N-HOW-WHY of UHF-TV See p. 41

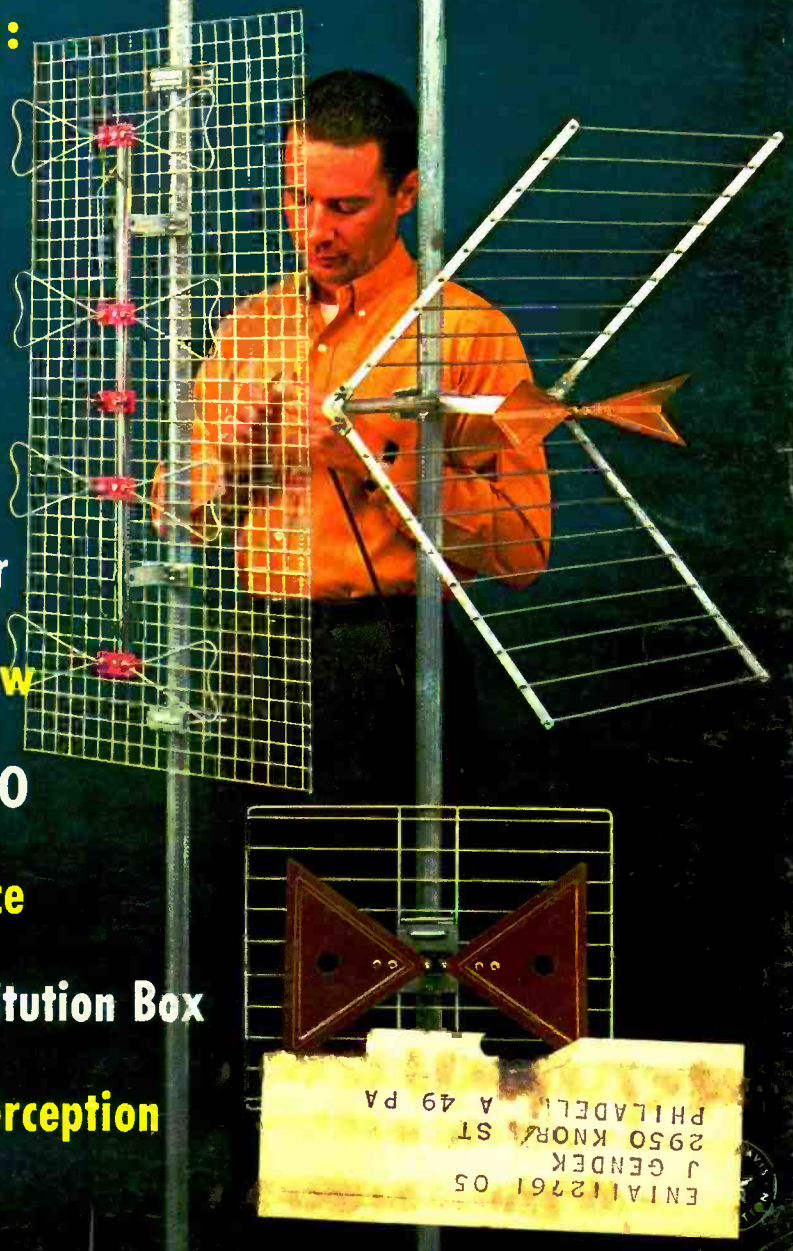
POPULAR ELECTRONICS

MAY 1962

35 CENTS

In This Issue You Can:

- Build 2-Watt Hi-Fi
- Check Capacitors
- Coil-Cord Your Mike
- Convert Record Player
- Build CB/Ham Monitor
- Sync Tape to Slide Show
- Build Sun-Powered CPO
- Find Speaker Impedance
- Make Transistor Substitution Box
- Electronically Check Perception



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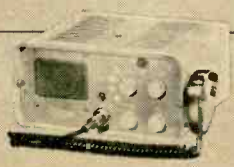

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This month's cover photo by Bruce Pendleton

VOLUME 16 MAY 1962 NUMBER 5

Special Feature

Electronic Construction Projects

Audio and High Fidelity

Amateur, CB, and SWL

Electronic Features and New Developments

Departments

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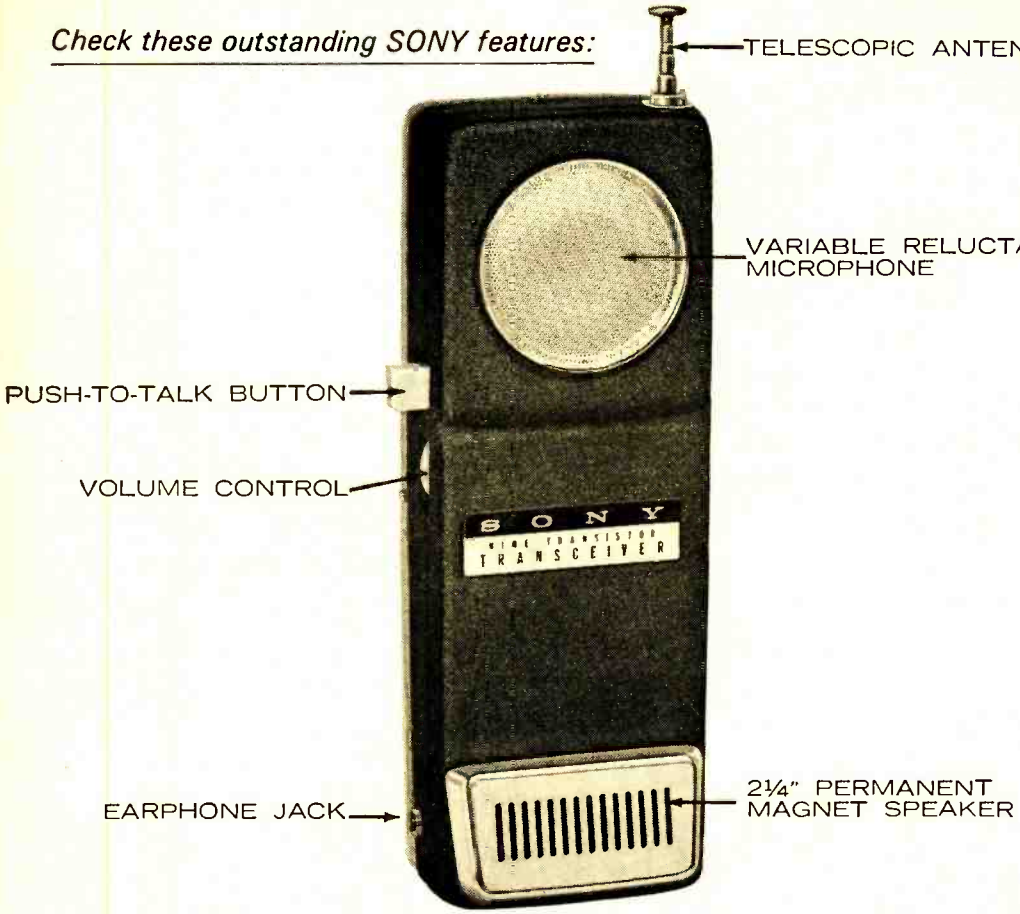

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POP'tronics
NEWS SCOPE

SUPER-DUPER MAGNET inside the vacuum bottle at left produces a field so intense that a conventional electromagnet drawing 100,000 watts of power and requiring 1000 gallons of water per hour for cooling would be needed to replace it. In a demonstration by IBM scientist Richard L. Garwin, two ordinary dry cells were connected briefly to a special alloy-wire coil immersed in liquid helium. The current racing around the coil continues to flow after the dry cells are disconnected and until the temperature is increased. Secret of the magnet: its coil's superconductivity, a property of some metals which lose all resistance to electric current at very low temperatures (–450°F, in this case).

KEEPING HOLE COSTS DOWN—Short-run printed-circuit board production has been costly to the electronics industry, but now G.E.'s Heavy Military Electronics Department has come up with some tape-programmed equipment that will make automation economically feasible. By positioning a stylus on "blueprint" holes and pushing a button, an operator programs a tape to control a drill press that can knock out 12 boards at the same time. This direct conversion from blueprints to programmed tapes simplifies engineering changes. The tapes can be filed for future use, eliminating the need for additional planning, programming, and tooling required by present production methods.

RIDING ON AIR—No, the pretty miss was not going too fast. Actually, this 2000-lb. sports car and driver—literally floating on air—are demonstrating the load capacity of a precision air bearing servo/rate turntable of the type that will test the inertial guidance system of NASA's Saturn rocket. Designed and built by Dunn Engineering Corporation, of Cambridge, Mass., the turntable's rotor rests on a thin film of compressed air instead of on conventional bearings. Thus, stiction (static friction) is eliminated and viscous friction is negligible, obviating drift problems that previously affected the testing of highly sensitive gyroscopes. The largest turntable ever built, it can support 6000 lb., or 3½ VW's.

ELECTRONIC TRUANT OFFICER automatically accepts "nose counts" from classroom instructors' push-button signals and then electronically tabulates them on a panel in the principal's office. Engineered by Minneapolis-Honeywell, the panel is one of a series of devices designed to give school administrators better control of buildings and facilities. Other electronic panels indicate fire and intrusion alarms, allow principal and other key school officials to keep their respective offices advised of their whereabouts, and show which classrooms are vacant. Many schools find that it costs them more not to automate than it does to hire silent electronic robots to handle routine jobs.

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✓ IT MUST gain recognition for you. Don't be satisfied with the mere promise of some sort of *diploma!* Be sure the course will qualify you for a nationally recognized measure of electronics knowledge – a FIRST CLASS Commercial FCC License. Remember: This is a U.S. Government license. No school can issue it, nor *promise it* to you! Select a school whose graduates consistently PASS the FCC exams.

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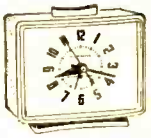

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By **ROBERT E. TALL**
Washington Correspondent

Two More CB Channels

UNDER the Federal Communications Commission's new "split channel" plan, CB'ers would be given two more channels on a shared basis, raising the total number of channels available for the Class D service to 25. The two new channels—27.235 and 27.275 megacycles—would be outside of the main Class D CB frequency block which begins at 26.96 mc. and ends at 27.23 mc. They would be available on the same basis as 27.255 (channel 23), which means that they would be shared by other private radio services—including common carrier stations, and industrial, scientific and medical (ISM) services.

The new frequencies were created by the agency in 1958 when a reduction in channel frequency separations was ordered. At that time, the agency put licensees of the 25-42 mc. frequencies on notice that the channel widths in the overall band were being reduced from 40 kilocycles to 20 kilocycles. The new narrow-band technical standards are to become fully effective by October 31, 1963. The CB service, which uses amplitude-modulated equipment, has been set up on 10-kc. channels, rather than the 20 kc. planned for other non-broadcast mobile services, which generally use frequency-modulated units.

In addition to the two CB channels which would be opened if the FCC adopts its proposal (after public comments are studied), the overall FCC plan would add 35 new channels for the business radio service; 31 for the local government radio service; 31 for the special industrial radio service; 10 for the power radio service; 8 for the petroleum radio service; and smaller numbers for other services—with some inter-service sharing contemplated.

CB Phone Patch. As it has done with regard to other private mobile radio services, the FCC, in response to inquiries, has

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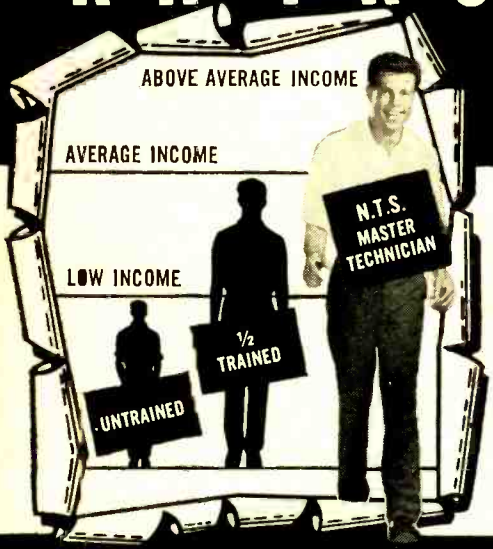

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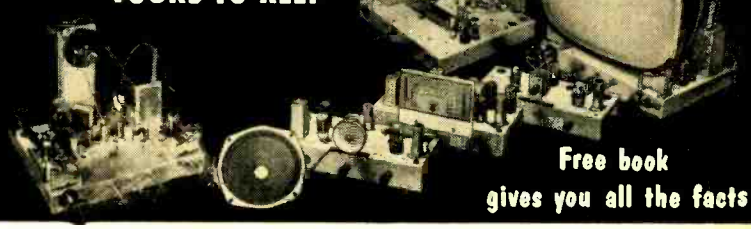

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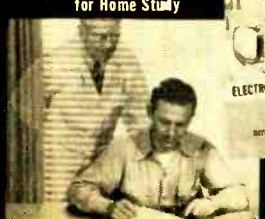

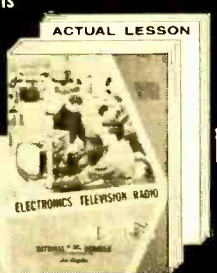

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FCC Report

(*Continued from page 8*)

spelled out its formal position on the possible use of "phone patches" by CB radio licensees. The Commission has not flatly said that the phone patches are illegal, but it has noted that most telephone company tariffs prohibit such devices, and that the tariff provisions are legally "binding" from an enforcement point of view.

The FCC says that its rules "contain no specific provision for, or prohibition against, the connection of citizens radio station equipment to commercial telephone facilities. However," the agency notes, "the tariffs of the various telephone companies on file with the Commission, which govern the provision of interstate and foreign message toll telephone service, provide that no equipment, apparatus, circuit, or device not furnished by the telephone company shall be attached to, or connected with, the telephone facilities of the company, either physically, by induction, or otherwise, with certain exceptions which do not include citizens radio equipment."

Under the Communications Act, the Commission declared, "such tariff regulations are binding on the company as long as they remain in effect." The agency pointed out that similar provisions are contained in the telephone company tariffs on file with the various state commissions for intrastate phone service.

Even if the phone company regulations would permit the phone patch, the FCC said, a CB unit, under Commission rules, "may not be used for the exchange of communications which are not directly concerning the business or personal activities of the licensee of that radio station unit." This, in effect, greatly curbs any possible legal use of the phone patch. For good measure, the Commission commented that the operation of a Class D citizens unit "may be controlled only by a person who is present at the location of the radio transmitter."

All this legal mumbo-jumbo boils down to one simple rule—don't use phone patches on CB or the FCC may be calling you.

License Revocations. The increase in the number of CB licenses being revoked by the FCC these days stems from one big point—the licensees involved are *not answering* their mail.

Usually when the initial notice of rule violation is issued by an FCC field office, the licensee is merely being put on notice that he has been caught operating his unit out-

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In what branch of Electronics are you interested? .....

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PE-90

FCC Report

(*Continued from page* 10)

side the regulations for the CB service, and if he would answer the Commission's notice right away—within ten days—the case would probably stop right there. Complications build up quickly, however, if he ignores the Commission's warning.

It's this simple. If you get a citation, let the FCC field office issuing the notice know of the steps you have taken to correct the condition under complaint. In many cases, it's as easy as saying, "I am sorry and will not do it again." But if the ten-day period goes by without an answer from you, you start getting into trouble, and eventually it becomes a real job just to hold onto your CB license.

Remember, the FCC wants you to own and use your CB license. The Commission is quick to forget and forgive one-time offenses, provided you give some indication —by a prompt reply—of your willingness to cooperate. —30—

COMING NEXT MONTH

This completed sideband transmitter has only three tubes! The secret? The "Simple Sidebander" is actually a *double* sidebander. And it packs more punch than the average 25-watt AM phone rig. You can use it for both local and DX work on the 80- and 40-meter bands.

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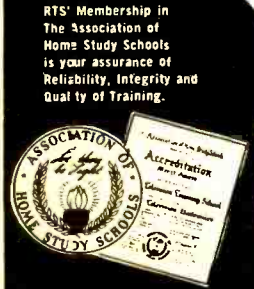

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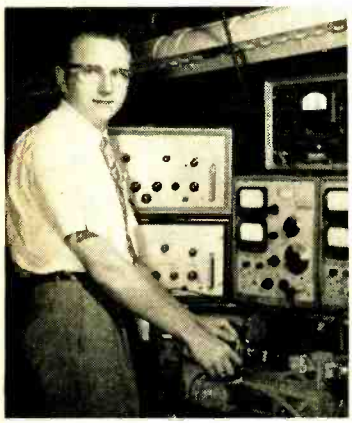
Published by Howard W. Sams & Co., Inc., 1720 East 38th St., Indianapolis 6, Ind. 224-288 pages per volume. Soft covers. $22.50. Volumes may also be purchased individually at $4.95 each.

HAM TV

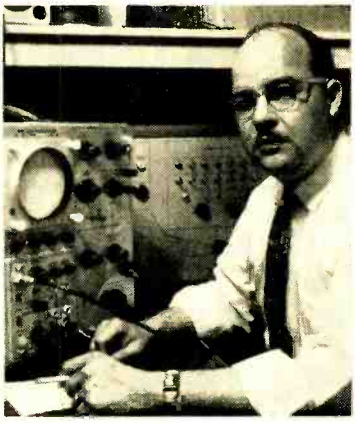
by Melvin Shadbolt, WØKYQ

Perhaps one of the reasons for the slow progress of ham TV has been the limited amount of readily available literature on the subject. This volume is intended to stimulate interest in this fascinating activity by supplying complete construction details for an economical, but effective, amateur TV station—including camera, modulator, transmitter, converter, and antenna. Enough basic theory is presented along the line so that Novices—as well as



RICHARD S. CONWAY (CREI grad 1960) is Supervisor, Electronic Test Department Wilcox Electric Co., Kansas City, Mo.

ROBERT T. BLANKS (CREI grad 1960) is Engineer, Research & Study Div., Vitro Labs., Division of Vitro Corp. of America, Silver Spring, Md.



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Bookshelf

(*Continued from page* 14)

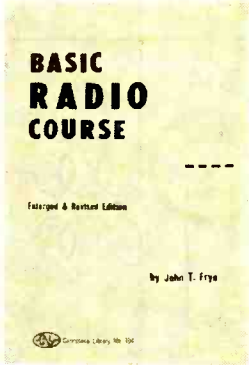
advanced hams—will be able to understand what they are building.

Published by Amateur Radio Publishing, Inc., 1379 East 15th St., Brooklyn 30, N.Y. 100 pages. Typewriter-style printing. Soft cover. $3.00.

BASIC RADIO COURSE (Enlarged & Revised Edition)

by John T. Frye

In this complete updating of the "best seller" original edition published over ten years ago, author Frye retains the same light touch which delights the readers of "Carl and Jerry" in POPULAR ELECTRONICS every month. The humor never detracts from the educational value of the book, however, but complements it and makes learning easier. Beginning with basic electron theory, Frye then discusses resistance, current, voltage, and Ohm's law. Progressing to a.c. circuits, he covers capacitance, inductance, impedance, and resonance, applying these principles to tubes, transistors, and other electronic components. (There is a whole new chapter on transistors, diodes and printed circuits.) In the concluding chapters, he explains the operation of every stage in a radio receiver and suggests appropriate servicing tools, instruments, and techniques.



Published by Gernsback Library, Inc., 154 W. 14th St., New York 11, N.Y. 224 pages. Soft cover, $4.10. Hard cover, $5.75.

CITIZENS BAND RADIO MANUAL, Volume I

by the Howard W. Sams Engineering Staff

This volume of CB-transceiver servicing information covers 46 popular 1960-1961 models produced by 17 major manufacturers. Schematics and chassis photos are provided, as well as parts lists' replacement data, and alignment information. A

(*Continued on page* 20)

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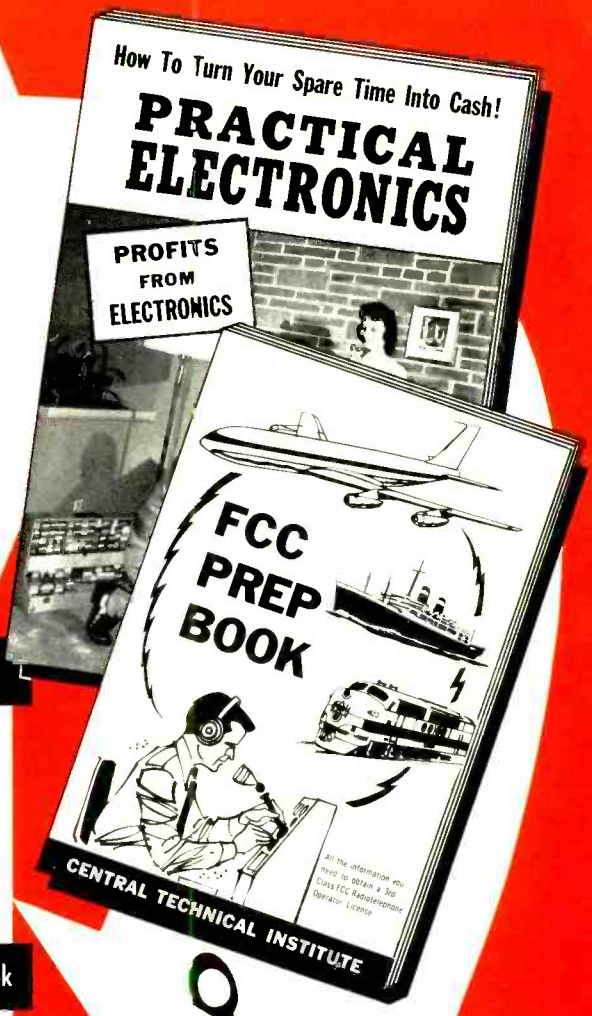

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Bookshelf

(Continued from page 16)

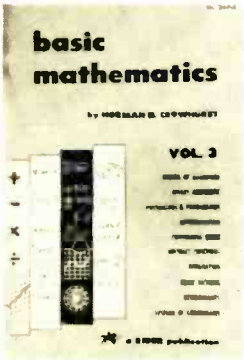
special feature is an editorial section on servicing CB equipment, which outlines the potential market for CB sales and service, qualifications for CB servicemen, and typical service problems and their solutions.

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

BASIC MATHEMATICS, Volume III

by Norman Crowhurst

Part of the Rider "pictured text" course in mathematics, Volume III is primarily concerned with developing algebra, geometry, trigonometry and calculus as "working tools." At least one illustration appears on every page to reinforce the ideas presented in the text. The four-volume course is designed to make it as simple as possible for anyone to acquire quickly a knowledge of all phases of the subject, and useful and important highlights are presented in easy-to-understand form. Volumes I and II of the course appeared in 1961; the final volume is scheduled for publication this year.



Published by John F. Rider Publisher, Inc., 116 W. 14th St., New York, N. Y. 152 pages. Soft cover. $3.90.

New Literature

Complete specifications for the H. H. Scott line of hi-fi amplifier and tuner kits are given in a new color brochure, which also pictures each unit. The free booklet can be obtained from H. H. Scott, Inc., Department P, 111 Powdermill Rd., Maynard, Mass.

Write to Cush Craft, 621 Hayward St., Manchester, N.H., for a free, up-to-date copy of "Amateur Communication Antennas" (Catalog #62). The 8-page brochure contains photos, technical details, and prices on VHF beams, VHF arrays, mobile halos, monoband beams, colinear arrays, groundplane antennas, etc. —30—

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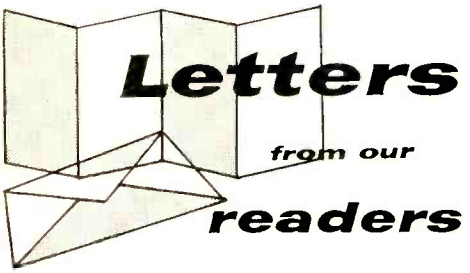


Kit for "10-8" Wanted

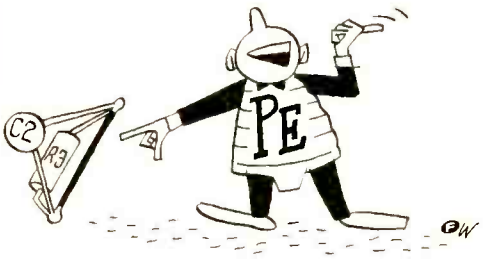
■ I enjoy reading your construction projects, but the thought of shopping for correct parts, laying them out, and drilling component holes has always discouraged me from attempting one. On the other hand, I have successfully built many kits. Isn't there someone, somewhere, who can furnish a kit (complete with a ready-punched chassis and the proper parts) for the "'10-8' De luxe" in your January 1962 issue? I'd be glad to pay a nominal fee for the service.

ALVIN C. TALBOT
3321 East 147th
Cleveland 20, Ohio

Perhaps one of our readers who have already completed the "'10-8' De luxe" with good results would like to pick up a little extra money by getting together a kit for Mr. Talbot.

Milliwatt on 6

■ While looking through your February 1962 issue, I became interested in an article entitled "Milliwatt on 6" by Charles Caringella. On close examination, however, I noticed a wire across



capacitor *C2* and resistor *R3* in the pictorial diagram that did not appear in the schematic. May I assume that this wire doesn't belong in the circuit?

STEVE MAAS, KN3RKL
Drexel Hill, Pa.

The schematic is correct, Steve. The wire you mention was printed in error and should be ignored.

Old Controversy Reopened

■ I've noticed, in past issues of P.E., that there has been a controversy over the Citizens Band. Myron Fox (in the March 1961 "Letters" column) said that the FCC "squelched" CB'ers. You replied that he probably wanted to rag-chew and told him to get a ham license. Steve Sokol (in August 1961 "Letters") felt that the FCC should make it easier to get an amateur radio license by

C-25. IN-CIRCUIT CAPACITOR TESTER KIT. Reveals shorted or open capacitors in the circuit, including electrolytics. Also reveals dried-out electrolytics through the Electrolytic Capacitance Dial. Kit: $19.95; Factory Wired, ready to operate: $29.95.

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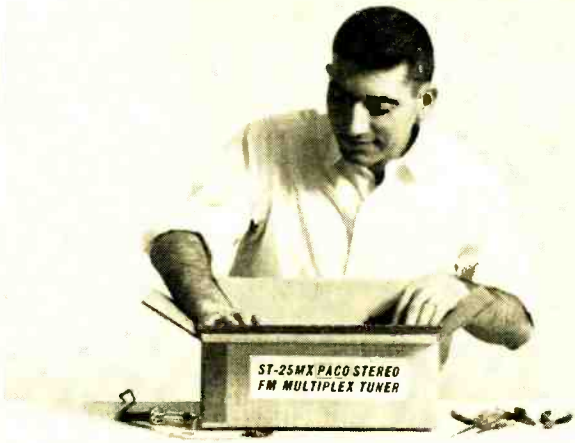

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*AS PICTURED ABOVE

PACO KITS

THE KITS YOU BUILD IN 1/3 LESS TIME

Letters

(*Continued from page 22*)

dropping the code part of the Technician Class examination.

A good ham rig costs a lot of money, while CB equipment is much cheaper. So why not set aside certain CB channels for rag-chewers only? If the FCC made such a rule and stuck to it, CB would be better for everyone.

HOWARD FRIEDMAN
Schenectady, N.Y.

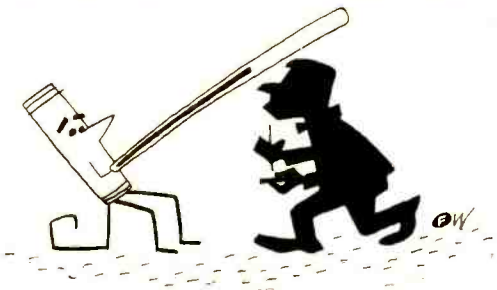
Well, first of all, reader Friedman, we don't agree with you about the expense of ham radio. It's possible, by building your own equipment, converting surplus rigs, or assembling kits, to get on the air for very little money. It's true that assembled ham equipment often costs more than a CB set—but that's because transmitting power is generally higher and receivers are usually tunable, with good bandspread. Ham equipment of the transceiver type is available, however. And those units having the same limitations as the transceivers designed for CB are comparable in price.

As to your proposal for turning over part of the Citizens Band to rag-chewers, we feel that this would be a bad idea. There's already too little room on this overcrowded spectrum for purposeful business and personal communications. And let's face it, such communications represent the only reason for the existence of this band.

So once again we urge: if you want to rag-chew, if you want to work DX, if you want to learn more about electronics, then get a ham license. Neither the code nor the written exam is difficult if you study properly. And once you have your "ticket," you'll be glad you made the effort. Let's leave CB for people who have a pressing need for restricted range radio communications.

Taking Your Transistor's Temperature

■ You may be asked questions concerning Fig. 5 of my article "Taking Your Transistor's Temperature" in the January 1962 issue. In order to raise the temperature of the 2N107 transistor signifi-



cantly, the latter must be biased as a power stage. The 100,000-ohm resistor shown is much too large to accomplish this purpose; its value should actually be 100 ohms.

FRANKLIN C. FITCHEN
West Kingston, R.I.

Crystal Set Becomes Tuner

■ I'm a freshman at the University of Michigan, and our campus radio station (WCBN) is very

NOW! Enjoy Quality Stereo Hi-Fi at Lowest Cost!

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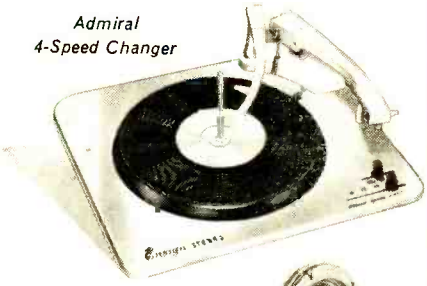
COMPLETE HOME MUSIC SYSTEM

Knight-Kit Stereo Amplifier

Admiral 4-Speed Changer



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Letters

(*Continued from page 24*)

similar to the one described in "Wired Wireless," your January "Carl and Jerry" episode. I enjoyed reading the story and was prompted by it to pass along the following experience to other students at universities with carrier-current stations. My hi-fi set has an FM tuner, but I had no way to pick up the AM campus broadcasts until I found an old crystal set in my spare-parts box. I wired

it to a spare preamp input and taped a 5-foot antenna to the wall. Station WCBN now comes in loud and clear, and the fidelity approaches that of my FM tuner.

EARL MORRIS, JR.
Ann Arbor, Mich.

Thanks a lot for the tip, Earl. Parts distributors near carrier-current stations had better stock up for a run on crystal sets.

Fixed-Frequency Signal Generator

■ In the "Fixed-Frequency Signal Generator" (July 1961 issue), 220,000-ohm resistors are specified for both *R8* and *R9*. This value seems a little high for *R9*, though; is it a misprint?

DOUGLAS FLETCHER
Ponchatoula, La.

Congratulations on your sharp detective work, Doug. Resistor R8 is 220,000 ohms, as specified, but R9 should be 150 ohms. —30—

HOW TO ORDER BACK ISSUES

Every month POPULAR ELECTRONICS receives many requests from readers who would like to know how to order back issues. Some readers want to obtain particular articles they have missed, while others want to complete their own back-issue files.

If you would like to order a specific issue of P.E., address your inquiry to:

Circulation Department
POPULAR ELECTRONICS
Ziff-Davis Publishing Co.
434 S. Wabash Ave.
Chicago 5, Ill.

Enclose 35 cents for each copy of issues less than six months old. 40 cents for each copy of older issues. Be sure to state the month and year of the issue(s) you want. In the event a requested issue is no longer in stock, your money will be returned.

How to test a stereo kit for top performance:

Simply look for this name.

You don't even have to open the box. If it's a Fisher StrataKit, you already have better proof of performance than if you had built any other manufacturer's kit and tested it in one of the world's most elaborately equipped audio laboratories.

How can Fisher make this claim? Very logically. Fisher has one of the world's most elaborately equipped audio laboratories. Fisher did build and test everyone else's kits before the StrataKit engineering program was finalized. The task then set for Fisher engineers was to outclass in every way what they had found in other designs. Which they did. They drew on all the knowledge accumulated in the course of 24 years in high fidelity and the results are in the box. StrataKits are easier to build than others, the StrataKit instruction manuals are clearer than others, the completed StrataKits have more advanced features and perform better than others. And we have yet to hear of someone who could not complete his StrataKit successfully and with the greatest of ease.

The Fisher StrataKits now at your dealer are the KX-200 80-watt stereo control-amplifier and the KM-60 FM Stereo Multiplex wide-band tuner. Both sell for $169.50. Both are the world's finest in their class. The proof is simply in their name.

USE THIS COUPON
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Fisher Radio Corporation
21-52 44th Drive
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Please send me without charge the complete Fisher StrataKit catalogue.

FISHER

Name_____

Address_____

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PES11

Hi-Fi Showcase

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

IF you're in the market for a multiplex adapter that you can tuck neatly out of sight, take a look at ***Fisher***'s MPX-200. Designed especially for people who want a unit for concealed installation, the MPX-200 is self-powered, compact, and can be placed up to three feet from the associated tuner or receiver. There are two controls on the adapter to insure identical output levels from both channels, and a "selector" switch makes it possible to record stereo programs monophonically. Price, $79.50. . . . Another FM multiplex unit, this one a stereo tuner, comes from ***Lafayette Radio.*** Designated as Model LT-700, the tuner boasts double-tuned dual limiters and a wide-band Foster-Seeley discriminator for top-rate performance. Its multiplex section can be controlled from the front panel, and there is an indicator light that lets you know when a station is broadcasting stereo. Finished in cream, brass, and beige, the LT-700 utilizes 12 tubes and 2 diodes and is priced at $124.50.

If you happen to own a monophonic Revere or Wollensak tape recorder, ***Nortronics*** can furnish a direct replacement for the original head. Known as Model WR-20, the replacement head has separate record/play and erase sections and is supplied complete with cable and plug, ready for installation in your recorder. Price, $15.60. . . . From ***Olson Electronics*** comes a five-speaker array which makes an excellent addition to any hi-fi system. Contemporary in design, this slim unit is truly a vibrant panel of sound with full, rich tone emanating from both sides. The system, Model S-468, measures 26¼" x 19⅞" x 5" and carries a price tag of $49.95. . . . One of the lightest stereo tape recorders ever produced, ***Pentron***'s Model 880 weighs only 28 pounds. It incorporates two hand-wired

Olson S-468 speaker system

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

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Address_____
City_____ Zone_____ State_____

Showcase

(*Continued from page* 28)

amplifiers and preamplifiers, two full-range speaker systems, two microphones, and a push-button-controlled tape transport mechanism in a fiber case measuring only 14" x 7¼" x 14½". And its special "Ad-asound" feature enables you to add voice, music, or special effects to prerecorded tapes for teaching or other purposes. Ready to record or play back either ¼- or ½-track stereo tapes, the 880 is priced at $369.95. . . . Ever think of playing your records at a tracking force of a low, low ¼ gram? It's possible, assuming you have a lightweight arm with a low coefficient of friction, and ***Pickering***'s new Model D-3805AA V-guard stylus assembly. Housed in clear plastic, the D-3805AA has a stylus radius of 0.5 mil, a price of $21.00.

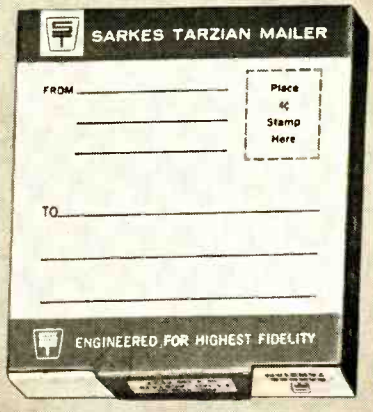
An FM stereo tuner and a 24-watt stereo amplifier from ***Radio Shack*** make up a first-rate stereo receiver. Designated as Model STA-7, the receiver incorporates a full range of controls and can be used as a stereo or mono amplifier for any phono or tape deck. The tuner section has 14 tubes (11 are dual-purpose, resulting in 25-tube performance); the amplifier has outputs for 4-, 8-, and 16-ohm speakers as well as stereo headphones. Housed in a handsome brushed-gold case, the STA-7 sells for $124.95. . . . Another new Radio Shack item, the "Realistic" FM multiplex adapter, is a perfect match for any current "Realistic" FM tuner. A selector switch and a stereo balance control are conveniently located on the front panel, and two separate pilot lights indicate when the adapter is on and when the station being received is broadcasting stereo. Fully assembled, the adapter sells for $39.95; a kit version is available at $29.95. . . . Two other Radio Shack products are the Nova 3 full-range speaker and the Nova T-1 tweeter (illustrated). An 8" speaker, the Nova 3 incorporates two separate cones, mounted separately but connected to the same 2" voice coil for true mechanical crossover. As for the Nova T-1 tweeter, it boasts a response within 2 db from 1200 to 25,000 cycles. Prices: $16.95 for the Nova 3; $49.65 for the Nova T-1.

Radio Shack Nova T-1 tweeter

Three new products from ***H. H. Scott*** include an amplifier kit, a completely assem-

LOOK ask DEMAND inquire ARGUE beseech INSIST

...for magnificent sound, get Tarzian Tape



To earn a 3-inch reel of tape...make a survey for Tarzian

Tarzian Tape has been advertised since December of 1960 in publications dealers are presumed to read...since February of 1961 in publications you are presumed to read. Tape quality is excellent—our engineers say, our users say. Sales are good, but would be better if more dealers carried the line. The line is 1½ mil and 1 mil acetate tape, and 1 mil Mylar* tape, in 3″, 5″ and 7″ reels. The price is competitive.

If you have tried Tarzian Tape or if you would like to try Tarzian Tape, here's how to get a 3-inch reel of it for no money, down or otherwise. Just ask your dealer for Tarzian Tape. If he has it, check the box and ask him what dealer publications he reads. If he does not carry it, check the box and ask him why not, and what dealer publications he reads. If he says he's never heard of it, by all means ask him what dealer publications he reads.

Send us your name and address and his name and address, and his answers and a verification by any dealer employee. We'll send you a self-mailing box (as illustrated) of 3″ 1½ mil acetate professional quality Tarzian Tape. The coupon is for your convenience. Use it as a guide if you'd rather reply on some other piece of paper.

**DuPont trademark for polyester film*

Sarkes Tarzian, Inc., Dept. FLI
Magnetic Tape Division,
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Address:_____

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Dealer does carry Tarzian Tape ☐
Dealer does not carry Tarzian Tape ☐ Why not?

_____

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He reads these dealer publications:

_____

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Dealer to sign this verification: The raw tape user named below got the answers shown above from me.

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User name_____

Address_____

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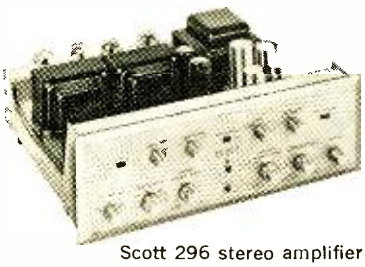
Showcase

(*Continued from page* 30)

bled stereo amplifier, and a multiplex tuner kit. The amplifier kit, Model LK-48, is a stereo unit conservatively rated at 24 watts per channel. It features separate bass and treble controls for each channel, a stereo balance control, front-panel tape-monitoring facilities, and a center-channel output. Construction should be a snap even for the relatively inexperienced: parts come mounted on separate "part-charts," one for each page of the instruction book, and all wires are pre-cut and pre-stripped. As for the Model 296 factory-assembled amplifier, it delivers a stirring 50 watts per channel and incorporates a variable control for precise matching to any phono cartridge or tape deck; other features include a patented "Dynaural" rumble suppressor, a front-panel stereo headphone jack, and a center-channel level control. The third item—the LT-110 FM multiplex tuner kit—boasts a pre-wired and tested multiplex section with special filters to allow off-the-air tape recording. Full-color assembly diagrams help prevent wiring mistakes, and parts come mounted on charts in the exact order used. Prices of the three units: $124.95 for the LK-48; $299.95 for the 296; and $159.95 for the LT-110. . . . ***Webcor*** has a low-priced tape recorder dubbed "The Statesman." A dual-track machine operating at both 3¾ and 7½ ips, it accepts up to 7" reels and is supplied complete with a hand-held microphone. Its low weight (14 lb.) makes the recorder conveniently portable. Price, $79.95.



Scott 296 stereo amplifier

Fisher Radio Corp., 21-21 44th Dr., Long Island City 1, N.Y.
Lafayette Radio Electronics Corp., 111 Jericho Turnpike, Syosset, L.I., N.Y.
Nortronics Co., Inc., 8101 W. 10th Ave. N., Minneapolis 27, Minn.
Olson Electronics Corp., 260 S. Forge St., Akron 8, Ohio
Pentron Electronics Corp., 777 S. Tripp Ave., Chicago 24, Ill.
Pickering and Co., Inc., Sunnyside Blvd., Plainview, L.I., N.Y.
Radio Shack Corp., 730 Commonwealth Ave., Boston 17, Mass.
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Webcor, Inc., 5610 W. Bloomingdale Ave., Chicago 39, Ill.

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

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

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

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

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

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

FROM OUR MAIL BAG

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

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

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

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

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

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

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Tips and Techniques

ALUMINUM FOIL SERVES AS HEAT SHIELD

A sheet of heavy aluminum foil makes an excellent shield for protecting transistors and other heat-sensitive components when

connections are being soldered nearby. For a very close fit around critical components, cut it to the exact shape required. Aluminum foil is also useful in keeping solder from running into places where it doesn't belong. *—Robert Hertzberg*

HEADSET PADS FROM FOAM RUBBER

If you'd like to add a pair of ear pads to your headset, or replace a pair that's wearing out, try using foam rubber or plastic. This material can usually be obtained at shoe or furniture supply houses and hardware stores. You can cut it easily with a pair of scissors and secure it to the earpieces with household cement. A 2" x 4" x 6" block is enough to make two pads.

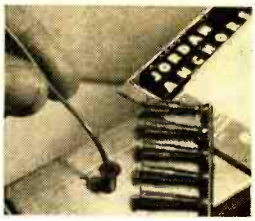
—Robert Micals

OPEN LINE FROM TWIN-LEAD

Need some 300-ohm, open-wire transmission line for your next antenna project? You can convert ordinary 300-ohm TV twin-lead to do the job, if you have both time and patience. Just take a paper punch and make holes in the insulation every eighth of an inch or so (be careful to avoid the conductors). This will reduce losses, and the twin-lead will then be comparable to open-wire line in its electrical characteristics. *—George Wlodarski, K8ABR*

SCREW ANCHORS MAKE FEED-THROUGH INSULATORS

The plastic "anchors" sold for fastening screws in plaster walls make ideal feed-through insulators for small wires. They come in a variety of sizes and can easily be "force-fitted" into chassis holes. Visit your neighborhood hardware store or five-and-ten and obtain a supply of these useful, inexpensive items. *—John A. Comstock*



MATCHBOOK CLEANS VOLUME CONTROL

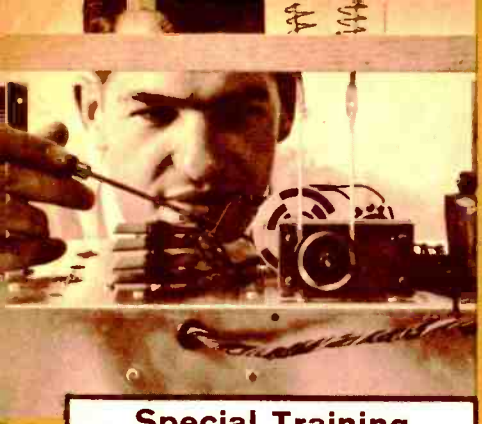
Stuck with a noisy volume control and no cleaner? Try lightly sanding both the carbon element and the sliding contact of the control with the "striking" surface from a pack of book matches. This material also does a good job of cleaning up worn or dirty relay contacts. *—Ted Hunter, K3HWQ*

CURTAIN RODS MOUNT MOBILE RIGS

Use an adjustable curtain rod of the sliding type to mount a light mobile rig in your car, and you'll be able to install and remove it with ease. Two short pieces of the inner section of the rod are bolted to the top of the equipment case, and two matching pieces of the outer section are fastened under the car's dash. Install washers (preferably lockwashers) under the rod sections bolted to the case top so that there'll be enough clearance for them to slide into the dash-mounted sections. Put a slight crimp in the latter if the rods don't fit together tightly enough. *—Jon L. Sugg*

PHONE LINE ACTS AS ANTENNA

Having trouble pulling in those DX broadcast stations on your small transistor portable? If you place the set near a telephone, the phone line will act as an auxiliary "antenna." Try the radio in different positions to get optimum results. *—Joseph Dube*



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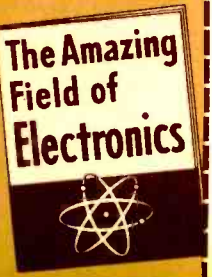

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BUILDING ELECTRONIC CIRCUITS on specially-designed plug-in type chassis, is the work of Robert H. Laurens, Hammonton, N. J. He is an Electronic Technician working on the "Univac" computer. Laurens says, "My NRI training helped me to pass the test to obtain this position."

"I OWE MY SUCCESS TO NRI" says Cecil E. Wallace, Dallas, Texas. He holds a First Class FCC Radiotelephone License and works as a Recording Engineer with KRLD-TV.

MARINE RADIO OPERATOR is the job of E. P. Searcy, Jr., of New Orleans, La. He works for Alcoa Steamship Company, has also worked as a TV transmitter engineer. He says, "I can recommend NRI training very highly."

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NEW products

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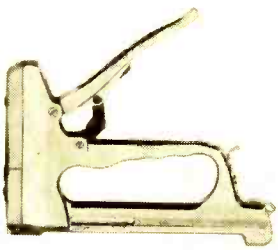
A new "walkie-talkie" Citizens Band radio transceiver is designed for quick, short-range communications by businessmen, industrial personnel, and sportsmen. Marketed by *The Hallicrafters Co.*, 4401 W. Fifth Ave., Chicago, Ill., the hand-held Model CB-4 "Littlefone" operates in the 27-mc. (Class D) band, and can be used with field, mobile, or base stations at an average range of two miles. The fully transistorized unit weighs one and a half pounds and measures 8" x 3⅜" x 1⅞". Power input is 100 milliwatts, receiver sensitivity 1 microvolt. Plug-in crystals and transistors make for easy channel changeover and servicing. The price of the Model CB-4 "Littlefone" is $89.95.

STAPLE GUN FOR WIRING

You can operate the Heller Model TO-12 electrical wire tacker with one hand! Ideal for most wiring jobs, it will fasten braided or jacketed, single- or double-strand cables—and even hollow tubing—up to 3/16" in diameter. A "controlled power chamber" prevents crushing. The self-clinching staples measure 3/16" across the crown and have ⅜" legs; the staples may be driven into plaster, hard or soft wood, and other hard materials. So that you can tell at a glance when the staples are running low, there's a convenient "window port" on the side of the staple reservoir. Price, $25.00 (*Heller Roberts Instruments Corporation,* 6115 Carnegie Ave., Cleveland 1, Ohio)



"FLUSH" CUTTER

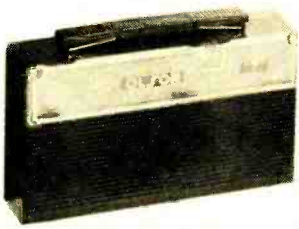
Intended primarily for making "flush" cuts in confined areas, the Hunter Model EREM 86 plier will snip wire at the extreme tip of the cutter. Made in 4½", 4¾", 5", and 6" sizes, it is especially handy for trimming off fine leads on printed-circuit boards. All sizes are available with or without leaf springs and come equipped with turquoise "cushion grip" handles. Price, about $4.50. (*R. N. Hunter Sales Co.,* 9851 Alburtus Ave., Santa Fe Springs, Calif.)

IN-CIRCUIT CAPACITOR TESTER

EICO's Model 955 capacitor tester measures capacitors from 0.1 to 50 μf., either in or out of the circuit. Accuracy is ± 10% at any point on the 4" Lucite dial. In addition, capacitors as large as 2000 μf. can be checked for shorts, and those as small as 15 μμf. can be checked for "opens." The short and open tests, like the measurements, can be conducted either in or out of the circuit. Indications are seen as sharp, bright bar patterns on an electron-ray tube. Price, $19.95 in kit form, $39.95 wired. (*EICO Electronic Instrument Co., Inc.,* 33-00 Northern Blvd., L. I. City 1, N.Y.)

TRANSISTOR RADIO KIT

Even if you haven't had any previous electronics experience, you should be able to build the Olson KB-137 7-transistor radio kit. Since two preassembled printed-circuit boards are included (a 4-transistor tuner and a 3-transistor push-pull audio amplifier), much of the wiring is already done. The set also has an



products

(*Continued from page* 37)

oversized output transformer, a 3" PM speaker, and a high-impact polystyrene case. Ideally suited for group activity in schools, scouting, radio clubs, etc., the kit can be put together in less than an hour. Four penlight batteries, not included in the $16.14 price, are required. (*Olson Electronics,* 260 S. Forge St., Akron 8, Ohio)

DECADE KITS

The new decade capacitance and resistance kits being produced by Heath are ideal for countless experimental applications. Fifty-four ½% 1-watt precision resistors are arranged in 6 decades in the Model IN-11 "Decade Resistance" (illustrated), with values of from 1 to 999,999 ohms available in 1-ohm steps. Capacitances from 100 $\mu\mu$f. to 0.111 μf. are provided in 100-$\mu\mu$f. steps by the 3-decade Model IN-21 "Decade Condenser," and the capacitors used are precision, 1% silver-mica types rated at 350 volts d.c. continuous, 500 volts d.c. intermittent. Model IN-11 sells for $24.95; Model IN-21 for $17.95. (*Heath Co.,* Benton Harbor, Mich.)

TV SERVICE AID

Designed for "one-stoop" TV repair, the Sencore Model HM119 "Handyman" provides many time-saving service aids in one compact unit. Included are filament, fuse, continuity, and voltage checkers, a trouble light, "cheater" cord with on-off switch, extension cord, and pin straighteners. The filament checker handles all tubes, including Nuvistors, Novars, compactrons, 10-pin types, and picture tubes. Price, $9.95. (*Sencore, Inc.,* 426 S. Westgate Drive, Addison, Ill.) —30—

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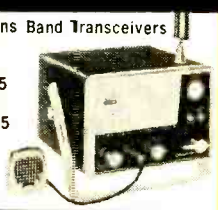

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MUST WE HAVE UHF-TV?

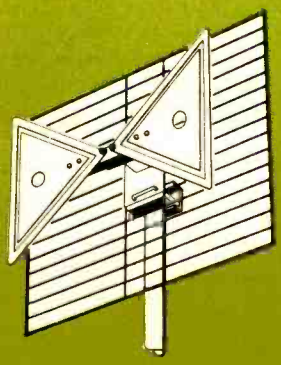
The odds are stacked 70 to 12 that we will.

By KEN GILMORE

LAST FALL, a new television station went on the air in New York City. Since New York already has six active channels, a seventh might seem barely newsworthy. And when you consider that less than 1% of the area's viewers are equipped to receive this new channel, it seems hardly worth mentioning. Yet the fact is that New York's new station—WUHF, telecasting on ultra-high-frequency channel 31—may turn out to be the most important television station in the United States.

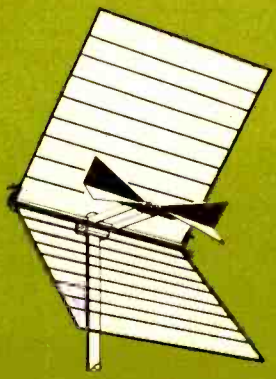
The results of tests now being conducted by WUHF are likely to have a profound effect on the nation's entire television setup. All current VHF stations (operating on channels 2 through 13) may be scrapped, and

UHF TV



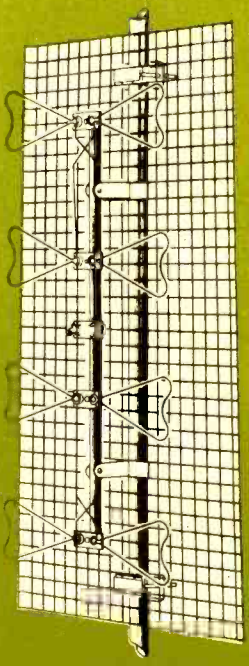
BOW-TIE REFLECTOR

Suitable for distances up to 25 miles. Has peak gain of 4 db.



BOW-TIE CORNER REFLECTOR

Ideal for reception at distances of 25 to 50 miles. Peak gain of 9 db.



4-BAY BOW-TIE REFLECTOR

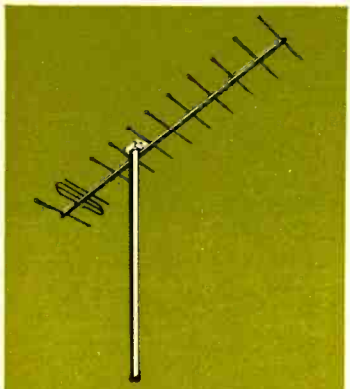
Like bow-tie reflector but uses four bow ties. Furnishes gain of 8 db. Six-bay bow-tie unit has 10-db gain and range up to 100 miles.

operations shifted to the UHF band—channels 14 through 83, now receivable by only a small fraction of the nation's TV sets. This means that even though you may now live in one of the country's few UHF areas, your present TV set probably isn't equipped to pick up the new channels. To watch UHF TV, you'll either have to add a UHF converter or buy a new set.

THE MESS IN TV. These drastic proposals are designed to do something meaningful about an inescapable fact: the present TV bands are in a mess. Stated very simply, there just aren't enough VHF channels to go around.

Many cities have only one or two TV stations, and consequently have to struggle along with extremely limited TV fare. Added stations in these cities would only interfere with existing stations in nearby cities. With the present 12-channel VHF system, all but a handfull of the more than 500 possible VHF stations are already on the air, and the

Antennas in cover photo and on page 41 courtesy of JFD Electronics Corporation, 6101 16th Ave., Brooklyn 4, N. Y.



12-ELEMENT UHF YAGI

Designed for single-channel reception. Has 12.5-db gain for excellent results at 75 miles; 16 elements will stretch range to 100 miles.

few more which could be are in remote areas where there simply isn't enough population to support them.

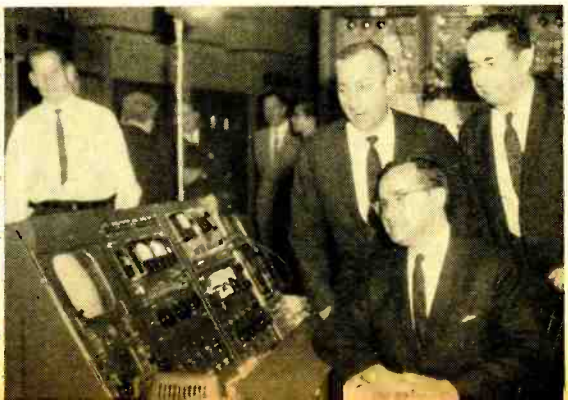
Many plans have been proposed to straighten out the mess. But the conviction is growing that only one scheme really has a chance to succeed: *throw out the present VHF band and shift everything to UHF.* Why UHF? Because the UHF band (channels 14-83) offers an abundance of possible TV stations—1500 or so across the country; although only about a hundred are in actual operation, for one reason or another.

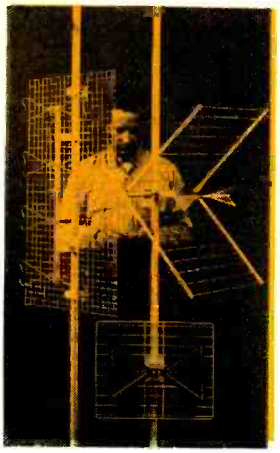
Actually, because of its relative disuse, the vast expanse of the UHF spectrum has become the favorite target for space scientists, military leaders, and international communications companies. All of these groups need spectrum space desperately and have many uses to which they would like to put the UHF TV band. If television broadcasters won't take advantage of it, they say, let's take it away from the TV people and give it to those who will. To find out why this situation exists, let's take a quick look at TV over the years.

LOOKING BACK. Television's current difficulties began back in the late 1940's when the then new broadcasting medium became an overnight success—a far bigger one than anyone had thought possible. Within a few years after the end of World War II, millions of TV sets were bought by eager audiences around the country. Television stations sprang up as fast as the FCC could license them. The country's big cities—New York, Los Angeles, Chicago, and others—quickly applied for and got many channels; they are the only areas, for the most part, which now have enough stations.

Far more quickly than anyone could predict, a large percentage of the available channels were in operation and there was still a terrific clamor for the few which remained. The basic trouble was that there were only 12 channels available. Since two stations transmitting on the same channel must be several hun-

An experimental ultra-high-frequency (UHF) station, New York City's WUHF has been on the air since November of 1961. Photos below show opening ceremonies and picture New York Fire Commissioner Edward Thompson and Municipal Broadcasting System Director Seymour N. Siegel (left), FCC Chairman Newton N. Minow (seated, right), and FCC Commissioner Robert E. Lee (standing, far right).





UHF TV

dred miles apart to keep from interfering with one another, only about 550 stations could be fitted into the 12 channels across the country.

Many smaller towns and cities found that most channels had already been grabbed up when they themselves got around to applying. Suddenly realizing there wouldn't be enough to go around, the FCC, in desperation, turned on *The Freeze*. For several years, the Commission turned over the thorny problem of what to do to its best legal and engineering minds. In 1952 they announced a solution: Establish 70 new channels in a new, ultra-high-frequency band, and at the same time retain the older VHF channels.

PEACEFUL COEXISTENCE? The two systems, it was thought, could peacefully co-exist. Unfortunately, the decision

WHAT YOU'LL NEED FOR UHF TV

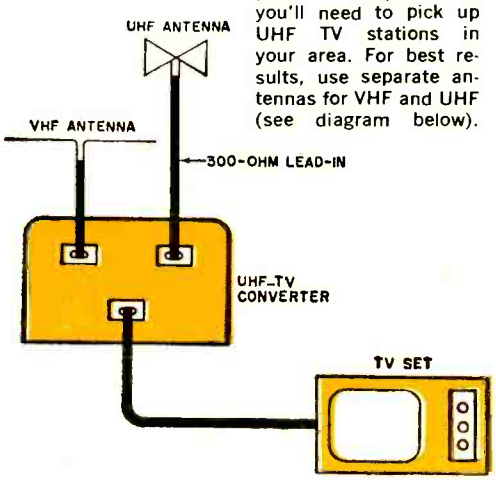
If you, like most televiewers, are currently equipped only for standard VHF reception, you'll want to know how you can pick up UHF programs when they are broadcast in your neighborhood. Let's say you want to keep your present TV set. In this case, you can just add a separate converter to it, such as the Blonder-Tongue 99R which sells for $22.95 (list). If you're thinking about buying a new set anyway, you'll want to consider one with a built-in UHF tuning section; such a receiver will probably cost only $20 to $40 more than a similar set without this feature.

You may have to do something about your antenna, too. The UHF signals—ranging from channel 14, transmitting on 470-476 mc., to channel 83, transmitting on 884-890 mc.—are on too high a frequency to be picked up efficiently on VHF antennas. If you need an outside VHF antenna now, chances are you'll need a separate outside antenna for UHF, too; such an antenna will cost you from $5 to $35, depending on how far you are from the station. On the other hand, if you now get by with rabbit ears on top of your set, a similar (but smaller) UHF unit may do the trick.

Remember, the prices above are today's prices. Given a nation-wide mass market, UHF television set and antenna manufacturers will be able to tumble costs considerably.

Blonder-Tongue Model 99R

A UHF converter (see photo above) is all you'll need to pick up UHF TV stations in your area. For best results, use separate antennas for VHF and UHF (see diagram below).



turned out to be a short-sighted one, though for a while it appeared to have a chance of success.

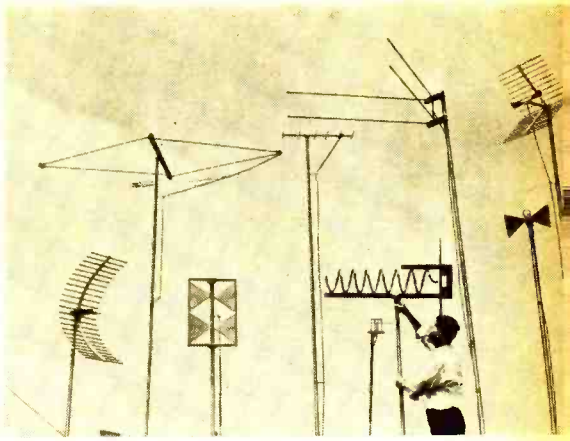
When the freeze lifted and the FCC again began taking applications for new stations in 1952, 200 of the first 500 applications were for stations in the newly created UHF band. The reason: some telecasters were eager to get on the air with the new stations and get the jump on competition. Since there was vigorous competition for the few remaining VHF's, many broadcasters were able to get a UHF license, build the station, and begin broadcasting, while the VHF channels were still tied up in hearings.

But by 1955, it was clear that the U stations were in serious trouble. As the V's continued coming on the air, the U's began falling like flies in a hailstorm. During the first three years, 131 of the authorized U's failed, 39 of them without ever having fired a kilowatt. For every VHF station that went out of business during the period, six U's couldn't make it, in spite of the fact that there were far fewer U's to begin with. The highest number of U's on the air at one time during the entire history of UHF was 171. Today, that number has shrunk to about 90 commercial operations—half of them are in trouble—and a sprinkling of educational U's.

The ultra-high-frequency stations couldn't compete for two reasons. First, their signals didn't go as far. A 100-kw. VHF station broadcasts a usable signal over a far greater area than a UHF station of the same power. This made advertisers reluctant to buy time on the U's with their smaller audience.

Second, and even more important, a very small proportion of televiewers across the country were willing to convert their sets to receive the UHF transmissions, or to buy a new television set with built-in provisions for covering both bands. In most parts of the country, then, only a small percentage of the potential audience could receive UHF signals.

The old chicken-and-egg problem cropped up: operators didn't want to build new UHF stations until there were enough receivers to make it worthwhile, and home viewers wouldn't buy UHF sets until there was something to see on them. Also, networks didn't want to affiliate with the few U's which did exist until they had larger audiences, and at the same time, the U's couldn't attract the audiences without the network programs. Consequently, the vast majority of the UHF channels have lain idle.



RCA

Nine different types of UHF antennas were tested by RCA back in the early 1950's. Shown left to right, they are: a parabolic reflector, rhombic, double-fan dipole, Yagi, a dipole variation, helical, stacked "V," single-fan dipole, and corner reflector.

OTHER POSSIBILITIES. Over the years, the FCC has made a number of attempts to do something about this sorry situation. First, it instituted a crash program to "de-intermix"; that is, whole cities would be made either all V or all U, so that stations in any community could compete on an even basis. This raised a howl from holders of VHF channels that hasn't died down yet. The de-intermix program never really got off the ground.

The FCC was diverted, for one thing, by a plan to increase the number of VHF stations from 12 to 50. Unfortunately, this scheme required that the military services give up a block of frequencies adjacent to the present television band. After considerable study, the military delivered the answer: NO. This left the Commission with only three choices.

- Give up and admit defeat.
- Keep both the UHF and VHF bands, and try to take measures to put them on a more competitive basis.
- Shift all stations to the UHF band in spite of the screams of rage from present holders of the highly profitable VHF outlets.

(*Continued on page* 97)

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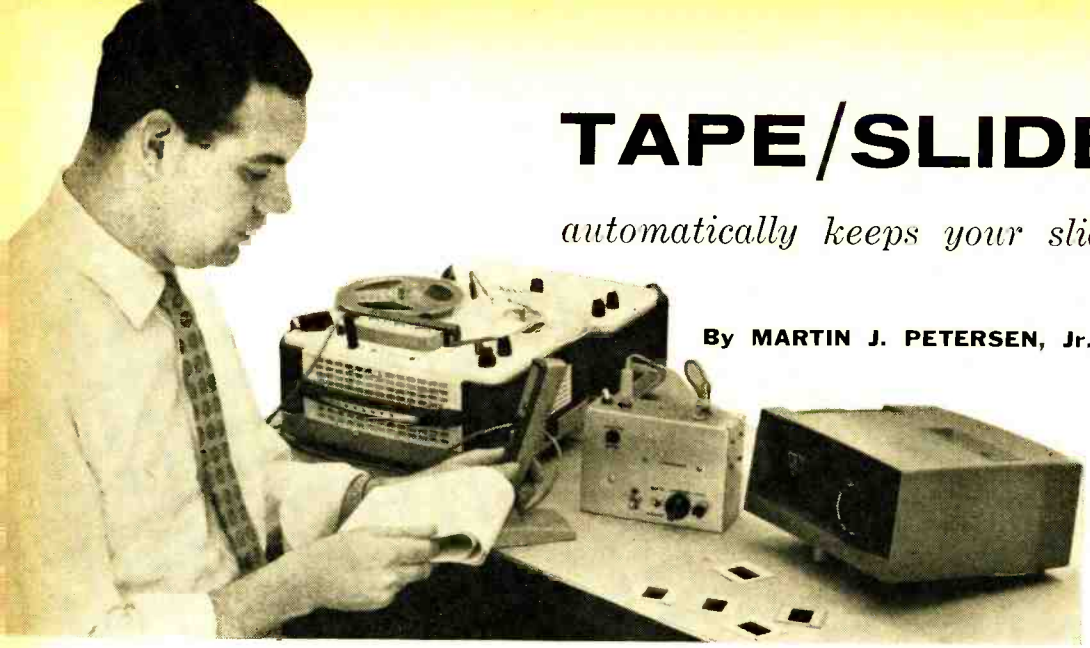


By MARTIN J. PETERSEN, Jr.

EVER TRIED showing your favorite slides to a group of friends, only to find that you couldn't remember all the details about those shots you took years ago? Adding a tape-recorded commentary to your slide "shows" will eliminate this frustrating experience as well as add a professional touch to the showing. But to be most effective, the slides should be synchronized with your narrative.

It's true that you *could* change slides manually as the narration is played back on your tape machine, but this would require that you be in constant attendance. And while slides can be cycled by the projector's automatic timed-cycling device, synchronization would be impossible; in only a matter of minutes, the sound would be ahead of the picture or vice versa.

The answer to the problem is the "Tape/Slide Synchronizer," which can be used with any stereo tape recorder and any slide projector having provisions for electrical remote push-button cycling. Easy and inexpensive to build, the Synchronizer will automatically change your slides at precisely the right time as your taped narration progresses. You, meanwhile, can relax comfortably in your easy chair, with nothing else to do but enjoy the program.

Construction and Testing. Building this two-transistor, two-relay unit is a one-evening project. While the parts layout isn't critical, you will probably want to use the pictorial diagram as a guide.

Jacks *J2* and *J3* (see the schematic diagram) can be standard open-circuit phone jacks, provided that they are insulated from the chassis. And while the center-tap on the primary of transformer *T1* wasn't used in the author's system, you can select any two of the three primary leads that give best results.

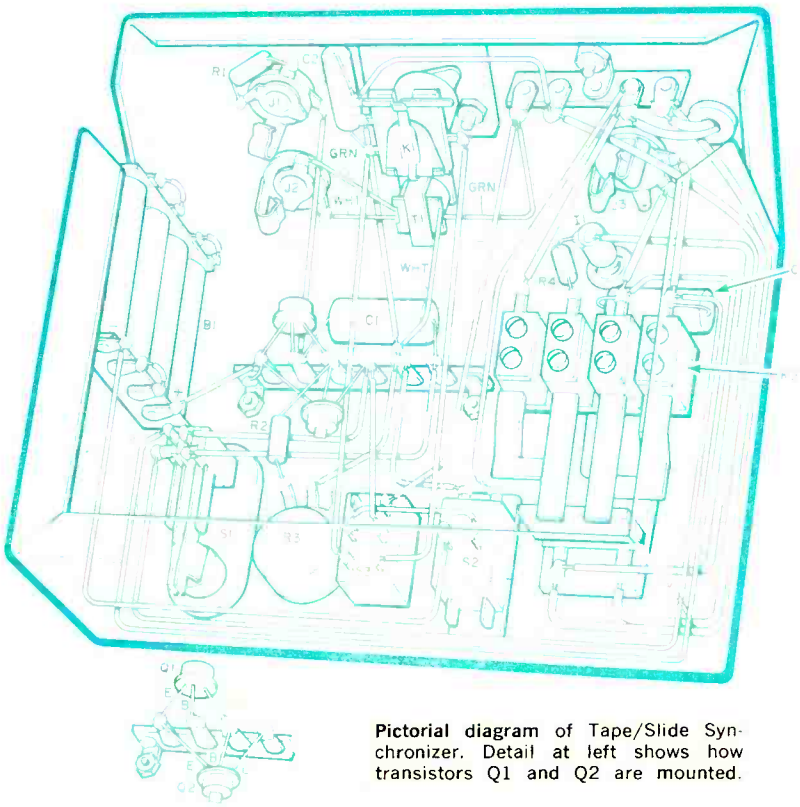
To test the unit, do not plug in the projector at first, but put an ohmmeter or other indicating device across the terminals of jack *J3* instead. Connect jack *J2* to a speaker, throw switch *S3* to the *record* position, and depress *cycle* switch *S1*. The ohmmeter should read zero, and an audio tone should be heard from the speaker. The gain (and the pitch, somewhat) will vary with the setting of *sensitivity* control *R3*.

Next, disconnect the speaker and connect the output of *J2* to the channel 2 input of your tape recorder (use the "auxiliary" rather than the "mike" input if your recorder has one). Again depress the *cycle* button, and adjust the setting of the recorder's channel 2 gain control until the "magic eye" (or other record-level indicator on your recorder) just "closes." Leaving the gain control at this setting, depress the *cycle* button repeatedly to record a few tones on tape.

Now set the recorder for playback and place the Synchronizer in the "play"

SYNCHRONIZER

projector and taped commentary "in step"



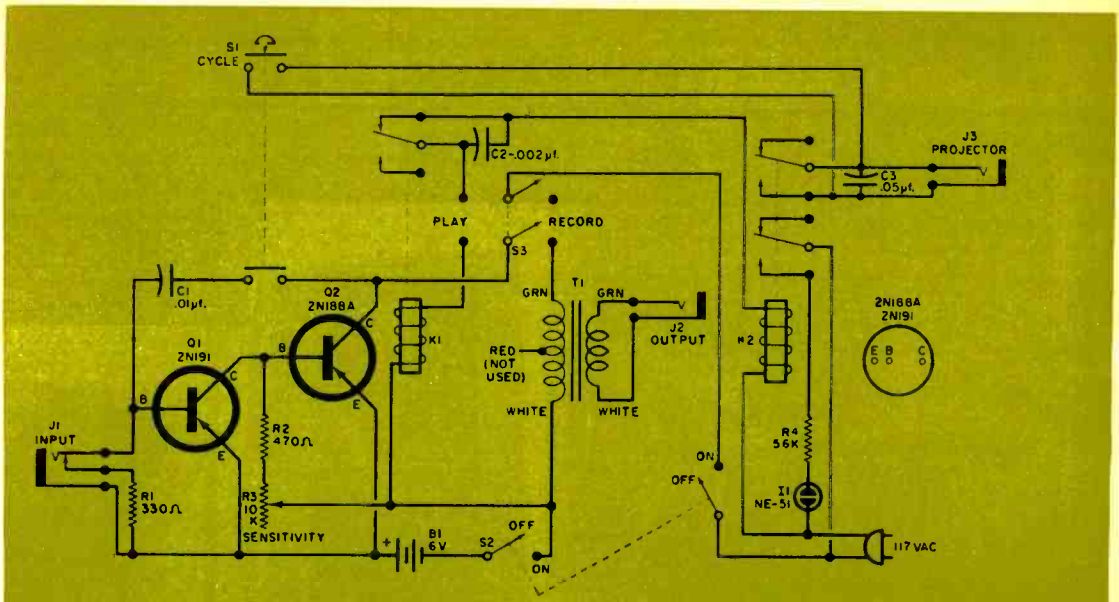
Pictorial diagram of Tape/Slide Synchronizer. Detail at left shows how transistors Q1 and Q2 are mounted.

position by throwing switch *S3* to *play*. If the Synchronizer is working properly, relay *K1*'s contacts should remain closed until a signal is applied to *J1*. Turn on the tape recorder and plug the output of channel 2 into *J1* to play back the tones through the Synchronizer. Each time a tone appears, *K1*'s contacts should open and the ohmmeter should read zero.

Sensitivity control *R3* should be adjusted for best operation of *K1*. At the minimum setting of *R3*, the audio signal may be too weak to de-energize *K1*. And at maximum setting, the relay may de-energize with random noise signals, and the projector may cycle many more times than is desired. Depending upon the relay used, the armature tension may have to be adjusted for best pull-in and seating operation.

When these adjustments have been made, you're ready to try operating the Synchronizer with your projector. The leads from *J3* should be connected to the same receptacle on the projector that ordinarily accepts the leads from a push-button remote-control switch (see block diagram). Because the *cycle* button operates the projector as the narration is being taped, the projector should be placed far enough away from the Synchronizer and tape recorder so that noise from its fan will not be picked up by the microphone.

Using the Synchronizer. To prepare your own slide show, first prearrange



Device is built around a two-stage amplifier/oscillator, as explained in "How It Works" at right.

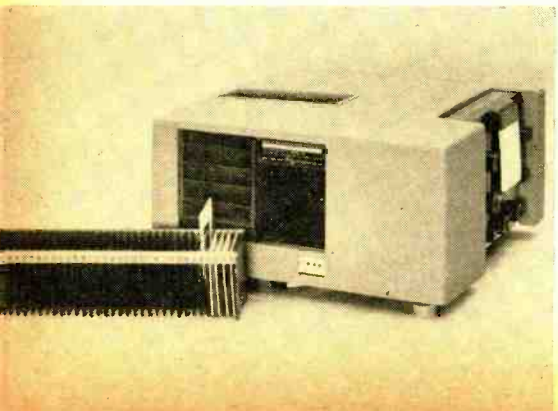
your slides in a magazine in the order in which they are to be shown. Know what you want to say about each slide (a script helps here), and set up your tape recorder to record your narration on channel 1.

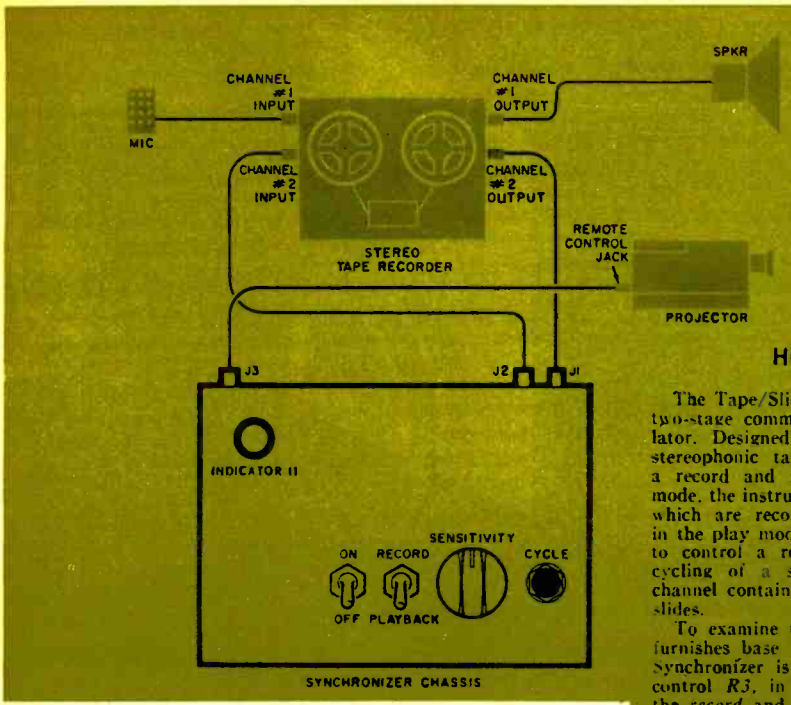
With the Synchronizer set in the *record* position, and nothing plugged into jack *J1*, you record your narration and depress the *cycle* button momentarily each time you want a slide to change. This will advance the slide magazine one "notch" by cycling the projector, and simultaneously record an audio tone generated by the Synchronizer on tape channel 2. Incidentally, holding the cycle button down for a short period caused the author's projector to "back up" one slide. This is an additional feature of the unit which you may find of value.

PARTS LIST

B1—6-volt battery (four Burgess Type Z cells or equivalent in series)
C1—0.01-μf., 400-volt paper capacitor
C2—0.002-μf., 600-volt paper capacitor
C3—0.05-μf., 400-volt paper capacitor
J1—Closed-circuit phone jack
J2, J3—Open-circuit phone jack
K1—S.p.d.t. plate-circuit relay, 1000-ohm coil (Sigma 4F-1000-S/SIL or equivalent)
K2—115-volt a.c. d.p.d.t. "universal" relay (Guardian Series 200 or equivalent)
Q1—2N191 transistor (General Electric)
Q2—2N188A transistor (General Electric)
R1—330-ohm, ½-watt resistor
R2—470-ohm, ½-watt resistor

Almost any slide projector will be suitable for use with the Synchronizer, as long as it is equipped for electrical remote push-button cycling. Tape recorder must be a 2- or 4-track stereo model.





Block diagram showing connections between Synchronizer, stereo tape recorder, and slide projector. Jacks J1 and J2 are actually directly above one another on unit; there must be no plug in J1 while recording.

I1—NE-51 neon glow lamp
R3—10,000-ohm potentiometer, linear taper
R4—56,000-ohm, ½-watt resistor
S1—D.p.s.t., normally open, momentary-contact push-button switch
S2—D.p.s.t. toggle or slide switch
S3—D.p.d.t. toggle or slide switch
T1—Transistor output transformer; primary, 500 ohms CT; secondary, 4/8/16 ohms (Stancor TA-42 or equivalent)
1—3" x 7" x 5" aluminum chassis (Bud AC-429 or equivalent)
Misc.—Sockets for Q1 and Q2, holder for B1, terminal strips, knobs, line cord and plug, wire, solder, grommets, etc.

When you have shown all the slides and completed the narration, rewind the tape and reload the projector with the same magazine. With the Synchronizer and the tape recorder both set in the *play* position, the tape you have just made will control the changing of slides automatically.

As you play the tape, the voice commentary will be heard at the output of tape channel 1; the audio tones from channel 2 (which are fed into the Synchronizer at *J1*) will operate the slide projector. Since channel 2 is disconnected from the speaker system, there is no way for the tones to be heard by the audience.

HOW IT WORKS

The Tape/Slide Synchronizer is built around a two-stage common-emitter audio amplifier/oscillator. Designed for use in conjunction with a stereophonic tape recorder, the unit has both a record and a play function. In the record mode, the instrument produces a series of "beeps" which are recorded on one tape channel. And in the play mode, it uses these recorded "beeps" to control a relay which in turn governs the cycling of a slide projector. The other tape channel contains a recorded commentary on the slides.

To examine the circuit generally, resistor *R1* furnishes base bias for transistor *Q1* when the Synchronizer is in the *record* mode; *sensitivity* control *R3*, in turn, controls the gain in both the *record* and *play* functions, and, with resistor *R2*, furnishes base bias for transistor *Q2*. The collector load for *Q2* is transformer *T1* when switch *S3* is in the *record* position, and relay *K1* when switch *S3* is in the *play* position. Capacitor *C1* is the feedback capacitor which converts the amplifier into an oscillator.

In the *record* function, the transistor circuitry is used as an audio oscillator. Whenever *cycle* switch *S1* is depressed, the upper section of the switch puts a short across the projector's remote control terminals (connected to jack *J3*), which causes the projector to advance one cycle. The lower section of the *cycle* switch connects capacitor *C1* into the circuit, which causes the circuit to go into oscillation. The audio tone generated is coupled through *T1* to the tape recorder's channel 2 input, connected to jack *J2*.

With *S3* in the *play* position, the circuit is an audio amplifier, with the input from tape channel 2 fed into *J1* and the output operating relays *K1* and *K2*. The audio signals recorded on tape channel 2 are fed into *J1* and amplified by *Q1* and *Q2*. With no signal input, relay *K1* is energized due to the heavy current flow through *Q2*, so *K2* is de-energized. Any "beep" signal from the recorder, however, will effectively decrease *Q2*'s base bias, decreasing the current through *Q2*, and de-energizing *K1*. As a result, *K2*'s contacts will close, placing a short circuit across jack *J3*, and causing the projector to advance one cycle.

Lamp *I1*, incidentally, is a visual indicator and will light whenever a "pulse" is applied to tape (or jack *J1*).

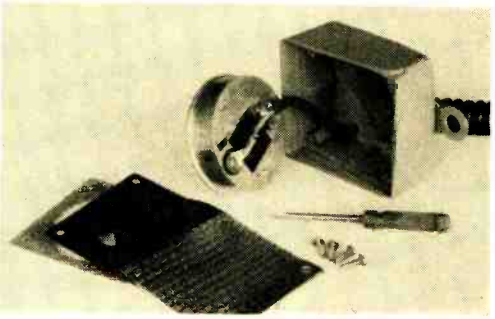
Note that the contacts of switch *S1* rather than relay *K2* cycle the projector in the *record* position. Therefore, there is no "clank" of an energizing relay to be picked up by the microphone when you're making a recording. —30—

COIL-CORD YOUR MIKES

Inexpensive cables will dress up any microphone

By FRED BLECHMAN, K6UGT

Here's a Lafayette Type PA-42 crystal mike with an Amphenol 75-PC1M mike connector installed at the rear of its case. Mating 75-MC1F connector is at one end of coiled cord.



Astatic's Model 151 ceramic mike can be disassembled and a new cord soldered directly to the cartridge.

The Turner Model 908 hand mike can't be disassembled, but you can still add a coiled cord. Splice the two cords together, taking care to shield the splice, or install in-line connectors.

COILED CORDS are almost the rule on microphones for mobile equipment, and their neatness, compactness, and convenience make them just as desirable for fixed station equipment. Unfortunately, mikes with coiled cords can be costly. However, shielded-conductor coiled cords are available for almost any microphone, whether its owner is a ham, a CB'er, or a tape recordist.

Such cords, mounted on fancy display cards, can be purchased "over the counter" if you're willing to pay the price. But a number of distributors (including mail-order houses) now stock long-life, neoprene-covered coiled cords made by Belden (a leading American wire and cable manufacturer) for as little as 73 cents each! On push-to-talk microphones, an extra conductor is needed, so Belden Type 8497 should be used. On regular ceramic, crystal, and other high-impedance mikes requiring a shielded cable, Belden Type 8499 will do the trick.

It's best to attach the coiled cord to the microphone at the cartridge, assuming that the mike can be disassembled. Some older microphones—such as the Turner crystal hand mike pictured on this page—cannot. In this case, you can still attach the coiled cord by splicing it to the original mike cord at a point near the microphone case. The shield on the cord should always be connected to the outside of the mike connector.

In some installations, it might be desirable to put an Amphenol 75-PC1M male connector on the case of the microphone and an Amphenol 75-MC1F female connector on the end of the coiled cord. This will allow you to use one coiled cord with several microphones. -30-

THE SIGNAL MONITOR

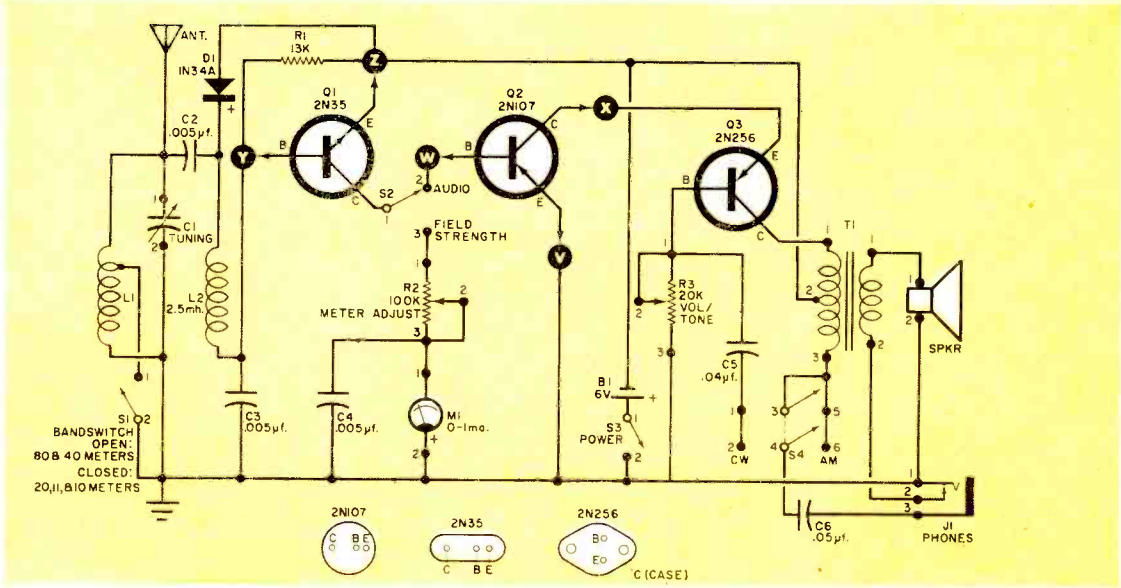
By **THOMAS M. BROWNING**

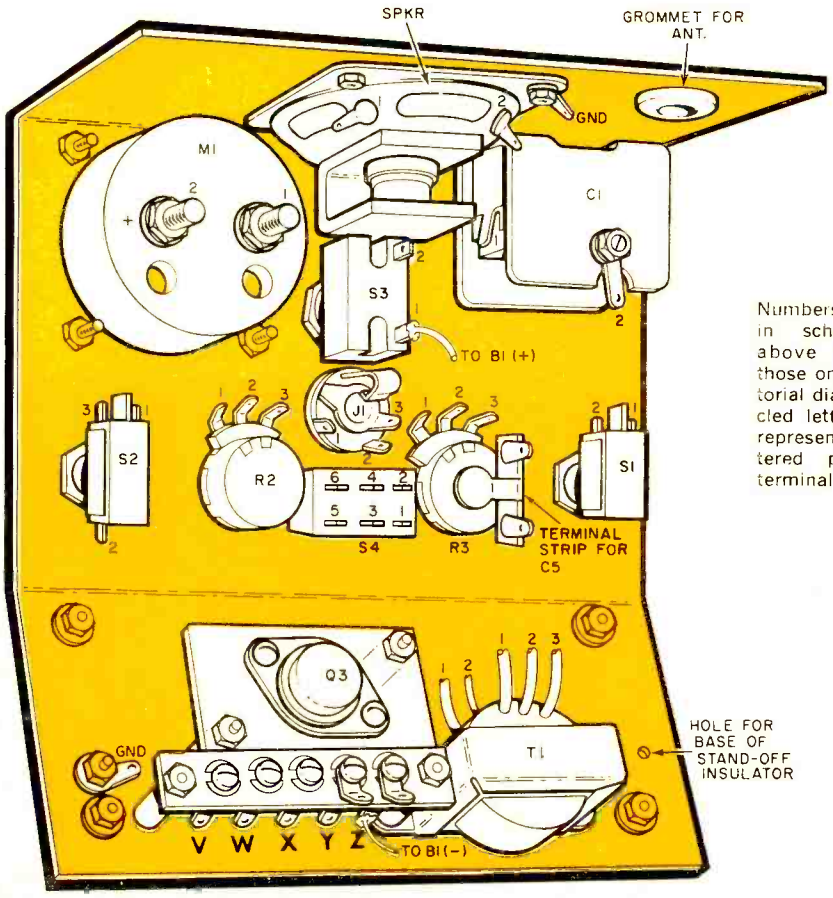
This combined field-strength meter and AM/CW monitor is self-powered, covers frequencies from 80 to 10 meters

ONCE you've put together this handy field-strength and audio monitor, you'll never have to guess about the tuning of your transmitter or wonder how good your signal sounds "on the air." Actually a simple, self-powered receiver, the instrument needs no connection to your rig. Just place it in, or near your shack, extend the short whip antenna, and you're ready to go.

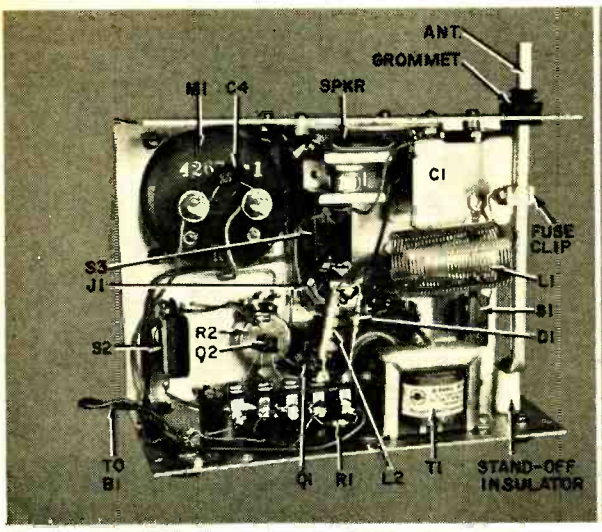
The Signal Monitor covers the frequencies from 80 to 10 meters (including the Citizens Band). When operating as a field-strength meter, it provides a visual indication of the transmitter's r.f. output. When it's set for audio monitoring, you can check the quality of your AM or CW signal using either the built-in speaker or a pair of headphones.

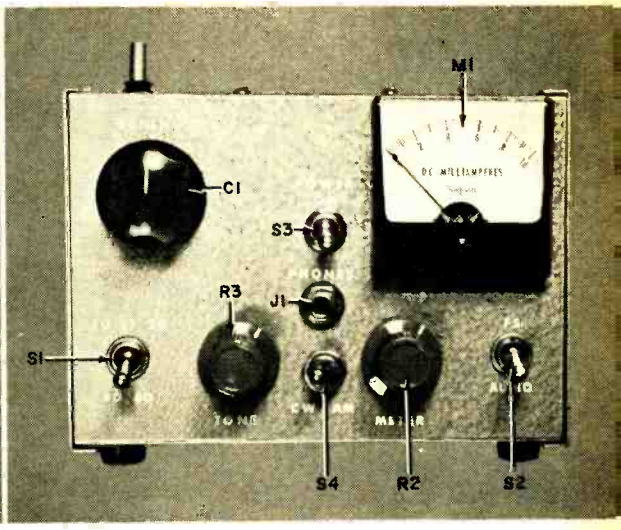
Construction. All of the components, except for the battery holder, are mounted on the main section of a 7″ x 5″ x 3″ aluminum utility box;





Numbers on connections in schematic diagram above correspond to those on terminals in pictorial diagram at left. Circled letters in schematic represent similarly lettered points on 5-lug terminal strip (see text).





Interior of completely wired Signal Monitor is seen at left. Battery B1 is located in the box cover (not shown). At right is view of front panel, showing placement of the various controls.

PARTS LIST

B1—6-volt battery (4 Burgess Type "Z" penlight cells in series, or equivalent)
C1—365-μμf. variable capacitor (Lafayette MS-214 or equivalent)
C2, C3, C4—0.005 μf. } *all ceramic disc capacitors, at least 25 volts*
C5—0.04 μf. } *all ceramic disc capacitors, at least 25 volts*
C6—0.05 μf. } *all ceramic disc capacitors, at least 25 volts*
D1—1N34A diode
J1—Closed-circuit phone jack
L1—28 turns cut from B&W 3015 (1"-diameter, 16 turns-per-inch) Miniductor coil stock, tapped at 5½ turns
M1—0-1 ma. d.c. milliammeter (Simpson Type 1227 or equivalent)
Q1—2N35 transistor (Sylvania)
Q2—2N107 transistor (G.E.)
Q3—2N256 transistor (CBS or Sylvania)
R1—13,000-ohm, ½-watt resistor
R2—100,000-ohm, linear-taper potentiometer (CTS-IRC Q11-128 or equivalent)
R3—20,000-ohm, linear-taper potentiometer (CTS-IRC Q11-119 or equivalent)
S1, S3—S.p.s.t. switch
S2—S.p.d.t. switch
S4—D.p.d.t. switch
SPKR—2½", 3.2-ohm speaker (Quam 25A07 or equivalent)
T1—Output transformer; primary, 14,000 ohms CT; secondary, 4 ohms (Stancor A-3496 or equivalent)
1—7" x 5" x 3" aluminum utility box (Bud CU-2108-A or equivalent)
Misc.—Battery holder, 5-lug screw-type terminal strip, 2-lug terminal strip, knobs, fuse clip for antenna connection, stand-off insulator, rubber feet, rubber grommet, etc.

the holder is installed on the box cover. Though there's little waste space, you should have no trouble duplicating the parts layout shown in the photographs and pictorial diagram.

When mounting the parts, remember that both the case of transistor *Q3* and the frame of jack *J1* must be insulated from ground. Transistor *Q3* is installed on a small square of Lucite (about 1¼" x 2") which is fastened to the box on a pair of ⅜" spacers. The mounting hole for *J1* is drilled slightly oversize and "sandwiched" between a pair of fiber insulating washers.

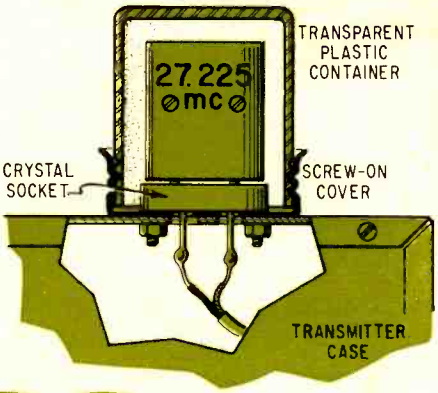
The antenna, which extends about 34" above the top of the box when open, can be cut from an old set of TV "rabbit ears." Pass its base into the box through a grommet-lined hole (see photograph at left, above), and secure it in place with a stand-off insulator. Connections can be made via a 3AG fuse clip snapped onto the bottom portion of the antenna at some convenient spot.

To simplify wiring, the terminals and leads of the components shown on the pictorial diagram are keyed, by matching numbers, to the corresponding connections on the schematic diagram. Since all the major chassis-mounted parts appear on the pictorial, it should be easy to "fill in" the others as you go along. Just

(*Continued on page* 100)

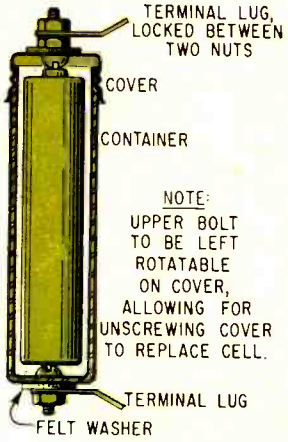
Drawings by Bruce Aldridge

Transmitting crystals can be protected against damage by housing them in spare plastic containers. The plastic won't affect the crystal's frequency, and you can still get at the crystal whenever you wish.



PLASTICS, PLEASE

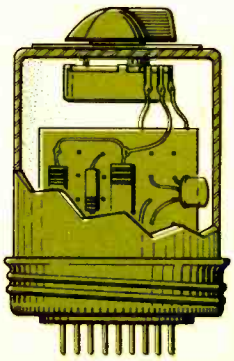
Flashlight cells are a "natural" for plastic containers. You should be able to find a container for practically any size cell, and you can secure the entire assembly to a chassis with a couple of clamps.

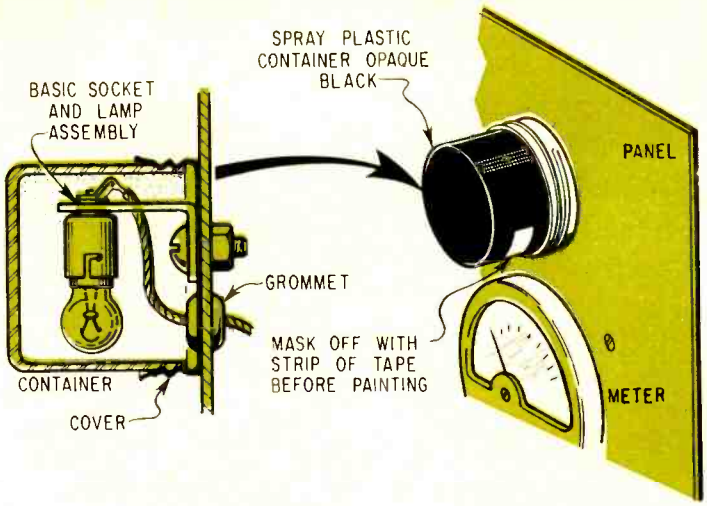


Transparent plastic containers come filled with everything from hairpins to hardware. Here are six ideas for putting those empty containers to work.

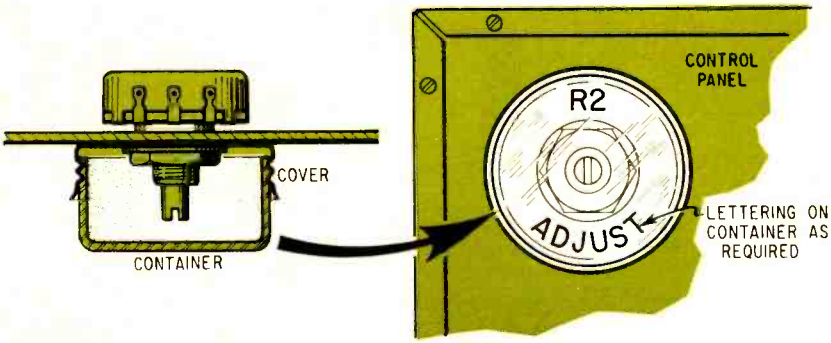
By MARTIN J. LEFF

"Plug-in" circuits can easily be assembled in plastic containers. Simply mount an octal plug, phone plug, or other connector in the screw-on cover, and wire your circuit on a small printed-circuit board.



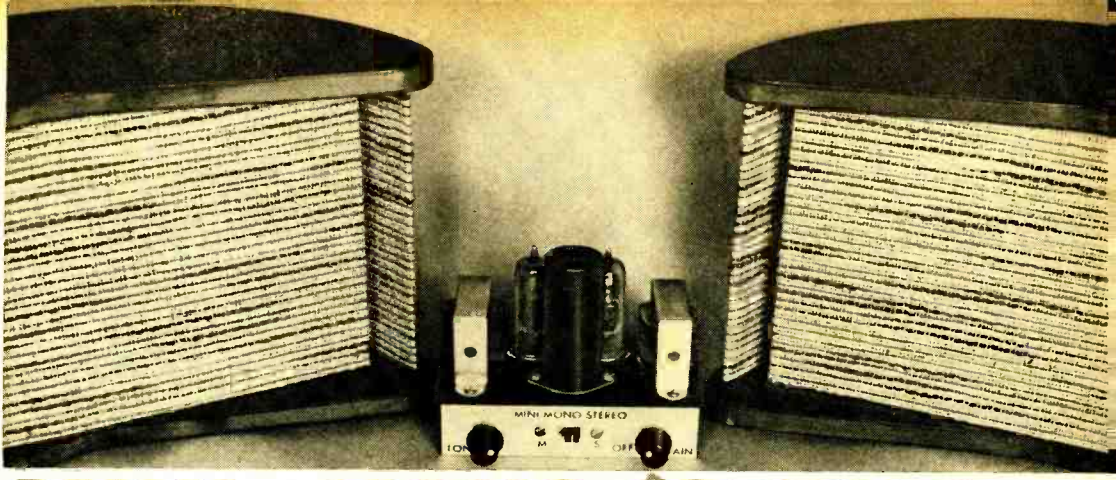


An illuminator for a meter, dial, or what have you, can be made up from an old plastic container, a miniature lamp, and a lamp mounting assembly. You'll want to spray the container to hide the components inside, of course, and putting a small strip of masking tape on the container before you spray it will leave a suitable "escape hatch" for the dial light to shine through.



Potentiometers and variable capacitors which require critical adjustment can be kept "spot on" the desired setting by mounting them under a plastic container as shown. You still have instant access to the controls by simply unscrewing the container, and you can even letter the plastic to indicate various settings, direction of rotation for "increase" or "decrease," and so on.

Attractive "billboard"-type "signs" can also be made out of plastic containers, much along the lines of the illuminator and control housings discussed above. If you shop around in your neighborhood art-supply and electronics parts stores, you should be able to pick up a variety of opaque, adhesive-backed letters and numbers which are just what you'll need for this project.



MINI-MONO/STEREO

Two dual-purpose tubes and an a.c./d.c. circuit explain this amplifier's miniscule proportions

By LEON A. WORTMAN, W2LJU

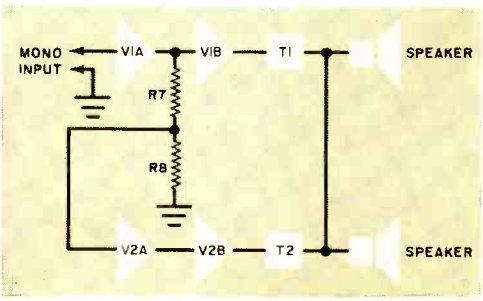
SAY SOMETHING about "compactness," and most people think of transistorized equipment. But here's a tiny *vacuum-tube* stereo amplifier that all but puts transistors to shame. It not only offers stereophonic or monophonic operation at the flip of a switch, but (believe it or not!) it packs voltage amplifiers, power amplifiers, tone and volume controls—everything, in fact—on a single 1¼" x 5½" x 3" chassis!

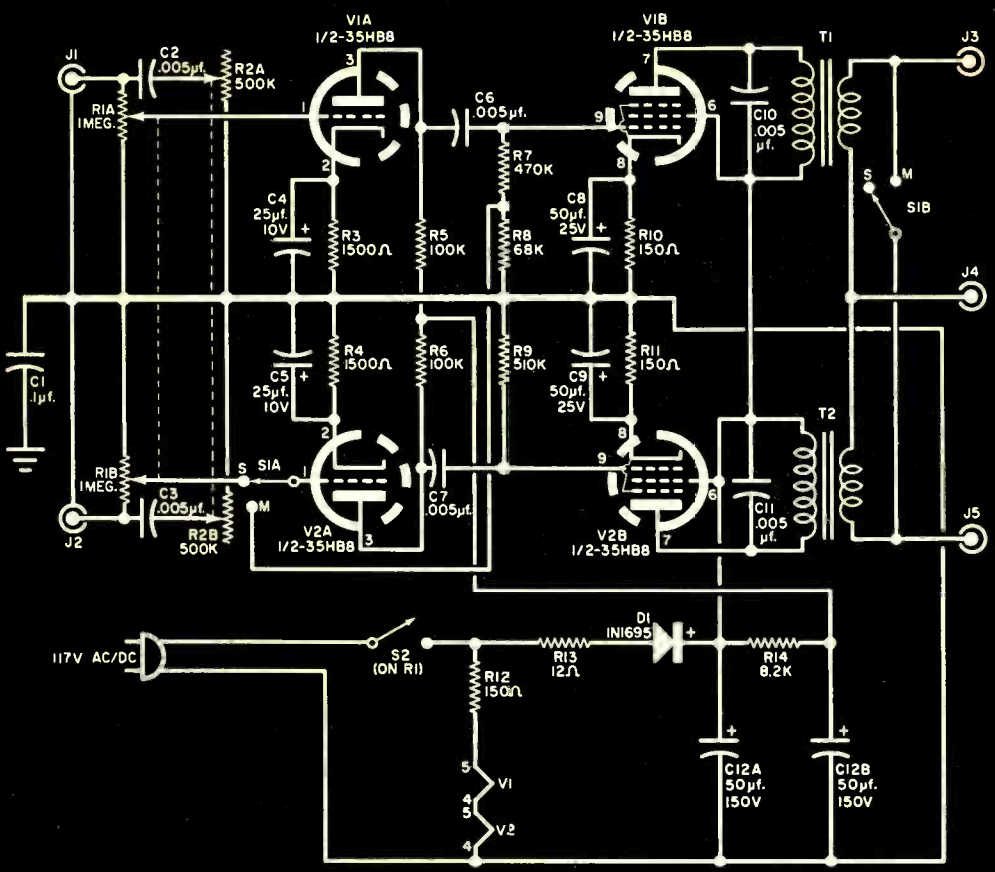
Dubbed the "Mini-Mono/Stereo," this miniaturized amplifier is equipped with two separate channels for stereophonic operation. A flip of the stereo/mono switch, and the two "channels" become a single monophonic "channel," complete with push-pull output.

Two In One. As you may have guessed from the appearance of the unit, this novel circuitry is made possible through the use of a dual-purpose tube which actually contains two different assemblies in a single glass envelope. The tube in this case is the 35HB8, which incorporates both a triode voltage amplifier and a pentode power amplifier. A semiconductor contributes to the design, too, since a tiny silicon diode rectifies the a.c. line.

Power output of the Mini-Mono/Stereo is approximately 1 watt per channel in the stereo hookup and about 1.75 watt in the monophonic mode—more than adequate for most low-level listening. Frequency response is reasonably flat from 50 to 10,000 cycles. All told, considering cost, simplicity, ease of construction, and fidelity, this little amplifier promises considerable satisfaction for the builder and hours of pleasure for the listener.

Block diagrams of amplifier in monophonic (left) and its circuit. In mono operation, tube V2a serves as a

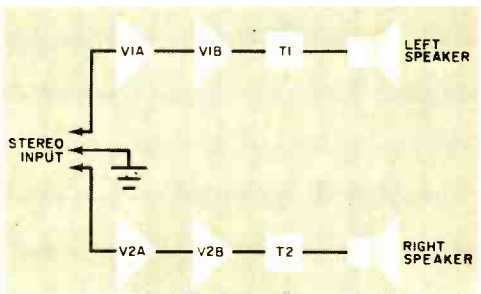




Stereo and Mono. The block diagrams show the separate stages and how they are interconnected in both stereo and mono. And reference to the circuit diagram should quickly reveal how the changeover is made from one mode to the other.

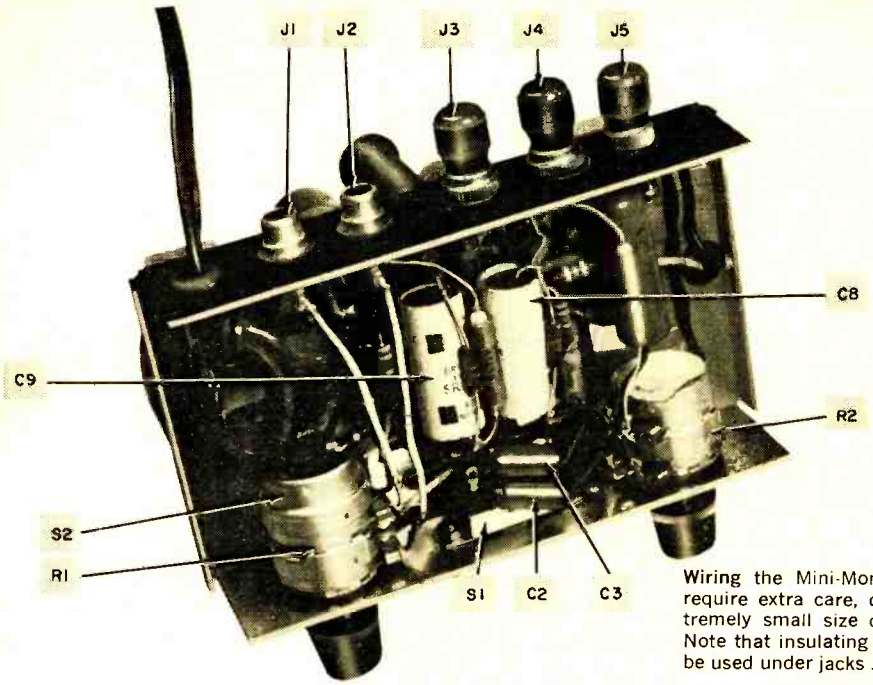
When switch *S1* is in the stereo or "S" position, tubes *V1* and *V2* operate as

stereophonic mode (right) should help you understand phase inverter, driving tubes V1b and V2b in push-pull.



PARTS LIST

C1—0.1-μf., 400-volt paper capacitor
C2, C3, C6, C7 C10, C11—0.005-μf., 400-volt paper capacitor
C4, C5—25-μf., 10-w.v.d.c. electrolytic capacitor
C8, C9—50-μf., 25-w.v.d.c. electrolytic capacitor
C12a/C12b—Dual 50-μf., 150-w.v.d.c. electrolytic capacitor
D1—1N1695 diode
J1, J2—RCA phono jack
J3, J4, J5—Insulated binding post
R1a/R1b—Dual 1-megohm potentiometer, audio taper (with s.p.s.t. switch S2)
R2a/R2b—Dual 500,000-ohm potentiometer, audio taper
R3, R4—1500 ohms
R5, R6—100,000 ohms
R7—470,000 ohms
R8—68,000 ohms
R9—510,000 ohms
R10, R11—150 ohms
All resistors ½ watt unless otherwise noted
R12—150 ohms, 25 watts, wire-wound
R13—12 ohms, 1 watt
R14—8200 ohms, 1 watt
S1a/S1b—D.p.d.t. slide switch
S2—S.p.s.t. switch (on R1)
T1, T2—Output transformer: primary, 4000 ohms; secondary, 3.5 ohms (Stancor A3328 or equivalent)
V1, V2—35HB8 tube
1—1¼"x5½"x3" "interlocking" chassis (LMB Type 139 or equivalent)
Misc.—Tube sockets, knobs, hardware, line cord and plug, wire, busbar, solder, etc.



Wiring the Mini-Mono/Stereo will require extra care, due to the extremely small size of its chassis. Note that insulating washers must be used under jacks J1 through J5.

separate amplifiers, each with its own input and output jacks. But throwing *S1* to the mono or "M" position connects the grid of *V2a* to the junction of resistors *R7* and *R8*. Since this pair of resistors functions as a voltage divider, a portion of the audio signal coming from the plate circuit of *V1a* is fed to the grid of *V2a*.

This "sample" is then amplified by *V2a*. Due to the ratio between *R7* and *R8*, the audio voltages appearing at the grids of power amplifiers *V1b* and *V2b* are still approximately equal in amplitude. But because of the phase reversal within *V2a*, they are now 180° out of phase with one another—a condition which is essential for push-pull operation of *V1b* and *V2b*.

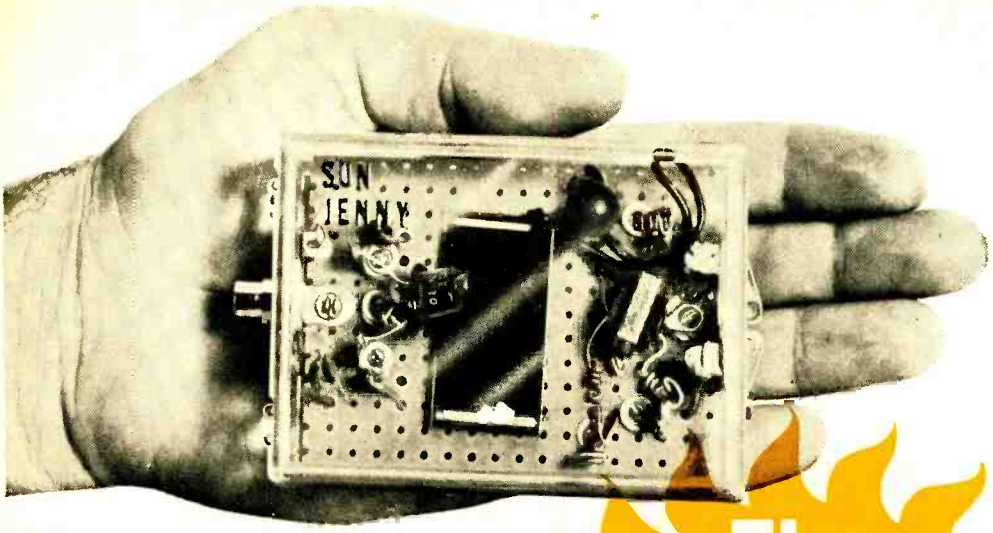
The "M" position of *S1* also connects the voice-coil windings of transformers *T1* and *T2* in parallel. Thus, we have *V1a* and *V2a* operating as a voltage amplifier/phase inverter, driving *V1b* and *V2b* functioning as a push-pull power amplifier.

Incidentally, you'll notice that the volume controls for the two separate channels are actuated simultaneously through the use of ganged potentiometers. The same is true of the tone controls; however, the volume and tone controls for *V2a* are automatically disconnected from the circuit when the unit is in the monophonic mode.

Wiring and Phasing. Since this is an a.c./d.c. circuit, it's important not to connect any of the circuit wiring to the chassis proper. Use a common wire or "busbar" for the "ground" connections instead, and connect a 0.1-μf. capacitor (*C1*) from the busbar to the chassis. In addition, be sure to insulate all jacks (*J1* through *J5*) from the chassis with fiber shoulder washers.

Proper phasing of the voice-coil windings of *T1* and *T2* is especially important in the monophonic hookup. Improper phasing may be difficult to detect when the unit is operating as a stereophonic system, but you'll have no difficulty picking up incorrect phasing in the monophonic hookup, since the outputs will tend to cancel each other. To correct this condition, simply reverse the secondary leads of either *T1* or *T2* at the output jacks. (Do *not* reverse the terminations of both transformers—just one!)

Your Mini-Mono/Stereo amplifier is now complete, and you're all set for years of pleasurable listening. Who would have thought a vacuum-tube stereo amplifier with such impressive performance could be so small? —30—



The SUN JENNY

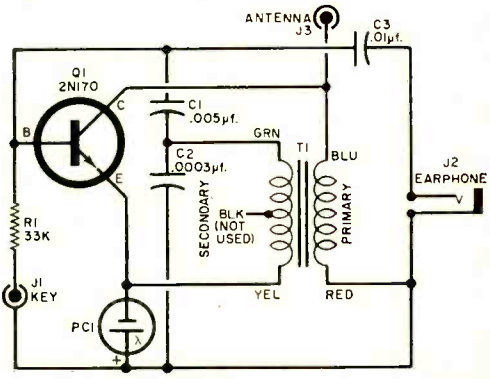
A selenium photocell drives this off-beat code practice oscillator

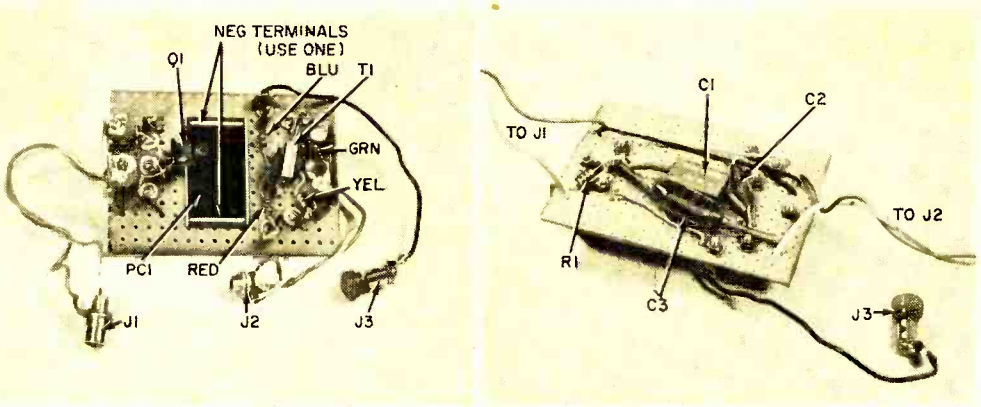
By FRANK A. PARKER

POWERED BY a photocell that will last a lifetime, this unusual code practice oscillator is small enough to put in your pocket. Though we call it the "Sun Jenny," direct sunlight isn't really necessary for its operation. Just place it on your window sill by day, under your desk lamp at night, and you'll be in business. The Sun Jenny has its own earphone, but if you don't feel like using it, you can listen over any BC-band radio! No connections to the receiver are required.

Construction. The components are mounted on a $2\frac{7}{16}$" x $3\frac{3}{8}$" perforated board as shown in the photographs. Transistor *Q1* is supported by its own leads, and transformer *T1* is bolted on through two convenient holes in the board. The three leads from *Q1* and the four from *T1* are fastened to solder lugs mounted on the board. These lugs are used to connect *Q1* and *T1* to the other components in the circuit. A 2-lug termi-

Schematic diagram of "Sun Jenny." Transformer T1 is standard unit, but its secondary (center-tapped) winding is used here as primary.





The three major components (Q1, PC1, and T1) are all mounted on one side of the board (left). Resistor, capacitors, and interconnecting wiring are on opposite side (right).

PARTS LIST

C1—0.005 μf.
C2—0.0003 μf. } *all ceramic capacitors, voltage not critical*
C3—0.01 μf.
J1—RCA-type phono jack, single-hole mounting
J2—Miniature open-circuit phone jack (Telex JMP02 or equivalent)
J3—Miniature binding post
PC1—Selenium photocell (Lafayette MS-773 or equivalent)
Q1—2N170 transistor (General Electric)
R1—33,000-ohm, ½-watt resistor
T1—Driver transformer; primary, 10,000 ohms; secondary, 2000 ohms CT; secondary center tap not used (Lafayette TR-98)
1—High-impedance crystal earphone (Lafayette MS-111 or equivalent)
1—Miniature phone plug for above (Telex PM-01 or equivalent)
1—2 1/16" x 3 3/8" perforated board (Lafayette MS-304 or equivalent)
1—3 5/8" x 2 5/8" x 1" plastic box (Lafayette MS-159 or equivalent)
Misc.—Solder lugs, terminal strips, screws and nuts, key with phono plug, wire, etc.

nal strip is mounted in the center of each of the short ends of the board. One of the strips is for the leads from key jack *J1*, the other for the leads from phone jack *J2*.

Begin construction by mounting the seven solder lugs and the two terminal strips, making sure you leave enough room for photocell *PC1* and transformer *T1*. Then fasten *T1* to the board. (Don't substitute another transformer for the one specified in the Parts List, incidentally, or the Sun Jenny may not oscillate properly.) Now wire *T1*'s leads to the four lugs provided, but do not solder. Note that the transformer's black lead (the center tap of the 2000-ohm winding) is not used.

Install resistor *R1*, capacitors *C1*, *C2*, and *C3*, and any necessary interconnecting jumpers, on the opposite side of the board. All lead-ends are passed up through perforations for attachment to the appropriate lugs. Leave the solder off the lugs to which the transistor, photocell, antenna binding post, key jack, and phone jack leads will be connected.

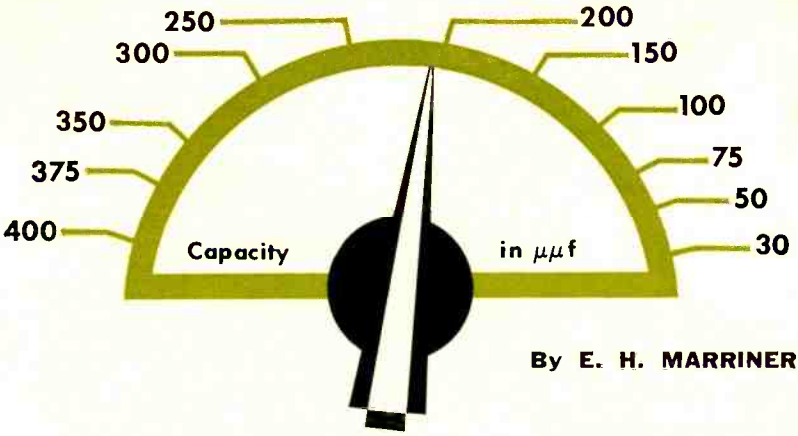
A 6" length of twisted-pair wire is connected to each of the two 2-lug terminal strips. Then jacks *J1* and *J2*, respectively, are wired to the free ends of the appropriate pairs.

Note that one surface of photocell *PC1* is dark blue and shiny; this is the light-sensitive side and also the cell's negative "terminal." The light-sensitive surface is usually provided with two leads, either one of which may be used. The single positive lead, on the other hand, runs out through the back of the photocell.

Mount the photocell, using a drop of household cement on its back, between *Q1* and *T1*. The positive lead can be passed to the other side of the board through one of the perforations and run up to *J1*'s terminal strip through another hole. Wire the negative lead to the emitter lug of transistor *Q1* and, if there's an extra negative lead, cut it off.

Connect a 4" piece of wire to the lug

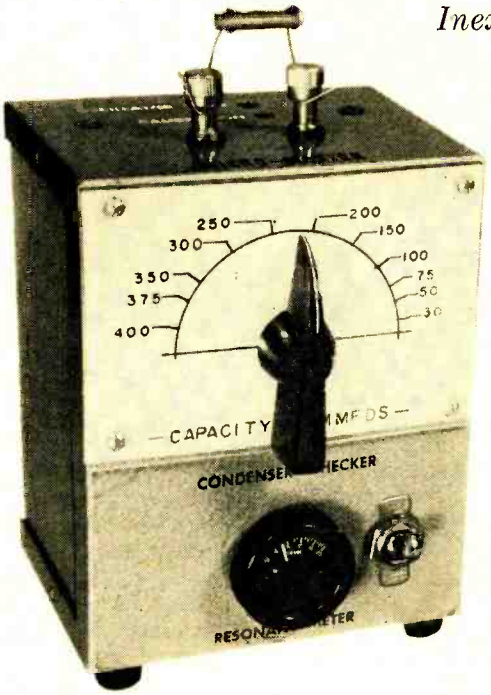
(*Continued on page* 95)



By **E. H. MARRINER,** W6BLZ

The MICRO-MASTER

Inexpensive "capacity meter" will clear up the confusion in your spare-parts box

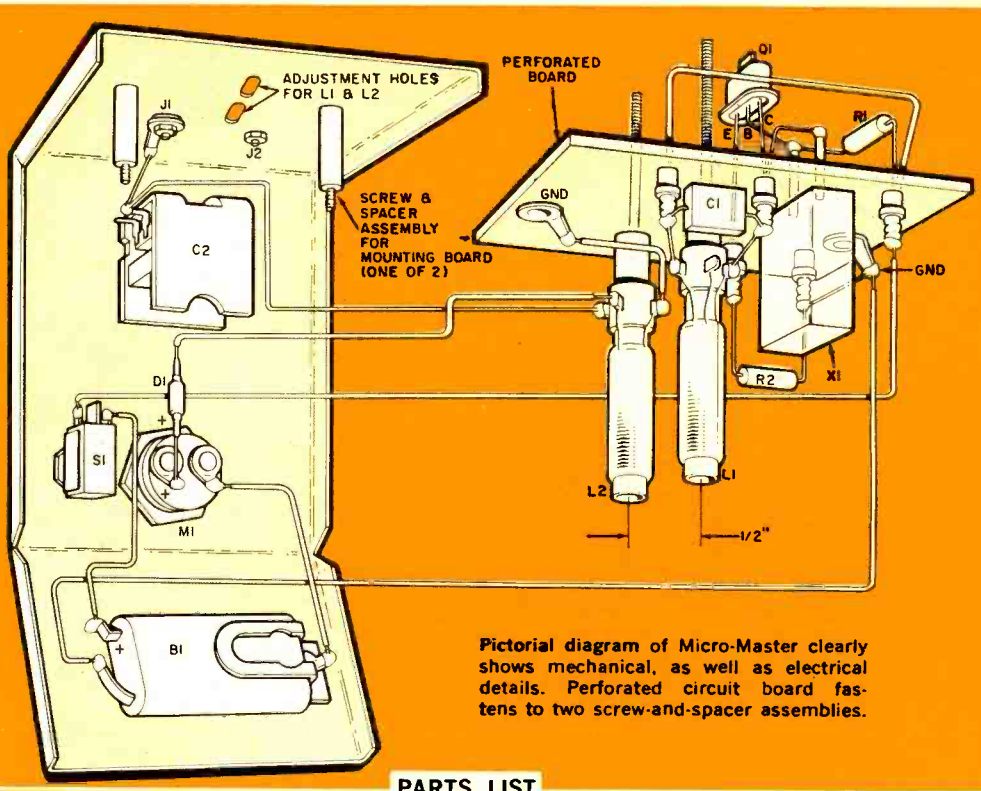


IF YOU'RE LIKE most experimenters, you probably have a large collection of small mica, ceramic, or trimmer capacitors salvaged from government surplus equipment, old receivers, etc. And we'll bet that many of these capacitors have been collecting dust simply because you don't know their values. The identifying markings may be partially obliterated, entirely absent, or they may follow non-standard or obsolete codes.

To clear up this situation, why not put together the Micro-Master? It will measure or test capacitors with values from about 10 to 410 μμf., a range which takes in all of the most popular sizes. With this low-cost unit, you can end the confusion in your spare-parts box for good.

Construction. The Micro-Master is housed in a 5" x 4" x 3" aluminum utility box. Begin construction by drilling mounting holes for binding posts *J1* and *J2*, capacitor *C2*, meter *M1*, switch *S1*, and battery *B1*. Since *J2* is to be grounded, it should be of the uninsulated type. If it's not, the insulating washers should be removed.

The rest of the components are mounted on a 3½" x 1½" section of perforated board. In general, parts locations are not critical, but coils *L1* and *L2* should be placed so that their centers are ½" apart. No socket is used for crystal *X1*; the unit is simply cemented in place, its pins passing through two convenient



Pictorial diagram of Micro-Master clearly shows mechanical, as well as electrical details. Perforated circuit board fastens to two screw-and-spacer assemblies.

PARTS LIST

B1—3-volt battery (Burgess 422 or equivalent)
C1—270-μμf. silvered-mica capacitor
C2—409-μμf. variable capacitor (Allied 61 H 009 or equivalent)
D1—General-purpose diode (1N34A or equivalent)
J1—Binding post, insulated type
J2—Binding post, uninsulated type
L1, L2—Ferrite-core antenna coil (Miller 2007)
M1—0-200μa. meter—see text
Q1—2N170 transistor
R1—150,000-ohm, ½-watt resistor
R2—220-ohm, ½-watt resistor
S1—S.p.s.t. switch
X1—475-kc. crystal—see text
1—5" x 4" x 3" aluminum utility box (Bud CU-2105-A or equivalent)
Misc.—Rubber feet, Lucite to cover dial face, pointer knob, battery holder, spacers, perforated board, calibrating capacitors, etc.

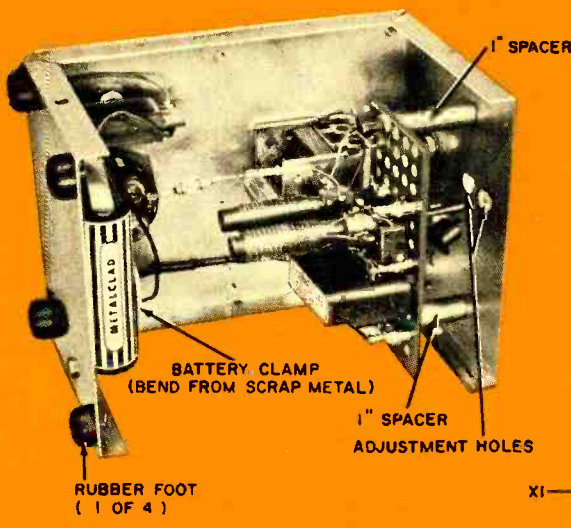
holes in the board. Solder the connections directly to the pins, but be careful to apply no more heat than is absolutely necessary. The same precaution applies when soldering to the leads of transistor *Q1*. Use pliers as heat sinks.

All wiring on the board is point-to point, and leads should be kept as short as possible. The author used special push-in solder terminals to make connections between groups of wires on opposite sides of the board. If you have a hard time locating such terminals, screws and nuts fastened through the board perforations will work just as well.

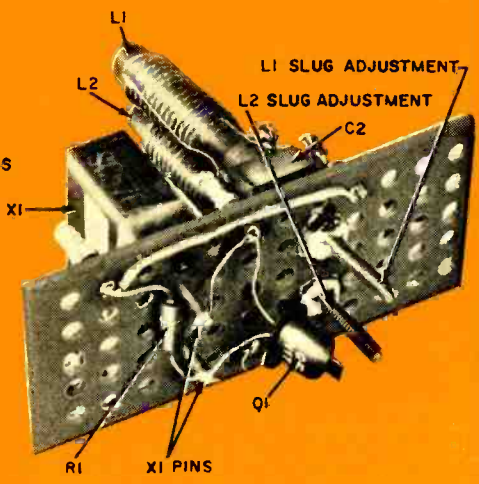
The board will be mounted under the top of the box, just behind binding posts *J1* and *J2*. Machine screws, nuts, and spacers are used to hold it in place, and solder lugs fastened under the mounting nuts serve as grounding points. Two adjustment holes are drilled in the top of the box, directly over the slug screws of coils *L1* and *L2*.

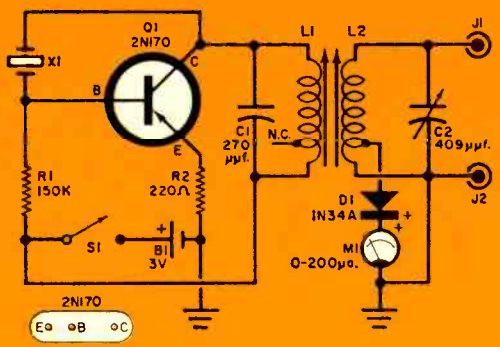
After the mounting holes for the perforated board—and the adjustment holes —have been made, the wired-up board and all of the other components can be fastened in place and interconnected as shown in the pictorial diagram. Fasten a solder lug under the mounting screw for *B1*'s holder; this will be used to ground the negative terminal of *M1*. When wiring in diode *D1*, once again remember to take precautions against overheating.

To keep costs down, the author used a government-surplus meter and crystal



Completely assembled unit is illustrated at left. Circuit board subassembly can be seen in close-up below.





The simple circuit is basically a 475-kc. oscillator. Coils L1 and L2 are identical, but L1's tap isn't used.

at *M1* and *X1*, respectively. The meter was a subminiature job, but any 0-200 μa. unit will work. As far as the crystal is concerned, just about any type ground for 475 kc. (or thereabouts) will do. Check your favorite surplus outlet for both items.

Once you have the Micro-Master put together, glue a paper scale to the upper half of the front panel and attach a pointer knob to the shaft of *C2*. After calibration (see page 64), you may want to fasten a clear plastic cover over the scale. As a final touch, install four rubber feet on the bottom of the instrument.

About the Circuit. Transistor *Q1*, controlled by crystal *X1*, operates as a 475-kc. oscillator. The oscillator's output is inductively coupled from resonant circuit *L1/C1* to resonant circuit *L2/C2*. A portion of the r.f. energy induced in *L2/C2* is taken from a tap on *L2*, rectified by diode *D1*, and passed through meter *M1*.

When *L2* is tuned (by variable capacitor *C2*) to resonate at 475 kc., meter *M1* will indicate a maximum reading. The setting of *C2* at which resonance is attained will vary according to the unknown capacitor (which is connected, via binding posts *J1* and *J2*, in parallel with *C2*). Since *C2* is provided with a pointer knob and calibrated dial, the value of the unknown capacitor can be determined from the resonance setting.

Adjustment. To tune the oscillator coil and capacitor (*L1* and *C1*) for resonance at the crystal frequency, close *S1* and adjust the slug of *L1* using a screwdriver

inserted through the hole provided in the case. Monitor the oscillator's signal with a receiver which tunes to 475 kc. or an r.f. probe and VTVM, setting *L1* for maximum output. If neither a receiver nor a probe is available, set *C2* so that it's fully meshed and adjust *L1* for a maximum reading on *M1*. The indication on *M1* will be very slight, but usable.

Because of manufacturing variations in the coil used at *L1*, you may have to change the value of capacitor *C1*. If you can't quite reach resonance with *L1*'s slug all the way *out*, reduce *C1* to about 250 $\mu\mu$f.; if you can't quite reach resonance with *L1*'s slug all the way *in*, increase *C1* to about 280 $\mu\mu$f.

Calibration and Use. Calibration is best accomplished with a series of known capacitors. The Centralab TCN series of "temperature compensating" capacitors is ideal for the purpose because they are inexpensive and have very small tolerances. The 25-, 50-, and 100-$\mu\mu$f. sizes are rated at $\pm$ 2%; the 300-$\mu\mu$f. unit is $\pm$ 5%. As can be seen from the calibration chart, one each of the above (plus an extra 100-$\mu\mu$f. unit) will provide 13 reasonably accurate calibration points. You shouldn't have to pay much more than $1.65 for all five capacitors.

Begin the calibration by turning on the unit and connecting the first capacitor listed on the chart (25 $\mu\mu$f.) across the terminals of *J1* and *J2*. Now adjust the slug of *L2* so that a resonant point (maximum indication on *M1*) is reached when capacitor *C2* is set so that its plates are not quite fully meshed. Mark this position of *C2*'s pointer "25 $\mu\mu$f."

CALIBRATION CHART

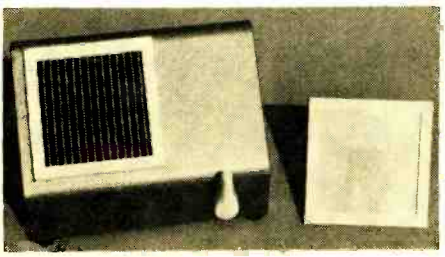
Pointer Setting ($\mu\mu$f.)	Capacitors Used* ($\mu\mu$f.)	Maximum Error ($\mu\mu$f.)
25	25	$\pm$ 0.5
50	50	$\pm$ 1
75	25+ 50	$\pm$ 1.5
100	100	$\pm$ 2
125	100+ 25	$\pm$ 2.5
150	100+ 50	$\pm$ 3
175	100+ 50+25	$\pm$ 3.5
200	100+100	$\pm$ 4
225	100+100+25	$\pm$ 4.5
250	100+100+50	$\pm$ 5
300	300	$\pm$15
350	300+ 50	$\pm$16
400	300+100	$\pm$17

**All values are ±2% with the exception of the 300-μμf. unit, which is ±5%*

Continue down the chart, connecting each capacitor (or group of capacitors) listed, in turn, across *J1* and *J2*. In each case, rotate *C2*'s pointer knob until resonance is indicated by a maximum reading on meter *M1*; then mark the pointer setting with the appropriate value. Where groups of capacitors are called for, all units should be connected in parallel.

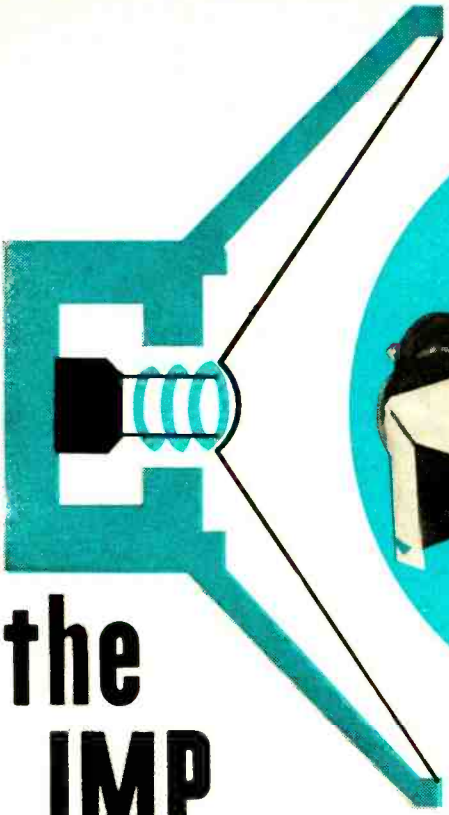
With the dial completely calibrated, the value of an unknown capacitor can be determined by connecting it as above and rotating *C2*'s knob till you find the resonant point. The pointer will then indicate the capacitance. If no resonant point can be found, the size of the capacitor lies outside the range of the Micro-Master. -30-

PICTURE FRAME MOUNTS GRILLE CLOTH

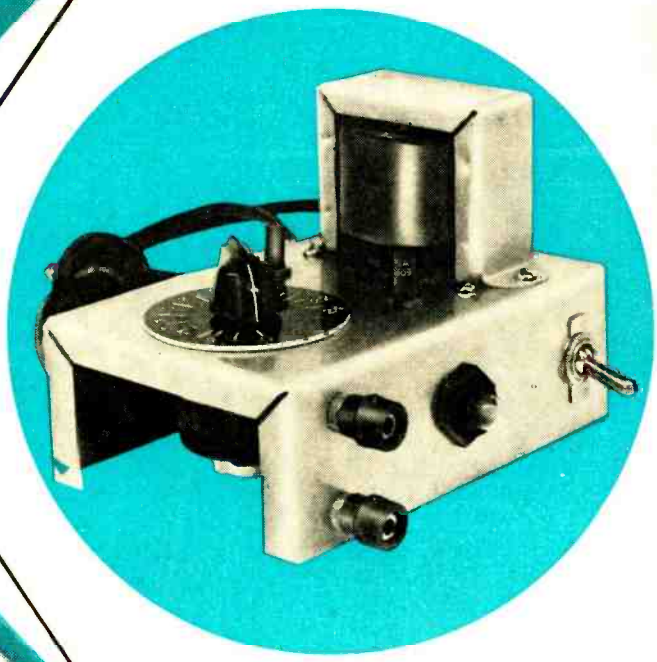


The plastic snapshot frames commonly available in photo shops and 5-and-10's are excellent for mounting grille cloth over panel openings for small speakers. Simply remove the glass and back from the frame and substitute a piece of perforated cardboard to which you have glued the cloth. The finished assembly may now be cemented to the panel or fastened on with screws and nuts. Shown in the photo are an unmodified frame (at the right) and a completed grille cloth assembly as used on the "3-Way Intercom" which was described in the May 1961 issue of POPULAR ELECTRONICS.

—*Jim Goss*



the IMP SLEUTH



Simple bridge circuit measures impedances of speakers and output transformers

By ANTHONY TROIANO*

MATCHING IMPEDANCES, as every hi-fi fan knows, is mighty important. But what can you do about those spare speakers around the house that carry no indication of what their impedances might be?

While you *could* simply measure the d.c. resistance of the speaker voice coils and assume that their impedances were roughly equal to these values, this would hardly solve the problem. A voice coil's impedance is *not* the same as its d.c. resistance and can actually be as much as ten times as large.

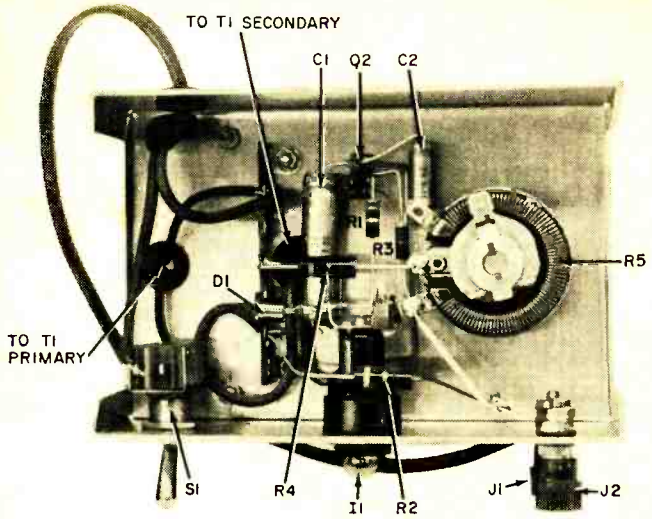
Speaker impedances, as you may already be aware, are usually measured at around 800 cycles with an a.c. bridge. But such equipment is costly and ordinarily found only in laboratories. The "Imp Sleuth" described here is intended as a simple and inexpensive substitute.

Easily constructed from readily available parts, the "Imp Sleuth" utilizes the 60-cycle frequency of the a.c. line. While not the equal of its more elaborate counterparts, it can be used to obtain a fairly close approximation of speaker and even transformer impedances in the range from 0 to 25 ohms.

Construction and Calibration. Building the "Imp Sleuth" should be a snap, if you follow the schematic diagram closely and use the photos as a guide.

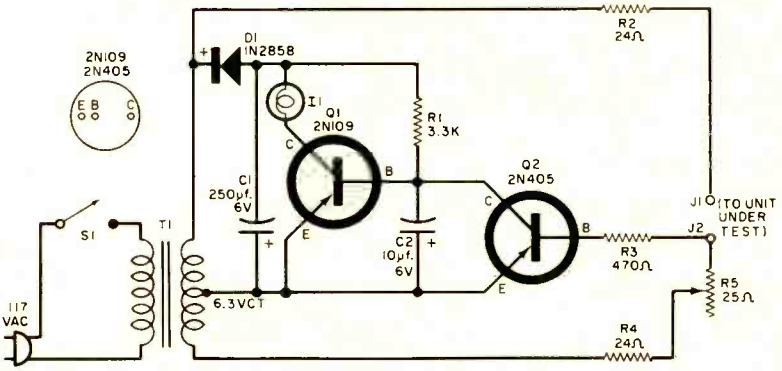
Although a Stancor Type P6465 or equivalent is specified for transformer *T1* in the Parts List, this component can

*Semiconductor and Materials Division, Radio Corporation of America, Somerville, N.J.



Bottom view of the "Imp Sleuth," showing location of most major components. Transistor Q1 is directly beneath indicator lamp I1 and therefore is not visible.

Schematic diagram of this inexpensive impedance-measuring device. Polarities of capacitors and diode must be observed; potentiometer R5 can be wire-wound.



PARTS LIST

C1—250-mf., 6-w.v.d.c. electrolytic capacitor
C2—10-mf., 6-w.v.d.c. electrolytic capacitor
D1—1N2858 diode
I1—Type 49 miniature lamp
J1, J2—Insulated binding post
Q1—2N109 transistor (RCA)
Q2—2N405 transistor (RCA)
R1—3300-ohm, ½-watt resistor, 10% tolerance
R2, R4—24-ohm, 1-watt resistor, 5% tolerance
R3—470-ohm, ½-watt resistor, 10% tolerance
R5—25-ohm, 2-watt potentiometer, linear taper
S1—S.p.s.t. toggle switch
T1—Filament transformer: primary, 117 volts a.c.; secondary, 6.3 volts CT @ 0.5 amp. or more (Stancor P6465 or equivalent—see text)
1—2"x4½"x3¼" aluminum chassis (Bud CB-1625 or equivalent)
Misc.—Mounting assembly for I1, switchplate for S1, pointer knob and dial for R5, sockets for Q1 and Q2, grommets, line cord and plug, wire, hardware, solder, etc.

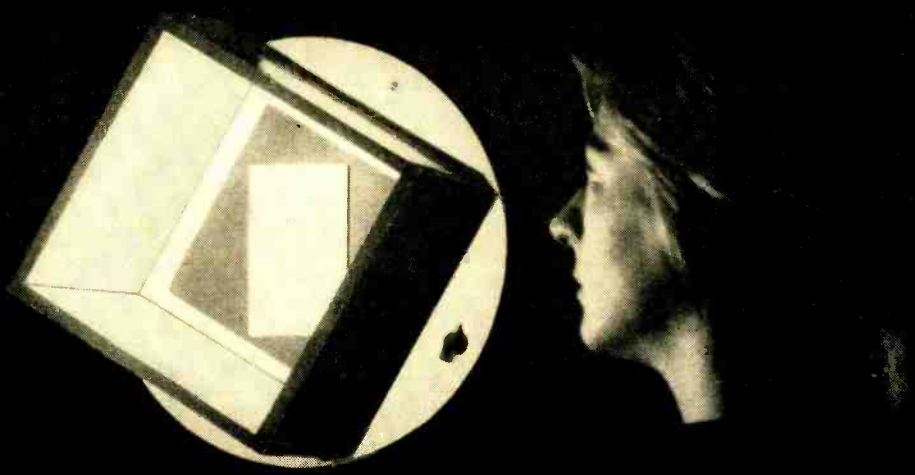
have almost any current rating as long as it is center-tapped. When wiring, be sure that you connect the positive leads of electrolytic capacitors *C1* and *C2* to this center tap, and make certain that you hook up diode *D1* exactly as shown.

To calibrate the unit, simply place an ohmmeter across jacks *J1* and *J2*. Rotate the pointer knob on *R5* from minimum to maximum setting, and mark the various resistances indicated on the ohmmeter directly on the dial plate.

If an ohmmeter isn't available, you can calibrate the "Imp Sleuth" by an alternate method. Connect resistors of known value (in the range of 0 to 25 ohms) across jacks *J1* and *J2*, then rotate the knob on *R5* and mark the position at which indicator lamp *I1* shows maximum brightness. Only three or four points need be marked; other values can be determined by extrapolation.

Applications. To measure the impedance of a speaker, connect its voice coil to jacks *J1* and *J2*, and rotate the knob on *R5* until indicator lamp *I1* reaches maximum brightness. The impedance can

(*Continued on page* 96)



HANG AN ELECTRONIC PICTURE

Electronics and psychology team up to discover which of your friends really think for themselves

By JAMES G. BUSSE

HAVE you ever straightened a picture hanging on a wall? Although you probably didn't realize it, chances are you used the vertical walls of the room as a guide. But what would you do if the walls of the room were crooked, too?

A psychologist by the name of Witkin has been studying this question for some time now. Recently, he discovered that there is a definite relationship between a person's personality and his reaction to such a situation. People who tend to be "conformists" or "yes men," it seems, will always tilt the picture somewhat toward the tilt of the walls. Individualists, on the other hand, can usually hang the picture straight up and down with a minimum of error, no matter how crooked the walls may be.

The "Perceptometer" is a home-brew electronic version of the original apparatus used by Dr. Witkin in his experiments. You can build one in a couple of

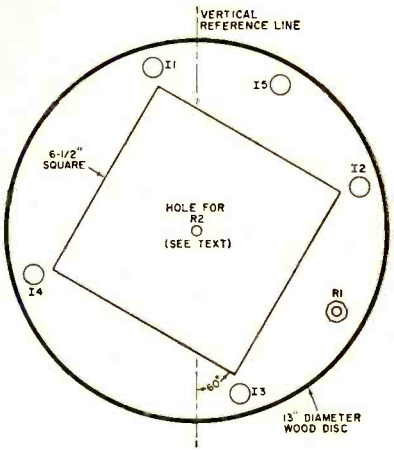


Fig. 1. Begin construction by cutting out a 13" wooden disc. A 6½" square is then traced on the completed disc, and holes are made for R1, R2, and the lamps. Hole for R1 must be counterbored.

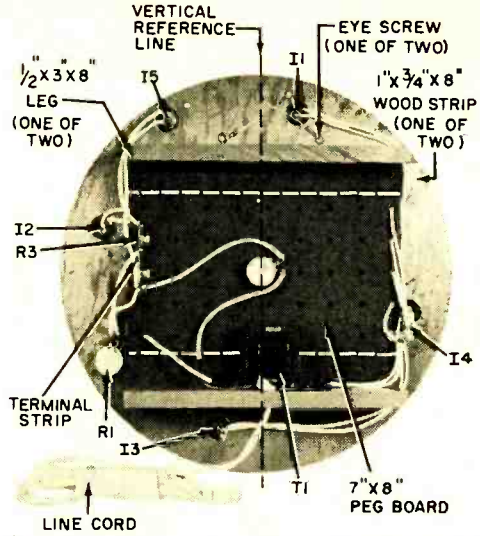


Fig. 2. Mount the pegboard assembly on the back of the disc as shown. The wiring is done later.

evenings for a cost of less than five dollars, and you'll have loads of fun finding out which of your friends and relatives can really think for themselves. The amusing little device is guaranteed to liven up the dullest party or, if you take it to work, you can quickly spot the "yes men" in your shop or office.

Construction. To begin with, cut a large wooden disc 13" in diameter from ¼" to ½" stock (see Fig. 1) and draw a line across it, through the center. This will be the vertical reference line for construction purposes. Next, cut a square, 6½" on a side, out of thin cardboard; draw diagonal lines through the corners to determine its exact center. Now stick a straight pin through the center of the square and fasten it to the center of the disc. The square should be rotated so that one of its sides makes a 60° angle with the vertical reference line, and its outline traced on the disc.

Remove the cardboard and drill a hole through the center of the disc; it should be large enough to pass the shaft of potentiometer *R2* and allow it to turn freely, but no larger. Drill a larger hole, near the edge of the disc, to mount potentiometer *R1*; it will be necessary to counter-bore this hole on the front surface of the disc so that the lock washer and nut will fit on the threaded section of *R1*.

Holes for illuminating lamps *I1*, *I2*, *I3*, and *I4* are made in the disc near the corners of the outline of the 6½" square; these openings should be just large enough to hold the lamps in place. Similarly, drill a hole for neon lamp *I5* near the edge of the disc. All of these holes should be counter-bored from the back of the disc so that there will be adequate clearance for soldering connections to the lamps. With the drilling completed, cement the lamps in place.

On the back side of the disc, nail two 1" x ¾" x 8" strips of wood, parallel to each other, about 4½" apart, and perpendicular to the vertical reference line drawn on the front side. Secure a 7" x 8" pegboard across the two wooden strips using ½" wood screws (see Fig. 2). Beside each of the strips, nail a strip of ½" x 3" x 8" wood; these will serve as legs. Attach two eye-screws to the edge of one of the legs and connect them with picture-hanging wire (for hanging the Perceptometer on a wall).

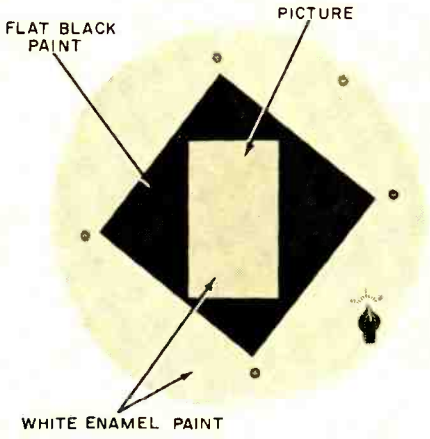
Now carefully paint the outline of the square on the face of the disc with *flat-black* paint. (Refer to Fig. 3.) The rest of the front side of the disc should be painted with *white enamel.* While the paint is drying, you can put together the frame and the picture.

The frame, technically known as the *reference frame*, represents the walls

PARTS LIST

I1, I2, I3, I4—6-18 volt, 0.15-amp. pilot lamp (General Electric Type 47 or equivalent)
I5—NE-51 neon lamp
R1—100,000-ohm potentiometer (linear taper)
R2—600,000-ohm potentiometer (linear taper)
R3—22,000-ohm, ½-watt resistor
T1—Power transformer; primary, 117 volts; secondaries, 125 volts @ 15 ma., 6.3 volts @ .6 amp. (Stancor PS8415 or equivalent)
Misc.—Lumber, hookup wire, solder, etc.

Fig. 3. With the pegboard installed, both disc and picture are painted. The picture is not mounted until the frame and wiring are in place.



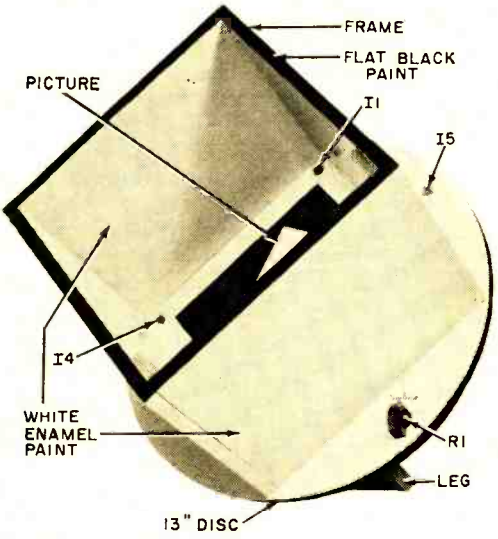
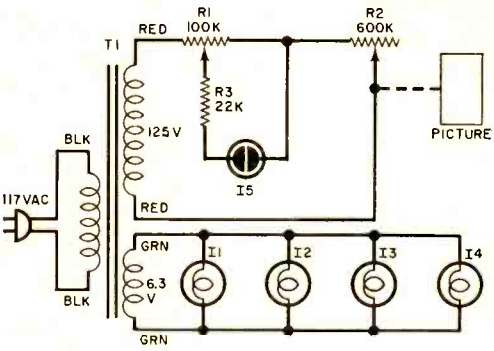


Fig. 4. The frame is installed and painted; then the electrical components are mounted and wired. Finally, the picture is installed.

Fig. 5. Schematic diagram of the Perceptometer. Transformer T1 powers the illuminating lamps and isolates high voltage from the line.



of the room. (See Fig. 4.) From a length of board ½" thick and at least 10" wide, cut four 8½"-long pieces. Nail them together, overlapping end over edge, to make a square frame 9" long on a side and 10" deep. When this frame, painted with white enamel on the inside and outside, is fixed to the face of the disc, a margin of white (which includes *I1*, *I2*, *I3* and *I4*) will run around the black square.

The "picture" to be straightened in the reference frame is simply a 3" x 5" rectangle cut from a piece of ¼" board. It's important to cut this out as accurately as possible. When it's finished, draw diagonal lines through the corners to determine the center. Drill a hole at the center of the rectangle a little bit smaller than the hole going through the center of the disc; the shaft end of *R2* should fit into it snugly. Finally, paint the "picture" completely white using a high-gloss paint.

After the white paint has dried, mount the electrical components on the disc, as shown in Fig. 2. Drill a hole through the pegboard to mount *R2*, and install *R1* in the hole made for it in the wooden disc. Transformer *T1* can be screwed to the side of one of the strips on the back of the disc, but be sure no part of it sticks out past the strip; otherwise, the Perceptometer will not hang flat against the wall. The parts can now be wired in accordance with the schematic diagram (Fig. 5).

When the wiring is completed, attach the "picture" to the end of *R2*'s shaft

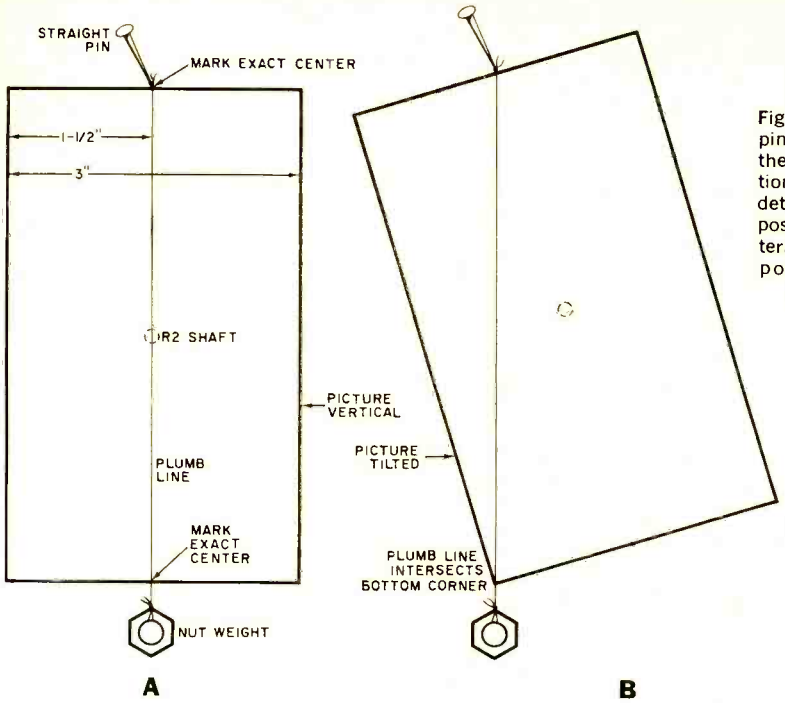


Fig. 6. A plumb line and pin are used to position the picture for calibration. "A" shows how to determine the vertical position, "B" how to determine one of two tilted positions. See text.

and cement it in place. It should be possible to rotate the "picture" at least 45° to either side of the vertical reference line. (See Fig. 3.) Paint over the center of the picture again to cover the cement. Then place the frame around the black square and lamps; you can either nail or screw it in place through the back of the disc. Paint the edges of the frame and the disc flat-black, and your Perceptometer is finished. (See Fig. 4.)

Calibration. The easiest way to calibrate the Perceptometer is to use a plumb line. (See Fig. 6.) This is simply a short length of black thread with a straight pin attached to one end and a small weight, such as a little screw or nut, attached to the other.

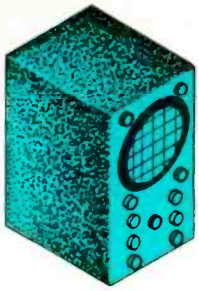
Hang the Perceptometer on the wall at eye level. Using a short ruler, make a tiny pencil mark at the centers of the 3" edges of the picture; try to be as accurate here as you possibly can. Then stick the pin of the plumb line into the upper edge of the picture at the pencil point and let the thread hang down. To make the "picture" vertical, turn it until both of these center marks are lined up on the plumb line.

Now plug the power cord into a power outlet. With the "picture" vertical, turn the knob on *R1* until the neon lamp *just fires*. Mark this point "1" with India ink and a fine pen. Then turn the "picture" until the thread crosses one of its lower corners. Rotate the knob of *R1* again until the neon lamp just fires, and mark this point, "5." Do the same for the other corner of the "picture," marking that point "5" too. Draw three equally-spaced lines, representing the numbers 2, 3 and 4 between the "1" and each "5" point.

Using the Perceptometer. Anyone can learn how to operate the Perceptometer in a matter of minutes. It must, however, be used in a room that can be completely darkened. Simply hang the instrument on the wall at eye-level and plug it into the closest outlet. The cord should be at least 10 feet long; don't let it hang straight down to the floor, but tape it to the wall at odd angles.

Turn *R1* to "1" and rotate the "picture" until the neon lamp just fires. Attach the plumb line to the center of the upper edge of the "picture" and let it hang down. Now rotate the whole instrument one way or the other until the mark in the center of the lower edge of the "picture" is lined up with the plumb

(*Continued on page* 106)



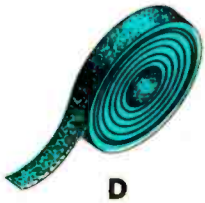
A

B

C

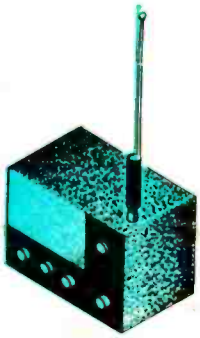
ELECTRONIC UNIT QUIZ

By **ROBERT P. BALIN**



D

Electronic devices have their sensitivity and operating ratings given in units that describe their most important characteristics. See if you can match the 9 electronic units listed below with the sketches (A through I).



E

1 Ohms per volt ____

2 Inches per second ____

3 Micromicrofarads per foot ____

4 Microvolts per meter ____

5 Cycles per second ____

6 Gilberts per centimeter ____

7 Volts per inch ____

8 Revolutions per minute ____

9 Volts per mil ____

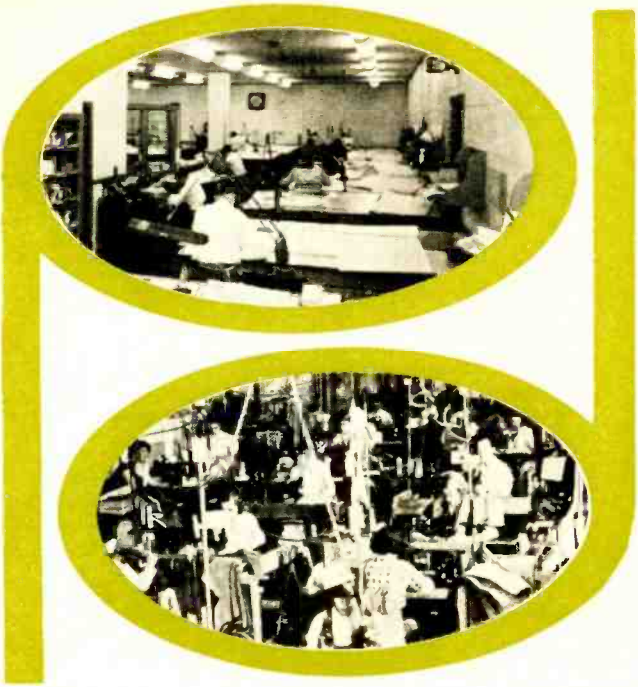
F

(*Answers on page* 103)

I

H

G



MUSIC

How Muzak pipes

By MEL MANDELL

THERE'S nothing new about music while you work—just in the way it's created. Back in the days of wooden ships and no phonographs or tape recorders, sailors heaving round on the anchor windlass sang chanties to give themselves a little added push. Nowadays, people seem to have given up singing while they work. Instead, they tend to rely on someone else to make their music for them.

Like practically everything else these days, "work" music has been scientifically automated. Tapes, discs, and radio broadcasts have replaced on-the-spot performances, and soft background music is the rule in thousands of factories and offices.

Although Mark Twain (of all people!) experimented with piping music into homes and hotels as long ago as 1906, modern recorded "work" music began some 25 years ago when the Muzak Corporation first fed its magic melodies into a factory.

Today, Muzak makes its own master recordings of special arrangements by dozens of leading orchestras. From a library of 8000 "masters," a tape is prepared carrying hours of music interspersed with short silent periods. This master tape is duplicated on other tapes, which are then forwarded to Muzak's more than 230 "distributors" in the United States, as well as Argentina, Australia, Belgium, Brazil, Canada, Colombia, England, Finland, Mexico, Peru, the Philippines, and Puerto Rico.

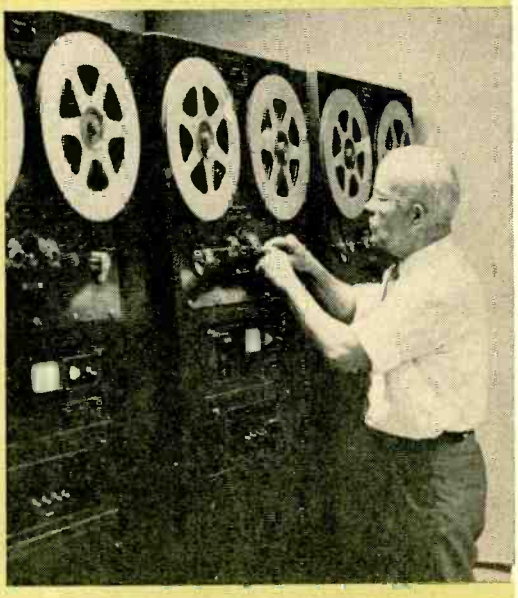
Most of the "distributors" are connected with their subscribers by special telephone lines, but a good number of subscribers receive their music by means of special FM or FM multiplex broadcasts. A distributor plays a tape once in a given locality, then sends it on to the next town. Usually, the Muzak distributors change tapes only once in a full 16- or 24-hour day. The reason: a code signal at the end of one tape automatically starts the next one.

Although costs naturally vary, charges for Muzak music may be as low as $8.00 to $10.00 a week for small plants and offices. In larger installations, such service may cost hundreds of dollars a week. But everyone seems agreed that it's worth pretty much whatever it costs to have pleasant music to work by. -30-

TO WORK BY

harmony into offices and factories around the world

Music librarian removes one of the 8000 exclusive recordings from the Muzak library. Her schedule gives the exact sequences and times at which the various selections will be played.



Discs are then transferred to tape on one of the 32 machines in the Muzak recording studios (left). Tapes are played back (right) on equipment at local franchised distributors.

Transistor Topics

By **LOU GARNER,** Semiconductor Editor

IF YOU'RE one of the regular readers of POPULAR ELECTRONICS, you may recall seeing a story about how stereo techniques are applied in dental anesthesia ("The Noise That Banishes Pain," January, 1961, p. 47). Now, stereo forms the basis for a new type of diagnostic instrument—a dual-channel transistorized electronic stethoscope produced by MED Electronics, Inc. (1200 First St., Alexandria, Va.).

Designated as the Model 100 G/N Stereostethoscope, the instrument is an improved version of an electronic stethoscope originally developed for use in obstetrics. In its present form, it is a general-purpose unit intended for applications not only in obstetrics but also in studies of the heart, lungs, and other organs. This means that it is suitable for clinical studies as well as for general diagnosis.

Since it operates on the "stereo" principle, the Model 100 offers the medical practitioner a distinct advantage over conventional monaural techniques. Its stereo reproduction results in an added sense of depth, making it possible to reinforce desired sounds and to exclude extraneous body noises. The result is a more accurate interpretation of body conditions.

The instrument differs from conventional electronic stethoscopes in several respects. It offers much greater sensitivity; it can be used as a "stereo" (binaural) instrument; it is equipped with pickup transducers of special design; it has much wider overall frequency response; its tone characteristics can be readily switched to any of several preselected modes to provide optimum response for the case being studied; and it is equipped with auxiliary output jacks to permit monitoring with an oscilloscope, tape recorder, or voltmeter at the same time that the headset is used.

A block diagram of the G/N Stereostethoscope appears in Fig. 1. Both channels are identical and consist of a pickup transducer (a special type of contact microphone), a six-stage high-gain audio amplifier, and half of a stereo headset. Internal shielding and isolated power supplies help prevent inter-channel coupling and "cross-talk." Both coarse (the step attenuator) and fine gain controls are provided, as well as a special feedback-type tone-control network.

Although each amplifier channel is made up of six stages, a unique composite circuit design permits the stages to be grouped into two direct-coupled sections of three stages each. Thus, only two coupling capacitors are used in each channel, permitting excellent low-frequency response. The latter is extremely important when you remember that the basic heartbeat rate approaches one cycle per second.

In operation, the signal supplied by the pickup transducer(s) on the patient's body is coupled through the step attenuator to a composite three-stage preamplifier. This is made up of two low-noise silicon transistors (types 2N2049) in a Darlington configuration, direct-coupled to a germanium unit (type 2N104); note that the tone-control feedback circuit forms part of the preamplifier.

The output of the preamplifier is applied through the fine gain control to a composite three-stage output amplifier, and, from this point, through the output selector to the headset. The output amplifier, much like the preamp stage, is

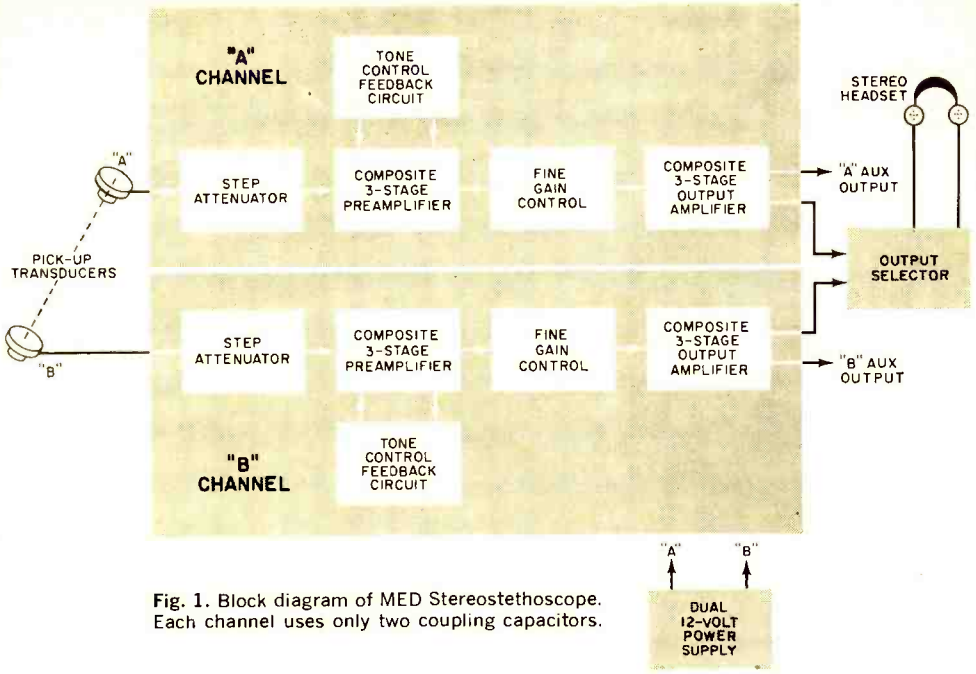


Fig. 1. Block diagram of MED Stereostethoscope. Each channel uses only two coupling capacitors.

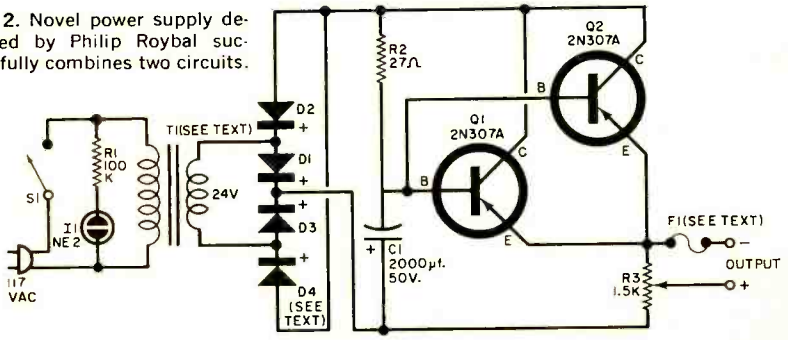
made up of two silicon transistors (type TI-495) direct-coupled to a germanium unit (type 2N109).

Although basically a stereo instrument, the G/N unit can be employed in a variety of operating modes, thus increasing its versatility as a diagnostic tool. Depending on the setting of the controls, either channel can be used alone as a high-gain electronic stethoscope, both will function together for stereo operation, or, for extreme sensitivity, the channels can be cross-coupled.

Reader's Circuit. Quite often, a worthwhile project can be developed by simply combining two or three basic circuits. As an example, the general-purpose, low-voltage power supply circuit shown in Fig. 2 resulted when reader Philip Roybal (4635 Lemona Ave., Sherman Oaks, Calif.) combined a simple power supply with "The Trans-Filter" described by author Forrest H. Frantz, Sr. in the August 1961 issue (p. 63).

Referring to the schematic diagram, an NE-2 neon pilot lamp (*I1*) is used across the line, in series with current-limiting resistor *R1*. Line voltage is stepped down to approximately 24 volts by transformer *T1* and applied to a full-wave bridge rectifier (*D1, D2, D3, D4*). From here, the rectified voltage is applied to the "Trans-Filter" (*R2, C1, Q1, Q2,* and *R3*). Philip has replaced the fixed load resistor with a potentiometer (*R3*) to permit a control over output voltage,

Fig. 2. Novel power supply designed by Philip Roybal successfully combines two circuits.



and an output fuse (*F1*) protects the circuit against overloads.

Although Philip built his model from spare and surplus components, standard parts can be used to assemble a similar supply. Resistors *R1* and *R2* are ½-watt units, capacitor *C1* is a 2000-μf., 50-w.v.d.c. electrolytic, and the transistors are type 2N307A's. Switch *S1* is a s.p.s.t. unit and may be a slide, toggle, push-button, or rotary type. The power transformer, *T1*, can be a Stancor Type RT-201, or a similar unit capable of supplying approximately 24 volts at 1 to 2.0 amperes.

The bridge rectifier (*D1-D4*) can be a single unit, such as an International Rectifier Type J29B1, or you can use four individual elements if you prefer. Output control *R3* should be a 25- to 50-watt unit; Philip used a 1-ampere fuse in his output circuit, but the size you select will depend on other component ratings.

The power supply can be assembled breadboard fashion, in a commercial cabinet, or even in a Minibox, depending on individual preferences; neither layout nor lead dress is critical. Once assembled, the instrument can be used as a bench power source for light electroplating, trickle-charging batteries, or powering experimental transistor circuits.

Oops!!! Humans make mistakes (if they didn't, there would be no need for erasers on pencils!). This is not an alibi, but an explanation, for yours truly made a slight boo-boo!

In January of last year, we predicted that a transistorized SSB ham transmitter would be introduced during 1961. Later, when recapping our "box-score" on predictions in January, 1962, we credited ourselves with a strike-out on this prediction.

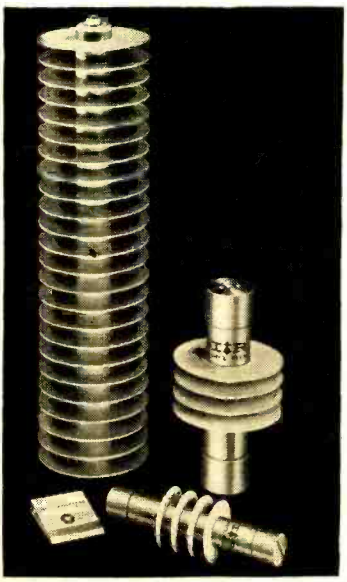
However, reader C. Bradford Sheppard (765 Moredon Rd., Meadowbrook, Pa.) wrote us a note recently, enclosing an ad for a transistorized SSB exciter-transmitter that was offered in 1961. The supplier? Davco Electronics Co., 113 Norwood Ave., Asheville, N.C.

So we goofed! But not in the prediction—only in scoring!

Product News. High-voltage selenium rectifier columns capable of delivering up to 1 million volts are now in production at International Rectifier Corp. (233 Kansas St., El Segundo, Calif.). These new devices feature cartridge- or stud-type construction with unique integral cooling fins; current ratings range from 40 to 400 ma., depending on type.

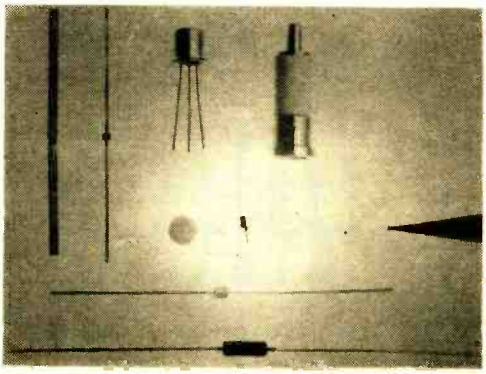
Germanium switching tunnel diodes with a switching time of less than five picoseconds are currently being supplied by General Electric's Semiconductor Products Dept. (Electronics Park, Syracuse, N.Y.). A picosecond, incidentally, is one-trillionth of a second, a thousandth

(*Continued on page* 102)



Three new selenium rectifier columns produced by International Rectifier.

Tunnel diode now available from General Electric boasts less than 5-picosecond switching time. Pencil point (right) indicates size of diode's axial package (highlighted) compared with other TD units.



On the Citizens Band

with **DICK STRIPPEL,** 2W1452, CB Editor

Two late arrivals stand by as ticket agent calls dispatcher on field to hold aircraft.

A NEW USE for Citizens Band radio which should gladden the hearts of both the FCC and late-arriving air travelers has been instituted by American Airlines at New York's LaGuardia Field. American's decision to turn to CB was prompted by an ICC regulation demanding that a flight be held up until all passengers who purchase tickets at the airport are loaded aboard.

It seems as if such a regulation would be simple enough to adhere to, but there is often as much as a five-minute walk from ticket counter to plane, and frequently a plane would be "buttoned up" and all set to take off before a late arrival reached it. To save time that would otherwise be lost in "unbuttoning" planes, and to insure greater "on-time" departures, American has purchased Lafayette CB units, one base station transceiver and several hand-held portables.

Now the ticket agent inside the terminal can keep in touch with the flight dispatcher, who holds the plane until all passengers are on board. Thus, CB has provided a perfect and inexpensive solution to an annoying problem.

License Application Fee. The FCC has proposed charging a filing fee of $10.00 for CB license applications. The Commission did not single out the Citizens Radio Service for this "honor"—hams will pay $5.00, and TV broadcasters up to $250.00, if it goes through.

In fairness to the general taxpayer who bears the burden of supporting the FCC and other Federal agencies, the government has adopted a policy that the recipient of special benefits conveyed by any Federal agency should pay a reasonable fee. The amounts involved here were not picked out of an FCC commissioner's hat but were arrived at after consideration of the costs involved and the value to the license holder.

The FCC is now processing over 40,000 applications for special and safety radio services (including CB and amateur radio), not counting those for broadcasting and common carrier services. With the added cash in the till, the Commission will be able to cope with its financial and work load problems, and at the same time speed up and improve the service on CB and other licenses.

REACT! That's the word formed from the initial letters in the *R*adio *E*mergency *A*ssociated *C*itizens *T*eams, a pro-

(*Continued on page* 94)

DEUTSCHE MARK FOR YOUR THOUGHTS

Tourists in the town of Annweiler, West Germany, need have no worries about the language problem. Night or day, rain or shine, Annweiler's multi-lingual "electronic guide" is on the job. Actually a 4-track, tape-playback machine, the guide can be "hired" for one Deutsche Mark (about 25 cents). Recorded on each of its tracks is a commentary on the points of interest in the town and surrounding area. And each of the four commentaries is in a different language. After having started the machine by dropping in his Deutsche Mark, a tourist can select the German, French, Dutch, or English version by pressing a button. The unit is manufactured by Vistaphone of West Germany and is said to be in use in several other towns, both in Germany and France.

—*Hans F. Kutschbach*

FINGERTIP BULBS LIGHT SPACE

A sparkling new feature of the space suit finery worn by Astronaut John H. Glenn, Jr., during his orbital flight was a set of miniature fingertip lights. The vital experience obtained during the sub-orbital flights of Astronauts Alan B. Shepard and Virgil Grissom indicated a need for such lights to read instruments and charts. Four bulbs, each ½" long and one-third the diameter of those in a conventional flashlight, were added to the glove tips of the index and middle finger of each hand by space suit designers at the B. F. Goodrich plant in Akron, Ohio. Powered by two small batteries attached to the back of each glove, the bulbs produce 5-candlepower light beams directed through fixed-focus lenses in the bulb ends. In photo at left, Astronaut Glenn grins as space technicians check out the fingertip lights prior to the big shoot.

TRANSISTOR SUBSTITUTION BOX

By LEON A. WORTMAN, W2LJU

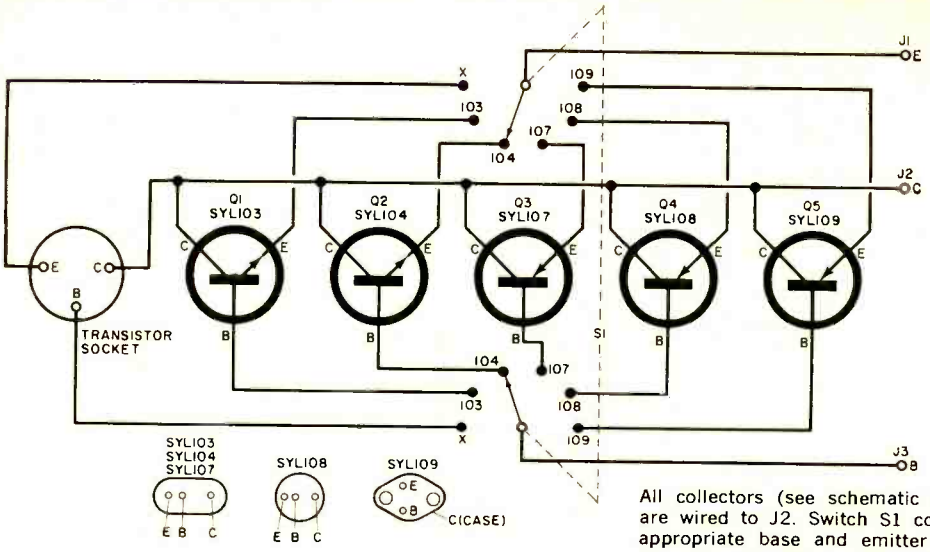
Five "universal" transistors in a simple circuit replace 211 audio types at the flick of a switch

THE NEW "universal" transistors now on the market are a boon both to radio servicemen and experimenters. Sylvania's "Big 9" kit, for example, contains five audio and four r.f. transistors which, together, replace over 300 standard entertainment types. This means that, with a very small inventory of transistors, it's possible to substitute for almost any unit suspected to be defective, and to build many different kinds of experimental circuits.

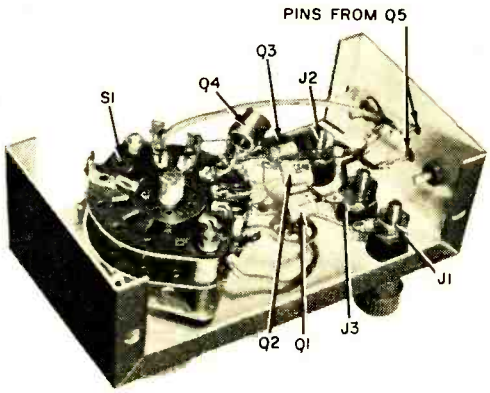
The handy substitution box described here incorporates the five audio transistors (which may be purchased individually) from the Sylvania kit. Not being suitable for an application of this kind, the r.f. units were not used.

The audio transistors were wired to a standard rotary switch so that any one of them might be selected to appear across the "E," "B," and "C" binding posts of the box. An auxiliary transistor socket, also wired to the switch, allows the selection of any transistor plugged into it.

If you use the five Sylvania transistors employed by the author, you'll be able to



All collectors (see schematic above) are wired to J2. Switch S1 connects appropriate base and emitter to J3 and J1, respectively. Photo (below, left) shows details of construction.



PARTS LIST

J1, J2, J3—Combination binding post and banana jack

Q1—SYL103
Q2—SYL104
Q3—SYL107
Q4—SYL108
Q5—SYL109
} *All Sylvania "universal" transistors, or equivalent*

S1—2-pole, 6-position rotary switch, non-shorting type
1—4¼" x 2¼" x 1½" aluminum utility box (Bud CU-2116-A or equivalent)
1—Transistor socket (Elco 3310 with Elco 757 mounting ring, or equivalent)
1—Power transistor mounting kit (Motorola MK-15 or equivalent); optional—see text
Misc.—Knob for S1, wire, solder, etc.

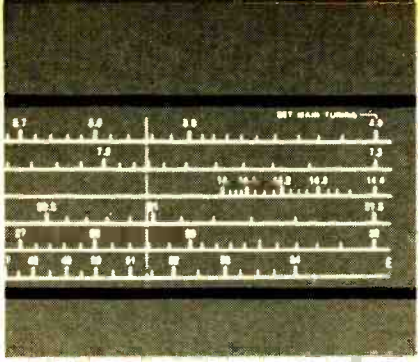
substitute for 33 *npn* types and 178 *pnp*'s. Check with your local parts dealer for a complete list of possible substitutions. He'll also be able to tell you about the universal transistors available from other manufacturers.

Construction. A 4¼" x 2¼" x 1½" aluminum utility box is just the right size to house all of the components comfortably. Binding posts *J1, J2,* and *J3,* the transistor socket, and switch *S1* are mounted on the front panel. Transistors *Q1, Q2, Q3,* and *Q4* are supported, inside the box, by their own leads. Power transistor *Q5* is installed on top of the box, which acts as a heat sink.

When mounting *Q5,* be sure that the holes for its base and emitter pins are large enough to prevent possible shorts. The case of *Q5* is at collector potential and should therefore be insulated from the box. (The author used a mica spacer between the case and the box, and a couple of insulating washers under the mounting nuts; a standard power-transistor mounting kit will also do the job.) Place a solder lug under one of the mounting nuts to serve as the collector terminal.

The wiring is quite simple and needs little comment. Connect the arm of one pole of the switch to the "B" binding post (*J3*); connect the arm of the other to the "E" binding post (*J1*). Now wire the base and emitter leads of the tran-

(*Continued on page* 101)



Across the Ham Bands

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

AMATEUR RADIO AND THE COMMUNITY

ONE OF the primary values of the amateur radio hobby is the service that it can render to the community. Here are just a few "assist" items in the recent record of the ham fraternity. We hope they will encourage you to look for ways in which *you* can serve too.

1961 Edison Award. A ham radio operator who has voluntarily taught Morse code and electronics to more than 2800 people recently received the General Electric Company's 1961 Edison Radio Amateur Award for public service. He is William G. Welsh, W1SAD/6, of Burbank, Calif., and is the tenth winner of this well-known trophy. It was presented to him, together with a $500 cash prize, at a banquet held early this spring in Washington, D. C.

Now employed as an engineering writer by Librascope, Inc., a Glendale, Calif., electronics firm, Bill devoted 20 to 30 spare-time hours every week to teaching radio during the past ten years. He worked out a course which includes eight 1800-foot code practice tapes as well as text material. In addition, he prepared a 70-page instructor's handbook to help others teach radio, and has made copies of his tapes available, free of charge, to study groups in nearly every state in the U. S. and at least a dozen foreign countries.

Bill lived in Cambridge, Mass., before moving to California last winter (he worked for the Raytheon Corporation in Waltham, Mass., in a similar capacity), and he taught radio classes at various locations in the Boston area. The proceeds from one course, the only one for which he was ever paid, were used to buy duplicating equipment and other materials to extend his teaching work.

In his zeal for helping prospective hams "get on the air," Bill obtained a commission as a notary public so that he could speed up the processing of FCC application forms. And, by arrangement with the Boston office of the FCC, he has even held special license examination sessions.

Bill's wife, Marie, holds ham call letters W1COL/6, and often assists her husband with his teaching work. Since their oldest son Richard (12) is also a licensed ham (KN1SAR/6), the Welsh family is well represented in the amateur radio field.

At the same time Bill received his trophy, special citations went to Robert T. Herndon, W5URW, Eugene M. Link, WØIA, and George L. Thurston, W4MLE. Bob provided emergency communications after Hurricane Carla; Gene handled over 9000 reports for the Denver Weather Bureau; and George organized emergency communications in Florida.

Field Day. Over the years, amateur radio has established a wonderful record in providing emergency communications

1961 Edison Award winner William G. Welsh takes a few minutes to give two neighborhood youngsters in San Gabriel, Calif., some electronics pointers.

Novice Station of the Month

Bob Roth, WV2QAE, 11 Chesley Road, White Plains, N.Y., sent in this month's winning photo. Bob operates exclusively on 21,195 kc. and has made more than 500 contacts (39 of them DX) with his Globe Chief De luxe transmitter and National receiver. A 3-element beam antenna does the radiating.

Bob will receive a 1-year free subscription to P.E. for his photo. If you'd like to try for a similar award, send us a picture of your station—preferably with you at the controls, and include some information about yourself, your equipment, and your activities. Maybe you'll be one of the lucky winners. Entries should be sent to Herb S. Brier, c/o POPULAR ELECTRONICS, P.O. Box 678, Gary, Indiana.

during disasters of all types. One of the latest examples is the excellent job done by hams last September during Hurricane Carla, which spread death and destruction over thousands of square miles of Texas. (In the stricken Port Lavaca area, Edison citation winner W5URW and his fellow hams furnished 90% of all the communications for two days.)

Most ham clubs are now deep in preparation for the 24-hour "Field Day," which is scheduled for Saturday, June 23, and Sunday, June 24. Starting on that Saturday afternoon, club members will operate portable, emergency-powered ham stations set up in tents, trailers, and sheds located in such places as parks and farmers' fields. They'll try to establish radio communications with as many other hams as possible.

Girlstown director Mrs. Vivian McCracken (seated, right) poses with the seven Novices. They are: Sandra, WN5ASZ, and (standing, left to right) Donna, WN5APM; Linda, WN5AOG; Ella, WN5AUJ; Bonnie, WN5AUI; Nina, WN5AUQ; Carol, WN5APG.

What does Field Day have to do with emergency communications? Well, Field Day is both an acid test and a dramatic demonstration of the willingness and ability of all hams—not just a few—to furnish emergency communications when needed. Are you helping your club with its Field Day preparations?

Girlstown, USA. Through the help of the Terry County (Brownfield, Texas) Amateur Radio Club members, Girlstown, USA, near Whiteface, Texas, recently acquired seven YL Novice operators. Here's the story.

Girlstown, USA, is the home of 32 girls (up to 17 years old) who have lost their parents. A recent winter ice storm cut off all their electric power, leaving them without heat or light, and there was no telephone on which to call for help. So the members of the Terry County club decided that Girlstown needed ham radio.

Starting last March, representatives of the club made the 26-mile trip from Brownfield to Girlstown every Friday evening, and often on Sundays, to teach code and theory to interested girls and staff members. Result: seven of the girls obtained Novice licenses. (See photograph at left.)

The Girlstown operators work 80 and 40 meters and are open for schedules. They use a Hammarlund HQ-180 receiver and a Heathkit DX-60 transmitter, which the Terry County club purchased for them (the club members are still paying for the equipment, incidentally). Code and theory classes are still being

held at Girlstown, and at least four of the girls and several staff women are well on their way towards General Class licenses.

Having only 23 members, the Terry County Amateur Radio Club is not large —but it gets things done. Some of the most active of the group are: E. C. Pool, W5NFO; Dave, K5LFI; Glen, W5JMS; Bill, K5JST; Don, K5LFJ; Curtis, W5DRJ; Bill, K5CWL; Ralph, WN5KWZ; Don, K5BDX; and several XYL's. (You may be interested to know that your Amateur Radio Editor has mailed a small check to Dave Nicholson, K5LFI, P.O. Box 809, Brownfield, Texas, with a request to be made an honorary member of this fine club.)

CONTROL FOR LOW-POWER STATIONS

One of the oddities of ham radio is that the operators of low-power stations often have to flip a handful of switches to change from "transmit" to "receive," while the more complicated, high-power stations are usually controlled by a single switch. Fortunately, a convenient and safe control system is easy to install. The one described here is suitable for power levels up to a few hundred watts. It provides one-switch changeover and, as an extra bonus, gives you master power switches for your transmitter and receiver, and for their accessories.

The Circuit. Switch *S1* is the "send-receive" switch. Pole "A" of *S1* connects the antenna to the transmitter or to the receiver in positions 1 or 2, respectively. In position 3, the antenna is disconnected entirely (for tuning purposes). If you have a balanced antenna, you'll need a 5-pole, 3-position switch instead of the 4-pole version illustrated; the extra pole will be needed to switch the other half of the antenna line.

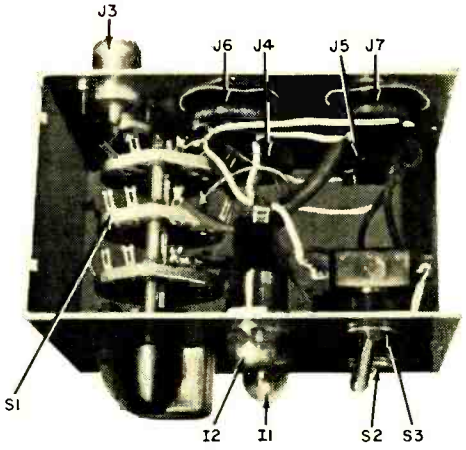
Generally speaking, the leads from pole "B" of *S1* are wired in parallel with the transmitter's send/receive switch, those from pole "C" with the receiver's. Check your transmitter and receiver wiring diagrams, though, before making the connections. Be sure that the transmitter will be activated in positions 1 and 3 of pole "B" and that the receiver will be activated in positions 2 and 3 of pole "C."

Pole "D" of *S1* supplies normal screen voltage to the transmitter final output tube in position 1. But in positions 2 and 3, the voltage is removed and the screen terminal is grounded. This permits tuning the transmitter oscillator or spotting the transmitter frequency on the receiver dial without using the final.

The leads from pole "D" are connected in series with the wire supplying voltage to the screen of the output tube. The "hot" end of the severed wire should be attached to lead "A" of pole "D" (see schematic on next page); the "screen" end is attached to lead "B."

If your transmitter already has a "tune" switch, it may be possible to wire leads "A" and "B" in parallel with it, accomplishing the same result. Check the transmitter schematic first, though, before wiring.

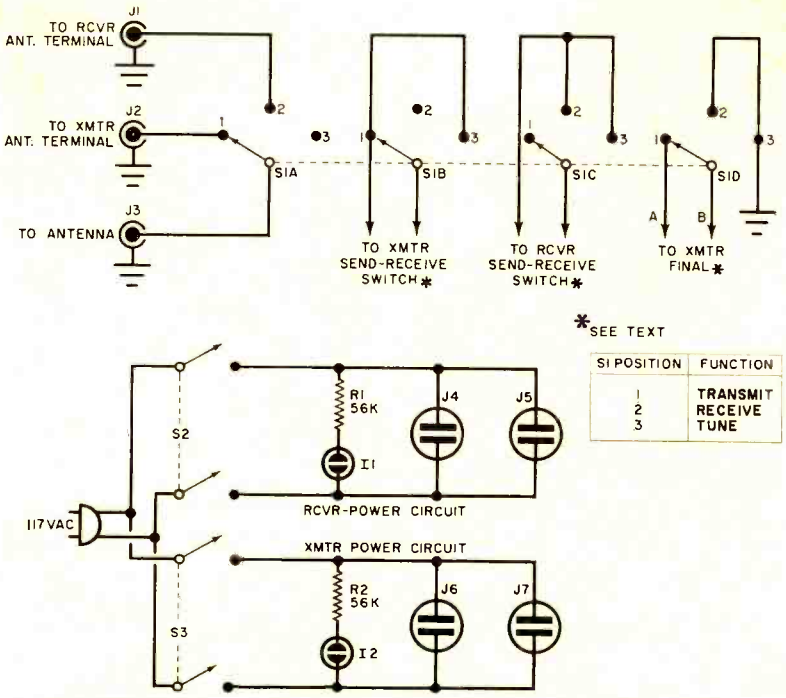
Switch *S2* controls the line voltage to sockets *J4* and *J5*. One of these sockets



Major components of control box are identified above. When connected to transmitter, receiver, antenna, and a.c. line, the unit will provide one-switch transmit/receive changeover and also act as a master power control center.

PARTS LIST

I1, I2—NE-51 neon lamp
J1, J2, J3—Chassis-type coaxial connector (Amphenol 83-1R or equivalent)
J4, J5, J6, J7—Chassis-type line receptacle (Amphenol 61-F or equivalent)
R1, R2—56,000-ohm, ½-watt resistor (in pilot light assembly)
S1—Steatite-insulated, non-shorting rotary switch; at least 4 poles, 3 positions—see text
S2, S3—D.p.s.t. toggle switch
2—Pilot light assemblies (for I1 and I2) with built-in 56,000-ohm current-limiting resistors (Dialco Series 95408X or equivalent)
1—6" x 5" x 4" aluminum utility box (Bud CU-2107-A or equivalent)
Misc.—Line cord and plug, cable for connections to receiver and transmitter, grommets, etc.



Schematic diagrams of the changeover and power control circuits in the control box. Don't forget to ground the completed unit to both transmitter and receiver chassis.

powers the receiver, the other a Q-multiplier or other receiver accessory. Similarly, switch *S3* controls power to sockets *J6* and *J7*, into which the transmitter, keying monitor, modulator, etc., are plugged. Neon pilot bulbs *I1* and *I2* indicate when the sockets are energized. Although only two sockets are shown on each switch, additional ones may be added as desired.

Construction and Use. All the components fit neatly into a 6″ x 5″ x 4″ aluminum utility box as shown in the photograph. Neither the parts locations nor the wiring is critical. When the unit is complete, ground it to both the transmitter and receiver chassis.

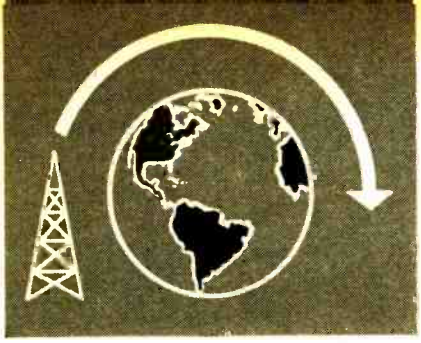
Connect the receiver and transmitter antenna terminals, and the antenna, to jacks *J1*, *J2*, and *J3*, respectively. Next, plug the receiver and its accessories into jacks *J4* and *J5*, and the transmitter and its accessories into jacks *J6* and *J7*. Insert the control unit's own plug into a convenient wall socket.

Flip on *S2* to supply power to your receiving apparatus, *S3* to power your transmitting apparatus. Then switch on all your equipment as you normally would. Turn *S1* to position 1 to transmit, position 2 to receive, and position 3 to tune.

(*Continued on page* 107)

ARRL CONVENTION

If you're going to be in the Los Angeles area on June 1st, 2nd, and 3rd, you may want to take in the ARRL Southwestern Division Convention at the Disneyland Hotel (Anaheim, Calif.). In addition to all the attractions of a major ham convention, special arrangements have been made for the delegates and their families to enjoy Disneyland at reduced rates on Saturday evening, June 2nd. Also, the first annual Lee DeForest memorial plaque will be awarded to the person in the Southwestern Division who has contributed the most to ham radio during the past year. For full information, write to: ARRL Convention, P. O. Box 1685, Newport Beach, Calif.



Monthly Short-Wave Report

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

SHORT-WAVE STATIONS OF GUATEMALA

IN PLACE OF the usual lead story this month, we are going to give you a complete and up-to-date listing of short-wave stations in Guatemala. This list was compiled by Jack Perolo (PY2PE1C), Sao Paulo, Brazil, who visited some of the stations while en route from the United States to his home. The number, in each case, indicates the frequency in kilocycles.

3355 *Radio Club.* Remote-control transmitter being modified for broadcasting in 90-meter band with 150 watts. Call-sign still unknown. Operations scheduled to start early this year. (See *Radio Club* listing under 6160 kc.)

4685 *R. Victoria?* See next item.

4900 TGLAB, *R. Victoria,* 2a Av. 14, Masatenango Such. Reportedly on the air with 20 kw., but not heard in Guatemala City despite a clear channel. Station with similar slogan noted on 4685 kc. several months ago.

5952.5 TGNA, *R. Cultural,* Apartado Postal 601, Guatemala City. Strong signal, 5 kw. All-Spanish religious programs. On the air to as late as 2300.

5970 TGLA, *R. Victoria.* (See 4900-kc. listing.) Reportedly on the air with 500 watts, but only station heard is one in Santo Domingo, D. R.

5980 TGAR, *R. Quetzal,* 12-Av. 26-27, Zona 5, Guatemala City. A 1-kw. station, running to 2300 or later, with marimba music and commercials.

5990 TGJA, *R. Nuevo Mundo,* 6a Av. 10-45, Zona 1, Guatemala City. A 3-kw. station. Very strong signal. Usual s/off time around 0100.

6000 TGTA, *R. Sonora,* 5a Av. 16-38, Zona 1, Guatemala City. Off the air since 1959. New Collins 1-kw. xmtr now being installed. Expected to be in operation shortly with schedule of 0700-0000.

6020 TGDA, *La Voz del Ocidente,* Quezaltenango. A 1-kw. outlet with all-Spanish programming and many commercials, ID every 15 minutes.

6030 TGTQ, *R. Internacional,* 12 C.5-62. Zona 1, Guatemala City. A 7-kw. station scheduled for 0730-0100, all-Spanish. World news bulletin given at 2330.

6040 TGCO, *La Voz del Tropico,* Coatepeque, Quez. Reported running 500 watts, but not heard. Channel occupied by a Colombian station.

6050 TGXB, *R. Centro Musical,* 5a C. 026, Zona 1, Guatemala City. Now on the air with 5 kw. at 0700-0000. Reports welcomed.

Larry Marshall, of Devils Lake, N.D., is also known as WPEØBNX. The equipment in Larry's monitoring shack (at right) includes a Hallicrafters S-108 receiver, a Q-multiplier, and a tape recorder.

6060 *R. Landivar,* 4a Avenida 14, Quezaltenango. Not on the air. Attempts to obtain information fruitless.

6060 TGXX, *R. Ciro's,* 8a. C. 2-28, Guatemala City. Expected to be on the air in May with 1500 watts and a schedule of 0600-0100.

6070 TGPA, *R. Palmeras,* Escuintla. Said to be on the air, but channel is occupied by unidentified station, possibly Ecuadorian.

6080 TGOB, *R. Colonial,* Antigua Guatemala. Listed with 250 watts. Not on the air; channel being used by a Colombian station.

6100 TGOA, *La Voz de las Americas,* 2a Av. 13-39, Zona 1, Guatemala City. Off the air in April, 1961, due to heavy QRM. Testing on 6295 kc. but unable to get authorization to broadcast. Authorization requested for operation on 25 meters (daytime) and 60 meters (nighttime) with 500 watts at 0600-0100.

6110 TGQA, *R. Nacional.* (See 6177- and 11,700-kc. listings.) Power, 1 kw. Not heard at present.

6140 TGHC, *R. Universal.* 7a Av. 9-34, Ap. 403. Guatemala City. On the air at 0700-0100 with 500 watts (1 kw. from June, 1962). Reports well kept and welcomed.

6150 TGAZ, *R. Continental,* 13 C. 12-26, Zona 1, Guatemala City. Rated at 500 watts. Commercials and Latin American pop tunes, with all-Spanish programming.

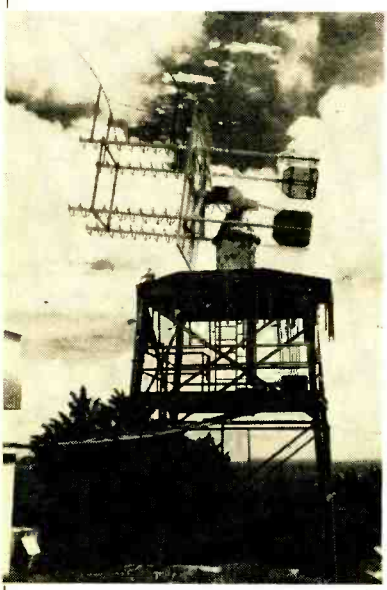
6160 TGZA, *R. Club,* 4a Av. 12-74, Zona 1, Guatemala City. On the air from June, 1957, to November, 1961. Presently being moved outside of city; should return to air shortly with a schedule of 0700-0500 and dual outlet on 3355 kc. Verification by letter and pennant.

6177 TGWB, *R. Nacional,* C. 18 Sept. 7a Av., Guatemala City. Recent move downward made to avoid QRM from Colombian station. Power, 1 kw. Said to be able to substitute for 6110-kc. outlet from Quezaltenango now off the air.

The listing of Guatemalan short-wave stations will be concluded next month. In the meantime, you might like to try to check out some of the above items.

(*Continued on page* 109)

THE BIG LAUNCH



NASA

At the Bermuda Com site, the 15-mc. beam is mounted above 4 helix antennas used for VHF telemetry reception.

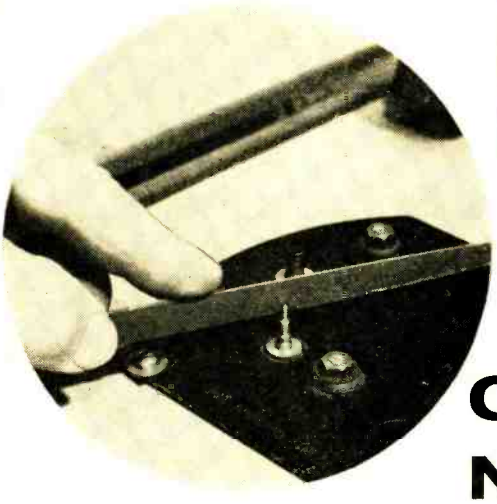
The BIG news as this issue goes to press is the successful launch and orbit of Lt. Col. John H. Glenn. Short-wave listeners knew for some time that 90% of the two-way voice communications between the capsule, "Friendship 7," and the extensive network girdling the earth would take place on the short-wave bands. As soon as the launch was announced, most SWL's started a frantic search for the right frequencies.

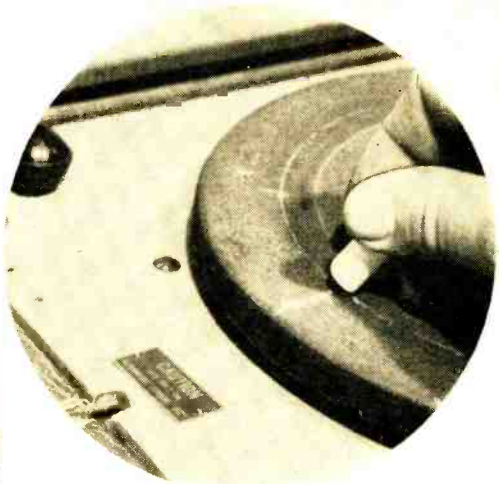
The first—and probably the most important—channel to be spotted by DX'ers in North America was 15.016 mc. If you tuned this frequency, you could hear Cape Com, Bermuda Com, Guaymas (Mexico), Corpus Christi, and many other stations. Reports received here differ as to whether the capsule was also transmitting on or very near this frequency. It seems likely that it was, but we will await your verification of these reports.

On the other side of the earth, DX'ers claimed hearing the Project Mercury Network stations on about 7.575 and 10.61 mc. And if you tuned higher than the Cape Com channel on 15.016 mc., the various ships at sea standing by for the recovery operation could be heard. Newscasters were intercepted on SSB near 15.70 mc.

All in all, it was an exciting morning, and one that SWL's probably enjoyed more than TV viewers. —*Hank Bennett*

Two simple operations can bring almost any 78-rpm phonograph down to today's 33⅓-rpm speed. Having chalk-marked the turntable (right), you then file the motor shaft (below) until the chalk mark revolves exactly 33⅓ times a minute.





OLD PLAYER, NEW SPEED

How to convert your 78-rpm phono for LP's

By GLEN F. STILLWELL

OCCASIONALLY, you'll run into an old phonograph—perhaps a portable radio-phono combination—that has an acceptable tone, a heavy-duty motor, a well-balanced turntable, and even a satisfactory amplifier. The catch? The unit will play only old-fashioned 78-rpm records!

If converted to play today's 33 1/3-rpm records, however, such an old player can bring hours of pleasure to young and old. Fortunately, its speed can easily be reduced to a satisfactory 33 1/3 rpm at negligible cost by either replacing the motor shaft bushing or reducing the size of the original shaft. The only other things you'll have to do to play 33 1/3-rpm discs are install a "long-play" (i.e., microgroove) needle and reduce the stylus pressure accordingly.

The first step in the conversion is to establish a method for checking the speed. To do this, you can simply chalk-mark the turntable and count the number of revolutions per minute as you make the alterations (see photo above). Or, if you prefer, you can purchase a standard strobe disc from almost any electronics parts distributor.

If a motor shaft bushing of the proper size for playing 33 1/3-rpm records can't be found, then the size of the shaft itself can be reduced by holding a fine file against it when it is revolving (see photo at left). This "filing" must be done very carefully, or an out-of-round shaft will be the result.

Holding the file rigidly, press it lightly against the shaft while the motor is running. Check the turntable speed frequently, because the exact speed will "come up" quickly after it reaches a point close to that required.

If necessary, the turntable surface can be reflocked or covered with velvet for a more presentable appearance. —30—

The SPARKING LIGHT

a Carl and Jerry Adventure

"HEY, Jer," Carl called as he came swinging through the door of the Parvoo University residence hall room he shared with his home-town pal, Jerry Bishop, "guess what I just heard down . . ."

He stopped in mid-sentence at the sight of the intriguing array of equipment spread out on the desk in front of Jerry. This included a VTVM, a bell transformer, some pilot-light bulbs, a multi-cell flashlight with the lens removed and two wires leading from an adapter screwed into the bulb socket, plus several tiny objects that looked like elongated clear glass beads with gold-colored wires protruding from opposite ends.

"What are you up to behind my back?" Carl demanded accusingly.

"Not a thing, but while you were shooting the breeze up and down the halls I've been experimenting with these developmental General Electric subminiature silicon *pnpn* light-activated switches," Jerry retorted. "Two of them are Type ZJ235A; the other two, Type ZJ235B. I conned a lab Prof into the loan of them."

"What are they? Come to think of it, *where* are they?"

"Right here," Jerry replied, poking the little glass beads, each of which was about three tenths of an inch long and one eighth inch in diameter, with a forefinger. "You know how a silicon controlled rectifier works. In spite of voltage applied across it, it passes no appreciable current in either direction until a signal voltage is applied to the gate lead; then it conducts heavily in the forward direction like an ordinary silicon rectifier, even after the signal voltage is removed from the gate. When the applied voltage is removed, the rectifier lapses again into its non-conducting state. These switches work the same way except that light, instead of a gate signal voltage, triggers them into conduction. Both devices are solid-state kissing cousins of vacuum tube thyratrons.

"Let me show you," Jerry offered. "See: I have a pilot lamp and a ZJ235A connected in series across the secondary of this bell transformer whose primary is plugged into the a.c. line. Watch what happens when I shine this penlight on the little rectifier."

When the cone of light struck the semiconductor, the lamp bulb glowed at about half its normal brilliance. When the penlight was shut off, the light bulb went out.

"Current flows through the bulb only during the half of the a.c. cycle being rectified," Jerry explained. "Remember, this 'switch' passes current only in one direction even when 'closed' by the presence of light. Now I'll parallel the ZJ235A with another unit that's reversed so it will pass the other half of the cycle during the presence of light."

He did so and demonstrated that when the light beam shone on either switch,

By
JOHN T. FRYE
W9EGV

the lamp glowed dully as before; but when the beam covered both silicon units simultaneously, the lamp glowed brightly.

The VTVM, with the meter pointer adjusted to rest at center scale with no applied voltage, was then connected across the lamp. Rectified d.c. voltage across the bulb made the pointer swing right or left according to which switch was illuminated; but when both switches were receiving the light, the a.c. voltage present across the bulb left the meter pointer quivering in the center.

One of the light-activated switches was removed, and a relay was substituted for the bulb. Now light shining on the switch would cause the relay contacts to close; however, the relay hummed and chattered until Jerry connected an ordinary silicon diode across the relay coil. This quieted the relay completely.

"That diode is connected so that its polarity presents a very high reverse resistance to the d.c. pulses delivered by the semiconductor switch," Jerry continued; "but it has a very low forward resistance to the e.m.f. produced by the collapsing field of the armature coil between pulses. The result is that current flows through the relay coil at all times. During the pulse, current flows from the power supply through the coil. Between pulses, self-induced current of the coil flows through the diode. The continuous current gives the relay no opportunity to chatter."

"Wouldn't a big capacitor connected across the coil accomplish the same thing by feeding stored current through the coil between pulses?" Carl wanted to know.

"Yes, but that arrangement has two drawbacks. First, the presence of the capacitor would slow down the pull-in and drop-out time of the relay. Second, the light-activated switch would be working into a capacitive load instead of the resistive or inductive loads for which it is rated. The d.c. voltage stored in the capacitor would appear in series with the a.c. voltage applied and would substantially reduce the r.m.s. voltage that can safely be applied to the switch without exceeding peak voltage ratings. But let's see how the educated speck of silicon acts on d.c."

Jerry connected one of the ZJ235A's in series with a lamp bulb across the leads coming from the batteries in the big flashlight. When the flashlight switch was closed, nothing happened; but when the penlight beam struck the semiconductor switch, the bulb glowed brightly. Its light continued undiminished after the penlight was shut off. But when the switch on the flashlight was opened, the bulb went out and refused to light again even when this switch was closed *until* light from the penlight once more "closed" the *pnpn* switch.

"On d.c. that thing acts like a latching relay," Carl observed. "Once it starts conducting, you have to remove the power

to make it stop. How much light is required to trip it?"

"Between 80 and 500 footcandles, with 125 footcandles being a typical value. And in some applications the ZJ235D, which is rated at 400 peak volts, will handle 160 watts. Unlike ordinary photocells, it needs no amplifiers to control considerable power. For example, it can operate heavy-duty relays directly. At the same time, its tiny size permits it to be mounted behind a small hole in a meter face so that the shadow of the pointer cutting off light shining onto the unit through that hole could operate it. Since the input is light, the input and output circuits are entirely separate from each other . . .

"What were you going to say before we got started on all this?" Jerry finally asked.

"Oh, I was going to tell you that Jodi, the nice YL kid from Florida we met when we were tunnel-stomping a couple of months ago, has a date tonight with that big ox, Bruce, down the hall. How he talked her into it I'll never know, unless he used some of that hypnotism of his. Anyway, he was telling a gang in his room how he plans to park with her at The Wall tonight under the pretext of showing her an imaginary satellite about which he is supposed to have some inside info. It makes my blood boil to think of his using a cheap trick like that on our— I mean on Jodi. Anyway, we still owe him one for making you look silly with that post-hypnotic-suggestion bit."

"Yes-s-s-s-s, that we do," Jerry said thoughtfully as he rolled one of the little light-activated switches between a thumb and forefinger; "and this may be the time to pay off. Doesn't he have classes all afternoon?"

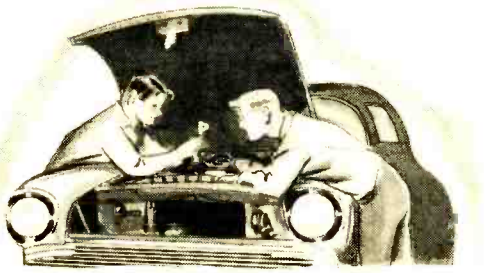
"Yes, but what have you got in mind?"

"Come on down to the parking lot for a look at his car and I'll show you. Just let me collect a few things first."

THE WALL was a Parvoo tradition. It was a secluded area at the edge of the campus alongside a retaining wall where couples were permitted to park unmolested by the university police. School officials apparently felt it was better to have the students park where they would be safe than invite robbery and attack by parking on back roads.

The parking lot was just across the street from the H-3 Residence Hall. Bruce's car was not locked, and Jerry quickly set to work. First he disconnected the battery. Then he removed the wire going from the fuse block to the door-operated switches for the dome light of the car. A wire was run from the hot side of the fuse block through one of the light-activated switches and directly to the dome light bulb. The threads of the screw-on glass cover of the dome light were coated with Duco cement and the cover was screwed into place.

The light-activated switch was mounted in a small cardboard tube so that



light gathered by a small lens in the end of the tube focused on the light-sensitive silicon area. This tube was mounted underneath the car at the rear with the lens pointing backward. A little paper cap was slipped over the lens, and the battery was reconnected. Now, opening the doors did not cause the dome light to come on, but removing the cap from the end of the cardboard tube did. Naturally, once the switch was triggered "closed" by the daylight, there was no way to turn the dome light off except to disconnect the battery. Pulling the bypassed dome light fuse or working the bypassed dome light switch had no effect whatever.

The battery was disconnected again while the lens cap was replaced. One end of a short length of string was cemented to the lens cap and the other end was cemented to the concrete beneath the car. Finally, the battery cable was replaced.

"When the sun sets," Jerry explained, "there won't be enough incident light to trigger the switch, even with the aid of the light-gathering lens. It will be almost dark when Bruce drives off for his date; so the automatic removal of the lens cap at that time will not trigger the switch."

"Won't he think it funny that the

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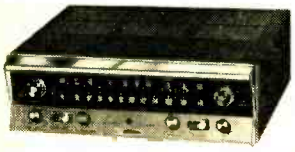

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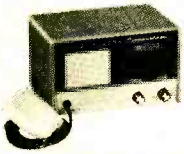

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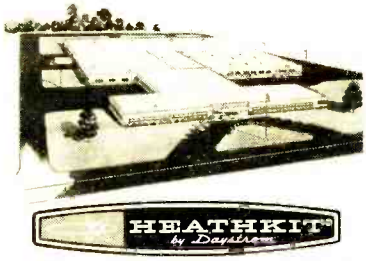

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Carl and Jerry

(*Continued from page* 90)

dome light doesn't come on when he opens the doors?"

"He'll just think the bulb burned out and won't bother to replace it. After all, light in that car is not exactly what he wants tonight!"

Carl and Jerry never waited more impatiently for the start of a date of their own than they waited to see Bruce waddle out to his car about eight o'clock. Both heaved a sigh of relief as he drove away from the parking stall with the dome light still dark.

"So far so good," Carl remarked. "According to Bruce's announced plan, he intends to drive around for a couple of hours while he exposes Jodi to 'the full force of his winning personality' and sells her on the satellite story. That means he should be parking at The Wall about 10:00. What say we study for an hour or so and then amble over that way?"

This they did, but judging from the frequent glances at their watches, it's doubtful either of them got much out of the studying. At 9:30 they took the powerful flashlight and strolled over to the field across the road from The Wall.

IT WAS a beautiful warm spring night, and the boys lay on their backs on the grass and studied the stars sparkling overhead. They became so engrossed in identifying the great rectangle of departing Orion, the sickle of Leo, and the parallel lines of Gemini, that they were astonished to see it was 10:30 when a car drove slowly down the road and joined several others parked at widely separated points along The Wall.

"That's Bruce's car," Carl muttered as the tail-lamps flickered out. "It was thoughtful of him to park so that the rear of the car is aimed our way. How close do we have to be to trigger the switch with this flashlight?"

"Well, the flashlight puts a lot of candlepower into a very small spot, and the lens in front of the ZJ235A increases the effectiveness of the light many times, but let's Indian-crawl a little closer to be sure. See if you can hit the lens with the first beam of light."

When they were within fifty yards of the car, Carl took careful aim with the long barrel of the flashlight and pushed the switch. Instantly the interior of the car was bathed with light from the dome lamp. Jodi could be seen peering expectantly up through the windshield at

the silhouette of the water tower on the hill in front of the car. She obviously had bought the satellite story.

Bruce's fat hand reached up and worked the dome light switch, casually at first and then vigorously, with growing exasperation. He opened his door and punched the little push-button switch on the door jamb repeatedly. Then he heaved himself out of the car and went around to the door on Jodi's side and did the same thing, but the light kept right on burning. By this time his plight had attracted the amused attention of couples in the other cars.

"That your sparking light, Bruce?" a voice called.

"Smart girl, that one," a feminine voice observed. "She knows better than to be alone with you in the dark."

"Drop dead, you jokers," Bruce snarled from where he lay on his back beneath the steering column reaching up for the fuses mounted on the rear of the fire-wall. But pulling the dome light fuse had no effect. Carl and Jerry could hardly restrain their laughter as they watched him wrenching vainly at the cemented dome light cover.

"Hey, Bruce, your little see-the-satellite scheme isn't doing so good, is it?" a voice drawled from the darkness.

That did it. Carl and Jerry could see Jodi talking fast and angrily. Then they watched Bruce switch on the headlights,

back out into the road, and drive away with the interior of the car still brightly lighted.

WANTING to see the finale of their efforts, Carl and Jerry took a short cut to X-Hall where Jodi lived and concealed themselves in some shadows near the door. Almost immediately Bruce's car came down the street, and it had scarcely stopped rolling when Jodi popped out of her door and slammed it hard behind her.

"All I've got to say to you," she said indignantly in her rich Southern accent, "is that I've never been so embarrassed in my whole life. Don't ever ask me to go out with you again. And if I were you, I'd change schools. An EE who can't turn off a little old lamp bulb is going to make a pretty sorry engineer!"

"Wow! That's telling him!" Jerry chuckled as Bruce slammed the car into gear and drove away with an angry screeching of tires. "Steamed as he is, he undoubtedly will disconnect the battery tonight and plan on looking the car over good tomorrow; so as soon as he leaves the car, we'll remove the ZJ235A, wash off the Duco with a little acetone, and restore the wiring to its original condition. Tomorrow, when he finds everything working normally, he'll think he's flipping his wig. And I'll bet Jodi will really appreciate our looking out for her when we tell her about it."

Carl gave his pal a quizzical look. "Jer," he said slowly, "nobody makes better sense when he talks about electronics than you do; but this one time you'd better listen to me. Let's not say a thing to Jodi about this. If there's one thing a girl can't stand, it's having someone think she isn't capable of handling the curliest wolf that ever trotted down the path. If she learned we were protecting her without being asked, she'd be as mad at us as she is at Bruce."

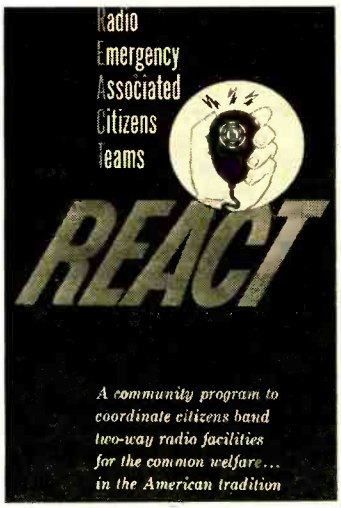
Jerry's round face puckered into a thoughtful frown in the moonlight and then smoothed out into a cheerful grin. "Could well be you're right," he acknowledged, "but suppose on the way back to the parking lot you tell me where you learn these interesting things about how girls think!" —30—

On the Citizens Band

(*Continued from page 77*)

gram sponsored and supported by The Hallicrafters Co., a leading manufacturer of communications equipment. The program is a federation of volunteer CB radio operators, and the national headquarters of the organization is in Chicago. REACT has two primary objectives: (1) to provide a 'round-the-clock radio communications system effectively supplementing police, fire, ambulance, hospital and CD efforts, and (2) to promote correct and efficient use of CB radio.

Membership in REACT is free, and each participant receives a metalized, weatherproof sticker for his automobile, a membership card, and periodic bulletins



from REACT headquarters. Under the program, a monitor station will be in operation 24 hours a day in each city and town to relay messages to the proper authorities, either from other REACT members or from any CB operator who has an emergency message.

Further details can be obtained from REACT, National Headquarters, 4401 W. Fifth Ave., Chicago 24, Ill.

Tech Notes. We've had some letters from CB'ers who seem to be rather confused about the meanings behind "S" units and "db above S-9." Let's see if we can straighten a few things out.

In the first place, an S-unit is a completely arbitrary designation. For example, take the definition of "S-9"—"a very strong signal." Throughout the years, receiver manufacturers have tried to standardize the S-unit, but so far they have been unsuccessful. A fairly widespread value for an S-9 signal is 50 microvolts of received signal at a receiver's antenna terminal. However, since the vast majority of CB'ers do not possess a signal generator capable of delivering *exactly* 50 microvolts to the transceiver's antenna fitting, this value is meaningless for CB'ers, and "a very strong signal" is probably the most acceptable definition.

One thing upon which there is universal agreement is that each S-unit is equal to a 6-db increase in received or transmitted power. A 6-db signal increase in transmitting power is equal to stepping up the power at the transmitting antenna about four times. Since transmitter design now gives almost maximum efficiency, this means that the power input must be increased to 20 watts. But what is one S-unit at the receiver end? Nothing much when you start to compare S-2 signals to S-3 signals. So power increase at the transmitter is not the answer.

A sure way to get a rig's S-meter pinning at the high end is to (1) put the antenna system in tip-top order, and (2) tune up the receiver for optimum sensitivity. From time to time, in this column, we will give hints on signal boosting at the receiver end that will make your S-meter read in double figures. For a starter, look up the snappy Q-multiplier construction article in the March 1961 issue of P.E.—it's a real "nit picker."

Is Self-Policing the Answer? Many CB clubs throughout the nation are advocating that several channels be kept clear for *business* users of the CB frequencies. *Non-essential* contacts and discussions would be held on other specifically "allocated" channels. Trial runs of this "program" have been partially successful and are now being evaluated in Washington. Enforcement is the big question; without it, the program fails. Rumor has it—at this writing—that the FCC may take some action.

Club Notes. The Saginaw Valley CB Association, Saginaw, Mich., has the necessary equipment for fully checking out CB transmitters (contact Kenneth

Young, 1417 Passolt St., Saginaw, Mich.). They also have been quite active in local Civil Defense. . . . The Roundtable CB Club (23625 Clifford Drive, North Olmstead, Ohio) has been pubishing an excellent bulletin. It contains well-written items of interest to all members, and includes—believe it or not—a recipe column. . . . The Montgomery County (Pa.) Jr. CD Organization is a Citizens Band club with a definite purpose, and it is made up of trained first-aid people. It boasts 18 members, five mobile units, and four walkie-talkies. If you're in Montgomery County, contact the club president, Albert S. Sergio, 9 S. Chestnut St., Ambler, Pa. . . . The Central Arkansas Citizens Band Radio Club (P. O. Box 534, Little Rock) has been collecting money for a transceiver to be installed in the local police headquarters; a distributor in the area has donated an antenna. The club's CD activities are tied in closely with those of the police department.

In future issues we plan to highlight a CB club each month. If you'd like to have your club represented, send us full details on how and when it was formed; its membership, goals and projects. We'll personally acknowledge all club notices. —30—

The Sun Jenny

(*Continued from page* 60)

to which the blue lead of *T1* is wired and attach a solder lug to the free end. Finally, complete the soldering of all the connections and you're finished with the wiring.

The final step in the construction is to mount the circuit in a plastic box. The author used a box measuring 3⅜" x 2⅝" x 1" but, if you'd like more "elbow room," you can use a larger size. Drill ¼" mounting holes for jacks *J1* and *J2* and a small screw hole for binding post *J3*. You'll find it easier to make holes in the plastic if you support the back of the surface to be drilled with a block of scrap wood.

Now mount jacks *J1* and *J2* and binding post *J3* in their holes. The solder lug on the end of the 4" piece of wire

last installed should be fastened under *J3*'s mounting screw. Pop the circuit board inside the box, close the latter, and you're ready to use the Sun Jenny.

Operation. The unit should be placed so that the photocell is illuminated by daylight or by a 40-watt bulb about two feet away. Plug a key into *J1* and a crystal earphone into *J2* and start sending—that's all there is to it.

For wireless operation, connect a 3- to 5-foot length of insulated wire to binding post *J3* and drape it around the cabinet of any broadcast-band receiver. Close the key and slowly tune the receiver across the band starting from the 550-kc. end. You should hear the "peep" somewhere between 550 and 700 kc. If a local broadcast station is interfering with reception, don't worry. You'll also be able to pick up harmonics at about 900, 1200, and 1500 kc.

The crystal earphone, incidentally, could be shorted out for wireless operation. However, in the author's case at least, the presence of the earphone in the circuit seemed to "perk up" the signal. —30—

The Imp Sleuth

(*Continued from page* 66)

then be read directly from the scale.

The bridge can also be used to measure the impedance of output transformers designed to match speakers in the range of 0 to 25 ohms. For example, you may have an output transformer of unknown primary impedance which you want to use with an 8-ohm speaker. To find its impedance, connect jacks *J1* and *J2* of the "Imp Sleuth" to the secondary (speaker side) of the transformer, and a resistor of some known value across its primary.

If the impedance read on the bridge is less than 8 ohms, the primary impedance is greater than the value of the resistor, and vice versa. Given two or three tries, you should be able to find a resistor which will indicate approximately 8 ohms on the "Imp Sleuth." The value of this resistor is the primary impedance of the transformer. —30—

Must We Have UHF-TV?

(*Continued from page 45*)

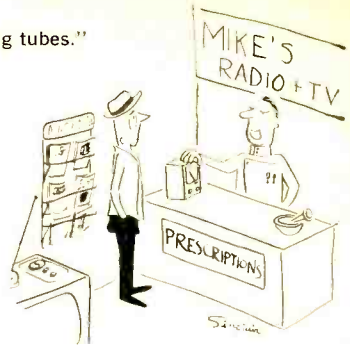
Although all three approaches have their advocates, everybody agrees on one thing: if more new stations—desperately needed in some parts of the country—are to be had, then somehow the FCC must find a way to breathe life back into the UHF corpse.

With that goal in mind, the FCC is deliberating on a compromise program—not even all Commissioners agree on the best approach—and will presumably come to some firm decision in the next few months. Tentatively, the plan involves keeping both the VHF and UHF bands—at least for the time being, and at the same time launching a vigorous program to make the U's more competitive. The main provisions of the plan:

- Take an unequivocable public stand in favor of promoting UHF broadcasting.
- Begin a stern program of de-intermixture. in spite of the vigorous protests which are bound to result. As a matter of fact, the Commission has already tentatively selected eight urban areas* to be switched to all-UHF service.
- Relax some engineering standards now required in the construction of UHF stations. This would allow operators to build and run UHF stations more cheaply than at present.
- Encourage VHF operators to build UHF transmitters and broadcast the same programs on the two channels simultaneously. The idea here is to urge telecasters to build in anticipation of an eventual switch to all-UHF service. (Reserve your channel now, the FCC is saying, and you can have your pick of the desirable low-numbered channels—wait until later, and they may all be gone.)
- Eliminate competitive hearings on new UHF stations. If an applicant meets the minimum standards and there are no other applicants, he gets the license without argument.
- Sponsor a bill in Congress to require that all TV sets shipped in interstate

*Montgomery, Ala.; Hartford, Conn.; Champaign, Ill.; Rockford, Ill.; Binghampton, N.Y.; Erie, Pa.; Columbia, S.C.; Madison, Wis.

"Why not?
They're selling tubes."



commerce be equipped to receive both VHF and UHF broadcasts. This would make it far easier for new U's to go on the air, by giving them ready-made potential audiences.

UHF TEST TUBE. In addition, the FCC has launched the $2-million experiment in UHF telecasting, New York's station WUHF operating on channel 31. The program, which should be completed by 1963, is designed to test the transmission characteristics of UHF in a big city area. Thousands of householders are being supplied with UHF receivers and asked to report on reception quality.

Although the results of the WUHF experiment will not be known for some time, word has it that UHF reception is about the same as VHF reception. Commissioner Robert E. Lee, for example, speaking before an IRE group shortly after the tests got under way, observed that results were "pretty encouraging" in that early reports indicated "no significant difference, within 25 miles, of low VHF, high VHF, and UHF transmissions."

Many industry observers feel that the whole thing is nothing but window dressing. "The Commission is planning to switch all stations to UHF as soon as it can," said one industry figure. "But they figured it would help shift public opinion if they had a test, showing that UHF reception was as good as or maybe even a little better than VHF reception. The engineers knew what the results of this test would be before it ever got started."

Whether this is true or not, it does look as though the FCC finally means business. Its dynamic young chairman, Newton Minow, says he is in favor of retaining both the U and V channels.

Without the bill requiring that sets be built to receive both V and U stations, though, Minow is doubtful about the success of the program. And at the moment —although committees in both houses of Congress have held hearings on the bill—the prospects for its passage do not look too bright.

LIKELY OUTCOME. Without such a law, feels Newton Minow, the Commission may ultimately have no alternative but to scrap the VHF band entirely, forcing all operations to the UHF band.

This step, while drastic, could be taken with a minimum of inconvenience to all concerned by careful planning. If the final date for cutting off all V's were ten years from now, for example, broadcasters could write off their transmitting equipment between now and then, and prepare for UHF operations at the same time. Home viewers, meanwhile, could continue to use their present sets until they wore out, then replace them with sets capable of receiving both kinds of broadcasts.

Although few responsible figures are willing to say it, this is likely to be the outcome. The FCC fumbled the ball in 1952 when it decided that VHF and UHF could coexist comfortably. With the lessons of experience behind it, the Commission is not likely to make the same mistake again. —30—

IS UHF BETTER THAN VHF TV?

At present, very little information is available from the FCC and the companies conducting the VHF/UHF comparison tests in New York City. However, there is some indication (based on 100 home installations) that VHF telecasts have a slight edge over UHF.

In general, outdoor antennas benefit UHF somewhat more than VHF. Man-made noise seems to be a very small problem on either. Thermal noise is a bit more troublesome on UHF, but improved receiver design can eliminate this drawback. And UHF seems to be just a trifle "ghostier."

In all, some 800 to 1000 test installations are planned, with one out of every 10 using a color TV receiver. Only when all tests have been completed can definite conclusions be drawn from the compiled data, and the fate of UHF decided.

The Signal Monitor

(*Continued from page* 53)

try to keep all wiring associated with capacitor *C1* and coil *L1* very short.

Coil *L1* and transistors *Q1* and *Q2* are supported only by their own leads. Transistor *Q1*'s base and emitter leads, and all of the leads from *Q2*, are wired into the circuit by means of a 5-lug, screw-type terminal strip. The lugs on this strip are lettered "V" through "Z" on the pictorial diagram and represented by identically lettered circles on the schematic diagram. All leads to the latter circles are connected to the appropriate terminals on the strip. The leads ending in arrows are fastened under the screw; the plain ones are soldered to the lug.

About the Circuit. The signal from the transmitter is picked up by the monitor's whip antenna (*ANT*), tuned by *L1/C1*, and rectified by diode *D1*. Switch *S1*, which shorts out part of *L1* when closed, acts as a band selector. Passing from *D1* to transistor *Q1*, the signal is amplified and fed to switch *S2*.

When *S2* is in the "Field Strength" position, meter *M1* is connected to *Q1*'s output through "Meter Adjust" potentiometer *R2*. The meter then provides a visual indication of the relative signal strength. With *S2* in the "Audio" position, *Q1*'s output is fed to the base of transistor *Q2* and further amplified by *Q2* and *Q3*. The output of *Q3* is coupled either to the speaker or to a set of headphones plugged into *J1*.

If a CW signal is being monitored, switch *S4* is flipped to the "CW" position. This introduces collector-to-base feedback in *Q3*, providing a BFO action, and potentiometer *R3* acts as a combined volume and "pitch" control. For AM monitoring, *S4* is set at "AM," disabling the feedback; in this case, *R3* acts only as a volume control.

Power for the unit comes entirely from 6-volt battery *B1* and is controlled by "Power" switch *S3*.

Operation. Turn on "Power" switch *S3*, extend the antenna, and set "Band-switch" *S1* to the desired bands.

If you're going to measure field strength, throw switch *S2* to the "Field

Strength" position and rotate "Meter Adjust" potentiometer *R2* fully clockwise. Turn on your transmitter and peak capacitor *C1* for maximum indication on *M1*. Should the meter go off scale, turn potentiometer *R2* counterclockwise to reduce the reading. The results of any adjustments made on the transmitter can now be readily seen on *M1*.

To monitor AM or CW, set *S2* to the "Audio" position and turn *S4* to either "AM" or "CW." With *S4* in the "AM" position, potentiometer *R3* will act as a volume control; with the switch set for "CW," *R3* will act as a combined volume and "pitch" control. Headphones may be plugged into *J1* (disconnecting the speaker) at any time, and can be used to avoid feedback through the transmitter mike, in situations where there isn't enough gain to operate the speaker, etc.

When working close to the transmitter, the instrument may become overloaded by too much signal. If so, shorten the antenna and/or detune *C1*. -30-

Transistor Substitution Box

(*Continued from page* 80)

sistors and the auxiliary transistor socket to the switch contacts, as shown in the schematic diagram. The collector leads of *Q1, Q2, Q3, Q4,* and the transistor socket are all connected to the "C" binding post (*J2*), as is the collector terminal of *Q5*.

Be sure to exercise caution when soldering the transistor leads. Use a low-wattage soldering iron and a heat sink, applying the iron to the joint only as long as is absolutely necessary.

Operation. Set switch *S1* for the proper universal transistor (or set the switch to "X" if you're using a transistor plugged into the auxiliary socket). Then connect binding posts *J1, J2,* and *J3* into the test circuit with insulated clip leads.

Always set *S1 before* connecting up the binding posts. You could easily burn out a transistor by switching it, even for a brief time, into a circuit for which it was not designed. The danger is particularly great if you switch a *pnp* unit into an *npn* circuit, or vice versa. -30-

Transistor Topics

(*Continued from page 76*)

of a nanosecond, or a millionth of a microsecond—like fast, man! The units are packaged in a special axial container.

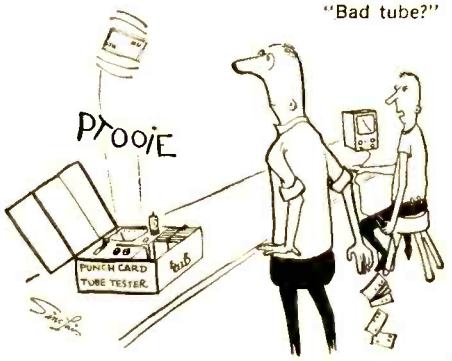
Silicon super power transistors with voltage ratings up to 800 volts have been produced by the Delco Radio Division of General Motors (Kokomo, Ind.). They feature good stability at elevated temperatures, have *betas* in the vicinity of 12, and are capable of 75 watts dissipation at 100° C.

Solid State Electronics Co. (15321 Rayen St., Sepulveda, Calif.) is now offering an ultra-high-gain composite transistor, Type SST 610. An *npn* silicon diffused mesa unit, it has a *beta* of about 5000, a maximum current rating of 500 ma., a maximum voltage rating of 30 volts, and can dissipate 1 watt at 25° C.

A "universal" small- to medium-signal, germanium *pnp* transistor is available from the U.S. Transistor Corp. (149 Eileen Way, Syossett, L.I., N.Y.). It can be used as a direct replacement for such types as the 2N416, 2N417, 2N521, 2N522, 2N1017, 2N1316, 2N1317, 2N1344, 2N1345, 2N1346, and 2N1357.

The Raymond Development Co. (P.O. Box 333, Watertown 72, Mass.) is now producing a hand-held, watertight sonar device for skindivers. Dubbed the "Hydro-Probe," it shows the distances to large objects as much as 100 feet away. If you're a skindiver, and interested, the tab is $245.00, delivered.

That does it for now, fellows. *Au revoir, mes amis . . .* —*Lou*



Electronic Unit Quiz Answers

(*Quiz on page* 71)

1 — G The deflection sensitivity of a basic meter movement is given in ohms per volt, which is the reciprocal of the current required to produce full scale deflection of the meter.

2 — I The speed at which the tape passes the recording and playback heads in a tape recorder is usually 7½ or 3¾ inches per seconds (ips).

3 — F The conductor and metallic braid of a shielded cable form a capacitor, with the insulating material between them acting as the dielectric. When the $\mu\mu$f. per foot and the length of a cable are known, its total capacitive effect can be determined.

4 — E The strength of a received signal is measured in microvolts per meter —the dielectric stress existing between two points in the wave front 1 meter apart and lying on a line parallel to the electric lines of force.

5 — H The precise and stable frequency of vibration of a tuning fork given in cycles per second is often used as a reference frequency in electronic testing.

6 — B The amount of magnetizing force required to produce a magnet of a given strength is measured in gilberts, or ampere turns, per centimeter length of the magnetic circuit. One gilbert per centimeter is called an "oersted."

7 — A The deflection sensitivity of an oscilloscope is specified by giving the amount of input voltage required to produce a one inch peak-to-peak deflection on the cathode-ray tube screen.

8 — C Phonograph turntable speeds used today are 16⅔, 33⅓, 45, and 78 revolutions per minute.

9 — D The insulating ability of tape is given as the number of volts it can withstand per mil, or one-thousandth of an inch, of its thickness.

ELECTRONICS DATEBOOK

MAY 21-24
Electronic Parts Distributors Show & Conference
Conrad Hilton Hotel, Chicago, Ill.

MAY 24-27
Southwest Air, Space & Electronic Exposition
Market Hall, Dallas, Texas

JUNE 1-3
Southwestern Division ARRL Convention
Disneyland Hotel, Anaheim, Calif.

JUNE 12-14
Armed Forces Communications & Electronics Show
Sheraton Park & Shoreham Hotels, Washington, D. C.

JUNE 24-28
Music Industry Trade Show
New York Trade Show Building and Hotel New Yorker, New York, N. Y.

AUG. 13-16
Pacific Energy Conversion Conference
Fairmont Hotel, San Francisco, Calif.

AUG. 21-24
WESCOM
Ambassador Hotel & Memorial Sports Arena, Los Angeles, Calif.

AUG. 31-SEPT. 9
World's Fair of Music and Sound
McCormick Place, Chicago, Ill.

SEPT. 1-3
National ARRL Convention
Memorial Coliseum, Portland, Oregon

OCT. 2-4
1962 Symposium on Space Electronics
Fontainebleau Hotel, Miami Beach, Fla.

OCT. 8-10
National Electronics Conference (NEC)
McCormick Place, Chicago, Ill.

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

Receivers | Make . . . . . | Model . . . . .

Make . . . . . | Model . . . . .

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

Type of Antenna Used . . . . .

Signature . . . . . Date . . . .

Hang an Electronic Picture

(*Continued from page 70*)

line. Then remove the plumb line from the "picture" and the Perceptometer is ready for action.

The person being tested should stand directly in front of the instrument, about four feet from the wall. He is asked to "straighten the picture," as best he can, without taking his eyes off the Perceptometer. The operator stands to one side, next to the wall, and turns the "picture" one way or the other according to directions of person being tested.

Everyone should have three chances to "straighten the picture," but not in a row. If you are testing a group of people, have them take turns and determine the average score for each person. Those who are not being tested must remain off to one side of the instrument where they cannot see the "picture." If you are only testing one person, have him move to the side of the instrument for a few minutes and relax between tests.

Before starting, turn *R1* all the way to the right or left so that the neon bulb is always off. Let the person being tested take all the time he needs. When he is satisfied with the position of the "picture," ask him to step to the side. Then, turn the knob on *R1* until the neon light just comes on.

When the neon indicator has told you how straight the picture is hanging, record the score. You may record half-scores ($2\frac{1}{2}$, $4\frac{1}{2}$, etc.) if necessary. Then turn the picture over on its side, turn *R1* off scale, and you are ready for the next test.

You'll find that most people score between $\frac{1}{2}$ and $3\frac{1}{2}$ on either side of "1." People making large errors and those making small errors have been compared by giving them a number of personality tests. It has been found that those with large errors tend to lack self-insight and repress impulses. They are often suggestible, dependent, and have inferiority feelings. People with small errors, on the other hand, tend to have self-awareness and express impulses directly. They usually resist suggestion and are self-assured and independent. —30—

Across the Ham Bands

(*Continued from page* 84)

News and Views

Jim Hadlock, K7JRE, 15305 S.E. 42 St., Bellevue, Wash., spent a full year on the Novice bands with a Heathkit DX-20 transmitter and National NC-60 receiver abetted by a Heathkit QF-1 Q-multiplier. He now sports a General license, a Globe Chief De luxe transmitter, a Hammarlund HQ-110 receiver, and a Knight VFO on 20- and 40-meter CW. A pair of 6L6's modulate the Globe Chief on phone. All states and five countries worked, plus a 20-wpm code certificate, are the things Jim likes to talk about. . . . **Jay Klien, WA2PKD,** 2195 Grand Concourse, Bronx 53, N. Y., uses a Johnson Viking II transmitter feeding a Hy-gain doublet antenna; he receives on a Hallicrafters SX-111. Fifteen and 20 meters are his favorite bands, and his record is 38 states and 20 countries worked. . . . **Mike Wendland, KN8ZRH,** 1813 Ninth St., Bay City, Mich., spends most of his time on 80 meters. In his first two weeks on the air, he racked up 125 contacts with a home-brew 15-watter. Then, graduating to a Globe Chief running 75 watts, he brought his WAS record up to 28 states, plus Canada. A real old-time Sparton receiver with a Q-multiplier added does Mike's receiving; his antenna is an 80-meter dipole, 25′ high.

Tom Ginkel, WNØAHV, 1016 N. State St., New Ulm, Minn., is an ex-member of the "Aching Fist Radio Club." With his first home-built 10-watt transmitter, he made two contacts after hundreds of calls. Then he got a Johnson Adventurer transmitter running 50 watts to a 40-meter doublet, 15′ high, and worked 26 states in less than three weeks! He receives on a Hallicrafters SX-24 receiver. So far Tom has helped three other Novices get their licenses, and he offers to help others. He'll sked you on 40 meters, too, if you need a Minnesota con-

tact. . . . **"Lucky" King, K1KOB,** Jones Ave., Portsmouth, N. H., suggests that the 6-meter DX'ers monitor 50.2 mc. for New Hampshire contacts. The Exeter (N. H.) Amateur Radio Society (they're all EARS) just elected new officers: Pres., W1HIE; V. P., K1KLA; Treas., K1KKE; and Sec., K1KOB.

Tom Murph, KN8BKU, 4240 Philadelphia Dr., Dayton 5, Ohio, is pulling a switch on us. Instead of studying for his General Class ham ticket, he's studying for his Second Class Commercial Telephone ticket! As a Novice, Tom has worked 20 states on 40 and 15 meters. A Hallicrafters HT-40 transmitter, feeding a 40-meter dipole, and a Hallicrafters SX-110 receiver are the tools of his Novice trade. A Heathkit SWR bridge helps in tuning for maximum transmitter efficiency. . . . **Randy Howard, KN7RFZ,** 0550 S.W. Palatine Hill Rd., Portland 19, Oregon, does it the hard way. His home-brew 80-meter transmitter runs only six watts input. Nevertheless, he has made lots of contacts in five states and two Canadian provinces. Randy's doublet antenna is 30' high and he receives on a National NC-183. . . . **Travis Cox, WN4CQJ,** P.O. Box 116, Oxford, N. C., took six months to convince himself that he ought to see for himself how radio conditions were at 3:00 a.m. He immediately worked his DX to date—California. This gave him 27 states worked on 40 meters with his Knight-Kit T-50 transmitter, a 40-meter dipole 20' high, and a Hallicrafters SX-43 receiver, which a ham sold him for $15.00.

Glen Zook, K9STH, 1006 W. 16th St., La Porte, Ind., who is now ARRL Emergency Coordinator for La Porte County, has a few gripes. The biggest one is about the small percentage of Novices who use VFO's in violation of the Novice regulations. He has called CQ, then heard a Novice swoop down on his frequency with a VFO and start calling him; shifting to another frequency and calling CQ again resulted in the same Novice once more "zero-beating" his frequency, and calling him again. Obviously, Glen treats these "lids" as they deserve—he ignores their calls. Glen also voices the common complaint against marathon CQ's, in which the CQ'er transmits "CQ" 25 times, gives his own call letters 10 times, then repeats the performance 6 times. . . . **Skip Snyder, KN3RTG,** 246 West Main St., Uniontown, Pa., is another addition to the rapidly growing list of former CB operators who have graduated to the ham bands. Skip likes 80-meter CW. He operates a converted BC-457 "surplus" transmitter driven to 75 watts input with a husky, home-built power supply. An inverted-V antenna fed through a low-pass filter does the radiating, and a Hammarlund HQ-110C does the receiving. Twelve states worked in three weeks is Skip's record to date.

Let's have your YOUR *News and Views.* Send them to: Herb S. Brier, W9EGQ, c/o POPULAR ELECTRONICS, P.O. Box 678, Gary, Indiana. 73,

Herb, W9EGQ

Short-Wave Report

(*Continued from page* 86)

The following is a resume of current station reports. All times given are Eastern Standard and the 24-hour system is used. At time of compilation all reports are accurate, but stations may change frequency and/or schedule with little or no advance notice.

Albania—Tirana is now heard daily on 9480 kc. relaying *Radio Peking* at 1930-1957. This station no longer operates on 9700 kc.

Argentina—Buenos Aires continues to be well received during the Central Europe xmsn from 1400 to 2000 in Sp., Ger., It., Fr., Eng., and Port. on 11,730 kc.; and in Eng. to E.N.A. at 2200-2300 and to W.N.A. at 0002-0102 on 9690 kc.

Austria—Vienna has been noted on 7170 kc. at weak level from 1400 to 1430 with Eng. and Fr. announcements. This is a previously unreported frequency. The N.A. service (at time of compilation) is heard at 1430-1700 on OEI21, 6155 kc., and OEI47, 9770 kc.

Azores—*Emissora Regional*, Ponta Delgada, can be tuned on 4865 kc. in Port. from around 1800 until 1904/close. Program consists of talks and music; there is some QRM from a Brazilian station on the same channel. The s/off anthem is "A Portuguesa."

British Honduras—There are conflicting statements concerning *R. Belize*. 3300 kc. Numerous reports indicate that the station returned to the air last December but only for a short time and that it has not been heard since. One late report, however, indicates a possible resumption of service: it was noted from 2215 to 2235 s/off with a Billy Graham program and a program preview.

Burma—The Burma B/C Service, Rangoon, is received well at times on 6035 kc. between

The listening post of Armand Olean, WPE1CLH, Westport, Conn., contains a wealth of equipment. He has four receivers—surplus ARB, RA10, and BC-603 units, and a 220-mc. set—plus a Gonset tri-band converter, International Crystal converter for 144 mc. with a 6CW4 preamp, and both an SCR-522 and a Harvey-Wells TBS-50D transmitter.

0745 and 0915 with Burmese talks and instrumental music. There may be an Eng. ID around 0801.

Cambodia—*R. Phnom-Penh* has a new 50-kw. xmtr operating on 9695 kc., with Eng. scheduled at 1538-1600. An Eng. schedule is given at 1600 but is usually difficult to copy.

Canada—A challenge to the ability of any DX'er is the 10-watt CKFX, Vancouver, 6080 kc. Relaying CKWX, it operates 24 hours daily but has a very short range.

Chile—CE970, 9700 kc., uses two ID slogans: *La Voz de Chile* and *R. Cooperativa Vitalicia*. It has been noted from 2208 to 2330 s/off with all-Spanish news, talks, music. The IS is "Yankee Doodle" and the s/off theme is "Pomp and Circumstance." Newscasts are given at 2230 and 2325, with a local news bulletin at 2257.

China—Peking has been noted on the unannounced frequency of 3450 kc. at 0900-1000 with Eng. to India, Pakistan, and Ceylon. A late schedule indicates that Eng. is being broadcast to Western Europe at 1400-1700 on 6150, 6210, 7035, 7115, 9457, and 9800 kc.; to E.N.A. at 2000-2200 on 7480, 9480, 11,730, 11,945, 11,975, and 15,115 kc.; and to W.N.A. at 2200-0000 on 7350, 9457, 9785, 11,715, 11,820, 15,060, 15,260, and 17,745 kc. Other frequencies being used include 11,820 kc. (at 2209, in Eng.); 9945 kc. (at 2038, in Eng.); 9550 kc. (at 1915, in Chinese); 11,980 kc. (at 1936, in Chinese); 7015 kc. (at 1250-1300, in Chinese and Ger.); 7335 kc. (at 1305, in Eng.); and 9860 kc. (at 1330, in Chinese).

Cuba—Broadcasts have been heard on 5990 kc. to N.A. at 2200-2300 and 0000-0100 in Eng. and 2330-0000 in Fr., with popular Cuban music from 2300 to 2330; on 17,875 and 15,290 kc. at 1800-1900 to Europe; on 15,340 kc. at 0945 in Sp. to Caribbean areas and South America at 0500-1245, dual to 9765 and 5990 kc.; on 15,285 kc. afternoons to 1645 to Europe, replacing 15,300 kc., in Sp., Eng., Fr.; on 6060 kc. in Sp. to South America at 1930-1952 and later. Two new channels are 11,980 kc., heard from 0830, and 9770 kc., from 2330, both with Spanish.

Denmark—*The Voice of Denmark*, Copenhagen, has Eng. to N.A. at 2030-2130 and 2200-2300 on 9520 kc. Both segments include 10 minutes in Danish. Other xmsns: 1330-1430 to North Africa and the Mid-East; 1445-1545 to S. Africa; 0400-0500 to the Far East, New Zealand, and Australia; 0930-1030 to S. Asia; and 0730-0820 to Greenland; all on 15,165 kc. DX bulletin: Tuesdays and Thursdays.

Fiji Islands—*R. Fiji*, Suva, has been found on 4760 kc. at 0325-0523 in Eng. and Hindi, with s/off at 0523.

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Leroy Wanamaker *(LW)*, Stoneham, Mass.
John Young *(JY)*, Redondo Beach, Calif.

Formosa—This is the complete, current schedule from Taipei: Eng. at 2010-2040 on 17,785, 15,345, 15,225, 11,825, 6095 kc., and at 0510-0555 on 11,825, 9720, 9660, 7130, and 6095 kc.; the "Dragon Show" at 0730-0825 on 11,825, 9720, 9660, 7235, 7130, and 6095 kc.; Japanese at 0555-0625 on 11,825, 9720, 9660, 7130, 6095 kc.; Mandarin at 0630-0730 on 11,825, 9720, 9660, 7255, 7130, 6095 kc.; Amoy at 2300-2330 on 17,890, 15,345, 15,225, 7130, 6095 kc., and at 1000-1030 on 11,825, 9720, 6095 kc.; Cantonese at 2330-0000 on 17,890, 15,345, 15,225, 7130, 6095 kc., at 0930-1000 on 11,825, 9720, 6095 kc., and at 1220-1305 on 9960, 7235, 7130 kc.; Korean at 0425-0455 on 7130 and 6095 kc.; Indonesian at 0900-0930 on 11,825, 9720, 6095 kc.; Vietnamese (Sunday only) at 0030-0100 on 17,890, 15,345, 15,225, 7130, and 6095 kc., and at 0825-0850 on 11,825, 9720, 7235, 7130, and 6095 kc.

France—Paris is noted on 21,675 kc. at 0815-0850 with Eng. news, music, and a French lesson; on 15,250 kc. to 1345 s/off to Canada; on 7160 kc. in Eng. at 1945, with a French lesson at 0745; on 9615, 11,845, and 11,855 kc. from 1815 s/on in French and Spanish. An up-to-date schedule would be appreciated by your Short-Wave Editor.

Guinea—Conakry has been testing a new high-powered xmtr on 11,965 kc. at 1300-1730 (Sundays to 1900) with Eng. news at about 1600.

Iceland—TFJ, Reykjavik, operates in Icelandic daily on 11,780 kc. at 1530-1700, Sundays at 0815-1000.

SHORT-WAVE ABBREVIATIONS

B/C—Broadcasting	Port.—Portuguese
E.N.A.—Eastern North America	QRM—Station interference
Eng.—English	R.—Radio
Fr.—French	s/off—Sign-off
Ger.—German	s/on—Sign-on
ID—Identification	Sp.—Spanish
IS—Interval signal	W.N.A.—Western North America
It.—Italian	xmsn—Transmission
kc.—Kilocycles	xmtr—Transmitter
kw.—Kilowatts	

Iran—Teheran has been heard on 7285 kc. at 2215 in Arabic; this runs to 2358 s/off with "In A Persian Market." Another outlet is tuned on 7097 kc., but at poor level, from 2122 to 2130 with chanting.

Katanga—Leopoldville is scheduled at 1200-1500 to Africa and at 1530-1830 to Asia, Europe, and Oceania, all in French, and at 1900-2200 in Eng. to the Western Hemisphere on 11,755 kc.

Mexico—A new station is XERR, Mexico City, 15,110 kc. Operating dual to XEHH, 11,880 kc., it is a relay of XERH and is heard well from 0700 to 2000.

Mozambique—A new channel for Lourenco Marques is 7249 kc., tuned at 2320 with recordings and chatter, ID at 2330, some language commercials and more music. It was still going strong at 2355 and later.

Netherlands—Hilversum operates with the following Eng. schedule: at 0200-0250 to Aus-

tralia, New Zealand, and Pacific areas on 11,730 and 9590 kc.; at 0900-0950 to S. Asia on 21,565 and 15,445 kc.; at 1430-1520 to Africa and Europe on 15,425 and 11,950 kc. (also on 6020 kc. to Europe); at 1630-1720 to Europe and N.A. on 11,730 and 9590 kc. (also on 6020 kc. to Europe); at 2030-2120 to N.A. on 9590, 6020, and 5980 kc. This schedule is effective weekdays only.

Nicaragua—YNX, *Estacion X* (or *R. Equis*). 6025 kc., Managua, is noted at 2310-0001 with pop music, few ID's, all Spanish. Scheduled to run to 0000, it is usually QRM'ed by the *VOA (Voice of America)* after 2355.

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Philippines—DZI6, Manila, 17,805 kc., is noted at 1830-1845 with Eng. news, from 1845 in Indonesian. English continues on 21,515 and 15,385 kc. The *VOA* North Luzon outlet on 9665 kc. is noted in Oriental language and Eng. intermittently from 0630 to 1206.

Poland—Warsaw has Eng. at 1330-1400 on 6195 kc., at 1430-1500 on 9540 and 7105 kc., at 1530-1600 on 9525 and 7285 kc., and at 1630-1700 on 9540 and 6195 kc. There is no xmsn to N.A.

Portugal—*Voice of the West*, Lisbon, operates to N.A. at 2100-2130 and 2300-2330 on 6025 and 6185 kc.

South Africa—Johannesburg is noted on 15,200 kc. from 1408 to 1420 with weather, news, and music, and on 15,085 kc. from 1350 to 1500 with Eng. on Tuesdays, Thursdays, and Saturdays.

Sudan—*R. Omdurman*, Khartoum, is now on 4990 kc. at 2325-0035 in Arabic, with news at 2330. This one has a fairly good signal.

Sweden—Stockholm now operates on 6065 kc. at 2000-2115 to E.N.A. and at 2130-2245 to W.N.A., a big improvement over the operation on the previously used 9725 kc.

Venezuela—Being reported for the first time is YVMC, *R. Mara*, Maracaibo, 3275 kc., heard at various times during the evening, all Spanish. This is a 1-kw. outlet.

Windward Islands—Grenada has moved to 9780 kc., replacing 11,975 kc., and is scheduled to operate at 1745-2115. This xmsn and those at 1029-1230 and 1459-1735 on 15,085 kc. are beamed to Jamaica. Eastern Caribbean and Windward Islands xmsns are aired at 1029-1230 on 9520 and 5010 kc., at 1459-1735 on 5010 kc., and at 1745-2115 on 3365 kc.

Clandestine—*R. Libertad, La Voz Anti-Communista de America*, is noted on 7325 kc. at 2042-2215 with Sp. talks, and on 15,050 kc. at 0830-0900 (varies to 0915) but with QRM from *R. Caribe*. —30—

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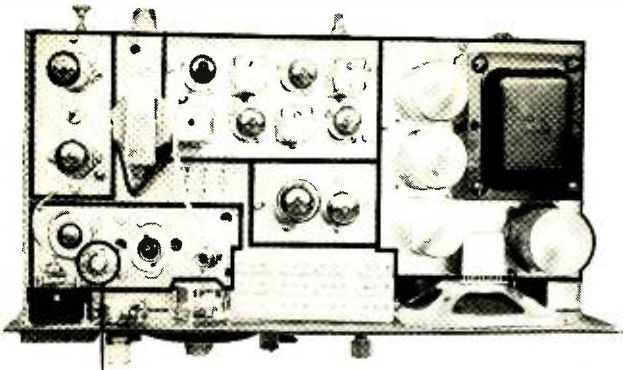

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