Citizens Emergency Radio Patrol (CERP), of N. Tonawanda, N.Y. So far as equipment is concerned, three of CERP's mobile units have emergency oxygen equipment, and a fourth unit is available for those in need, free of charge. Standard equipment for all CERP mobiles includes jumper cables, blankets, several gallons of gasoline, tow ropes or chains, flares, emergency flashers, portable spotlight, fire extinguisher, flashlight, and first aid kit. One of the mobiles was recently equipped with an emergency generator and floodlight.

The Citizens Emergency Radio Patrol celebrated its third anniversary last October while on Halloween patrol duty with the Niagara County Sheriff's Department. Five mobile units operated in strategic areas within the county. Together the members of the team recorded a total of 60 man hours and drove 1217 miles while handling Halloween prankster calls. Their duties freed county patrol squads for more serious law enforcement.

According to CERP secretary Vernon W. Batt, Sheriff James K. Murphy and

Members of the Citizens Emergency Radio Patrol, N. Tonawanda, N. Y., look on as Niagara County Sheriff James K. Murphy makes his annual inspection of CERP patrol equipment. Shown at left is Wayne Shoen, K1C5821; at the far right, CERP secretary Vernon Batt, K1C5311.



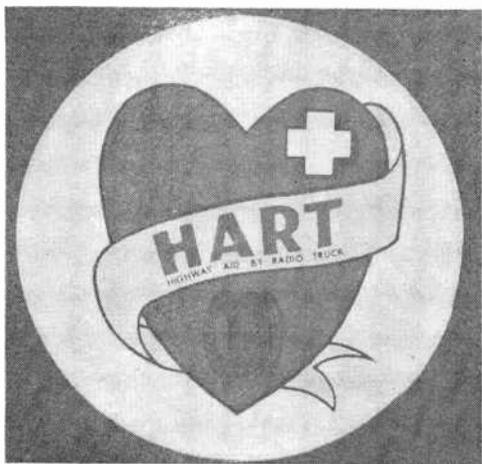
members of the Niagara County Sheriff's Department have been instrumental in molding CERP into an efficient working team. The department's suggestions regarding operational procedure, equipment, and training have helped to build enthusiasm among patrol members, and have given them a sense of accomplishment and a feeling of true community service.

Since May, 1965, CERP has had a day-time monitor in operation on channel 9 from 8 a.m. to 5 p.m. Nightly monitors take over from 5 p.m. to 1 a.m. This 17-hour daily monitoring system has been credited with hundreds of assists to tourists and motorists in distress.

The present officers of CERP include: Alfred Shoen, KIC4169, president; John McKnight, 20Q4712, vice president; Vernon Batt, KIC5311, secretary; and Jerauld Adams, 20Q0083, treasurer.

HART. Highway Aid by Radio Truck is the title applied to an organization of members of the trucking industry who have incorporated CB radio as an emergency aid. HART is a non-profit, self-supporting association, organized in November, 1963, and has been officially recognized by the Michigan State Police and the Michigan Sheriff's Association. Its services are free to the motoring public. The association's objectives are the maintenance of an excellent relationship between the motorist and the trucking industry, and the promotion of highway safety.

Truckers travel millions of miles per year on American highways. The addition of CB radio equipment makes each vehicle an effective emergency unit to aid motorists in distress. This is important on our turnpikes and growing networks of expressways where telephone service is usually at a minimum.



In addition, HART members are instructed in first aid, carry minor first aid equipment, and are trained in emergency procedures. The average trucker also has a fair knowledge of mechanics and can usually determine the service needed in the case of breakdowns. This service not only saves time but eliminates the necessity of a motorist leaving his auto unattended.

Among the strict set of rules for HART members, emphasis is placed on proper CB licensing; promotion of safe driving and exceptional care and maintenance of member vehicles; all possible courtesies and aid to be extended to those in need; detailed handling of major emergencies, including the notification of proper authorities; the protection of exposed personal property of victims at an accident scene; and the extending of HART services without payment.

Present HART officers include: Harold Liskum, KHH3286, president; Edward Dezomits, KHJ8112, vice president; Richard Larsh, KHI9745, secretary/treasurer; Ray Bartell, KLM8643, recording secretary; and three trustees. Editor of the HART newsletter is Richard Montgomery, KHI4650.

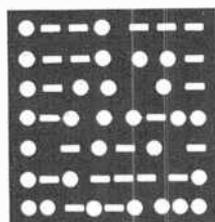
CB'ers employed by the trucking industry who own—or have free access to—at least one mobile unit can obtain more information by writing to HART, Box 141, Dept. CB, Pontiac, Mich.

Station Identification Rules Clarified. Effective Feb. 1, 1966, the Federal Communications Commission amended the CB Rules, Part 95.95 (C) to include examples of proper CB station identification. The Rules now specifically require the use of the call-signs of your station and the station being called or worked—if interstation—in every transmission. When working your own mobiles—intrastation—it is permissible to use an identifier (base, mobile 1, etc.) and the full call-sign once every 15 minutes.

1966 OTCB Club Roster. The following CB clubs are reporting to the "On the Citizens Band" column for the first time this year. All clubs that want to be on our active list should forward complete details to: 1966 OTCB Club Roster. POPULAR ELECTRONICS, One Park Avenue, New York, N.Y. 10016.

Industry, California: San Gabriel Valley REACT Monitor. With a membership of 60, this team has answered an average of 350 requests for aid per month through its REACT monitoring facilities. Present officers: Walter T. LeBlanc, KKY0332, president; Richard Ballew, KFA7543, vice president; Alan Reichard, KFA8441, commanding officer; Gary Carrico, KMX4681,

(continued on page 98)



AMATEUR RADIO

By **HERB S. BRIER**, W9EGQ
Amateur Radio Editor

AMATEUR OPERATING PROCEDURES

AFTER operating on the 75-meter phone band for a few days, an amateur whose previous operating experience had been on CW and in local rag-chewing on 2-meter phone complained to your Amateur Radio Editor that 75-meter phone operators were not very cordial to newcomers. It turned out that he had overheard two operators whom he had worked a short time before talking about him. He heard one of them say, "I don't know where some of these fellows learn to become hams, but you can always spot them by their funny operating procedures." The other operator replied, "Yeah. I'll go along with that. Maybe they watch too many TV programs."

While I could sympathize with my friend over the shock of discovering that not everyone thought he was as good an operator as he thought he was, I had to agree that some of the operating practices in both the CW and phone bands seem to emanate from a science-fiction TV program. Fortunately, it doesn't take the average amateur very long to "get with it" once he realizes

that he sounds more like a 10-year-old with a 100-milliwatt "walkie-talkie" than a licensed radio amateur. The trouble is getting the message through to him tactfully.

One reason for poor operating procedures on the air is that no one seems to bother to teach good procedures to new amateurs. Radio clubs and others that offer code and theory courses to prospective hams, for example, too often merely teach the students just enough code and theory to enable them to pass the FCC examinations. They could easily make better operators out of their graduates by including instructions on operating procedures as part of their courses.

Including such instructions would not require much class time. The students could be told to study the operating procedures discussed in the Amateur Radio Chapter of the *POPULAR ELECTRONICS Communications Handbook*, for example, or in other amateur publications. In later code-practice sessions, the code instructor could assign call letters to each student and "work" them in turn via the key and code oscillator,

Robert Vierling, K5WYN, of Galveston, Texas, does most of his operating in the Delta SSB Net and the West Gulf Emergency Net with his Collins KWM-2 transceiver driving a Heathkit SB-200 amplifier. Bob also has a Swan-175 transceiver in his car, and 2-meter and CB equipment for local and emergency use in connection with Civil Defense, the Red Cross, and the police. He has worked all states and a handful of foreign countries using an 80-meter dipole fed with tuned feeders on all bands between 3.5 and 30 mc. K5WYN will receive a one-year subscription for submitting this winning photo in our Amateur Station of the Month contest. If you would like to enter the contest, send us a clear picture of your station with you at the controls, and some details on your amateur career and on the equipment you use. Entries go to: Amateur Photo Contest, c/o Herb S. Brier, Amateur Radio Editor, P.O. Box 678, Gary, Ind. 46401.

AMATEUR STATION OF THE MONTH





During a recent trip through Europe, Bill Halligan, W9AC/W4AK, was appointed Chairman of "The International Amateur Radio Hall of Fame" Committee. Bill, now Chairman of the Board, Hallicrafters Co., was also honored by several European radio clubs. In this photograph, Bill is shown accepting the scroll and pin signifying his honorary membership in the Italian Amateur Radio Society.

and then let the students "work" each other. Each "contact" could follow the pattern of an actual on-the-air contact and include "call-up's" and "sign-off's," procedure signals, and Q signals. At the end of each "contact," the instructor could make appropriate suggestions. Of course, simulated phone contacts could also be set up.

Space doesn't permit a detailed discussion of operating procedures here, but we can make a few general comments on the



Curt Bowen, WA9NVF, Joliet, Ill., and other hams at his high school are organizing a radio club to teach amateur radio to other students. See News and Views, p. 106, for data on Curt's ham career.

subject. Besides excessively long CQ's and call-up's, probably the most common operating errors are the use of phone procedures on CW, and CW procedures on phone.

On CW, every character sent must be transmitted *dit by dit*; good operators, therefore, eliminate unnecessary key pounding by using abbreviations, procedure signals, and Q signals. Many CW operators do not use Q signals and laboriously spell out in full every word they send, including unnecessary phrases such as "Well, back to you." In addition, they sprinkle their transmissions liberally with unnecessary commas and periods.

On phone, on the other hand, many operators are constantly throwing Q signals and CW abbreviations into their transmissions. Thus, they frequently say something like, "The QRM was heavy on that Xmission," which translates to "The *I am being interfered with* was heavy. . . ." The prize-winner on phone, however, is the operator who cannot repeat a set of call letters—any call letters—or say three words in a row without spelling them out phonetically, even when signals are strong and interference is nil.

FCC News. With the recent signing of a reciprocal operating agreement between the United States and the United Kingdom, the U.S. now has agreements with the following countries to allow licensed amateurs of one country to obtain permission to operate in the other country. The list includes: Australia, Belgium, Bolivia, British Isles, Canada, Colombia, Costa Rica, Dominican Republic, Ecuador, Luxembourg, Peru, Portugal, and Sierra Leone. Similar agreements with other countries are presently in the process of negotiation.

Vietnam is on the air! K1YPE/XV5 is operating from Vietnam by the authority of the Vietnamese government and has been authorized to handle third-party messages. The FCC has announced, therefore, that it has no objection to U.S. licensed amateurs working K1YPE/XV5.

To bring 10-meter, F1 radioteleprinter operation in line with RTTY operation on 80, 40, 20, and 15 meters, the ARRL has petitioned the FCC to authorize RTTY operations in the 28 to 28.5 mc. segment of the 10-meter band. Also, the ARRL has requested the FCC to shift the 2-meter A1 (CW) assignment from the 147.9 to 148 mc. segment up to 144 to 144.1 mc. This change is desired to aid "moon bounce," satellite, and other amateur communications. It would concentrate these operations in the frequency range assigned to radio amateurs internationally. For similar reasons, the Ca-

(Continued on page 100)

Some Plain Talk from KODAK about Tape:

Sobering thoughts about slitting... and making the best basically better

A wise man once said, "Baloney's basic worth is unaffected by the manner in which you slice it." Maybe so for baloney . . . but certainly not for sound recording tape. Slicing, or to be technically correct, slitting quarter-inch ribbons of tape from the 42-inch-wide master web in manufacture takes a pretty sharp eye. This slitting operation is important to your pleasure since the closer the tape comes to being

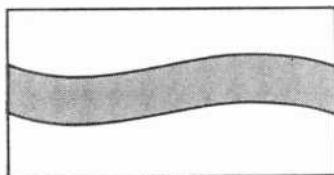


dimensionally perfect, the better is the azimuth relationship between the recorded signal and the reproduce head. Like it in plainer English? Then consider some examples of poor slitting . . . and what they sound like.

"Drunken" slitting and others.

Variations from the ideal occur if tape is too wide, too narrow, or if its width varies. If the tape is too wide, it may actually override the guides on your tape deck. If the tape is too narrow, it may see-saw as it passes by the head. Either way, you're in trouble. Variations also occur if the edges are not straight. One such variation goes by the name of "drunken" slitting. Sound bad? You bet. The edges

snake even though the width is constant (see drawing). As a result, on playback the output varies as the tape weaves past the reproduce head . . . causes a warbling of the signal. This is a type of distortion the human ear is most sensitive to. You wouldn't like it.



Drunken slitting, a dramatization

Quality-control makes the difference. Standard industry specification calls for a tolerance on width of $\pm .002$ inches. To start, we hold ours to $\pm .001$ inches. And to make things more interesting we make our test over a twelve-inch span to equal or exceed guide spacing on most tape recording equipment. Next, not relying on eyeball tests as others do, we test for drunken slitting or fluted edges by actually running the tape with a recorded short wavelength signal through a tape recorder. This "drunkometer" test helps us spot any tape that's had even one beer. The slightest whiff, and out it goes. Lastly, Kodak Sound Tapes have to go under the microscope where we watch for rough or dirty edges. When you buy Kodak Tapes, you know they're clean.

Best base better? Strength and toughness sound like they mean the same thing . . . but they don't

quite when it comes to a tape base. Take a piece of spaghetti. It's stronger when it's dry . . . but tougher when it's wet—harder to break, that is, and not just because it's slippery. Designing a tape base, you're always up against the problem of making it strong so it doesn't stretch . . . and tough so it doesn't break. Today's DUROL base, the best there is, is now more resistant to shock abuse and carelessness. It's even tougher than before while it still retains the strength that made it famous.



Kodak tapes—on Durol and Polyester bases—are available at most electronic, camera, and department stores. To get the most out of your tape system, send for free, 24-page "Plain Talk" booklet which covers the major aspects of tape performance. Write: Department 8, Eastman Kodak Company, Rochester, N. Y. 14650.

EASTMAN KODAK COMPANY
Rochester, N. Y.

ULTRASONIC OMNI-ALARM

(Continued from page 45)

$\frac{1}{16}$ " thick. Replace the cover and seal the seam with rubber cement to prevent the transducer case from rattling.

If everything seems to be in working order, set the sensitivity control to obtain a 10-volt reading and have someone take a walk to break the path between the transducers. The meter reading should drop to zero and the relay should drop out.

Installation. You can mount the transducers for direct or for reflected beam operation as shown in Fig. 6. Direct-type operation is more effective over greater distances. With the reflected-type setup, both transducers can be mounted on the same wall to cover hallways and small rooms. Do not use more cable than necessary for the receiving transducer; the longer the cable, the more capacitance it has; and the greater the capacitance, the greater the loss in signal to the receiver. If the system is to be used as an intruder alarm, mount the transducers high enough and in such a way that a cat or a dog will not break

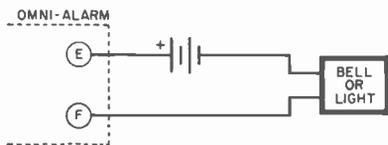


Fig. 7. Simple alarm circuit can be compromised by cutting one of the wires. Use of a battery causes the alarm to sound in the event of a power failure.

the beam and cause a false alarm—unless you would like to know about the uninvited four-legged visitor.

Keep the beam as far away from heating or air conditioning ducts as possible. Although this system will tolerate some air motion, violent or turbulent motion can set it off. The Omni-Alarm cannot normally be used outside, especially in a windy place—the “sound” beam can be blown away enough to cause the alarm to trip.

Any type of alarm device that can be activated by a switching action can be

connected to the relay contacts. Perhaps the simplest arrangement is that of a bell or light connected to points E and F as shown in Fig. 7. But while this hookup will work fine, it can be put out of commission simply by cutting the wires.

If you want to make the installation tamperproof, you can enclose the external alarm and its circuitry in a locked steel box, mounted high above ground level. The alarm will sound if an intruder breaks the beam, cuts or shorts the wires, or if there is a power failure. Two identical relays are used as shown

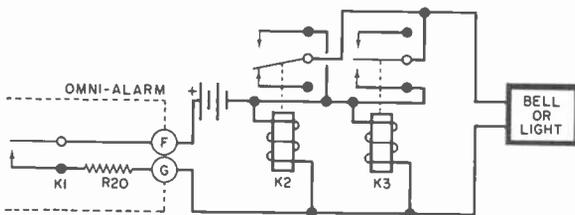


Fig. 8. Fail-safe external alarm system will cause an alert if the wires are cut or shorted, if the battery is weak, or if the power line should fail.

in Fig. 8. All relays have a higher pull-in than drop-out current, and you can take advantage of this characteristic. Resistor R20, installed in the alarm control unit, is selected to allow a small current to flow through K2 and K3, which is too small to pull in the relays, but large enough to hold them in. Set the alarm and manually close the contacts of K2. Now, if anyone cuts the wires or breaks the beam to open K1, K2 will open and sound the alarm. If someone shorts the wires, R20 is bypassed and K2 closes, and sounds the alarm.

If you want to be real “mean,” you can put a Microswitch in the bottom of the case. Then the alarm will sound if the case is picked up. An added safety feature inherent in this type of circuit is that the alarm will sound when the batteries approach their end life.

To obtain pinpoint control in a production line setup, you can insert one or both of the transducers into one end of a 1"-diameter plastic tube. This reduces the range. Distances of one to three feet can be monitored without feedback problems.

—30—

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*Automobile Mfg. Association H.E.L.P. Application Pending Before Federal Communications Commission.



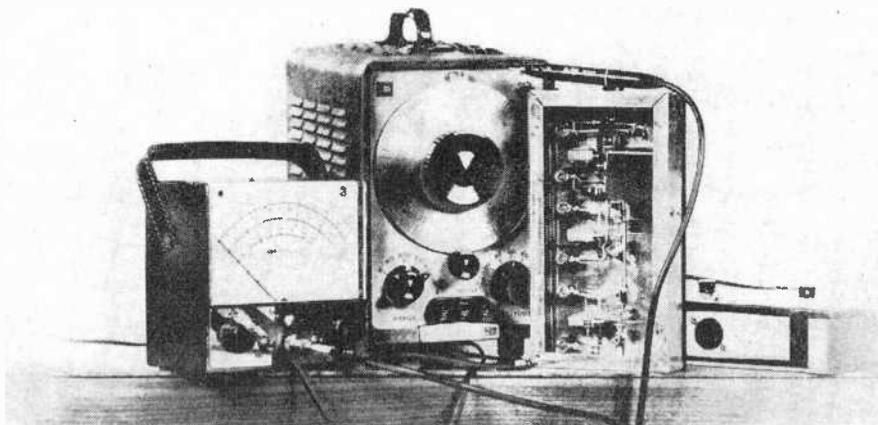
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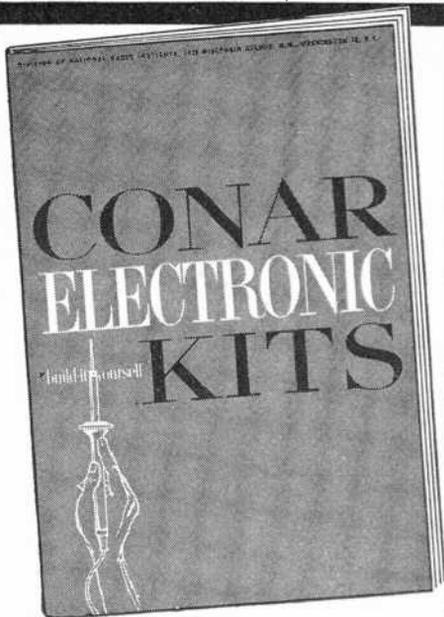
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CIRCLE NO. 7 ON READER SERVICE PAGE

TEST OUT YOUR HI-FI

(Continued from page 59)

channel, for instance, you'd add a little bass boost on that side. Or if one speaker is noticeably brighter than the other, you can bring it in line by cutting treble in that channel either at the amplifier or at the tweeter control.

To help you adjust balance over a wide frequency spectrum, the Columbia and HiFi/Stereo Review records introduce a new method. They have so-called "pink noise" bands. These bands contain all musical frequencies thrown together at random but with equal strength in every octave. With this type of signal, you can balance your speakers for the entire musical range in a single adjustment.

Frequency Response. On most test records, the frequency response test consists of a series of tones spotted between 30 and 15,000 cycles. Listening to these test tones reveals three vital things about your system: (a) the top frequency it can reproduce; (b) the bottom frequency; and (c) uniformity of response—or lack of it—for the frequencies in between.

The first two factors are clear enough. If, instead of a rich, full-bottomed 50-cycle bass, your speaker only coughs up a hoarse rattle—or if all sound vanishes above 10,000 cycles—you know your system is holding out on you. Not all the music is getting through.

Uniformity of response is harder to judge. It tells you whether your system is reproducing all notes between top and bottom with exactly the right emphasis. Ideally, the system shouldn't stress any note or frequency more than others. This is what is meant by the expression "flat frequency response."

Offhand, you might think that all you have to do to check for flat frequency response is listen to test tones and observe if they are equally loud. But such comparison can be misleading because the listener's hearing does not have flat response. The notes in the middle—from about 1000 to 3000 cycles—generally seem louder than either low bass or extreme treble. As a result, you are

CIRCLE NO. 32 ON READER SERVICE PAGE →

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Mark VIII: \$99.95*

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apt to think your treble and bass are weak—compared to midrange—when in fact they are just at the right level.

Columbia's STR-101 and the HiFi/Stereo Review Test Record cleverly get around this difficulty. A separate midrange "pilot tone" is heard before each test tone. In effect, this pilot tone calibrates your ears so you can judge the test tones correctly. You compare the loudness of the test tone with the pilot tone that accompanies it.

Can You Test By Ear? These new test-by-ear methods are stirring up lively arguments. Some experts claim that listening tests are more valuable for total system checkout than conventional engineering measurements. With instruments hooked to the amplifier output, it's impossible to account for two of the most important items in any hi-fi setup—the speakers and room acoustics.

"You don't listen inside a VOM," insists one engineer. "You listen in your room. That makes the room part of the system."

Other experts disagree. Room effects, they say, should be ruled out. Otherwise, they argue, you're just testing room acoustics—not the performance of the system.

Their reasoning is based on the fact that every room has resonances of its own. If a test tone on the record happens to match one of those resonances, the whole room booms like a barrel. This is called a "standing wave" in engineering lingo. Naturally, it throws off your judgment of frequency response.

But the engineers who designed the Columbia and HiFi/Stereo Review test records found a neat way to lick this problem. Instead of using steady notes as test tones, they put wobbly notes on the record. The rapid up-and-down warbling of these notes keeps the "standing wave" from building up at any given frequency.

These wobbles are so weird that when you first hear them you may find it hard to use them to judge anything. But after playing the record through a few times, you get used to the unearthly sounds, and with a little practice they'll help you run an accurate check on your hi-fi system.

(Continued on page 92)

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You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licensees. You will build 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.

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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 Receiver, Transmitter, Code Oscillator, Signal Tracer, Square Wave Generator and Signal Injector circuits. These are not unprofessional wiring and soldering on metal chassis, plus the new method of radio construction known as "Printed Circuitry." These circuits operate on your regular AC or DC house current.

THE "EDU-KIT" IS COMPLETE

You will receive all parts and instructions necessary to build twenty 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, hardware, tubing, punched metal chassis, instruction manuals, hook-up wire, solder, selenium rectifiers, coils, 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. Radio Amateur License training. You will also receive lessons for servicing television, using the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guide and a Quiz Book. You receive Membership in Radio-TV Club, Free Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.

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.

FREE EXTRAS

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- 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. Statuits, 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 Vafario, 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."

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CIRCLE NO. 31 ON READER SERVICE PAGE

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Increase your coverage with the new super-directional

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CB BASE STATION ANTENNA
(Based on our well-known MJ-27)

CHECK THESE FEATURES:

- ✓ rugged electrically and mechanically
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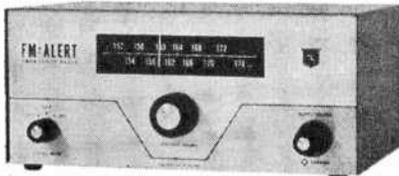
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CIRCLE NO. 25 ON READER SERVICE PAGE

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ambulance emergency
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First crystal FM emergency receiver at a down-to-earth price. Two crystal receive channels plus tunable control. Sensitive, selective, stable receiver. Smooth, adjustable squelch. Choice of two models: FM Alert 152—152 to 174 mc; or FM Alert 30—30 to 50 mc. Only \$89.95. Matching speaker \$9.95. Sold by communications specialists, or write Squires-Sanders Inc., Millington, N. J. 07946.



Squires Sanders

CIRCLE NO. 40 ON READER SERVICE PAGE

Separation & Tracking. The HiFi/Stereo Review record offers a unique test for stereo separation. A test signal is recorded in one channel, a reference tone in the other. You throw the stereo balance control all the way to the left, then all the way to the right. By comparing the loudness of the two signals, you get an accurate notion of how much "left" signal is sneaking over into the right channel and vice versa.

To measure the ability of your cartridge to track loud tones without distortion, the Columbia and HiFi/Stereo Review discs have test bands recorded with extreme amplitudes. These wide-swinging tracks will help you find the tracing pressure needed to keep your stylus from jumping grooves during a fortissimo.

On most records, the rumble test is simply a silent groove which shows up any rude noises made by your turntable, and flutter is usually revealed by a steady note on the record that refuses to stay steady in playback.

The ultimate test, however, is music. That's why many test records—including the Westminster, Command, and HiFi/Stereo Review records—contain several musical passages especially picked to give your system a tough workout. Blaring brass, crashing percussion, and the great power surges of deep bass combine into brilliant orchestral climaxes. But these rich orchestrations are sheer torture to your stereo components. If they come through this musical ordeal without jumping, buzzing, screeching or rattling, you can take one thing for granted: your rig is ready for anything. —30—

HEADPHONE CONTROL UNIT

(Continued from page 73)

equipped with a phasing switch which has two positions: "normal" and "reverse." If the speakers have been phased properly, the switch will be in the "normal" position.

It is simple to check the phasing of the headphone control unit. Place the "Mode" selector switch on your stereo amplifier in the monophonic position.

Be creative—and thrifty too!

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EICO supports your sense of achievement with no-compromise engineering, finest parts, dramatic esthetics, simple step-by-step instructions and large pictorial diagrams. You need no technical background—just pliers, screw-driver, soldering iron. Three million

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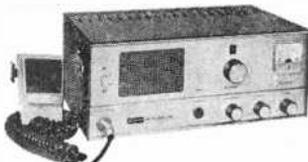
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TEST EQUIPMENT



Model 232 Peak-to-Peak VTVM. A must for color or B&W TV and industrial use. 7-non-skip ranges on all 4 functions. With Uni-Probe. © \$29.95 kit, \$49.95 wired.

CITIZENS BAND/ HAM RADIO



New Model 779 Sentinel 23 CB Transceiver. 23-channel frequency synthesizer provides crystal-controlled transmit and receive on all 23 channels. No additional crystals to buy ever! Features include dual conversion, illuminated S/R meter, adjustable squelch and noise limiter, TVI filter, 117VAC and 12VDC transistorized dual power supply. Also serves as 3.5 watt P.A. system. \$169.95 wired.

STEREO/HI-FI



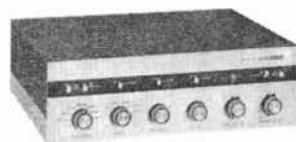
New Model 356B All Solid-State Automatic FM MPX Stereo Tuner/Amplifier. "Very satisfactory product, very attractive price"—Audio Magazine. No tubes, not even novistors. Delivers 112 watts IHF total to 4 ohms, 75 watts to 8 ohms. Completely pre-wired and pre-aligned RF, IF and MPX circuitry, plus plug-in transistor sockets. \$219.95 kit (optional walnut cabinet \$14.95), \$325.00 wired including walnut cabinet. UL approved.



Model 460 Wideband Direct-Coupled 5" Oscilloscope. DC-4.5mc for color and B&W TV service and lab use. Push-pull DC vertical amp., bal. or unbal. input. Automatic sync limiter and amp. \$89.95 kit, \$129.50 wired.



New Model 712 Sentinel 12 Dual Conversion 5-watt CB Transceiver. Permits 12-channel crystal-controlled transmit and receive, plus 23-channel tunable receive. Incorporates adjustable squelch & noise limiter, & switches for 3.5 watt P.A. use, spotting, & Part 15 operation. Transistorized 12VDC & 117VAC dual power supply. \$99.95 wired only.



Model ST70 70-Watt Integrated Stereo Amplifier. Best buy of highest ranked stereo amplifiers according to independent testing. \$99.95 kit, \$149.95 wired. ST40 40-Watt Integrated Stereo Amplifier. \$79.95 kit, \$129.95 wired. ST97 Matching FM MPX Stereo Tuner, \$89.95 kit; \$139.95 wired.



Model 324 RF Signal Generator. 150kc to 435mc range. For IF-RF alignment and signal tracing of TV, FM, AM, CB and mobile. Built-in and ext. modulation. \$32.95 kit, \$44.95 wired.



New Model 753 The one and only SSB AM CW Tri-Band Transceiver Kit. "The best ham transceiver buy for 1965"—Radio TV Experimenter Magazine. 200 watts PEP on 80, 40 and 20 meters. Receiver offset tuning, built-in VOX, high level dynamic ALC. Unequaled performance, features and appearance. Sentionally priced at \$179.95 kit, \$299.95 wired.

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1945-1965: TWENTY YEARS OF LEADERSHIP IN CREATIVE ELECTRONICS

CIRCLE NO. 9 ON READER SERVICE PAGE

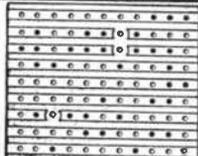
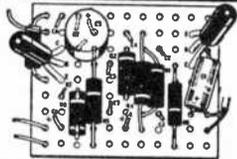
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CIRCLE NO. 15 ON READER SERVICE PAGE

Connect the control unit to the amplifier, and plug the earphones into the phone jack. The selector switch on the control unit should be in the "Speakers" position. Turn the stereo system on and adjust the speaker volume to your normal listening level, then flip the selector switch on the control to the "Phones" position and adjust the headphone volume to a comfortable level.

Now flip the phasing switch on the amplifier back and forth from the "Normal" to the "Reverse" position. The sound in the headphones will be "cleaner" and undistorted (and possibly slightly louder) in one of the positions. If this occurs when the phasing switch is in the "normal" position, no changes will have to be made within the control unit. If it occurs in the "reverse" position, then interchange the red and blue leads in the primary winding of either $T1$ or $T2$. (Note: disregard the blue lead not connected.)

If your amplifier is not equipped with a speaker phasing switch, then simply alternate the red and blue leads on one of the transformers for best sound.

It is possible to operate another set of stereo headphones from the control. To do so, you add another 3-conductor phone jack to the unit. Connect the "common" lines together. Another dual 100-ohm potentiometer should be paralleled across $R1a$ and $R1b$ if individual control of the two headphones is desired; if not, simply parallel the new phone jack across the existing one. —50—

ELECTRONICS DATA GUIDE

Would you like to have a handy pocket-sized guide which shows most-often-used formulas, color code and other important information? The formulas include those for figuring antenna length, impedance for series and parallel circuits, transformer relationships, Q , resonant frequency, wavelength, resistors in series and in parallel circuits, sine wave voltage and current relationships, power factor, and other conversion factors and constants. Also included is a decibel table for converting power, voltage and current ratios into db. The Electronics Data Guide is available free from Cleveland Institute of Electronics, 1776 E. 17 St., Cleveland, Ohio 44114—just send your name and address to the Institute and ask for one.



Why We Make the Model 211 Available Now

Although there are many stereo test records on the market today, most critical checks on existing test records have to be made with expensive test equipment.

Realizing this, HiFi/STEREO REVIEW decided to produce a record that allows you to check your stereo rig, accurately and completely, just by listening! A record that would be precise enough for technicians to use in the laboratory—and versatile enough for you to use in your home.

The result: the HiFi/STEREO REVIEW Model 211 Stereo Test Record!

Stereo Checks That Can Be Made With the Model 211

- ✓ Frequency response — a direct check of eighteen sections of the frequency spectrum, from 20 to 20,000 cps.
- ✓ Pickup tracking — the most sensitive tests ever available to the amateur for checking cartridge, stylus, and tone arm.
- ✓ Hum and rumble — foolproof tests that help you evaluate the actual audible levels of rumble and hum in your system.
- ✓ Flutter—a test to check whether your turntable's flutter is low, moderate, or high.
- ✓ Channel balance — two white-noise signals that allow you to match your system's stereo channels for level and tonal characteristics.
- ✓ Separation—an ingenious means of checking the stereo separation at seven different parts of the musical spectrum—from mid-bass to high treble.

ALSO: ✓ Stereo Spread
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Channel Identification

PLUS SUPER FIDELITY MUSIC!

The non-test side of this record consists of music recorded directly on the master disc, without going through the usual tape process. It's a superb demonstration of flawless recording technique. A demonstration that will amaze and entertain you and your friends.

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UNIQUE FEATURES OF HiFi/STEREO REVIEW'S MODEL 211 STEREO TEST RECORD

- Warble tones to minimize the distorting effects of room acoustics when making frequency-response checks.
- White-noise signals to allow the stereo channels to be matched in level and in tonal characteristics.
- Four specially designed tests to check distortion in stereo cartridges.
- Open-air recording of moving snare drums to minimize reverberation when checking stereo spread.

All Tests Can Be Made By Ear

HiFi/STEREO REVIEW's Model 211 Stereo Test Record will give you immediate answers to all of the questions you have about your stereo system. It's the most complete test record of its kind—contains the widest range of check-points ever included on one test disc! And you need no expensive test equipment. All checks can be made by ear!

Note to professionals: The Model 211 can be used as a highly efficient design and measurement tool. Recorded levels, frequencies, etc. have been controlled to very close tolerances — affording accurate numerical evaluation when used with test instruments.

DON'T MISS OUT—ORDER NOW

The Model 211 Stereo Test Record is a disc that has set the new standard for stereo test recording. There is an overwhelming demand for this record and orders will be filled by POPULAR ELECTRONICS promptly upon receipt. At the low price of \$4.98, this is a value you won't want to miss. Make sure you fill in and mail the coupon together with your check (\$4.98 per record) today.

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Please send me _____ test records at \$4.98 each. My check (or money order) for \$ _____ is enclosed. I understand that you will pay the postage. (Orders from outside the U.S.A. add 50c to partially defray postage and handling costs.) N.Y.C. residents please add 5% sales tax. N.Y. State residents 2% sales tax.

Name _____ (Please Print)

Address _____

City _____ Zone _____ State _____

Sorry—No charges or C.O.D. orders! PE-46

Robuk tape recorder; has 3 motors, 2 heads. Schematic and operating manual needed. (William Heiler, 1089 Huntingdon Pike, Bethayres, Pa.)

Link Model 1383 receiver; has 6 tubes; tunes FM between 152 and 162 mc. Schematic needed. (Jim H. Weber, 11349 Hannum Ave., Culver City, Calif. 90230)

PP-31/TIQ2-TM11-2596 vibrator power supply, surplus. Source for #127 vibrators needed. (Brother Joseph H. Winblad, Brother Rice High School, 10001 S. Pulaski Rd., Chicago, Ill. 60642)

Standard Electric Model BC-455 aircraft receiver. Tuning coils for 1.5 to 3.0 mc., and 3.0 to 6.0 mc., and instructions to convert to all bands needed. (A. Ponce W., P.O. Box M-8916, Mexico, D.F., Mexico)

Polyrad Model KR-6TS35 receiver, circa 1959. Oscillator coil and operating manual needed. (Richard C. Pasco, 661 Cavan Ln., Des Plaines, Ill. 60016)

Air Associates RT-27/PRC-14 transceiver, surplus. Operating manual needed. (William G. Alnoch, 2211 Tebeaw St., Waycross, Ga. 31501)

Espey Model 104 tube tester, circa 1942. Operating manual needed. (Robert Laag, 7405 Kingsley Way, Riverside, Calif.)

RCA Model AR 885A "Radiola" receiver, circa 1920; tunes 150 to 700 mc.; has 3 tubes. Operating manual, schematic, and source for tubes and batteries needed. **Majestic** Model 70 receiver; has 8 tubes. Schematic and source for parts needed. (Ben Pizzuto, 49 Brescia Blvd., Highland, N. Y. 12528)

Kay Lab closed-circuit television system, consisting of camera, Model 1984C; camera switcher, Model ACS-2; camera control, Model 1984CCU; and monitor, Model 1984-A2. Schematic, operating manual, and adjustment procedures needed. (John W. Smith, Dept. of Anatomy and Physiology, Indiana University, Bloomington, Ind. 47405)

Calex Model 602 "E-Z" tube tester. Schematic and tube chart needed. **Superior Instruments** Model 500 industrial analyzer. Schematic needed. (Basil A. Costanzo, 26281 Park Lane Dr., Euclid 32, Ohio)

Tritronic "Rangexpander" 11-meter CB transceiver. Schematic needed. (Charles Holton, 55 Pacific St., Massapequa Park, L. I., N. Y. 11762)

Philco Model 06546 receiver, circa 1937, chassis type 46 W, code 121; has 5 tubes; tunes 550 to 1600 kc. Schematic needed. (T. J. O'Meara, 849 Colson Ave., Ottawa 8, Ontario, Canada)

Philco Model 7008 visual alignment generator for TV and FM, circa 1953. Schematic and operating manual needed. (J. F. Robinson, P.O. Box 2346, R.C.A.F., Cold Lake, Alberta, Canada)

Morrow Model MB-500 AM transmitter, circa 1951; covers 80 to 10 meters on 4 bands. Power requirements and schematic needed. (Pfc. Howard E. Osterkamp, U.S. 55 785 151, U.S. Army, 29th Trans. Co. (ACDS), APO New York, N. Y. 09046)

Stromberg Carlson Model 425H receiver. Schematic and parts list needed. (Stephen R. Horton, 38 S. Cedar Ave., Maple Shade, N.J.)

Browning Model OL-15B oscillosynchroscope. Operating manual needed. (Birger Eriksson, Enspännargatan 14, 4 tr, Vällingby-Stockholm, Sweden)

Atwater Kent Model 20 receiver; has 5 01A's. Schematic and tubes needed. (Don Corsa, 945 Cherrywood Drive, Baldwin, N. Y.)

Teletest Model RT 203 Rejuvater, ser. 2268. Operating manual, schematic, and address of company needed. (Christopher F. Lindsay, RR #2, Corbell, Ontario, Canada)

Harvey Wells Model TBS-50D transmitter; covers 80 to 2 meters; 90 watts; has 6146 P.A., and 6L6 modulators. Schematic needed. (G. W. Westrup, 3913 Forest Ave., Downers Grove, Ill. 60515)

Atwater Kent Model 53 receiver. Copper tuning band needed. **Zenith** Model 1501; has 15 tubes. Dial face glass needed. (Gerald Lee Grulkey, 2801 Greenwood Dr., Richmond, Calif.)

Westinghouse Model WR-10 receiver. Schematic needed. (Eugene D. Kelm, 88 Freemont Ave., Depew, N.Y.)

Photronic Corp. Model PCA electronic flash. Schematic needed. (Arthur F. Altro, Box 193, Hartsdale, N.Y. 10530)

Gemark Model 1081 tape recorder, ser. 80313. Source for parts, and address of manufacturer needed. (H.P. Bharuchi, 1309 Wilson Ave., Apt. #508, Downsview, Ontario, Canada)

RCA RB-2 receiver, made for U.S. Navy; tunes 4 to 27 mc.; has 16 tubes and separate power supply. Operating manual needed. (Fritz Husher, 677 Chestnut St., Waban, Mass. 02168)

Radiomarine Corp. receiver, type CRM-46153, circa 1942; tunes 240 to 2050 kc.; has 8 tubes. Schematic and source for parts needed. **Radio City Products** Model 805B receiver. Source for parts and address of manufacturer needed. (Robert Morrison, R.D. #2, Box 69, Franklin, Pa. 16323)

Belmont Model 5D110 receiver; tunes 540 to 1800 kc. Schematic, operating manual, and parts list needed. (Lee Freshwater, 2601 Lancaster Dr., Muncie, Ind. 47304)

Zenith receiver, circa 1940; tunes BC and s.w. from 5.6 to 16 mc. on 2 bands; has 6 tubes. Schematic and parts list needed. (Allan B. Kachel, 137-22 70th Rd., Flushing, N.Y. 11367)

MN26C receiver, made for U.S. Navy; tunes 150 to 1500 kc.; has 12 tubes. Operating manual needed. (Don Erickson, 24360 Myers St., Sunnymead, Calif. 92388, and Steve Price, 1162 18th Ave., Longview, Wis. 98632)

Philco Model 65 receiver, circa 1943; tunes AM; has 6 tubes. Schematic needed. (Allen Comstock, Box 387, Langley Wash. 98260)

Eagle Radio "Neutrodyne" receiver, ser. 8210, type B, circa 1924. Schematic and tube layout needed. (Willard Lamade, RD #1, Alburg, Vt.)

Gonset "Communicator IB (or II)" transceiver, circa 1957; covers 49 to 54 mc. Schematic, operating manual, and service data needed. (Jay M. Finkelstein, 377 Eastern Pkwy., Brooklyn, N.Y. 11216)

Atwater Kent Model 20 receiver, ser. 68653; has 5 tubes. Schematic and source for parts needed. (Fredrick Karstedt, P.O. Box 138, Cecil, Wis. 54111)

-30-

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Will substitute up to 4 different components at the same time

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CIRCLE NO. 26 ON READER SERVICE PAGE

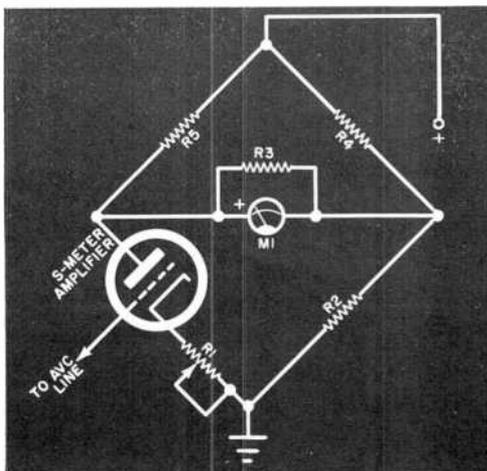
CONFUSED ABOUT S-UNITS?

(Continued from page 56)

it on the receiver panel *upside down*, while inverting the meter scale so it is read right side up. This explains why some receiver S-meters are pivoted at the top of the meter face, and why others, although pivoted at the bottom, deflect to the right when you turn off the receiver.

A more elaborate, but forward-reading S-meter circuit is also shown on p. 55. This is essentially a bridge circuit (see familiar version below) where R_4 and R_5 are equal in value. The other legs in the bridge are R_2 and the equivalent of tube resistance plus the zero-adjust potentiometer R_1 . The pot is adjusted for zero reading on the meter (balancing the bridge) with no a.v.c. voltage present. Application of a.v.c. reduces the amount of current flowing through the tube, thus increasing the tube resistance and unbalancing the bridge, causing the meter needle to deflect upward.

Regardless of the kind of circuit your S-meter has, always remember to use it as an indicator of relative signal strength in the receiver, and nothing more, except for tuning and alignment of the receiver and transmitter. When you tell a guy that his signal is 30 db over S9, you are actually indicating how well his signal is getting through your rig. —30—



This diagram shows the bridge circuit of a forward-reading S-meter in its more familiar presentation.

April, 1966



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CIRCLE NO. 42 ON READER SERVICE PAGE

ON THE CITIZENS BAND

(Continued from page 78)

secretary/treasurer; and four board members.

Brooklyn, Maryland: Brooklyn Park CB Radio Club. Officers are: Richard Lehr, director; Raymond Cole, assistant director; Bob Lehr, secretary/treasurer; and a three-member board. Club is associated with REACT and HELP projects.

St. Louis, Missouri: Mid-West REACT Service. Organized October, 1965. The 24 members serve St. Louis, East St. Louis, and surrounding territory. Group is also active in HELP project.

Parlin, New Jersey: Middlesex County Emergency Communications, Inc. The 35 members serve motorists in distress. Club is also dedicated to assisting communities with emergency communications when needed. All mobiles are equipped to handle most emergencies; members carry first aid equipment and are trained to aid accident victims. This group is seeking permission from police and fire departments within the county to permit members to assist at accident scenes and during emergencies where additional manpower may be required.

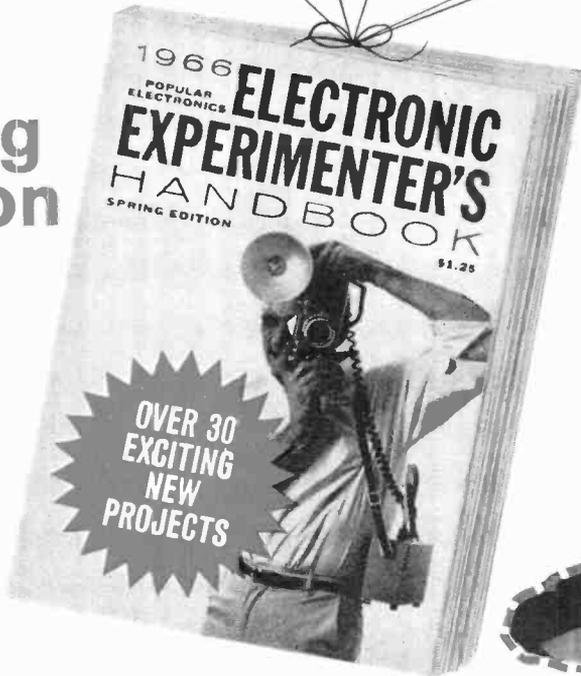
Bronx, New York: Bronx Westchester CB Association, Inc. Current membership: 66. Club just received charter and incorporation papers. A CB 11-Meter Award program is under way for "states heard" (only) and verified, for CB'ers, amateurs, or SWL's. Interested communicators should contact Mr. Leo Fleury, 1075 Grand Concourse, Bronx 52, N. Y.

Long Island, New York: Circuit Breakers CB Radio Club. The 30 members are active in REACT and Civil Defense programs. Club serves Suffolk County. Present officers: Fred Kenneth, 2Q6944, president; John Lee, KBI5116, vice president; Charles Reimann, KBG0711, chairman; Richard Marcotte, KBI3195, secretary; James Eckardt, KBI4001, treasurer; and Harry Weissgerber, KBI2540, sergeant at arms.

Scarsdale, New York: Radio Respond. This group organized in the summer of 1965 with 13 members. Emergency net serves towns of Scarsdale, Hartsdale, and White Plains in Westchester County. They expect to be associated with Civil Defense and REACT in the near future. Coordinators for the emergency group are Mark Linett, KMD5177; and Tom Garwin, KMD4638.

Toronto, Ontario, Canada: North Toronto CB Radio Group. Club publishes clean-cut quarterly journal, supplements it with periodic bulletins. Articles are directed to

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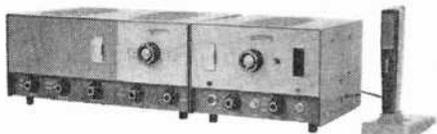
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CIRCLE NO. 5 ON READER SERVICE PAGE

all age groups; a technical column is included. Officers: Bill Jones, XM41-069, president and journal editor; Peter Dunn, XM41-2915, vice president; Jane Eyer, XM41-4408, secretary/treasurer.

Don't forget to keep us posted on upcoming events and activities your group or club will be involved with. Give us all the details on your emergency and rescue squads, and enclose a good, clear photograph so we can show the rest of the CB world what's happening at your end of the band. The address is: Matt P. Spinello, CB Editor, POPULAR ELECTRONICS, One Park Avenue, New York, N. Y. 10016.

I'll CB'ing you.

—Matt, KHC2060

AMATEUR RADIO

(Continued from page 80)

nadian government recently assigned the 144 to 144.1 mc. segment for exclusive amateur CW use in Canada. By the way, the maximum authorized amateur transmitter input power in Canada is now 1000 watts, the same as it is in the United States.

How a QSL Bureau Works. In the November, 1965, issue of the Rochester Amateur Radio Association's *RaRa Rag*, Dick Bourne, WA2HUV, describes how the world's busiest QSL Bureau works. The second call area QSL Bureau operated for the ARRL by the North Jersey DX Association handles thousands of incoming DX cards each month.

Every few days, a club member picks up the cards from P. O. Box 303, Bradley Beach, N.J. 07720, and holds them until just before the monthly club meeting. Then, several members open the packages and sort the cards alphabetically—a task which takes several hours. At the club meeting, the cards are distributed to additional NJDXA members who place them in envelopes and mail them. Envelopes must be supplied, or paid for, by the recipients. Cards for which no envelopes are provided are held for one year and then destroyed.

The envelopes come from two sources. Amateurs in the second call area who work foreign amateurs may send a supply of stamped, pre-addressed, business-size envelopes with their call letters prominently printed in the upper left corner to the Bureau. Or they may send \$1, their call letters and address, and the club will prepare up to 12 envelopes as they are required.

(Continued on page 106)

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This has resulted in a gold mine of new business for licensed service technicians. A typical mobile radio service contract pays an average of about \$100 a month. It's possible for one trained technician to maintain eight to ten such mobile systems. Some men cover as many as fifteen systems, each with perhaps a dozen units.

Coming Impact of UHF

This demand for licensed operators and service technicians will be boosted again in the next 5 years by the mushrooming of UHF television. To the 500 or so VHF television stations now in operation, several times that many UHF stations may be added by the licensing of UHF channels and the sale of 10 million all-channel sets per year.

Opportunities in Plants

And there are other exciting opportunities in aerospace industries, electronics manufacturers, telephone companies, and plants operated by electronic automation. Inside industrial plants like these, it's the licensed technician who is always considered first for promotion and in-plant training programs. The reason is simple. Passing the Federal government's FCC exam and get-

ting your license is widely accepted proof that you know the fundamentals of electronics.

So why doesn't everybody who "tinkers" with electronic components get an FCC License and start cleaning up?

The answer: it's not that simple. The government's licensing exam is tough. In fact, an average of two out of every three men who take the FCC exam fail.

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Although the second method means more work, the NJDXA prefers it, because it helps solve the problem of storing thousands of pre-addressed envelopes. Other call area QSL Bureaus with more room or less business prefer the envelopes. The addresses of the other U.S. and Canadian QSL Bureaus appear in the *Communications Handbook*.

News and Views

Ron, W9JVF, reports via 75-meter phone that his pet peeve is the operator who asks, "What's your handle for the log?" What the fellow is actually saying is, "I really don't care what your name is. I just want to put something in my logbook."...

Bruce Heimlich, WN2UVP, 8-09 Plymouth Drive, Fair Lawn, N. J., wound up his new EICO 723 60-watt transmitter, Hammarlund HQ-170 receiver, and Hy-Gain 14-AVQ antenna and worked seven states and Canada his first three days on the air...

Curt Bowen, WA9NVF, 1316 Oneida St., Joliet, Ill., received QSL cards from 27 states as a Novice. After six weeks as a General, Curt has 41 states worked, 33 confirmed, and has also picked up a lot of Canadians, Bermudans, Belgians, and Mexicans. He used a Heathkit DX-60A transmitter and HR-10 receiver in conjunction with 40- and 20-meter dipole antennas—and, as a General, a Heathkit HG-10 VFO. Under construction is an 80-meter vertical antenna and a 20-watt, 2-meter transmitter.

Bill Fries, 7906 Meredith Ave., Omaha, Nebr., spent seven months SWL'ing as WPEØEPA before getting his Novice call, **WNØMNO**. He now works 40 and 15 meters using a 40-meter dipole antenna in tandem with the Heathkit DX-60A transmitter and HR-10 receiver twins. The combination has racked up 21 states... **Dale E. Putnam, WNØIRJ**, Wray, Colo., runs close to 75 watts to his Heathkit DX-40 transmitter on 80, 40, and 15 meters feeding separate dipole antennas for each band. Dale receives on 80 and 40 meters with a war-surplus BC-348, which tunes only up to 18 mc. An old Hallicrafters S-38, therefore, takes over on 21 mc. Dale boasts a 100% record on QSL returns from 26 states! When he earns his General ticket, he will operate a Heathkit DX-100 and an SB-10 SSB adapter on 80 and 40 meters. Besides hamming, he likes to motorcycle... If you are one of those who think there really aren't any hams in Utah, your Amateur Editor now has evidence to the contrary, thanks to **Steve Hartsis, WN7DAM**, 627 "K" St., Salt Lake City, Utah. Steve sent a photograph of Mark, **WN7DAN**; Robert, **WN7EDV**; Homer, **WN7DXD**; and himself, all from Salt Lake City. Unfortunately, the picture is too dark for reproduction here. Each of them operates on 40 and 15 meters using Knight-Kit T-60 transmitters. Furthermore, they will gladly work anyone needing a Utah QSL card. Steve receives on a Hallicrafters SX-140 receiver and has a vertical ground-plane antenna; with this combination, he has worked 38 states and six countries. If all goes well, the four of them will have their General tickets by the time you read this item.

Gary Kaser, W8KME, 314 Birch Lane, Paw Paw, Mich., sticks mostly to 40 and 80 meters. Using a Johnson "Ranger" transmitter and a Lafayette KT-320 receiver, and either a horizontal dipole antenna 45' high or a vertical antenna, he has worked 45 states and has QSL cards from 43 of them. Gary has a 20-wpm code certificate and says he acknowledges all QSL cards received... **Bob Pace, WB6NBU**, 7721 Westlawn Ave., Los Angeles, Calif., has worked all states and all continents in his 10 months as a General, but he still needs a QSL card from Africa for his WAC certificate. Forty countries—25 of them confirmed—have been worked in the process. Although Bob uses a Swan-

350 SSB/CW transceiver, he is on CW at least 90% of the time. And when he is not on 15 meters—his favorite haunt since he worked two Europeans in a row there—you will find WB6NBU on 20 meters. Oh, yes. Bob's antenna farm grows but a single crop—a Hy-Gain 14-AVQ vertical.

Gary Tremblay, W6GNYM, 4566 Deal Drive Long Beach, Calif., quickly decided that the interference was too great for him on the lower frequency amateur bands; so he transferred operations from 80 and 40 meters to 2 meters. On "2" he transmits with an AMECO TX-62 and receives either on the receiver mode of his Heathkit "Twoer" or on a Gonset GR-212 and a home-brew converter. A solitary 19" ground-plane antenna takes care of the outside work. Gary expects to stay on the VHF's, even when his General ticket arrives.

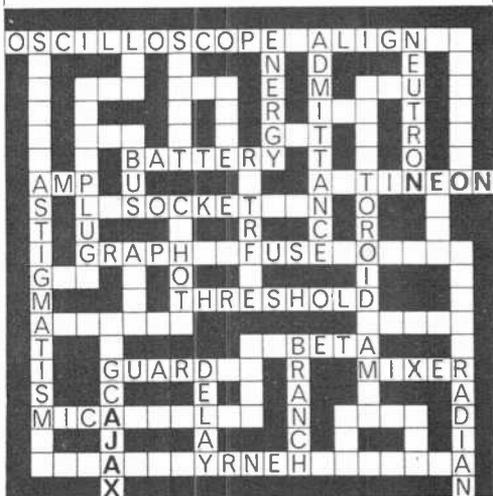
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73, Herb, W9EGQ

ELECTROMAZE SOLUTION

(Puzzle appears on page 63)

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| 2 Energy | 16 Plug |
| 3 Battery | 17 Amp |
| 4 Bus | 18 Astigmatism |
| 5 Socket | 19 Mica |
| 6 TRF | |
| 7 Fuse | Exit 2. Ajax |
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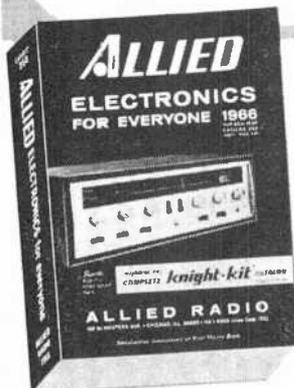


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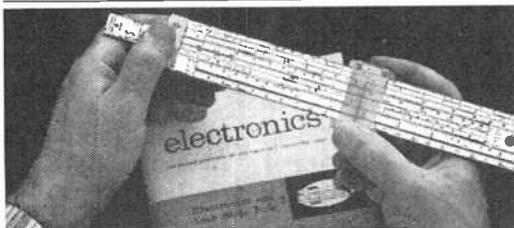
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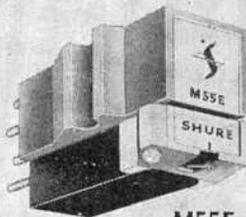
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SHORT-WAVE LISTENING

(Continued from page 69)

kc. and 99.9 mc. will be used in the system's AM and FM operations."

Another report, from Western Pennsylvania, reads: "Television Station WTAE, Pittsburgh, recently had a film on the air which showed the *Blue Eagle*, a U. S. Navy Lockheed Constellation plane. It was equipped with several antennas protruding and complete facilities, including multiple banks of tape machines and studios, control consoles, and other items. The plane reportedly had just returned from the Pacific area where it was broadcasting to our troops in Vietnam. A stopover was made in Pittsburgh for fitting it out with special equipment which is produced locally in that area. The plane was going to be used in some sort of geological survey work and its broadcasting days may be over . . ."

Your Short-Wave Editor would draw the following conclusion from the above reports (bear in mind that this is only conjecture and not, as yet, fact): The plane in Pittsburgh was a test model. Additional equipment, possibly for the short waves, FM, and television, was installed. The plane made more tests in eastern areas, thereby producing the transmissions which were reported by many of our monitors. Two new planes were outfitted with equipment, based on the tests made by the single plane, and the latter, having served its purpose, will now go into service in the geological survey field.

Monitors in West Coast areas, as well as those in the South Pacific and Southeast Asia sectors, should be on the watch for broadcasts from the newer planes.

CURRENT STATION REPORTS

The following is a resume of current reports. 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. All times shown are Greenwich Mean Time (GMT) and the 24-hour system is used. Reports should be sent to SHORT-WAVE LISTENING, P.O. Box 333, Cherry Hill, N.J., 08034, in time to reach your Short-Wave Editor by the fifth of each month; be sure to include your WPE Monitor Registration and the make and model number of your receiver. We regret that we are unable to use all of the reports received each month, due to space limitations, but we are grateful to all contributors.

Albania—Tirana has a new Eng. xmsn at 2200-2230 on 7265 kc. Albanian, probably to N.A., is aired at 0030-0057 on 9470 and 12,035 kc.

Angola—Luanda is currently quite audible on 7235 kc. from 0600 s/on, preceded by the IS and followed by a version of "A Portuguesa," a plainly given ID, and a program of pop music.

Bechuanaland—A portable radio xmtr has been flown into this country for the purpose of relaying

the BBC into Rhodesia, which has stopped re-broadcasts since its unilateral declaration of independence. A tentative schedule lists the hours of operation as 0400-0730, 1015-1145, and 1545-2015, on approximately 908 kc. A short-wave outlet is reportedly in progress and one report shows activity from Francistown on 5016 kc. at 0400.

British Guiana—Station ZFY, *R. Demerara*, Georgetown, is active again on 3265 kc. after an absence of over a year. It was noted from 0240 with a brief news summary at 0243, and s/off anmts for 3265 and 760 kc. at 0245. The signal suggests a new and powerful xmtr.

Ceylon—The Commercial Service from Colombo was logged with BBC news ending at 1710, then music (that's just past high noon. EST!—*Ed.*), while the VOA outlet from Colombo was tuned in Eng. at 1230. Both xmsns were on 7110 kc.

For the first time in two years, the VOA relay on 11,835 kc. is audible from 1100 to 1300 s/off with mostly Eng. programming. The 9667-kc. outlet continues to be heard from 1230 with pop music, at 1300 with a BBC news relay, then pop music and anmts to 1330, and a request program from 1500 to 1530.

Colombia—The station reported here during the past two months is, according to an overseas source, *La Voz del Llano*, operating on 6117 kc. A new station is *Emisora Mariana*, Pasto, 4761 kc., noted relaying HJHZ, 1250 kc., evenings to 0310 s/off.

Congo (East)—Elisabethville, 11,866 kc., is again being heard from 1730 to 2058 with pop music and anmts, mostly in French. Another outlet on 9540 kc. is believed to be Elisabethville on a new frequency; it was logged at 0433-0448 with local music and French.

Dominican Republic—Station HICN, *R. Antillas*, 4962 kc., was noted from 0050 to 0115 when HJAE,

UNIDENTIFIED STATIONS

Here are some real stumbers that only the most ambitious SWL's will want to try to identify. Let us know how you make out.

An Iranian regional station was heard on 7082 kc., at 1740-1830 s/off, with an ID (partial) of *Inja Sadoye*. . . . There was some music of the Balkan and Persian types and some chanting. The spoken words were given very slowly and loudly.

Ecuadorians have been noted on 4971 kc. at 0305 with news in Spanish, giving Loja date-lines, and on 3929.5 kc. at 0440-0452 with a sporting event.

Brazilians have been logged on 4915 kc. at 0925 with commercials in Portuguese (three stations are listed for this frequency) and on 3295 kc. from 0840 to 0900 with uninterrupted Latin American vocals and anmts in Portuguese. The ID at 0900 was given over a theme played on a celeste.

Another Latin American station is on 4795.5 kc. around 0300-0400 using a format typical of that region, but with poor audio.

Two Asians have been heard on 4220 kc. and 4020 kc., both around 1115-1130. They may be in Peking, but the language used was not Chinese. The two stations were not in parallel.

Colombia, signed on. Station HIAF, *R. Monte Cristy*, 3245 kc., is good around 0850-0900 with a "Rumbo Dominicano" program in Spanish.

Ecuador—Possibly a new station is *R. Mil*, 3370 kc., heard at 0310-0330 with anmts in Spanish and Eng. stating that the station is broadcasting "from Esmeraldas, Ecuador." Station HCVS6, *La Voz de Saquisilí*, is very weak around 0227-0245 on 4903 kc. Station HCAU2, *Emisoras Atalaya*, Guayaquil, seems to be the one logged on 4600 kc. at times.

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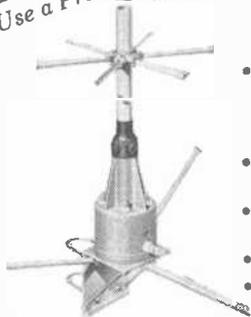
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usually with sports at 0200; this may be a move from 4790 kc. Another move involves HCJA5, *La Voz del Rio Tarqui*, Cuenca, from 3995 kc. to the listed 3990-kc. channel where it is heard with listener's request periods to 0430 closing. Station HCJB, Ecuador, has Eng. to 2130, news in Spanish to 2136, then music, on 11,770 kc.

Ethiopia—ETLF, Addis Ababa, was noted closing its "evening" religious broadcast in Eng. at 1815 on a new frequency of 9575 kc.

France—Two new frequencies for Paris are; 11,905 kc., noted from 0700 with news in French and dual to 11,920 kc.; and 11,950 kc. noted from 1730 s/on but badly mixed with VOA-Greenville.

French Guiana—Cayenne has a new frequency and a revised schedule: 3385 kc. at 0915-1100 and 2030-0100; and 6170 kc. at 1500-1800. The best bet is the 3385-kc. outlet from 0915 s/on. This station has also been noted testing on the same frequency with pop music until 0300 closing. Evidently they have a new and higher powered xmtr.

Guatemala—After an absence of 20 years, TGWA, Guatemala City, has made an appearance on 15,170 kc. where it is heard well from 1800 to 2200 and around 0330 with marimba music. The dual channel, 9760 kc., has also been reopened, and the station is heard on that frequency at 2312-0002 and around 0515 with requests for reports. To date, only Spanish has been noted.

India—All India Radio, Delhi, has Eng. to Australia and New Zealand on 11,710 kc. at 1000-1100, with news at opening, commentary, Indian music, and a talk. This is a good bet for those who need India.

Indonesia—West Coast DX'ers might look for YDF3, 17,795 kc. (20 kw.), or YDF8, 9865 kc. (50 kw.), around 1430-1530 in English. Another good bet is an apparently very powerful xmtr on 7190 kc., heard as late as 1330. The location is not known, but it may be Tandung Pinang or Sukarnopura.

Iran—Teheran is found on 7135 kc. continuously from 1445 to 1715, mostly in Persian. This is another example of reception of a station at a time when you would least expect it to be heard.

Lebanon—The current schedule for xmsns from Beirut to Africa, North and South America, and Europe, reads as follows: to Africa at 1830-2030 (Eng. at 1830-1900) on 11,770 kc.; to South America at 2300-0100 (no Eng.) on 9750 kc.; to North America, including the U. S., Canada, Mexico and Antilles, plus Europe, at 0310-0200 (in French), at 0200-0230 (Arabic to the East Coast), at 0230-0300 (Eng.) at 0300-0330 (Arabic to the West Coast),

SHORT-WAVE ABBREVIATIONS

anmt—Announcement	kw.—Kilowatts
BBC—British Broadcasting Corporation	N.A.—North America
CBC—Canadian Broadcasting Corporation	QRM—Station interference
Eng.—English	R.—Radio
ID—Identification	s/off—Sign-off
IS—Interval signal	s/on—Sign-on
kc.—Kilocycles	VOA—Voice of America
	xmsn—Transmission
	xmtr—Transmitter

and at 0330-0400 (Spanish) on 9710 kc. Omnidirectional xmsns are broadcast daily at 0430-0730 and 1415-1820 on 5980 kc., and at 0930-1400 on 9545 kc.

Malaysia—A recent verification from *R. Malaysia Singapore* listed Eng. daily at 1200-1500, 1700-2200, and 2300-0600 on 11,940 kc. The IS consists of three notes played on chimes. Reports go to: Broadcast Division, Ministry of Culture, P. O. Box 1902, Singapore.

New Zealand—*R. New Zealand*, Wellington, broadcasts to the Pacific Islands at 1700-1945 and 0600-0845 on 9540 and 11,780 kc., and at 2000-0545 on 15,280 kc.; to Australia at 2000-2230 on 11,780

DX PROVINCES AWARDS PRESENTED

To be eligible for one of the DX Provinces Awards designed for WPE Monitor Certificate holders, you must have verified stations (any frequency or service) in 6, 8, 10, or 12 Canadian provinces. (For these awards, the Yukon Territory and the Northwest Territories are considered as provinces.) The following DX'ers are the first to qualify for and receive awards in the categories indicated.

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TEN PROVINCES VERIFIED

Mike Shannon (WPE9HDX), Appleton, Wis.
Chuck Edwards (WPE4BNK), Fort Lauderdale, Fla.

EIGHT PROVINCES VERIFIED

Gregg Calkin (VE1PE3L), Saint John, N. B., Canada
Mike Wolowich (VE3PE1TW), Fort William, Ont., Canada

SIX PROVINCES VERIFIED

Roger Camire (WPE1GCK), Manchester, N. H.
Craig Dewey (WPE9HLD), Menomonee Falls, Wis.
Tim Turnbull (VE2PE1GS), Montreal, Que., Canada
Patrick Richardson (WPE9GLO), Chicago, Ill.
Kenneth Kuberacki (WPE8CM), Detroit, Mich.
Lawrence Share (WPE9HNO), Chicago, Ill.
Martin Schneider (WPE2SV), Watertown, N. Y.
Bruce Gemmill (VE7PE1AD), Vancouver, B.C., Canada

kc., and at 2245-0345 on 15,110 kc.; and to Antarctica at 0815-0845 (Sundays only) on 9540 kc.

Nigeria—The latest schedule from Lagos reads: 1300-2205 on 7275 and 9690 kc.; 1300-2.60 on 11,915 and 15,255 kc. Reports indicate best reception at 2000-2200. All outlets are now up to 100-kw. power.

Panama (Republic)—The only known short-wave outlet on the air at present is *La Voz del Barú*, David, 6045 kc. You may be able to log it with native music and a gong between some selections up to 0355 s/off.

Peru—Station OAX8W, *R. Sideral*, Pucallpa, has been noted on 9752 kc. at 2230-0028 with Latin American vocals.

Station OAX9D, *R. Tropical*, Tarapoto, has moved from 9710 kc. to 9772 kc. where it has been noted prior to 2300. Do not confuse this station with OAX80, *R. Amazonas*, Iquitos, which is only 4 kc. lower.

Portugal—Although Lisbon's "Voice of the West" program is announced for 5975 kc., it has been heard evenings anywhere from 5960 to 5985 kc.

Spain—Madrid has been noted on a new and unlisted frequency of 9568 kc. from 1950 to 2010 in Spanish. This station has also been heard testing on 9755 kc. with s/off in Eng. at 0145.

Spanish Guiana—The latest schedule from Santa Isabel, Fernando Poo, is: 0700-2300 in Spanish (on weekends), 1600-1630 in Annobonesa, 1630-1730 in Pamue, 1730-1830 in Bubi, and 1830-1900 in Eng. (the 1600-1900 schedule is for weekdays). No frequencies were given but presumably they are 6240, 6345 and/or 7160 kc.

Sudan—An accurate schedule from *R. Omdurman* has been difficult to obtain for some time. Information from the station now gives the following: an Arabic program, daily except Friday, at 0400-0530, 0600-0900, 1100-1300, and 1400-2100; and on Fridays at 0400-0500, 0600-1300, and 1400-2100; a daily local program for Southern Sudan at 1300-1400; and daily European Service at 0530-0600. Frequencies used are 4494 and 9508 kc.

Sweden—*R. Sweden*, Stockholm, reports the extension of two programs: The Home Service, First Program, Sundays, on 6065 kc., from 0930-1030 to 0930-1115, omnidirectional; and the daily xmsn to South America on 11,705 kc. from 0100-0315 to 0100-0345. The omnidirectional European Service at 0900-1215 is now aired on 9625 kc. (previously 9620 kc.) due to heavy QRM; at 1400-1430, however, 9620 kc. is still used.

Thailand—Bangkok, 11,943 kc., opens in Eng. at 1025, at a fair level but with poor modulation. Listen for the IS chimes of DO-MI-SOL-MI-DO.

U.S.S.R.—Leningrad, 6200 kc., was heard with six pips at 0800 and an unfamiliar 8-note IS on chimes; then the ID "Govorit Leningrad, govorit gorod Lenina" was given twice, after which there was a narrative reading. Dual channels are 7290 and 9625 kc. and all three broadcasts were heard until past 1000. (The monitor who sent in this report also states: "I hasten to add that the xmtrs are not located in Leningrad—they are either in the Moscow area or the Far East, or a combination of the two. The programs are produced in the Leningrad studios 'dyla sovmyorya'—roughly, 'for

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CIRCLE NO. 23 ON READER SERVICE PAGE

Soviet people at sea—but are carried by any number of Russian xmt's. The Eng. xmsn from Vilnius has been noted on 6200 kc., for example."

Other xmsns not-too-easy to hear are: Frunze, Kirghiz SSR, 4010 kc., at 1142-1159 with Moscow relay, and six pips at 1200; Krasnoyarsk, Asiatic SSR, 5260 kc., in the clear at 1140 with songs in Russian; Petrozavodsk, 5065 kc., in Russian at 0940 with Home Service programming; and Blagoveshchensk, 4957 kc., with talks and music at 0530-0545 fade-out.

A Turkish monitor reports hearing *R. Moscow* on 900 kc. (medium waves) from 0100 to 0130 in

SHORT-WAVE CONTRIBUTORS

Bill Smith (WPE1FZ), Usbridge, Mass.
Chris Lobdell (WPE1GCI), Reading, Mass.
Roger Camire, Jr. (WPE1GK), Manchester, N. H.
Stanley Mayo (WPE1GMP), Portland, Maine
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Eng., to 0200 in Spanish, and to 0230 in English. The program was announced as being beamed to N.A. (*Editor's Note:* This was probably a Home Service relay of the N.A. program. It is highly unlikely that N.A. DX'ers would be able to hear it on 900 kc. because of the large number of North American stations already on that channel. It's worth a try, however).

Vietnam (North)—Hanoi, 11,755 kc., is heard at 1250 with Eastern music, at 1300 with ID in Eng., and at 1305 with Chinese music. An outlet, believed to be Hanoi, on 15,116 kc., is heard from 0007 to 0025 s/off with nationalistic music and commentary in Vietnamese.

—50—

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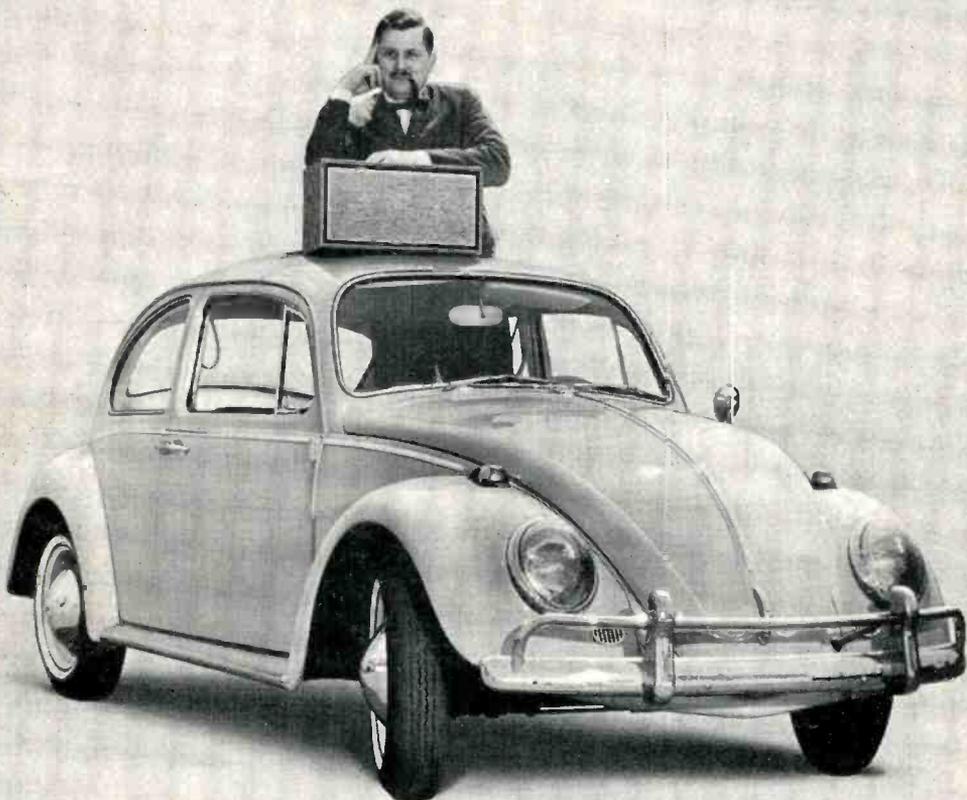
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