

TV TAPE RECORDING AT HOME

POPULAR ELECTRONICS

SEPTEMBER
1963

35
CENTS

BUILD

- Safety Flasher
- 2-Meter Superhet
- Model Control Unit
- Hi-Fi Test Load
- Stereo Indicator
- Ident-o-Minder
- Photocell Circuits

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- DX Program Directory for SWL
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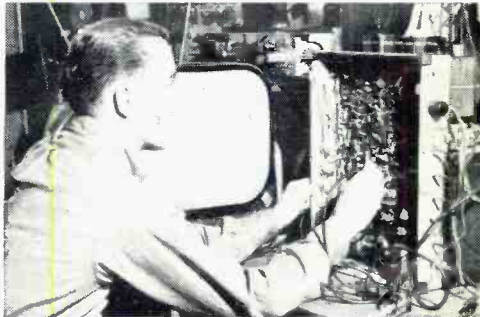
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VOLUME 19

SEPTEMBER 1963

NUMBER 3

Special Features

Calling All SWL DX'ers	Gerry L. Dexter, WPEØJJ	39
A Home Television Tape Recorder for Under \$200.....	W. Steve Bacon	60
Student Experimental Radio Station	David T. Geiser, WA2ANU/20W2456	69

Electronic Construction Projects

2-Meter Simple Superhet	Charles Green, W3IKH	43
Power Line Antenna Adapter	Lou Garner	50
The Identio-Minder	Hartland B. Smith, W8VVD	51
Automatic Safety Flasher	Lou Garner	56
Better Model Control for \$5.50	Homer L. Davidson	66
40-Meter Antenna for Small Roof	Herb S. Brier, W9EGQ	75

Audio and High Fidelity

Resistive Load for Hi-Fi Test	Walter Temcor	54
Hi-Fi Lab Check: EICO ST-70 Stereo Integrated Amplifier		58
Build a Stereo Indicator	Charles Caringella	63

Amateur, CB, and SWL

Satellites on the Air		31
New CB Features "DSRC"		68
Across the Ham Bands:		
Amateur License Fees and ARRL Petition.....	Herb S. Brier, W9EGQ	73
Short-Wave Report: Notes from Your Short-Wave Editor's Desk	Hank Bennett, W2PNA	79
DX Awards		83
Short-Wave Broadcast Predictions	Stanley Leinwoll	84
On the Citizens Band	Matt P. Spinello, 18W4689	87

Electronic Features and New Developments

Photocell Circuits for Experimenters	C. L. Henry	47
Transistor Replacement Technique	Roy E. Pafenberg, W4WKM	62
New Nomenclature	E. G. Louis	71
Lissajous Pattern Quiz	Robert P. Balin	72
Transistor Topics	Lou Garner	76
"All's Fair—" (a Carl and Jerry Adventure)	John T. Frye, W9EGV	82

Departments

Tips and Techniques	6
Coming Next Month	10
Letter Tray	11
Out of Tune	20
POP'tronics Bookshelf	22
Operation Assist	26
New Products	27
This Month's Cover	32

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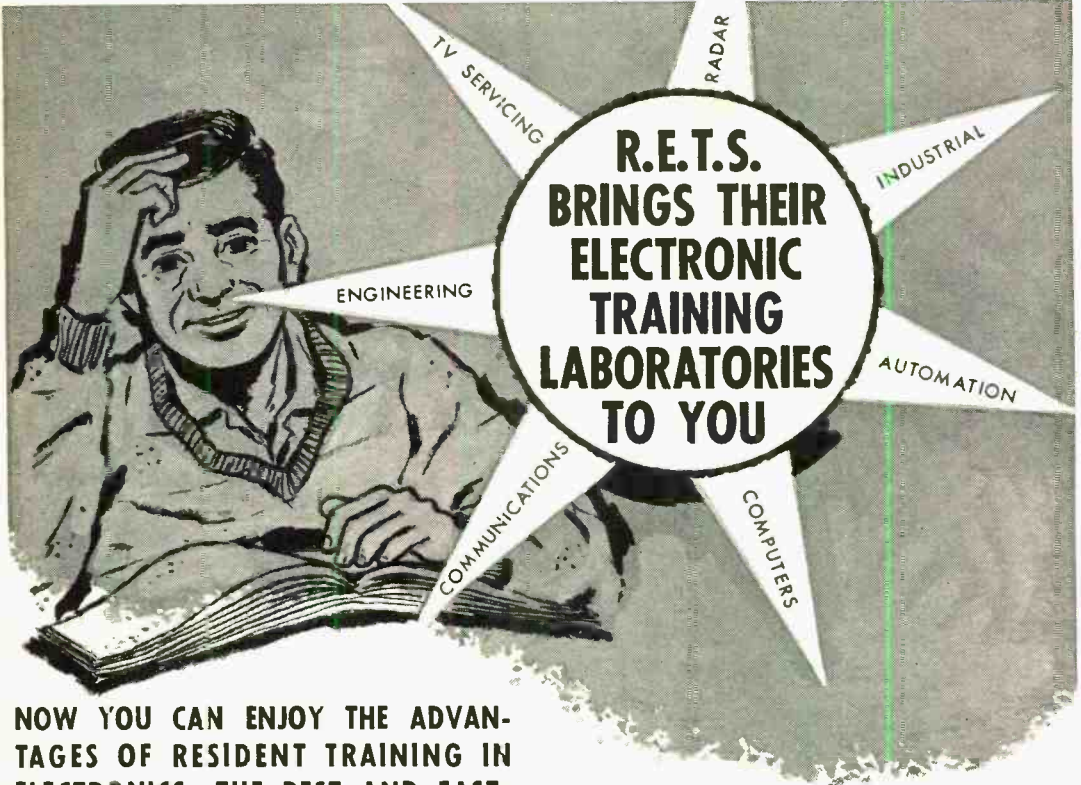


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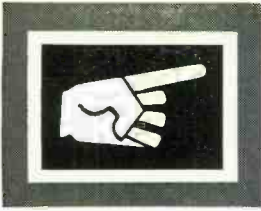
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Tips and Techniques

ANOTHER KIND OF THIRD HAND

If you're suffering from the same old problem of not having enough hands to hold a component, a soldering iron, and a roll of solder (unless, of course, you use your



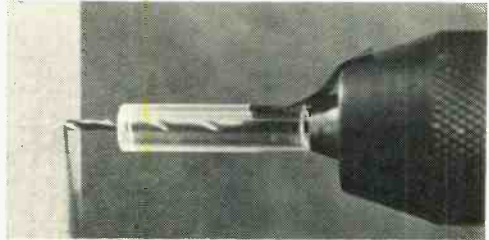
teeth!), try this idea. Slip a small rubber grommet over the end of a pair of needle-nose pliers and use them to hold the com-

ponent. This "third hand" can also be used when you solder transistors, diodes or other small parts requiring a heat sink.

—Charles Caringella

SLEEVE PROTECTS AGAINST DRILLING DAMAGE

If you find it necessary to drill holes in delicate pieces of electronic equipment, protect them from damage by using a piece of polystyrene tubing over the bit as shown in the photo. The tubing, which can be



taped to the drill chuck to hold it in place, will keep the bit from plunging through the hole when the metal gives way, and then striking and damaging delicate components on the other side of the panel.

—Stanley E. Bammel

(Continued on page 10)

NEW Increased Range for Short Wave Listening with a **Hy-Gain** ANTENNA

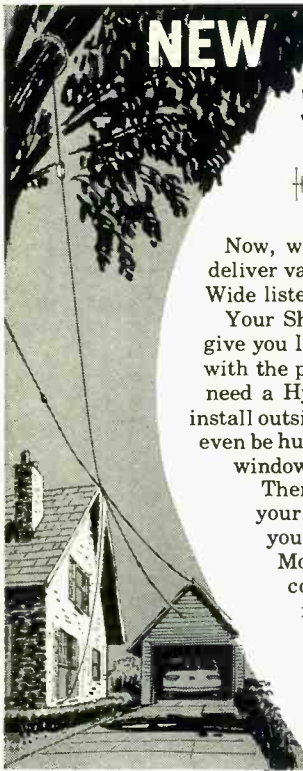
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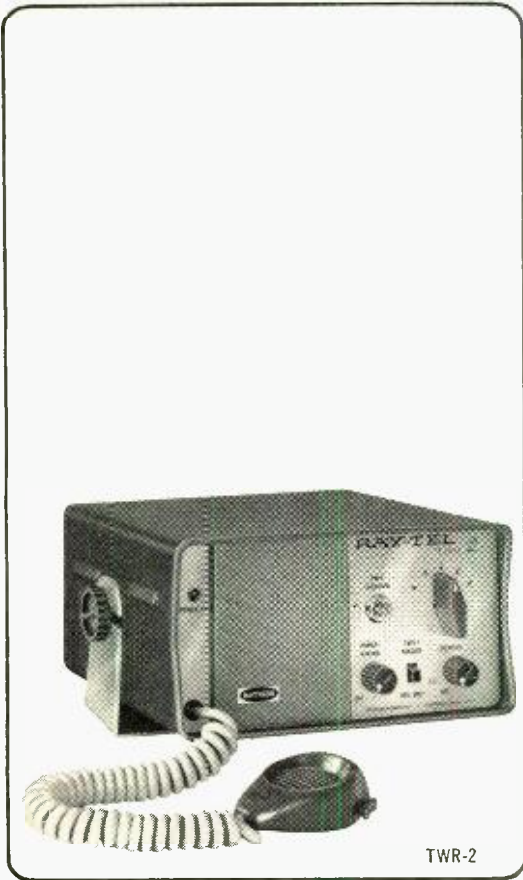
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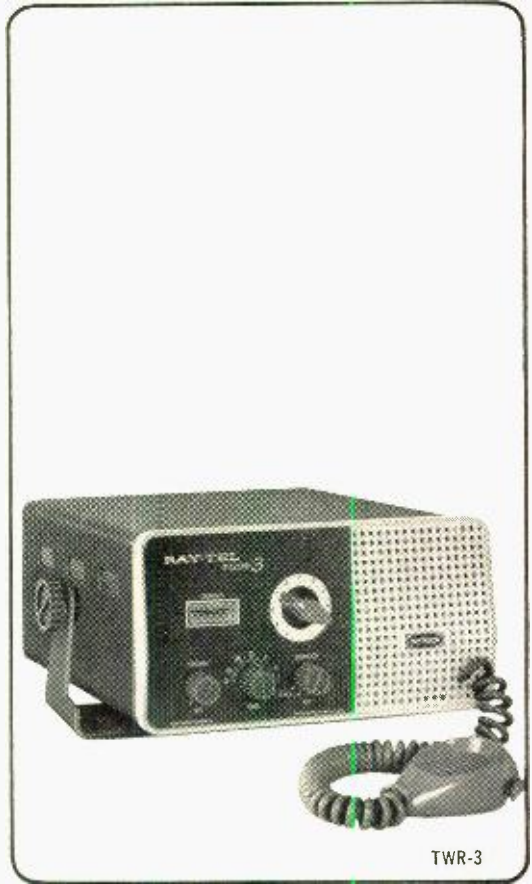
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*Suggested list price

For descriptive literature on both the Ray-Tel TWR-2 and TWR-3, please write Raytheon Company, Distributor Products Division, Westwood, Massachusetts.



If you lost your job in electronics

tomorrow Yes, it can happen to you. Particularly if you have less education in electronics than other men at your job level. And you may have trouble finding another. Openings are few for men with limited education. If you find one, it may pay less than you're making now. Employers are much more demanding than they were a few years ago. Only men with sound education in electronics have any real security. You would be wise to go back to school—but that may be impossible. But you can get additional education through a CREI Home Study Program in Electronic Engineering Technology. CREI programs cover every major area of electronics from communications to computers—even the new field of space electronics. You're eligible if you work in electronics and have a high school education. And CREI has a refresher course if you need to brush up on fundamentals. For FREE book, mail coupon or write CREI, Dept. 1209-A, 3224 Sixteenth St. N.W., Washington 10, D.C.



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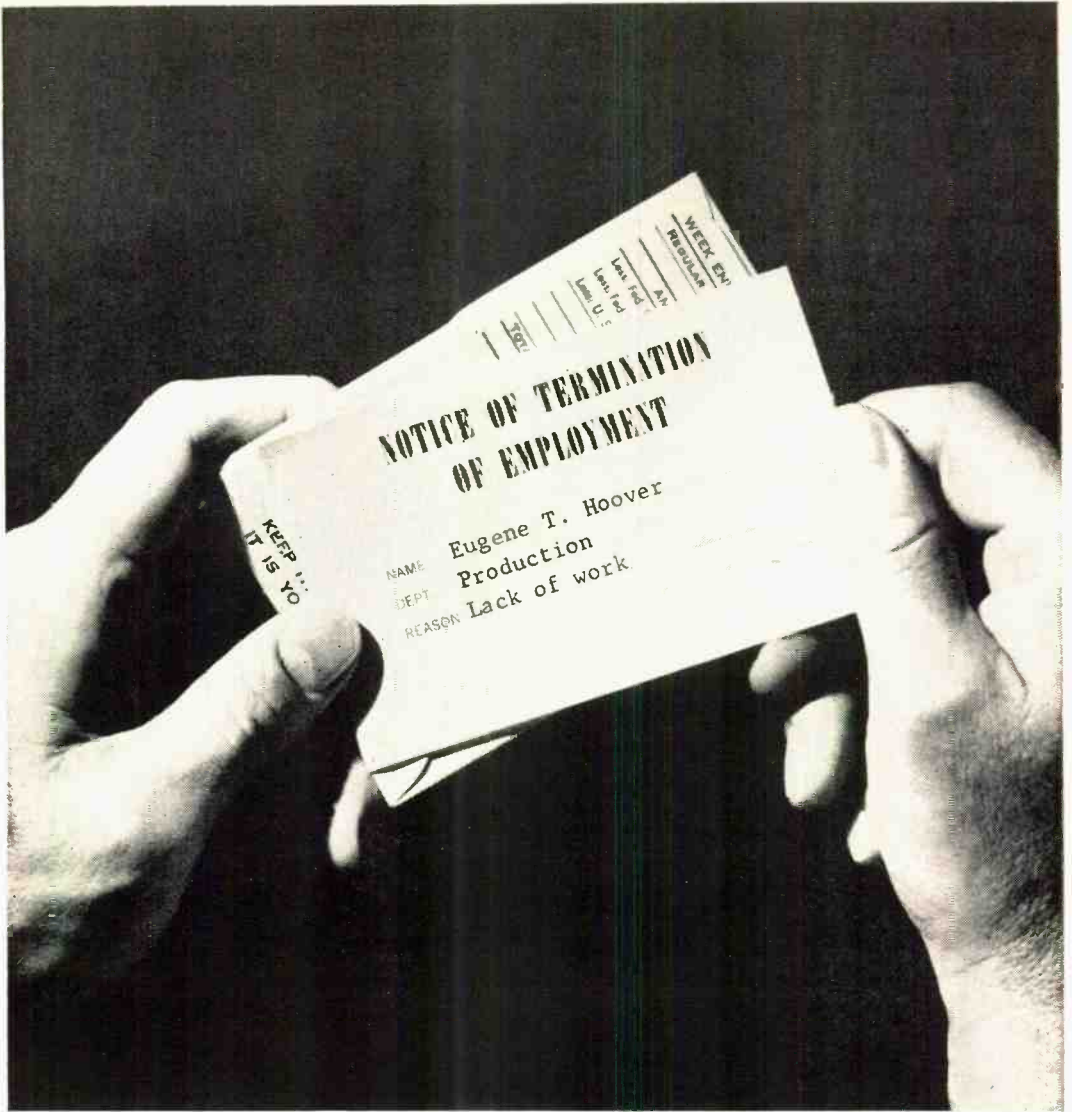
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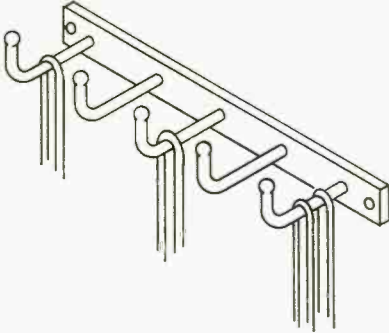
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Tips

(Continued from page 6)

TIE RACK FOR TEST LEADS

After Christmas or your most recent birthday is safely in the past, you may want to dispose of your appreciated but not very practical gifts. Perhaps you've received several necktie or belt hangers over the years as I have—from some well-meaning maiden aunt, etc. If you have more hangers



than things to hang on them, here's the answer: They perform very well as neat racks for test leads.

—Kent A. Mitchell, W3WTO

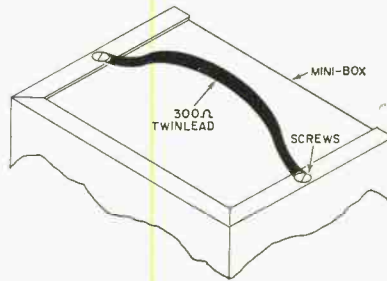
MAKE LOW-VALUE PENCIL RESISTORS

The next time you need a low value resistor (anything from 1 to 5000 ohms) for a breadboard circuit or as a temporary expedient until you can get to a parts store, try a wooden pencil or a spare lead for your mechanical pencil. If you use a wooden pencil, cut off the eraser end, measure the resistance of its full length, and then measure and cut off a piece just a little longer than you need. Notch the wood at each end and fasten wire leads around the pencil lead, being careful not to break it. If bare mechanical pencil lead is used, make the resistor pigtails by first looping the wire around a nail about the size of the lead. Insert the lead in the loops, and gently squeeze the wire and solder. Or an old tube socket will supply handy connectors to slip on the end of the lead. Another idea is to make an adjustable resistor or temporary potentiometer with a long piece of lead and a slider arm. A wooden pencil can also be tapped at several points and pigtails attached. The resistance of a piece of lead depends on its type and diameter as well as its length.

—SFC William F. Fahlgren

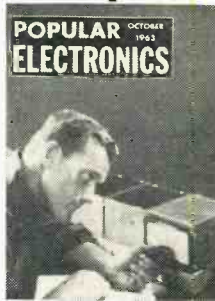
HANDLES FOR MINIBOXES

Good-looking, sturdy handles for units built into Miniboxes can be made with pieces of 300-ohm TV twin lead. Determine how long



the handle should be, cut the twin lead to length, and punch a small hole at each end through the center of the insulation. Fasten the handle in place with two of the screws that hold the box together. If the unit is rather heavy, a stronger handle can be made by cutting the twin lead a bit longer than needed, stripping off some insulation at each end, and twisting and soldering the two conductors together. —Jay Prager

COMING NEXT MONTH



Now you can listen to police and fire company units, airplanes, hams, FM broadcast and TV sound—all with a single receiver. Build this brand-new VHF unit with modular "front ends" designed to cover various frequency ranges. Part 1, of a five-part story, gives details on the audio, BFO, and power supply sections.

ON SALE SEPTEMBER 26

- **TRANSISTORIZED IGNITION**
The overwhelming response to the "Operation PICKUP" ignition system (June, 1963) has resulted in a follow-up with diagrams for building positive ground systems. Included are parts values for modifying the 12-volt "PICKUP" for 6 volts, and techniques to simplify the assembly.
- **THE SQUEALER**
Recall our two previous articles on "Starved Circuits" in July 1961 and November 1962? Here is an audio oscillator that needs a bare minimum of plate voltage and can be used as a code oscillator or audio test set.



Letter Tray

Address correspondence for this department to:
Letters Editor, POPULAR ELECTRONICS
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Or Five-Cent Beer?

■ With the advent of changing times, one cannot help but wonder what has happened to the good ol' days:

"What If's"

- What if "Across the Ham Bands" was changed back to "The Transmitting Tower?"
- What if Herb Brier didn't come to the end of his column with "News and Views?"
- What if Carl and Jerry were still back in high school?
- What if POP'tronics still had pictorial wiring views for all projects?
- What if the price were still a quarter?
- What if *everybody* read POPULAR ELECTRONICS?

PHIL HILL, WASIFB
Walled Lake, Mich.

While we appreciate your faithful readership, Phil, we must note that the days of the nickel beer and trolley ride have vanished into limbo, even as the dodo bird. "The Transmitting Tower" didn't imply that any reception went on—in other words, everybody talked, nobody listened—and Herb Brier has to end his column somewhere to make room for the other P.E. features. We do try to use pictorials where needed. Carl and Jerry would have flunked out of high school by this time, and if POPULAR ELECTRONICS were still a quarter, it would have vanished. On your last point we agree, and as the world's largest-selling electronics magazine, we're getting there!

High-Pass Filters for TVI

■ I especially liked the article by Fred Blechman on "That Vile Interference" (March, 1963, page 77), but one piece of information is incorrect. On the basis of the article, I requested a high-pass filter from RCA. They informed me that a service man would have to inspect the set and determine whether or not I needed a filter; they would then supply one if he requested it. In other words, you have to pay for a service call before this manufacturer will help you. I'd like to see an article on how to make your own high-pass filter.

E. H. NEWSON
Seattle, Wash.

Lodestar Metal Locator Pans Out

■ I had good success in building "The Lodestar" (September, 1962), with some modifications, as a school science project. To begin with, I had more npn transistors (mostly from surplus com-

puter boards) than pnp's, so I turned the battery and electrolytics around. Having a "Jack Benny-ish" attitude toward buying modules, and a pocket full of 10- μ f. miniature capacitors, I built my own three-stage RC-coupled amplifier section. I found that the excellent circuit described in the article is quite flexible. With all my tinkering, I got such good results that I could pick up a watch at 6", a coin at 1", and a transformer or other heavy object at 2' or more underground.

JAMES G. STUART
Mont Clare, Pa.

Congratulations on your project, Jim. We were especially impressed with your ingenuity in re-designing the circuit to suit the parts you had available. Perhaps other readers will want to make similar modifications.

More Emphasis on Hi-Fi

■ In the June issue of POP'tronics, I counted approximately 30 pages of ham and CB articles and less than three pages on high fidelity. The



only hi-fi article was entitled, ironically enough, "Hi-Fi Shutoff." I'm not against ham radio or CB, but how about more articles on hi-fi?

RICHARD A. BUSCH
Silver Spring, Md.

There will be some good articles coming your way in the near future, Richard. We trust that you enjoyed "Slim Silhouette Speaker Systems" in the July issue.

Heart Monitor Wins Prize

■ I built the heart monitor featured in the June, 1961 issue ("Listen to Your Heart," page 47) and won a "first" in the local science fair. Could you publish another project that would make a good science fair entry? Also, could you tell me if it's possible to determine the cone resonance of a speaker without expensive equipment?

MIKE LIVELY
Sheppard A. F. Base, Texas

Glad you were able to put the heart monitor to good use, Mike. We are always on the lookout for good science fair project possibilities, and you may find one that appeals to you in almost any issue. In answer to your second question, connect the output of any audio signal generator in series with

Letter Tray

(Continued from page 11)

a resistance of about 100 ohms to the voice coil of the speaker. Vary the frequency of the generator until the point of greatest response is found.

Bouquet for Totalizer

■ I recently built the photoelectric counter ("1-2-3 Totalizer," August, 1962) in about 20 hours. Although the article said that it would count over 400 times a minute, I got it to count 500 times a minute or about 8 times a second. Congratulations to author Harold Reed for this one.

FREDERIC HENDRICKSON
Takoma Park, Md.

Building For "One-Sixty"

■ Here are two ideas that might be considered by those building the excellent 160-meter transmitter featured in the June, 1963, issue ("Top Band Goes Mobile"). The war-surplus 12A6, which can be bought for next to nothing, can probably be substituted for the 12AQ5's, and should be close enough in characteristics to function well with the same circuit components. It is slightly larger (octal base), but the filament drain is low (150 ma. vs. 225 ma. for the 12AQ5), and it has the shielding advantage of being a metal tube. Secondly, I believe that the ideal modulation trans-

former is the one marked "alternate" on the schematic diagram due to the fact that the unused secondary can be used to drive a loudspeaker to check the modulator or, with the r.f. tubes pulled, for public address purposes.

FRANK BODINE, W4JVZ
Fort Myers, Fla.

Quiz Notebook

■ Maybe this isn't a new idea, but as soon as I read each issue of POP'tronics, I immediately cut out Robert P. Balin's Quiz and staple it to a piece of paper with the answer box on the reverse side. I insert the quizzes in a loose-leaf notebook, and frequently go through the series as a self-examination.

RICO CARNEVALE, WNØBTB
St. Joseph, Mo.

Mail From Chile

■ As an 18-year-old beginner in ham radio, I feel that I owe much to POPULAR ELECTRONICS. Here in Chile only a few copies are sold, and one must fight to get one even though they come two or three months late if at all. Incidentally, I am interested in building a 6-meter transmitter with a 829-B tube, and a 6-meter receiver. Perhaps some P.E. readers could help me out with suitable diagrams.

CLAUDIO SPENCER G.
Gmo. Franke 2362
Santiago, Chile

(Continued on page 14)

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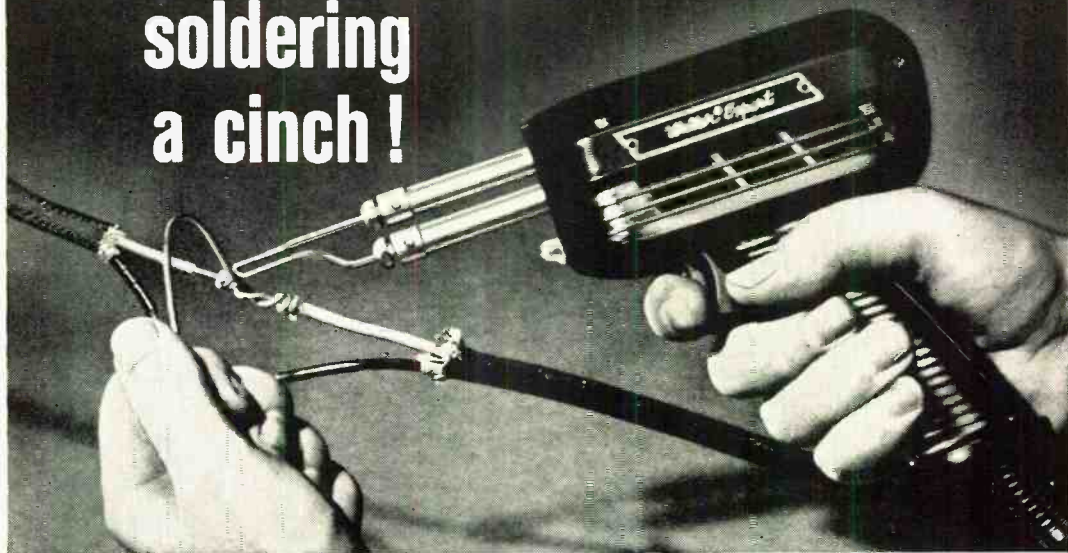
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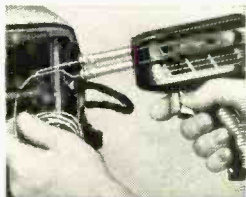
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Letter Tray

(Continued from page 12)

Hula Hoop Antenna Applauded

■ The photo below shows a "Hula Hoop" (July, 1963, page 25) installed on the 1962 Ranchero which we use in our business. The construction details given in your article were excellent, and



our antenna went together exactly as expected. More important, it outperforms and outreaches any other antenna we have ever used. A hearty "well-done" to the author for an all-around good project.

PHIL M. HENSLEY
Hensley Motor Co.
Antioch, Ill.

More On Bottled Radios

■ I was surprised to learn that Dennis Mullenix and others have had difficulty in building a radio inside a bottle ("Letter Tray," July, 1963). If Dennis will give me his address, I will be glad to



send him a bottled-up radio which I am in the process of building.

MICHAEL KALMAN
Wethersfield, Conn.

Michael and all other "radio-bottlers" are hereby invited to send us the circuit used, bottle dimensions, and a good, clear photograph (no crystal sets or simple transistor circuits, please!).

"Add-On S-Meter" Gives Good Results

■ I was extremely pleased with the results that I got with the "Add-On S-Meter" (February, 1963, page 48). It is the first POP'tronics project I have attempted, and it works perfectly.

OWEN GRAY, VE3PE1WA
Toronto, Ontario

(Continued on page 20)

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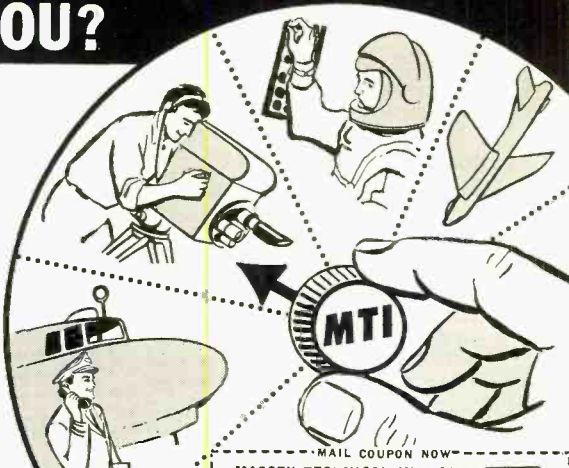
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Letter Tray

(Continued from page 14)

WPE SWL's Take Note

Although space does not permit printing letters from all those desiring to form WPE Clubs, the following readers have expressed a desire to do so, and should be contacted by those interested: Dick Swanson, WPEØBNM, Wellman 3, Iowa (WPEØ's); Jim Fitch, WPE6EQZ, 163 Hartzell Ave., Redlands, Calif. (WPE6's); Bud Cancasci, WPE8FZR, 10614 Manor Ave., Cleveland 4, Ohio (WPE8's); Tim Odbert, WPE3DXY, 2511 Urbana Dr., Silver Spring, Md. (WPE3's), and David M. Reed, 546 Pond Run Road, Raceland, Ky.

Other last-minute letters were received from: John Davis, WPEØBUI, 1102 West 5th St., Oswego, Kan. (WPEØ's); Randy Riskin, WPE9FFF, 806 Webster Lane, Des Plaines, Ill. (WPE9's); Samuel W. Kyriess, WPE7ASI, KN7WPN, 3715 E. Long St., Sweet Home, Ore. (Northwest SWL club); Fred Wright, WPE8GDK, 1228 W. North St., Kalamazoo, Mich. (Great Lakes short-wave club); Thomas Schoen, WPE8FAM, 1634 Birdie Dr., Toledo 15, Ohio (Midwest SWL club). —30—

Out of Tune

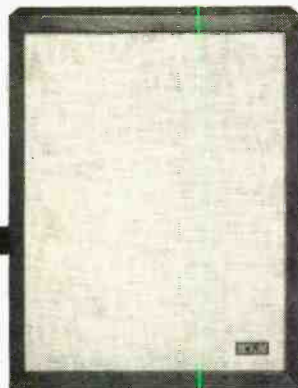


The Signal Stethoscope (July, 1963, page 61). The second pole of the two-pole, five-position wafer switch, which controls the PK543 amplifier, is shown with a jumper connected between lugs 3 and 4. The jumper should be connected between lugs 2 and 3.

Slim Silhouette Speaker Systems (July, 1963, pages 42-43). The center speaker on page 43, identified erroneously in the caption on page 42, is actually the Model X-20 slim-compact speaker system made by Jensen Mfg. Co. The Utah SH4, used in the "Sorcerer" system (described in the text on page 43) uses a "wrap around" magnet structure rather than an inverted magnet; the voice coil is relatively large for a speaker of this type.

Exterminate TV Sync-Bug Interference! (July, 1963, page 52). The TV horizontal sweep frequency is actually 15.75 kc. This high power waveform, rich in interference-causing harmonics, is applied to the *yoke leads* rather than to the leads of the picture tube socket. It is suggested that a mailing tube or piece of heavy vinyl sleeving be slipped over the *yoke leads*, and that they then be shielded with a piece of grounded foil as described in the text. —30—

Breaking the 'small enclosure barrier' with... frequency contouring



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There are two major problems in achieving good reproduction in a small speaker — to reduce distortion and to provide decent bass performance. Always, the process of solving one of these problems has intensified the other. To reduce distortion, we need precise control over the movement of the cone. To provide adequate bass output, we need to move large volumes of air. The smaller the cone in relation to the size of the magnet, the more precisely it can be controlled. But the larger the cone, the more air it can push. The customary solution — a separate large speaker for the bass — can not be fully effective in a small enclosure. The unavoidable compromise of these factors in a small speaker system has always meant unacceptable bass performance and/or unacceptable distortion.

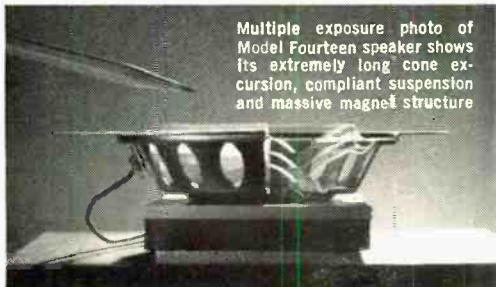
In order to solve these problems, the KLH Model Fourteen embodies a series of vital departures from any speaker system ever produced before. The Model Fourteen contains two extremely compliant speakers. The diameter of their cones is only 3". Yet they are

lem, since the damping effect of the heavy magnet increases at the lower frequencies, tending to restrict the bass output of the speaker. The crucial innovation in the Model Fourteen — designed to extend its bass output while preserving the advantages of a heavy magnet and a small cone — is the first use, in a small multi-speaker system, of the revolutionary technique called frequency contouring. This technique was pioneered by KLH in the now famous Model Eight FM Receiving System and Model Eleven Portable Stereophonic Phonograph. Incorporated in the Model Fourteen is a passive electronic network which has been designed with the speakers as an integrated unit. This network reshapes the power output of any conventional amplifier to match exactly the low frequency power requirements of the speakers, so that their bass output remains flat far below its normal roll-off point. Through the magic of this new technique, it is at last possible to avoid the drawbacks of tweeter, midrange speaker, woofer and crossover networks in a compact speaker system. It is now possible to have all the advantages of a small-diameter, high-compliance speaker and heavy magnet — flawless smoothness throughout its frequency range; clean transparent midrange and highs — and full, undistorted bass performance, too. The KLH Model Fourteen, at any given loudness level within its operating range, will deliver more bass power, at lower frequencies, with less distortion than any other speaker of comparable size or cost.

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During its development, the Model Fourteen has been tested against every other small speaker system with any claim to respectability, in order to help us define and solve the special problems of the small speaker. The result of this development is a clarity, smoothness and freedom from distortion, a frequency range, dynamic range and bass performance you have never heard before in a compact speaker. You will find that the overall sound quality of the Model Fourteen is not only beyond that of all other compact speaker systems, but also beyond your fondest hopes for any compact speaker.

*Slightly higher west of Rockies



Multiple exposure photo of Model Fourteen speaker shows its extremely long cone excursion, compliant suspension and massive magnet structure

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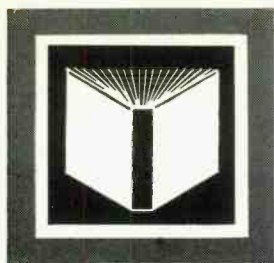


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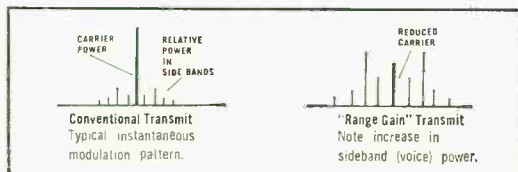
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The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. You will learn radio theory, construction and servicing. You will learn how to build radios, using regular schematics; how to solder and wire in a professional manner; how to service and trouble-shoot radios. You will learn how to work with punched metal chassis as well as the new Printed Circuit chassis. You will learn the principles of RF and AF amplifiers and oscillators, detectors, rectifiers, test equipment. You will learn and practice code, using the Progressive Code Oscillator. You will build 20 Receiver, Transmitter, Code Oscillator, Signal Tracer, Square Wave Generator, Amplifier and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for TV. In brief, you will receive a basic education in Electronics and Radio, worth many times the small price you pay, only \$26.95 complete.

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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." You begin by building a simple radio. Gradually, in a progressive manner, and at your own rate, you construct more advanced multiple tube radio circuits, learn more advanced theory and techniques, and do work like a professional radio technician. These circuits operate on your regular AC or DC house current.

**THE KIT FOR
EVERYONE**

You do not need the slightest background in radio or science. The "Edu-Kit" is used by Young and old, schools and clubs, by Armed Forces Personnel and Veterans Administration for training and rehabilitation. One of the most important aspects of the "Edu-Kit" is the Consultation Service which we provide. We welcome students to send us their problems, whether related to any of the material covered in the "Edu-Kit" course, or encountered in other experiences in the field of electronics.

THE "EDU-KIT" IS COMPLETE

You will receive all parts and instructions necessary to build 20 different radio and electronic circuits, each guaranteed to operate. Our kits contain tubes, tube sockets, variable, electrolytic, mica, ceramic and paper dielectric condensers, resistors, tie strips, coils, hardware, tubing, punched metal chassis, Instruction Manuals, hookup wire, solder, selenium rectifiers, volume controls, 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, pliers-cutters, an alignment tool, professional electric soldering iron, wrench set, a self-powered, dynamic Radio and Electronics Tester. The "Edu-Kit" also includes Code instructions and the Progressive Code Oscillator. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guide, FCC Amateur License Training Book, and a Quiz Book.

All parts, components, etc., of the "Edu-Kit" are 100% unconditionally guaranteed, brand new, carefully selected, tested and matched. Everything is yours to keep. The complete price of this practical home Radio and Electronics course is only \$26.95.

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Bookshelf

(Continued from page 22)

progress toward WAS, WAZ, and WAC, plus sections for keeping DX records, a call-name-QTH index, a future calls schedule, net data, and equipment records. A list of world prefixes is thrown in for good measure. Although, as a station log, this publication leaves something to be desired—there is too much printing on the pages for one thing, and the price is considerably higher than that for more conventional logs—hams who like to keep careful records will find it very useful.

Published by **Howard W. Sams & Co., Inc.**, 4300 W. 62nd St., Indianapolis 6, Ind. 128 pages 8 1/4" x 11", plus indexed dividers. Soft cover. \$3.95.

**HOW TO INSTALL AND REPAIR
MARINE ELECTRONIC EQUIPMENT**

by **Elbert Robberson**

It's always a pleasure to read something written by POPULAR ELECTRONICS contributor Elbert Robberson. A competent writer in any case, Robberson has a particular feel for his "first love"—marine electronics. That feel is obvious in this book, which encompasses topics as diverse as galvanic action, Loran, Consolan, test equipment, radiotelephones, employment opportunities, sailboat antennas, etc. Unlike the books assembled by some would-be authors, this one is not a rehash of press releases and manufacturers' throw-aways. The information is carefully presented and as thorough as any reader could desire.

Published by **Hayden Publishing Co., Inc.**, 850 Third Ave., New York 22, N.Y. 206 pages. Soft cover, \$4.50; hard cover, \$5.95.

Capsule Reviews

ALL ABOUT HIGH FIDELITY & STEREO AND UNDERSTANDING AND USING CITIZENS BAND RADIO. Allied Radio has become an increasingly active publisher of very basic handbooks. These two titles are the latest additions to the Allied Radio library. Both books are filled with good solid information and written to appeal to the novice—be he interested in stereo/hi-fi or CB'ing. Published by **Allied Radio Corp.**, 100 N. Western Ave., Chicago 80, Ill. Both soft cover. Hi-fi book is 96 pages (75 cents); CB book is 112 pages (50 cents).

Always say you saw it in—POPULAR ELECTRONICS

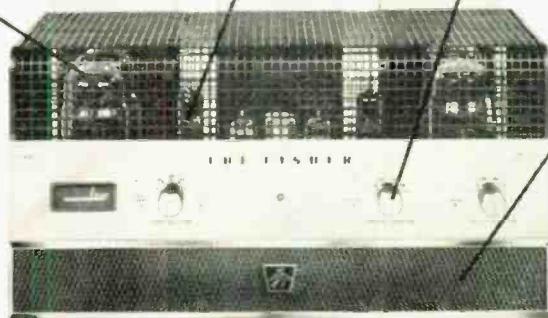
Type 8417 output pentodes with cavity anode design.

Totally resonance-free ultra-wide-band output transformers.

Triode-connected dual power-pentode driver stage.

Oscilloscope-type cathode-follower input stage with compensated attenuator.

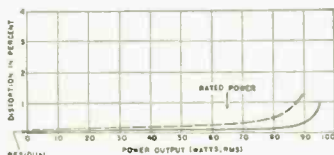
Hinged cover for rarely used controls (bias and balance).



150 Watts of the cleanest audio power ever produced!

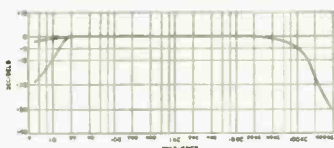
The Fisher K-1000 is a challenge to the severest critics and most discriminating judges of professional sound reproducing equipment, both as to specifications and listening quality. Its music power rating is 150 watts IHF Standard, with both channels driven. The RMS power rating, again with both channels driven, is 130 watts (65 watts per channel). However, as a glance at the intermodulation curve will show, each channel will deliver 80 watts at 0.5% 1M distortion, thus indicating the extreme conservativeness of the official rating.

Total Harmonic Distortion at 1 kc: Solid Line
Intermodulation Distortion (60 cps/7 kc, 4:1):
Dotted Line



The output stage of the K-1000 is engineered around the newly developed 8417 beam power pentodes, *never before used in any electronic device*. Designed specifically for use in this amplifier, the 8417 offers extreme linearity, resulting in greatly reduced distortion, and has unusually low drive-voltage requirements, permitting the previous stages to "coast" at their lowest possible distortion levels. The unique *cavity anode* design of the 8417 is an important factor of its superior performance characteristics.

Frequency Response (0 db = 4 watts)
Subsonic Filter: Dotted Line



Each pair of 8417's in the K-1000 drives a giant output transformer via plate-cathode coupling — a modified and im-

proved 'ultra-linear' configuration that provides 12 db of the most desirable and stable type of negative feedback in the output stage. The custom-wound output transformers are unlike all others in that their response rolls off below 5 cps and above 200 kc without the slightest peaks or dips. (See the frequency response curve.) This results in exceptional stability and superb square wave reproduction.

The driver stage, too, is entirely novel. A triode-connected 6HU8/ELL80 dual power pentode circuit developed by Fisher engineers is capable of delivering 40% more drive to the output stage than is required — and at a remarkably low impedance. The result is very low distortion, the fastest possible recovery time, great stability and hence outstanding transient response.

For the pre-driver and phase inverter stage, an ECC83/12AX7 dual triode is used in a DC-coupled cathodyne configuration characterized by extremely low distortion and phase shift. A feedback loop from the output transformer secondary to the pre-driver cathode provides 17 db of distortion-reducing feedback.

The input stage of the K-1000 is of a type widely used in laboratory oscilloscopes but never before in high-fidelity amplifiers. A compensated input attenuator in conjunction with a cathode-follower circuit permits adjustment of the input signal from 0 db to -12 db in closely calibrated 3 db steps without the slightest effect on input impedance and frequency response. This feature in effect provides five different input sensitivities, ranging from 0.5 to 2.0 volts (for full rated RMS output), so that the preamplifier volume control can be operated strictly within its optimum range.

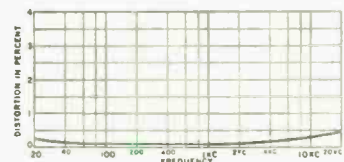
A switchable subsonic filter has also been designed into the input stage, in keeping with the widely held engineering opinion that, for the majority of practical applications, response should be flat down to 20 cps only and then fall off as rapidly as possible. (See dotted part of frequency response curve.)

The power supply of the K-1000 is one of the most elaborate ever used in a stereo power amplifier. Regulation and filtering are of the highest order and all silicon diodes as well as filter capacitors are most conservatively operated.

Bias is readily adjustable on each channel by means of the built-in laboratory-type calibration meter, but the controls for these rarely needed adjustments are ingeniously concealed behind an attractive hinged cover — another Fisher exclusive.

Now you can be sure your home-built unit will perform as perfectly as though it were factory-wired. Fisher has devised what is now the **StrataBalance Technique**†, a simple testing procedure which, by the use of an ordinary light bulb, enables the builder to attain precise and absolute balance of the push-pull circuitry of the K-1000.

Total Harmonic Distortion (One Channel)
at 65 watts RMS
(Note that from 20 cps to 10 kc distortion does not rise above ¼% even at maximum rated power.)



The K-1000 StrataKit is priced at only \$279.50*. It is also available factory-wired as the SA-1000, priced at only \$329.50*. Both carry the famous Fisher Warranty for all tubes, diodes and parts for a period of one year from date of purchase.

FREE! \$1.00 VALUE! The Kit Builder's Manual, a new illustrated guide to high fidelity kit construction, plus detailed brochure on the Fisher K-1000 / SA-1000 Stereo Power Amplifier.

The Kit Builder's Manual

FISHER RADIO CORPORATION
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The Fisher

* SLIGHTLY HIGHER IN THE FAR WEST. EXPORT: FISHER RADIO INTERNATIONAL, INC., LONG ISLAND CITY 1, N. Y. CANADA: TRI-TEL ASSOCIATES, LTD., WILLOWDALE, ONT. † PAT. PEND.

To kit builders who go through **THICK** and **THIN**



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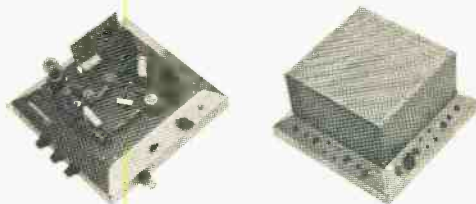
Address _____

City _____ Zone _____ State _____

New Products

(Continued from page 27)

relatively permanent operational units are now available from Alan Kits, Inc. The parts include metal bases with or without $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{8}$ ", and $\frac{5}{8}$ " component-mounting holes, and punched insulating boards which come in XXXP, epoxy paper, or epoxy glass,



and with either .093" or .062" holes. Perforated metal enclosures convert the breadboard circuits into permanent pieces of equipment. Also available are many sizes of terminals, tube sockets, transistor sockets, universal brackets, and terminal boards compatible with punched board mounting. (Alan Kits, Inc., P.O. Box Y4, Anaheim, Calif.)

DOUBLE-SIDEBAND CB TRANSCEIVER

A double-sideband, reduced-carrier transmitter putting 10 watts PEP ("talk-power") into the antenna, and a double-conversion receiver with adjustable squelch and noise limiter make up the new Model RA-590 "Side-Bander" CB transceiver available from Olson Electronics. The unit, which comes equipped with all crystals for 23-channel crystal-controlled receiving and



transmitting, also has a *delta* tuning circuit to bring in off-frequency stations, a sensitivity of $\frac{1}{2}$ μ v. for 10 db signal-to-noise ratio, and a usable audio output power of 9 watts. Also featured is full metering (two dual-function meters are used), and a power supply which operates from either 117 volts a.c. or 12 volts d.c. Price, \$219.95. (Olson Electronics, Inc., 260 S. Forge St., Akron 8, Ohio)

-30-



August 15, 1963

Boys

After five weeks of basic training, these airmen seem to walk a foot taller in their Air Force blue.

But the Air Force does more than give you pride and confidence. It gives you the chance to work for the future—your country's and your own—the chance to build a career on the Aerospace Team.

You'll learn a vital Aerospace skill, such as guided missile systems...aircraft maintenance...



September 22, 1963

Men

...photography. Under "Operation Bootstrap," you'll have an opportunity to continue your formal education—even earn a college degree.

And all the while, you'll be helping America to maintain its lead in the Aerospace Age! Remember, the Air Force gives you an aptitude test before you enlist, without obligation. So get a blueprint of your future from your Air Force recruiter.

U. S. Air Force



The "X" means it's built for experimenters

Here's a whole line of components for experimenters . . . with hundreds of schematics for building everything from HO gauge controls, remote controls, amplifiers, and transistorized citizens band receivers to ingenious alarm systems to scare away burglars.

Take this one, GE-X1. It's a solid state switch which controls up to 4.7 amps and 117 volts. Available in a self-contained, dust-proof, plastic blister package, with circuit diagrams. For hams, there's the GE-M100, Germanium Mesa transistor, packaged with wiring diagrams for building transistorized receivers. But maybe you need a reed switch or a special low voltage-high frequency PNP transistor? Fine. Look over these components and applications, then stop in at your General Electric Electronic Components Distributor. See him soon and ask him to show you the complete G-E Experimenter Line.

WITH THESE COMPONENTS, EXPERIMENTING JUST COULDN'T BE EASIER



GE-X1 SILICON CONTROLLED RECTIFIER. 117-volt, solid state switch. Controls up to 4.7 amps.

Applications: Plug in speed control for hand tools, blenders, mixers, lamp dimmers, HO train controls, automotive alternator regulators.



GE-X2 LIGHT ACTIVATED POWER SWITCH. It will conduct up to 1/4 ampere, up to 25 volts.

Applications: Photoelectric controls, experimental ignition systems, shave photoflash circuits, miniature lightweight static relays and punched card or tape readouts.



GE-X3 HIGH CURRENT SILICON CONTROLLED RECTIFIER. For high current (up to 13 amps) at lower voltage up to 50 PIV.

Applications: 12-volt regulated battery chargers, electroplating, relay replacement or low voltage controls operating from car or boat batteries.



GE-X4 CONVENTIONAL HIGH CURRENT SILICON RECTIFIER. 20 amp rating. For voltages up to 200 PIV.

Applications: High-low-off controls for heaters, lamps and motors. For battery chargers, and in conjunction with the GE-X1, or GE-X3, full wave SCR light dimmers or DC power supplies.



GE-X5 HIGH SENSITIVITY SILICON CONTROLLED RECTIFIER. For special circuits up to 1.6 amps and 50 volts. Activated by extremely low signal power (a momentary signal power of 200 micro watts or less).

Applications: Enlarger phototimers, simple remote controls, temperature controls, alarm systems.



GE-X6 PHOTO CONDUCTIVE CELL. Cadmium sulfide, end-illuminated type. Can be used up to 250 volts peak AC or DC.

Applications: Light target night lights with automatic on-off controls, punched card readouts, remote indicators, relay controls.



GE-X7 REED SWITCH. Carries loads ranging from 15 volt-amperes to micro-amperes. External magnetic actuation.

Applications: Night lights and burglar alarms, automatic on-off controls, liquid-level controls, weight measuring devices, multiple relays.



GE-X8 MED. SPEED, NPN TRANSISTOR. Germanium. Isolated case. For low level switching and amplification.

Applications: Oscillators, direct coupled amplifiers, light flashers, triggered light sources, bi-stable lamp driver circuits.



GE-X9 MED. SPEED, PNP TRANSISTOR. Germanium alloy. For medium power amplification and switching at low frequency.

Applications: Light flashers, light target, triggered light sources.



GE-X10 NEW UNIUNCTION TRANSISTOR. Three-terminal semiconductor with properties not found in conventional transistors. Has low value of firing current, stable negative resistance, stable firing current, high pulse current capability.

Applications: Oscillators, tachometers, timing circuits, voltage sensing circuits, SCR firing circuits, bi-stable circuits.



GE-X11 ZENER DIODE. Silicon Zener diode rated 8.2 volts at 1 watt.

Applications: For low voltage transistor and silicon controlled rectifier applications requiring voltage regulation or protection against voltage transients.



2N107 AUDIO PNP TRANSISTOR. Alloy junction.

Applications: Audio amplifier, radio receiver, practice oscillator, radio receiver loud-speaker, one, two or three transistor broadcast radios.



2N170 AUDIO NPN TRANSISTOR. Low voltage, high frequency transistor.

Applications: Three transistor radio receivers, direct coupled "battery saver" amplifiers, pre-amplifiers.



2N2160 UNIUNCTION TRANSISTOR.

Applications: Transistor metronome and code practice oscillators.



GE-M100 GERMANIUM MESA TRANSISTOR.

Applications: Citizens band receivers, and control units (27 MC).

NEW ELECTRONICS EXPERIMENTER/HOBBYIST MANUAL
Packed with information on experimental circuits, new SCR and rectifier applications. Pick up a copy at your G-E Electronic Components Distributor today. \$1.00

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GENERAL  ELECTRIC

September, 1963



The following satellites, launched by the United States, were reported to have beacon and telemetry transmissions as of July 17, 1963. The satellites are listed by their code names, according to frequency; because some transmit on more than one frequency, they appear more than once.

Transit 4A	54.000 mc.
Vanguard 1*	108.023 mc.
Telstar 2	136.050 mc.
Alouette**	136.080 mc.
Relay 1	136.140 mc.
Explorer 16**	136.200 mc.
Transit 4A	136.200 mc.
Tiros 5	136.233 mc.
Tiros 6	136.233 mc.
Tiros 7	136.235 mc.
Explorer 17**	136.316 mc.
Lofti IIA	136.380 mc.
Ariel	136.406 mc.
1963 14C (US)	136.410 mc.
Explorer 14	136.440 mc.
Syncom II***	136.470 mc.
Explorer 17	136.559 mc.
Alouette	136.590 mc.
Relay 1	136.620 mc.
OSO 1	136.744 mc.
Syncom II***	136.770 mc.
Anna 1B	136.815 mc.
Explorer 16	136.860 mc.
Injun 3**	136.868 mc.
Solar Radiation	136.890 mc.
1963 14B (US)	136.892 mc.
Tiros 6	136.921 mc.
Tiros 7	136.922 mc.
Tiros 5	136.923 mc.
Anna 1B	136.975 mc.
Alouette**	136.978 mc.
Syncom II***	136.980 mc.

*Transmits only while satellite is in sunlight

**Transmits only upon command from ground stations—not during every pass

***To be launched

Satellites of the Soviet Union have telemetry and tracking transmissions in the 19.990-20.010 mc. band. Whenever a Cosmos series satellite is launched, check Radio Moscow for an announcement of tracking frequencies. Most Cosmos series satellites re-enter the atmosphere in 60-90 days. Cosmos 2 and 8 are in orbit at press time, but do not seem to be transmitting.

If you're interested in eavesdropping on satellites, and missed our June 1962 article on the NASA-136 converter, we recommend that you look it up. Easy to construct, this sensitive converter can intercept the satellites operating in the 136-137 mc. band.



THIS MONTH'S COVER

CONTESTS seem to appeal to everybody, so this month you're invited to compete in identifying the parts displayed on our cover.

To the uninitiated, electronic parts have probably always looked a bit odd. But to insiders in electronics during the 30's and 40's, many parts acquired a certain homely familiarity. Resistors looked like gaily painted firecrackers, coils like bedsprings, and capacitors like bigger firecrackers (paper), small bathtubs (metal cased), or bread slicers (variables).

But with the coming of the space age,

weight, size, precision, stability, and outlandish operating conditions put a mighty squeeze on electronic parts. Designers had to trim off as much "fat" (and "lead") as possible. New materials, new manufacturing techniques, and outright new components have all entered the parts picture.

As a result, many of the modern parts furnished by Harvey Radio Co. of New York for our September cover bear little resemblance to their older counterparts, and an old-timer might scan the entire lot and see no more than one or two familiar forms.

All of which suggested an interesting way for POPULAR ELECTRONICS' readers to test their own knowledge of the shape of electronic things, not to come, but already on the scene. Try your hand at identifying the 35 parts shown on our cover. Trace the outline of each part, in position, on thin paper, and tell us what each is. The first five entries correctly identifying each part by its functional name (such as "binding post") will earn the writers a free one-year subscription. Postal cancellation will determine priority. All set? Go!

*"Messenger" CB Transceivers...rated
BEST in Nation by Electronic
Distributor Salesmen**

*New impartial survey by leading electronic magazine shows Johnson "Messenger" Transceivers rated "BEST"—BEST BY NEARLY 50% OVER SECOND CHOICE BRAND.

4 feature-packed "Messengers"...and Selective Call System outperform everything!

Compact, Hand-Held—100 milliwatt or 1 watt "Personal Messengers". Rugged and reliable—11 transistors, 4 diodes! Twice the sensitivity and 40% more range than similar units with conventional circuitry—more output than similar units with same rated inputs!

Mobile or Base Stations—performance proved Viking "Messenger" and new "Messenger Two". Punches your signal across the miles—high efficiency design makes full use of maximum legal power. Excellent receiver sensitivity and selectivity. Automatic "squelch" control—5 or 10 channel coverage—easy to install anywhere!

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NEW! 4-COLOR BROCHURE—write for your free copy!



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1AX2	.62	6AV6	.41	6SA	.52	12CU6	1.06				
1B3	.79	6AW8	.90	6SA7GT	.99	12CX6	.54				
1DN5	.55	6AX4	.66	6SH7	1.02	12DA	.69				
1G3	.79	6AX5	.74	6SJ7	.88	12DE8	.83				
1J3	.79	6BA6	.50	6SK7GT	.95	12DL8	.88				
1K3	.79	6BC5	.61	6SL7GT	.84	12DQ6	1.04				
1R5	.77	6BC8	1.04	6SN7	.65	12DS7	.84				
1S5	.75	6BE6	.55	6SQ7GT	.94	12DT5	.76				
1T4	.72	6BF5	.90	6T4	.99	12DT7	.79				
1U5	.65	6BF6	.44	6T8	.85	12DT8	.78				
1X2B	.82	6BG6	1.70	6U8	.83	12DW8	.89				
2AF4	.96	6BH8	.98	6V6GT	.54	12DZ6	.62				
3AL5	.46	6BJ6	.65	6W4	.61	12ED5	.62				
3AU6	.54	6BJ7	.79	6W6	.71	12EG6	.62				
3AV6	.42	6BK7	.85	6X4	.41	12EK6	.62				
3BC5	.63	6BL7	1.09	6X8	.80	12EL6	.50				
3BN6	.75	6BN6	.74	7A8	.68	12EZ6	.57				
3BU8	.78	6BQ6	1.12	7AU7	.65	12F8	.66				
3BY6	.58	6BQ7	1.00	7EY6	.75	12FA6	.79				

3BZ6	.56	6BU8	.70	7Y4	.69	12FM6	.50
3CB6	.56	6BX7	1.11	8AU8	.90	12FR8	.97
3CS6	.56	6BZ6	.55	8AW8	.93	12FX8	.90
3DC4	.85	6BZ7	1.03	8BQ5	.60	12GC6	1.06
3DK6	.60	6C4	.45	8C7	.63	12J8	.84
3DT6	.54	6CB6	.55	8CM7	.70	12K5	.75
3GK5	.99	6CD6	1.51	8CN7	.97	12L6	.73
3Q4	.63	6CG7	.61	8CS7	.74	12SF7	.69
3S4	.75	6CG8	.80	8EB8	.94	12SK7GT	.95
3V4	.63	6CL8	.79	8FQ7	.56	12SL7	.80
4BQ7	1.01	6CM7	.69	9CL8	.79	12SN7	.67
4CS6	.61	6CN7	.70	11CY7	.75	12SQ7GT	.91
4DTG	.55	6CQ8	.92	12A4	.60	12U7	.62
4GM6	.60	6CR6	.60	12AB5	.60	12V6	.63
5AM8	.79	6CS6	.57	12AC6	.55	12W6	.71
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5BR8	.83	6DA4	.68	12AF6	.62	18FY6	.50
5CG8	.81	6DE6	.61	12AL5	.47	19AJ4	.87
5CL8	.76	6DG6	.62	12AL8	.95	19BG6	1.39
5CQ8	.84	6DJ8	1.21	12AO5	.60	19EA8	.79
5EA8	.80	6DK6	.59	12AT6	.50	19TB	.85
5EU8	.80	6DN6	1.55	12AT7	.76	21EX6	1.49
5J6	.72	6DQ6	1.10	12AU6	.51	25AX4	.70
5T8	.86	6DT5	.81	12AU7	.61	25C5	.53
5U4	.60	6DT6	.53	12AV6	.41	25CA5	.59
5U8	.84	6DT8	.94	12AV7	.82	25CD6	1.52
5V6	.56	6EA8	.79	12AX4	.67	25CU6	1.11
5X8	.82	6EB5	.73	12AX7	.63	25DN6	1.42

5Y3	.46	6EB8	.94	12AY7	1.44	25EH5	.55
6AB4	.46	6EM5	.77	12AZ7	.86	25L6	.57
6AC7	.96	6EM7	.82	12B4	.68	25W4	.68
6AF4	1.01	6EU8	.79	12BB6	.50	32ET5	.55
6AG5	.70	6EV5	.75	12BE6	.53	35C5	.51
6AH4	.81	6EW6	.57	12BF6	.60	35L6	.60
6AH6	1.10	6EY6	.75	12BH7	.77	35W4	.42
6AK5	.95	6FG7	.69	12BK5	1.00	35Z5	.60
6AL5	.47	6FV8	.79	12BL6	.56	36AM3	.36
6AM8	.78	6GH8	.80	12BQ6	1.16	50B5	.69
6AQ5	.53	6GK5	.61	12BR7	.74	50C5	.53
6ASS	.60	6GK6	.79	12BV7	.76	50EH5	.55
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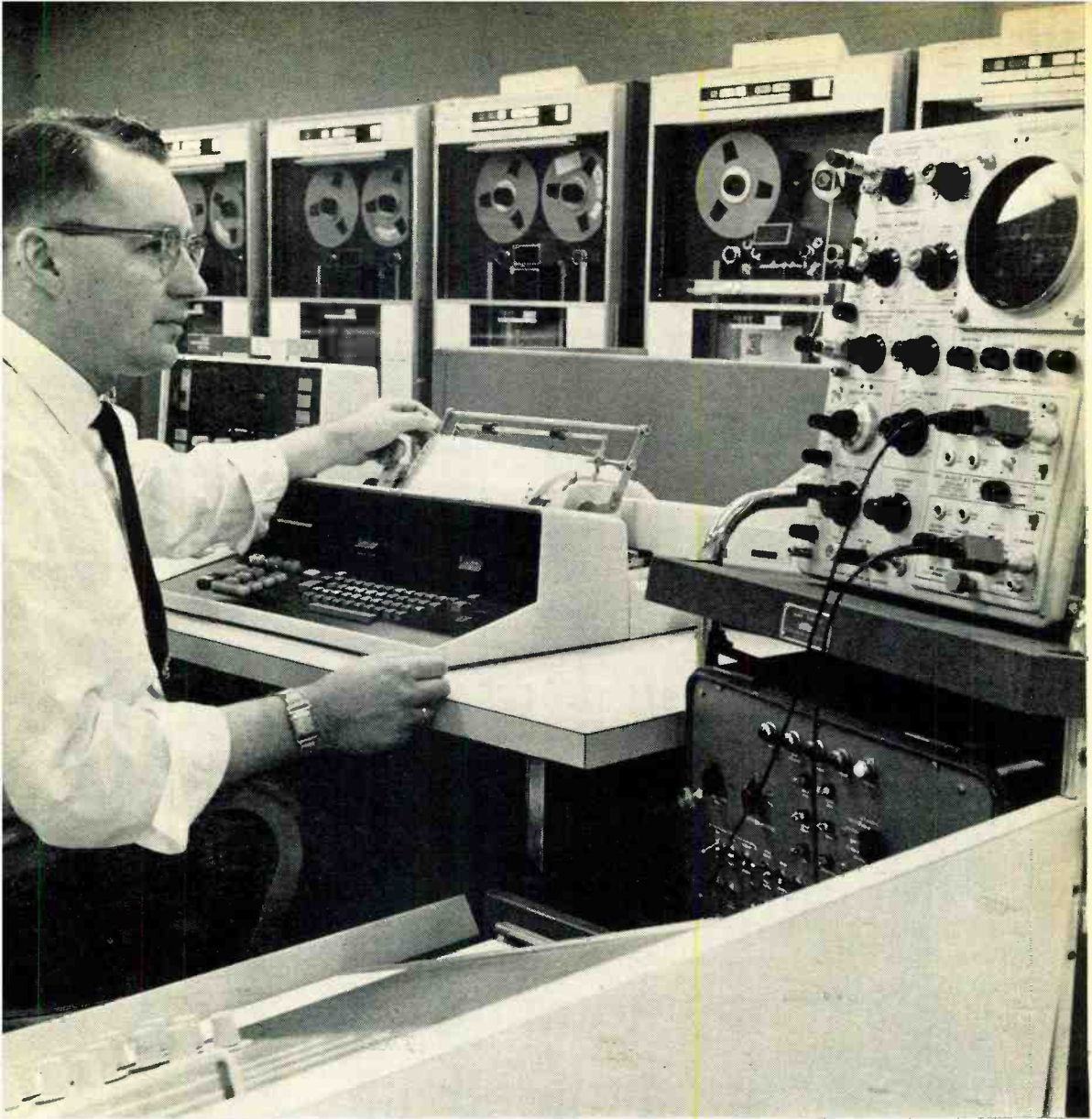
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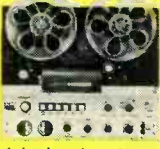
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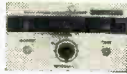


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Calling All SWL DX'ers

***A directory of programs especially for the SWL
broadcast by short-wave stations all over the world***

By **GERRY L. DEXTER, WPEØJJ**

THE SERIOUS short-wave listener knows how important it is to keep up to date on news of new stations, frequency and schedule changes, propagation forecasts and tips on DX'ing. For that reason, most SWL's find reading POPULAR ELECTRONICS' "Monthly Short-Wave Report" and membership in one or more DX clubs very profitable. In addition, many DX'ers get tips and information hot off the receiver by listening to the regular programs, presented by radio stations all over the world, which are designed especially with the SWL in mind.

These programs are likely to include news of new stations, frequency and schedule changes, loggings of other listeners, propagation forecasts, technical information, acknowledgements of reports to the station in question, and special interviews and other features of interest to the SWL. You've undoubtedly monitored a few of these programs, but you probably haven't heard them all. The directory which begins on the next page will fill you in on those you've missed, and start you on your way toward getting the latest and most reliable short-wave news available.

In most cases the information given was received directly from the station itself (a few of the listings are identified with an asterisk, indicating another source). With the exception of seasonal and unannounced schedule changes, all of the data is as accurate as possible. Note that the programs are listed alphabetically by country, and that the frequencies are given in megacycles. In many instances, the times (which are all EST) are the transmission times for a particular service, and the DX program will be heard within those time periods.

Calling SWL DX'ers



Radio Prague's DX program is conducted by ham operator Peter Skala, shown here with his rig.

Editors S. B. Duke and J. D. Nicholson talk things over during a broadcast of "Radio Canada Shortwave Club."

Australia—Radio Australia*

"Australian DX'ers Calling"

Schedule: Sundays to East Coast North America at 0800 on 11.710 mc.; to West Coast North America at 1100 on 11.760, 11.710, 9.570, and 7.220 mc.

Program: General DX news (new stations, schedule changes, etc.). Editor—Graham Hutchins.

Correspondence: DX Program, Radio Australia, P.O. Box 428G, G.P.O., Melbourne, Australia.

Canada—Canadian BC Corp.

"Radio Canada Shortwave Club"

Schedule: Saturdays at 1545-1630 to Europe on 11.720, 9.630, and 5.970 mc., at 0530-1415 to Africa on 15.320, 11.720, and 9.630 mc., at 1800-1830 to the Caribbean on 11.720, 9.625, and 5.970 mc.; Sundays at 0215-0300 to Australasia on 9.625 and 5.970 mc.

Program: DX and SWL club news, plus tips on reception reporting, interference, fading, improving reception, technical questions. Editors—S. B. Duke and J. D. Nicholson.

Correspondence: Radio Canada Shortwave Club, International Service, Canadian Broadcasting Corporation, P.O. Box 6000, Montreal, Canada.

Note: Membership in the Radio Canada Shortwave Club is available and qualifications will be announced soon.

Czechoslovakia—Radio Prague

Schedule: Alternate Thursdays (repeated following Sunday) at 2000 and 2330 to North

America on 7.345, 9.550, 9.795, 15.835 (or 11.745) mc.

Program: News of activities of Czechoslovakian amateurs and propagation forecasts. Editor—Peter Skala.

Correspondence: North American Service, Radio Prague, Prague, Czechoslovakia.

Denmark—Danish Shortwave Service*

"DX Bulletin"

Schedule: Mondays at 2030-2220 and 0400 on 9.520 mc.

Program: DX news. Cooperating organization—*World Radio Television Handbook*.

Correspondence: "DX Bulletin," Danish Shortwave Service, Copenhagen, Denmark.

Ecuador—HCJB

"DX Party Line"

Schedule: First Sunday of the month at 2200 on 15.115, 11.915 and 9.745 mc.

Program: Short-wave station news, answers to questions about HCJB, technical news. Editors—Bill and Irene Ridgeway.

Correspondence: "DX Party Line," Radio Station HCJB, Casilla 691, Quito, Ecuador.

England—British BC Corp.

"SWL Corner"

Schedule: Tuesdays at 0515-0530 and 1930-1945, Thursdays at 1045-1100. A new frequency list goes into effect September 1.

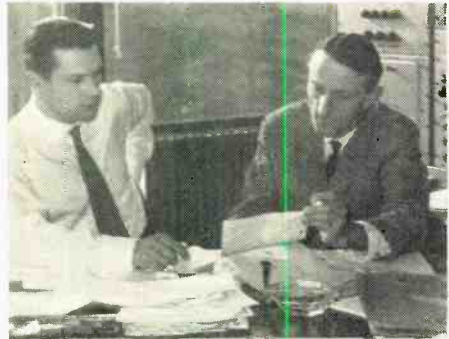
Program: Advice on reception from the BBC Engineering Department, helpful hints,



Taking part in a "Musical Mailbag" recorded by the Finnish Broadcasting Company are editor Eric Gagneau and Miss Maj-Britt öhornberg.



The second Sunday of every month brings North American listeners Deutsche Welle's DX news announced by G. C. Thiele.



Radio Nederland's "DX Juke Box" is conducted by editors J. Vastenhaus and D. S. Jordan.

changes in short-wave schedules, items of interest to both the SWL and the amateur. Editor—Dorothy Logan.

Correspondence: SWL Corner, BBC, London, England.

Finland—Finnish BC Co. Ltd.

Schedule: First and third Fridays of month at 1600-1645 on 15.190 mc.

Program: DX hints and special reports from Sweden, Denmark and Norway. Editor—Eric Gagneau. Cooperating organization—Finlands DX Club.

Correspondence: The Finnish Broadcasting Co., DX Editor, Helsinki, Finland.

German Federal Republic

Deutsche Welle—The Voice of Germany

Schedule: Second Sunday of month at 2325 on 9.605 and/or 9.745, and 6.145 mc.

Program: News for DX listeners and amateurs. Editor—G. C. Thiele.

Correspondence: Deutsche Welle, Anstalt des öffentlichen Rechts, DX Editor, G. C. Thiele, DL1ZK, Postfach 344, Cologne, Germany.

Note: The *Voice of Germany* publishes a monthly DX bulletin which is available to contributors.

Haiti—Station 4VEH

Schedule: Fridays at 2200-2230 on 11.835 mc. (4VEJ), 9.770 mc (4VEH). 6.120 mc. (4VE), and 2.450 mc. (4VSO—applied for).

Program: News of short-wave stations, items concerning DX activity, acknowledgments of

reception reports to 4VEH. Editor—Miss Miriam Stockton. Cooperating organizations—Newark News Radio Club, Sweden Calling DX'ers, Shortwave Messenger, and Mr. August Balbi of Los Angeles.

Correspondence: Shortwave (or DX) Editor, Station 4VEH, Box 1, Cap Haitien, Haiti.

Netherlands—Radio Nederland

"DX Juke Box"

Schedule: Wednesdays to North America at 2030-2120 on one of the following frequencies: 9.745, 9.715, 9.630, 9.590, 6.058, 6.035, 6.025, 6.020, 5.985, or 5.980 mc.; Thursdays to North America and Europe at 1630-1730 on 6.020 mc. (to Europe only) and on one of the following frequencies: 15.445, 15.425, 15.220, 11.950, 11.800, 11.780, 11.730, or 11.710 mc.

Program: Propagation tips, "informative features," interviews, discussions of new and existing electronic apparatus, applications, plus popular music. Editors—J. Vastenhaus and D. S. Jordan. Cooperating organizations—Benelux DX Club and the Finnish DX Club.

Correspondence: DX Juke Box, Radio Nederland, P.O. Box 222, Hilversum, Holland.

Note: This station has recently begun a radio servicing course along with tips on receiver maintenance. An outline of the course can be obtained by writing to *Radio Nederland*.

Netherlands Antilles (Aruba)

Radio Victoria—PJA6

Schedule: First day of each month at 0030 on 905 kilocycles (BCB).

(Continued on next page)

Calling SWL DX'ers



The Swiss "SBC DX Corner," heard in North America on Sundays, is edited by Ronald Green (right).



The three DX editors of Radio Sweden (left to right—Jan Erik Raf, Arne Skoog, and Lars Ryden) collaborate on "Sweden Calling DX'ers."

Program: DX news. Editor—Charles Jobes.

Correspondence: Charles Jobes, Chief Engineer, Radio Victoria, PJA6, Aruba, Netherlands Antilles.

Note: Mr. Jobes is very anxious to hear from DX'ers.

New Zealand—Radio New Zealand

"This Radio Age"

Schedule: First Wednesday of the month at 0143 to the Pacific on 9.540 mc., at 0530 to Australia on 9.540 and 6.080 mc.

Program: DX news. Editor—Arthur Cushen.

Correspondence: Radio New Zealand, P.O. Box 2396, Wellington, New Zealand.

Nigeria—Nigerian BC Service*

"Listeners Club"

Schedule: Mondays at 1330 on 9.535 mc.

Philippines—Far East BC Co.*

Schedule: Wednesdays at 0245 and 1000 on one or more of the following frequencies: 17.810, 17.500, 15.380, 15.300, 11.920, 11.850, 9.730, or 7.320 mc.

Poland—Radio Warsaw

Schedule: Second Friday of the month and repeated the following Monday. Fridays at 1330 on 9.540 mc.; Mondays at 1630 on 11.865, 9.540, and 7.125 mc.

Rumania—Radio Bucharest

Schedule: Thursdays and Fridays at 1830 on 1.795 and 6.190 mc.; at 1100 on 11.940, 9.570, 7.225, and 5.990 mc.

Program: DX news items, technical information, DX contest reports. Editor—Paul Brad. Cooperating organization—Central Radio Club of Bucharest.

Correspondence: Radioteleviziunea Rumania, P.O. Box 111, Bucharest, Rumania.

Note: Radio Bucharest is happy to participate in Club DX contest. Reports are welcome.

Sweden—Radio Sweden

"Sweden Calling DX'ers"

Schedule: Sundays to Western North America at 2215-2245 on 11.805 mc.; Mondays to Far East at 0730-0800 on 9620 mc., to Eastern North America at 0900-0930 on 11.805 mc., to Middle East at 1115-1145 on 11.705 and 15.240 mc., to Africa at 1445-1515 on 11.705 mc., to South Asia at 1515-1545 on 15.420 mc., and to Europe at 1700-1730 on 6.065 mc.

Program: Short-wave and BCB DX news.

Correspondence: "Sweden Calling DX'ers," Radio Sweden, Stockholm 1, Sweden. Editors—Arne Skoog, Jan Erik Raf, and Lars Ryden.

Note: Radio Sweden publishes a DX bulletin called "Sweden Calling DX'ers" which is available to all who contribute, free of charge.

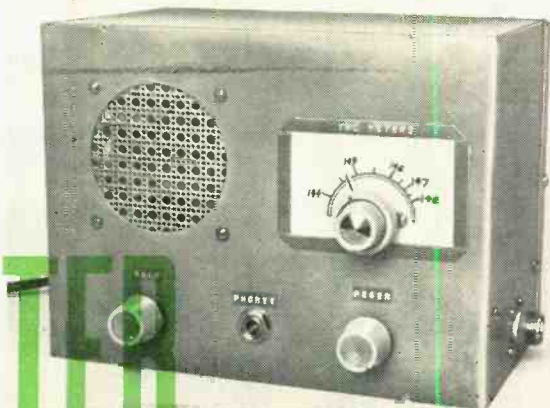
Switzerland—Swiss BC Corp.

"SBC DX Corner"

Schedule: Saturdays to Africa at 0253 on 17.795, 15.305, and 11.715 mc.; to Australia/New Zealand at 0453 on 17.795, 15.315, and 11.865 mc.; to Southeast Asia at 0838 on 17.795, 15.315, and 9.665 mc.; to India/Pakistan at 1038 on 17.795, 15.305, and 11.815 mc.; to Africa at 1038 on 21.520 mc.; to Middle East at 1038 on 11.865 and 9.665 mc.; to United Kingdom and Scandinavia at 1438 on 9.665 and 6.055 mc.; to North America at 2123 and 0023 (Sundays) on 11.865, 9.535, and 6.165 mc.

Program: First and third weeks—broadcasting news; second and fourth weeks—amateur

(Continued on page 100)



By CHARLES GREEN, W3IKH

2-METER SIMPLE SUPERHET

Need a receiver for the 2-meter amateur band? You can build this sensitive unit easily, at low cost

READERS RESPONDED to the appeal of the "Simple Superhet for 6" (in April, 1963, POPULAR ELECTRONICS) so well that a 2-meter version was quickly assembled and tested. It covers the 144- to 148-mc. amateur band, with enough overlap at the band ends to include MARS and CAP frequencies. Three tubes are used to provide a superhet-type front end and a superregenerative second detector, as in the 6-meter version. This combination provides exceptional performance, considering the number of tubes and the overall simplicity of the circuit.

Most details of design and construction closely follow those of the 6-meter model, with a utility box again serving as the cabinet, which also contains the built-in speaker and power supply. The construction is straightforward and free of tricky assembly problems, so with the careful wiring and attention to detail that all VHF circuits require, you should have little trouble getting it going.

About the Circuit. The coaxial line from the antenna connects to jack *J1*, which is connected internally to the tuned input circuit, made up of *C7* and *L2*. This circuit is adjusted to peak broadly at 145 mc. by means of trimmer capacitor *C7*. The 2-meter signals are coupled to the grid of mixer *V1b* via *C8*.

A "gimmick" capacitor made by twisting two lengths of insulated wire

2-METER SIMPLE SUPERHET

together is used to couple the output of oscillator $V1a$ to the grid of $V1b$. The oscillator frequency is basically set by trimmer capacitor $C3$ and $L1$. This frequency is variable from about 138 to 142 mc., tuning 6 mc. below the desired signal, which establishes the correct 6-mc. i.f. frequency.

The i.f. output of mixer $V1b$ is coupled by $C9$ to the tuned circuit of the second detector, which consists of $L3$ and $C10$. This circuit is adjusted to 6 mc. by means of the tuning slug in $L3$. The *REGEN* control, potentiometer $R6$, adjusts the screen voltage of $V2$, to control the superregenerative action of the detector stage.

To prevent overdriving the grid of $V3$ with the quench frequency output of $V2$,

$R8$ and $C14$ are connected as a low-pass filter section. The detected audio output from $V2$ passes via $R8$ and $C15$ to *GAIN* control $R9$, from which the signal is applied to the grid of $V3$. The amplified output of $V3$ is coupled through output transformer $T1$ to closed circuit jack $J2$ and the loudspeaker. Plugging in a set of headphones disconnects the speaker and provides output to the phones through $C18$.

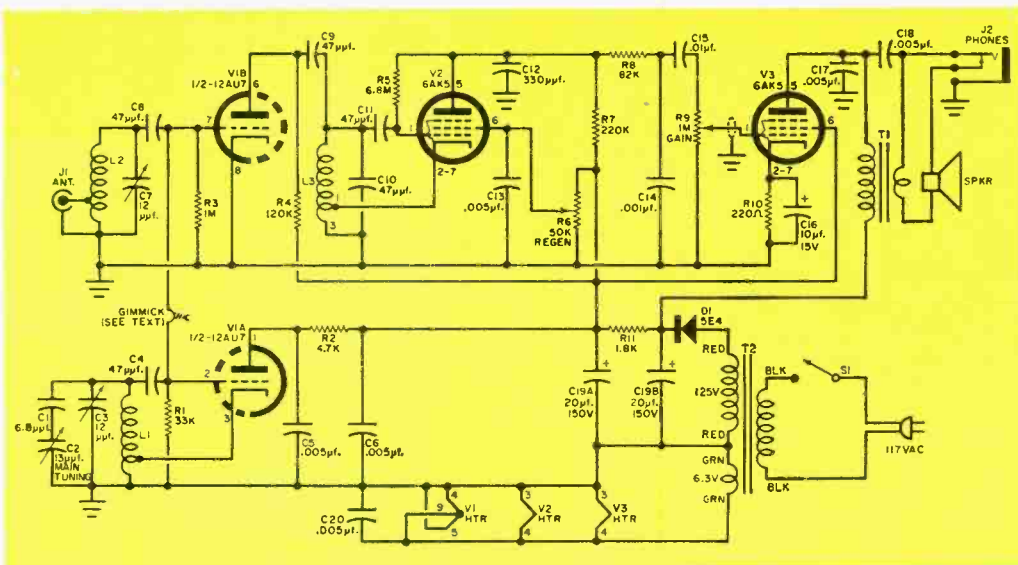
Power transformer $T2$, rectifier diode $D1$, and the filter made up of $R11$ and $C19$ provide the necessary B+ voltages.

Construction. An 8" x 6" x 4½" aluminum utility box is used as the receiver cabinet. The chassis shelf is made from an 8" x 4¾" aluminum sheet. Two pieces of aluminum angle support the chassis shelf about 1¼" from the bottom of the cabinet.

The parts layout is shown in Figs. 2, 4, and 5, and, as we said before, the placement of parts and wiring must be closely followed, as in all VHF devices. Only by doing so can you be sure of duplicating the performance of the prototype.

Tuning capacitor $C2$ is mounted on three ¾" metal spacers. A solder lug is screwed to a tapped hole in the frame of $C2$, and soldered to the free end of a second solder lug, which is held to the chassis shelf by one of the screws that

Fig. 1. Schematically, the 2-meter set closely resembles the 6-meter unit.



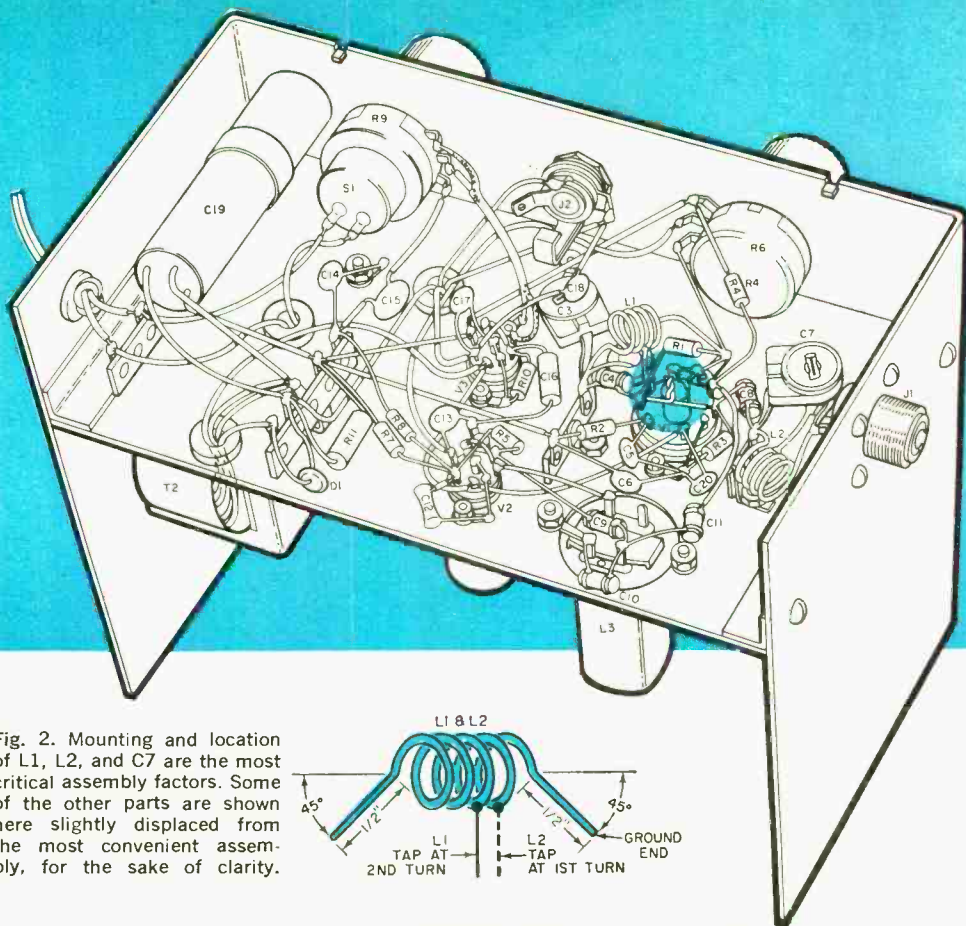
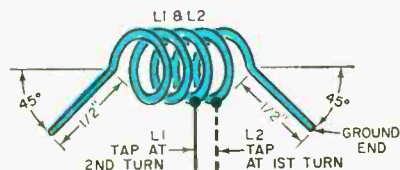


Fig. 2. Mounting and location of L1, L2, and C7 are the most critical assembly factors. Some of the other parts are shown here slightly displaced from the most convenient assembly, for the sake of clarity.



PARTS LIST

- C1—6.8- $\mu\text{f.}$, 600-volt, NPO ceramic tubular capacitor (5- $\mu\text{f.}$ and 2- $\mu\text{f.}$ units wired in parallel)
 C2—13- $\mu\text{f.}$ variable capacitor, with vernier shaft and dual knob assembly (Lafayette HP229)
 C3, C7—12 $\mu\text{f.}$, NPO ceramic trimmer capacitor
 C4, C8, C9, C10, C11—47- $\mu\text{f.}$, 600-volt ceramic disc capacitor
 C5, C6, C13, C17, C18, C20—0.005- $\mu\text{f.}$, 600-volt ceramic disc capacitor
 C12—330- $\mu\text{f.}$, 600-volt ceramic tubular
 C14—0.001- $\mu\text{f.}$, 600-volt ceramic disc capacitor
 C15—0.01- $\mu\text{f.}$, 600-volt ceramic disc capacitor
 C16—10- $\mu\text{f.}$, 15-volt miniature electrolytic
 C19—Dual 20- $\mu\text{f.}$, 150-volt electrolytic capacitor
 D1—400 PIV, 450-ma. silicon rectifier (International Rectifier Corp. 5E4 or equivalent)
 J1—Chassis mounting type coaxial receptacle (Amphenol 83-1R or equivalent)
 J2—Closed circuit phone jack
 L1—4 turns of #16 tinned copper wire, wound $\frac{1}{2}$ " long on $\frac{1}{4}$ " diameter; tap at second turn from ground end, leave $\frac{1}{2}$ " leads at 45° angle—see Fig. 6
 L2—Same as L1 but tap at first turn from ground end—see Fig. 6
 L3—Oscillator coil (Stancor 8764)

- R1—33,000 ohms
 R2—4700 ohms
 R3—1 megohm
 R4—120,000 ohms
 R5—6.8 megohms
 R6—50,000-ohm carbon potentiometer
 R7—220,000 ohms
 R8—82,000 ohms
 R9—1-megohm carbon potentiometer (with S1)
 R10—220 ohms
 R11—1800 ohms
 S1—S.p.s.t. switch (on R9)
 SPKR—3.2-ohm, 3" speaker (Utah SP3A or equivalent)
 T1—Output transformer; primary, 10,000 ohms; secondary, 4 ohms (Stancor A3879 or equiv.)
 T2—Power transformer; primary, 117 volts; secondaries, 125 volts @ 15 ma., 6.3 volts @ 0.6 amp. (Stancor PS-8415 or equivalent)
 V1—12AU7A tube
 V2, V3—6AK5 tube
 1—8" x 6" x 4 $\frac{1}{2}$ " aluminum utility box (LMB 146 or equivalent)
 1—8" x 4 $\frac{3}{8}$ " aluminum plate (for chassis shelf)
 Misc.—Line cord and plug, "K-Tran" mounting plate (for L3), tube sockets, aluminum angle stock, grommets, terminal strips, knobs, perforated aluminum for speaker grill, #16 bus wire, insulated hookup wire, shielded wire, etc.

All resistors
 $\frac{1}{2}$ -watt, 10% unless
 otherwise specified

secures the socket of V1. This provides a short ground path for C2, and helps to stiffen the structure mechanically, which improves stability.

A "K-Tran" type of mounting plate was used to mount 6-mc. coil L3. Since it is not an exact fit for the Stancor coil specified, care must be taken to avoid shorting the coil terminals. Use short lengths of sleeving over the coil leads or, alternatively, drill holes in the chassis and mount L3 by its spring clips.

A 3" square of perforated aluminum is used as the speaker grille, and a 1" bracket held by the lower left-hand speaker mounting screw aids in supporting the chassis. The small pointer
(Continued on page 108)

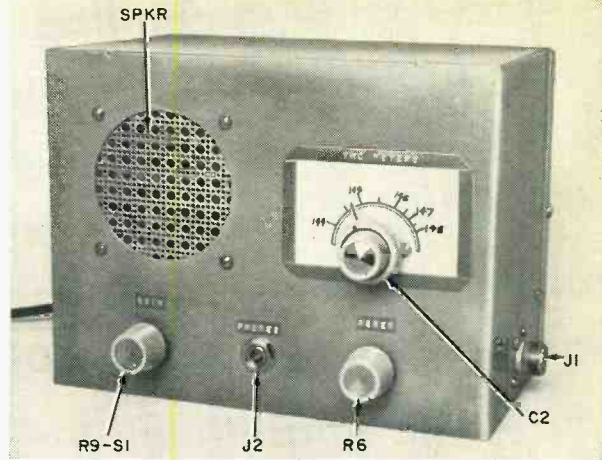


Fig. 3. Panel controls are straightforward and functional, for ease and efficiency of operation.

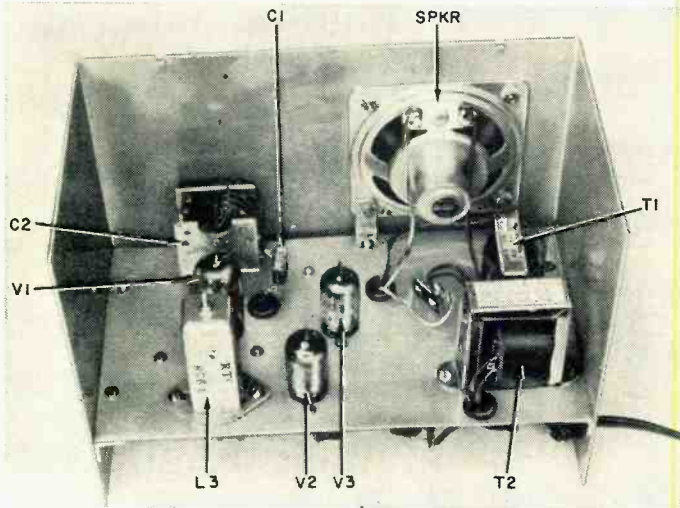


Fig. 4. Rigidity in the mounting of C1 and C2 is important for good tuning stability. This top view shows their relationship.

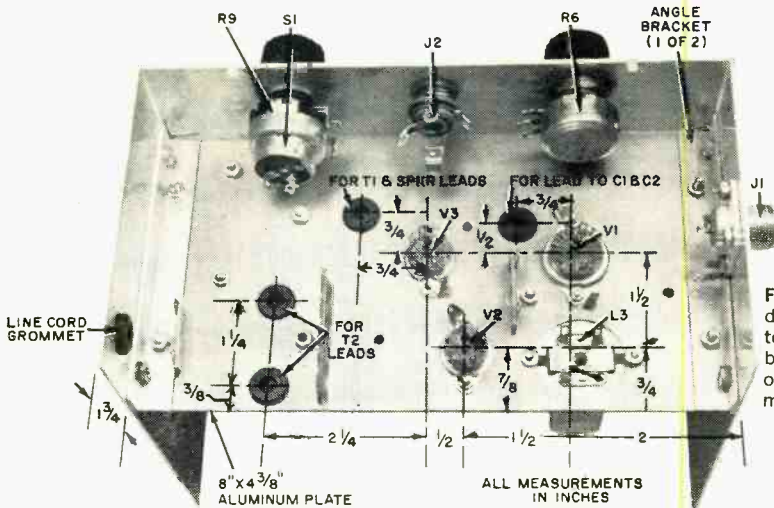
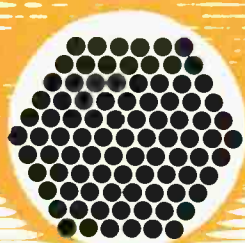


Fig. 5. The spacing and dimensions in this bottom view are important because of the very high operating frequency, and must be followed closely.



PHOTOCELL

Circuits for Experimenters

Light-sensitive devices have intrigued experimenters since the first man noticed that the sunflower kept its face to the sun. Here are five photosensitive circuits with many practical uses.

By C. L. HENRY

LIKE MOST OTHER parts of the broad field of electronics, photocell technology continues to show rapid growth and development. One result of this progress is the availability in recent years of cadmium selenide and cadmium sulphide photocells, at relatively modest prices. These units make possible many useful and interesting photocell circuits that were formerly impractical because of cost, complexity, or power supply requirements. In fact, modern photocells can be used in many ways that would be most uneconomical for older phototubes. Some of these uses are given here, along with suggestions for others your own ingenuity will enable you to develop.

Circuit 1. A good example of a circuit not very practical with older phototubes is shown in Fig. 1. Suppose we want to cause a large lamp or sign to flash on and go off at regular intervals. It can be done with a motor, a train of reduction gears, and a cam-operated switch or switches, but such things are expensive and require considerable maintenance. In the circuit of Fig. 1, the only moving part is the armature of relay *K1*, and this relay can be of a type designed for long service. The photocell (*PC1*) is connected in series with battery *B1* and the coil of *K1*. Lamp *L1* is connected across the battery through a normally closed pair of *K1*'s contacts. The lamp is mounted against the sensitive surface of the photocell, and both are mounted in a light-tight box, so that ambient light cannot affect operation.

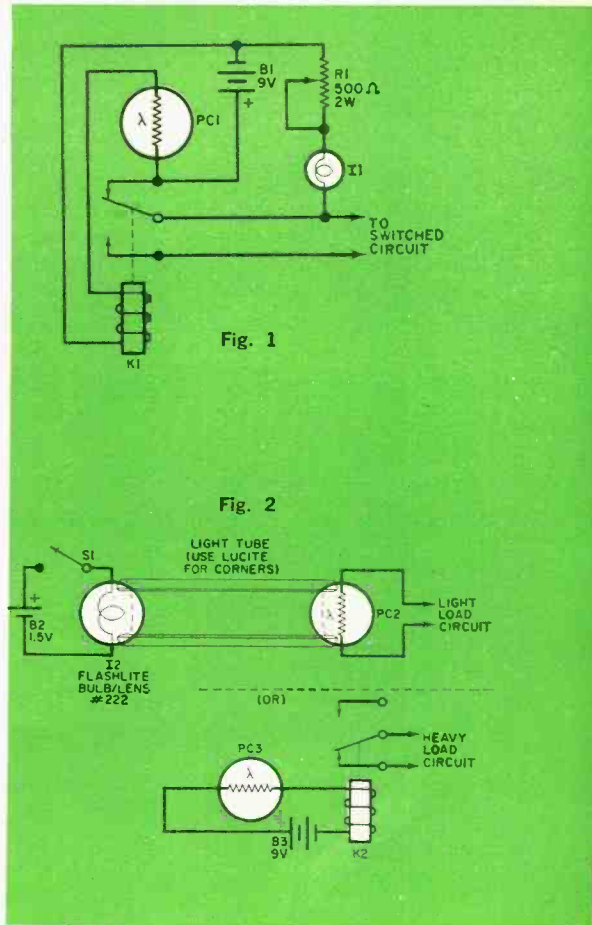
PHOTOCELL Circuits for Experimenters

As the light output from *I1* increases, it causes the resistance of *PC1* to drop, until a point is reached where *PC1* passes enough current to cause *K1* to close. This action closes the external circuit, and opens the circuit through *PC1* to the coil of *K1*. This allows the armature of *K1* to return to the original position, and the cycle repeats itself continuously. The time period of a complete cycle can be varied over a considerable range by adjusting *R1*, which is connected as a rheostat. The more resistance included in the circuit, the longer the time for a complete cycle.

Since the timing circuit is battery-operated, it is possible to include the moving contact of *K1* in the external circuit, even if it is connected to the a.c. line. If you want complete isolation between the external and internal circuits, use a d.p.d.t. relay for *K1*.

Circuit 2. Other control circuits using light to turn some device on or off are also in wide use. The principle is illustrated in Fig. 2. Here, closing switch *S1* lights *I2*, and the light emitted causes the resistance of *PC2* to drop sharply, allowing current to flow in the external load circuit. If the load requires more current than the photocell itself can handle safely, a relay can be used to pass the actual load current, as shown in the alternate circuit of Fig. 2. Lamp *I2* is shown here mounted at the end of the light tube, but in practical cases, the light source can be at any reasonable distance, so long as it is strong enough to affect *PC2*.

Thus, the photocell unit can open garage doors at night when actuated by car headlights in the driveway. It can be mounted in the garage, behind a hole the diameter of the light tube, which should be of black cardboard or some other opaque material. With the tube pointed down the driveway so as to let



the headlights shine on the photocell when the car enters, sunlight is prevented from operating the door since it does not arrive from the proper direction.

Circuit 3. In the photocell application illustrated in Fig. 3, the *absence* of light is used to control the circuit action. The circuit is a smoke detector, which in the author's case is fastened to the ceiling of the basement workshop. When no smoke is present in the box to reduce the

amount of light reaching photocell $PC4$ from lamp $I3$, relay $K3$ is held closed so that the doorbell circuit is open.

If the furnace smokes, or a fire gets started in the basement, smoke rising into the box reduces the amount of light reaching $PC4$, causing its resistance to increase. This reduces the current in the

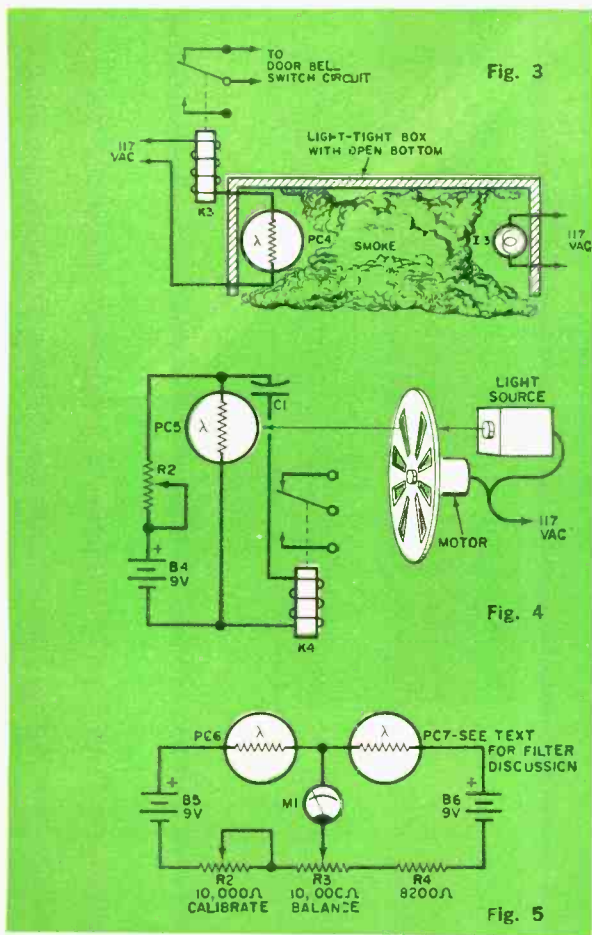
considerably simplified by the use of a cadmium sulphide photocell. The circuit shown in Fig. 4 has the added advantage of being immune to activation by light from a source other than its own. This result is accomplished by interrupting the light from the source at a certain frequency, and making the relay coil circuit resonant at the same frequency.

The flasher in Fig. 1 can be used as the interrupted light source, or light from an ordinary incandescent lamp can be interrupted by a motor-driven shutter. The latter is nothing more than a cardboard or plastic disc with an appropriate number of equally spaced slots, turned by a small synchronous motor.

The relay coil inductance is tuned to series resonance at the frequency of the light interruption by capacitor $C1$. As the interrupted light from the source causes the resistance of the photocell to vary at the interruption frequency, the voltage across the relay coil circuit varies at the same frequency. This causes enough a.c. to flow in the relay coil to hold the contacts in the alarm circuit open.

When the light beam is interrupted, as by an intruder, the relay coil is de-energized, causing the alarm to sound. The relay is not affected by steady room light or daylight, unless it is much stronger than the chopped light source, because there is no d.c. path through the relay coil circuit. Attempts to deactivate the alarm by shining a flashlight into the photocell will also fail for the same reason.

Circuit 5. A very different use for photocells is illustrated in Fig. 5. Two cells are used to compare the light transmitted through samples of translucent materials, such as photographic negatives. The circuit is first balanced by adjusting $R3$ for zero meter reading, with both cells illuminated by the same light source, and $R2$ set at the middle of its range. Next, one of the two samples to be compared for density is placed in front of each of the photocells. Any displacement of the meter pointer from the center zero position is due to a difference in light transmission between the specimens. The amount of difference can be determined by noting how great a readjustment of $R2$ is needed to return the pointer to the zero position.

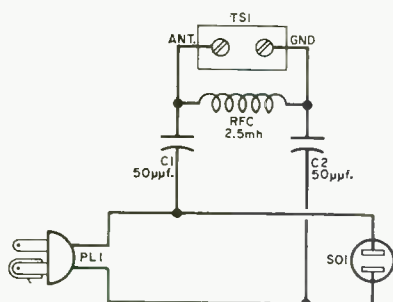
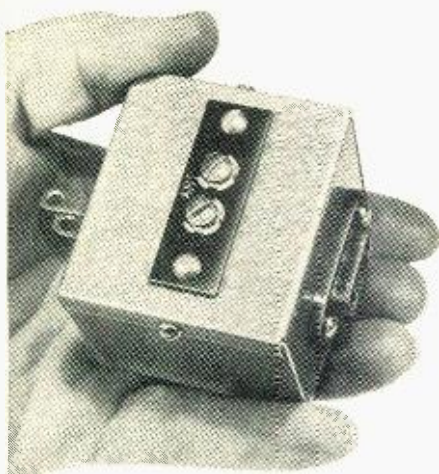


coil of $K3$, allowing its normally closed contacts to close the doorbell circuit, alerting the household.

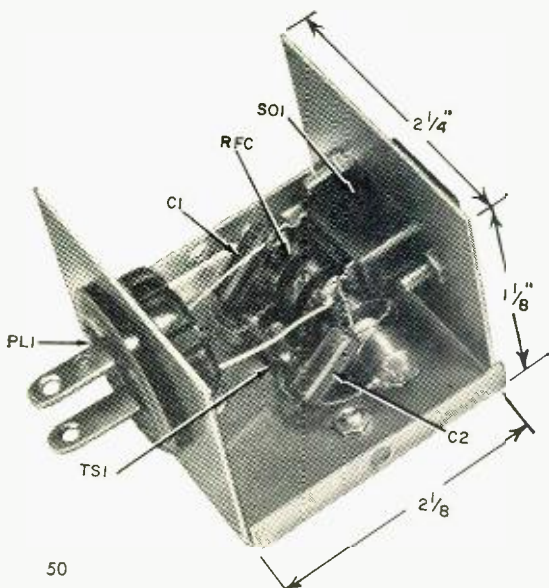
As a variation, a cadmium selenide photocell can be used in place of the cadmium sulphide cell as $PC4$. Cadmium selenide is sensitive to infrared light from flames, and the circuit can be rearranged to cause the doorbell circuit to close when flames are detected.

Circuit 4. The old standby burglar alarm light beam circuit can be con-

POWER LINE ANTENNA ADAPTER



Determine the grounded side of the a.c. line with a neon test lamp. Flatten the blade of the plug and be sure it is inserted in the appropriate side of the wall socket. Widening the blade can also be accomplished with a paper clip soldered around the edge of the blade.



NOTHING beats a good outdoor antenna for short-wave and broadcast listening, but if you're one of the unfortunates who lacks room to string up a long wire or a dipole, this gimmick may be for you. Use of the a.c. power line as a receiving antenna is hardly a new idea, and, if you have a bad impression of it, there may be valid reasons. Most of the "junk" power line adapters consist, simply, of a small capacitor attached to one side of the a.c. line. Since they pick up some signal along with a lot of noise, they are usually downright inefficient.

The adapter circuit at left couples the receiver to the power line for r.f., but at the same time it acts as a high-pass filter, cutting out some of the noise. It also takes advantage of the "natural" ground in every household a.c. line. Leakage current is minimal, and the a.c. line voltage is isolated from the receiver antenna terminals.

The adapter is constructed in a small aluminum box using an Amphenol 61M male plug and low-cost female chassis receptacle. The 2.5-mh. choke is of the four-pie variety. Capacitors *C1* and *C2* can be either 50 or 100 $\mu\mu\text{f.}$; they must be rated at a minimum of 400 w.v.d.c. and should be of the ceramic type.

A certain amount of experimentation may be necessary to insure best performance. First try connecting your receiver to just the antenna terminal, then to just the ground terminal. Finally, connect the receiver to both terminals.

—Lou Garner

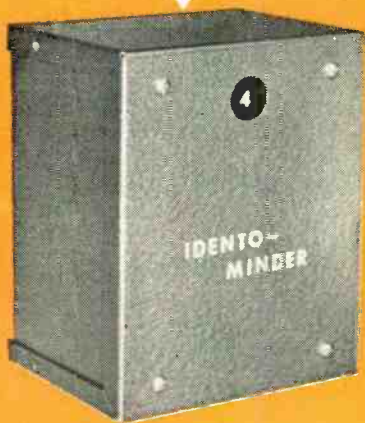
CAUTION

Do not substitute components.
Do not eliminate choke coil.
Use only with transformer-powered, standard radio receivers.

HOW ABOUT IT, OM, what precautions have you taken to make sure you comply with the FCC's ten-minute identification rule? Do you rely on the tumbling sand grains of an egg timer to alert you for an ID? Or have you placed your faith in one of those gadgets that ticks like a time bomb and, every now and then, gives out with a nerve-shattering bong—provided you go to the trouble of resetting it every ten minutes. Probably you trust to luck and memory to stay legal.

The "Idento-Minder" overcomes the inconvenience of

THE IDENTO- MINDER



***Ten-minute ID's? You'll
never forget with a
gadget for the ham shack
that times QSO's***

By HARTLAND B. SMITH, W8VVD

other timing gadgets, and the uncertainty of depending on memory. Housed in a 3" x 4" x 5" Minibox, it tells you not only when to identify, but also lets you know at a glance how many minutes have elapsed since the previous ID has been given. Its quiet electric movement requires no winding, and its flashing neon indicator, while an effective reminder, will neither startle nor annoy you with unnecessary in-shack QRM.

The heart of the Idento-Minder is a small synchronous timing motor that drives a 3½"-diameter disc at a speed

THE IDENTO-MINDER

of 1/10th rpm. At ten-minute intervals, a 9/16" hole, cut 1/2" from the edge of the disc, uncovers a blinking neon bulb to alert the operator in time for proper station identification.

The Blinker Circuit. A relaxation oscillator circuit is formed by *R1*, *D1*, *C1*, and *I1*. When the direct current passed by *D1* charges *C1* to the bulb's striking voltage, *I1* lights up and discharges the capacitor. As soon as the capacitor voltage drops to a low level, the bulb goes out and remains extinguished until *C1* recharges. The amount of resistance at *R1* governs capacitor *C1*'s charging time. The higher the resistance, the longer the intervals between flashes. When a 470,000-ohm resistor is employed, the neon bulb blinks approximately four times per second.

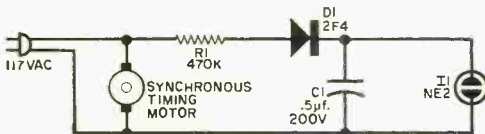
Although synchronous timing motors are listed in many radio catalogs and bargain bulletins, you undoubtedly *won't*

be able to find one rated at exactly 1/10th rpm. The solution to this problem is to use a pulley and belt arrangement like that shown in the photos below to achieve the proper disc speed.

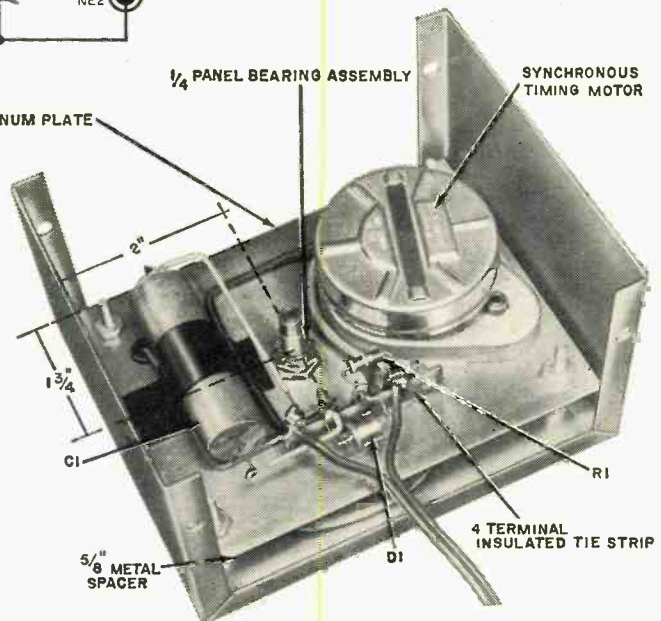
Making the Pulleys. The motor in the prototype is a 1/4th-rpm type which requires a pulley diameter ratio of 1:2.5. A suitable motor pulley was fashioned from a 1/2" length of 1/2"-diameter polystyrene rod. After cutting a fairly deep groove around the rod with a small rat-tail file, the pulley was drilled at the center and pressed on the motor shaft.

A larger pulley, slightly more than 1" in diameter, was then scroll-sawed from a piece of 1/4" plywood and also grooved with a file. After drilling a 1/4" hole at its center, the wooden pulley was pushed onto the shaft of the 1/4" panel bearing assembly visible in the first two photos and fastened in place with epoxy cement. An ordinary rubber band serves as the belt which transfers power from one pulley to the other.

The exact pulley diameters you use will, of course, depend on the speed of your particular motor. The motor suggested in the Parts List, for example, turns at only 1/15th rpm. Therefore, it requires a 1/2" *disc pulley* and a 3/4" *motor pulley* to bring the disc speed up



3 1/2" x 4 3/4" ALUMINUM PLATE



All of the parts for the Idento-Minder are bolted on a 3 1/2" x 4 3/4" aluminum panel which is mounted inside a Minibox with spacers to permit rotation of the "time" disc. The blinker circuit, shown in the schematic above, is simple and requires a minimum of components.

to 1/10th rpm. If you use a motor with a different speed, vary the pulley size accordingly.

All of the parts for the Idento-Minder are mounted on the 3½" x 4¾" aluminum plate. Approximate the parts layout, and then drill holes for the timing motor, the panel bearing assembly, and the four-terminal tie strip. Drill four mounting holes for the bolts with spacers which hold the panel to the front of the Minibox. While you're at it, drill a hole 9/16" in diameter centered 13/16" from the top of the front panel of the Minibox for the "time" window, and another hole (line with a grommet) in the back for the a.c. line cord.

Assembly. Mount all of the components on the aluminum panel. The tie strip supports *D1*, *R1*, and the leads of *C1*. You can prevent the capacitor from flopping around inside the case by taping it tightly to the panel as shown in the first photo.

After fabricating and installing the pulleys, cut a 3½"-diameter disc from stiff cardboard or other suitable material, and make a 9/16" hole centered ½"

from the edge for the warning light to shine through. Spray the disc with black paint and apply equally-spaced number decals. To install it, simply cement it to the disc pulley.

To finish the job, insert bolts through the front of the Minibox, slip ⅝" metal spacers over them to provide clearance between the panel and the box for the rotating disc, and bolt the panel in place. Screw on the back of the Minibox, and you're ready to go.

Install the Idento-Minder where it will be in your line of vision when you're on the air. Don't worry about having to watch the little gadget like a hawk, however, since its flashing neon indicator is so insistent that you'll have a difficult time ignoring it, even when your eyes are focused on an object as much as 90 degrees away from it. Due to the disc's slow rotation, the bulb is visible for almost a minute as the hole passes by, and you're bound to notice the winking light. The numbers also keep you alert because they indicate how many minutes have gone by since the previous ID. —30—

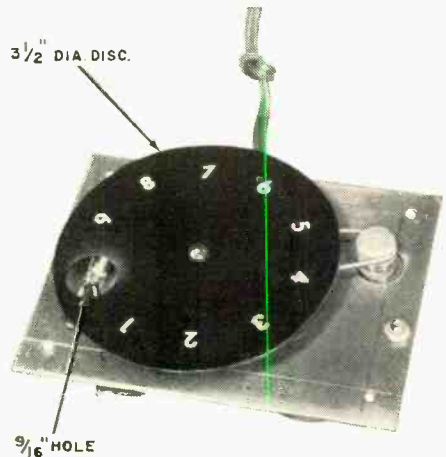
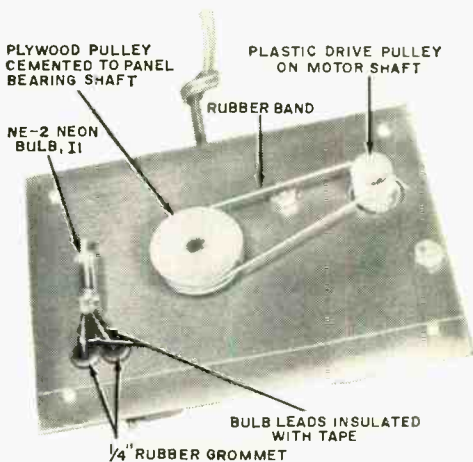
PARTS LIST

- C1*—0.5-μf., 200-volt paper capacitor
- D1*—200-ma., 400-PIV silicon rectifier (Sarkes Tarzian 2F4 or equivalent)
- I1*—NE-2 neon bulb
- R1*—470,000-ohm, ½-watt resistor
- 1—120-volt, 60-cycle synchronous timing motor (Allied Radio, 78B-497, \$2.40)
- 1—½" disc pulley for use with above motor—see text

- 1—¾" motor pulley for use with above motor—see text
- 1—3" x 4" x 5" Minibox (Bud CU-2105-A)
- 1—3½" x 4¾" aluminum plate
- 1—¾" panel bearing assembly
- 4—⅝" spacers for #6 machine screws
- Misc.—Decals, 4-terminal tie strip, hookup wire, hardware, 3½" cardboard disc, black spray paint

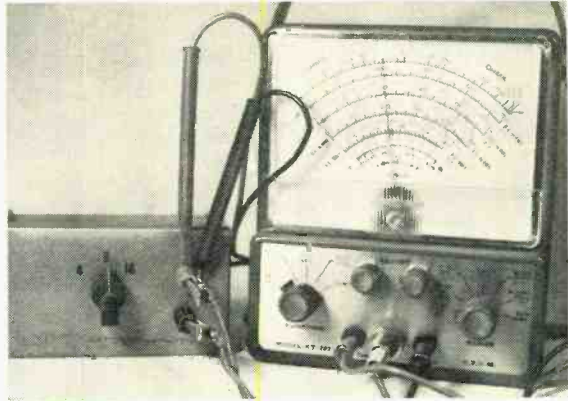
Pulleys are mounted on front of inside panel and coupled with a rubber band. Mount bulb *I1* as shown.

Glue the 3½" disc to the large pulley, and position bulb *I1* so it shines through the "ten minute" hole.



RESISTIVE LOAD

If you're tired of using makeshift resistive loads when testing audio amplifier projects, this adjustable unit is for you. The cost is low, and it can be built in two hours



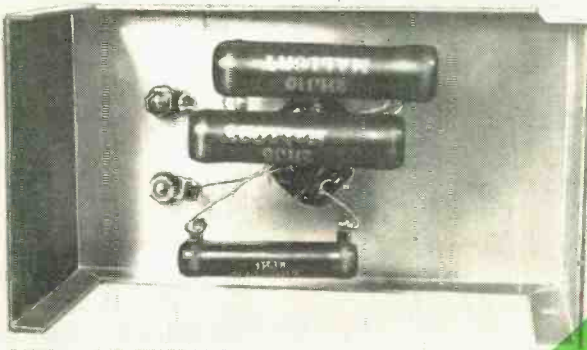
When testing hi-fi amplifiers, a load of the rated resistive impedance that will not shatter the eardrums is a must. Such a test load should also have a negligible reactance over the frequency range of interest, and should be capable of dissipating a reasonable amount of power, at least for short periods. Most of us go along for years haywiring the test load with clip leads, which short out or let go while we're setting the bias or adjusting the feedback, with disastrous results.

The writer finally got fed up with haywire and makeshifts and built this adjustable load unit, which you can duplicate quickly at nominal cost. It is so simple that it can be wired merely by following the schematic diagram and the pictures, without special construction data. Power-handling ability is 15 watts on the 4-ohm, 30 watts on the 8-ohm, and 40 watts on the 16-ohm switch position, if adequate ventilation is provided. Higher-wattage resistors can be used if desired, but will require a larger box and better ventilation.

As a bonus, use of the load permits you to read power output by connecting your VTVM or wide-band multimeter across the load, and choosing the appropriate a.c. scale. Just read the voltage and convert it to watts by means of the graph. The dashed lines show sample measurements of 6.0 volts across the 4-ohm load and 9.0 volts across the 16-ohm load. And if you're worried by the inductance of wire-wound resistors, forget it. Up to well above 100 kc., the inductance of even the 16-ohm resistor is negligible.

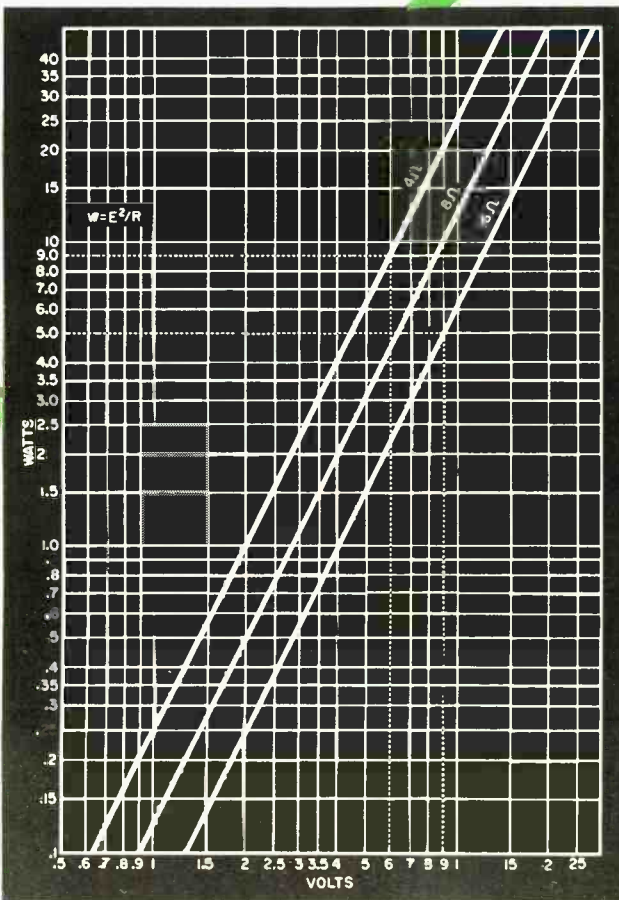
FOR HI-FI TEST

By WALTER TEMCOR

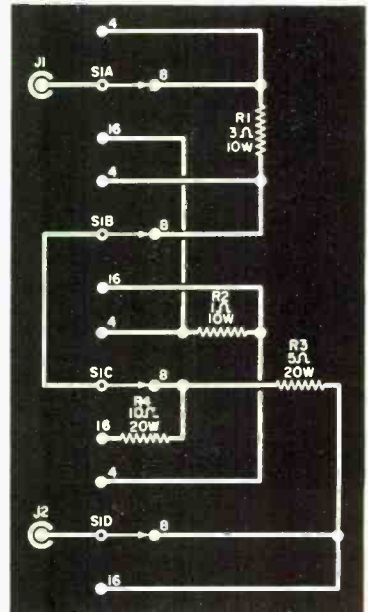


Resistors making up the adjustable load are mounted directly on the switch terminals for wiring ease.

Straightedge and voltmeter are all you need to read watts output from power graph.



Switching connections are easily followed in the schematic diagram. Don't forget wire lead between S1b and S1c arms.



PARTS LIST

- R1—3-ohm, 10-watt wire-wound resistor (Mallory 1113 or equivalent)
- R2—1-ohm, 10-watt wire-wound resistor (Mallory 1111 or equivalent)
- R3—5-ohm, 20-watt wire-wound resistor (Mallory 2115 or equivalent)
- R4—10-ohm, 20-watt wire-wound resistor (Mallory 2110 or equivalent)
- S1—3-position, 4-pole rotary switch (Lafayette SW-30 or equivalent)
- 2—Binding posts
- 1—5¼" x 3" x 2⅛" aluminum box (Premier PMC 1006 or equivalent)
- 1—Pointer knob
- Misc.—Hookup wire, solder, etc.

Build This Automatic

This caution light turns itself

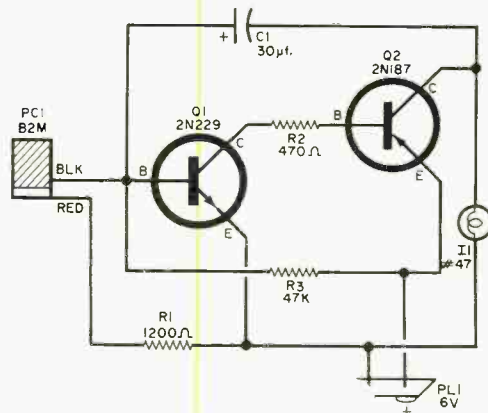
THE HOME OWNER will find many uses for this automatically operating safety flasher. It can warn of an open ditch or hole, attract the attention of a taxi driver or doctor arriving at night, or serve as a beacon to point the way for after-dinner guests. And you can take it on trips as a safety accessory in case of highway breakdowns.

The handy part about this flasher is that it may be left unattended. As sky lighting decreases, it is sensed by photocell *PC1*, and the flasher automatically goes into operation. When the photocell is again illuminated, *Q1* is biased to cut-off by the action of *PC1*, causing the flasher to stop operating.

Construction. The safety flasher is easily assembled from inexpensive components and housed in a standard aluminum box. The 6-volt battery drain is so low that the battery can be attached to the flasher through plug *PL1*, eliminating an on-off switch. The battery plug



If other transistors are substituted for *Q1* and *Q2*, different values of *R2* and *R3* may be needed.



POPULAR ELECTRONICS

Safety Flasher

By LOU GARNER

on at dusk and off at dawn

is affixed to the edge of a small perforated Bakelite subchassis. This insulated chassis holds all of the components. The transistor sockets are wedged into place through holes cut in the Bakelite and the leads are arranged to support the rest of the circuit.

Neither lead dress nor layout is critical. The transistors could be wedged into the Bakelite chassis and the leads permanently soldered into place. However, if you do this, be sure to use a heat sink to prevent accidental heat damage. Regardless of the layout used, cut a hole in the aluminum box to permit light to shine on *PC1*.

Modifications. Some builders may prefer to construct a larger unit with four flashlight D cells in series. This design would require an on-off switch, since without it the flasher would turn itself on when stored in darkness. The unit shown here can be stored just by unplugging the battery.

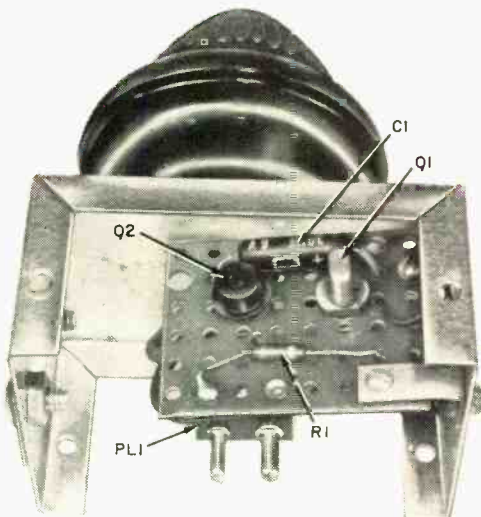
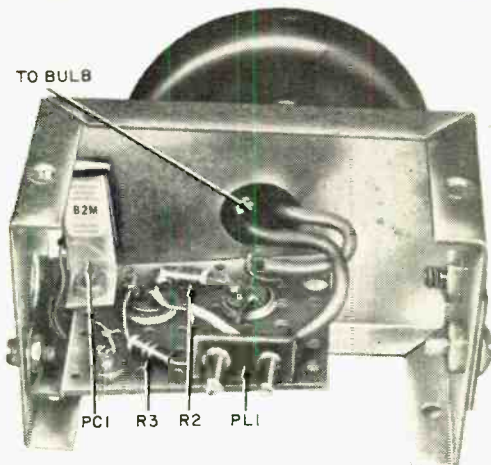
Experiment with the value of *R3* for optimum performance, or, as an alternative, use a 100,000-ohm potentiometer in place of this bias resistor. The flashing rate can be adjusted by changing the value of *C1*; use smaller values for a faster rate. Keep in mind that the light will not appear as bright as a continuously lit bulb—the flasher applies current to the bulb in short pulses and the light output is accordingly somewhat lower.

-30-

PARTS LIST

C1—30- μ f., 10-volt electrolytic capacitor
I1— \approx 47 pilot lamp
PC1—B2M photocell (International Rectifier)
PL1—Battery plug for Burgess F4P1 battery
Q1—2N229 npn transistor (Sylvania)
Q2—2N187 pnp transistor (General Electric)
R1—1200-ohm, $\frac{1}{2}$ -watt resistor
R2—470-ohm, $\frac{1}{2}$ -watt resistor
R3—47,000-ohm, $\frac{1}{2}$ -watt resistor
Misc.—Small aluminum box, clearance light assembly and bracket, transistor sockets, lantern-type battery (Burgess F4P1), Bakelite chassis
— see text, screws and nuts, wire, solder, etc.

Don't forget the hole in the chassis to let in daylight on the B2M self-generating photocell.





Hi-Fi Lab Check

EICO ST-70 Stereo Integrated Amplifier

Manufactured by EICO Electronic Instrument Co., Inc., 33-00 Northern Blvd., Long Island City 1, N.Y.

Prices: \$99.95 (kit); \$149.95 (wired)



IF YOU ARE susceptible to first impressions, you're bound to appreciate the ST-70. This is a big brute of an integrated stereo amplifier that just looks and feels like it means business. Keeping in character with the rest of the EICO hi-fi line, the ST-70 has all the control functions an audiophile will ever need. The mechanical layout is wide-open and there's no stinting on room, parts quality, or sound engineering practices. While possibly not one of the easiest stereo amplifiers to assemble (20-22 hours wiring time), the ST-70 commands the respect of its builders, and from what we've seen, those who listen to it as well.

CIRCUIT REPORT: Exclusive of the rectifier stage, the EICO ST-70 is an 11-tube amplifier rated at 35 watts per channel (continuous sine wave power). Two 12AX7 tubes are used in the preamplifier stages for amplifying tape head and low output phono cartridges. Four 12DW7/7247 tubes appear in the control stages. These are followed by a single triode

section of another 12AX7 into a pair of 6SN7GTB's as phase inverters. The output tubes in each section are a pair of 7591's.

Balance and bias of the output stages are individually adjusted with controls on the top of the chassis deck. A center speaker may be fed directly from the ST-70. Each channel has a separate hum adjustment and separate filament winding. Power consumption is approximately 125 watts.

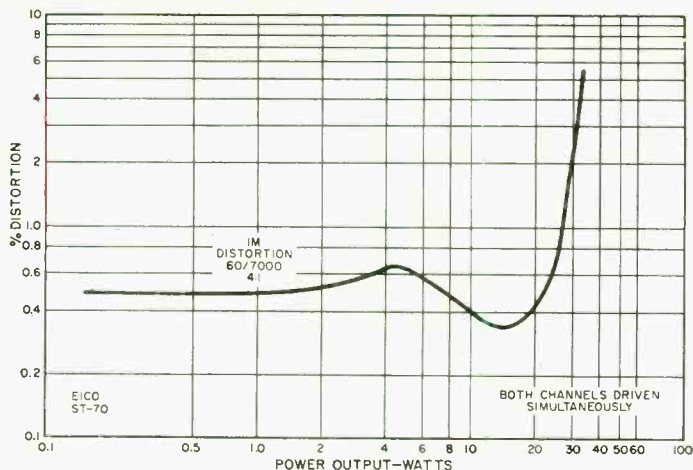
HIRSCH-HOUCK LAB CHECK: Power output of the ST-70 is 30 watts at 1000 cycles when both channels are driven, or 35 watts with only one channel driven at a time. This agrees with the manufacturer's rating.

Distortion (IM) was about 0.5%, or less, up to 25 watts with both channels in operation (see graph at top of next page). The ST-70 is a high-gain ampli-

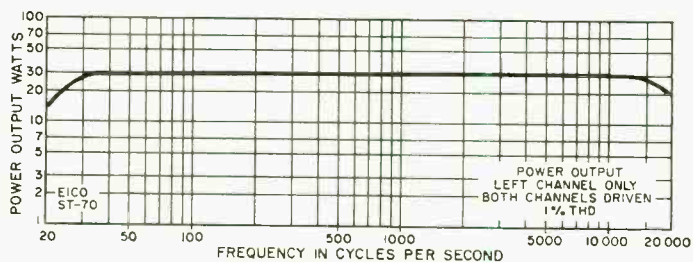
Partial view shows the open design of the ST-70. The selector switch is mounted in the recess of the chassis deck. Some of the slide switches are also visible.



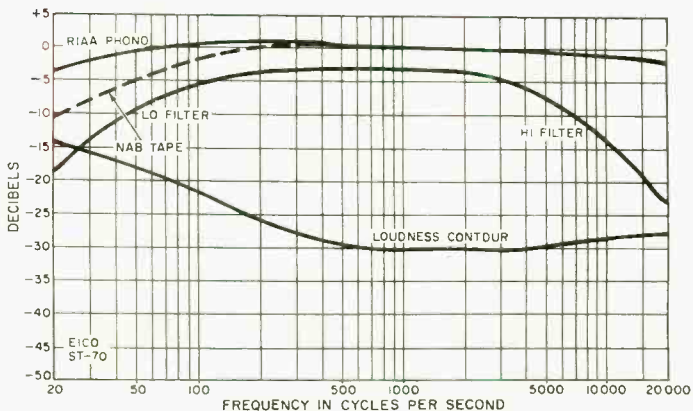
The IM distortion level is equal to the manufacturer's specifications when one channel is driven with the other idling. When both channels are driven from the same signal source, the curve at right results.



Power response is flat from 30 to 15,000 cycles (1% THD) when both channels are driven. With only a single channel driven, the curve rose to 35 watts and flattened out over a much wider frequency response range.



This family of curves shows the effects of the switched loudness compensation control, RIAA phono and NAB tape head compensation. The last curve shows both the low and high filters switched into the circuit. In setting this graph, the loudness compensation is -30 db.



fier that requires only 2.5 millivolts of phono signal to drive it to 10 watts output. The a.c. hum level at 10 watts is down about 70 db. Hum level differs on each channel, but is not objectionable; another sample amplifier had an even lower hum level.

The tone control range is within the range specified by the manufacturer. Loudness tracking was average, and both RIAA and NAB tape compensation were good to fair with modest drops below 60-70 cycles.

IN CLOSING: The EICO ST-70 has a front panel "balance switch" (not to be confused with the balance control) that makes possible a perfect electrical match between the two channels. Of course, this matching process requires identical speakers or speakers that are very similar, but it is a clever design feature that is not found in most other equipment. All of this adds up to the fact that the ST-70 is one of the best amplifier buys you can make for a modest number of dollars.

British Manufacturer Claims

A Home Television Tape

A TV TAPE RECORDER for the home? "Oh sure," a spokesman for a large electronics manufacturer exclaimed recently, "in another ten years. We're working on it, of course, but we just can't get the price down below \$1500.00."

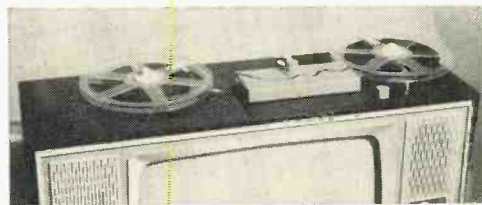
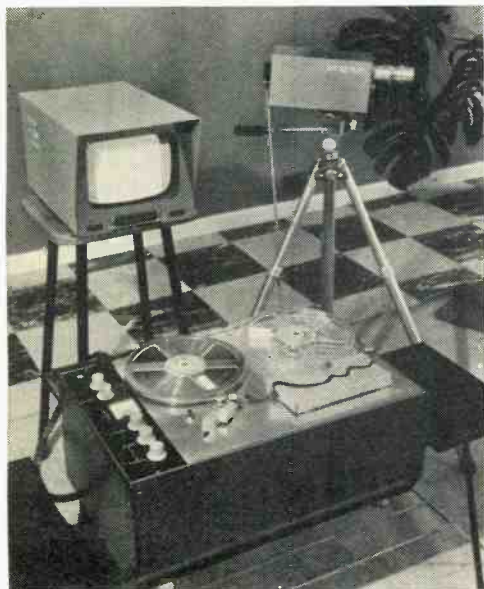
Among the companies which have been attempting to come up with a TV recorder—a device which would actually allow the home viewer to record his favorite programs, including both video and sound—are Sony, RCA, and a raft of others. And why not? There would be an enormous, ready-made market for such a device if the price were low enough. Generally speaking, however, current tape recorders that come close to being suitable for home use carry a price tag of about \$12,000.00. It is true that there has been much discussion of

units retailing for \$500 to \$1000, but even the most optimistic target date has been set for some time in 1965.

In this easy-going atmosphere of speculation as to future possibilities, a bombshell exploded recently. Telcan, Ltd., a newly formed British concern in Nottinghamshire, England, announced that it will shortly market (perhaps as soon as this Christmas) a 6" x 9" x 17" unit capable of recording up to 40 minutes of sound and video on two tracks using a standard 10½" reel of quarter-inch audio tape. The price? Roughly \$160 for the recorder, or just \$60 extra for a TV set with a recorder built in!

How Did They Do It? This was one of the questions being asked by the experts after the announcement of the unit. Although technical information available to date on "Telcan" (the name of the recorder as well as the company) is sketchy, the following specifications have been released: playing time, 20 minutes per track, or 40 minutes total; maximum spool size, 11"; resolution, 300 lines peak white; system rise rate, 0.2 microsecond; signal-to-noise ratio, 28 db; system tape

"Telcan," a sound and video tape unit that reputedly can be produced for \$160, is shown at left with monitor and NEV Icon TV camera made by same firm. The camera, said to be priced at just \$210, can be used with recorder to make electronic home movies.



A television set with built-in video tape recorder would cost about \$60 more, Telcan Ltd. claims. Not stated are circuit details and other data on unit.

Recorder for Under \$200

tracking, double; sound system, signal-to-noise ratio 40 db. One published account of the system puts the tape speed at 120 inches per second, but this figure has not been verified by the manufacturer, and would seem unlikely in view of the difficulty involved in putting enough tape on an 11" reel to give a total recording time of 40 minutes.

According to other released information, "Telcan" takes the TV signal from the detector of a television set, amplifies it, and assembles it in a form that can be recorded on tape by "the special transducer mechanism. The same transducer, which has no moving parts, reconverts the signal on the tape on replay into electrical impulses which are assembled by the following circuitry into a normal TV signal, which is then applied to the grid of the video output valve (tube) in the TV set."

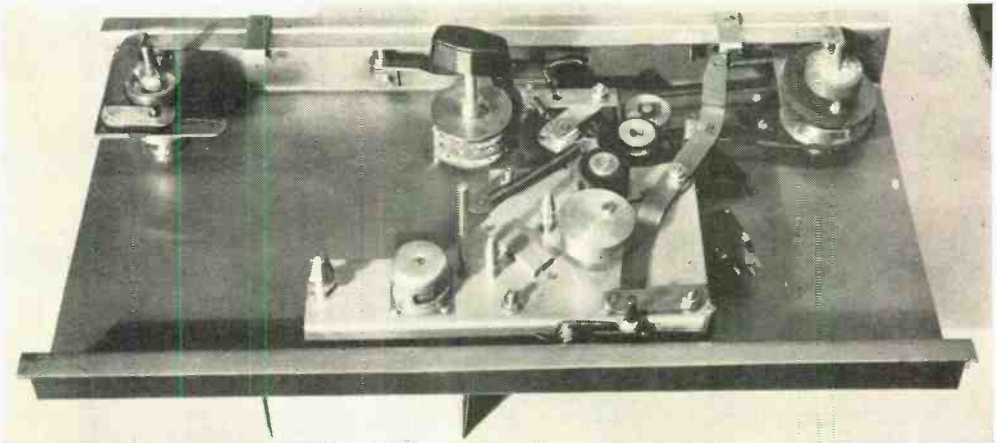
The Problems. Television tape recording has been the object of much head-scratching. The first TV broadcast recorders appeared in 1956; they were very large, in terms of both physical size and price. What had to be done, of

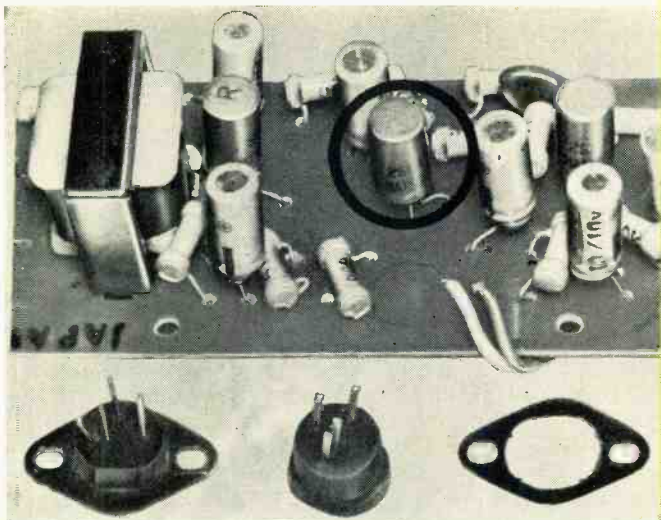
course, was to find a way to put on tape a video signal 4.5 megacycles wide—many times the bandwidth of the usual 20- to 20,000-cps audio signal. To compound the difficulty, it was also necessary to provide for the TV horizontal and vertical sync pulses and the audio, for a cue track, and for a special control track to help keep the TV tape recorder in synchronization.

In final form, all this required tape 2" wide traveling at 15 ips, a special rotating head assembly with four separate recording heads for the video, and enough associated electronic and mechanical gear to fill a warehouse.

If "Telcan," a greatly simplified TV tape recorder, is a success, the developers, Noman Rutherford, Michael Turner, Brian North, and Jack Jones, will have solved some formidable problems. —30—

The "Telcan" tape transport with cover removed. Information as to tape speed has not yet been released.





The first step is to isolate the bad transistor (circled), clip it out, and clean the solder out of the holes in the printed circuit board. Replace it on the board with an inexpensive imported transistor socket with the metal mounting ring and extra pin removed.

TRANSISTOR REPLACEMENT in commercially wired gear has always been a tricky business. Not only do you have to find the bad transistor and wrestle it out of the circuit board, but you have the problem of finding a replacement transistor that will work as well as the original. This latter step can get a bit sticky if you can't identify the original transistor, or if the circuit involved is a bit critical and refuses to work with just any replacement you happen to have in the junk box.

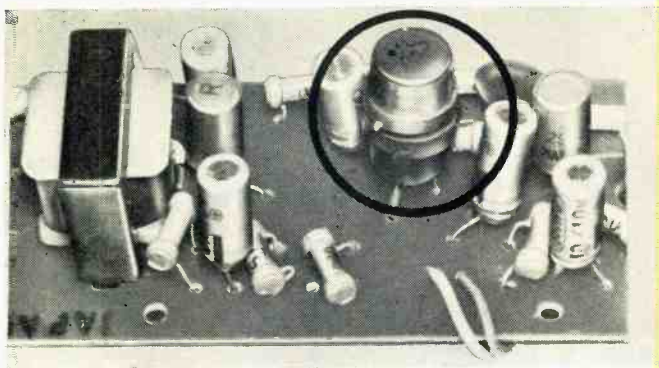
If trial and error substitution is the only answer, you can save yourself time, trouble, and a damaged circuit board by installing an inexpensive transistor socket. Since most of these sockets are equipped with four contacts, remove the contact that does not mate with the drilling pattern of the circuit board, and carefully work the remaining pins into the holes in the board. Solder the pins to the foil, and insert a substitute transistor in the socket.

When you find a suitable replacement transistor that performs to perfection, you can either leave it installed in the socket, or remove the socket and solder the transistor to the circuit board.

—Roy E. Pafenberg, W4WKM

Transistor Replacement Technique

Why solder in a doubtful replacement when this trick allows a variety of substitutes?



To install the socket, carefully push the leads through the holes in the board, making sure that the orientation matches that of the bad transistor. Plug in a substitute, and you're back in business.

Build a STEREO INDICATOR



Stereo multiplex FM programs are becoming more and more common. This indicator lets you know when you have tuned in a stereo transmission

By CHARLES CARINGELLA

A STEREO INDICATOR of some sort (usually a panel lamp) is now a standard feature of most commercial multiplex adapters and FM-multiplex receivers. Such an indicator helps the user find FM-stereo signals when tuning, and eliminates any doubts as to whether the transmission is stereo or not.

If your equipment does not have one of these stereo indicators, don't despair; the low-cost unit described here can be added to any multiplex adapter or FM receiver. In fact, the transistorized device can easily be tucked away inside most multiplex adapter or FM receiver enclosures. Or, if desired, the unit can be built into a separate enclosure as shown.

How It Works. The transmitted stereo signal contains, along with other modulation components, a 19-kc. pilot sub-carrier. The multiplex information, in-

cluding the 19-kc. signal, appears at the output of the FM receiver. This 19-kc. signal is constant in amplitude and, when present, constitutes the signal that turns on the stereo indicator light.

Multiplex signal output from the FM tuner is fed into jack *J1* (see Fig. 1) and then out again through jack *J2* to the multiplex adapter. If your FM tuner has a built-in multiplex circuit, then it is only necessary to bring out one shielded line from the tuner to *J1*, the input of the indicator circuit. This will necessitate an internal connection in the tuner at the detector output, or at the input of the multiplex circuit in the receiver.

The tuned circuit made up of coil *L1* and capacitor *C1* resonates at 19 kc. This allows only the 19-kc. signal to pass, and all the other components present in the complete multiplex signal are greatly attenuated. The 19-kc. signal is

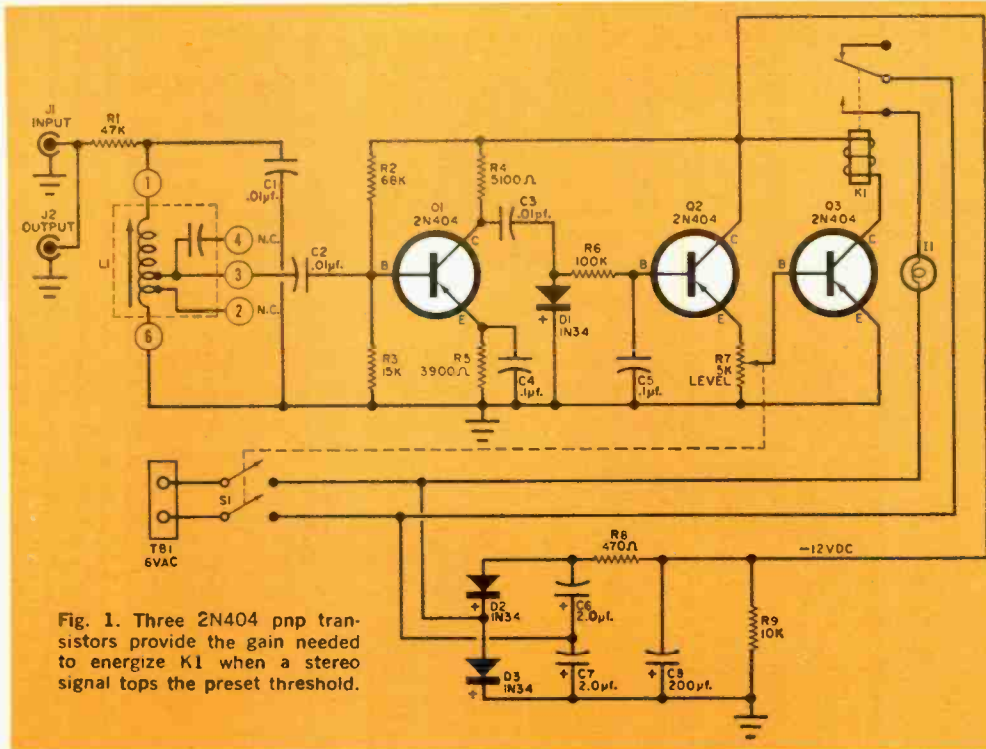


Fig. 1. Three 2N404 pnp transistors provide the gain needed to energize K1 when a stereo signal tops the preset threshold.

then amplified by transistor *Q1*, which is a conventional Class A amplifier.

The amplified 19-kc. signal is then rectified by diode *D1*, and the output is smoothed by resistor *R6* and capacitor *C5*. Transistors *Q2* and *Q3* amplify this d.c. signal and, the final output controls a sensitive relay (*K1*). The relay controls a pilot lamp (*I1*), which is lighted whenever the 19-kc. signal is present.

The only primary power required for the unit is 6-volt a.c. **CAUTION!** The source of this 6-volt supply must *not* be grounded! The voltage can be taken from the power transformer of the tuner, multiplex adapter, or hi-fi amplifier *only* if the winding supplying the 6-volt a.c. is *known* to be ungrounded. If you can't be perfectly sure that it is, use a separate, small, 6-volt filament transformer for power. This precaution is necessary because of the voltage doubler circuit in the power supply of the indicator unit.

The 6-volt a.c. is applied directly to the voltage doubler circuit, and through normally open contacts of *K1* to the indicator lamp. The output of the voltage doubler circuit is smoothed by resistor



Fig. 2. In the self-contained unit, all connections are made on the rear panel. The name "Multiplex" refers to a function that no longer applies.

R8 and capacitor *C8*, and provides about 12 volts d.c. negative to ground across bleeder *R9*. Since the total current drain is only about 3 ma., inexpensive 1N34 (or equivalent) diodes are satisfactory as rectifiers.

Construction and Adjustment. The entire circuit is constructed on a piece of 6" x 3" Vector board. Placement of parts is not critical; however, the layout shown in Figs. 3 and 4 will provide a handy guide. The relay is mounted on the Vector board also, since the arma-
(Continued on page 107)

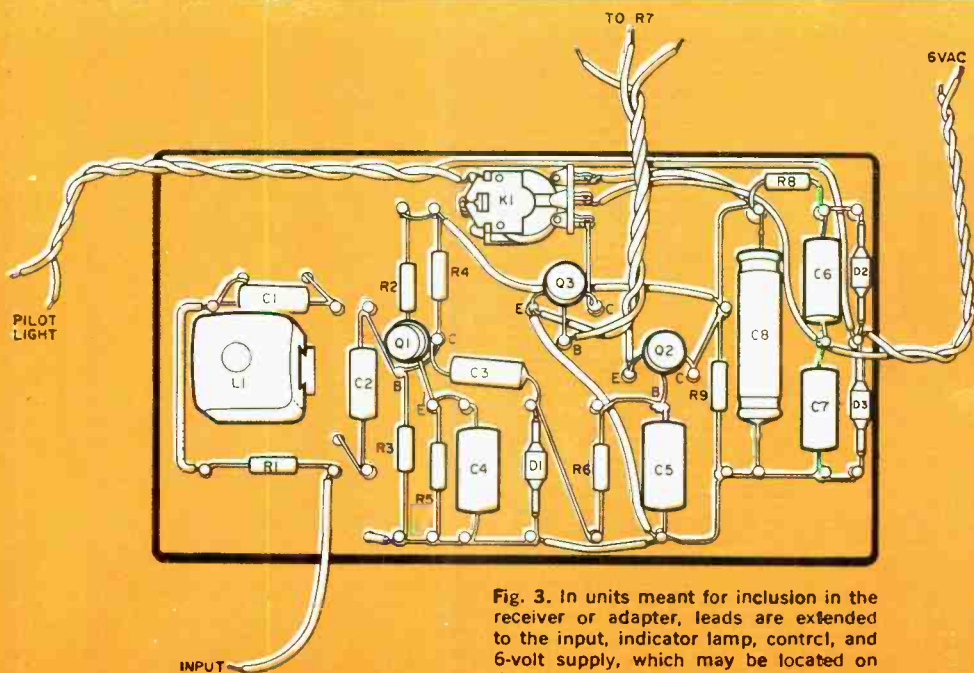


Fig. 3. In units meant for inclusion in the receiver or adapter, leads are extended to the input, indicator lamp, control, and 6-volt supply, which may be located on the main receiving unit, or control panel.

PARTS LIST

C1, C2, C3—0.01- μ f., 200-volt d.c., paper capacitor
 C4, C5—0.1- μ f., 200-volt d.c., paper capacitor
 C6, C7—2- μ f., 15-volt d.c., electrolytic capacitor
 C8—200- μ f., 15-volt d.c., electrolytic capacitor
 D1, D2, D3—1N34 germanium diode (or equivalent)
 I1—G.E. \approx 47 6-volt lamp (or equivalent)
 J1, J2—Phono jack
 K1—Relay, 5000-ohm coil (Lafayette F-260 or equivalent)
 L1—10-ke. multiplex coil (Miller 1354)
 Q1, Q2, Q3—GE 2N404 transistor (or equiv.)
 R1—47,000 ohms

R2—68,000 ohms
 R3—15,000 ohms
 R4—5100 ohms
 R5—3900 ohms
 R6—100,000 ohms
 R7—5000-ohm potentiometer, linear taper, with d.p.s.t. switch S1
 R8—470 ohms
 R9—10,000 ohms
 S1—D.p.s.t. switch (part of R7)
 1—6" x 3" Vector board
 1—6 $\frac{1}{4}$ " x 3 $\frac{1}{2}$ " x 2 $\frac{1}{8}$ " aluminum box chassis
 Misc.—Pilot lamp socket assembly, knob, 2-lug terminal board

All resistors
 $\frac{1}{2}$ watt, \pm 10%

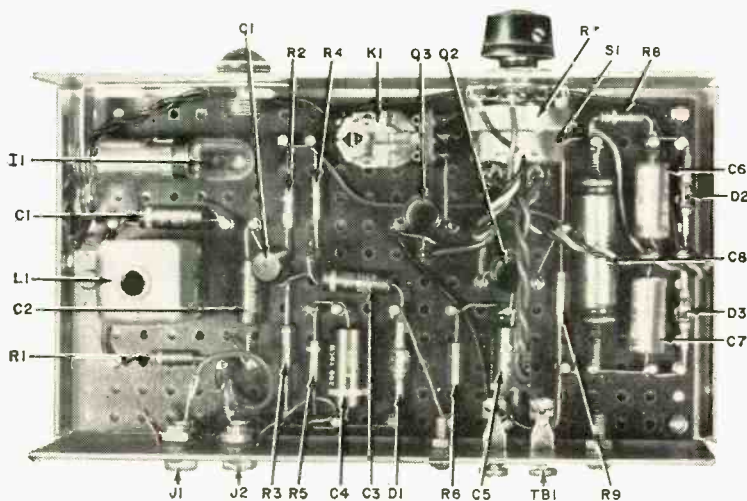


Fig. 4. The layout of parts lends itself to ease of assembly and trouble-shooting. Make sure you do not ground the relay while you're mounting or wiring it.

Better Model Control

Battery-operated toys are more fun with this power unit having a speed-direction control

By HOMER L. DAVIDSON



THAT MODEL train or auto road racing set you got for Christmas would be a lot more fun to operate if it was really easy to control. And how about that toy motor you use to power some of your other working models? With smooth, easy control from full forward to full reverse, all devices powered by small d.c. motors take on renewed interest.

Here's a model power unit that will provide dependable, convenient operation. At the same time, it's inexpensive and fun to build.

About the Circuit. Using the output from a small step-down transformer (*T1*), the model power unit rectifies the 60-cycle, a.c. voltage and develops a d.c. output across the rheostat (*R1*) in such a way as to make one end negative and the other end positive with respect to a neutral reference point in the circuit—one end of the secondary of *T1*.

Diodes *D1* and *D2* conduct on the positive half of the a.c. cycle, producing about 6 volts and charging filter capacitor *C1*. On the negative half of the a.c.

cycle, *D3* and *D4* conduct, and charge filter capacitor *C2*. In effect, each pair of diodes forms a half-wave rectifier circuit. The total effect is that of a voltage doubler circuit supplying 12 volts across the two ends of *R1*, but 6 volts positive and 6 volts negative with respect to the neutral point. This gives us exactly what we want: smooth, proportional control from forward to reverse and back again.

Transformer *T1* is a 6.3-volt filament transformer which can be salvaged from other equipment or purchased at low cost. Two 750-ma. "top hat" silicon diodes were used in each leg of the rectifier circuit so that double their current ratings, 1½ amperes, could be drawn from the power supply. Two 1½- or 2-ampere diodes can be substituted for the four 750-ma. units if desired.

Filter capacitors *C1* and *C2* are 500- μ f., 12-w.v.d.c. electrolytics. The 500-ohm, 3-watt wire-wound rheostat, *R1*, varies the output voltage from negative to neutral to positive.

A fuse is placed in one leg of the output to protect the power supply. If

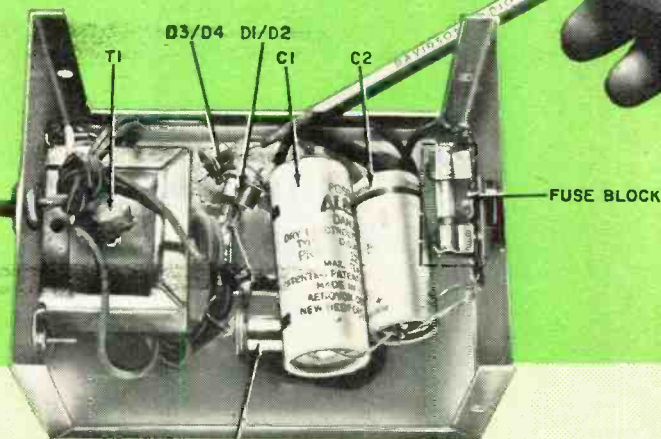
for \$5.50

PARTS LIST

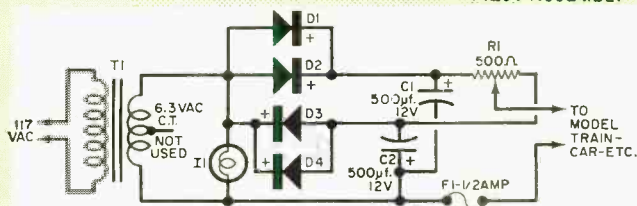
- C1, C2—500- μ ., 12-volt electrolytic capacitor*
D1, D2, D3, D4—750-ma. silicon diode—see text
R1—500-ohm, 3-watt rheostat (Clarostat 58-500)
T1—6.3-volt filament transformer (Stancor P6134, secondary 6.3 volts @ 1.2 amperes)
 1—Fuse holder
 1—Jewel pilot light assembly
 1—3" x 4" x 5" Minibox
 Misc.—Wire, a.c. cord, fuses, 3-lug terminal strip, hardware, alligator clips, grommets, pointer knob



This photo of the inside of the power unit shows how the parts are mounted in the main section of a 3" x 4" x 5" box. Make sure the fuse strip is insulated from the chassis.



PILOT ASSEMBLY



Two half-wave rectifier sections give 12 volts—6 volts negative and 6 volts positive relative to the neutral end of transformer T1.

the train or car pulls less than 500 ma., use a 1/2-ampere fuse. Larger fuses can be used for larger loads, the limiting factors being the current ratings of T1 and the silicon diodes.

Mechanical Details. The model power unit is assembled inside the main section of a 3" x 4" x 5" Minibox. At one end, drill mounting holes for T1 and an additional hole for the a.c. line cord. Drill holes in the top of the box for R1, the jewel pilot light assembly (for any standard 6-volt pilot bulb), and a three-lug, insulated terminal strip for connect-

ing the diodes and other components. At the other end of the box, drill holes to mount the fuse holder and to bring out the d.c. power leads. Line the holes for the output leads and the a.c. cord with rubber grommets.

Now wire the components in place, making sure you observe the polarity of the diodes (the cathode corresponds to the "bar" in the symbol for a diode, and the anode or plate to the "delta"). Use alligator clips to connect the output to the car or train, and you're ready to go—full speed ahead!

—50—

Equipment Report

NEW CB FEATURES "DSRC"

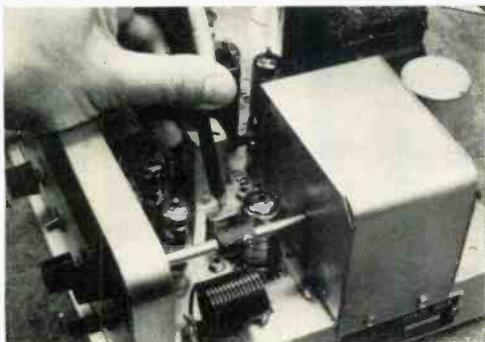
WHEN the \$269.95 Regency "Range Gain" transceiver was announced, some eyebrows were immediately raised. In addition to its clean appearance and catchy name, it had something called "double-sideband reduced carrier." Radio hams had used DSRC since World War II, but because a full kilowatt of power is legal on the hams bands, the increased efficiency of DSRC was considered marginally useful. However, the engineers at Regency Electronics, Inc., 7900 Pendleton Pike, Indianapolis 26, Ind., wisely decided to adapt DSRC to its natural habitat—CB, where every db of talk power is important.

Use of DSRC enables the "Range Gain" to run 8-10 watts PEP (peak envelope power) input and still be perfectly legal. The transmissions are regular AM and sound like those of any other transceiver. However, unmodulated carrier output is reduced while the amplitude of the modulation envelope is increased without over-modulation or distortion. Regency has combined DSRC output with a frequency-synthesis circuit that allows 23-channel, crystal-controlled operation.

The receiver is very sensitive and has a crystal filter for additional selectivity. Noise limiting, squelch, and antenna loading are all adjustable by the operator.

The "hidden" advantage of the "Range Gain" transceiver is not so much in the additional talk power, but in the reduction of heterodynes (since the carrier output is reduced). This permits a DSRC signal to get through where regular AM signals suffer from overpowering heterodyne interference. —30—

Frequency-controlling circuit is in sealed can. The pencil in this photo points to one of the 7500 kc. crystals used in the frequency-synthesizing circuit.



Meter has three functions: to read received signal strength, "S," and the voltage, "V," and current, "C," to final transmitter stage. Noise limiter (A.N.L.) is adjustable to provide a wide range of clipping.



Channel numbers appear in window in consecutive order. Control at lower right "dips" final stage for proper loading. Squelch is adjustable. Delta tuning knob permits several kc. adjustment of receiver to peak up off-frequency stations.

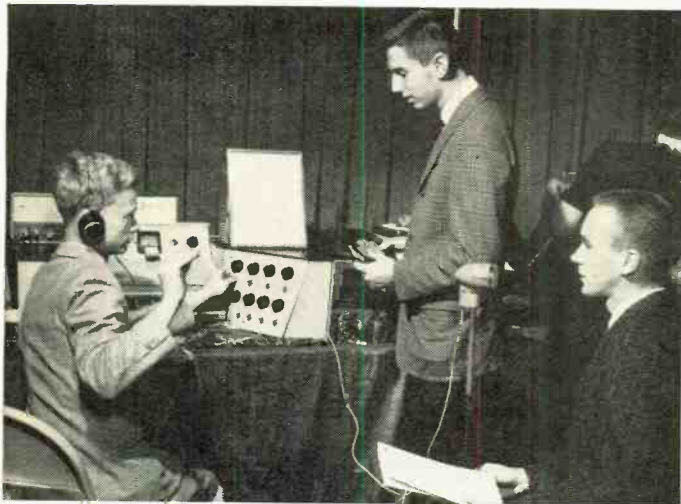
BOX SCORE				
	Excellent	Good	Fair	Poor
Talk Power	✓✓			
Selectivity	✓			
Sensitivity	✓			
Squelch	✓			
Noise Limiting	✓			
Stability	✓			
Operating Ease	✓✓			



How You Can Get a License to Operate A Student Experimental Radio Station

By **DAVID T. GEISER,**
WA2ANU, 20W2456

Radio Station KF2XGJ: Albert Pabin and other students demonstrate audio console by using it during actual broadcast. Station was licensed by FCC under little-known provision which permits Student Authorizations for some experimental purposes.



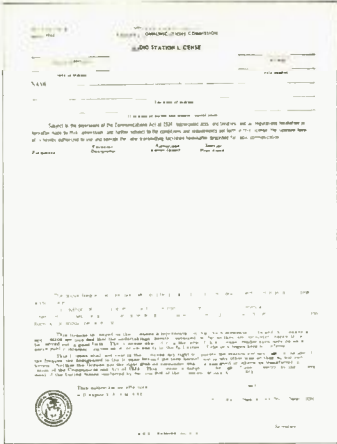
ARE YOU a student in the seventh grade or higher? Do you need to use a radio transmitter for a classroom or science fair demonstration, or an experiment of some kind? If you are a citizen of the United States, and you have a definite plan to use a radio station for one of the above purposes, there is a special class of license issued by the Federal Communications Commission that will permit you to do so!

A case in point is that of Science-Fair'er Albert Pabin, a ninth grader at Utica Free Academy, Utica, N.Y., who wanted to demonstrate under actual broadcast conditions an audio console which he had designed and built. A Citizens Band transmitter was available. The only problem was, could the demonstration be conducted legally? Pabin, on checking, found that it could—thanks to

a little-known section of the FCC rules—and applied for and received a license to operate under the call KF2XGJ.

Experimental Licenses. The FCC has set up several radio services with authorization to "experiment." An amateur radio licensee can experiment on a non-commercial basis, but he must be able to pass a technical examination and send and receive code. Those who operate in the commercial and scientific experimental radio service must prepare exhaustive technical justifications for their use of radio frequencies, and furnish equally exhaustive technical reports on the results.

In either case, it is hard for a beginner in radio to qualify for a license to put a transmitter on the air. Yet, most students *are* beginners. What can be done under these circumstances?



FCC Form 452-4 is the "ticket" used for issuing Student Authorizations. Applications are made by letter to FCC.

According to Part 5, Subpart H, of the FCC Rules and Regulations, actual experiments with "live" radio transmitting apparatus can be made by students. We are not talking about very low power devices such as "wireless microphones." We refer to radio transmitters with potential ranges of hundreds of miles.

All the FCC asks of a student who applies for a "Student Authorization" is that he have a good idea of what he is trying to show, and that he have older and more knowledgeable persons available to help him in case of difficulty. If the student's request is reasonable, the FCC will grant a license.

License Privileges. Before getting into what you *can* do, it should be noted that an experimental license is just that: you *can't* use it for casual conversation or to see how far you can talk. You are restricted as to *when* you can use it, and you must have a *definite plan* before you apply.

Some of the demonstrations that seem to fall within the meaning of Section 5, Subpart H of the FCC rules are: (1) how a radio transmitter's characteristics are measured; (2) the actions of an antenna or various types of antennas; (3) the effects of one communications station upon another.

The FCC believes that a student's instructors are fair judges of his motives and sincerity, and looks favorably on projects endorsed by an instructor. Aside from this, it's a good idea to talk over a project with an instructor before you spend time or money on it.

Points to Remember. Among the things you should keep in mind is that Congress and the FCC consider the radio spectrum as a valuable natural resource which should be used in the public interest. Any application for a Student Authorization based on this principle will receive serious consideration. Think carefully how your demonstration will

STUDENT AUTHORIZATIONS

The following is a direct quotation from Part 5, Subpart H, of the FCC Rules and Regulations: "... an application for a student authorization may be filed in letter form, in duplicate. The application shall contain the information set forth in paragraph (b) of this section.

(b) The application shall contain the following information:

- (1) Name and address of applicant.
 - (2) A statement that the applicant is a citizen of the United States.
 - (3) Applicant's school and grade.
 - (4) A detailed description in narrative form of the project including the type and purpose of operation.
 - (5) Place of operation — street address, name of building, or other specific location.
 - (6) Date(s) of operation including the exact hours, when known, as well as the duration of each period of operation.
 - (7) Equipment to be used. If manufactured, list name of manufacturer and type number. For other equipment, describe in detail and furnish a circuit diagram.
 - (8) Frequency (ies) desired and range of frequencies which could be employed.
 - (9) The method by which the frequency of operation will be determined.
 - (10) Frequency tolerance.
 - (11) The means by which this tolerance will be maintained.
 - (12) D.C. plate power input to final radio frequency stage. If not known, indicate any known power rating of equipment and state whether this is power output of transmitter or radiated power, and whether average or peak.
 - (13) Type of emission including a description of the modulation that will be applied, if modulated.
 - (14) Description of the antenna to be used, including height above ground.
- (c) The application shall be accompanied by a signed statement from the principal of the school, or a member of its faculty, on appropriate letterhead, stating that the project has the approval of the school and indicating the person under whose general supervision the project will be conducted."

serve *other* people, and include this information in your application.

The other important fact to remember is that the FCC expects you to propose
(Continued on page 106)

tera 10^{12} mega 10^6 nano 10^{-9} pico 10^{-12}
 pico 10^{-12} nano 10^{-9} mega 10^6 tera 10^{12}
 tera 10^{12} mega 10^6 nano 10^{-9} pico 10^{-12}

NEW NOMENCLATURE

By E. G. LOUIS

PUZZLED BY EXPRESSIONS such as *picofarad* and *nanosecond*? Don't feel bad if you find these relatively new terms a trifle confusing—even old-timers often do a "double-take" the first time around.

These terms, and many related ones, are coined by adding standard numerical prefixes to familiar unit designations. Scientists and engineers have used a variety of prefixes to designate multiple and fractional unit quantities for some time, and most hobbyists, hams, and audiophiles are quite familiar with older terms such as *kilocycle*, *microfarad*, and *millihenry*.

In recent years, expanding technology has necessitated additions to the list of "standard" numerical prefixes. The current list, as adopted by the U.S. Bureau of Standards and various international agencies, is given below. There are fourteen terms, including such interesting expressions as *tera-*, *giga-*, and *femto-*. By referring to the chart, you should have no trouble in "translating" any unit designation you may encounter. A *picofarad*, for example, is our familiar friend, the *micromicrofarad* ($\mu\mu\text{f}$).

Although some of the prefixes listed are not found extensively in radio and electronics literature, more and more engineers and technical writers are employing the new standards rather than the more cumbersome (and more familiar) older terms. Thus, *gigacycle* is being used in place of the older *kilomegacycle*, *picofarad* in place of *micromicrofarad*, and *nanosecond* in place of *millimicrosecond*.

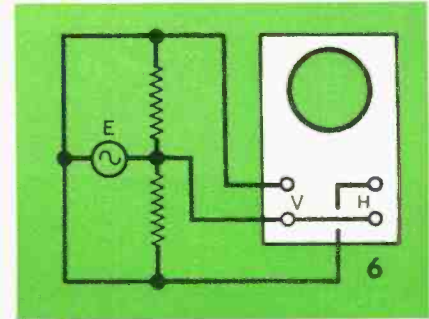
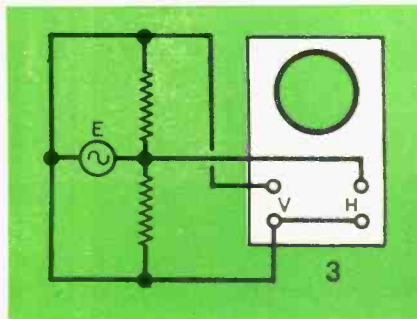
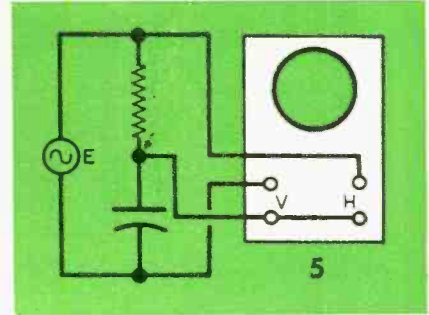
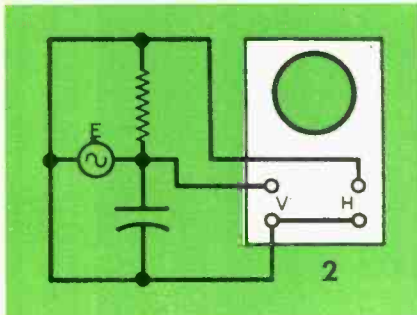
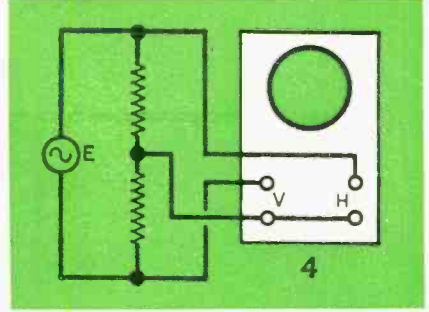
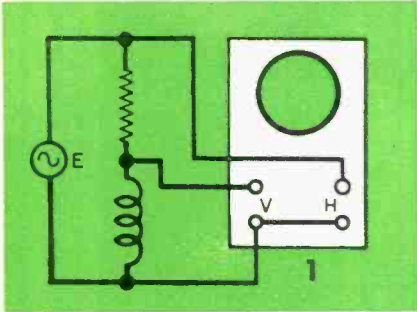
STANDARD PREFIXES

PREFIX	MULTIPLIER	DEFINITION
tera	10^{12}	million millions (British billion)
giga	10^9	thousand millions (American billion)
mega	10^6	millions
kilo	10^3	thousands
hecto	10^2	hundreds
deka	10	tens
deci	10^{-1}	tenths
centi	10^{-2}	hundreths
milli	10^{-3}	thousandths
micro	10^{-6}	millionths
nano	10^{-9}	thousandths of a millionth (also millimicro)
pico	10^{-12}	millionths of a millionth (also micromicro)
femto	10^{-15}	thousandths of a millionth of a millionth (also millimicromicro)
atto	10^{-18}	millionths of a millionth of a millionth

LISSAJOUS PATTERN QUIZ

A good technician, knowing what sine-wave signals are simultaneously applied to the horizontal and vertical inputs of an oscilloscope, can predict what the displayed Lissajous pattern will be. In this quiz, the same signal is applied to both amplifiers, but through combinations of impedances that cause differences in the phase angle and amplitude of the actual a.c. voltages reaching the inputs. All resistances and reactances have the same ohmic impedance at the applied frequency, the gain of both amplifiers is equal, and positive-going voltage deflects the spot upward, or to the right. See if you can match up the input circuits (1-6) with the patterns (A-F) produced.

By ROBERT P. BALIN



(Answers on page 98)



A



B



C



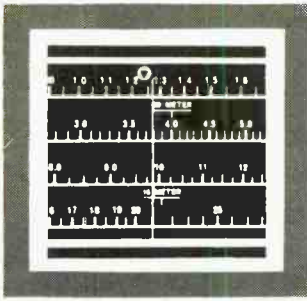
D



E



F



Across the Ham Bands

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

AMATEUR LICENSE FEES AND ARRL PETITIONS

EARLY in May, the Federal Communications Commission issued its long-expected findings regarding license fees under Docket No. 14507. A schedule of fees was set up for radio and TV licenses ranging from \$2.00 to \$100.00. For amateurs, it will cost \$4.00 for a new or renewed license of any class except the Novice class, and \$2.00 for a modified license (change of address, etc.). As it now stands, there will be *no fee charged for Novice licenses.*

The FCC's authority for imposing the new fees is Title V of the Independent Offices Appropriations Act of 1952, which states that any license, permit, etc., issued by a Federal Agency "... shall be self-sustaining to the full extent possible ... taking into consideration direct and

indirect cost to the Government, value to the recipient, public policy or interest served, and other pertinent facts."

In announcing the fees, the FCC stated: "Probably the most vigorous opposition of any group to the fee proposal came from the licensees of the Amateur Radio Service." This opposition was led by the American Radio Relay League and resulted in a sharp reduction in the amount of the proposed fees and the total exemption of the Novice class license from the fee schedule.

Effects of the New Fees. Starting on January 1, 1964, your remittance (\$4.00 for a new or renewed license, \$2.00 for a modified license) payable to the Federal Communications Commission must accompany your application for a new,

Novice Station of the Month

Joe De Marte, WN4EWK, Memphis, Tenn., exhibits the kind of concentration that enabled him to work 26 states (including Hawaii), Puerto Rico, Canada, and Midway Island. His Knight-Kit T-150 transmitter feeds a 40-meter "inverted-V" antenna on 40 and 15 meters, and his receiver is a National NC-125. If you want to contact Joe, try after 1:00 a.m. on 40 and week ends on 15. For submitting this photo in our monthly Novice Station of the Month contest, Joe will receive a one-year subscription to POPULAR ELECTRONICS. If you would like to enter the contest, send us a clear picture of your station—preferably showing you at the controls—along with some information about yourself, your equipment, and your operating achievements. Even if you don't win, we'll try to publish your picture as space permits. All entries should be sent to Herb S. Brier, Amateur Radio Editor, POPULAR ELECTRONICS, P. O. Box 678, Gary, Indiana.



When band conditions permit, Don Simonsen, DJØIR, works Novices from West Germany on 40 and 15 meters. See News and Views section for details.



New "Second Op"

A well-known DX'er in amateur circles, W9IOP, has just announced a new, up-to-date version of his popular "Second Op." This handy, 10½"-diameter cardboard calculator is a valuable addition to any ham or SWL shack. All of the recognized countries of the world are listed alphabetically on the perimeter of the calculator according to call letter prefix. Shown in the three "windows" are great circle bearings (from East Coast, Midwest, and West Coast), time differential, postal rates (all classes), and continent and zone for each country. One side of the calculator lists QSL bureaus around the world, as well as the ARRL U.S. and Canadian QSL Bureaus; the other side contains useful information on time conversion and postal rates. The "Second Op" is available from most radio supply houses, but may also be ordered directly from Electro-Voice, Dept. PE9, Buchanan, Mich., for \$1.00.

renewed or modified amateur license of any class except the Novice class. If you are applying for a new license and fail to pass the examination, your fee will not be returned. And the next time you apply for the license, you'll have to ante up another \$4.00.

In our opinion, this latter provision will, to a large extent, dry up the flood of applications by would-be hams who

rather foolishly apply for licenses, even though they know they are not properly prepared to pass the exams, "because it doesn't cost anything." With this exception, we doubt whether the new fees will have any particular effect on the average ham, especially since the Novice licenses are exempted. After all, 80 cents a year isn't an exorbitant fee.

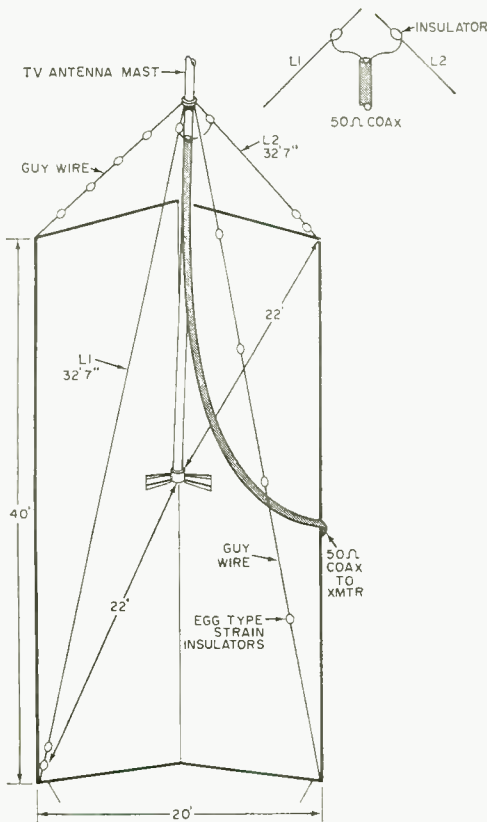
Of course, January is still four months away, so people with an eye on a license above the Novice grade can forestall paying the fee for another five years by bearing down on their studies and qualifying for their new licenses before January 1.

There is another fee of minor interest to most hams: \$20.00 for special call-signs issued under section 12.81 of the amateur regulations (reassignment of a call held formerly, etc.). The fees for CB licenses, incidentally, will be \$10.00 for Class A licenses, \$8.00 for all others.

ARRL News. At its annual May board meeting, the ARRL Board of Directors voted to petition the FCC to open the entire 144-148 mc. (2-meter) amateur band to Novice and Technician licensees, instead of restricting them to the center 2 mc. of the band (145-147 mc.) as at present. Since there is little, if any, opposition to this proposal, it should be adopted very soon.

At the same meeting, the ARRL board also voted to petition the FCC to require Conditional Class license holders to obtain a General Class license within a specified time limit. This would smoke out the unqualified holders of such licenses who obtained them by dubious means in the first place. The provision would not apply to invalids and other hardship cases.

Another ARRL petition will ask the FCC to rewrite the technical exams for



the different classes of ham licenses to bring them up to date, and to restore incentive licensing to the amateur radio picture by re-establishing the Advanced Class license last issued in the early 1950's. The restored "Class A" license would require a more comprehensive written examination than the General Class exam, but no additional code examination. The eventual aim would be to grant the holders of the new license extra operating privileges in some of the more desirable bands.

We predict that some form of this last proposal will be adopted by the FCC after much discussion, and that plenty of time will be allowed after it is adopted to permit amateurs to qualify for the new license before it goes into effect.

40-METER ANTENNA FOR SMALL ROOF

Are you one of those people who claim that they don't have room on the roof for an efficient transmitting antenna? Actually, if you have an outside TV antenna, you probably do have room for an

Where roof space is at a minimum, a pair of guy wires supporting a TV antenna installation can be used as the radiating portions of a 7-mc. (and 21-mc.) "inverted-V" transmitting antenna.

effective 40-meter (7-mc.) antenna which will also work on 15 meters. The secret is to use a pair of the TV antenna guy wires as the radiating portion of an "inverted-V" transmitting antenna as shown in the diagram.

Let's work out the details for installing a 40-meter dipole which has an overall length of approximately 66 feet on a 20' x 40' roof—a very small roof, incidentally. You'll need a few "egg" type strain insulators (approximately 1 3/4" x 3/4") and some 50-ohm coaxial feedline to do the job. Use RG-8/U coaxial cable if you can; RG-58/U will be okay if the length is not excessive.

Design Details. Assuming that the TV antenna is mounted in the center of the roof, we first determine the distance from its base to the corners of the roof, where the guy wires are undoubtedly anchored.

Using the Pythagorean theorem (*the square of the hypotenuse of a right triangle is equal to the sum of the squares of the other two sides, or $Z^2 = X^2 + Y^2$*), and substituting the distances from the TV antenna base to one side and to the front (or back) of the roof in the formula, we come up with $10^2 + 20^2 = 500$. From a table of roots and squares in a high-school math book, the square root of 500 is something over 22 feet.

Allowing a foot at each end of the dipole for insulators means that approximately 34 feet will be required to accommodate each half of the antenna. Substituting 34 feet for Z and 22 feet for X in the formula gives: $500 + Y^2 = 1152$. Solving for Y , we get $Y = 26$ feet, approximately. Consequently, the apex of the "V" will have to be 26 feet higher than the ends to fit in the available space. If your TV antenna mast is not high enough for the purpose, you can add a length of mast to it above the TV antenna.

Modifying the Guy Wires. Insert an egg-type strain insulator (which is stronger than ordinary antenna insula-
(Continued on page 109)



Transistor Topics

By LOU GARNER, Semiconductor Editor

WITH BUT few exceptions, modern multitesters and volt-ohm-milliammeters (VOM's) originally were designed for the measurement of electrical values in vacuum tube circuits. Too often, however, difficulties are encountered when these "tube-oriented" instruments are used to check transistor and related semiconductor circuits. In some cases, it may be difficult to obtain significant readings; in others, the component checked may be physically damaged by the test procedure.

First, there is the matter of ranges. The voltages, currents, and impedances (resistances) found in transistor circuits are of a different order of magnitude than those found in tube circuits. For example, transistor circuit voltages, as a rule, are multiples of standard cell voltages—typically, 1.5, 3.0, 4.5, 6.0 and 9.0 volts, as opposed to the 100 to 400 volts encountered in plate circuits. A voltmeter with, say, 0-1, 0-10, 0-100 and 0-1000 volt ranges, is not as suitable for checking a 1.5-volt cell as is a meter with either a 0-2 or 0-3 volt range. Quite often, too, more current ranges are needed for checking transistor circuits, where currents can range from a few microamperes to as high as several amperes (in the case of power transistors).

Secondly, there is the possibility of electrical damage when some types of VOM's are used as ohmmeters. There are two basic types of ohmmeter circuits in common use: *shunt* and *series*. In the *shunt* type, the external circuit serves as a shunt across the internal meter circuit; as a result, relatively high currents may flow through the tested circuit—as high as several hundred milliamperes in a few cases, easily exceeding the maximum current ratings of most small signal transistors. The *series* type circuit, in which the external circuit current equals meter current, is preferred for checking transistor circuits, but, even here, trouble may be encountered, for a few manufacturers use high voltage batteries (up to 30 volts, or more) in their ohmmeter circuits. Where the ohmmeter battery voltage exceeds a tran-

sistor's maximum voltage rating, there is danger of junction breakdown when resistance tests are made.

Recognizing the need for a VOM specifically designed for semiconductor testing, the Triplett Electrical Instrument Co. (Bluffton, Ohio) has developed and introduced such an instrument. Identified as the Model 630-L VOM, it has a basic sensitivity of 20,000 ohms/volt d.c., 5000 ohms/volt a.c., and is assembled in a black molded case with a transparent Lucite meter window. Measuring 3-11/32" x 5-1/2" x 7-1/2" over-all, the instrument weighs five pounds.

The 630-L offers two special low power ohms circuits on the X1 and X10 ranges. Designed for safe testing of semiconductor circuits, these ranges have a maximum open circuit test voltage of only 0.140 volt (compared to 1.50 volts in conventional ohmmeter circuits), permitting tests well below the breakdown voltages of transistors and diodes without current overloads. The maximum power dissipation in the semiconductor under test is less than 420 microwatts.

The 630-L's other ranges are selected for maximum utility in semiconductor work. It has a low voltage range of 2.5 volts d.c., for example, and is equipped with five current ranges with full-scale readings of 100

The first VOM specifically designed for semiconductor testing as well as for conventional VOM tasks, Triplett's 630-L features a low-voltage ohmmeter circuit, a low d.c. voltage range of 2.5 volts, and a sensitive meter movement which will measure low currents.



POPULAR ELECTRONICS

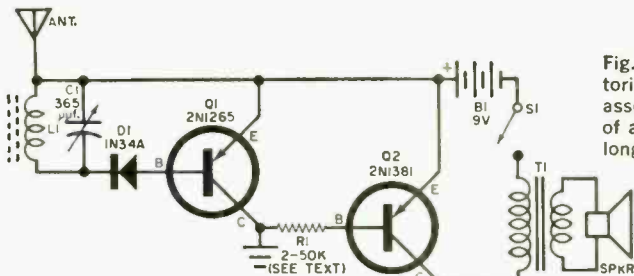


Fig. 1. Reader Bill Harvey's transistorized AM receiver circuit can be assembled in a single evening. Use of a good ground and a 30'- to 100'-long external antenna is recommended.

ma., 10, 100 and 1000 ma., and, finally, 10 amperes, thus covering the full gamut of currents encountered in transistor circuits.

Readers' Circuits. Our featured circuits this month were submitted by readers from opposite coasts of the nation. The receiver circuit illustrated in Fig. 1 was contributed by Bill R. Harvey, WN6BHO, of Oakland, Calif. (2032-94th Ave.), while the audio amplifier circuit shown in Fig. 2 was sent in by reader Steven Dick, of New York City (241 E. 169th St.). Both circuits feature *pnp* transistors in direct-coupled arrangements.

Designed to cover the AM broadcast band, Bill Harvey's receiver circuit (Fig. 1) can be assembled either breadboard fashion or on a conventional metal chassis in a single evening. Standard parts are used throughout. Coil *L1* is a Miller Type 2001 antenna coil and *C1* is a 365- μ f. tuning capacitor. Transistors *Q1* and *Q2* are a 2N1265 and a 2N1381, respectively, while *D1* is a type 1N34A diode. Resistor *R1* is a half-watt unit; its value is determined experimentally for best performance but, in general, will fall somewhere between 2000 and 50,000 ohms. The output transformer, *T1*, should have a 2000-ohm primary and a secondary to match the voice coil impedance of the loudspeaker used. Any s.p.s.t. switch. . . . toggle, slide, rotary, or what have you? . . . will do for *S1*, and the power supply is a standard 9-volt transistor battery (*B1*). According to Bill, best performance is obtained when his receiver circuit is used with a good ground and a 30- to 100'-long external antenna.

Referring to the diagram, incoming r.f. signals are picked up by the antenna-ground system and selected by tuned circuit *L1-C1*. Diode *D1* serves as a detector, with the resulting audio signal amplified by the two-stage direct-coupled amplifier, *Q1-Q2*, and applied to the speaker through output transformer *T1*.

Suitable for use as a crystal radio amplifier or simple audio signal tracer, the circuit

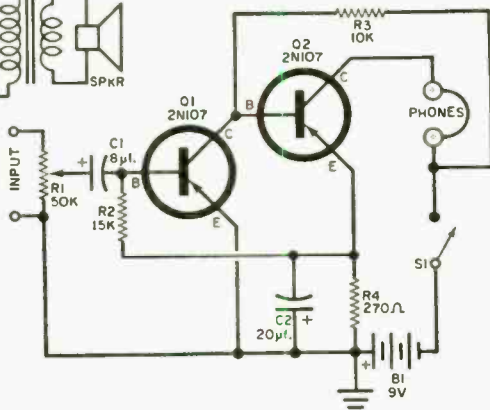


Fig. 2. Steven Dick's crystal radio amplifier (or simple audio signal tracer) requires relatively few parts. It can deliver up to 6-mw. power output, and has an over-all gain of about 54 db.

illustrated in Fig. 2 requires relatively few components. Yet, according to Steven Dick, it will deliver up to 6 mw. power output and has an over-all gain of approximately 54 db. Both transistors are 2N107's, while all resistors (*R2*, *R3* and *R4*) are half-watt units. Capacitors *C1* and *C2* are 12-volt electrolytics. A 500,000-ohm audio taper potentiometer (*R1*) serves as a gain control. Operating power is supplied by a 9-volt transistor battery, controlled by a s.p.s.t. toggle or slide switch, and standard 2000- to 3000-ohm dynamic or magnetic headphones are used as an output device.

Turning to the schematic, incoming signals are applied first to *R1*. A portion of the signal appearing here, depending on the control's setting, is applied through d.c. blocking capacitor *C1* to *Q1*'s base circuit. Transistor *Q1*'s base bias is supplied through *R2* and obtained from *Q2*'s emitter resistor, *R4*, bypassed by *C2*. Transistor *Q2*'s base bias is supplied through *R3*, which also serves as *Q1*'s collector load. Direct-coupling is used between the two common-emitter stages. The final amplified signal is applied to the headphones which serve as *Q2*'s collector load.

Steven's audio amplifier circuit can be assembled breadboard fashion, on a conventional metal chassis, or on an etched circuit board, depending on individual pref-

erences. Neither layout nor lead dress should be critical, but good wiring practice should be followed, with signal leads kept short and direct. Steven suggests the use of shielded wire in the input circuit.

Transitips. The two-stage complementary amplifier is one of the simplest of direct-coupled arrangements. It is reasonably stable, can provide high gain, has a wide frequency response and, with suitable transistors, is capable of delivering a fair amount of power. It can be used, then, in a wide variety of applications. A typical complementary circuit is illustrated in Fig. 3.

Referring to the schematic diagram, *npn* (*Q1*) and *pnp* (*Q2*) types are used in the common-emitter configuration. Transistor *Q1*'s collector is direct-coupled to *Q2*'s base so that *Q1*'s collector current becomes *Q2*'s base current. The base current of *R1* may be supplied by internal leakage (in some applications) or by a separate bias resistor (*R1*) returned to the power supply (*B1*). Transistor *Q2*'s output load may be any of a number of devices, depending on the circuit's specific application, including a relay, transformer, resistor, speaker voice coil, headphones, solenoid, motor or lamp bulb.

The basic circuit can be assembled with a number of transistor types, depending on individual needs. It is not necessary that "matched" transistors be used, as in complementary push-pull circuits. In many applications, both *Q1* and *Q2* will be small signal types. However, power types can be used, if needed; and, where a moderate power output coupled with high gain is required, *Q1* can be a small signal type and *Q2* a "high power" transistor. Nor is it necessary that the exact arrangement shown be followed—the *npn* and *pnp* types can be interchanged *provided that* battery polarity is reversed.

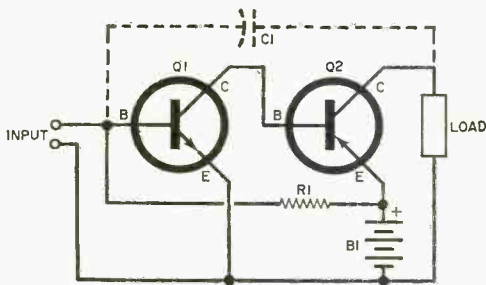


Fig. 3. This typical two-stage complementary amplifier is adaptable to many applications. Various types of transistors can be used, but one value is critical: *Q1*'s internal leakage. If this is moderate rather than low, resistor *R1* should be omitted.

In practical circuits, individual transistor characteristics are not overly critical and almost any combination of *npn* and *pnp* types will give acceptable performance provided that bias current values are adjusted for best operation (generally, by adjusting *R1*'s value). There is one critical value involved, however . . . *Q1*'s internal "leakage." If *Q1*'s leakage is very low, *R1* will provide adequate bias (*R1*'s value may range from 100,000 ohms to 1 megohm in typical circuits); if *Q1*'s leakage is moderate, no external bias resistor is needed (*R1* is omitted); finally, if *Q1*'s leakage current is high, *Q2* may be biased to near saturation and the circuit will not work. If difficulty is encountered in obtaining satisfactory performance, then, one of the first troubleshooting steps is to check *Q1*'s leakage, replacing this transistor if necessary.

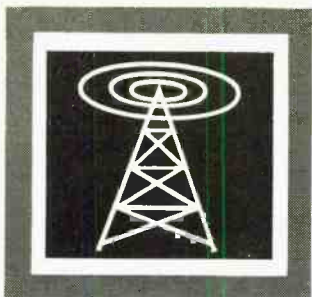
Transistor *Q2*'s output load is selected on the basis of circuit application. If the complementary amplifier is to be used, for example, as an instrument preamplifier, a resistor can be employed . . . with small signal types, values from 1000 to 20,000 ohms will do the trick. If *Q2* is a power transistor, it will drive a 4-8 ohm loud-speaker voice coil quite nicely. Relays may be used where the complementary circuit is to serve in control applications—high-impedance types (coils) where small signal transistors are employed, and low-impedance types in the case of power transistors.

The circuit itself can be modified considerably to meet special needs. An input coupling capacitor can be used in a.c. amplifier work, with another coupling capacitor in the output where a resistive load is involved. The circuit's effective input impedance can be raised from a low to a moderate or high value by inserting a small (unbypassed) resistor in series with *Q1*'s emitter—typical values are 100 to 1000 ohms where small signal transistors are used and from 1 to 10 ohms where power types are used.

In addition to its wide range of applications as an amplifier, the basic complementary circuit can also be made to serve as a multivibrator or oscillator simply by coupling the "input" and "output" circuits through a suitable feedback capacitor . . . *C1*, shown dotted in Fig 3. Depending on the choice of output load, types of transistors, and *C1*'s value, this circuit may be used as an audio signal source, code practice oscillator, metronome, or lamp flasher.

Perhaps the best way to become familiar with the complementary circuit is to bread-board an experimental setup, using a resistance substitution box for bias resistor *R1*

(Continued on page 111)



Monthly Short-Wave Report

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

NOTES FROM YOUR SHORT-WAVE EDITOR'S DESK

DEUTSCHE WELLE, *The Voice of Germany*, has come a long way since its inception. When it first went on the air, just 10 years ago, a three-hour program was broadcast in German from a 1000-watt station located in Osterloog in the northern part of the country. A 20-kw. unit was installed a few months later. But it was not until 1956 that *Deutsche Welle* was able to increase its power and programming.

In April of that year, a new station in Julich (about 30 miles from Cologne) was opened. This enabled *The Voice of Germany* to broadcast 15 hours daily over five 100-kw. transmitters. The former Osterloog 20-kw. unit was held for stand-by service.

In 1960, the programming was increased to a total of 45 hours, with other languages being used as well as German. And in October, 1962, another 100-kw. unit was placed in service. By March of this year, *Deutsche Welle's* programming had gone up to 54 hours and 25 minutes. They are currently broadcasting in 17 different languages.

Radio Prague. Broadcasting in Czechoslovakia also had an anniversary—the 40th!

Radio Prague first began operations in 1923 from a 1000-watt station located in the Kbely district of Prague.

To commemorate this anniversary, *Radio Prague* has issued a new QSL card (see illustration). Designed by Vaclav Vrba, it features a multi-colored symbolic skyline of Prague, and the call-sign and seal of the station appear in the background. The station will continue to use this new card for the remainder of 1963 at least.

Our thanks for the above information go to Peter Skala, DX Editor of *Radio Prague*.

From the Philippines. Your Short-Wave Editor has received a letter from Roy Humphrey, engineering consultant of *The Voice of Christian Brotherhood*, owners of stations DYSR, DYCR, DYB4, and DYH4 in Dumaguete City, Philippines. In his letter, Mr. Humphrey stated that they expected a new 50,000-watt transmitter to arrive from the United States in September, and that they hope to have it on the air by the end of the year. The new unit will be used for DYH5, 6, 7, 8, and 9.

Mr. Humphrey hinted that there might

Radio Prague's new QSL card was issued to commemorate the station's 40th anniversary in broadcasting. Their DX program can be heard every other Wednesday at 2000-2055 and 2330-0030 EST; it's repeated on the following Saturday.





The short-wave receivers in the shacks of Richard Mills (left) and Frank Siedlack, Jr. (below) are both Hallicrafters units, an SX-42 and an SX-62A respectively. Richard, WPE2HOZ, in New York City, has 299 verifications, 162 of which are from medium-wave stations. Frank, DX'ing from Medina, Ohio, has logged 27 states, 24 of them verified.



be quite a story behind the construction of a 50-kc. station with four new antennas for just \$37,000.00. We'll try to get that story for a future issue.

He also asked us to point out that many "reception reports" have been received for DYB4 although the station is not even on

the air! We know not whether any of our readers have been guilty of reporting a station that hasn't been broadcasting, but suggest that you carefully check the identity of the station in the Philippines that you tune so you won't find yourself in this dubious position.

ENGLISH-LANGUAGE NEWSCASTS TO NORTH AMERICA

All of the stations below specifically beam English-language newscasts to the U.S.A. The times may vary a few minutes from day to day.

COUNTRY	STATION	FREQUENCY (kc.)	TIMES (EST)
Australia	Melbourne	17,840, 15,220, 9580	2030, 2130, 2230, 0745
Bulgaria	Sofia	6070	1900, 2000, 2300
Canada	Montreal	15,190, 11,720, 9625	1800 (Caribbean)
East Congo	Leopoldville	11,755	1630, 2100, 2230
West Congo	Brazzaville	11,725	2015
Czechoslovakia	Prague	11,990, 9795, 9550, 7345, 5930	2030, 2330
Denmark	Copenhagen	9520	2100, 2230
West Germany	Cologne	15,405, 11,795 9640, 6160 11,795, 9735, 6145	1010 2035 0000
Hungary	Budapest	11,890, 9833, 7220 9833, 7220, 5960	1900 2230
Italy	Rome	9575, 5960	1930, 2205
Netherlands	Hilversum	15,445, 11,950 17,810, 15,445 15,445, 9715 9590, 5985	1030 (Tues., Fri.) 1415 (Tues., Fri.) 1630 (exc. Sun.) 2030 (exc. Sun.)
Portugal	Lisbon	6185, 6025 (may use 9740)	2105, 2305
Spain	Madrid	9360, 6130	2215, 2315, 0015
Sweden	Stockholm	17,840 11,805	0900 2045, 2215
U.S.S.R.	Moscow	(announced) 9650, 9570, 7320, 7250, 7150, 7130; (also monitored on 7230, 7200, 7110, 7070, 7030)	1700, 1900, 2000, 2100, 2300, 0000 0040
Vatican City	Vatican City	9645, 7250	1950

Finally, Mr. Humphrey would definitely like to receive reports on DYH4, 6055 kc., 250 watts. The schedule: 1600-0100 and 0330-0900.

From Oklahoma. From Okmulgee, Okla., Mr. W. E. Biege sends in the suggestion that a public note of thanks be given to the boys in the Oklahoma Storm Warning Net. The amateurs in that net operate their stations in the public interest, on their own time and at their own expense, for the purpose of relaying "advisories" on tornadoes and other severe weather disturbances.

While amateur radio is not really within the province of this column, we do agree that the storm warning nets cannot be over-thanked for the tremendous job of saving lives and minimizing property damage that they have done in years past and will continue to do in the future. This applies not only to the "Sooners" but to all of the storm warning nets all over the country.

QSL-SWL "Spark Plug." As a follow-up to our discussion of the QSL-SWL bureau last month, here's a personal note on LeRoy Waite, the bureau's "spark plug." LeRoy started SWL'ing back in 1928, and his record is a handsome one—286 countries heard, 279 verified. The equipment in his shack includes a Hallicrafters SX-100 receiver and an RME DB23 preselector; his antenna is a Hy-Gain 12AV vertical. A retired mailman, LeRoy has served as manager of the SWL-QSL bureau since 1956.

Apologies in Order. A clerical oversight was responsible for our turning down certain applications for DX Awards in which the applicants had listed East and West Germany, North and South Korea, and North and South Vietnam as six separate countries. Our country list had showed that they were to be counted as three countries only. But this situation has now been corrected, and we will be happy to accept applications containing separate listings for these countries.

(Continued on page 113)

The listening post of Grant Power, VE2PE6K, Montreal, Quebec, contains a Lafayette HE-30 receiver, Lafayette Explor-Air stand-by unit, and a Selpir tape recorder. When he wrote to us, Grant had logged 46 countries, received 35 veries.

DX Awards Presented

Qualifying for awards this month (25, 50, and 150 countries verified) are the DX'ers listed below. Congratulations, and welcome to the Awards List!

One Hundred and Fifty Countries

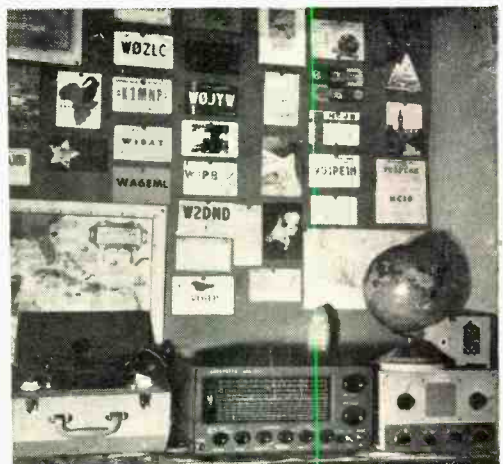
Don Jensen (WPE9EZ), Racine, Wis.

Fifty Countries

Jonah Heffler (WPE2GPN), Bronx, N. Y.
Lawrence Elkin (WPE2CGM), Bronx, N. Y.
Thomas Campanile (WPE2CKI), Brooklyn, N. Y.
Alvin Turetsky (WPE1NQ), Bridgeport, Conn.
George Hemingway (WPE1DYC), Taftville, Conn.

Twenty-Five Countries

Bob Golder (WPE2HVV), Broad Channel, N. Y.
Norman Newhall (WPE1ACG), Granby, Conn.
Lawrence Thompson (WPE8EKM), Cincinnati, Ohio
Jack Lane (WPE9EVU), Lafayette, Ind.
Jan Dyroff (WPE3DSU), Norristown, Pa.
Brian Palin (VE3PE1LW), Port Credit, Ont.
Robert Dilzer, Jr. (WPE1HV), Woodbridge, Conn.
Edward Light (WPE2FBT), New York, N. Y.
Paul Rudbeck (WPE9CXF), South Bend, Ind.
William Pate, Jr. (WPE4CIR), Lawrenceville, Ga.
Rickey Williams (WPE5BLV), Shreveport, La.
Thomas Colyard, Jr. (WPE2JXA), West Belmar, N. J.
Gary Atkins (WPE4EHL), Louisville, Ky.
Frank Gregory (VE3PE1VQ), Brampton, Ont.
Ron Kusmack (VE4PE4U), Winnipeg, Man.
Franklyn Colby (WPE2KAH), Buffalo, N. Y.
Arno Feltner (WPE5CN), New Braunfels, Texas
Ray Fronczak (WPE9CMG), St. Louis, Mo.
Richard Roll (WPE2ALE), Hamburg, N. Y.
S. Joseph Trapasso (WPE1EQI), Winthrop, Mass.
William Rodgers (WPE0EX), Florissant, Mo.
Jeff Fagen (WPE2JYV), Brooklyn, N. Y.



"ALL'S FAIR—"

A Carl and Jerry Adventure in Electronics

By
JOHN T. FRYE
W9EGV



When Carl pushed the button, the car ahead stalled. The thieves started to run, but drawn revolvers changed their minds . . .

CARL AND JERRY were sitting on a bench inside the fenced enclosure waiting, according to their natures, their turn on the park tennis courts. Carl moved restlessly up and down the bench, swishing his racquet through the air in anticipation. Jerry was completely relaxed with his arms stretched out comfortably along the back of the bench.

"Hi, Butch," Jerry greeted a tanned, blond, shirtless youth who wandered over and slumped down beside him. "Why the morose mug? You look like you've lost your best friend."

"That's just it. I probably have," Butch answered.

"You mean you and Kathy broke up?" Carl exclaimed with sudden incredulous interest. "Not the 'Made for Each Other Couple' of our high school prom!"

"We had a scrap Sunday about her wearing those new stretch pants, and now she's dating Cecil Langtry tomorrow night. I wouldn't mind so much if it were anyone but that fluff buff."

"What did you call him?" Jerry asked.

"A fluff buff. You know: a doll dazzler, a pro lobo; what our grandparents used to call a woman chaser or a lounge

lizard. It's natural for a guy to like gals, and I'm all for it, but that character has made a career of women ever since kindergarten. Kathy doesn't know anything about handling a wolf like that. Maybe I ought to go mess him up right now," he concluded, getting to his feet and clenching his fists.

"Hold it!" Jerry exclaimed. "I'm no expert on feminine psychology, but something tells me thumping old Cecil isn't the answer. That would just make you look like a bully."

"Yeah," Carl added. "What you want to do is let Little Red Riding Hood see those long wolfish fangs of his for herself."

"Exactly," Jerry agreed, "and the 'Riding' bit gives me an idea. What would Kathy think if Cecil pulled the old 'that's-funny-my-car-won't-run' routine on her tomorrow night?"

"She'd flip," Butch answered promptly, sitting back down, "but Cecil is too experienced to try that on a first date."

"Maybe we could make it look like he was trying it," Jerry murmured thoughtfully.

(Continued on page 92)



DX AWARDS

FLASH! The first 150-country WPE DX Award has been issued—see page 81. You, too, can qualify for an award, if you have logged and verified as few as 25 countries. To be eligible, you must be a WPE Monitor and you must comply with the rules listed here. Read them over carefully, then fill out the coupon below. Start working toward your award NOW!

1 Each applicant must be a registered WPE Short-Wave Monitor, and must enter his call letters on the application form.

2 Each applicant must submit a list of stations for which he has received verifications, one for each country heard. The list should contain 25, 50, 75, 100, or 150 countries, depending on which DX Award is being applied for. And the following information must be furnished in tabular form for each verification:

- (a) Country heard
- (b) Call-sign or name of station heard
- (c) Frequency
- (d) Date station was heard
- (e) Date of verification

All the above information should be copied from the station's verification. Do not list any verification you cannot supply for authentication on demand.

3 All pertinent verifications, whether QSL cards or letters, should be carefully packaged and stored by the applicant until such time as instructions are received to send in some or all of them for checking purposes. Instructions on how and to whom to send the verifications will be given at that time. Failure to comply with these instructions will disqualify the application.

4 A fee of 50 cents (in U.S. coin) must accompany the list of verifications to cover the costs of printing, handling, and mailing. This fee will be returned in the event an applicant is found to be ineligible for an Award.

5 Apply for the highest DX Award for which you are eligible. If, at a later date, you become eligible for a higher Award, then apply for that Award, following these rules and regulations exactly as before.

6 Awards will be issued to all duly qualified applicants whose applications are received during the year 1963. Any applications postmarked after midnight, December 31, 1963, will be invalid.

7 Mail your verification list, 50¢ fee, and application form to: Hank Bennett, Short-Wave Editor, POPULAR ELECTRONICS DX AWARDS, P. O. Box 254, Haddonfield, N. J. Include in the envelope only those items which are directly related to your entry for the Award. Do not include an application for a Short-Wave Monitor Certificate (you are not eligible for any of the Awards until you have a Short-Wave Monitor Certificate in your possession). If you want to ask other questions or supply news items, reports, etc., use another envelope.

POPULAR ELECTRONICS' DX AWARD APPLICATION FORM					
(please print)					
WPE Call Letters		Name			
Address		City	Zone	State	
Please enter my application for the following POPULAR ELECTRONICS' DX AWARD:					
(check one)	25 <input type="checkbox"/>	50 <input type="checkbox"/>	75 <input type="checkbox"/>	100 <input type="checkbox"/>	150 <input type="checkbox"/>
<input type="checkbox"/>	I have enclosed a list of the required number of countries, and I hereby certify that I hold a verification from at least one short-wave broadcasting station in each of the countries listed				
<input type="checkbox"/>	I have enclosed 50 cents to help cover the costs of processing and mailing my DX Award				
Signature _____				Date _____ 1963	
This form valid only through December 31, 1963					

Mail to Hank Bennett, POPULAR ELECTRONICS DX AWARDS, P. O. Box 254, Haddonfield, N. J.



Short-Wave Broadcast Predictions

SEPTEMBER 1963

By **STANLEY LEINWOLL**

Radio Propagation Editor

SEPTEMBER is a month of transition. Radio propagation, which exhibits certain characteristics every summer, begins to change to characteristics typical of winter. The maximum usable frequencies (MUF's) for daylight paths, which are at their lowest yearly values during summer, start to swing higher. Night MUF's, which reach their highest yearly values during summer, start to drop. In addition, noise levels on the lower bands begin to decrease sharply after the summer high, with a significant improvement in reception. Sporadic E-layer activity also drops sharply in September, after peaking during the summer months.

TIME (EST)

Between Eastern USA and:	00	02	04	06	08	10	12	14	16	18	20	22	24
Western Europe	7	6	7	9	11	15	15	15	15	11	9	7	
Eastern Europe	7	6	7	9	11	11	15	15	15	11	11	7	
South & Central America	11	9	9	9	15	17	17	17	17	17	15	11	
Near East	7	6	7	9	11	15	15	15	15	15	9	7	
North Africa	7	7	7	9	11	15	15	15	15	11	9	7	
South & Central Africa	7	7	9	11	15	15	17	17	11	9	9	7	
Australia & New Zealand	9	9	9	9	9	9	*	11	15	17	17	17	

TIME (CST)

Between Central USA and:	00	02	04	06	08	10	12	14	16	18	20	22	24
Western Europe	7	6	7	9	11	15	15	15	15	11	9	7	
Eastern Europe	7	7	7	9	11	11	15	15	11	9	9	9	
South & Central America	9	7	7	15	15	17	17	17	17	15	11	11	
North Africa	7	6	7	9	11	15	15	15	15	11	9	7	
South & Central Africa	9	9	9	11	15	15	15	15	11	9	9	9	
Far East	9	7	7	7	9	9	11	11	15	15	15	15	
Australia & New Zealand	9	9	7	7	9	9	*	15	15	17	17	15	

TIME (PST)

Between Western USA and:	00	02	04	06	08	10	12	14	16	18	20	22	24
Western Europe	7	7	7	9	11	11	11	15	15	9	9	9	
Eastern Europe	7	7	7	9	11	11	11	9	9	7	9	9	
South & Central America	7	7	7	11	15	17	17	17	17	15	11	9	
Africa	7	6	7	11	15	15	15	11	11	9	9	9	
Far East	11	9	9	9	9	11	11	11	15	15	15	15	
South Asia	9	7	7	9	9	11	11	15	15	15	15	15	
Australia & New Zealand	11	11	9	9	9	9	11	15	17	17	17	17	

To determine the frequencies and times for best short-wave reception in the United States, select the table for the area you are located in, read down the left-hand column to the region you want to hear, then follow the line to the right until you are under the figures indicating your approximate local time. The boxed numbers will tell you the frequency band (in megacycles) to listen to during any 2-hour interval. Asterisk (*) indicates that signals will probably not be heard.



On the Citizens Band

with **MATT P. SPINELLO**, 18W4689, CB Editor

WITHIN the last few months several sources have attempted to total up the number of Citizens Band clubs organized in the U.S. and Canada. While some have published figures ranging upwards of 1500, others have announced the existence of 350 to 400 CB clubs.

There may very well have been 1500 clubs in operation at one time or another, but it is very doubtful that there is anywhere near that number today, since many supposedly organized groups fall by the wayside almost before they get started.

CB CLUB SUCCESS STORY

Let's say, then, that while there could easily be a list of some 1500 clubs, the top question of the year would be: "How many are still around?"

For our purposes, let's decide that there are 400 active CB associations still in existence. This leads to another question: "How many of these groups were actually organized with a useful purpose in mind—one that includes all the possible areas in which such an organized facility might aid others, unrewarded?"

Well, as doubtful as it may seem to other types of antenna-wavers over the many frequencies that make up our radio communications spectrum, there are at least 200 CB clubs that have held their ground from start to present, stumbling, sometimes failing miserably, yet never yielding to the obstacles that threatened to disintegrate their efforts. Today, those groups that were organized with a positive, constructive purpose in mind, that were willing to admit their mistakes in their first attempts at heading down the right frequency, stand stronger than ever.

One such CB success story stems from our elongated, western-most state where the Southern California Citizens Band Association of San Diego has hung its mike since the early days of 1959. At our request, C. Clif Morris, KEJ3300, editor of the club's professionally-produced newspaper, the *11W Call Card*, forwarded us a splendid account of the group's progress from the first day the idea of the S.C.C.B.A. entered the minds of Leon Carney, 11W4560, and Robert Carlile, 11W4847, over a cup of coffee.

After this first step, familiar to most CB club organizers, approximately 35 interested CB'ers attended the club's first formal-type

A regular meeting of the Southern California Citizens Band Association of San Diego usually results in standing-room only, even though there are more than 100 chairs available in the meeting area.



meeting atop Mt. Soledad in January, 1960. The group weighed plans for the future, selected temporary officers, and decided that in the beginning, a donation, or sort of "pay-as-you-can" plan be put in effect to carry any expenses incurred by the infant organization. By the end of March, the club had appointed a Board of Directors, decided to call itself the Southern California Citizens Band Association, and was well on its way to finalizing its constitution and proposed bylaws.

Typical CB club events engaged in by the group during its first months included coffee-breaks, wiener roasts, camping trips, dinners, and game nights. With the S.C.C.B.A., these activities were strictly family affairs, and they continue to be so today. The club feels that this is one of the main reasons why the organization has enjoyed a successful existence since "hour-one" over those two cups of coffee! For business

CB'ers, lent itself to ridicule from outsiders who contended that the committee was attempting to act as the FCC. Finally, the S.C.C.B.A. met with no success in efforts with officials to bring out the need for emergency CB service systems.

To most CB'ers, it's obvious that these are the types of pressures that cause many CB clubs to crumple—along with a loss of interest, lack of cooperation from members themselves, and the mounting problem of 11-meter violations. However, groups with the will to work out such problems exist, and one of them is the now-successful S.C.C.B.A. While the S.C.C.B.A. is not without problems today, the club members have learned that there is a solution to any difficulty that arises as long as there is enough interest to pay the price of removing the obstacles. The price? Cooperative effort!

President Lee Carney, 11W8929, played a large part in helping the club back on its



These are the officers and executive board members of the Southern California CB Association. President Lee Carney is in the center and Clif Morris, editor of the "11W Call Card," is at the far right.

meetings, "Mama Bea" Calchina, 11W6820, was instrumental in securing the club a regular meeting place which has continued to serve for almost three years on the second Sunday of each month.

As membership rose, more elections were held, more committees were added, the club adopted its decal (a familiar sight to Citizens Banders from coast-to-coast), and Clif Morris went to work on the club's official publication, the *11W Call Card*.

But it wasn't all "5 watts in and 3½ out" with this club. The growing pains grew! The club meetings turned into long, dragged-out, argumentative discussions that ran for as long as four hours without, at times, any accomplishments, and the club paper began to drain the treasury through printing costs and wider distribution. The group's TVI committee, organized to aid all area

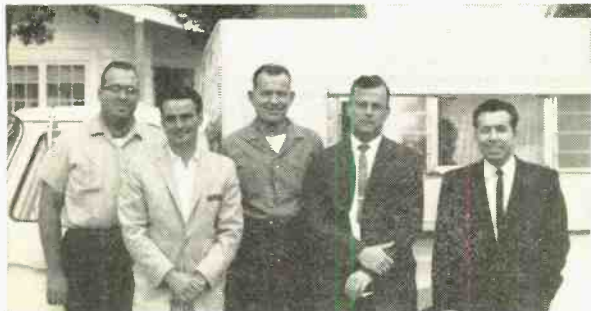
feet by suggesting an Executive Board that would meet twice a month (once before the monthly meetings and again some time after) to discuss, filter and vote upon club business matters. In this way, the Executive Board would preplan the important features of the next general gathering, eliminating unimportant subjects that would tend to lengthen and detract from the original purpose of the get-together.

It worked! Meetings were trimmed to two hours with all necessary business included, and scads of time was left over for chitchat and refreshments. The results were informative, compact, interest-holding meetings. To put the club paper back in business, Clif and his able staff turned to another printing operation (their fifth) which gave them more efficient, less expensive, offset newspaper reproduction. Additionally, they added

advertising space to put the newspaper on a self-supporting basis.

As for the club's TVI committee, it is now used strictly for the benefit of the members of the group. They've even gone so far as to supply the FCC with a complete club roster so that the club may be notified in the event of a violation, at which time the organization stands ready to aid those affected as much as might be needed.

Probably one of the most rewarding achievements chalked up by the club to date was acceptance of the group by the San



One of the several S.C.C.B.A. emergency squads is on stand-by at all times. A number of member-owned campster-type trucks (such as above) are equipped with CB gear, p.a. system, and first aid facilities.

Mid-meeting coffee-breaks for the S.C.C.B.A. members need no "second call!" The same scene takes place all over again at the end of each meeting.



Diego County Sheriff's Department for the purpose of organizing an auxiliary communications unit to blanket the county with communications facilities whenever needed. In addition, the S.C.C.B.A.'s own emergency squad is also back in operation.

So, they've done it! With their fourth birthday just around the corner, the Southern California Citizens Band Association has managed quite well in keeping the wolf away from the door, and in solving the problems that threatened to break the club apart.

The philosophy of the S.C.C.B.A. might

be best summed up by quoting from Cliff Morris' own words: "The Southern California Citizens Band Association recognizes all CB clubs as an equal part of . . . CB . . . and wishes to cooperate fully with all concerned in making our radio band what it ought to be. We have devoted our club and ourselves to the functions of rendering radio service to our friends, neighbors, and community whenever the need might arise . . . We therefore invite every CB'er . . . to join with us . . . Our nation is built around groups of free-thinking individuals . . . Join a CB club of your choice and become a part of the real world of Citizens Radio. CB strength depends entirely upon the way that you and I lay the foundation!"

Complete Compact. This is Keith Cheshire's "red bug" (as he puts it) operating as station 7Q0244 in the Pompano Beach, Fla., area. In addition to a Heath GW-11,

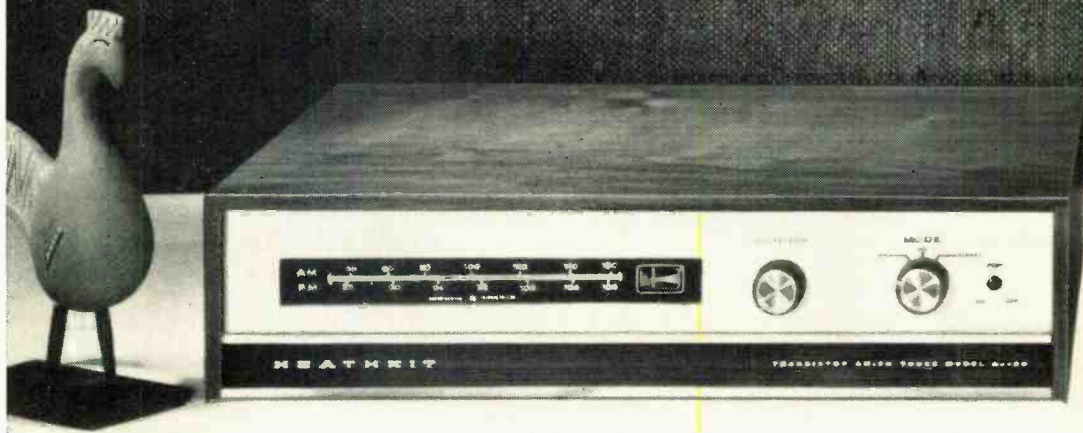


an AM car radio, a separate FM radio and a VHF converter to be installed to serve Keith in his police reserve duties, he also hopes to add a complete ham rig shortly, having just completed his amateur exam. When the final touches are added, we're sure he won't have too many friends riding in the front seat beside him!

The unusual part of Keith's mobile operation (as you may have already noticed in the photo) is that his CB antenna is mounted on the *front* bumper rather than the rear as in most applications. While it may appear that Keith decided that a bumper mount could be attached on any bumper, wherever one pleased to install same, the whole project actually started out as a temporary solution to an interference problem. However, Keith found that his temporary "tenna-stallation" worked so well that he decided to leave his antenna right where you see it—he never did bother to add a suppression kit. Should he decide to install

(Continued on page 98)

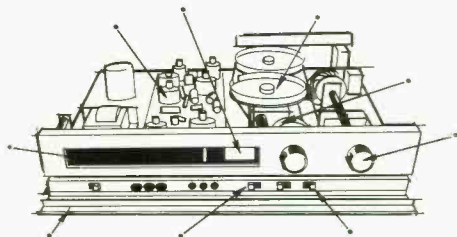
Two More Reasons why Heathkit Leads in Transistor Stereo



New, All-Transistor AM-FM-FM Stereo Tuner

Low-Silhouette Walnut Cabinetry Plus That Clean "Transistor Sound" ... Only \$99.95 Each!

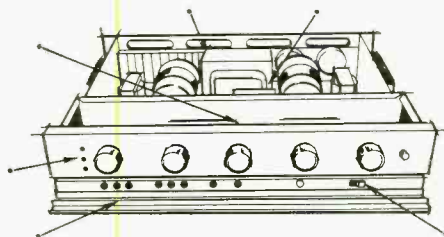
Advanced All-Transistor Circuitry ... for cool, fast operation, lower power consumption, longer life, and the instant response and realism of "transistor sound." **Compact, Low-Silhouette Styling** ... luxurious walnut cabinets with extruded brushed gold-anodized aluminum front panels that add a rich, modern touch to any decor. **An Easy-On-The-Budget Price** ... that anyone who's longed for the advantages of transistor stereo equipment can afford ... only \$99.95 each! These are the "whys" of Heathkit's new all-transistor stereo twosome. In addition, both units offer: • 20 transistor, 10 diode circuit • Secondary controls that are hidden under the hinged front panel to prevent any accidental changes in system settings • Compact size ... each unit measures only 15" W x 3¼" H x 11¾" D.



AJ-33 TUNER FEATURES:

- Stereo phase control • Automatic stereo indicator • AFC and AGC • Filtered stereo tape recorder outputs • Built-in stereo demodulator • Slide-rule dial • Prealigned FM tuner and circuit board for ease of assembly • Flywheel tuning
- Tuning meter • Brushed gold-anodized aluminum front panel conceals secondary controls • Walnut cabinet

Kit AJ-33, 14 lbs....no money down, \$10 mo..... \$99.95

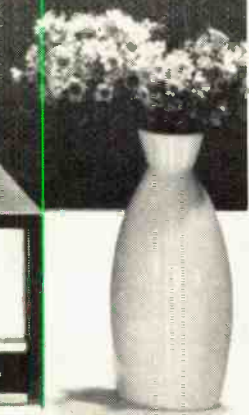
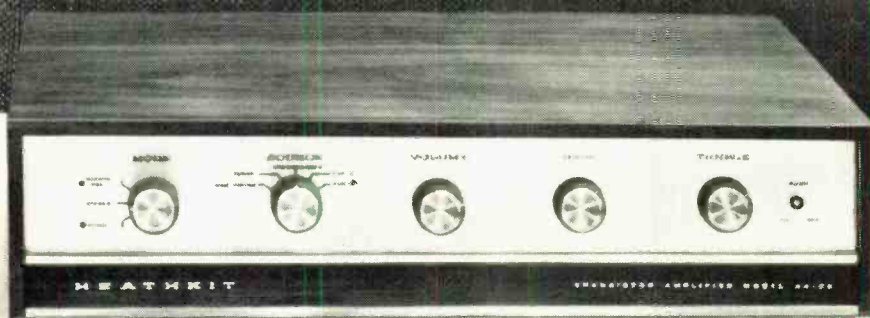


AA-22 AMPLIFIER FEATURES:

- 40 watts of power (20 watts per channel) • Transformerless output circuits • Five stereo inputs • Speaker phase switch • Miniature indicator light for each position on mode switch • Brushed gold-anodized aluminum front panel conceals secondary controls • Walnut cabinet

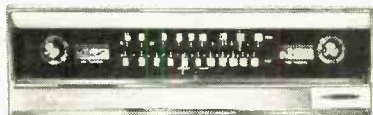
Kit AA-22, 14 lbs....no money down, \$10 mo..... \$99.95

Move up to the "better listening" of all-transistor stereo equipment with Heathkit's newest, today!



and All-Transistor 40-Watt Stereo Amplifier

Deluxe "Matched" All-Transistor Stereo Twins



New! AJ-43 AM-FM-FM Stereo Tuner

- 25 transistors, 9 diodes • Automatic Stereo Indicator plus Automatic Switching to stereo
- AFC and AGC • Stereo Phase Control
- Filtered stereo tape recorder outputs.

Kit AJ-43, 18 lbs. . . . no money down,
\$11 mo. **\$119.95**



AA-21 Stereo Amplifier

- 26 transistors, 10 diodes • 70 watts power at ± 1 db from 13 to 25,000 cycles • Circuit board construction and encapsulated component modules for ease of assembly.

Kit AA-21, 28 lbs. . . . no money down,
\$13 mo. **\$139.95**

Both units secondary controls are free from accidental changes because they are "out of the way" under the hinged lower front panels.

HEATHKIT-1964

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See the latest new products in Heathkit's wide, wonderful line. Over 250 do-it-yourself kits for stereo/hi-fi, marine, TV, electronic organs, amateur radio, test instruments, educational, and home and hobby items that will save you up to 50%. Send for your free copy today!

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**FOR
ADULTS
ONLY!**



NEW CADRE C-75 CB TRANSCEIVER


The new Cadre C-75 1.5-watt, 2-channel transceiver is 15 times too powerful for youngsters (under 18 years of age) to operate, according to FCC regulations. Clearly, it's not a toy. It's designed for serious CBers who need 'big set' performance that can be used anywhere.

The new C-75, weighing less than 2 lbs; provides clear, reliable 2-way communications up to 5 miles and more. All solid state design creates an extremely rugged transceiver to absorb rough handling, stays on frequency. Two crystal-controlled channels spell perfect communications contact everytime. Sensitive superhet receiver ($1\mu\text{v}$ for 10 db S/N ratio) brings in signals in poor reception areas. Powerful transmitter has one watt output to the antenna. Adjustable squelch silences receiver during standby. AGC assures proper listening level. In a word, the C-75 has all the features you'd look for in a quality full size CB unit.

The C-75 has all the portable conveniences you'd want, too: operates on alkaline or mercury penlite cells (8-hour rechargeable nickel-cadmium battery available); ear-phone and antenna jacks; built-in retractable antenna; jack for base operation while recharging.

Use the Cadre C-75 anywhere in the field, for vehicle, office, boat or plane. Use it constantly too, because its all-transistor modular circuit (11 transistors and 2 diodes) is virtually maintenance free. **\$109.95.** Recharger and 2 nickel-cadmium batteries **\$31.85.**

Cadre also offers a complete line of 5-watt all transistor transceivers and accessories.

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porting, 458 B'way, N. Y. 13, N. Y.

"All's Fair—"
(Continued from page 82)

"Knock it off, Jer," Carl broke in. "This is none of our affair. Cecil never did anything to us, but I can tell by that gleam in your eye you're dreaming up something pretty nasty for him."

"Whose side are you on?" Butch demanded. "You guys know what a sweet girl Kathy is—most of the time. You like her, too. She's been my girl ever since our sophomore year in high school, and Cecil has been trying to horn in the whole time. If Jerry can help, let him do it. Don't worry about Cecil. 'All's fair in love and war,' and all that kind of jazz."

"What I have in mind may be a little illegal, but it will be an interesting electronic experiment," Jerry said persuasively.

"Okay, so you twisted my arm," Carl surrendered. "What wicked scheme is brewing in that criminal mind of yours?"

"Carl and I have been experimenting with small transistorized receivers for garage door openers," Jerry explained to Butch. "Although they usually work off the power line, you can power them with a battery, too. A transmitter mounted in your car or held in your hand sends out an r.f. signal modulated with a certain audio tone. The receiver picks up this signal and amplifies and detects it. The audio tone feeds through a sharply tuned filter to the base of a relay-control transistor, causing it to conduct and close a relay in its collector circuit, which starts the garage door opening and closing mechanism. The receiver relay won't close unless both the r.f. carrier and the modulating tone are the right frequencies.

"Here's my idea. We'll mount one of these little receivers in Cecil's car tonight. The normally-closed relay contacts will be wired into the lead going from the ignition switch to the ignition coil. As long as no signal is being received from the garage door transmitter in our car, Cecil's car will work fine, but when we push the transmitter button,

(Continued on page 94)



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Featuring Tests Never Before Available
To The Hobbyist

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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- 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.

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The Model 211 Stereo Test Record is a disc that has set the new standard for stereo test recording. Due to the overwhelming demand for this record, only a limited number are still available thru this magazine. They will be sold by POPULAR ELECTRONICS on a first come, first serve basis. 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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his ignition will be cut out and stay cut out until the button is released.

"All we have to do tomorrow night is follow along behind Kathy and Cecil—the receiver's sensitive enough to pick up our signal up to a mile away—and kill his engine when he gets to some lonely spot. We wait until Kathy gets suspicious, and then we 'happen' by. When Cecil says he can't start his car, we try. Naturally, it starts and runs perfectly with the transmitter off. Kathy will decide that Cecil is a tricky make-out artist and will want us to take her home. You'll have to keep out of sight, Butch, but you should find Kathy in a different mood next time you see her."

"Sounds great!" Butch exclaimed. "Putting that whatchamajigger on Cecil's car will be no sweat. He leaves it parked in front of the house every night, and it's dark under those shade trees. Think you can have it ready tonight?"

"Sure," Jerry answered. "Of course Carl and I will have to forget our game of tennis in the hot sun, but that's life. Come on, Carl. Let's take a look under the hood of a car like Cecil's to get the lay of the land. The quicker you can connect that receiver tonight, the better."

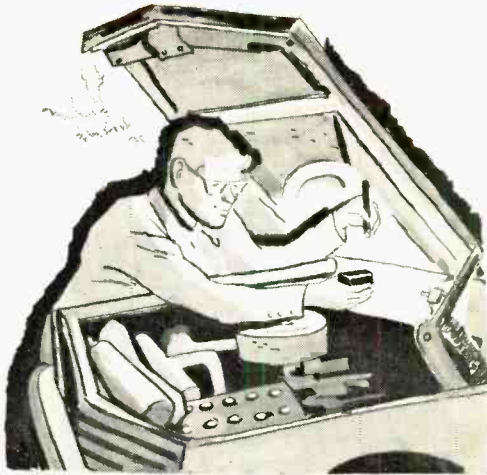
"I can connect it!" Carl repeated. "This is your idea and Butch's girl. Why me?"

"Because you know more about it than Butch, and besides, you can run faster than I can," Jerry replied with simple but irrefutable logic.

HAVING OBTAINED the information they wanted at an auto showroom, the boys went to their basement laboratory and quickly made the necessary conversion in the transistorized receiver. This consisted of powering it with a small battery and equipping the case with powerful little magnets that would hold it in place against the steel fire wall of the car. Leads were brought out from the relay contacts, and a short wire, serving as an antenna, was arranged to extend down beneath the motor.

About midnight the three boys cruised slowly past Cecil's home to find his classy-looking convertible parked at the curb and the house dark. This was fortunate, because a thunderstorm was coming up fast. Jerry parked a half a block down the street, and Carl got out and

Always say you saw it in—POPULAR ELECTRONICS



Jerry pushed a button beneath the dash several times.

"Carl's listening for the receiver relay to click when I push this transmitter button," Jerry said, answering Butch's questioning look. "It does, all right. See him waving the flashlight up and down? Wonder what he's waiting on."

Aided by the flickering lightning, the boys could see Carl poised in front of the car with his hand on the raised hood. Finally a peal of thunder followed a flash of lightning, and Carl slammed the hood at the same time, so that the noise was completely covered by the roar.

Jerry started his car, and Carl got in on the run just as the first big drops of rain came splattering down.

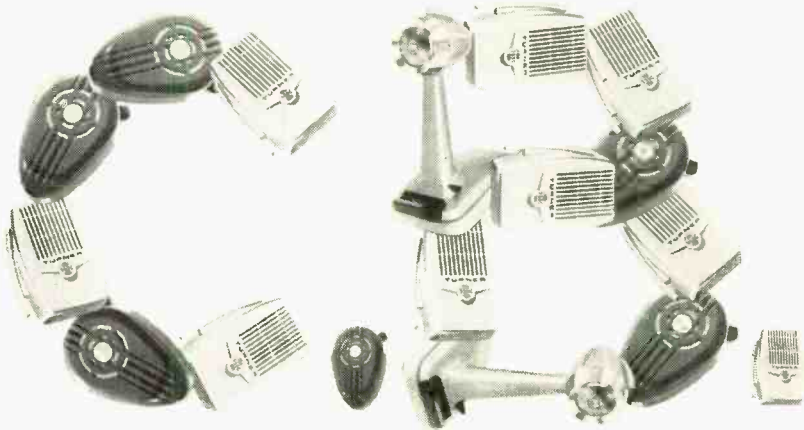
walked quickly along in the shadows of the trees.

Reaching the car, he quietly lifted the hood and went to work with the aid of a tiny penlight. Thanks to careful preparation, the operation was quickly completed. Carl stood erect and waved his flashlight from side to side, whereupon

THERE is no way of knowing how Teagerly Kathy looked forward to her date the next night, but the three youths could hardly wait. Finally, just at dusk, from a vantage point far down the street, they watched Cecil escort her to his convertible and drive away. Cautiously, they followed the car.

"Hey," Butch observed a few minutes

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later, "he must be heading for the dance at Ideal Beach by way of the old river road. Right now he's probably telling her it will be cool and nice driving down along the river."

"I don't *know* about you," Carl muttered. "For a non-wolf, you seem to know a lot about the technique. Jerry, the loneliest spot on the road is just around that next bend. Do I push the button?"

"Go ahead. I'll stop here and let Butch get back in the trunk. Hold that button in so Cecil can't start his car."

As Jerry was closing the trunk lid, two rough-looking youths came roaring up from behind and flashed past in a car with a sputtering, coughing motor.

"Holy cow!" Carl exclaimed, jumping out as the other car went careening past. "Those guys didn't hit you, did they?"

"No, but we better get going. I'm sure Cecil would pull over to the side of the road when his motor quit, but—hey! you took your finger off the button! Cecil probably started his car and is a mile away by now!"

The boys got into their car and quickly drove around the bend in the road. There, standing in the beam of the headlights, were Kathy and Cecil frantically waving their arms. Behind them was the car that had passed so recklessly. Cecil's convertible was not in sight.

"Keep right on going!" Cecil urged Carl and Jerry as he helped Kathy into the back seat and got in beside her. "Some guys up ahead have my convertible. It quit running, and before I could find out what was wrong a couple of hoods came up in a car that was just about out of gas. They pulled out a cou-

ple of switch-blades and said to get out because they were taking over. I told them it wouldn't run, but the funny thing is, it started right off for them when they tried it."

"A very funny thing!" Kathy remarked acidly.

Jerry already had his car rolling at nearly top speed, and they soon caught sight of the convertible ahead. Carl reached for the push button that would stop the stolen car, but Jerry shook his head. "Let's see where they go," he suggested. "Even four—I mean three—of us can't go up against a couple of switch-blade knives."

Reaching the highway, the convertible doubled back toward town with Jerry doggedly following a quarter of a mile behind. Cecil understood vaguely that the boys hoped to corner the thieves where more help was at hand, but naturally he knew nothing of their ace-in-the-hole.

At the edge of town, Jerry speeded up until he was immediately behind the convertible. He noticed with satisfaction that the thieves were sticking to the highway which ran right down Main Street. They probably planned to be on the opposite side of town when the car-theft was reported.

"Now, listen, Cecil," Jerry called over his shoulder. "When your car is right opposite the police station a block ahead, it's going to develop engine trouble and stall. Be ready to jump out and run like a rabbit into the station and tell the police those two stole your convertible. You don't need to worry about their getting it started again, but they won't stick around long fooling with it."

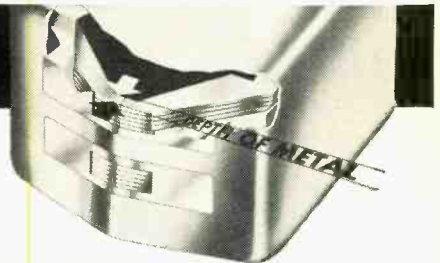
ALL TAPE HEADS WEAR OUT! HERE'S HOW AND WHY!

Magnetic tape itself is the real cause of head wear—its abrasive action as it passes over the head face gradually wears away the *depth of metal* (see at right). Wear is nearly always uneven with craters or ripples forming on the face making it impossible to achieve good contact between the head gap and signal recorded on the tape! Severe high frequency losses and erratic output result from such poor tape-to-gap contact—the outstanding fidelity of tape reproduction is lost!

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"Okay, but I don't see how you know—"

Before he could finish, they were opposite the police station. Carl pushed the button under the dash, and the convertible slowed down and stopped.

As soon as Jerry jammed on his brakes, Cecil was out and running toward a couple of policemen coming out of the station. He shouted, and pointed at the two youths in his car. The thieves hopped out of the convertible and started to run, but the drawn revolvers of the two patrolmen quickly changed their minds.

"WE'VE been wanting to catch these two red-handed for a long time," one of the policemen said as the two surly-looking young men were relieved of their knives and handcuffed. "How did you persuade them to come right to us?"

"Well,—" Jerry began, only to be interrupted by a great kicking and shouting from the trunk of his car. "Good grief!" he exclaimed. "We forgot all about Butch."

The latter was released from the trunk, and now there was nothing to do but tell the whole story. Jerry told it while Carl thoughtfully recovered the transistorized receiver from Cecil's car and restored the ignition wiring.

As the tale unfolded, Cecil's face looked more and more grim. Kathy looked bewildered, then angry, and finally kind of starry-eyed. Butch, sure he had lost her for good, looked plain miserable.

"I'm not sure if I should thank you guys for saving my car or bust you in the snoot for what you were trying to do to me," Cecil said at the conclusion.

"They weren't trying to do anything to you, they were trying to protect me," Kathy retorted. "And when you try to park with a girl on the first date, almost make her walk home, and get her mixed up with car thieves and the police, she needs protection. If I never see you again it'll be too soon. Butch, will you take me home?"

Cecil watched in bewilderment as the couple walked away, holding hands. Then he went over to his car and slumped heavily down in the seat.

"Women!" he exclaimed in deep disgust as he stepped on the starter. —30—

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On the Citizens Band

(Continued from page 89)

any more gear, we're quite certain that the next thing Keith will be forced to purchase is a gasoline generator to tag along behind his "red bug"!

Stand and Be Recognized. There is a definite upswing in CB jamborees this year logically attributable to the rise in CB licensing and the successful results of "jams" gone-by. Having attended many of these hooplas, several CB club members have since inquired as to where they might purchase the numerous means of identification they've seen sported by CB'ers from Roswell, New Mexico to Quebec, Canada.

Specializing in almost 200 different items covering everything from cast aluminum license plates to FCC warning decals is K9TVA Enterprises of Chicago. Chuck and Dad, Mel, (18Q6133) Baer feature just

Lissajous Pattern Quiz Answers

(Quiz on page 72)



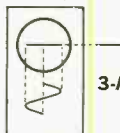
1-E

$V = .707E$; $H = E$
 V leads H by 45°



2-D

$V = E$
 $H = 0$



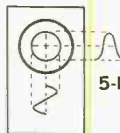
3-A

$V = 0$
 $H = E$



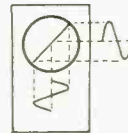
4-F

$V = H = E/2$
 V is 180° out-of-phase with H



5-B

$V = .707E$
 $H = .707E$
 V leads H by 90° , but signals are taken off 180° out-of-phase; hence V lags H by 90°



6-C

$V = E$
 $H = E$
 V and H in phase

about every conceivable means of CB and ham identification in a line that has continually grown with communications through the years. Personalized items include laminated formica lapel badges so familiar at jamborees and club gatherings, custom club decals produced to individual specifications with up to 6 colors, jewelry, felt call letters, QSL cards, reflectorized call letters, call letter plaques, and some very interesting award presentation items. A detailed, illustrated pamphlet covering the entire line is available from K9TVA Enterprises, 6429 North Glenwood Ave., Chicago 26, Ill.

CB Jamborees. A Labor Day week-end CB Jamboree is planned by the North Georgia CB Club of Dalton, Ga., for August 31 and September 1. The group promises several acres of parking and camping area, an orchestra for dancing, plus many recreational events including skating, swimming, and fishing, and prizes galore. Signs will be posted and monitors will stand by on channels 11 and 21 to direct traffic to the site. The N.G.C.B.C. has also invited Mr. A. T. Cline (engineer in charge of the Atlanta FCC District) to be their guest speaker. . . . And, the Maumee Valley CB Radio Association will sponsor a CB-Fest

at Hessen Hall, Fort Wayne, Ind., on September 22.

Club News. Sally Marhofke, KHA0677, secretary of the Waukesha County CB Club, Inc., recently informed us that the club, which is now three years old, will soon begin its own news-monthly, having just acquired a mimeograph machine. (We look forward to receiving it, Sally—the newspaper, not the mimeograph!) Members of this group recently participated in a fox hunt sponsored by the Hook 'n Shell Club of Mapleton, Wis. They furnished walkie-talkies and mobile units to establish close teamwork between the drivers and the standers. They chalked up one fox during the hunt. (Maybe the rest of the foxes had walkie-talkies, too?) Additional services of the W.C.C.B.C. include their donation of CB gear to the Boy Scouts for use during a Scout-O-Rama held at Greenland School in Oconomowoc, Wis., and the establishment of an emergency unit to aid civil authorities at any time their services may be needed. Wisconsinites interested in joining this group should contact Sally Marhofke at 463 W. Wisconsin Ave., Oconomowoc, Wis.

The Kern County Citizens Radio Association of Bakersfield, Calif., has just placed a

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1L4	6AH6	6CF6	6S8GT	7A5	724	12SA7
1L6	6AK5	6CC7	6SA7	7A6	714	12S67
1NSGT	6AL5					12S7J
1Q5GT	6AL7					12SK7
1R5	6AM8					12SN7GT
1S5	6AN8					12SQ7
1T4	6AQ5					12V6GT
1U4	6AQ6					12W6GT
1U5	6A07GT					12X4
1V2	6AR5					12Z3
1X2	6AS5					14A7/
2A3	6AT6					14B6
2AF4	6AT8					14Q7
3BC5	6AU4GT					19A4GT
3BN6	6AUSGT					19B6GG
3BZ6	6AUG					19J6
3CB6	6AUS					19T8
3CF6	6AV5GT					24A
3C56	6AV6					25AV5
3LF4	6AW8					25BQ6
3Q4	6AX4GT					25DN6
3P4	6AX5GT					25L6GT
3V4	6BB					25W4GT
4BQ7A	6BA6					25Z5
4BZ7	6BC5					25Z5
5A58	6BC8					25Z5
5A78	6BD6					26
5AV8	6BE6					35A5
5AW4	6BF5					35B5
5BK7	6BF6					35C5
5J6	6BG6G					35L6GT
5T8	6BH6					35W4
5U4G	6BU6					35V4
5UB	6BK5					35Z5GT
5V4G	6BK7					37
5V6GT	6BL7GT					39/44
5A8	6BN6					42
5Y3GT	6BQ6GT					43
5Y4G	6BQ7					45
6A7	6B15G					50A5
6A8	6BZ6					50B5
						50C5
						50L6GT
						50X6

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6BH6	6CS6	7B6	12A07
6CU6	6SL7GT	7B7	12A6
6DE6	6SN7GT	7B8	12AV7
6DQ6	6SQ7	7C4	12AX4GT
6E6	6SS7	7C5	12AX7
6G7	6T4	7C6	12AZ7
6H8	6T8	7C7	12B4
6J8	6U8	7E6	12BA6
6K7	6V6	7E7	12B6
6KGT	6W4GT	7F7	12B6G
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Operating under a strict set of regulations, the new association promises to be of great value to the sheriff's department, the county and of course the participating CB'ers. Many cheers to another law enforcement agency who has recognized the advantages in enlisting an organized group of Citizens Band operators!

A new name (but certainly not a new club) has been added to the column this month via information received from Miriam Wade, secretary of the Sociable 5 Watts Club of Beaver Falls, Pa. While Miriam didn't give the date the club was organized, she did inform us that membership has approached the 100 mark. The club publishes its own monthly newspaper with much informative CB news, and is crammed with paying advertisers. The group sponsors year-round activities for its members, with summer meetings held at Brady's Run Park so the youngsters can romp around while the meetings are in session. Present officers include: Roy Shetler, 20W7473, president; Paul Hamilton, KIC5934, vice president; Miriam Wade, KIC7874, secretary; Ruth Vogler, KIC2808, assistant secretary; and Robert Foster, KIC0214, treasurer.

Hope to see you at one of the CB jam-bores! In the meantime, drop us a line, fill us in on all the CB activities in your area. And don't forget the pictures!

—Matt, 18W4689

Calling All SWL DX'ers

(Continued from page 42)

news. Regularly—DX mailbag, acknowledgment of listeners' reports, DX contest call. Editor—Ronald Green. Cooperating—Otto Berner, HB9GI (broadcasting) and Bob Thomonn, HB9GX (amateur).

Correspondence: DX Corner, Swiss Short-wave Service, Giacomettistr. I (or Berne 16), Berne, Switzerland. (This is a new address.)

Note: SBC has a fortnightly report on short-wave station activity which is available for a self-addressed envelope and one International Reply Coupon. If the demand for this service is high enough, a subscription plan

will be introduced whereby listeners can receive the bulletin regularly. When writing, please put your name and address in capital letters.

Information regarding the sunspot count is given the first week of the month, five minutes before "DX Corner."

United States

VOA—"Radio Amateur Program"

Schedule: Since the Voice of America amateur schedule is very lengthy, space does not permit its reproduction here. However, a copy of the schedule can be obtained by writing to: Frequency Division IBS/EF, Office of Engineering Manager, United States Information Agency, Washington 25, D. C.

Program: Amateur radio news and propagation reports. Editor—Bill Leonard, W2SKE.

Correspondence: Bill Leonard, P.O. Box 29, Geneva 12, Switzerland, or Amateur Radio, Box 922, Washington 24, D. C.

WRUL—"Calling Shortwave Listeners"

Schedule: Fridays at 1440 on 9.695 and 6.015 mc.; Saturdays at 1415 on 17.810, 17.760, 15.440, and 15.385 mc.; Sundays at 0715 on 17.880, 17.810, 17.760, 15.440, and 15.385 mc.

Program: All types of information concerning DX. Editor—James Lowry.

Correspondence: DX, Radio Station WRUL, New York 19, N. Y.



Radio Moscow's DX editor, Anatole Keyzhanski, discusses ham news and activities in Russia.

Note: WRUL would like to have tapes from short-wave clubs for broadcast on program.

U.S.S.R.—Radio Moscow

Schedule: Sundays at 1850 on 9.730, 9.680, 9.650, 9.620, 9.570, 7.320, 7.200, and 7.150 mc.; Saturdays at 2250 on 9.740, 9.730, 9.700, 9.680, 9.650, 9.620, 9.570, 7.320, 7.310, and 7.150 mc.

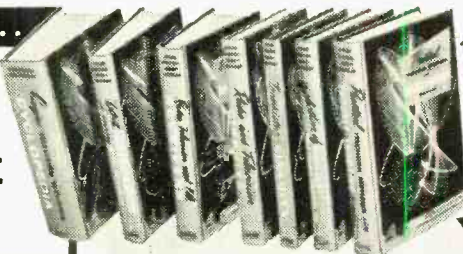
Program: Ham news, listeners' letters, Soviet ham activities. Editor—Anatole Keyzhanski.

Correspondence: North American Service of Radio Moscow, Moscow, U.S.S.R.

-30-

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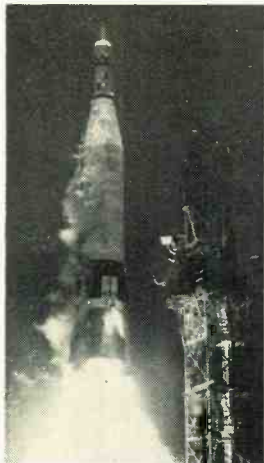
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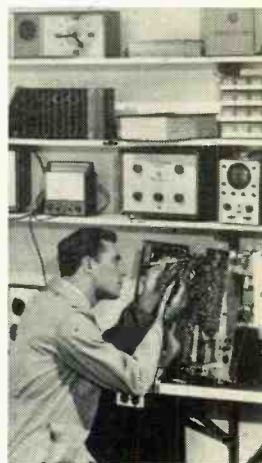
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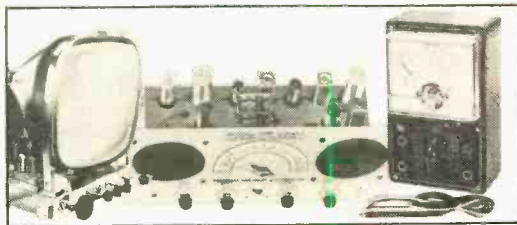
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20 GLENWOOD
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Experimental Radio Station

(Continued from page 70)

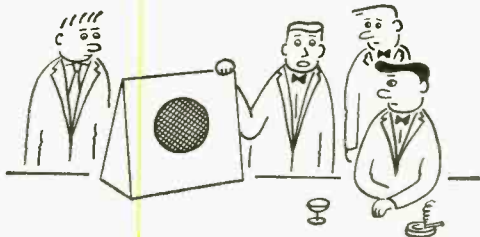
operation on frequencies and at power levels unlikely to trouble other radio services. They do not ask you to make *perfect* proposals, but they do want you to have some understanding of radio transmission and frequency assignments so that you can plan intelligently and avoid causing interference if you are licensed.

What Can You Ask For? In a sense, this is a trick question—you can *ask* the FCC for anything. Of course, it will probably not be granted if it falls outside the bounds of what the FCC feels is necessary for the orderly use of the radio spectrum. Guidelines are as follows.

You must propose a time, frequency (ies), power, and specify the type of equipment you want to use. The time does not have to be exact in your proposal—just the days of possible operation and the number of minutes or hours a day is sufficient. The frequencies generally available are 27.23-27.28 mc., 460-461 mc., 462.525-467.475 mc., and 2450-2500 mc.

The power limitation is often (but not always) a maximum of 5 watts. A major reason for limiting power is the reduction of possible interference. The 5-watt level is also one reasonable for the pocketbooks of students—it can be achieved with receiving-type parts. If the power is unknown, a good description of the make and model of the equipment (if commercial) may be sufficient.

Your Responsibilities. A grant of a Student Authorization carries with it a



vispali

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few obligations which you should observe. You must make certain that the station operates only on the assigned frequency (ies), that you use the station only in the way proposed, and that you keep records of station operation. Operation must be stopped if interference occurs.

Other procedures are to notify the Engineer in Charge of your FCC district *in advance* as to where and when you will operate, on what frequency, and with what call. "In advance" in the legal sense means that you do your best to have the letter mailed and post-marked before actual operation.

This, then, is the whole story. If your science fair or other project depends on your being able to operate a radio station, there's a way you can do it: a legal way that requires little except good sense and a respect for the rights of other licensees. -30-

Stereo Indicator

(Continued from page 65)

ture is connected to the frame, and in the case of the stereo indicator, it's necessary to keep it off ground.

Connect a multimeter or VTVM across diode *D1*, and tune in a stereo signal. A negative potential of about 0.5 volt d.c. will appear across the diode with respect to ground. If no stereo signal is available at the time, a 19-kc. signal from the audio oscillator can serve as the input. Set the audio oscillator to provide a signal of 0.5 to 1.0 volt or so, and tune coil *L1* for maximum voltage across *D1*. The input sensitivity of the stereo indicator is about 0.03 volt r.m.s. at 19 kc.

Potentiometer *R7* is a level or threshold control. Adjust it to set the threshold high enough to light the lamp when a moderate level FM stereo signal is being received, but not so high that the unit trips on inter-station noise. Stronger bursts of noise between stations will trip the relay. However, careful adjustment of the threshold level control will eliminate most of the trouble from this source. -30-



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2-Meter Simple Superhet

(Continued from page 46)

cemented to the back of the outer tuning knob can be made of stiff cardboard or white plastic. The dial calibration is inked on heavy bond paper and taped to the panel.

The connection from *L1* to *C1* is made by means of a piece of #16 bus wire, which passes through a grommited hole in the chassis. The "gimmick" capacitor is formed by soldering two short pieces of insulated hookup wire to pins 2 and 7 of *V1*'s socket, and twisting them together. Trim the pair with your diagonal cutters to leave about two complete twists.

Several $\frac{3}{8}$ " holes drilled in the back of the cabinet cover will provide ventilation. In addition, two accurately placed holes in the bottom are required to permit adjustment of trimmers *C3* and *C7* with the cover on.

As with any other construction job, it is important to do all cutting, drilling, and deburring before beginning assembly. You'll probably find it easier to wire the tuned circuits connecting to *V1* before wiring the other stages.

Testing and Calibration. When assembly and wiring is completed, carefully check all connections against Figs. 3 and 5 before firing up. That done, plug into the a.c. line, turn on the set, and allow a 10-minute warm-up. Set the *GAIN* control to maximum and increase the *REGEN* control setting until you hear the typical superregenerative detector hiss from the speaker.

Before aligning the front end to cover the 2-meter amateur band, it's necessary to align the second detector to the 6-mc. i.f. channel. First, make an approximate adjustment of *L3* by turning the slug screw until about $\frac{1}{4}$ " is exposed above the lock nut on the can. If you have a generator that will provide a 6-mc. signal, apply it to the coax antenna input, back off the *REGEN* control until the hiss just disappears, and adjust the slug in *L3* for maximum output from the speaker. This puts the detector circuit on 6 mc.

To align the front end when no gener-

ator covering the 2-meter band is available, set trimmers C3 and C7 to about half capacity, and main tuning capacitor C2 at a little more than half capacity. Connect a good 2-meter antenna to J1, and adjust oscillator trimmer C3 until 2-meter amateur signals are heard. On a medium strength ham signal, adjust C7 for maximum gain.

If you have a generator covering 2 meters, connect it to J1 and set it to give a modulated signal at 145 mc. Turn up the REGEN control until you hear the hiss, and adjust C3 with a nonmetallic screwdriver until you hear the generator signal.

Finally, adjust C7 for maximum signal output while rocking the main tuning capacitor slightly. This adjustment is necessary because changing C3 affects the oscillator frequency.

-30-

Across the Ham Bands

(Continued from page 75)

tors) in the pair of guy wires where they are fastened to the mast. Then determine the exact length of each half of the antenna (L1 and L2 in the diagram) for the desired frequency with the formula: $Length_{ft.} = 234 / Freq_{mc.}$, which works out to 32' 7" for 7.175 mc., the center of the 40-meter Novice band. Both L1 and L2 should be cut to this exact size if you want to operate around this frequency.

Now measure off the desired lengths from the center insulators and insert



Michael Teders, KN3VPY, Pittsburgh, Pa., excites a Hy-Gain vertical with a home-brew 40-wattter sporting an 807. His receiver is a National NC-60.

September, 1963

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another strain insulator at each measured point. If your transmitter power is much over 100 watts, it might be wise to use two strain insulators in series at these points for increased insulation.

Finally, solder the inner conductor of your coaxial feedline to one side of the antenna at the apex and the outer shield to the other side. Tightly tape the end of the cable to keep moisture out of it, and drop the cable down the pole, along the roof, and into the radio room.

Don't worry about the guy wires not being copper; they will radiate okay. But you might insert strain insulators in the unused guy wires at 10' intervals for slightly improved results.

News and Views

Walter A. Peter, WN2DFY, Box 253, Hobart, N. Y., gets excellent results with the "High-Performance" 6L6 transmitter described in our January, 1962, column. Walt operates on 80 meters, usually on Saturday afternoons, and has nine states worked. He receives on a Hallicrafters S-120, and his antenna is an end-fed long wire. . . . **Greg Markowski, WN9CWU**, 220 E. Van Norman Ave., Milwaukee 7, Wis., really operates his Knight-Kit T-60 transmitter, Knight-Kit R-100 receiver, plus 80- and 40-meter dipole antennas, like a "pro." Forty-seven states worked — including Hawaii — and 46 confirmed show that. Greg usually works both 80 and 40 meters, but recently has been burning the midnight oil on 40. . . . **Thomas A. Watson, WN5FAA**, 223 College St., Pittsburg, Texas, uses his Novice license on all four Novice bands with an EICO 720 transmitter, Lafayette HE-30 receiver, and a Heathkit "Two-er." His antenna farm sprouts a dipole antenna, a Gotham V-80 vertical, and a home-brew, 2-meter beam. Put them all together and you have 35 states, Canada, and Mexico worked, and a Rag Chewers' Club certificate on the shack wall. A General Class license is on the way.

If you are one of those who wrote to the

Continental QSL Club after we mentioned it in our May (1963) column only to have your unopened letter returned stamped "Out of Business" or something similar, here is the reason: the club was found to be in violation of U.S. postal laws, and it was forced to close up shop.

Is Yuri Gagarin, the Russian cosmonaut, a radio amateur? Some say yes; some say no. If he is, **Alan Day, K8ITH**, P.O. Box 303, Canton, Ohio, believes his call letters may be UA1LO. Alan has worked UA1LO, and has his QSL card, which consists of a picture of the cosmonaut and is signed "Yuri." On the other hand, Yuri is a rather common Russian name; so the matter is still open to speculation. . . . **Danny King, WN4LZQ**, 801 Westchester Drive, Madison, Tenn., uses a Globe Chief De luxe transmitter and a Heathkit GR-91 receiver, helped by a Heathkit HD-11 Q-multiplier (all assembled from kits) in conjunction with 80- and 40-meter dipole antennas. Thirty-nine states and Canada in nine weeks indicates that Danny is both a good kit builder and a good operator. A Rag Chewers' Club certificate proves, too, that his radio contacts are not just "hello-and-goodbye" affairs. . . . **Clint Krislov, WN8FXT**, 3694 Strandhill Rd., Shaker Heights 22, Ohio, runs a "conservative" 74.925 watts input to his EICO 720 transmitter, which ionizes the electrons in space via a Hy-Gain 40-through-10 meter trap dipole. Taking to heart someone's advice to get the best ham receiver he could afford, Clint is struggling along with a Collins 75S-1. He divides his time between 15 and 40 meters, and has 34 states, Brazil, Canada, Mexico, and Puerto Rico worked.

Frank N. Meacher, WN4GZV, 5 Clarkin Ave., Charleston Hgts., S.C., is apparently the man to contact if you need a South Carolina QSL; he QSL's 199-9/10%. He uses either a Heathkit DX-60 or a Knight-Kit T-60 transmitter on 15, 40, and 80 meters, receives on a National NC-105, and radiates on a home-brew, 3-band doublet antenna. Forty states and Canada worked are the results. . . . From Hawaii, **Richard Klinger, KH6EZO**, or his dad, **Ken, KH6FBX**, (3803 Kidd Drive, Honolulu 18, Hawaii), keep the bands hot with a Heathkit DX-40 transmitter. A war-surplus Hammarlund "Super Pro" and a Hallicrafters S-120 do the inhaling. Their DX record includes



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Russia, Alaska, Australia, Midway, Japan, and South America. In the states, they have worked as far east as Wisconsin and Mississippi—so far. . . . Going in the other direction, **Don Simonsen, DJØIR**, Park Str. 47-be: Bressler 35 Kassel, West Germany, started working Novices on 15 meters immediately after his letter appeared in "News and Views" in May of this year. He still looks for Novices on 15 and 40 meters when the bands are open to the U.S.A. Don now has his antennas on the roof, instead of hanging from the window of his shack; he gets out much better as a result. . . . **Jack Taylor, WASEIN**, 1456 Champlin Circle, Handsboro, Miss., recently obtained his General ticket but still likes to rag-chew in the 80-meter Novice band. The old Novice transmitter—a Heathkit DX-40 running 75 watts—is now driven by a Heathkit VFO. His antenna is an "inverted V," 50' high in the center, and the receiver is a National NC-173—which gets a real work-out since John, WN5DMU, his next-door neighbor, got on the air.

That's all until next month, when we hope to see *your* news, pictures, and suggestions in this column. Send them to: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Indiana. 73,
Herb, W9EGQ

Transistor Topics

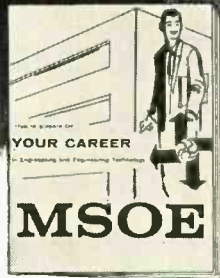
(Continued from page 78)

and arranging a group of various output loads for test purposes. Low-cost experimenter's transistors can be employed for test purposes. Battery voltages are not critical, as long as *R1* is readjusted for best performance. The complementary circuit can be operated on from 1.5 to 12 volts (or more), depending on the output load and power output needed.

Product News. Fairchild Semiconductor (545 Whisman Rd., Mountain View, Calif.) has introduced a high-efficiency power transistor capable of delivering 0.75 watt at 500 mc. Type 2N2884 utilizes a special multiple area geometry. Currently rather expensive, it is indicative of what hams and other experimenters can expect for their high-frequency applications in the future.

Another new high-frequency transistor has been announced by the Amperex Electronic Corporation (230 Duffy Ave., Hicksville, L. I., N. Y.). Manufactured using a refinement in their PADT technique, Type 2N2495 is a germanium *pnp* unit which delivers a power gain of 15.5 db at 200 mc. It is specifically suited for all stages of receivers, from the r.f. front-end through

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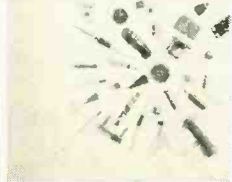
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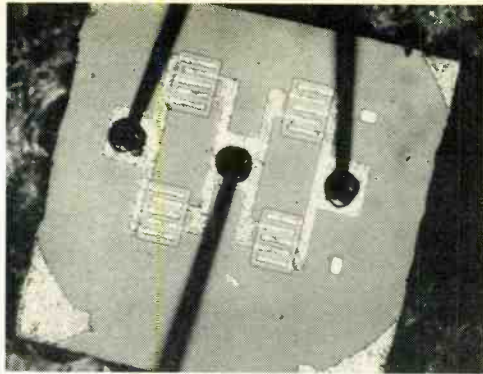
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Microphotograph of the geometry of Fairchild's new multiple-area 2N2884 transistor. The metalized contact zone (light area) provides for connecting an emitter (center) and two parallel base leads. The collector is bonded to the transistor case.

i.f., at frequencies up to 470 megacycles.

The Bendix Corporation (Holmdel, N. J.) has announced a series of six new 3-ampere DAP transistors, Types 2N2282-2N2284 and 2N2467-2N2469. All six are germanium *pn*p units designed for power switching applications and capable of switching up to 300 watts in microseconds.

The Semiconductor Division of Sylvania Electric Products, Inc. (Woburn, Mass.) is producing two new series of microwave germanium tunnel diodes for such high-frequency applications as oscillators, amplifiers, frequency converters, and high-speed switches. Designated as Types D4961 and D4971, the units have cutoff frequencies from 3 kmc. to 32 kmc. and peak currents from 2.0 to 100 ma.

Motorola Semiconductor Products, Inc. (5005 E. McDowell Rd., Phoenix 8, Ariz.) is now producing a series of silicon gate controlled switches. Designated as Types MGCS 821-1 through MGCS 821-6, these units combine the high-current, high-voltage and latching control properties of a SCR with the turn-on, turn-off control characteristics of a power transistor in a single semiconductor device. In contrast to the SCR, which, when fired, cannot be turned off by means of a gate signal, the new Motorola units can be turned *either* "on" or "off" by gate current pulses of opposite polarities. They are suitable for automotive ignition systems, bistable latching switches, power inverters, power switches, amplifiers, and pulse generators.

That ends our story for this month . . . and the lazy, hazy, crazy days of summer have just about run their course. Have you planned your fall projects yet?

—Lou

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Short-Wave Report

(Continued from page 81)

Current Station Reports

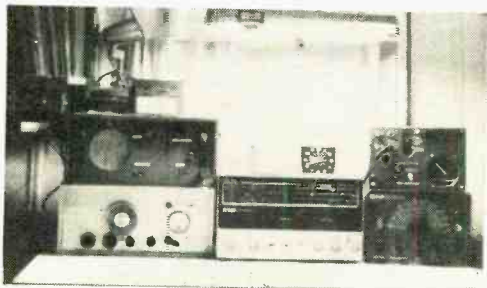
The following is a resume of current reports. At time of compilation all reports are as accurate as possible, but stations may change frequency and/or schedule with little or no advance notice. All times shown are Eastern Standard and the 24-hour system is used. Reports should be sent to P.O. Box 254, Haddonfield, N.J., in time to reach your Short-Wave Editor by the eighth 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 everyone who contributes to this column.

Albania—Tirana, new on 9395 kc., has Eng. at 1500-1530 and 1630-1700. This is probably a change from 9677 kc.

Angola—CR6RZ, *Emissora Oficial*, Luanda, has opened on 17,705 kc. where it is noted in Portuguese at 1616-1758 and 2100-2300. A newscast is given at 2245.

Australia—Melbourne is noted on 17,870 kc. at 1935-2130 to S. & S.E. Asia and at 0015-0045 on 17,870 kc. (S.E. Asia), 17,820 kc. (Africa), and 21,450 and 15,240 kc. (Mid-Pacific). Other xmsns noted: at 0000-0230 (Eng. from 0100) to United Kingdom and Europe on 11,710 and 9570 kc., and at 2000-2300 in General Service on 9580 kc., with newscasts at 2030, 2130, and 2230. The N.A. xmsn continues to be heard well at 2000-2300 on 17,840 and 15,220 kc.

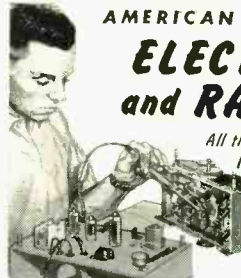
Bolivia—Station CP9, *R. Amauta*, La Paz, has drifted up from 6270 kc. to 6380 kc., where it is noted around 2345 in Spanish. Station CP41, *R. Loyola*, 5994 kc., is back on the air with a 1-kw. xmtr; religious programming is heard around 1900, a lengthy news bulletin is given at 2100, and s/oft time is 2130, all Spanish. *R. Nacional*, Huanuni, 5862 kc., verified 'promptly' (after four years of trying on the part of our reporter); they are now using



There's a wealth of equipment in the listening post of Lance Mastrov, WPE2EMU, Brooklyn, N. Y. Shown in the photo are a Knight R-55 receiver, a Knight signal generator, homemade oscillator-amplifier, 3-tube superregenerative receiver, power supply, and a speaker system and antenna selector. To date Lance has over 50 verifications from 23 countries.

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a French TRT xmtr, rated at 2000 watts, and the schedule is 0500-1300 and 1630-0000; reports go to Mr. Alfonso Rojas Moncayo.

Brazil—Reported as being inactive, *R. Amazonas*, Manaus, is very much alive on 17,796 kc.; it was heard at 1145-1230 but after 1230 was buried under QRM. *R. Cultura*, 17,815 kc., Sao Paulo, is another rough one to log; try for it around 1200-1300 broadcasting in Portuguese; there is considerable QRM from *R. Nederland*, 17,810 kc. Station ZYU60, *R. Guaiaba*, Porto Alegre, was noted on 5965 kc. at 0455 with ads and music, at 0515 with news. *R. Clube de Teresina*, Piaui, has moved to 4885 kc. from the 3-mc. band and was tuned from 0330 s/on. *R. Rio Sao Francisco*, Alagoas, 4915 kc., is heard as early as 0240 with religious talks and music, in Portuguese.

Cameroon—*R. Yaounde* has made some changes in the schedule. It now broadcasts Mondays through Fridays at 0000-0200, 0630-0830, and 1130-1600, Saturdays at 0000-0200 and 0500-1600, Sundays at 0000-1600, on 4972.5 or 6050 kc.

Ceylon—Colombo's schedule to S. E. Asia in Eng. is 2030-2230 on 15,270 and 9670 kc., and 0730-1145 on 9670 kc. Reports should be sent to: Commercial Service of *R. Ceylon*, Torrington Square, Colombo, Ceylon.

Congo (East)—Leopoldville operates Sundays, Mondays, and Tuesdays at 2000-2300, Wednesdays and Thursdays at 1500-1545 and 2000-2015, Fridays at 1600-1645, Saturdays at 1600-1645 and 2000-2300, according to their QSL card. Special newscasts are given at 1630, 2100, and 2230; all broadcasts are on 11,755 kc.

Ecuador—Station HC1EM, *Ondas Carchenses*, Tulcan, 6062 kc., was heard at 0155-0206 with local music and dedications. Station HC1W5, *R. Mercurio*, Cuenca, 5836 kc. (down from 6350 kc.), is tuned at 1930-2100; do not confuse this one with another Spanish station on 5830 kc.

England—London's schedule to the Americas at deadline time read: 1500-1715 on 21,550 kc.; 1500-1845 on 17,870, 17,790, and 17,740 kc.; 1500-1930 on 15,300, 15,260, 15,140, and 15,070 kc.; and 1715-2200 on 12,040, 11,780, and 11,750 kc. Xmsns in Portuguese have been resumed to Europe and N. Africa at 1615-1630 and 1715-1730 on 7325 and 9625 kc.

In accordance with a long-term expansion policy, new relay stations are being constructed on Ascension Island and on Fiji Island; the former is nearly completed.

Germany (East)—*R. Berlin International* is scheduled to W. Africa at 0130 and 1330 on 11,795 kc., at 0730 on 15,255 kc., and at 1630 on 15,395 kc.; to Central Africa at 0000 and 1430 on 11,795 kc., at 0830 on 17,825 kc., and at 1100 on 15,255 kc. Other xmsns noted: Eng. to Europe at 1230-1300 and 1445-1515 on 6060, 6080, 6115, and 7300 kc., at 1430 on 9730 kc., and at 1700-1730 on 6080, 7300, and 9730 kc.; broadcasts to N.A. at 2000-2200 (Eng. at 2000-2030 and 2100-2130) on 6080 kc. English is also noted at 2000 and 2130 on 9560 kc., according to late reports.

Guinea—Conakry has been found on 6160 kc. at 0130-0200 in French, with Eng. lessons.

India—All *India Radio* broadcasts in Eng. at 1930-1940 on 9765, 11,785, and 15,125 kc.; at

2330-2340 on 15,130 and 17,855 kc.; at 0500-0600 on 11,710, 11,730, 15,105, 15,290, and 17,855 kc.; at 0830-1000 on 11,810 and 15,255 kc.; at 1445-1545 on 7235, 9520, 9690, 9870, and 11,835 kc.; and at 1045-1130 (Eng. and Swahili) on 11,715 and 15,105 kc. Other xmsns noted: Eng. news at 0300-0310 on 17,705 or 17,740 kc., and at 2145 on 15,310 kc.

Japan—The latest schedule from Tokyo reads: to N.A. at 1830-1930 on 15,135, 15,285, and 17,875 kc. (replacing 11,780 kc.); to N.A. and L.A. at 2100-2300 on 11,705, 15,135, 15,235, and 17,875 kc.; to Europe at 0145-0345 on 15,135, 15,425, and 17,875 kc. (replacing 11,705 kc.); to L.A. at 0400-0530 on 9530, 9580, and 11,705 kc.; and to S. Asia at 1000-1100 on 11,780 and 15,135 kc. (replacing 9525 kc.). Changes in the General Service: broadcasts at 0600, 0700, 0800, and 0900 are now on 9505, 15,195, and 15,323 kc. (replacing 11,815 & 15,310 kc.). The balance of the schedule remains unchanged.

Kuwait—R. Kuwait is scheduled at 2130-0200 and 0400-1630 daily (Fridays at 2130-1630) on 4967.5 kc. (10 kw.) and 15,150 kc. (50 kw.). Tests will begin "shortly" on 6055 and 9520 kc.

Lebanon—Beirut carries Eng. at 1630-1645 on 11,770 kc. (replacing 11,890 kc.).

Liberia—Station ELWA, Monrovia, is operating on this schedule: on 3225 kc. at 0115-0430 and 0745-1745 (Sundays on 3335 kc. at 0115-1815); on 4770 kc. at 0115-0430 and 1400-1730 (Sundays at 1445-1815); on 11,975 kc. at 0000-0300 and 0600-1330 (Sundays at 0000-1430); and on 15,155 and 21,535 kc. at 1015-1630

and 1700-1745 (Sundays at 0930-1645 and 1700-1745).

Malaya—The BBC Far Eastern Station is now using these new channels: 6110 kc. at 1100-1150; 7120 kc. at 0945-1150; and 9580 kc. at 0915-1150.

Mexico—A new station is XEUDS, R. Universidad Sonora, Hermosillo, 6140 kc. It is noted from 2146 to 0000 s/off with considerable Eng. and many requests for reports.

A medium-wave station, XELO, Ciudad Juarez, 800 kc., is anxious to receive reports and will verify by QSL card. Broadcasting mostly in Eng., they can be widely heard at 2200-0000.

Nepal—A new station, *The Voice of the Himalayas*, will begin tests during the coming monsoon season, and regular broadcasts are expected to begin in March or April, 1964. Two new 100-kw. xmtrs are now en route to Nepal.

Netherlands—The "Happy Station Program" on Sundays to New Zealand, Australia, and Pacific areas at 0100-0225 in Eng. is now aired on 9630 and 11,730 kc. (replacing 15,445 kc.).

Peru—R. Loreto, Iquitos, is noted often on 9465 kc., up from 9375 kc., around 2330. Station OAZ4R, R. San Juan, Tarma, 4890 kc., was noted with Peruvian music and a greetings program in Spanish at 0012; frequent ID's and time checks were recorded; s/off time is irregular, from 0015 to 0100 or later.

Philippines—Here is the complete Eng. schedule for the Far East B/C Co. on 17,810

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kc. to Australia, N.Z., and New Guinea at 1655-2000, to Malaya and Indonesia at 2100-0330 and 0400-0730, and to Malaya, Indonesia, Laos, Cambodia, Thailand, and Vietnam at 0330-0400; on 15,380 kc. to Thailand, Laos, Cambodia, Vietnam, and General Service at 1830-2100; on 15,300 kc. to Australia, N.Z., and New Guinea at 1655-1800, to Malaya and Indonesia at 1800-1830, 2100-0330, and 0730-0830, to Malaya, Indonesia, Thailand, Laos, Cambodia, and Vietnam at 0330-0400; on 11,920 kc. to Thailand, Laos, Cambodia, and Vietnam at

Domestic Service is heard on 4890 kc. from 0100 s/on.

South Africa—Paradys is fair on 6095 kc. with Eng. news at 0000.

Sweden—Stockholm's updated schedule to N.A. now reads: to Eastern N.A. on 17,840 kc. at 0900-0930 and on 11,805 kc. at 2045-2115; to Western N.A. on 11,805 kc. at 2215-2245.

Switzerland—The latest schedule from Berne reads: to United Kingdom and Ireland at 1345-1530 on 9665 and 6055 kc.; to N.A. at 2030-2215 and 2330-0015 on 11,865, 9535, and 6165 kc.; to Australia, N.Z., and the Far East at 0400-0545 on 17,795, 15,315, and 11,775 kc.; to South Asia and Japan at 0745-0930 on 17-795, 15,315, and 11,865 kc.; to India, Pakistan, and Africa at 0945-1130 on 17,795, 15,305, and 11,865 kc.; to the Middle East at 1145-1330 on

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SHORT-WAVE ABBREVIATIONS

N.A.—North America	BBC—British Broadcasting Corporation
N.Z.—New Zealand	B/C—Broadcasting
QRM—Station interference	Eng.—English
R.—Radio	ID—Identification
s/off—Sign-off	IS—Interval signal
s/on—Sign-on	kc.—Kilocycles
xmsn—Transmission	kw.—Kilowatts
xmtr—Transmitter	

11,865 and 9665 kc.; and to Africa at 0200-0345 on 17,795, 15,305, and 11,715 kc. There is a DX program on Saturdays at 2100 during the N.A. xmsn.

Thailand—Station HS10S, Bangkok, is a new one; owned by the King of Thailand, it reportedly operates on Saturdays only from 2345 on 9900 kc. Further details are requested.

Turkey—Ankara has opened on 15,160 kc. (replacing 7285 kc.) and is noted at 1220-1303 in native language; at 1600-1700 in Eng. to Western Europe; and at 2000-2200 to Europe and N.A. with Eng. during the latter portion.

U.S.S.R.—Kiev, new on 11,790 kc., is noted at 2030-2130 in Ukrainian, dual to 11,960, 9710, and 9650 kc.

Windward Islands—St. Georges can be tuned at 2100-2115 with Eng. news on 9730 and 3280 kc. Medium-wave DX'ers might try for the dual channels of 540 kc. (St. Georges), 1530 kc. (Roseau, Dominica Island), 1570 kc. (Kingstown, St. Vincent Island), or 1580 kc. (Castries, St. Lucia Island).

Yemen—A letter to *Sweden Calling DX'ers* from Abdullah Humran, Director General, *Radio Sanaa*, reveals that there are three xmtrs operating with a combined power of 70 kw. at 2200-0100, 0600-1000, and 1100-1700 on 5950 and 15,170 kc. However, reports still indicate activity on 15,785 kc., as listed in this column last month.

Clandestine—*Radio Portugal Libre* is heard nightly on 8300 kc. (approx.) with political talks dealing largely with Africa. The IS, given just prior to s/on, is a few chords on an organ, then an anthem. Time of s/off varies from 1845 to 1850.

Bizam Radio has been reported at 0530-0545 in Turkish on 9730 kc. Just after the end of the Turkish program, a few words of German were spoken, but it could not be determined whether the German had any connection with the Turkish broadcast.

-30-

2100-0330, and to Australia, N.Z., and New Guinea at 0400-0500; on 11,850 kc. to Australia, N.Z., and New Guinea at 0330-0400, to Thailand, Laos, Cambodia, Vietnam, and General Service at 0400-0500 (heard also from 0030, Sundays only), at 0730-0900 and 1030-1130; on 9730 kc. to Japan at 2100-0400; on 7230 kc. to Hong Kong and Formosa at 1830-2000 and 0545-0830. There is a mailbag program on Wednesdays at 0830-0845 on 11,850 kc.

Reunion—*Radiodiffusion de la Reunion*, St. Denis, 3385 kc., opens at 2129 with "La Marseillaise," then has news in French to 2145. This is followed by modern pop tunes to 2215.

Senegal—Dakar has replaced 9720 kc. with 5960 kc. and apparently a 100-kw. xmtr; s/on at 0100 with news in French at 0200-0210. The

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POPULAR ELECTRONICS

September 1963

Advertisers Index

ADVERTISER	PAGE NO.
Allied Radio	85, 86
American Basic Science Club, Inc	113
American Institute of Engineering & Technology	114
Bailey Technical Schools	12
Burstein-Applebee Co	108
Cadre Industries Corp	92
Capitol Radio Engineering Institute, The	8, 9
Central Technical Institute	94
Cleveland Institute of Electronics	34, 35, 36, 37
Conar	28
Coyne Electrical School	101, 109
DeVry Technical Institute	3
Dymo Industries, Inc	4
EICO Electronic Instrument Co., Inc	38
Fisher Radio Corporation	25
GC Electronics Co	100
General Electric Company	30, 31
General Radiotelephone Company	100
Hallcrafters	94
Heath Company	90, 91
Hitchings	114
Hy-gain Antenna Products Corp	6
Indiana Institute of Technology	112
International Crystal Mfg. Co., Inc	97
Johnson Company, E.F.	32
KLH Research Company	21
Kuhn Electronics Inc	106
Lafayette Radio Electronics	THIRD, FOURTH COVER
Massey Technical Institute	14
Merrell	109
Micro Electron Tube Co	99
Milwaukee School of Engineering	111
Multicore Sales Corp.	109
Nation-Wide Tube Co	115
National Radio Institute	SECOND COVER, 1
National Technical Schools	102, 103, 104, 105
Nortronics	96
Poly Paks	98
Progressive "Edu-Kits" Inc	24
RCA Institutes, Inc	16, 17, 18, 19
R.E.T.S. Electronic Schools	5
Rad-Tel Tube Co	33
Raytheon Company	7
Regency Electronics, Inc	22
S W Index	112
Sams & Co., Inc., Howard W	20
Scott Inc., H.H.	106
Sonar Radio Corporation	110
Sony Corporation of America	107
Telex	97
Tri-State College	114
Turner Microphone Company, The	95
U.S. Air Force	23
U.S. Army	29
Utica Communications Corp	15
Valparaiso Technical Institute	112
Weller Electric Corp	13

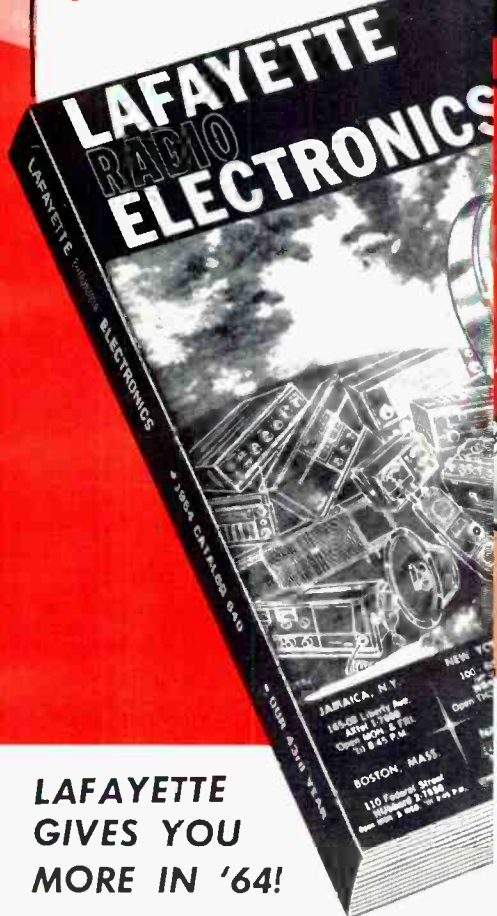
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